Network Working Group
Request for Comments: 1130
Obsoletes: RFCs 1100, 1083

Internet Activities Board
J. Postel, Editor

October 1989

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 Activities Board (IAB). Distribution of this memo is unlimited.

Introduction

An overview of the standards procedures is presented first, followed by discussions of the standardization process and the RFC document series, then the explanation of the terms is presented, the lists of protocols in each stage of standardization follows, and finally pointers to references and contacts for further information.

This memo is issued quarterly, please be sure the copy you are reading is dated within the last three months. 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 memo after 31-Jan-90.

See Section 6.1 for a description of recent changes.

1. Overview of Standards Procedures

The Internet Activities Board maintains a list of documents that define standards for the Internet protocol suite (see RFC-1120 for an explanation of the role and organization of the IAB). 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.

Protocol standards may be suggested by anyone in the Internet community, by writing and submitting an RFC. In general, any suggested protocol will be reviewed or developed in the context of some Task Force of the IAB, or some research group or working group within that Task Force. The IAB will assign a suggested protocol to a working group or research group if official delegation is necessary.

Given the important role of the Internet Engineering Task Force in the evolution of the Internet Architecture, all proposed protocols will be reviewed by the Internet Engineering Steering Group (IESG) which is composed of the Technical Area Directors.

The recommendation of the IESG and working group or research group is given major consideration in the decision by the IAB to assign a state and status to the protocol. The general policy is to gain implementation experience with a protocol before considering a possible designation as an official standard.

In cases where there is uncertainty as to the proper decision concerning a protocol, the IAB may convene a special review committee consisting of interested parties from the working group and members of the IAB itself, with the purpose of recommending some explicit action to the IAB.

A few protocols have achieved widespread implementation without the approval of the IAB. For example, some vendor protocols have become very important to the Internet community even though they have not been proposed or reviewed 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 term "standard" in any RFC to only those protocols which the IAB has approved.

2. The Standardization Process

Anyone can invent a protocol, document it, implement it, test it, and so on. The IAB believes that it is very useful to document a protocol at an early stage to promote suggestions from others interested in the functionality the of protocol and from those interested in protocol design. Once a protocol is implemented and tested it is useful to report the results. The RFC document series is the preferred place for publishing these protocol documents and testing results.

The IAB encourages the documenting of every protocol developed in the Internet (that is, the publication of the protocol specification as an RFC), even if it is never intended that the protocol become an Internet standard. A protocol that is not intended to become a standard is called "experimental".

Protocols that are intended to become standards are first designated as "proposed" protocols. It is expected that while in this state the protocol will be implemented and tested by several groups. It is likely that an improved version of the protocol will result from this

activity.

Once a proposed protocol has become stable and has a sponsor (an individual willing to speak for the protocol to the IAB) it may advance to the "draft standard" state. In this state, it should be reviewed by the entire Internet community. This draft standard state is essentially a warning to the community that unless an objection is raised or a flaw is found this protocol will become a "standard".

Once a protocol has been a draft standard for a sufficient time (usually 6 months) without serious objections the IAB may act to declare the protocol an official Internet standard.

Some protocols have been superseded by better protocols or are otherwise unused. Such protocols are designated "historic".

In addition to a state (like proposed or standard) a protocol is also assigned a status. A protocol can be required, meaning that all systems in the Internet must implement it. For example, the Internet Protocol (IP) is required. A protocol may be recommended, meaning that systems should implement this protocol. A protocol may be elective, meaning that systems may implement this protocol; that is, if (and only if) the functionality of this protocol is needed or useful for a system it must use this protocol to provide the functionality. A protocol may be termed not recommended if it is not intended to be generally implemented; for example, experimental or historic protocols.

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, multi-user hosts. It is not necessary for a gateway to implement TCP and the protocols that use TCP (though it may be useful). It is expected that general purpose hosts will implement at least IP (including ICMP), TCP and UDP, Telnet, FTP, SMTP, Mail, and the Domain Name System (DNS).

3. The Request for Comments Documents

The documents called Request for Comments (or RFCs) are the working notes of 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).

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

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 to refer to for the current specification of each protocol.

The RFCs are available from the Network Information Center at SRI International. For more information about obtaining RFCs see the contact information at the end of this memo.

4. Other Reference Documents

There are four other reference documents of interest in checking the current status of protocol specifications and standardization. These are the Assigned Numbers, the Official Protocols, 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 4.5.

4.1. 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-1010.

Another document, Internet Numbers, lists the assigned IP network numbers, and the autonomous system numbers. Internet Numbers was most recently issued as RFC-1117.

4.2. Official Protocols

This document list the protocols and describes any known problems and

ongoing experiments. Official Protocols was most recently issued as RFC-1011.

4.3. Gateway Requirements

This document reviews the specifications that apply to gateways and supplies guidance and clarification for any ambiguities. Gateway Requirements is RFC-1009.

4.4. Host Requirements

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

4.5. 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.

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.

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

5. Explanation of Terms

There are two independent categorizations of protocols. The first is the state of standardization which is one of "standard", "draft standard", "proposed", "experimental", or "historic". The second is the status of this protocol which is one of "required", "recommended", "elective", or "not recommended". One could expect a particular protocol to move along the scale of status from elective to required at the same time as it moves along the scale of standardization from proposed to standard.

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

	Req	Rec	Ele	Not
Std	XXX	XX	X	
Draft		X	XX	
Prop			XXX	X
Expr			X	XXX
Hist				XXX

Some protocol 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.

5.1. Definitions of Protocol State

5.1.1. Standard Protocol

The IAB has established this as an official standard protocol for the Internet. 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.

5.1.2. Draft Standard Protocol

The IAB is actively considering this protocol as a possible Standard Protocol. Substantial and widespread testing and comment is 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.

5.1.3. Proposed 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. Revisions of the protocol specification are likely.

5.1.4. 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 a specific 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, draft, and then standard protocols, the designation of a protocol as experimental is meant to suggest that the protocol, although perhaps mature, is not intended for operational use.

5.1.5. 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. These are protocols that are at an evolutionary dead end.

5.2. Definitions of Protocol Status

5.2.1. Required Protocol

All systems must implement the required protocols.

5.2.2. Recommended Protocol

All systems should implement the recommended protocols.

5.2.3. 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.

5.2.4. 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.

6. The Protocols

This section list the standards in groups by protocol state.

6.1. Recent Changes:

The Host Requirements [RFC-1122, RFC-1123] is now a Required Standard.

The Network Time Protocol [RFC-1119] is now a Recommended Standard.

The Internet Group Multicast Protocol [RFC-1112] is now a Recommended Standard.

The mail Content Type Header Field [RFC-1049] is now a Recommended Standard.

The "Internet Numbers" list was recently issued as RFC-1117.

The Telnet Linemode Option [RFC-1116] is now a Elective Proposed standard.

The mail Privacy procedures [RFC-1113, RFC-1114, and RFC-1115] are now Elective Draft Standards.

The Border Gateway Protocol [RFC-1105] is a Not-Recommended Experimental protocol.

A procedure for sending IP over FDDI networks [RFC-1103] is now a Specific Standard.

The Trivial File Transfer Protocol [RFC-783] is now a Elective Draft Standard.

6.2. Standard Protocols

Protocol	Name	Status	RFC
	Assigned Numbers	Required	1010
	Gateway Requirements	Required	1009
	Host Requirements - Communications	Required	1122
	Host Requirements - Applications	Required	1123
IP	Internet Protocol	Required	791
	as amended by:		
	IP Subnet Extension	Required	950
	IP Broadcast Datagrams	Required	919
	IP Broadcast Datagrams with Subnets	Required	922
ICMP	Internet Control Message Protocol	Required	792
IGMP	Internet Group Multicast Protocol	Recommended	1054
UDP	User Datagram Protocol	Recommended	768
TCP	Transmission Control Protocol	Recommended	793
DOMAIN	Domain Name System	Recommended	1034,1035
TELNET	Telnet Protocol	Recommended	854
FTP	File Transfer Protocol	Recommended	959
SMTP	Simple Mail Transfer Protocol	Recommended	821
MAIL	Format of Electronic Mail Messages	Recommended	822
CONTENT	Content Type Header Field	Recommended	1049
EGP	Exterior Gateway Protocol	Recommended	904
ECHO	Echo Protocol	Recommended	862
NTP	Network Time Protocol	Recommended	1119
NETBIOS	NetBIOS Service Protocols	Elective	1001,1002
DISCARD	Discard Protocol	Elective	863
CHARGEN	Character Generator Protocol	Elective	864
QUOTE	Quote of the Day Protocol	Elective	865
USERS	Active Users Protocol	Elective	866
DAYTIME	Daytime Protocol	Elective	867
TIME	Time Server Protocol	Elective	868

6.3. Specific Standard Protocols

Protocol	Name	Status	RFC
ARP	Address Resolution Protocol	Elective	826
RARP	A Reverse Address Resolution Protocol	Elective	903
IP-ARPA	Internet Protocol on ARPANET	Elective	BBN 1822
IP-WB	Internet Protocol on Wideband Network	Elective	907
IP-X25	Internet Protocol on X.25 Networks	Elective	877
IP-E	Internet Protocol on Ethernet Networks	Elective	894
IP-EE	Internet Protocol on Exp. Ethernet Nets	Elective	895
IP-IEEE	Internet Protocol on IEEE 802	Elective	1042
IP-DC	Internet Protocol on DC Networks	Elective	891
IP-HC	Internet Protocol on Hyperchannnel	Elective	1044
IP-ARC	Internet Protocol on ARCNET	Elective	1051
IP-SLIP	Transmission of IP over Serial Lines	Elective	1055
IP-NETBIOS	Transmission of IP over NETBIOS	Elective	1088
IP-FDDI	Transmission of IP over FDDI	Elective	1103

Note: 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.

6.4. Draft Standard Protocols

Protocol	Name	Status	RFC
	Mail Privacy: Procedures	Elective	1113
	Mail Privacy: Key Management	Elective	1114
	Mail Privacy: Algorithms	Elective	1115
SNMP	Simple Network Management Protocol	Recommended	1098
CMOT	Common Management Information Services and Protocol over TCP/IP	Recommended	1095
MIB	Management Information Base	Recommended	1066
SMI	Structure of Management Information	Recommended	1065
BOOTP	Bootstrap Protocol	Recommended	951,1048,1084
TFTP	Trivial File Transfer Protocol	Elective	783

The Internet Activities Board has designated two different network management protocols with the same status of "Draft Standard" and "Recommended". The two protocols are the Common Management Information Services and Protocol over TCP/IP (CMOT) [RFC-1095] and the Simple Network Management Protocol (SNMP) [RFC-1098]. The IAB intends each of these two protocols to receive the attention of implementers and experimenters. The IAB seeks reports of experience with these two protocols from system builders and users. By this action, the IAB recommends that all IP and TCP implementations be network manageable (e.g., implement the Internet MIB [RFC-1066], and that implementations that are network manageable are expected to adopt and implement at least one of these two Internet Draft Standards. The motivation for this position is discussed in RFCs 1052 and 1109.

6.5. Proposed Protocols

Protocol	Name	Status	RFC
SUN-NFS	Network File System Protocol	Elective	1094
POP3	Post Office Protocol, Version 3	Elective	1081,1082
RIP	Routing Information Protocol	Elective	1058
SUN-RPC	Remote Procedure Call Protocol	Elective	1057
PCMAIL	Pcmail Transport Protocol	Elective	1056
VMTP	Versatile Message Transaction Protocol	Elective	1045
NFILE	A File Access Protocol	Elective	1037
	Mapping between X.400 and RFC-822	Elective	987,1026
STATSRV	Statistics Server	Elective	996
NNTP	Network News Transfer Protocol	Elective	977
NICNAME	WhoIs Protocol	Elective	954
HOSTNAME	HOSTNAME Protocol	Elective	953
POP2	Post Office Protocol, Version 2	Elective	937
SFTP	Simple File Transfer Protocol	Elective	913
RLP	Resource Location Protocol	Elective	887
RTELNET	Remote Telnet Service	Elective	818
FINGER	Finger Protocol	Elective	742
SUPDUP	SUPDUP Protocol	Elective	734
NETED	Network Standard Text Editor	Elective	569
RJE	Remote Job Entry	Elective	407

6.6. Experimental Protocols

Protocol	Name	Status	RFC
BGP	Border Gateway Protocol	Not Recommended	1105
IP-DVMRP	IP Distance Vector Multicast Routing	Not Recommended	1075
TCP-LDP	TCP Extensions for Long Delay Paths	Not Recommended	1072
IP-MTU	IP MTU Discovery Options	Not Recommended	1063
NETBLT	Bulk Data Transfer Protocol	Not Recommended	998
IMAP2	Interactive Mail Access Protocol	Not Recommended	1064
COOKIE-JAR	Authentication Scheme	Not Recommended	1004
IRTP	Internet Reliable Transaction Protocol	Not Recommended	938
AUTH	Authentication Service	Not Recommended	931
RATP	Reliable Asynchronous Transfer Protocol	Not Recommended	916
THINWIRE	Thinwire Protocol	Not Recommended	914
LDP	Loader Debugger Protocol	Not Recommended	909
RDP	Reliable Data Protocol	Not Recommended	908
ST	Stream Protocol	Not Recommended	IEN 119
NVP-II	Network Voice Protocol	Not Recommended	ISI memo

6.7. Historic Protocols

Protocol	Name	Status	RFC
SGMP	Simple Gateway Monitoring Protocol	Not Recommended	1028
HEMS	High Level Entity Management Protocol	Not Recommended	1021
HMP	Host Monitoring Protocol	Not Recommended	869
GGP	Gateway Gateway Protocol	Not Recommended	823
CLOCK	DCNET Time Server Protocol	Not Recommended	778
MPM	Internet Message Protocol	Not Recommended	759
NETRJS	Remote Job Service	Not Recommended	740
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

7. Contacts

7.1. Internet Activities Board Contact

Contact:

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Please send your comments about this list of protocols and especially about the Draft Standard Protocols to the Internet Activities Board.

7.2. Internet Assigned Numbers Authority Contact

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

Please refer to the documents "Assigned Numbers" (RFC-1010) and "Official Internet Protocols" (RFC-1011) 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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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:

DDN Network Information Center
SRI International
Room EJ291
333 Ravenswood Avenue
Menlo Park, CA 94025

1-800-235-3155
1-415-859-3695

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.

RFCs can be obtained via FTP from NIC.DDN.MIL with the pathname RFC:RFCnnnn.TXT where "nnnn" refers to the number of the RFC. A list of all RFCs may be obtained by copying the file RFC:RFC-INDEX.TXT. Log in with FTP username ANONYMOUS and password GUEST.

The NIC also provides an automatic mail service for those sites which cannot use FTP. Address the request to SERVICE@NIC.DDN.MIL and in the subject field of the message indicate the RFC number, as in "Subject: RFC nnnn".

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

The file RFC:IAB-STANDARDS.TXT may be copied via FTP from the NIC.DDN.MIL computer following the same procedures used to obtain RFCs.

7.5. Other Sources for Requests for Comments

NSF Network Service Center (NNSC)

NSF Network Service Center (NNSC)
BBN Systems and Technology Corporation
10 Moulton St.
Cambridge, MA 02238

617-873-3400

NNSC@NNSC.NSF.NET

NSF Network Information Service (NIS)

NSF Network Information Service
Merit Inc.
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Ann Arbor, MI 48109

313-763-4897

INFO@NIS.NSF.NET

CSNET Coordination and Information Center (CIC)

CSNET Coordination and Information Center
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8. Security Considerations:

Security issues are not addressed in this memo.

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