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7. I declare under penalty of perjury that the foregoing is true and correct.

DATE: April 26, 2023

Nathaniel E Frank-White

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1247 **OSPF Version 2** J. Moy [Jul-01-1991] (TXT, PS, PDF = 433332, 989724, 490300 bytes)(Obsoletes RFC1131) (Obsoleted by RFC1583) (Also RFC1246 ,RFC1245)
1246 **Experience with the OSPF Protocol** J. Moy [Jul-01-1991] (TXT, PS, PDF = 70441, 141924, 84633 bytes)(Also RFC1247 ,RFC1245)
1245 **OSPF Protocol Analysis** J. Moy [Jul-01-1991] (TXT, PS, PDF = 26160, 33546, 31723 bytes)(Also RFC1247 ,RFC1246)
1244 **Site Security Handbook** J.P. Holbrook, J.K. Reynolds [Jul-01-1991] (TXT = 259129 bytes)(Obsoleted by RFC2196)
1243 **AppleTalk Management Information Base** S. Waldbusser [Jul-01-1991] (TXT = 61985 bytes)(Obsoleted by RFC1742)
1242 **Benchmarking terminology for network interconnection devices** S. Bradner [Jul-01-1991] (TXT = 22817 bytes)
1241 **Scheme for an internet encapsulation protocol: Version 1** R.A. Woodburn, D.L. Mills [Jul-01-1991] (TXT, PS, PDF = 42468, 128921, 44593 bytes)
1240 **OSI connectionless transport services on top of UDP: Version 1** C. Shue, W. Haggerty, K. Dobbins [Jun-01-1991] (TXT = 18140 bytes)
1239 **Reassignment of experimental MIBs to standard MIBs** J.K. Reynolds [Jun-01-1991] (TXT = 3656 bytes)(Updates RFC1229 ,RFC1230 ,RFC1231 ,RFC1232 ,RFC1233)
1238 **CLNS MIB for use with Connectionless Network Protocol (ISO 8473) and End System to Intermediate System (ISO 9542)** G. Satz [Jun-01-1991] (TXT = 65159 bytes)(Obsoletes RFC1162)
1237 **Guidelines for OSI NSAP Allocation in the Internet** R. Collela, E.P. Gardner, R.W. Callon [Jul-01-1991] (TXT, PS, PDF = 116989, 160478, 171423 bytes)(Obsoleted by RFC1629)
1236 **IP to X.121 address mapping for DDN** L. Morales, P. Hasse [Jun-01-1991] (TXT = 12626 bytes)
1235 **Coherent File Distribution Protocol** J. Ioannidis, G. Maguire [Jun-01-1991] (TXT = 29345 bytes)
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1233 **Definitions of managed objects for the DS3 Interface type** T.A. Cox, K. Tesink [May-01-1991] (TXT = 49559 bytes)(Obsoleted by RFC1407) (Updated by RFC1239)
1232 **Definitions of managed objects for the DS1 Interface type** F. Baker, C.P. Kolb [May-01-1991] (TXT = 60757 bytes)(Obsoleted by RFC1406) (Updated by RFC1239)
1231 **IEEE 802.5 Token Ring MIB** K. McCloghrie, R. Fox, E. Decker [May-01-1991] (TXT = 53542 bytes)(Obsoleted by RFC1743 ,RFC1748)(Updated by RFC1239)
1230 **IEEE 802.4 Token Bus MIB** K. McCloghrie, R. Fox [May-01-1991] (TXT = 53100 bytes)(Updated by RFC1239)
1229 **Extensions to the generic-interface MIB** K. McCloghrie [May-01-1991] (TXT = 36022 bytes)(Obsoleted by RFC1573) (Updated by RFC1239)
1228 **SNMP-DPI: Simple Network Management Protocol Distributed Program Interface** G. Carpenter, B. Wijnen [May-01-1991] (TXT = 96972 bytes)(Obsoleted by RFC1592)
1227 **SNMP MUX protocol and MIB** M.T. Rose [May-01-1991] (TXT = 25868 bytes)
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1165 **Network Time Protocol (NTP) over the OSI Remote Operations Service** J. Crowcroft, J.P. Onions [Jun-01-1990] (TXT = 18277 bytes)
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1163 **Border Gateway Protocol (BGP)** K. Lougheed, Y. Rekhter [Jun-01-1990] (TXT = 69404 bytes)(Obsoletes RFC1105) (Obsoleted by RFC1267)
1162 **Connectionless Network Protocol (ISO 8473) and End System to Intermediate System (ISO 9542) Management Information Base** G. Satz [Jun-01-1990] (TXT = 109893 bytes)(Obsoleted by RFC1238)
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1158 **Management Information Base for network management of TCP/IP-based internets: MIB-II** M.T. Rose [May-01-1990] (TXT = 212152 bytes)(Obsoleted by RFC1213)
1157 **Simple Network Management Protocol (SNMP)** J.D. Case, M. Fedor, M.L. Schoffstall, C. Davin [May-01-1990] (TXT = 74894 bytes)(Obsoletes RFC1098) (Also STD0015)
1156 **Management Information Base for network management of TCP/IP-based internets** K. McCloghrie, M.T. Rose [May-01-1990] (TXT = 138781 bytes)(Obsoletes RFC1066)
1155 **Structure and identification of management information for TCP/IP-based internets** M.T. Rose, K. McCloghrie [May-01-1990] (TXT = 40927 bytes)(Obsoletes RFC1065) (Also STD0016)
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1150 **FYI on FYI: Introduction to the FYI Notes** G.S. Malkin, J.K. Reynolds [Mar-01-1990] (TXT = 7867 bytes)(Also FYI0001)
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1148 **Mapping between X.400(1988) / ISO 10021 and RFC 822** S.E. Kille [Mar-01-1990] (TXT = 194292 bytes)(Obsoleted by RFC1327 ,RFC2156)(Updates RFC0822 ,RFC0987 ,RFC1026 ,RFC1138)
1147 **FYI on a Network Management Tool Catalog: Tools for Monitoring and Debugging TCP/IP Internets and Interconnected Devices** R.H. Stine [Apr-01-1990] (TXT, PS, PDF = 336906, 555225, 308602 bytes)(Obsoleted by RFC1470)
1146 **TCP alternate checksum options** J. Zweig, C. Partridge [Mar-01-1990] (TXT = 10955 bytes)(Obsoletes RFC1145)

1145 **TCP alternate checksum options** J. Zweig, C. Partridge [Feb-01-1990] (TXT = 11052 bytes)(Obsoleted by RFC1146)

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1141 **Incremental updating of the Internet checksum** T. Mallory, A. Kullberg [Jan-01-1990] (TXT = 3587 bytes)(Updates RFC1071) (Updated by RFC1624)

1140 **IAB official protocol standards** Defense Advanced Research Projects Agency, Internet Activities Board [May-01-1990] (TXT = 60501 bytes)(Obsoletes RFC1130) (Obsoleted by RFC1200)

1139 **Echo function for ISO 8473** R.A. Hagens [Jan-01-1990] (TXT = 14229 bytes)(Obsoleted by RFC1574 ,RFC1575)

1138 **Mapping between X.400(1988) / ISO 10021 and RFC 822** S.E. Kille [Dec-01-1989] (TXT = 191029 bytes)(Obsoleted by RFC1327 ,RFC2156)(Updates RFC0822 ,RFC0987 ,RFC1026)(Updated by RFC1148)

1137 **Mapping between full RFC 822 and RFC 822 with restricted encoding** S. Kille [Dec-01-1989] (TXT = 6266 bytes)(Updates RFC0976)

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1131 **OSPF specification** J. Moy [Oct-01-1989] (TXT, PS, PDF = 268, 857280, 398863 bytes)(Obsoleted by RFC1247)

1130 **IAB official protocol standards** Defense Advanced Research Projects Agency, Internet Activities Board [Oct-01-1989] (TXT = 33858 bytes)(Obsoletes RFC1100) (Obsoleted by RFC1140)

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1128 **Measured performance of the Network Time Protocol in the Internet system** D.L. Mills [Oct-01-1989] (TXT, PS, PDF = 314, 633742, 197897 bytes)

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1125 **Policy requirements for inter Administrative Domain routing** D. Estrin [Nov-01-1989] (TXT, PS, PDF = 55248, 282123, 289862 bytes)

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1120 **Internet Activities Board** V. Cerf [Sep-01-1989] (TXT = 26123 bytes)(Obsoleted by RFC1160)

1119 **Network Time Protocol (version 2) specification and implementation** D.L. Mills [Sep-01-1989] (TXT, PS, PDF = 143, 518020, 187940 bytes)(Obsoletes RFC0958 ,RFC1059)(Obsoleted by RFC1305) (Also STD0012)

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1113 **Privacy enhancement for Internet electronic mail: Part I - message encipherment and authentication procedures** J. Linn [Aug-01-1989] (TXT = 89293 bytes) (Obsoletes RFC0989 ,RFC1040)(Obsoleted by RFC1421)

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1111 **Request for comments on Request for Comments: Instructions to RFC authors** J. Postel [Aug-01-1989] (TXT = 11793 bytes)(Obsoletes RFC0825) (Obsoleted by RFC1543 ,RFC2223)

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1101 **DNS encoding of network names and other types** P.V. Mockapetris [Apr-01-1989] (TXT = 28677 bytes)(Updates RFC1034 ,RFC1035)

1100 **IAB official protocol standards** Defense Advanced Research Projects Agency, Internet Activities Board [Apr-01-1989] (TXT = 30101 bytes)(Obsoletes RFC1083) (Obsoleted by RFC1130)

1099 **Request for Comments Summary: RFC Numbers 1000-1099** J. Reynolds [December 1991] (TXT = 49108 bytes)

1098 **Simple Network Management Protocol (SNMP)** J.D. Case, M. Fedor, M.L. Schoffstall, C. Davin [Apr-01-1989] (TXT = 71563 bytes)(Obsoletes RFC1067) (Obsoleted by RFC1157)

1097 **Telnet subliminal-message option** B. Miller [Apr-01-1989] (TXT = 5490 bytes)

1096 **Telnet X display location option** G.A. Marcy [Mar-01-1989] (TXT = 4634 bytes)

1095 **Common Management Information Services and Protocol over TCP/IP (CMOT)** U.S. Warrier, L. Besaw [Apr-01-1989] (TXT = 157506 bytes)(Obsoleted by RFC1189)

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1087 **Ethics and the Internet** Defense Advanced Research Projects Agency, Internet Activities Board [Jan-01-1989] (TXT = 4582 bytes)

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1085 **ISO presentation services on top of TCP/IP based internets** M.T. Rose [Dec-01-1988] (TXT = 64643 bytes)

1084 **BOOTP vendor information extensions** J.K. Reynolds [Dec-01-1988] (TXT = 16327 bytes)(Obsoletes RFC1048) (Obsoleted by RFC1395 ,RFC1497 ,RFC1533)
1083 **IAB official protocol standards** Defense Advanced Research Projects Agency, Internet Activities Board [Dec-01-1988] (TXT = 27128 bytes)(Obsoleted by RFC1100)
1082 **Post Office Protocol: Version 3** M.T. Rose [Nov-01-1988] (TXT = 25423 bytes)
1081 **Post Office Protocol: Version 3** M.T. Rose [Nov-01-1988] (TXT = 37009 bytes)(Obsoleted by RFC1225)
1080 **Telnet remote flow control option** C.L. Hedrick [Nov-01-1988] (TXT = 6688 bytes)(Obsoleted by RFC1372)
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1074 **NSFNET backbone SPF based Interior Gateway Protocol** J. Rekhter [Oct-01-1988] (TXT = 10872 bytes)
1073 **Telnet window size option** D. Waitzman [Oct-01-1988] (TXT = 7639 bytes)
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1059 **Network Time Protocol (version 1) specification and implementation** D.L. Mills [Jul-01-1988] (TXT = 140890 bytes)(Obsoletes RFC0958) (Obsoleted by RFC1119 ,RFC1305)
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0891 **DCN local-network protocols** D.L. Mills [Dec-01-1983] (TXT = 66769 bytes)(Also STD0044)
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0889 **Internet delay experiments** D.L. Mills [Dec-01-1983] (TXT = 27128 bytes)
0888 **"STUB" Exterior Gateway Protocol** L. Seamonson, E.C. Rosen [Jan-01-1984] (TXT = 53227 bytes)(Updated by RFC0904)
0887 **Resource Location Protocol** M. Accetta [Dec-01-1983] (TXT = 36770 bytes)
0886 **Proposed standard for message header munging** M.T. Rose [Dec-15-1983] (TXT = 30566 bytes)
0885 **Telnet end of record option** J. Postel [Dec-01-1983] (TXT = 3232 bytes)
0884 **Telnet terminal type option** M. Solomon, E. Wimmers [Dec-01-1983] (TXT = 7881 bytes)(Obsoleted by RFC0930)
0883 **Domain names: Implementation specification** P.V. Mockapetris [Nov-01-1983] (TXT = 175067 bytes)(Obsoleted by RFC1034 ,RFC1035)(Updated by RFC0973)
0882 **Domain names: Concepts and facilities** P.V. Mockapetris [Nov-01-1983] (TXT = 79776 bytes)(Obsoleted by RFC1034 ,RFC1035)(Updated by RFC0973)
0881 **Domain names plan and schedule** J. Postel [Nov-01-1983] (TXT = 23490 bytes)(Updated by RFC0897)
0880 **Official protocols** J.K. Reynolds, J. Postel [Oct-01-1983] (TXT = 37332 bytes)(Obsoletes RFC0840) (Obsoleted by RFC0901)
0879 **TCP maximum segment size and related topics** J. Postel [Nov-01-1983] (TXT = 22024 bytes)
0878 **ARPANET 1822L Host Access Protocol** A.G. Malis [Dec-01-1983] (TXT = 74774 bytes)(Obsoletes RFC0851)
0877 **Standard for the transmission of IP datagrams over public data networks** J.T. Korb [Sep-01-1983] (TXT = 3272 bytes)(Obsoleted by RFC1356)
0876 **Survey of SMTP implementations** D. Smallberg [Sep-01-1983] (TXT = 37775 bytes)
0875 **Gateways, architectures, and heffalumps** M.A. Padlipsky [Sep-01-1982] (TXT = 22816 bytes)
0874 **Critique of X.25** M.A. Padlipsky [Sep-01-1982] (TXT = 36386 bytes)
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0870 **Assigned numbers** J.K. Reynolds, J. Postel [Oct-01-1983] (TXT = 56055 bytes)(Obsoletes RFC0820) (Obsoleted by RFC0900)
0869 **Host Monitoring Protocol** R. Hinden [Dec-01-1983] (TXT = 94550 bytes)
0868 **Time Protocol** J. Postel, K. Harrenstien [May-01-1983] (TXT = 3140 bytes)(Also STD0026)
0867 **Daytime Protocol** J. Postel [May-01-1983] (TXT = 2405 bytes)(Also STD0025)
0866 **Active users** J. Postel [May-01-1983] (TXT = 2087 bytes)(Also STD0024)
0865 **Quote of the Day Protocol** J. Postel [May-01-1983] (TXT = 1734 bytes)(Also STD0023)
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0863 **Discard Protocol** J. Postel [May-01-1983] (TXT = 1297 bytes)(Also STD0021)
0862 **Echo Protocol** J. Postel [May-01-1983] (TXT = 1294 bytes)(Also STD0020)
0861 **Telnet Extended Options: List Option** J. Postel, J.K. Reynolds [May-01-1983] (TXT = 3181 bytes)(Obsoletes NIC 16239) (Also STD0032)
0860 **Telnet Timing Mark Option** J. Postel, J.K. Reynolds [May-01-1983] (TXT = 8108 bytes)(Obsoletes NIC 16238) (Also STD0031)
0859 **Telnet Status Option** J. Postel, J.K. Reynolds [May-01-1983] (TXT = 4443 bytes)(Obsoletes RFC0651) (Also STD0030)
0858 **Telnet Suppress Go Ahead Option** J. Postel, J.K. Reynolds [May-01-1983] (TXT = 3825 bytes)(Obsoletes NIC 15392) (Also STD0029)
0857 **Telnet Echo Option** J. Postel, J.K. Reynolds [May-01-1983] (TXT = 11143 bytes)(Obsoletes NIC 15390) (Also STD0028)
0856 **Telnet Binary Transmission** J. Postel, J.K. Reynolds [May-01-1983] (TXT = 9192 bytes)(Obsoletes NIC 15389) (Also STD0027)
0855 **Telnet Option Specifications** J. Postel, J.K. Reynolds [May-01-1983] (TXT = 6218 bytes)(Obsoletes NIC 18640) (Also STD0008)
0854 **Telnet Protocol Specification** J. Postel, J.K. Reynolds [May-01-1983] (TXT = 39371 bytes)(Obsoletes RFC0764) (Also STD0008)
0853 **Not Issued** [ ] (= 28 bytes)
0852 **ARPANET short blocking feature** A.G. Malis [Apr-01-1983] (TXT = 17151 bytes)
0851 **ARPANET 1822L Host Access Protocol** A.G. Malis [Apr-18-1983] (TXT = 72042 bytes)(Obsoletes RFC0802) (Obsoleted by RFC0878)
0850 **Standard for interchange of USENET messages** M.R. Horton [Jun-01-1983] (TXT = 43871 bytes)(Obsoleted by RFC1036)
0849 **Suggestions for improved host table distribution** M.R. Crispin [May-01-1983] (TXT = 5178 bytes)
0848 **Who provides the "little" TCP services?** D. Smallberg [Mar-14-1983] (TXT = 10985 bytes)
0847 **Summary of Smallberg surveys** D. Smallberg, A. Westine, J. Postel [Feb-01-1983] (TXT = 3789 bytes)(Obsoletes RFC0846)
0846 **Who talks TCP? - survey of 22 February 1983** D. Smallberg [Feb-23-1983] (TXT = 45597 bytes)(Obsoletes RFC0845) (Obsoleted by RFC0847)
0845 **Who talks TCP? - survey of 15 February 1983** D. Smallberg [Feb-17-1983] (TXT = 45983 bytes)(Obsoletes RFC0843) (Obsoleted by RFC0846)
0844 **Who talks ICMP, too? - Survey of 18 February 1983** R. Clements [Feb-18-1983] (TXT = 9078 bytes)(Updates RFC0843)
0843 **Who talks TCP? - survey of 8 February 83** D. Smallberg [Feb-09-1983] (TXT = 46193 bytes)(Obsoletes RFC0842) (Obsoleted by RFC0845) (Updated by RFC0844)
0842 **Who talks TCP? - survey of 1 February 83** D. Smallberg [Feb-03-1983] (TXT = 45962 bytes)(Obsoletes RFC0839) (Obsoleted by RFC0843)
0841 **Specification for message format for Computer Based Message Systems** National Bureau of Standards [Jan-27-1983] (TXT = 231871 bytes)(Obsoletes RFC0806)
0840 **Official protocols** J. Postel [Apr-13-1983] (TXT = 33534 bytes)(Obsoleted by RFC0880)
0839 **Who talks TCP?** D. Smallberg [Jan-26-1983] (TXT = 45175 bytes)(Obsoletes RFC0838) (Obsoleted by RFC0842)
0838 **Who talks TCP?** D. Smallberg [Jan-20-1983] (TXT = 45033 bytes)(Obsoletes RFC0837) (Obsoleted by RFC0839)
0837 **Who talks TCP?** D. Smallberg [Jan-12-1983] (TXT = 44864 bytes)(Obsoletes RFC0836) (Obsoleted by RFC0838)
0836 **Who talks TCP?** D. Smallberg [Jan-05-1983] (TXT = 43643 bytes)(Obsoletes RFC0835) (Obsoleted by RFC0837)
0835 **Who talks TCP?** D. Smallberg [Dec-29-1982] (TXT = 42959 bytes)(Obsoletes RFC0834) (Obsoleted by RFC0836)
0834 **Who talks TCP?** D. Smallberg [Dec-22-1982] (TXT = 42764 bytes)(Obsoletes RFC0833) (Obsoleted by RFC0835)
0833 **Who talks TCP?** D. Smallberg [Dec-14-1982] (TXT = 42973 bytes)(Obsoletes RFC0832) (Obsoleted by RFC0834)
0832 **Who talks TCP?** D. Smallberg [Dec-07-1982] (TXT = 42751 bytes)(Obsoleted by RFC0833)
0831 **Backup access to the European side of SATNET** R.T. Braden [Dec-01-1982] (TXT = 11735 bytes)
0830 **Distributed system for Internet name service** Z. Su [Oct-01-1982] (TXT = 31597 bytes)
0829 **Packet satellite technology reference sources** V.G. Cerf [Nov-01-1982] (TXT = 10919 bytes)
0828 **Data communications: IFIP's international "network" of experts** K. Owen [Aug-01-1982] (TXT = 29922 bytes)
0827 **Exterior Gateway Protocol (EGP)** E.C. Rosen [Oct-01-1982] (TXT = 68436 bytes)(Updated by RFC0904)
0826 **Ethernet Address Resolution Protocol: Or converting network protocol addresses to 48.bit Ethernet address for transmission on Ethernet hardware** D.C. Plummer [Nov-01-1982] (TXT = 22026 bytes)(Also STD0037)
0825 **Request for comments on Requests For Comments** J. Postel [Nov-01-1982] (TXT = 4255 bytes)(Obsoleted by RFC1111 ,RFC1543 ,RFC2223)
0824 **CRONUS Virtual Local Network** W.I. MacGregor, D.C. Tappan [Aug-25-1982] (TXT = 58732 bytes)
0823 **DARPA Internet gateway** R.M. Hinden, A. Sheltzer [Sep-01-1982] (TXT = 62620 bytes)(Updates IEN IEN 109, IEN 30) , IEN IEN 109, IEN 30))
0822 **Standard for the format of ARPA Internet text messages** D. Crocker [Aug-13-1982] (TXT = 109200 bytes)(Obsoletes RFC0733) (Obsoleted by RFC2822) (Updated by

0822 **Standard for the format of ARPA Internet text messages** D. Crocker [Aug-13-1982] (TXT = 109200 bytes)(Obsoletes RFC0733) (Obsoleted by RFC2822) (Updated by RFC1123 ,RFC1138 ,RFC1148 ,RFC1327 ,RFC2156)

0821 **Simple Mail Transfer Protocol** J. Postel [Aug-01-1982] (TXT = 124482 bytes)(Obsoletes RFC0788) (Obsoleted by RFC2821)

0820 **Assigned numbers** J. Postel [Aug-14-1982] (TXT = 54213 bytes)(Obsoletes RFC0790) (Obsoleted by RFC0870)

0819 **Domain naming convention for Internet user applications** Z. Su, J. Postel [Aug-01-1982] (TXT = 35314 bytes)

0818 **Remote User Telnet service** J. Postel [Nov-01-1982] (TXT = 3693 bytes)

0817 **Modularity and efficiency in protocol implementation** D.D. Clark [Jul-01-1982] (TXT = 45931 bytes)

0816 **Fault isolation and recovery** D.D. Clark [Jul-01-1982] (TXT = 20106 bytes)

0815 **IP datagram reassembly algorithms** D.D. Clark [Jul-01-1982] (TXT = 14575 bytes)

0814 **Name, addresses, ports, and routes** D.D. Clark [Jul-01-1982] (TXT = 24663 bytes)

0813 **Window and Acknowledgement Strategy in TCP** D.D. Clark [Jul-01-1982] (TXT = 38110 bytes)

0812 **NICNAME/WHOIS** K. Harrenstien, V. White [Mar-01-1982] (TXT = 5389 bytes)(Obsoleted by RFC0954)

0811 **Hostnames Server** K. Harrenstien, V. White, E.J. Feinler [Mar-01-1982] (TXT = 7771 bytes)(Obsoleted by RFC0953)

0810 **DoD Internet host table specification** E.J. Feinler, K. Harrenstien, Z. Su, V. White [Mar-01-1982] (TXT = 14196 bytes)(Obsoletes RFC0608) (Obsoleted by RFC0952)

0809 **UCL facsimile system** T. Chang [Feb-01-1982] (TXT = 171153 bytes)

0808 **Summary of computer mail services meeting held at BBN on 10 January 1979** J. Postel [Mar-01-1982] (TXT = 15930 bytes)

0807 **Multimedia mail meeting notes** J. Postel [Feb-09-1982] (TXT = 11633 bytes)

0806 **Proposed Federal Information Processing Standard: Specification for message format for computer based message systems** National Bureau of Standards [Sep-01-1981] (TXT = 216377 bytes)(Obsoleted by RFC0841)

0805 **Computer mail meeting notes** J. Postel [Feb-08-1982] (TXT = 12522 bytes)

0804 **CCITT draft recommendation T.4** International Telegraph and Telephone Consultative Committee of the International Telecommunication Union [Jan-01-1981] (TXT = 17025 bytes)

0803 **Dacom 450/500 facsimile data transcoding** A. Agarwal, M.J. O'Connor, D.L. Mills [Nov-02-1981] (TXT = 33826 bytes)

0802 **ARPANET 1822L Host Access Protocol** A.G. Malis [Nov-01-1981] (TXT = 62470 bytes)(Obsoleted by RFC0851)

0801 **NCP/TCP transition plan** J. Postel [Nov-01-1981] (TXT = 42041 bytes)

0800 **Request For Comments summary notes: 700-799** J. Postel, J. Vernon [Nov-01-1982] (TXT = 18354 bytes)

0799 **Internet name domains** D.L. Mills [Sep-01-1981] (TXT = 13896 bytes)

0798 **Decoding facsimile data from the Rapicom 450** A.R. Katz [Sep-01-1981] (TXT = 38867 bytes)

0797 **Format for Bitmap files** A.R. Katz [Sep-01-1981] (TXT = 3067 bytes)

0796 **Address mappings** J. Postel [Sep-01-1981] (TXT = 11239 bytes)(Obsoletes IEN 115)

0795 **Service mappings** J. Postel [Sep-01-1981] (TXT = 5228 bytes)

0794 **Pre-emption** V.G. Cerf [Sep-01-1981] (TXT = 5906 bytes)(Updates IEN 125)

0793 **Transmission Control Protocol** J. Postel [Sep-01-1981] (TXT = 172710 bytes)(Also STD0007)

0792 **Internet Control Message Protocol** J. Postel [Sep-01-1981] (TXT = 30404 bytes)(Obsoletes RFC0777) (Updated by RFC0950) (Also STD0005)

0791 **Internet Protocol** J. Postel [Sep-01-1981] (TXT = 97779 bytes)(Obsoletes RFC0760) (Also STD0005)

0790 **Assigned numbers** J. Postel [Sep-01-1981] (TXT = 35316 bytes)(Obsoletes RFC0776) (Obsoleted by RFC0820)

0789 **Vulnerabilities of network control protocols: An example** E.C. Rosen [Jul-01-1981] (TXT = 25541 bytes)

0788 **Simple Mail Transfer Protocol** J. Postel [Nov-01-1981] (TXT = 109001 bytes)(Obsoletes RFC0780) (Obsoleted by RFC0821)

0787 **Connectionless data transmission survey/tutorial** A.L. Chapin [Jul-01-1981] (TXT = 84265 bytes)

0786 **Mail Transfer Protocol: ISI TOPS20 MTP-NIMAIL interface** S. Sluizer, J. Postel [Jul-01-1981] (TXT = 3129 bytes)

0785 **Mail Transfer Protocol: ISI TOPS20 file definitions** S. Sluizer, J. Postel [Jul-01-1981] (TXT = 7032 bytes)

0784 **Mail Transfer Protocol: ISI TOPS20 implementation** S. Sluizer, J. Postel [Jul-01-1981] (TXT = 5856 bytes)

0783 **TFTP Protocol (revision 2)** K.R. Sollins [Jun-01-1981] (TXT = 23522 bytes)(Obsoletes IEN 133) (Obsoleted by RFC1350)

0782 **Virtual Terminal management model** J. Nabielsky, A.P. Skelton [Jan-01-1981] (TXT = 43589 bytes)

0781 **Specification of the Internet Protocol (IP) timestamp option** Z. Su [May-01-1981] (TXT = 4002 bytes)

0780 **Mail Transfer Protocol** S. Sluizer, J. Postel [May-01-1981] (TXT = 80352 bytes)(Obsoletes RFC0772) (Obsoleted by RFC0788)

0779 **Telnet send-location option** E. Killian [Apr-01-1981] (TXT = 2564 bytes)

0778 **DCNET Internet Clock Service** D.L. Mills [Apr-18-1981] (TXT = 9464 bytes)

0777 **Internet Control Message Protocol** J. Postel [Apr-01-1981] (TXT = 19407 bytes)(Obsoleted by RFC0792) (Updates RFC0760)

0776 **Assigned numbers** J. Postel [Jan-01-1981] (TXT = 30311 bytes)(Obsoletes RFC0770) (Obsoleted by RFC0790)

0775 **Directory oriented FTP commands** D. Mankins, D. Franklin, A.D. Owen [Dec-01-1980] (TXT = 9511 bytes)

0774 **Internet Protocol Handbook: Table of contents** J. Postel [Oct-01-1980] (TXT = 3452 bytes)(Obsoletes RFC0766)

0773 **Comments on NCP/TCP mail service transition strategy** V.G. Cerf [Oct-01-1980] (TXT = 22181 bytes)

0772 **Mail Transfer Protocol** S. Sluizer, J. Postel [Sep-01-1980] (TXT = 61061 bytes)(Obsoleted by RFC0780)

0771 **Mail transition plan** V.G. Cerf, J. Postel [Sep-01-1980] (TXT = 18623 bytes)

0770 **Assigned numbers** J. Postel [Sep-01-1980] (TXT = 26248 bytes)(Obsoletes RFC0762) (Obsoleted by RFC0776)

0769 **Rapicom 450 facsimile file format** J. Postel [Sep-26-1980] (TXT = 4079 bytes)

0768 **User Datagram Protocol** J. Postel [Aug-28-1980] (TXT = 5896 bytes)(Also STD0006)

0767 **Structured format for transmission of multi-media documents** J. Postel [Aug-01-1980] (TXT = 59971 bytes)

0766 **Internet Protocol Handbook: Table of contents** J. Postel [Jul-01-1980] (TXT = 3465 bytes)(Obsoleted by RFC0774)

0765 **File Transfer Protocol specification** J. Postel [Jun-01-1980] (TXT = 146641 bytes)(Obsoletes RFC0542) (Obsoleted by RFC0959)

0764 **Telnet Protocol specification** J. Postel [Jun-01-1980] (TXT = 40005 bytes)(Obsoleted by RFC0854)

0763 **Role mailboxes** M.D. Abrams [May-07-1980] (TXT = 942 bytes)

0762 **Assigned numbers** J. Postel [Jan-01-1980] (TXT = 24668 bytes)(Obsoletes RFC0758) (Obsoleted by RFC0770)

0761 **DoD standard Transmission Control Protocol** J. Postel [Jan-01-1980] (TXT = 167049 bytes)

0760 **DoD standard Internet Protocol** J. Postel [Jan-01-1980] (TXT = 81507 bytes)(Obsoletes IEN 123) (Obsoleted by RFC0791) (Updated by RFC0777)

0759 **Internet Message Protocol** J. Postel [Aug-01-1980] (TXT = 123606 bytes)

0758 **Assigned numbers** J. Postel [Aug-01-1979] (TXT = 22911 bytes)(Obsoletes RFC0755) (Obsoleted by RFC0762)

0757 **Suggested solution to the naming, addressing, and delivery problem for ARPANET message systems** D.P. Deutsch [Sep-10-1979] (TXT = 35618 bytes)

0756 **NIC name server - a datagram-based information utility** J.R. Pickens, E.J. Feinler, J.E. Mathis [Jul-01-1979] (TXT = 23491 bytes)

0755 **Assigned numbers** J. Postel [May-03-1979] (TXT = 22039 bytes)(Obsoletes RFC0750) (Obsoleted by RFC0758)

0754 **Out-of-net host addresses for mail** J. Postel [Apr-06-1979] (TXT = 19212 bytes)
0753 **Internet Message Protocol** J. Postel [Mar-01-1979] (TXT = 93363 bytes)
0752 **Universal host table** M.R. Crispin [Jan-02-1979] (TXT = 33793 bytes)
0751 **Survey of FTP mail and MLFL** P.D. Lebling [Dec-10-1978] (TXT = 10069 bytes)
0750 **Assigned numbers** J. Postel [Sep-26-1978] (TXT = 19979 bytes)(Obsoletes RFC0739) (Obsoleted by RFC0755)
0749 **Telnet SUPDUP-Output option** B. Greenberg [Sep-18-1978] (TXT = 8933 bytes)
0748 **Telnet randomly-lose option** M.R. Crispin [Apr-01-1978] (TXT = 2741 bytes)
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0744 **MARS - a Message Archiving and Retrieval Service** J. Sattley [Jan-08-1978] (TXT = 10984 bytes)
0743 **FTP extension: XRSQ/XRCP** K. Harrenstien [Dec-30-1977] (TXT = 16249 bytes)
0742 **NAME/FINGER Protocol** K. Harrenstien [Dec-30-1977] (TXT = 12321 bytes)(Obsoleted by RFC1288 ,RFC1196 ,RFC1194)
0741 **Specifications for the Network Voice Protocol (NVP)** D. Cohen [Nov-22-1977] (TXT = 57581 bytes)
0740 **NETRJS Protocol** R.T. Braden [Nov-22-1977] (TXT = 38833 bytes)(Obsoletes RFC0599)
0739 **Assigned numbers** J. Postel [Nov-11-1977] (TXT = 16346 bytes)(Obsoletes RFC0604 ,RFC0503)(Obsoleted by RFC0750)
0738 **Time server** K. Harrenstien [Oct-31-1977] (TXT = 1851 bytes)
0737 **FTP extension: XSEN** K. Harrenstien [Oct-31-1977] (TXT = 2127 bytes)
0736 **Telnet SUPDUP option** M.R. Crispin [Oct-31-1977] (TXT = 3081 bytes)
0735 **Revised Telnet byte macro option** D. Crocker, R.H. Gumpertz [Nov-03-1977] (TXT = 10585 bytes)(Obsoletes RFC0729)
0734 **SUPDUP Protocol** M.R. Crispin [Oct-07-1977] (TXT = 33256 bytes)
0733 **Standard for the format of ARPA network text messages** D. Crocker, J. Vittal, K.T. Pogran, D.A. Henderson [Nov-21-1977] (TXT = 73006 bytes)(Obsoletes RFC0724) (Obsoleted by RFC0822)
0732 **Telnet Data Entry Terminal option** J.D. Day [Sep-12-1977] (TXT = 57160 bytes)(Obsoletes RFC0731) (Updated by RFC1043)
0731 **Telnet Data Entry Terminal option** J.D. Day [Jun-27-1977] (TXT = 61648 bytes)(Obsoleted by RFC0732)
0730 **Extensible field addressing** J. Postel [May-20-1977] (TXT = 9519 bytes)
0729 **Telnet byte macro option** D. Crocker [May-13-1977] (TXT = 6509 bytes)(Obsoleted by RFC0735)
0728 **Minor pitfall in the Telnet Protocol** J.D. Day [Apr-27-1977] (TXT = 2224 bytes)
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0725 **RJE protocol for a resource sharing network** J.D. Day, G.R. Grossman [Mar-01-1977] (TXT = 44025 bytes)
0724 **Proposed official standard for the format of ARPA Network messages** D. Crocker, K.T. Pogran, J. Vittal, D.A. Henderson [May-12-1977] (TXT = 75554 bytes) (Obsoleted by RFC0733)
0723 **Not Issued** [ ] (= 29 bytes)
0722 **Thoughts on Interactions in Distributed Services** J. Haverty [Sep-16-1976] (TXT = 29478 bytes)
0721 **Out-of-Band Control Signals in a Host-to-Host Protocol** L.L. Garlick [Sep-01-1976] (TXT = 13566 bytes)
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0719 **Discussion on RCTE** J. Postel [Jul-22-1976] (TXT = 4708 bytes)
0718 **Comments on RCTE from the Tenex Implementation Experience** J. Postel [Jun-30-1976] (TXT = 3829 bytes)
0717 **Assigned Network Numbers** J. Postel [Jul-01-1976] (TXT = 2322 bytes)
0716 **Interim Revision to Appendix F of BBN 1822** D.C. Walden, J. Levin [May-24-1976] (TXT = 3345 bytes)
0715 **Not Issued** [ ] (= 27 bytes)
0714 **Host-Host Protocol for an ARPANET-Type Network** A.M. McKenzie [Apr-21-1976]
0713 **MSDTP-Message Services Data Transmission Protocol** J. Haverty [Apr-06-1976] (TXT = 41175 bytes)
0712 **Distributed Capability Computing System (DCCS)** J.E. Donnelley [Feb-05-1976]
0711 **Not Issued** [ ] (= 27 bytes)
0710 **Not Issued** [ ] (= 27 bytes)
0709 **Not Issued** [ ] (= 27 bytes)
0708 **Elements of a Distributed Programming System** J.E. White [Jan-28-1976] (TXT = 57888 bytes)
0707 **High-level framework for network-based resource sharing** J.E. White [Dec-23-1975] (TXT = 57254 bytes)
0706 **On the junk mail problem** J. Postel [Nov-08-1975] (TXT = 2085 bytes)
0705 **Front-end Protocol B6700 version** R.F. Bryan [Nov-05-1975] (TXT = 70998 bytes)
0704 **IMP/Host and Host/IMP Protocol change** P.J. Santos [Sep-15-1975] (TXT = 7504 bytes)(Obsoletes RFC0687)
0703 **July, 1975, survey of New-Protocol Telnet Servers** D.W. Dodds [Jul-11-1975] (TXT = 5691 bytes)
0702 **September, 1974, survey of New-Protocol Telnet servers** D.W. Dodds [Sep-25-1974] (TXT = 5386 bytes)
0701 **August, 1974, survey of New-Protocol Telnet servers** D.W. Dodds [Aug-01-1974] (TXT = 3549 bytes)
0700 **Protocol experiment** E. Mader, W.W. Plummer, R.S. Tomlinson [Aug-01-1974] (TXT = 14600 bytes)
0699 **Request For Comments summary notes: 600-699** J. Postel, J. Vernon [Nov-01-1982] (TXT = 14688 bytes)
0698 **Telnet extended ASCII option** T. Mock [Jul-23-1975] (TXT = 5086 bytes)
0697 **CWD command of FTP** J. Lieb [Jul-14-1975] (TXT = 3047 bytes)
0696 **Comments on the IMP/Host and Host/IMP Protocol changes** V.G. Cerf [Jul-13-1975]
0695 **Official change in Host-Host Protocol** M. Krilanovich [Jul-05-1975] (TXT = 3425 bytes)
0694 **Protocol information** J. Postel [Jun-18-1975]
0692 **Comments on IMP/Host Protocol changes (RFCs 687 and 690)** S.M. Wolfe [Jun-20-1975] (TXT = 2681 bytes)(Updates RFC0690)
0691 **One more try on the FTP** B. Harvey [Jun-06-1975] (TXT = 32821 bytes)
0690 **Comments on the proposed Host/IMP Protocol changes** J. Postel [Jun-06-1975] (TXT = 7215 bytes)(Updates RFC0687) (Updated by RFC0692)
0689 **Tenex NCP finite state machine for connections** R. Clements [May-23-1975] (TXT = 13101 bytes)
0688 **Tentative schedule for the new Telnet implementation for the TIP** D.C. Walden [Jun-04-1975] (TXT = 1593 bytes)
0687 **IMP/Host and Host/IMP Protocol changes** D.C. Walden [Jun-02-1975] (TXT = 6013 bytes)(Obsoleted by RFC0704) (Updated by RFC0690)
0686 **Leaving well enough alone** B. Harvey [May-10-1975] (TXT = 24605 bytes)
0685 **Response time in cross network debugging** M. Beeler [Apr-16-1975] (TXT = 6914 bytes)

0684 **Commentary on procedure calling as a network protocol** R. Schantz [Apr-15-1975] (TXT = 21164 bytes)
0683 **FTPSRV - Tenex extension for paged files** R. Clements [Apr-03-1975] (TXT = 8806 bytes)(Updates RFC0354)
0681 **Network UNIX** S. Holmgren [Mar-18-1975] (TXT = 18874 bytes)
0680 **Message Transmission Protocol** T.H. Myer, D.A. Henderson [Apr-30-1975] (Updates RFC0561)
0679 **February, 1975, survey of New-Protocol Telnet servers** D.W. Dodds [Feb-21-1975]
0678 **Standard file formats** J. Postel [Dec-19-1974] (TXT = 12393 bytes)
0677 **Maintenance of duplicate databases** P.R. Johnson, R. Thomas [Jan-27-1975] (TXT = 22990 bytes)
0675 **Specification of Internet Transmission Control Program** V. Cerf, Y. Dalal, C. Sunshine [Dec-01-1974] (TXT = 156874 bytes)
0674 **Procedure call documents: Version 2** J. Postel, J.E. White [Dec-12-1974] (TXT = 12178 bytes)
0672 **Multi-site data collection facility** R. Schantz [Dec-06-1974] (TXT = 25736 bytes)
0671 **Note on Reconnection Protocol** R. Schantz [Dec-06-1974]
0669 **November, 1974, survey of New-Protocol Telnet servers** D.W. Dodds [Dec-04-1974]
0667 **BBN host ports** S.G. Chipman [Dec-17-1974]
0666 **Specification of the Unified User-Level Protocol** M.A. Padlipsky [Nov-26-1974]
0663 **Lost message detection and recovery protocol** R. Kanodia [Nov-29-1974] (TXT = 44702 bytes)
0662 **Performance improvement in ARPANET file transfers from Multics** R. Kanodia [Nov-26-1974] (TXT = 8872 bytes)
0661 **Protocol information** J. Postel [Nov-23-1974]
0660 **Some changes to the IMP and the IMP/Host interface** D.C. Walden [Oct-23-1974] (TXT = 4991 bytes)
0659 **Announcing additional Telnet options** J. Postel [Oct-18-1974]
0658 **Telnet output linefeed disposition** D. Crocker [Oct-25-1974] (TXT = 6484 bytes)
0657 **Telnet output vertical tab disposition option** D. Crocker [Oct-25-1974] (TXT = 5759 bytes)
0656 **Telnet output vertical tabstops option** D. Crocker [Oct-25-1974] (TXT = 4858 bytes)
0655 **Telnet output formfeed disposition option** D. Crocker [Oct-25-1974] (TXT = 5991 bytes)
0654 **Telnet output horizontal tab disposition option** D. Crocker [Oct-25-1974] (TXT = 6158 bytes)
0653 **Telnet output horizontal tabstops option** D. Crocker [Oct-25-1974] (TXT = 4694 bytes)
0652 **Telnet output carriage-return disposition option** D. Crocker [Oct-25-1974] (TXT = 7003 bytes)
0651 **Revised Telnet status option** D. Crocker [Oct-25-1974] (TXT = 4360 bytes)(Obsoleted by RFC0859)
0647 **Proposed protocol for connecting host computers to ARPA-like networks via front end processors** M.A. Padlipsky [Nov-12-1974]
0645 **Network Standard Data Specification syntax** D. Crocker [Jun-26-1974]
0644 **On the problem of signature authentication for network mail** R. Thomas [Jul-22-1974] (TXT = 9501 bytes)
0643 **Network Debugging Protocol** E. Mader [Jul-01-1974] (TXT = 12563 bytes)
0642 **Ready line philosophy and implementation** J.D. Burchfiel [Jul-05-1974] (TXT = 8414 bytes)
0640 **Revised FTP reply codes** J. Postel [Jun-19-1974] (TXT = 39670 bytes)(Updates RFC0542)
0638 **IMP/TIP preventive maintenance schedule** A.M. McKenzie [Apr-25-1974] (TXT = 4088 bytes)(Obsoletes RFC0633)
0637 **Change of network address for SU-DSL** A.M. McKenzie [Apr-23-1974] (TXT = 916 bytes)
0636 **TIP/Tenex reliability improvements** J.D. Burchfiel, B. Cosell, R.S. Tomlinson, D.C. Walden [Jun-10-1974] (TXT = 19914 bytes)
0635 **Assessment of ARPANET protocols** V. Cerf [Apr-22-1974]
0634 **Change in network address for Haskins Lab** A.M. McKenzie [Apr-10-1974] (TXT = 1098 bytes)
0633 **IMP/TIP preventive maintenance schedule** A.M. McKenzie [Mar-18-1974] (TXT = 3733 bytes)(Obsoleted by RFC0638)
0632 **Throughput degradations for single packet messages** H. Opderbeck [May-20-1974] (TXT = 14563 bytes)
0631 **International meeting on minicomputers and data communication: Call for papers** A. Danthine [Apr-17-1974] (TXT = 2707 bytes)
0630 **FTP error code usage for more reliable mail service** J. Sussmann [Apr-10-1974] (TXT = 4070 bytes)
0629 **Scenario for using the Network Journal** J.B. North [Mar-27-1974] (TXT = 4504 bytes)
0628 **Status of RFC numbers and a note on pre-assigned journal numbers** M.L. Keeney [Mar-27-1974] (TXT = 1036 bytes)
0627 **ASCII text file of hostnames** M.D. Kudlick, E.J. Feinler [Mar-25-1974] (TXT = 2007 bytes)
0626 **On a possible lockup condition in IMP subnet due to message sequencing** L. Kleinrock, H. Opderbeck [Mar-14-1974] (TXT = 13150 bytes)
0625 **On-line hostnames service** M.D. Kudlick, E.J. Feinler [Mar-07-1974] (TXT = 2172 bytes)
0624 **Comments on the File Transfer Protocol** M. Krilanovich, G. Gregg, W. Hathaway, J.E. White [Feb-28-1974] (TXT = 10105 bytes)(Obsoletes RFC0607)
0623 **Comments on on-line host name service** M. Krilanovich [Feb-22-1974] (TXT = 3740 bytes)
0622 **Scheduling IMP/TIP down time** A.M. McKenzie [Mar-13-1974] (TXT = 4367 bytes)
0621 **NIC user directories at SRI ARC** M.D. Kudlick [Mar-06-1974] (TXT = 1351 bytes)
0620 **Request for monitor host table updates** B. Ferguson [Mar-01-1974] (TXT = 1950 bytes)
0619 **Mean round-trip times in the ARPANET** W. Naylor, H. Opderbeck [Mar-07-1974] (TXT = 30946 bytes)
0618 **Few observations on NCP statistics** E.A. Taft [Feb-19-1974] (TXT = 4929 bytes)
0617 **Note on socket number assignment** E.A. Taft [Feb-19-1974] (TXT = 8062 bytes)
0616 **Latest network maps** D.C. Walden [Feb-11-1973]
0615 **Proposed Network Standard Data Pathname syntax** D. Crocker [Mar-01-1974] (TXT = 9448 bytes)
0614 **Response to RFC 607: "Comments on the File Transfer Protocol"** K.T. Pogran, N. Neigus [Jan-28-1974] (TXT = 11409 bytes)(Updates RFC0542 ,RFC0607)
0613 **Network connectivity: A response to RFC 603** A.M. McKenzie [Jan-21-1974] (TXT = 2557 bytes)(Updates RFC0603)
0612 **Traffic statistics (December 1973)** A.M. McKenzie [Jan-16-1974] (TXT = 9667 bytes)
0611 **Two changes to the IMP/Host Protocol to improve user/network communications** D.C. Walden [Feb-14-1974] (TXT = 7481 bytes)
0610 **Further datalanguage design concepts** R. Winter, J. Hill, W. Greiff [Dec-15-1973] (TXT = 198692 bytes)
0609 **Statement of upcoming move of NIC/NLS service** B. Ferguson [Jan-10-1974] (TXT = 1260 bytes)
0608 **Host names on-line** M.D. Kudlick [Jan-10-1974] (TXT = 7010 bytes)(Obsoleted by RFC0810)
0607 **Comments on the File Transfer Protocol** M. Krilanovich, G. Gregg [Jan-07-1974] (TXT = 8652 bytes)(Obsoleted by RFC0624) (Updated by RFC0614)
0606 **Host names on-line** L.P. Deutsch [Dec-29-1973] (TXT = 6855 bytes)
0604 **Assigned link numbers** J. Postel [Dec-26-1973] (TXT = 2758 bytes)(Obsoletes RFC0317) (Obsoleted by RFC0739)
0603 **Response to RFC 597: Host status** J.D. Burchfiel [Dec-31-1973] (TXT = 1482 bytes)(Updates RFC0597) (Updated by RFC0613)
0602 **"The stockings were hung by the chimney with care"** R.M. Metcalfe [Dec-27-1973] (TXT = 1988 bytes)
0601 **Traffic statistics (November 1973)** A.M. McKenzie [Dec-14-1973] (TXT = 9100 bytes)

0600 **Interfacing an Illinois plasma terminal to the ARPANET** A. Berggreen [Nov-26-1973]
0599 **Update on NETRJS** R.T. Braden [Dec-13-1973] (TXT = 16590 bytes)(Obsoletes RFC0189) (Obsoleted by RFC0740)
0598 **RFC index - December 5, 1973** Network Information Center. Stanford Research Institute [Dec-05-1973]
0597 **Host status** N. Neigus, E.J. Feinler [Dec-12-1973] (TXT = 11678 bytes)(Updated by RFC0603)
0596 **Second thoughts on Telnet Go-Ahead** E.A. Taft [Dec-08-1973] (TXT = 11919 bytes)
0595 **Second thoughts in defense of the Telnet Go-Ahead** W. Hathaway [Dec-12-1973] (TXT = 13507 bytes)
0594 **Speedup of Host-IMP interface** J.D. Burchfiel [Dec-10-1973]
0593 **Telnet and FTP implementation schedule change** A.M. McKenzie, J. Postel [Nov-29-1973] (TXT = 2506 bytes)
0592 **Some thoughts on system design to facilitate resource sharing** R.W. Watson [Nov-20-1973]
0591 **Addition to the Very Distant Host specifications** D.C. Walden [Nov-29-1973] (TXT = 901 bytes)
0590 **MULTICS address change** M.A. Padlipsky [Nov-19-1973]
0589 **CCN NETRJS server messages to remote user** R.T. Braden [Nov-26-1973] (TXT = 7998 bytes)
0588 **London node is now up** A.V. Stokes [Oct-29-1973]
0587 **Announcing new Telnet options** J. Postel [Nov-13-1973]
0586 **Traffic statistics (October 1973)** A.M. McKenzie [Nov-08-1973]
0585 **ARPANET users interest working group meeting** D. Crocker, N. Neigus, E.J. Feinler, J. Iseli [Nov-06-1973] (TXT = 18243 bytes)
0584 **Charter for ARPANET Users Interest Working Group** J. Iseli, D. Crocker, N. Neigus [Nov-06-1973] (TXT = 3461 bytes)
0582 **Comments on RFC 580: Machine readable protocols** R. Clements [Nov-05-1973] (Updates RFC0580)
0581 **Corrections to RFC 560: Remote Controlled Transmission and Echoing Telnet Option** D. Crocker, J. Postel [Nov-02-1973]
0580 **Note to Protocol Designers and Implementers** J. Postel [Oct-25-1973] (TXT = 1451 bytes)(Updated by RFC0582)
0579 **Traffic statistics (September 1973)** A.M. McKenzie [Nov-26-1973]
0578 **Using MIT-Mathlab MACSYMA from MIT-DMS Muddle** A.K. Bhushan, N.D. Ryan [Oct-29-1973]
0577 **Mail priority** D. Crocker [Oct-18-1973]
0576 **Proposal for modifying linking** K. Victor [Sep-26-1973]
0574 **Announcement of a mail facility at UCSB** M. Krilanovich [Sep-26-1973]
0573 **Data and file transfer: Some measurement results** A.K. Bhushan [Sep-14-1973]
0571 **Tenex FTP problem** R.T. Braden [Nov-15-1973]
0570 **Experimental input mapping between NVT ASCII and UCSB On Line System** J.R. Pickens [Oct-30-1973]
0569 **NETED: A Common Editor for the ARPA Network** M.A. Padlipsky [Oct-15-1973] (TXT = 17717 bytes)
0568 **Response to RFC 567 - cross country network bandwidth** J.M. McQuillan [Sep-18-1973] (TXT = 3244 bytes)(Updates RFC0567)
0567 **Cross Country Network Bandwidth** L.P. Deutsch [Sep-06-1973] (TXT = 1529 bytes)(Updated by RFC0568)
0566 **Traffic statistics (August 1973)** A.M. McKenzie [Sep-04-1973]
0565 **Storing network survey data at the datacomputer** D. Cantor [Aug-28-1973]
0563 **Comments on the RCTE Telnet option** J. Davidson [Aug-28-1973]
0562 **Modifications to the Telnet specification** A.M. McKenzie [Aug-28-1973]
0561 **Standardizing Network Mail Headers** A.K. Bhushan, K.T. Pogran, R.S. Tomlinson, J.E. White [Sep-05-1973] (TXT = 6159 bytes)(Updated by RFC0680)
0560 **Remote Controlled Transmission and Echoing Telnet option** D. Crocker, J. Postel [Aug-18-1973]
0559 **Comments on The New Telnet Protocol and its Implementation** A.K. Bhushan [Aug-15-1973] (TXT = 10643 bytes)
0557 **Revelations in network host measurements** B.D. Wessler [Aug-30-1973]
0556 **Traffic statistics (July 1973)** A.M. McKenzie [Aug-13-1973]
0555 **Responses to critiques of the proposed mail protocol** J.E. White [Jul-30-1973] (TXT = 21521 bytes)
0553 **Draft design for a text/graphics protocol** C.H. Irby, K. Victor [Jul-14-1973]
0552 **Single access to standard protocols** A.D. Owen [Jul-13-1973] (TXT = 1404 bytes)
0550 **NIC NCP experiment** L.P. Deutsch [Aug-24-1973] (TXT = 3688 bytes)
0549 **Minutes of Network Graphics Group meeting, 15-17 July 1973** J.C. Michener [Jul-17-1973]
0548 **Hosts using the IMP Going Down message** D.C. Walden [Aug-16-1973] (TXT = 1435 bytes)
0547 **Change to the Very Distant Host specification** D.C. Walden [Aug-13-1973]
0546 **Tenex load averages for July 1973** R. Thomas [Aug-10-1973]
0545 **Of what quality be the UCSB resources evaluators?** J.R. Pickens [Jul-23-1973]
0544 **Locating on-line documentation at SRI-ARC** N.D. Meyer, K. Kelley [Jul-13-1973] (TXT = 1541 bytes)
0543 **Network journal submission and delivery** N.D. Meyer [Jul-24-1973]
0542 **File Transfer Protocol** N. Neigus [Aug-12-1973] (TXT = 100666 bytes)(Obsoletes RFC0354) (Obsoleted by RFC0765) (Updated by RFC0614 ,RFC0640)(Also RFC0454 ,RFC0495)
0539 **Thoughts on the mail protocol proposed in RFC 524** D. Crocker, J. Postel [Jul-07-1973] (TXT = 6213 bytes)
0538 **Traffic statistics (June 1973)** A.M. McKenzie [Jul-05-1973]
0537 **Announcement of NGG meeting July 16-17** S. Bunch [Jun-27-1973]
0535 **Comments on File Access Protocol** R. Thomas [Jul-25-1973]
0534 **Lost message detection** D.C. Walden [Jul-17-1973]
0533 **Message-ID numbers** D.C. Walden [Jul-17-1973] (TXT = 2102 bytes)
0532 **UCSD-CC Server-FTP facility** R.G. Merryman [Jul-12-1973]
0531 **Feast or famine? A response to two recent RFC's about network information** M.A. Padlipsky [Jun-26-1973] (TXT = 5070 bytes)
0530 **Report on the Survey project** A.K. Bhushan [Jun-22-1973]
0529 **Note on protocol synch sequences** A.M. McKenzie, R. Thomas, R.S. Tomlinson, K.T. Pogran [Jun-29-1973]
0528 **Software checksumming in the IMP and network reliability** J.M. McQuillan [Jun-20-1973]
0527 **ARPAWOCKY** D.L. Covill [May-01-1973] (TXT = 1857 bytes)
0526 **Technical meeting: Digital image processing software systems** W.K. Pratt [Jun-25-1973] (TXT = 4062 bytes)
0525 **MIT-MATHLAB meets UCSB-OLS -an example of resource sharing** W. Parrish, J.R. Pickens [Jun-01-1973]
0524 **Proposed Mail Protocol** J.E. White [Jun-13-1973]
0523 **SURVEY is in operation again** A.K. Bhushan [Jun-05-1973] (TXT = 2852 bytes)
0522 **Traffic statistics (May 1973)** A.M. McKenzie [Jun-05-1973]

0521 **Restricted use of IMP DDI** A.M. McKenzie [May-30-1973] (TXT = 3724 bytes)
0520 **Memo to FTP group: Proposal for File Access Protocol** J.D. Day [Jun-25-1973]
0519 **Resource evaluation** J.R. Pickens [Jun-01-1973]
0518 **ARPANET accounts** N. Vaughan, E.J. Feinler [Jun-19-1973]
0516 **Lost message detection** J. Postel [May-18-1973] (TXT = 4086 bytes)
0515 **Specifications for datalanguage: Version 0/9** R. Winter [Jun-06-1973]
0514 **Network make-work** W. Kantrowitz [Jun-05-1973]
0513 **Comments on the new Telnet specifications** W. Hathaway [May-30-1973] (TXT = 7980 bytes)
0512 **More on lost message detection** W. Hathaway [May-23-1973] (TXT = 3641 bytes)
0511 **Enterprise phone service to NIC from ARPANET sites** J.B. North [May-23-1973] (TXT = 4664 bytes)
0510 **Request for network mailbox addresses** J.E. White [May-30-1973]
0509 **Traffic statistics (April 1973)** A.M. McKenzie [Apr-07-1973]
0508 **Real-time data transmission on the ARPANET** L. Pfeifer, J. McAfee [May-07-1973]
0506 **FTP command naming problem** M.A. Padlipsky [Jun-26-1973] (TXT = 1974 bytes)
0505 **Two solutions to a file transfer access problem** M.A. Padlipsky [Jun-25-1973]
0504 **Distributed resources workshop announcement** R. Thomas [Apr-30-1973] (TXT = 9061 bytes)
0503 **Socket number list** N. Neigus, J. Postel [Apr-12-1973] (Obsoletes RFC0433) (Obsoleted by RFC0739)
0501 **Un-muddling "free file transfer"** K.T. Pogran [May-11-1973]
0500 **Integration of data management systems on a computer network** A. Shoshani, I. Spiegler [Apr-16-1973]
0499 **Harvard's network RJE** B.R. Reussow [Apr-01-1973]
0498 **On mail service to CCN** R.T. Braden [Apr-17-1973] (TXT = 5315 bytes)
0497 **Traffic statistics (March 1973)** A.M. McKenzie [Apr-10-1973]
0496 **TNLS quick reference card is available** M.F. Auerbach [Apr-05-1973] (TXT = 1110 bytes)
0495 **Telnet Protocol specifications** A.M. McKenzie [May-01-1973] (Obsoletes RFC0158)
0494 **Availability of MIX and MIXAL in the Network** D.C. Walden [Apr-20-1973]
0493 **Graphics Protocol** J.C. Michener, I.W. Cotton, K.C. Kelley, D.E. Liddle, E. Meyer [Apr-26-1973]
0492 **Response to RFC 467** E. Meyer [Apr-18-1973] (Updates RFC0467)
0491 **What is "Free"?** M.A. Padlipsky [Apr-12-1973]
0490 **Surrogate RJS for UCLA-CCN** J.R. Pickens [Mar-06-1973] (TXT = 9858 bytes)
0489 **Comment on resynchronization of connection status proposal** J. Postel [Mar-26-1973] (TXT = 2010 bytes)
0488 **NLS classes at network sites** M.F. Auerbach [Mar-23-1973] (TXT = 3806 bytes)
0487 **Free file transfer** R.D. Bressler [Apr-06-1973] (TXT = 3249 bytes)
0486 **Data transfer revisited** R.D. Bressler [Mar-20-1973] (TXT = 4664 bytes)
0485 **MIX and MIXAL at UCSB** J.R. Pickens [Mar-19-1973] (TXT = 2226 bytes)
0483 **Cancellation of the resource notebook framework meeting** M.D. Kudlick [Mar-14-1973] (TXT = 1021 bytes)
0482 **Traffic statistics (February 1973)** A.M. McKenzie [Mar-12-1973]
0480 **Host-dependent FTP parameters** J.E. White [Mar-08-1973] (TXT = 2084 bytes)
0479 **Use of FTP by the NIC Journal** J.E. White [Mar-08-1973] (TXT = 11183 bytes)
0478 **FTP server-server interaction - II** R.D. Bressler, R. Thomas [Mar-26-1973]
0477 **Remote Job Service at UCSB** M. Krilanovich [May-23-1973]
0476 **IMP/TIP memory retrofit schedule (rev 2)** A.M. McKenzie [Mar-07-1973] (TXT = 2281 bytes)(Obsoletes RFC0447)
0475 **FTP and network mail system** A.K. Bhushan [Mar-06-1973]
0474 **Announcement of NGWG meeting: Call for papers** S. Bunch [Mar-01-1973] (TXT = 1170 bytes)(Updates RFC0396)
0473 **MIX and MIXAL?** D.C. Walden [Feb-28-1973]
0472 **Illinois' reply to Maxwell's request for graphics information (NIC 14925)** S. Bunch [Mar-01-1973] (TXT = 4780 bytes)
0471 **Workshop on multi-site executive programs** R. Thomas [Mar-13-1973] (TXT = 3339 bytes)
0470 **Change in socket for TIP news facility** R. Thomas [Mar-13-1973] (TXT = 1014 bytes)
0469 **Network mail meeting summary** M.D. Kudlick [Mar-08-1973] (TXT = 17774 bytes)
0468 **FTP data compression** R.T. Braden [Mar-08-1973] (TXT = 14909 bytes)
0467 **Proposed change to Host-Host Protocol: Resynchronization of connection status** J.D. Burchfiel, R.S. Tomlinson [Feb-20-1973] (Updated by RFC0492)
0466 **Telnet logger/server for host LL-67** J.M. Winett [Feb-27-1973]
0464 **Resource notebook framework** M.D. Kudlick [Feb-27-1973] (TXT = 3684 bytes)
0463 **FTP comments and response to RFC 430** A.K. Bhushan [Feb-21-1973] (TXT = 5729 bytes)
0462 **Responding to user needs** J. Iseli, D. Crocker [Feb-22-1973] (TXT = 2808 bytes)
0461 **Telnet Protocol meeting announcement** A.M. McKenzie [Feb-14-1973] (TXT = 1966 bytes)
0460 **NCP survey** C. Kline [Feb-13-1973]
0459 **Network questionnaires** W. Kantrowitz [Feb-26-1973] (TXT = 1950 bytes)
0458 **Mail retrieval via FTP** R.D. Bressler, R. Thomas [Feb-20-1973]
0457 **TIPUG** D.C. Walden [Feb-15-1973] (TXT = 845 bytes)
0456 **Memorandum: Date change of mail meeting** M.D. Kudlick [Feb-13-1973] (TXT = 950 bytes)
0455 **Traffic statistics (January 1973)** A.M. McKenzie [Feb-12-1973]
0454 **File Transfer Protocol - meeting announcement and a new proposed document** A.M. McKenzie [Feb-16-1973] (TXT = 78966 bytes)(Updates RFC0354)
0453 **Meeting announcement to discuss a network mail system** M.D. Kudlick [Feb-07-1973] (TXT = 4572 bytes)
0452 **TELENET Command at Host LL** J. Winett [Feb-08-1973]
0451 **Tentative proposal for a Unified User Level Protocol** M.A. Padlipsky [Feb-22-1973] (TXT = 8114 bytes)
0450 **MULTICS sampling timeout change** M.A. Padlipsky [Feb-08-1973] (TXT = 924 bytes)
0449 **Current flow-control scheme for IMPSYS** D.C. Walden [Jan-06-1973] (TXT = 1662 bytes)(Updates RFC0442)
0448 **Print files in FTP** R.T. Braden [Feb-27-1973] (TXT = 6838 bytes)
0447 **IMP/TIP memory retrofit schedule** A.M. McKenzie [Jan-29-1973] (TXT = 2332 bytes)(Obsoletes RFC0434) (Obsoleted by RFC0476)
0446 **Proposal to consider a network program resource notebook** L.P. Deutsch [Jan-25-1973] (TXT = 3053 bytes)
0445 **IMP/TIP preventive maintenance schedule** A.M. McKenzie [Jan-22-1973] (TXT = 2668 bytes)

0444 **IMP/TIP preventive maintenance schedule** A.M. McKenzie [Jan-22-1973] (TXT = 2068 bytes)
0443 **Traffic statistics (December 1972)** A.M. McKenzie [Jan-18-1973]
0442 **Current flow-control scheme for IMPSYS** V. Cerf [Jan-24-1973] (Updated by RFC0449)
0441 **Inter-Entity Communication - an experiment** R.D. Bressler, R. Thomas [Jan-19-1973] (TXT = 12876 bytes)
0440 **Scheduled network software maintenance** D.C. Walden [Jan-01-1973] (TXT = 1870 bytes)
0439 **PARRY encounters the DOCTOR** V. Cerf [Jan-21-1973]
0438 **FTP server-server interaction** R. Thomas, R. Clements [Jan-15-1973]
0437 **Data Reconfiguration Service at UCSB** E. Faeh [Jun-30-1973] (TXT = 21562 bytes)
0436 **Announcement of RJS at UCSB** M. Krilanovich [Jan-10-1973] (TXT = 2579 bytes)
0435 **Telnet issues** B. Cosell, D.C. Walden [Jan-05-1973] (TXT = 23019 bytes)(Updates RFC0318)
0434 **IMP/TIP memory retrofit schedule** A.M. McKenzie [Jan-04-1973] (TXT = 2242 bytes)(Obsoleted by RFC0447)
0433 **Socket number list** J. Postel [Dec-22-1972] (TXT = 6834 bytes)(Obsoletes RFC0349) (Obsoleted by RFC0503)
0432 **Network logical map** N. Neigus [Dec-29-1972] (TXT, PDF, PS = 1291, 148880, 1344571 bytes)
0431 **Update on SMFS Login and Logout** M. Krilanovich [Dec-15-1972] (TXT = 4196 bytes)(Obsoletes RFC0399) (Updates RFC0122)
0430 **Comments on File Transfer Protocol** R.T. Braden [Feb-07-1973] (TXT = 18696 bytes)
0429 **Character Generator Process** J. Postel [Dec-12-1972] (TXT = 1319 bytes)
0426 **Reconnection Protocol** R. Thomas [Jan-26-1973] (TXT = 26548 bytes)
0425 **"But my NCP costs $500 a day"** R.D. Bressler [Dec-19-1972] (TXT = 1763 bytes)
0423 **UCLA Campus Computing Network Liaison Staff for ARPANET** B. Noble [Dec-12-1972] (TXT = 2890 bytes)(Obsoletes RFC0389)
0422 **Traffic statistics (November 1972)** A.M. McKenzie [Dec-11-1972]
0421 **Software Consulting Service for Network Users** A.M. McKenzie [Nov-27-1972] (TXT = 2483 bytes)
0420 **CCA ICCC weather demo** H. Murray [Jan-04-1973] (TXT = 14752 bytes)
0419 **To: Network liaisons and station agents** A. Vezza [Dec-12-1972] (TXT = 1252 bytes)
0418 **Server file transfer under TSS/360 at NASA Ames** W. Hathaway [Nov-27-1972]
0417 **Link usage violation** J. Postel, C. Kline [Dec-06-1972] (TXT = 901 bytes)
0416 **ARC System Will Be Unavailable for Use During Thanksgiving Week** J.C. Norton [Nov-07-1972] (TXT = 2205 bytes)
0415 **Tenex bandwidth** H. Murray [Nov-29-1972] (TXT = 3456 bytes)
0414 **File Transfer Protocol (FTP) status and further comments** A.K. Bhushan [Dec-29-1972] (TXT = 12845 bytes)(Updates RFC0385)
0413 **Traffic statistics (October 1972)** A.M. McKenzie [Nov-13-1972] (TXT = 16145 bytes)
0412 **User FTP Documentation** G. Hicks [Nov-27-1972] (TXT = 17510 bytes)
0411 **New MULTICS Network Software Features** M.A. Padlipsky [Nov-14-1972] (TXT = 3024 bytes)
0410 **Removal of the 30-Second Delay When Hosts Come Up** J.M. McQuillan [Nov-10-1972] (TXT = 3964 bytes)
0409 **Tenex interface to UCSB's Simple-Minded File System** J.E. White [Dec-08-1972]
0408 **NETBANK** A.D. Owen, J. Postel [Oct-25-1972] (TXT = 1645 bytes)
0407 **Remote Job Entry Protocol** R.D. Bressler, R. Guida, A.M. McKenzie [Oct-16-1972] (TXT = 47556 bytes)(Obsoletes RFC0360)
0406 **Scheduled IMP Software Releases** J.M. McQuillan [Oct-10-1972] (TXT = 2468 bytes)
0405 **Correction to RFC 404** A.M. McKenzie [Oct-10-1972] (TXT = 1103 bytes)(Updates RFC0404)
0404 **Host Address Changes Involving Rand and ISI** A.M. McKenzie [Oct-05-1972] (TXT = 944 bytes)(Updated by RFC0405)
0403 **Desirability of a network 1108 service** G. Hicks [Jan-10-1973]
0402 **ARPA Network Mailing Lists** J.B. North [Oct-26-1972] (TXT = 28162 bytes)(Obsoletes RFC0363)
0401 **Conversion of NGP-0 Coordinates to Device Specific Coordinates** J. Hansen [Oct-23-1972] (TXT = 3894 bytes)(Updates RFC0387)
0400 **Traffic Statistics (September 1972)** A.M. McKenzie [Oct-18-1972] (TXT = 5435 bytes)
0399 **SMFS Login and Logout** M. Krilanovich [Sep-26-1972] (TXT = 3024 bytes)(Obsoleted by RFC0431) (Updates RFC0122)
0398 **ICP Sockets** J.R. Pickens, E. Faeh [Sep-22-1972] (TXT = 3846 bytes)
0396 **Network Graphics Working Group Meeting - Second Iteration** S. Bunch [Nov-13-1972] (TXT = 2224 bytes)(Updated by RFC0474)
0395 **Switch Settings on IMPs and TIPs** J.M. McQuillan [Oct-03-1972] (TXT = 1827 bytes)
0394 **Two Proposed Changes to the IMP-Host Protocol** J.M. McQuillan [Sep-27-1972] (TXT = 5780 bytes)(Updates RFC0381)
0393 **Comments on Telnet Protocol Changes** J.M. Winett [Oct-03-1972] (TXT = 9435 bytes)(Also RFC0109 ,RFC0139 ,RFC0158 ,RFC0318 ,RFC0328)
0392 **Measurement of host costs for transmitting network data** G. Hicks, B.D. Wessler [Sep-20-1972] (TXT = 14462 bytes)
0391 **Traffic statistics (August 1972)** A.M. McKenzie [Sep-15-1972] (TXT = 4695 bytes)(Obsoletes RFC0378)
0390 **TSO Scenario** R.T. Braden [Sep-12-1972] (TXT = 6103 bytes)
0389 **UCLA Campus Computing Network Liaison Staff for ARPA Network** B. Noble [Aug-30-1972] (TXT = 2819 bytes)(Obsoleted by RFC0423)
0388 **NCP statistics** V. Cerf [Aug-23-1972] (TXT = 8458 bytes)(Updates RFC0323)
0387 **Some experiences in implementing Network Graphics Protocol Level 0** K.C. Kelley, J. Meir [Aug-10-1972] (TXT = 9059 bytes)(Updated by RFC0401)
0386 **Letter to TIP users-2** B. Cosell, D.C. Walden [Aug-16-1972] (TXT = 12475 bytes)
0385 **Comments on the File Transfer Protocol** A.K. Bhushan [Aug-18-1972] (TXT = 13030 bytes)(Updates RFC0354) (Updated by RFC0414)
0384 **Official site idents for organizations in the ARPA Network** J.B. North [Aug-28-1972] (TXT = 10401 bytes)(Obsoletes RFC0289)
0382 **Mathematical Software on the ARPA Network** L. McDaniel [Aug-03-1972] (TXT = 2041 bytes)
0381 **Three aids to improved network operation** J.M. McQuillan [Jul-26-1972] (Updated by RFC0394)
0379 **Using TSO at CCN** R.T. Braden [Aug-11-1972] (TXT = 8674 bytes)
0378 **Traffic statistics (July 1972)** A.M. McKenzie [Aug-10-1972] (TXT = 5730 bytes)(Obsoleted by RFC0391)
0377 **Using TSO via ARPA Network Virtual Terminal** R.T. Braden [Aug-10-1972] (TXT = 7093 bytes)
0376 **Network Host Status** E. Westheimer [Aug-08-1972] (TXT = 8861 bytes)(Updates RFC0370)
0374 **IMP System Announcement** A.M. McKenzie [Jul-19-1972] (TXT = 3963 bytes)
0373 **Arbitrary Character Sets** J. McCarthy [Jul-14-1972] (TXT = 7783 bytes)
0372 **Notes on a Conversation with Bob Kahn on the ICCC** R.W. Watson [Jul-12-1972] (TXT = 6040 bytes)
0371 **Demonstration at International Computer Communications Conference** R.E. Kahn [Jul-12-1972] (TXT = 3728 bytes)
0370 **Network Host Status** E. Westheimer [Jul-31-1972] (TXT = 8389 bytes)(Obsoletes RFC0367) (Updated by RFC0376)
0369 **Evaluation of ARPANET services January-March, 1972** J.R. Pickens [Jul-25-1972] (TXT = 24414 bytes)
0368 **Comments on "Proposed Remote Job Entry Protocol"** R.T. Braden [Jul-21-1972] (TXT = 3883 bytes)
0367 **Network host status** E. Westheimer [Jul-19-1972] (TXT = 8057 bytes)(Obsoletes RFC0366) (Obsoleted by RFC0370)

0366 **Network Host Status** E. Westheimer [Jul-11-1972] (TXT = 8278 bytes)(Obsoletes RFC0362) (Obsoleted by RFC0367)
0365 **Letter to All TIP Users** D.C. Walden [Jul-11-1972] (TXT = 10331 bytes)
0364 **Serving remote users on the ARPANET** M.D. Abrams [Jul-11-1972] (TXT = 11253 bytes)
0363 **ARPA Network mailing lists** Network Information Center. Stanford Research Institute [Aug-08-1972] (TXT = 25356 bytes)(Obsoletes RFC0329) (Obsoleted by RFC0402)
0362 **Network Host Status** E. Westheimer [Jun-28-1972] (TXT = 8631 bytes)(Obsoletes RFC0353) (Obsoleted by RFC0366)
0361 **Deamon Processes on Host 106** R.D. Bressler [Jul-05-1972] (TXT = 1480 bytes)
0360 **Proposed Remote Job Entry Protocol** C. Holland [Jun-24-1972] (Obsoleted by RFC0407)
0359 **Status of the Release of the New IMP System (2600)** D.C. Walden [Jun-22-1972] (TXT = 2015 bytes)(Obsoletes RFC0343)
0357 **Echoing strategy for satellite links** J. Davidson [Jun-26-1972] (TXT = 30103 bytes)
0356 **ARPA Network Control Center** R. Alter [Jun-21-1972] (TXT = 1963 bytes)
0355 **Response to NWG/RFC 346** J. Davidson [Jun-09-1972] (TXT = 3717 bytes)
0354 **File Transfer Protocol** A.K. Bhushan [Jul-08-1972] (TXT = 58074 bytes)(Obsoletes RFC0264 ,RFC0265)(Obsoleted by RFC0542) (Updated by RFC0385 ,RFC0454 ,RFC0683)
0353 **Network host status** E. Westheimer [Jun-12-1972] (TXT = 8747 bytes)(Obsoletes RFC0344) (Obsoleted by RFC0362)
0352 **TIP Site Information Form** D. Crocker [Jun-05-1972] (TXT = 2266 bytes)
0351 **Graphics information form for the ARPANET graphics resources notebook** D. Crocker [Jun-05-1972] (TXT = 2150 bytes)
0350 **User Accounts for UCSB On-Line System** R. Stoughton [May-18-1972] (TXT = 5117 bytes)
0349 **Proposed Standard Socket Numbers** J. Postel [May-30-1972] (TXT = 1663 bytes)(Obsoleted by RFC0433) (Also RFC0322 ,RFC0204)
0348 **Discard Process** J. Postel [May-30-1972] (TXT = 1181 bytes)
0347 **Echo process** J. Postel [May-30-1972] (TXT = 1377 bytes)
0346 **Satellite Considerations** J. Postel [May-30-1972] (TXT = 2778 bytes)
0345 **Interest in Mixed Integer Programming (MPSX on NIC 360/91 at CCN)** K.C. Kelley [May-26-1972] (TXT = 1999 bytes)
0344 **Network Host Status** E. Westheimer [May-22-1972] (TXT = 8221 bytes)(Obsoletes RFC0342) (Obsoleted by RFC0353)
0343 **IMP System change notification** A.M. McKenzie [May-19-1972] (TXT = 3370 bytes)(Obsoletes RFC0331) (Obsoleted by RFC0359)
0342 **Network Host Status** E. Westheimer [May-15-1972] (TXT = 8382 bytes)(Obsoletes RFC0332) (Obsoleted by RFC0344)
0340 **Proposed Telnet Changes** T.C. O'Sullivan [May-15-1972] (TXT = 2656 bytes)(Also RFC0328)
0339 **MLTNET: A "Multi Telnet" Subsystem for Tenex** R. Thomas [May-05-1972] (TXT = 7941 bytes)
0338 **EBCDIC/ASCII Mapping for Network RJE** R.T. Braden [May-17-1972]
0336 **Level 0 Graphic Input Protocol** I.W. Cotton [May-05-1972] (TXT = 3787 bytes)
0335 **New Interface - IMP/360** R.F. Bryan [May-01-1972] (TXT = 934 bytes)
0334 **Network Use on May 8** A.M. McKenzie [May-01-1972] (TXT = 1376 bytes)
0333 **Proposed experiment with a Message Switching Protocol** R.D. Bressler, D. Murphy, D.C. Walden [May-15-1972]
0332 **Network Host Status** E. Westheimer [Apr-25-1972] (TXT = 8427 bytes)(Obsoletes RFC0330) (Obsoleted by RFC0342) (Updates RFC0330)
0331 **IMP System Change Notification** J.M. McQuillan [Apr-19-1972] (TXT = 2339 bytes)(Obsoleted by RFC0343)
0330 **Network Host Status** E. Westheimer [Apr-13-1972] (TXT = 8085 bytes)(Obsoletes RFC0326) (Obsoleted by RFC0332)
0329 **ARPA Network Mailing Lists** Network Information Center. Stanford Research Institute [May-17-1972] (TXT = 23861 bytes)(Obsoletes RFC0303) (Obsoleted by RFC0363)
0328 **Suggested Telnet Protocol Changes** J. Postel [Apr-29-1972] (TXT = 2685 bytes)
0327 **Data and File Transfer workshop notes** A.K. Bhushan [Apr-27-1972] (TXT = 11792 bytes)
0326 **Network Host Status** E. Westheimer [Apr-03-1972] (TXT = 7944 bytes)(Obsoleted by RFC0330) (Updates RFC0319)
0325 **Network Remote Job Entry program - NETRJS** G. Hicks [Apr-06-1972] (TXT = 17499 bytes)
0324 **RJE Protocol meeting** J. Postel [Apr-03-1972] (TXT = 1176 bytes)
0323 **Formation of Network Measurement Group (NMG)** V. Cerf [Mar-23-1972] (TXT = 15777 bytes)(Updated by RFC0388)
0322 **Well known socket numbers** V. Cerf, J. Postel [Mar-26-1972] (TXT = 1735 bytes)
0321 **CBI Networking Activity at MITRE** P.M. Karp [Mar-24-1972] (TXT = 20500 bytes)
0320 **Workshop on Hard Copy Line Printers** R. Reddy [Mar-27-1972]
0319 **Network Host Status** E. Westheimer [Mar-21-1972] (TXT = 8955 bytes)(Obsoletes RFC0315) (Updated by RFC0326)
0318 **Telnet Protocols** J. Postel [Apr-03-1972] (TXT = 34928 bytes)(Updates RFC0158) (Updated by RFC0435) (Also RFC0139 ,RFC0158)
0317 **Official Host-Host Protocol Modification: Assigned Link Numbers** J. Postel [Mar-20-1972] (TXT = 1593 bytes)(Obsoleted by RFC0604)
0316 **ARPA Network Data Management Working Group** D.B. McKay, A.P. Mullery [Feb-23-1972] (TXT = 15494 bytes)
0315 **Network Host Status** E. Westheimer [Mar-08-1972] (TXT = 7818 bytes)(Obsoletes RFC0306) (Obsoleted by RFC0319)
0314 **Network Graphics Working Group Meeting** I.W. Cotton [Mar-14-1972] (TXT = 1836 bytes)
0313 **Computer based instruction** T.C. O'Sullivan [Mar-06-1972] (TXT = 19880 bytes)
0312 **Proposed Change in IMP-to-Host Protocol** A.M. McKenzie [Mar-22-1972] (TXT = 3562 bytes)
0311 **New Console Attachments to the USCB Host** R.F. Bryan [Feb-29-1972] (TXT = 3141 bytes)
0310 **Another Look at Data and File Transfer Protocols** A.K. Bhushan [Apr-03-1972] (TXT = 18593 bytes)(Updates RFC0264 ,RFC0265)
0309 **Data and File Transfer Workshop Announcement** A.K. Bhushan [Mar-17-1972] (TXT = 9404 bytes)
0308 **ARPANET host availability data** M. Seriff [Mar-13-1972] (TXT = 5948 bytes)
0307 **Using network Remote Job Entry** E. Harslem [Feb-24-1972] (TXT = 12032 bytes)
0306 **Network host status** E. Westheimer [Feb-15-1972] (TXT = 7485 bytes)(Obsoletes RFC0298) (Obsoleted by RFC0315)
0305 **Unknown Host Numbers** R. Alter [Feb-23-1972] (TXT = 1998 bytes)
0304 **Data management system proposal for the ARPA network** D.B. McKay [Feb-17-1972]
0303 **ARPA Network mailing lists** Network Information Center. Stanford Research Institute [Mar-03-1972] (TXT = 18193 bytes)(Obsoletes RFC0300) (Obsoleted by RFC0329)
0302 **Exercising The ARPANET** R.F. Bryan [Feb-08-1972] (TXT = 5452 bytes)
0301 **BBN IMP (#5) and NCC Schedule March 4, 1971** R. Alter [Feb-11-1972] (TXT = 1487 bytes)
0300 **ARPA Network mailing lists** J.B. North [Jan-25-1972] (TXT = 16357 bytes)(Obsoletes RFC0211) (Obsoleted by RFC0303)
0299 **Information Management System** D. Hopkin [Feb-11-1972] (TXT = 1825 bytes)
0298 **Network host status** E. Westheimer [Feb-11-1972] (TXT = 8770 bytes)(Obsoletes RFC0293) (Obsoleted by RFC0306)
0297 **TIP Message Buffers** D.C. Walden [Jan-31-1972] (TXT = 3517 bytes)
0296 **DS-1 display system** D.E. Liddle [Jan-27-1972]

0295 **Report of the Protocol Workshop, 12 October 1971** J. Postel [Jan-02-1972] (TXT = 5432 bytes)
0294 **The Use of "Set Data Type" Transaction in File Transfer Protocol** A.K. Bhushan [Jan-25-1972] (TXT = 3924 bytes)(Updates RFC0265)
0293 **Network Host Status** E. Westheimer [Jan-18-1972] (TXT = 7639 bytes)(Obsoletes RFC0288) (Obsoleted by RFC0298) (Updates RFC0288)
0292 **Graphics Protocol: Level 0 only** J.C. Michener, I.W. Cotton, K.C. Kelley, D.E. Liddle, E. Meyer [Jan-12-1972] (TXT = 22342 bytes)
0291 **Data Management Meeting Announcement** D.B. McKay [Jan-14-1972] (TXT = 3375 bytes)
0290 **Computer networks and data sharing: A bibliography** A.P. Mullery [Jan-11-1972] (TXT = 34329 bytes)(Obsoletes RFC0243)
0289 **What we hope is an official list of host names** R.W. Watson [Dec-21-1971] (TXT = 5069 bytes)(Obsoleted by RFC0384)
0288 **Network host status** E. Westheimer [Jan-06-1972] (TXT = 8501 bytes)(Obsoletes RFC0287) (Obsoleted by RFC0293) (Updated by RFC0293)
0287 **Status of Network Hosts** E. Westheimer [Dec-22-1971] (TXT = 9217 bytes)(Obsoletes RFC0267) (Obsoleted by RFC0288)
0286 **Network Library Information System** E. Forman [Dec-21-1971] (TXT = 2079 bytes)
0285 **Network graphics** D. Huff [Dec-15-1971] (TXT = 18076 bytes)
0283 **NETRJT: Remote Job Service Protocol for TIPS** R.T. Braden [Dec-20-1971] (TXT = 18771 bytes)(Updates RFC0189)
0282 **Graphics meeting report** M.A. Padlipsky [Dec-08-1971] (TXT = 18100 bytes)
0281 **Suggested addition to File Transfer Protocol** A.M. McKenzie [Dec-08-1971] (TXT = 12006 bytes)(Updates RFC0265)
0280 **A Draft of Host Names** R.W. Watson [Nov-17-1971] (TXT = 3629 bytes)
0278 **Revision of the Mail Box Protocol** A.K. Bhushan, R.T. Braden, E. Harslem, J.F. Heafner, A.M. McKenzie, J.T. Melvin, R.L. Sundberg, R.W. Watson, J.E. White [Nov-17-1971] (TXT = 7526 bytes)(Obsoletes RFC0221)
0276 **NIC course** R.W. Watson [Nov-08-1971] (TXT = 1183 bytes)
0274 **Establishing a local guide for network usage** E. Forman [Nov-01-1971] (TXT = 7114 bytes)
0273 **More on standard host names** R.W. Watson [Oct-18-1971] (TXT = 4589 bytes)(Obsoletes RFC0237)
0271 **IMP System change notifications** B. Cosell [Jan-03-1972] (TXT = 4022 bytes)
0270 **Correction to BBN Report No. 1822 (NIC NO 7958)** A.M. McKenzie [Jan-01-1972] (TXT = 1371 bytes)(Updates NIC 7959)
0269 **Some Experience with File Transfer** H. Brodie [Dec-06-1971] (TXT = 5961 bytes)(Updates RFC0122)
0268 **Graphics facilities information** J. Postel [Nov-24-1971] (TXT = 1298 bytes)
0267 **Network Host Status** E. Westheimer [Nov-22-1971] (TXT = 7862 bytes)(Obsoletes RFC0266) (Obsoleted by RFC0287)
0266 **Network host status** E. Westheimer [Nov-08-1971] (TXT = 3174 bytes)(Obsoletes RFC0255) (Obsoleted by RFC0267)
0265 **The File Transfer Protocol** A. Bhushan, B. Braden, W. Crowther, E. Harslem, J. Heafner, A. McKenzie, J. Melvin, B. Sundberg, D. Watson, J. White [Nov-17-1971] (TXT = 3914 bytes)(Obsoletes RFC0172) (Obsoleted by RFC0354) (Updated by RFC0281 ,RFC0294 ,RFC0310)(Also RFC0264)
0264 **The Data Transfer Protocol** A. Bhushan, B. Braden, W. Crowther, E. Harslem, J. Heafner, A. McKenize, B. Sundberg, D. Watson, J. White [Jan-04-1972] (Obsoletes RFC0171) (Obsoleted by RFC0354) (Updated by RFC0310) (Also RFC0265)
0263 **"Very Distant" Host interface** A.M. McKenzie [Dec-17-1971] (TXT = 3914 bytes)
0256 **IMPSYS change notification** B. Cosell [Nov-03-1971] (TXT = 1240 bytes)
0255 **Status of network hosts** E. Westheimer [Oct-26-1971] (TXT = 4002 bytes)(Obsoletes RFC0252) (Obsoleted by RFC0266)
0254 **Scenarios for using ARPANET computers** A. Bhushan [Oct-29-1971]
0253 **Second Network Graphics meeting details** J.A. Moorer [Oct-19-1971] (TXT = 1981 bytes)
0252 **Network host status** E. Westheimer [Oct-08-1971] (TXT = 5531 bytes)(Obsoletes RFC0240) (Obsoleted by RFC0255)
0251 **Weather data** D. Stern [Oct-13-1971] (TXT = 1907 bytes)
0250 **Some thoughts on file transfer** H. Brodie [Oct-07-1971] (TXT = 2446 bytes)
0249 **Coordination of equipment and supplies purchase** R.F. Borelli [Oct-08-1971] (TXT = 4561 bytes)
0247 **Proffered set of standard host names** P.M. Karp [Oct-12-1971] (TXT = 7122 bytes)(Obsoletes RFC0226)
0246 **Network Graphics meeting** A. Vezza [Oct-05-1971] (TXT = 856 bytes)
0245 **Reservations for Network Group meeting** C. Falls [Oct-05-1971] (TXT = 1142 bytes)
0243 **Network and data sharing bibliography** A.P. Mullery [Oct-05-1971] (TXT = 12432 bytes)(Obsoleted by RFC0290)
0242 **Data Descriptive Language for Shared Data** L. Haibt, A.P. Mullery [Jul-19-1971] (TXT = 18151 bytes)
0241 **Connecting computers to MLC ports** A.M. McKenzie [Sep-29-1971] (TXT = 3739 bytes)
0240 **Site Status** A.M. McKenzie [Sep-30-1971] (TXT = 7948 bytes)(Obsoletes RFC0235) (Obsoleted by RFC0252)
0239 **Host mnemonics proposed in RFC 226 (NIC 7625)** R.T. Braden [Sep-23-1971] (TXT = 2236 bytes)(Also RFC0226 ,RFC0229 ,RFC0236)
0238 **Comments on DTP and FTP proposals** R.T. Braden [Sep-29-1971] (TXT = 2735 bytes)(Updates RFC0171 ,RFC0172)
0237 **NIC view of standard host names** R.W. Watson [Oct-05-1971] (TXT = 2212 bytes)(Obsoleted by RFC0273)
0236 **Standard host names** J. Postel [Sep-27-1971] (TXT = 5112 bytes)(Obsoletes RFC0229)
0235 **Site status** E. Westheimer [Sep-27-1971] (TXT = 7994 bytes)(Obsoleted by RFC0240)
0234 **Network Working Group meeting schedule** A. Vezza [Oct-05-1971] (TXT = 1634 bytes)(Updates RFC0222 ,RFC0204)
0233 **Standardization of host call letters** A. Bhushan, R. Metcalfe [Sep-28-1971] (TXT = 3206 bytes)
0232 **Postponement of network graphics meeting** A. Vezza [Sep-23-1971] (TXT = 899 bytes)
0231 **Service center standards for remote usage: A user's view** J.F. Heafner, E. Harslem [Sep-21-1971] (TXT = 9692 bytes)
0230 **Toward reliable operation of minicomputer-based terminals on a TIP** T. Pyke [Sep-24-1971] (TXT = 7040 bytes)
0229 **Standard host names** J. Postel [Sep-22-1971] (TXT = 3388 bytes)(Obsoleted by RFC0236)
0228 **Clarification** D.C. Walden [Sep-22-1971] (TXT = 715 bytes)(Updates RFC0070)
0227 **Data transfer rates (Rand/UCLA)** J.F. Heafner, E. Harslem [Sep-17-1971] (TXT = 2451 bytes)(Updates RFC0113)
0226 **Standardization of host mnemonics** P.M. Karp [Sep-20-1971] (TXT = 2012 bytes)(Obsoleted by RFC0247)
0225 **Rand/UCSB network graphics experiment** E. Harslem, R. Stoughton [Sep-13-1971] (TXT = 13573 bytes)(Updates RFC0074)
0224 **Comments on Mailbox Protocol** A.M. McKenzie [Sep-14-1971] (TXT = 3583 bytes)
0223 **Network Information Center schedule for network users** J.T. Melvin, R.W. Watson [Sep-14-1971] (TXT = 5369 bytes)
0222 **Subject: System programmer's workshop** R.M. Metcalfe [Sep-13-1971] (Updates RFC0212) (Updated by RFC0234)
0221 **Mail Box Protocol: Version 2** R.W. Watson [Aug-27-1971] (Obsoletes RFC0196) (Obsoleted by RFC0278)
0219 **User's view of the datacomputer** R. Winter [Sep-03-1971]
0218 **Changing the IMP status reporting facility** B. Cosell [Sep-08-1971] (TXT = 1131 bytes)
0217 **Specifications changes for OLS, RJE/RJOR, and SMFS** J.E. White [Sep-08-1971] (TXT = 2956 bytes)(Updates RFC0074 ,RFC0105 ,RFC0122)
0216 **Telnet access to UCSB's On-Line System** J.E. White [Sep-08-1971]
0215 **NCP, ICP, and Telnet: The Terminal IMP implementation** A.M. McKenzie [Aug-30-1971] (TXT = 16645 bytes)
0214 **Network checkpoint** E. Harslem [Aug-21-1971] (TXT = 3152 bytes)(Obsoletes RFC0198)

0213 **IMP System change notification** B. Cosell [Aug-20-1971] (TXT = 1589 bytes)

0212 **NWG meeting on network usage** Information Sciences Institute University of Southern California [Aug-23-1971] (TXT = 4356 bytes)(Obsoletes RFC0207) (Updated by RFC0222)

0211 **ARPA Network mailing lists** J.B. North [Aug-18-1971] (Obsoletes RFC0168) (Obsoleted by RFC0300)

0210 **Improvement of Flow Control** W. Conrad [Aug-16-1971] (TXT = 3329 bytes)

0209 **Host/IMP interface documentation** B. Cosell [Aug-13-1971]

0208 **Address tables** A.M. McKenzie [Aug-09-1971] (TXT = 5858 bytes)

0207 **September Network Working Group meeting** A. Vezza [Aug-09-1971] (TXT = 3356 bytes)(Obsoleted by RFC0212)

0206 **User Telnet - description of an initial implementation** J.E. White [Aug-09-1971]

0205 **NETCRT - a character display protocol** R.T. Braden [Aug-06-1971]

0204 **Sockets in use** J. Postel [Aug-05-1971] (TXT = 1379 bytes)(Updated by RFC0234)

0203 **Achieving reliable communication** R.B. Kalin [Aug-10-1971]

0202 **Possible Deadlock in ICP** S.M. Wolfe, J. Postel [Jul-26-1971] (TXT = 2796 bytes)

0200 **RFC list by number** J.B. North [Aug-01-1971] (TXT = 19256 bytes)(Obsoletes RFC0170 ,RFC0160)(Obsoleted by NIC 7724)

0199 **Suggestions for a network data-tablet graphics protocol** T. Williams [Jul-15-1971]

0198 **Site Certification - Lincoln Labs 360/67** J.F. Heafner [Jul-20-1971] (TXT = 855 bytes)(Obsoletes RFC0193) (Obsoleted by RFC0214) (Updates RFC0193)

0197 **Initial Connection Protocol - Reviewed** A. Shoshani, E. Harslem [Jul-14-1971] (TXT = 7094 bytes)

0196 **Mail Box Protocol** R.W. Watson [Jul-20-1971] (TXT = 7016 bytes)(Obsoleted by RFC0221)

0195 **Data computers-data descriptions and access language** G.H. Mealy [Jul-16-1971] (TXT = 8704 bytes)

0194 **The Data Reconfiguration Service -- Compiler/Interpreter Implementation Notes** V. Cerf, E. Harslem, J. Heafner, B. Metcalfe, J. White [Jul-14-1971] (TXT = 32716 bytes)

0193 **NETWORK CHECKOUT** E. Harslem, J.F. Heafner [Jul-14-1971] (TXT = 3622 bytes)(Obsoleted by RFC0198) (Updated by RFC0198)

0192 **Some factors which a Network Graphics Protocol must consider** R.W. Watson [Jul-12-1971]

0191 **Graphics implementation and conceptualization at Augmentation Research Center** C.H. Irby [Jul-13-1971] (TXT = 8179 bytes)

0190 **DEC PDP-10-IMLAC communications system** L.P. Deutsch [Jul-13-1971]

0189 **Interim NETRJS specifications** R.T. Braden [Jul-15-1971] (TXT = 41383 bytes)(Obsoletes RFC0088) (Obsoleted by RFC0599) (Updated by RFC0283)

0188 **Data management meeting announcement** P.M. Karp, D.B. McKay [Jan-28-1971] (TXT = 3383 bytes)

0187 **Network/440 Protocol Concept** D.B. McKay, D.P. Karp [Jul-01-1971] (TXT = 25042 bytes)

0186 **Network graphics loader** J.C. Michener [Jul-12-1971]

0185 **NIC distribution of manuals and handbooks** J.B. North [Jul-07-1971] (TXT = 1406 bytes)

0184 **Proposed graphic display modes** K.C. Kelley [Jul-06-1971] (TXT = 18678 bytes)

0183 **EBCDIC codes and their mapping to ASCII** J.M. Winett [Jul-21-1971]

0182 **Compilation of list of relevant site reports** J.B. North [Jun-25-1971] (TXT = 2565 bytes)

0181 **Modifications to RFC 177** J. McConnell [Jul-21-1971] (TXT = 4892 bytes)(Updates RFC0177)

0180 **File system questionnaire** A.M. McKenzie [Jun-25-1971] (TXT = 8154 bytes)

0179 **Link Number Assignments** A.M. McKenzie [Jun-22-1971] (TXT = 1221 bytes)(Updates RFC0107)

0178 **Network graphic attention handling** I.W. Cotton [Jun-27-1971] (TXT = 24522 bytes)

0177 **Device independent graphical display description** J. McConnell [Jun-15-1971] (TXT = 20474 bytes)(Updates RFC0125) (Updated by RFC0181)

0176 **Comments on "Byte size for connections"** A.K. Bhushan, R. Kanodia, R.M. Metcalfe, J. Postel [Jun-14-1971] (TXT = 7269 bytes)

0175 **Comments on "Socket Conventions Reconsidered"** E. Harslem, J.F. Heafner [Jun-11-1971] (TXT = 2225 bytes)

0174 **UCLA - Computer Science Graphics Overview** J. Postel, V.G. Cerf [Jun-08-1971] (TXT = 5037 bytes)

0173 **Network Data Management Committee Meeting Announcement** P.M. Karp, D.B. McKay [Jun-04-1971] (TXT = 4239 bytes)

0172 **The File Transfer Protocol** A. Bhushan, B. Braden, W. Crowther, E. Harslem, J. Heafner, A. McKenzie, J. Melvin, B. Sundberg, D. Watson, J. White [Jun-23-1971] (TXT = 21328 bytes)(Obsoleted by RFC0265) (Updates RFC0114) (Updated by RFC0238)

0171 **The Data Transfer Protocol** A. Bhushan, B. Braden, W. Crowther, E. Harslem, J. Heafner, A. McKenize, J. Melvin, B. Sundberg, D. Watson, J. White [Jun-01-1971] (TXT = 20616 bytes)(Obsoleted by RFC0264) (Updates RFC0114) (Updated by RFC0238)

0170 **RFC List by Number** Network Information Center, Stanford Research Institute [Jun-01-1971] (TXT = 17670 bytes)(Obsoleted by RFC0200)

0169 **Computer networks** S.D. Crocker [May-27-1971]

0168 **ARPA Network mailing lists** J.B. North [May-26-1971] (TXT = 13294 bytes)(Obsoletes RFC0155) (Obsoleted by RFC0211)

0167 **Socket conventions reconsidered** A.K. Bhushan, R.M. Metcalfe, J.M. Winett [May-24-1971] (TXT = 7643 bytes)(Also RFC0147 ,RFC0129)

0166 **Data Reconfiguration Service: An implementation specification** R.H. Anderson, V.G. Cerf, E. Harslem, J.F. Heafner, J. Madden, R.M. Metcalfe, A. Shoshani, J.E. White, D.C.M. Wood [May-25-1971] (TXT = 42094 bytes)

0165 **Proffered official Initial Connection Protocol** J. Postel [May-25-1971] (Obsoletes RFC0145 ,RFC0143 ,RFC0123)(Updated by NIC 7101)

0164 **Minutes of Network Working Group meeting, 5/16 through 5/19/71** J.F. Heafner [May-25-1971] (TXT = 58597 bytes)

0163 **Data transfer protocols** V.G. Cerf [May-19-1971] (TXT = 5465 bytes)

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0160 **RFC brief list** Network Information Center. Stanford Research Institute [May-18-1971] (TXT = 12173 bytes)(Obsoleted by RFC0200 ,RFC0999)(Updates NIC 6716)

0158 **Telnet Protocol: A Proposed Document** T.C. O'Sullivan [May-19-1971] (Obsoleted by RFC0495) (Updates RFC0139) (Updated by RFC0318) (Also RFC0393)

0157 **Invitation to the Second Symposium on Problems in the Optimization of Data Communications Systems** V.G. Cerf [May-12-1971]

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0138 **Status report on proposed Data Reconfiguration Service** R.H. Anderson, V.G. Cerf, E. Harslem, J.F. Heafner, J. Madden, R.M. Metcalfe, A. Shoshani, J.E. White, D.C.M. Wood [Apr-28-1971] (TXT = 46641 bytes)
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0136 **Host accounting and administrative procedures** R.E. Kahn [Apr-29-1971]
0135 **Response to NWG/RFC 110** W. Hathaway [Apr-29-1971] (Updates RFC0110)
0134 **Network Graphics meeting** A. Vezza [Apr-29-1971] (TXT = 2684 bytes)
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0008 **Functional specifications for the ARPA Network** G. Deloche [May-05-1969]
0007 **Host-IMP interface** G. Deloche [May-01-1969]

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  (from FR). Uses GlimpseHTTP, searches multiple indexes, and it has some other helpful links. Search by number, name or keyword, and it also allows for misspellings. Nice site, not the most up to date.

- Core Networks, Inc./Listquest

  RFC search. Can specify search of body, subject, author, or combinations thereof. Can also list results by order of relevance or RFC number.

- Lynn Wheeler's

  (from US). For the person who knows how to find things. Very detailed with information on what RFC's are and links to RFC related sites. Frames and no-frames version, listed by author, date, category and number. Search by keyword. Great site.

- Nexor

  (from UK). Has an RFC index and search capability to search multiple indexes. Search by number or keyword.

- Normos

  (from Canada). Search by number for RFCs and RTRs. Very simple and well organized.

- SONY CSL

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==========

RFCs may be obtained via EMAIL or FTP from many RFC Repositories. The Primary Repositories will have the RFC available when it is first announced, as will many Secondary Repositories. Some Secondary Repositories may take a few days to make available the most recent RFCs.

Many of these repositories also now have World Wide Web servers. Try the following URL as a starting point:

http://www.rfc-editor.org/

Primary Repositories:

RFCs can be obtained via FTP from NIS.NSF.NET, FTP.RFC-EDITOR.ORG, WUARCHIVE.WUSTL.EDU, SRC.DOC.IC.AC.UK, FTP.NCREN.NET, FTP.NIC.IT, FTP.IMAG.FR, FTP.IETF.RNP.BR WWW.NORMOS.ORG, FTP.GIGABELL.NET, or OASISSTUDIOS.COM.

1. NIS.NSF.NET

To obtain RFCs from NIS.NSF.NET via FTP, login with username "anonymous" and password "name@host.domain"; then connect to the directory of RFCs with cd /internet/documents. The file name is of the form rfcnnnn.txt (where "nnnn" refers to the RFC number).

For sites without FTP capability, electronic mail query is available from NIS.NSF.NET. Address the request to NIS-INFO@NIS.NSF.NET and leave the subject field of the message blank. The first text line of the message must be "send rfcnnnn.txt" with nnnn the RFC number.

contact: rfc-mgr@merit.edu

2. FTP.RFC-EDITOR.ORG

RFCs can be obtained via FTP from FTP.RFC-EDITOR.ORG, with the pathname in-notes/rfcnnnn.txt (where "nnnn" refers to the number of the RFC). Login with FTP username "anonymous" and password "name@host.domain".

RFCs can also be obtained via electronic mail from FTP.RFC-EDITOR.ORG by using the RFC-INFO service. Address the request to "rfc-info@rfc-editor" with a message body of:

```
Retrieve: RFC
   Doc-ID: RFCnnnn
```

(Where "nnnn" refers to the number of the RFC (always use 4 digits - the DOC-ID of RFC 822 is "RFC0822")). The RFC-INFO@RFC-EDITOR.ORG server provides other ways of selecting RFCs based on keywords and such; for more information send a message to "rfc-info@isi.edu" with the message body "help: help".

contact: rfc-editor@rfc-editor.org

3. WUARCHIVE.WUSTL.EDU

RFCs can also be obtained via FTP from WUARCHIVE.WUSTL.EDU, with the pathname info/rfc/rfcnnnn.txt.Z (where "nnnn" refers to the number of the RFC and "Z" indicates that the document is in compressed form).

At WUARCHIVE.WUSTL.EDU the RFCs are in an "archive" file system and various archives can be mounted as part of an NFS file system. Please contact Chris Myers (chris@wugate.wustl.edu) if you want to mount this file system in your NFS.

WUArchive now keeps RFC's and STD's under

```
ftp://wuarchive.wustl.edu./doc/
or http://wuarchive.wustl.edu./doc/
```

contact: chris@wugate.wustl.edu

4. SUNSITE.ORG.UK (also known as SRC.DOC.IC.AC.UK)

RFCs can be obtained via FTP from SUNSITE.ORG.UK with the pathname rfc/rfcnnnn.txt or rfc/rfcnnnn.ps (where "nnnn" refers to the number of the RFC). Login with FTP username "anonymous" and password "your-email-address". To obtain the RFC Index, use the pathname rfc/rfc-index.txt.

For users with good fast Internet connections, the whole archive is also available by NFS (readonly) and the RFC area can be mounted as, e.g.

```
mount -r sunsite.org.uk:/public/rfc /mnt
```

RFCs are also available via the web at http://sunsite.org.uk/rfc/

contact: wizards@sunsite.org.uk

5. FTP.NCREN.NET

To obtain RFCs from FTP.NCREN.NET via FTP, login with username
"anonymous" and your internet e-mail address as password. The RFCs
can be found in the directory /rfc, with file names of the form:
rfcNNNN.txt or rfcNNNN.ps where NNNN refers to the RFC number.

This repository is also accessible via WAIS and the Internet Gopher.

contact: rfc-mgr@ncren.net

6. FTP.NIC.IT

RFCs can be obtained from the ftp.nic.it FTP archive with the pathname
rfc/rfcnnnn.txt (where "nnnn" refers to the number of the RFC). Login
with FTP, username "anonymous" and password "name@host.domain".

The summary of ways to get RFC from the Italian Network Information
Center is the following:

 Via ftp: ftp.nic.it directory rfc

 Via e-mail: send a message to listserv@nic.it whose body
                contains "get RFC/rfc<number>.[txt,ps]".
                For receiving a full list of the existing RFCs include
                in the body the command "index RFC/rfc".

Contact: D.Vannozzi@cnuce.cnr.it

7. FTP.IMAG.FR

RFCs can be obtained via FTP from ftp.imag.fr with the pathname
/pub/archive/IETF/rfc/rfcnnnn.txt (where "nnnn" refers to the number
of the RFC).

Login with FTP username "anonymous" and password "your-email-address".
To obtain the RFC Index, use the pathname
/pub/archive/IETF/rfc/rfc-index.txt

Internet drafts & other IETF related documents are also mirrored in
the /pub/archive/IETF directory.

Contact: rfc-adm@imag.fr

8. WWW.NORMOS.ORG

RFCs, STD, BCP, FYI, RTR, IEN, Internet-Drafts, RIPE and other
internet engineering documents can be found at http://www.normos.org
and ftp://ftp.normos.org.

The rfcs are available as:
        http://www.normos.org/ietf/rfc/rfcXXXX.txt
        ftp://ftp.normos.org/ietf/rfc/rfcXXXX.txt

STD,BCP,FYI,RTR,IEN documents are available as:

http://www.normos.org/ietf/[std,bcp,fyi,rtr,ien]/[std,bcp,fyi,rtr,ien]XXXX.txt

ftp://ftp.normos.org/ietf/[std,bcp,fyi,rtr,ien]/[std,bcp,fyi,rtr,ien]XXXX.txt

Internet-drafts are available as:
        http://www.normos.org/ietf/internet-drafts/draft-....txt
        ftp://ftp.normos.org/ietf/internet-drafts/draft-....txt

Full-text search and database queries are available from the web
interface.

Please send questions, comments, suggestions to info@normos.org.

9. FTP.IETF.RNP.BR

RFCs can be obtained via FTP from FTP.IETF.RNP.BR with the pathname
rfc/rfcnnnn.txt (where "nnnn" refers to the number of the RFC) .
Login with FTP username "anonymous" and password
"your-email-address". To obtain the RFC Index, use the pathname
rfc/rfc-index.txt.

Internet-Drafts and other IETF related documents are also mirrored.

Contact: rfc-admin@ietf.rnp.br

10. FTP.GIGABELL.NET

To obtain RFCs from FTP.GIGABELL.NET via FTP, login with username
"anonymous" and password "name@host.domain"; then connect to the
directory of RFCs with cd /pub/rfc. The file name is of the form
rfcnnnn.txt (where "nnnn" refers to the RFC number). An index can be
obtained with the pathname pub/rfc/rfc-index.txt.

contact: ftpadmin@gigabell.net

11. FTP.FCCN.PT

To obtain RFCs from Oasis Studios via FTP, login to FTP.FCCN.PT with
username "anonymous" and password "name@host.domain"; then connect to
the directory of RFCs with cd /pub/IETF/RFCs. The file name is of the
form rfcnnnn.txt (where "nnnn" refers to the RFC number).

contact: webmaster@fccn.pt

12. OASISSTUDIOS.COM

To obtain RFCs from Oasis Studios via FTP, login to
FTP.OASISSTUDIOS.COM with username "anonymous" and password
"name@host.domain"; then connect to the directory of RFCs with cd
/pub/RFC. The file name is of the form rfcnnnn.txt (where "nnnn"
refers to the RFC number).

For sites without FTP capability, electronic mail query is available
from oasisstudios@OASISSTUDIOS.COM. Address the request to
oasisstudios@OASISSTUDIOS.COM and leave the body of the message
blank. The subject of the message must be "send rfcnnnn.txt" where
nnnn is the RFC number.

Oasis Global Inc. also provides an HTTP interface to the RFC
archive. To browse or search the archives via a web browser surf to:
http://www.oasisstudios.com/RFC

For more information send a message to "rfc-info@OASISSTUDIOS.COM"
with the subject "help".

contact: rfc-admin@oasisstudios.com

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Secondary Repositories:

Australia and Pacific Rim

        Site: munnari
        Contact: Robert Elz <kre@munnari.oz.au>
        Host: munnari.oz.au
        Directory: rfc
                        rfc's in compressed format rfcNNNN.Z
                        postscript rfc's rfcNNNN.ps.Z

        Site: The Programmers' Society
                        University of Technology, Sydney
        Contact: ftp@progsoc.uts.edu.au
        Host: ftp.progsoc.uts.edu.au
        Directory: pub/internet
                        Both are stored uncompressed.

Chile

        Site: OK Internet
        Host: http://www.ok.cl/rfcs/
        Directory: http://www.ok.cl/rfcs/

Denmark

        Site: University of Copenhagen
        Host: ftp.denet.dk
        Directory: mirror/ftp.isi.edu/in-notes

Finland

        Site: FUNET
        Host: nic.funet.fi
        Directory: index/RFC
        Directory: /pub/netinfo/rfc
        Notes: RFCs in compressed format. Also provides
                        email access by sending mail to
                        archive-server@nic.funet.fi.

France

        Site: Centre d'Informatique Scientifique et Medicale
                        (CISM)
        Contact: ftpmaint@univ-lyon1.fr
        Host: ftp.univ-lyon1.fr
        Directories: pub/rfc/*   Classified by hundreds
                        pub/mirrors/rfc Mirror of Internic
        Notes: Files compressed with gzip. Online
                        decompression done by the FTP server.

Romania

        Site: SunSITE Romania at the Politehnica University
                        of Bucharest
        Contact: space@sunsite.pub.ro
        Host: sunsite.pub.ro/pub/rfc
                        or via http:
                        sunsite.pub.ro/pub/mirrors/ds.internic.net

South Africa

        Site: The Internet Solution
        Contact: ftp-admin@is.co.za
        Host: ftp.is.co.za
        Directory: internet/in-notes/rfc

Sweden

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```
        Host:           ftp.chalmers.se
        Directory:      rfc


United Kingdom
--------------

        Site:           rfc.net
        Contact:        Alaric Williams <webmaster@rfc.net>


United States
-------------

        Site:           uunet
        Contact:        James Revell <revell@uunet.uu.net>
        Host:           ftp.uu.net
        Directory:      inet/rfc


UUNET Archive
-------------

     UUNET archive, which includes the RFC's, various IETF documents,
     and other information regarding the internet, is available to the
     public via anonymous ftp (to ftp.uu.net) and anonymous uucp, and
     will be available via an anonymous kermit server soon.  Get the
     file /archive/inet/ls-lR.Z for a listing of these documents.

     Any site in the US running UUCP may call +1 900 GOT SRCS and use
     the login "uucp".  There is no password.  The phone company will
     bill you at $0.50 per minute for the call.  The 900 number only
     works from within the US.


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Requests for special distribution of RFCs should be addressed to
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RFC-EDITOR@RFC-EDITOR.ORG

Submissions for Requests for Comments should be sent to
RFC-EDITOR@RFC-EDITOR.ORG.  Please consult "Instructions to RFC
Authors", RFC 2223, for further information.

Requests to be added to or deleted from the RFC distribution list should
be sent to RFC-REQUEST@ISI.EDU.

Users with .MIL addresses may send a request to MAJORDOMO@NIC.DDN.MIL
with an empty Subject: line and a message: subscribe rfc [your email
address].

Changes to this file "rfc-retrieval.txt" should be sent to
RFC-EDITOR@RFC-EDITOR.ORG.

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Network Working Group
Request for Comments: 2822
Obsoletes: 822
Category: Standards Track

P. Resnick, Editor
QUALCOMM Incorporated
April 2001

Internet Message Format

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Copyright Notice

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Abstract

This standard specifies a syntax for text messages that are sent between computer users, within the framework of "electronic mail" messages. This standard supersedes the one specified in Request For Comments (RFC) 822, "Standard for the Format of ARPA Internet Text Messages", updating it to reflect current practice and incorporating incremental changes that were specified in other RFCs.

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1. Introduction

1.1. Scope

This standard specifies a syntax for text messages that are sent between computer users, within the framework of "electronic mail" messages. This standard supersedes the one specified in Request For Comments (RFC) 822, "Standard for the Format of ARPA Internet Text Messages" [RFC822], updating it to reflect current practice and incorporating incremental changes that were specified in other RFCs [STD3].

This standard specifies a syntax only for text messages. In particular, it makes no provision for the transmission of images, audio, or other sorts of structured data in electronic mail messages. There are several extensions published, such as the MIME document series [RFC2045, RFC2046, RFC2049], which describe mechanisms for the transmission of such data through electronic mail, either by extending the syntax provided here or by structuring such messages to conform to this syntax. Those mechanisms are outside of the scope of this standard.

In the context of electronic mail, messages are viewed as having an envelope and contents. The envelope contains whatever information is needed to accomplish transmission and delivery. (See [RFC2821] for a discussion of the envelope.) The contents comprise the object to be delivered to the recipient. This standard applies only to the format and some of the semantics of message contents. It contains no specification of the information in the envelope.

However, some message systems may use information from the contents to create the envelope. It is intended that this standard facilitate the acquisition of such information by programs.

This specification is intended as a definition of what message content format is to be passed between systems. Though some message systems locally store messages in this format (which eliminates the need for translation between formats) and others use formats that differ from the one specified in this standard, local storage is outside of the scope of this standard.

Note: This standard is not intended to dictate the internal formats used by sites, the specific message system features that they are expected to support, or any of the characteristics of user interface programs that create or read messages. In addition, this standard does not specify an encoding of the characters for either transport or storage; that is, it does not specify the number of bits used or how those bits are specifically transferred over the wire or stored on disk.

1.2. Notational conventions

1.2.1. Requirements notation

This document occasionally uses terms that appear in capital letters. When the terms "MUST", "SHOULD", "RECOMMENDED", "MUST NOT", "SHOULD NOT", and "MAY" appear capitalized, they are being used to indicate particular requirements of this specification. A discussion of the meanings of these terms appears in [RFC2119].

1.2.2. Syntactic notation

This standard uses the Augmented Backus-Naur Form (ABNF) notation specified in [RFC2234] for the formal definitions of the syntax of messages. Characters will be specified either by a decimal value (e.g., the value %d65 for uppercase A and %d97 for lowercase A) or by a case-insensitive literal value enclosed in quotation marks (e.g.,

"A" for either uppercase or lowercase A). See [RFC2234] for the full description of the notation.

1.3. Structure of this document

This document is divided into several sections.

This section, section 1, is a short introduction to the document.

Section 2 lays out the general description of a message and its constituent parts. This is an overview to help the reader understand some of the general principles used in the later portions of this document. Any examples in this section MUST NOT be taken as specification of the formal syntax of any part of a message.

Section 3 specifies formal ABNF rules for the structure of each part of a message (the syntax) and describes the relationship between those parts and their meaning in the context of a message (the semantics). That is, it describes the actual rules for the structure of each part of a message (the syntax) as well as a description of the parts and instructions on how they ought to be interpreted (the semantics). This includes analysis of the syntax and semantics of

subparts of messages that have specific structure. The syntax included in section 3 represents messages as they MUST be created. There are also notes in section 3 to indicate if any of the options specified in the syntax SHOULD be used over any of the others.

Both sections 2 and 3 describe messages that are legal to generate for purposes of this standard.

Section 4 of this document specifies an "obsolete" syntax. There are references in section 3 to these obsolete syntactic elements. The rules of the obsolete syntax are elements that have appeared in earlier revisions of this standard or have previously been widely used in Internet messages. As such, these elements MUST be interpreted by parsers of messages in order to be conformant to this standard. However, since items in this syntax have been determined to be non-interoperable or to cause significant problems for recipients of messages, they MUST NOT be generated by creators of conformant messages.

Section 5 details security considerations to take into account when implementing this standard.

Section 6 is a bibliography of references in this document.

Section 7 contains the editor's address.

Section 8 contains acknowledgements.

Appendix A lists examples of different sorts of messages. These examples are not exhaustive of the types of messages that appear on the Internet, but give a broad overview of certain syntactic forms.

Appendix B lists the differences between this standard and earlier standards for Internet messages.

Appendix C has copyright and intellectual property notices.

2. Lexical Analysis of Messages

2.1. General Description

At the most basic level, a message is a series of characters. A message that is conformant with this standard is comprised of characters with values in the range 1 through 127 and interpreted as US-ASCII characters [ASCII]. For brevity, this document sometimes refers to this range of characters as simply "US-ASCII characters".

Note: This standard specifies that messages are made up of characters in the US-ASCII range of 1 through 127. There are other documents, specifically the MIME document series [RFC2045, RFC2046, RFC2047, RFC2048, RFC2049], that extend this standard to allow for values outside of that range. Discussion of those mechanisms is not within the scope of this standard.

Messages are divided into lines of characters. A line is a series of characters that is delimited with the two characters carriage-return and line-feed; that is, the carriage return (CR) character (ASCII value 13) followed immediately by the line feed (LF) character (ASCII value 10). (The carriage-return/line-feed pair is usually written in this document as "CRLF".)

A message consists of header fields (collectively called "the header of the message") followed, optionally, by a body. The header is a sequence of lines of characters with special syntax as defined in

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this standard. The body is simply a sequence of characters that follows the header and is separated from the header by an empty line (i.e., a line with nothing preceding the CRLF).

2.1.1. Line Length Limits

There are two limits that this standard places on the number of characters in a line. Each line of characters MUST be no more than 998 characters, and SHOULD be no more than 78 characters, excluding the CRLF.

The 998 character limit is due to limitations in many implementations which send, receive, or store Internet Message Format messages that simply cannot handle more than 998 characters on a line. Receiving implementations would do well to handle an arbitrarily large number of characters in a line for robustness sake. However, there are so many implementations which (in compliance with the transport requirements of [RFC2821]) do not accept messages containing more than 1000 character including the CR and LF per line, it is important for implementations not to create such messages.

The more conservative 78 character recommendation is to accommodate the many implementations of user interfaces that display these messages which may truncate, or disastrously wrap, the display of more than 78 characters per line, in spite of the fact that such implementations are non-conformant to the intent of this specification (and that of [RFC2821] if they actually cause information to be lost). Again, even though this limitation is put on messages, it is encumbant upon implementations which display messages

to handle an arbitrarily large number of characters in a line (certainly at least up to the 998 character limit) for the sake of robustness.

2.2. Header Fields

Header fields are lines composed of a field name, followed by a colon (":"), followed by a field body, and terminated by CRLF. A field name MUST be composed of printable US-ASCII characters (i.e., characters that have values between 33 and 126, inclusive), except colon. A field body may be composed of any US-ASCII characters, except for CR and LF. However, a field body may contain CRLF when used in header "folding" and "unfolding" as described in section 2.2.3. All field bodies MUST conform to the syntax described in sections 3 and 4 of this standard.

2.2.1. Unstructured Header Field Bodies

Some field bodies in this standard are defined simply as "unstructured" (which is specified below as any US-ASCII characters, except for CR and LF) with no further restrictions. These are referred to as unstructured field bodies. Semantically, unstructured field bodies are simply to be treated as a single line of characters with no further processing (except for header "folding" and "unfolding" as described in section 2.2.3).

2.2.2. Structured Header Field Bodies

Some field bodies in this standard have specific syntactical structure more restrictive than the unstructured field bodies described above. These are referred to as "structured" field bodies. Structured field bodies are sequences of specific lexical tokens as described in sections 3 and 4 of this standard. Many of these tokens are allowed (according to their syntax) to be introduced or end with comments (as described in section 3.2.3) as well as the space (SP, ASCII value 32) and horizontal tab (HTAB, ASCII value 9) characters (together known as the white space characters, WSP), and those WSP characters are subject to header "folding" and "unfolding" as described in section 2.2.3. Semantic analysis of structured field bodies is given along with their syntax.

2.2.3. Long Header Fields

Each header field is logically a single line of characters comprising the field name, the colon, and the field body. For convenience however, and to deal with the 998/78 character limitations per line, the field body portion of a header field can be split into a multiple line representation; this is called "folding". The general rule is

that wherever this standard allows for folding white space (not simply WSP characters), a CRLF may be inserted before any WSP. For example, the header field:

```
        Subject: This is a test
```

can be represented as:

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```
         Subject: This
          is a test
```

Note: Though structured field bodies are defined in such a way that folding can take place between many of the lexical tokens (and even within some of the lexical tokens), folding SHOULD be limited to placing the CRLF at higher-level syntactic breaks. For instance, if a field body is defined as comma-separated values, it is recommended that folding occur after the comma separating the structured items in preference to other places where the field could be folded, even if it is allowed elsewhere.

The process of moving from this folded multiple-line representation of a header field to its single line representation is called "unfolding". Unfolding is accomplished by simply removing any CRLF that is immediately followed by WSP. Each header field should be treated in its unfolded form for further syntactic and semantic evaluation.

2.3. Body

The body of a message is simply lines of US-ASCII characters. The only two limitations on the body are as follows:

- CR and LF MUST only occur together as CRLF; they MUST NOT appear independently in the body.

- Lines of characters in the body MUST be limited to 998 characters, and SHOULD be limited to 78 characters, excluding the CRLF.

Note: As was stated earlier, there are other standards documents, specifically the MIME documents [RFC2045, RFC2046, RFC2048, RFC2049] that extend this standard to allow for different sorts of message bodies. Again, these mechanisms are beyond the scope of this document.

3. Syntax

3.1. Introduction

The syntax as given in this section defines the legal syntax of Internet messages. Messages that are conformant to this standard MUST conform to the syntax in this section. If there are options in this section where one option SHOULD be generated, that is indicated either in the prose or in a comment next to the syntax.

For the defined expressions, a short description of the syntax and use is given, followed by the syntax in ABNF, followed by a semantic analysis. Primitive tokens that are used but otherwise unspecified come from [RFC2234].

In some of the definitions, there will be nonterminals whose names start with "obs-". These "obs-" elements refer to tokens defined in the obsolete syntax in section 4. In all cases, these productions are to be ignored for the purposes of generating legal Internet messages and MUST NOT be used as part of such a message. However, when interpreting messages, these tokens MUST be honored as part of the legal syntax. In this sense, section 3 defines a grammar for generation of messages, with "obs-" elements that are to be ignored, while section 4 adds grammar for interpretation of messages.

3.2. Lexical Tokens

The following rules are used to define an underlying lexical analyzer, which feeds tokens to the higher-level parsers. This section defines the tokens used in structured header field bodies.

Note: Readers of this standard need to pay special attention to how these lexical tokens are used in both the lower-level and higher-level syntax later in the document. Particularly, the white space tokens and the comment tokens defined in section 3.2.3 get used in the lower-level tokens defined here, and those lower-level tokens are in turn used as parts of the higher-level tokens defined later. Therefore, the white space and comments may be allowed in the higher-level tokens even though they may not explicitly appear in a particular definition.

3.2.1. Primitive Tokens

The following are primitive tokens referred to elsewhere in this standard, but not otherwise defined in [RFC2234]. Some of them will not appear anywhere else in the syntax, but they are convenient to refer to in other parts of this document.

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Note: The "specials" below are just such an example. Though the specials token does not appear anywhere else in this standard, it is useful for implementers who use tools that lexically analyze messages. Each of the characters in specials can be used to indicate a tokenization point in lexical analysis.

```
NO-WS-CTL       =       %d1-8 /         ; US-ASCII control characters
                        %d11 /          ;  that do not include the
                        %d12 /          ;  carriage return, line feed,
                        %d14-31 /       ;  and white space characters
                        %d127

text            =       %d1-9 /         ; Characters excluding CR and LF
                        %d11 /
                        %d12 /
                        %d14-127 /
                        obs-text

specials        =       "(" / ")" /     ; Special characters used in
                        "<" / ">" /     ;  other parts of the syntax
                        "[" / "]" /
                        ":" / ";" /
                        "@" / "\" /
                        "," / "." /
                        DQUOTE
```

No special semantics are attached to these tokens. They are simply single characters.

3.2.2. Quoted characters

Some characters are reserved for special interpretation, such as delimiting lexical tokens. To permit use of these characters as uninterpreted data, a quoting mechanism is provided.

```
quoted-pair     =       ("\" text) / obs-qp
```

Where any quoted-pair appears, it is to be interpreted as the text character alone. That is to say, the "\" character that appears as part of a quoted-pair is semantically "invisible".

Note: The "\" character may appear in a message where it is not part of a quoted-pair. A "\" character that does not appear in a quoted-pair is not semantically invisible. The only places in this standard where quoted-pair currently appears are ccontent, qcontent, dcontent, no-fold-quote, and no-fold-literal.

3.2.3. Folding white space and comments

White space characters, including white space used in folding (described in section 2.2.3), may appear between many elements in header field bodies. Also, strings of characters that are treated as comments may be included in structured field bodies as characters enclosed in parentheses. The following defines the folding white space (FWS) and comment constructs.

Strings of characters enclosed in parentheses are considered comments so long as they do not appear within a "quoted-string", as defined in section 3.2.5. Comments may nest.

There are several places in this standard where comments and FWS may be freely inserted. To accommodate that syntax, an additional token for "CFWS" is defined for places where comments and/or FWS can occur. However, where CFWS occurs in this standard, it MUST NOT be inserted in such a way that any line of a folded header field is made up entirely of WSP characters and nothing else.

```
FWS             =       ([*WSP CRLF] 1*WSP) /   ; Folding white space
                        obs-FWS

ctext           =       NO-WS-CTL /     ; Non white space controls

                        %d33-39 /       ; The rest of the US-ASCII
                        %d42-91 /       ;  characters not including "(",
                        %d93-126        ;  ")", or "\"

ccontent        =       ctext / quoted-pair / comment

comment         =       "(" *([FWS] ccontent) [FWS] ")"

CFWS            =       *([FWS] comment) (([FWS] comment) / FWS)
```

Throughout this standard, where FWS (the folding white space token) appears, it indicates a place where header folding, as discussed in section 2.2.3, may take place. Wherever header folding appears in a message (that is, a header field body containing a CRLF followed by any WSP), header unfolding (removal of the CRLF) is performed before any further lexical analysis is performed on that header field according to this standard. That is to say, any CRLF that appears in FWS is semantically "invisible."

A comment is normally used in a structured field body to provide some human readable informational text. Since a comment is allowed to

contain FWS, folding is permitted within the comment. Also note that since quoted-pair is allowed in a comment, the parentheses and

backslash characters may appear in a comment so long as they appear as a quoted-pair. Semantically, the enclosing parentheses are not part of the comment; the comment is what is contained between the two parentheses. As stated earlier, the "\" in any quoted-pair and the CRLF in any FWS that appears within the comment are semantically "invisible" and therefore not part of the comment either.

Runs of FWS, comment or CFWS that occur between lexical tokens in a structured field header are semantically interpreted as a single space character.

3.2.4. Atom

Several productions in structured header field bodies are simply strings of certain basic characters. Such productions are called atoms.

Some of the structured header field bodies also allow the period character (".", ASCII value 46) within runs of atext. An additional "dot-atom" token is defined for those purposes.

```
atext           =       ALPHA / DIGIT / ; Any character except controls,
                        "!" / "#" /     ;  SP, and specials.
                        "$" / "%" /     ;  Used for atoms
                        "&" / "'" /
                        "*" / "+" /
                        "-" / "/" /
                        "=" / "?" /
                        "^" / "_" /
                        "`" / "{" /
                        "|" / "}" /
                        "~"

atom            =       [CFWS] 1*atext [CFWS]

dot-atom        =       [CFWS] dot-atom-text [CFWS]

dot-atom-text   =       1*atext *("." 1*atext)
```

Both atom and dot-atom are interpreted as a single unit, comprised of the string of characters that make it up. Semantically, the optional comments and FWS surrounding the rest of the characters are not part of the atom; the atom is only the run of atext characters in an atom, or the atext and "." characters in a dot-atom.

3.2.5. Quoted strings

Strings of characters that include characters other than those allowed in atoms may be represented in a quoted string format, where the characters are surrounded by quote (DQUOTE, ASCII value 34) characters.

```
qtext           =       NO-WS-CTL /     ; Non white space controls

                        %d33 /          ; The rest of the US-ASCII
                        %d35-91 /       ;  characters not including "\"
                        %d93-126        ;  or the quote character

qcontent        =       qtext / quoted-pair

quoted-string   =       [CFWS]
                        DQUOTE *([FWS] qcontent) [FWS] DQUOTE
                        [CFWS]
```

A quoted-string is treated as a unit. That is, quoted-string is identical to atom, semantically. Since a quoted-string is allowed to contain FWS, folding is permitted. Also note that since quoted-pair is allowed in a quoted-string, the quote and backslash characters may appear in a quoted-string so long as they appear as a quoted-pair.

Semantically, neither the optional CFWS outside of the quote characters nor the quote characters themselves are part of the quoted-string; the quoted-string is what is contained between the two quote characters. As stated earlier, the "\" in any quoted-pair and the CRLF in any FWS/CFWS that appears within the quoted-string are semantically "invisible" and therefore not part of the quoted-string either.

3.2.6. Miscellaneous tokens

Three additional tokens are defined, word and phrase for combinations of atoms and/or quoted-strings, and unstructured for use in

unstructured header fields and in some places within structured header fields.

```
word            =       atom / quoted-string

phrase          =       1*word / obs-phrase
```



```
utext           =       NO-WS-CTL /     ; Non white space controls
                        %d33-126 /      ; The rest of US-ASCII
                        obs-utext

unstructured    =       *([FWS] utext) [FWS]
```

3.3. Date and Time Specification

Date and time occur in several header fields. This section specifies the syntax for a full date and time specification. Though folding white space is permitted throughout the date-time specification, it is RECOMMENDED that a single space be used in each place that FWS appears (whether it is required or optional); some older implementations may not interpret other occurrences of folding white space correctly.

```
date-time       =       [ day-of-week "," ] date FWS time [CFWS]

day-of-week     =       ([FWS] day-name) / obs-day-of-week

day-name        =       "Mon" / "Tue" / "Wed" / "Thu" /
                        "Fri" / "Sat" / "Sun"

date            =       day month year

year            =       4*DIGIT / obs-year

month           =       (FWS month-name FWS) / obs-month

month-name      =       "Jan" / "Feb" / "Mar" / "Apr" /
                        "May" / "Jun" / "Jul" / "Aug" /
                        "Sep" / "Oct" / "Nov" / "Dec"

day             =       ([FWS] 1*2DIGIT) / obs-day

time            =       time-of-day FWS zone

time-of-day     =       hour ":" minute [ ":" second ]

hour            =       2DIGIT / obs-hour

minute          =       2DIGIT / obs-minute

second          =       2DIGIT / obs-second

zone            =       (( "+" / "-" ) 4DIGIT) / obs-zone
```


The day is the numeric day of the month. The year is any numeric year 1900 or later.

The time-of-day specifies the number of hours, minutes, and optionally seconds since midnight of the date indicated.

The date and time-of-day SHOULD express local time.

The zone specifies the offset from Coordinated Universal Time (UTC, formerly referred to as "Greenwich Mean Time") that the date and time-of-day represent. The "+" or "-" indicates whether the time-of-day is ahead of (i.e., east of) or behind (i.e., west of) Universal Time. The first two digits indicate the number of hours difference from Universal Time, and the last two digits indicate the number of minutes difference from Universal Time. (Hence, +hhmm means +(hh * 60 + mm) minutes, and -hhmm means -(hh * 60 + mm) minutes). The form "+0000" SHOULD be used to indicate a time zone at Universal Time. Though "-0000" also indicates Universal Time, it is used to indicate that the time was generated on a system that may be in a local time zone other than Universal Time and therefore indicates that the date-time contains no information about the local time zone.

A date-time specification MUST be semantically valid. That is, the day-of-the-week (if included) MUST be the day implied by the date, the numeric day-of-month MUST be between 1 and the number of days allowed for the specified month (in the specified year), the time-of-day MUST be in the range 00:00:00 through 23:59:60 (the

time of day MUST be in the range 00:00:00 through 23:59:60 (the number of seconds allowing for a leap second; see [STD12]), and the zone MUST be within the range -9959 through +9959.

3.4. Address Specification

Addresses occur in several message header fields to indicate senders and recipients of messages. An address may either be an individual mailbox, or a group of mailboxes.

```
address         =       mailbox / group

mailbox         =       name-addr / addr-spec

name-addr       =       [display-name] angle-addr

angle-addr      =       [CFWS] "<" addr-spec ">" [CFWS] / obs-angle-addr

group           =       display-name ":" [mailbox-list / CFWS] ";"
                        [CFWS]
```



```
display-name    =       phrase

mailbox-list    =       (mailbox *("," mailbox)) / obs-mbox-list

address-list    =       (address *("," address)) / obs-addr-list
```

A mailbox receives mail. It is a conceptual entity which does not necessarily pertain to file storage. For example, some sites may choose to print mail on a printer and deliver the output to the addressee's desk. Normally, a mailbox is comprised of two parts: (1) an optional display name that indicates the name of the recipient (which could be a person or a system) that could be displayed to the user of a mail application, and (2) an addr-spec address enclosed in angle brackets ("<" and ">"). There is also an alternate simple form of a mailbox where the addr-spec address appears alone, without the recipient's name or the angle brackets. The Internet addr-spec address is described in section 3.4.1.

Note: Some legacy implementations used the simple form where the addr-spec appears without the angle brackets, but included the name of the recipient in parentheses as a comment following the addr-spec. Since the meaning of the information in a comment is unspecified, implementations SHOULD use the full name-addr form of the mailbox, instead of the legacy form, to specify the display name associated with a mailbox. Also, because some legacy implementations interpret the comment, comments generally SHOULD NOT be used in address fields to avoid confusing such implementations.

When it is desirable to treat several mailboxes as a single unit (i.e., in a distribution list), the group construct can be used. The group construct allows the sender to indicate a named group of recipients. This is done by giving a display name for the group, followed by a colon, followed by a comma separated list of any number of mailboxes (including zero and one), and ending with a semicolon. Because the list of mailboxes can be empty, using the group construct is also a simple way to communicate to recipients that the message was sent to one or more named sets of recipients, without actually providing the individual mailbox address for each of those recipients.

3.4.1. Addr-spec specification

An addr-spec is a specific Internet identifier that contains a locally interpreted string followed by the at-sign character ("@", ASCII value 64) followed by an Internet domain. The locally interpreted string is either a quoted-string or a dot-atom. If the string can be represented as a dot-atom (that is, it contains no characters other than atext characters or "." surrounded by atext

characters), then the dot-atom form SHOULD be used and the quoted-string form SHOULD NOT be used. Comments and folding white space SHOULD NOT be used around the "@" in the addr-spec.

```
addr-spec       =       local-part "@" domain

local-part      =       dot-atom / quoted-string / obs-local-part

domain          =       dot-atom / domain-literal / obs-domain

domain-literal  =       [CFWS] "[" *([FWS] dcontent) [FWS] "]" [CFWS]

dcontent        =       dtext / quoted-pair

dtext           =       NO-WS-CTL /     ; Non white space controls

                        %d33-90 /       ; The rest of the US-ASCII
                        %d94-126        ;  characters not including "[",
                                        ;  "]", or "\"
```

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The domain portion identifies the point to which the mail is delivered. In the dot-atom form, this is interpreted as an Internet domain name (either a host name or a mail exchanger name) as described in [STD3, STD13, STD14]. In the domain-literal form, the domain is interpreted as the literal Internet address of the particular host. In both cases, how addressing is used and how messages are transported to a particular host is covered in the mail transport document [RFC2821]. These mechanisms are outside of the scope of this document.

The local-part portion is a domain dependent string. In addresses, it is simply interpreted on the particular host as a name of a particular mailbox.

3.5 Overall message syntax

A message consists of header fields, optionally followed by a message body. Lines in a message MUST be a maximum of 998 characters excluding the CRLF, but it is RECOMMENDED that lines be limited to 78 characters excluding the CRLF. (See section 2.1.1 for explanation.) In a message body, though all of the characters listed in the text rule MAY be used, the use of US-ASCII control characters (values 1 through 8, 11, 12, and 14 through 31) is discouraged since their interpretation by receivers for display is not guaranteed.


```
message         =       (fields / obs-fields)
                        [CRLF body]

body            =       *(*998text CRLF) *998text
```

The header fields carry most of the semantic information and are defined in section 3.6. The body is simply a series of lines of text which are uninterpreted for the purposes of this standard.

3.6. Field definitions

The header fields of a message are defined here. All header fields have the same general syntactic structure: A field name, followed by a colon, followed by the field body. The specific syntax for each header field is defined in the subsequent sections.

Note: In the ABNF syntax for each field in subsequent sections, each field name is followed by the required colon. However, for brevity sometimes the colon is not referred to in the textual description of the syntax. It is, nonetheless, required.

It is important to note that the header fields are not guaranteed to be in a particular order. They may appear in any order, and they have been known to be reordered occasionally when transported over the Internet. However, for the purposes of this standard, header fields SHOULD NOT be reordered when a message is transported or transformed. More importantly, the trace header fields and resent header fields MUST NOT be reordered, and SHOULD be kept in blocks prepended to the message. See sections 3.6.6 and 3.6.7 for more information.

The only required header fields are the origination date field and the originator address field(s). All other header fields are syntactically optional. More information is contained in the table following this definition.

```
fields          =       *(trace
                          *(resent-date /
                            resent-from /
                            resent-sender /
                            resent-to /
                            resent-cc /
                            resent-bcc /
                            resent-msg-id))
                        *(orig-date /
                        from /
                        sender /
                        reply-to /
```



```
                        to /
                        cc /
                        bcc /
                        message-id /
                        in-reply-to /
                        references /
                        subject /
                        comments /
                        keywords /
                        optional-field)
```

optional-field)

The following table indicates limits on the number of times each field may occur in a message header as well as any special limitations on the use of those fields. An asterisk next to a value in the minimum or maximum column indicates that a special restriction appears in the Notes column.

Field	Min number	Max number	Notes
trace	0	unlimited	Block prepended - see 3.6.7
resent-date	0*	unlimited*	One per block, required if other resent fields present - see 3.6.6
resent-from	0	unlimited*	One per block - see 3.6.6
resent-sender	0*	unlimited*	One per block, MUST occur with multi-address resent-from - see 3.6.6
resent-to	0	unlimited*	One per block - see 3.6.6
resent-cc	0	unlimited*	One per block - see 3.6.6
resent-bcc	0	unlimited*	One per block - see 3.6.6
resent-msg-id	0	unlimited*	One per block - see 3.6.6
orig-date	1	1	
from	1	1	See sender and 3.6.2

sender	0*	1	MUST occur with multi-address from - see 3.6.2
reply-to	0	1	
to	0	1	
cc	0	1	
bcc	0	1	
message-id	0*	1	SHOULD be present - see 3.6.4
in-reply-to	0*	1	SHOULD occur in some replies - see 3.6.4
references	0*	1	SHOULD occur in some replies - see 3.6.4
subject	0	1	
comments	0	unlimited	
keywords	0	unlimited	
optional-field	0	unlimited	

The exact interpretation of each field is described in subsequent sections.

3.6.1. The origination date field

The origination date field consists of the field name "Date" followed by a date-time specification.

```
orig-date       =       "Date:" date-time CRLF
```

The origination date specifies the date and time at which the creator of the message indicated that the message was complete and ready to enter the mail delivery system. For instance, this might be the time that a user pushes the "send" or "submit" button in an application program. In any case, it is specifically not intended to convey the time that the message is actually transported, but rather the time at which the human or other creator of the message has put the message into its final form, ready for transport. (For example, a portable computer user who is not connected to a network might queue a message

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for delivery. The origination date is intended to contain the date and time that the user queued the message, not the time when the user connected to the network to send the message.)

3.6.2. Originator fields

The originator fields of a message consist of the from field, the sender field (when applicable), and optionally the reply-to field. The from field consists of the field name "From" and a comma-separated list of one or more mailbox specifications. If the from field contains more than one mailbox specification in the mailbox-list, then the sender field, containing the field name "Sender" and a single mailbox specification, MUST appear in the message. In either case, an optional reply-to field MAY also be included, which contains the field name "Reply-To" and a comma-separated list of one or more addresses.

```
from            =       "From:" mailbox-list CRLF

sender          =       "Sender:" mailbox CRLF

reply-to        =       "Reply-To:" address-list CRLF
```

The originator fields indicate the mailbox(es) of the source of the message. The "From:" field specifies the author(s) of the message, that is, the mailbox(es) of the person(s) or system(s) responsible for the writing of the message. The "Sender:" field specifies the mailbox of the agent responsible for the actual transmission of the message. For example, if a secretary were to send a message for another person, the mailbox of the secretary would appear in the "Sender:" field and the mailbox of the actual author would appear in the "From:" field. If the originator of the message can be indicated by a single mailbox and the author and transmitter are identical, the "Sender:" field SHOULD NOT be used. Otherwise, both fields SHOULD appear.

The originator fields also provide the information required when replying to a message. When the "Reply-To:" field is present, it indicates the mailbox(es) to which the author of the message suggests that replies be sent. In the absence of the "Reply-To:" field, replies SHOULD by default be sent to the mailbox(es) specified in the "From:" field unless otherwise specified by the person composing the reply.

In all cases, the "From:" field SHOULD NOT contain any mailbox that does not belong to the author(s) of the message. See also section 3.6.3 for more information on forming the destination addresses for a reply.

3.6.3. Destination address fields

The destination fields of a message consist of three possible fields, each of the same form: The field name, which is either "To", "Cc", or "Bcc", followed by a comma-separated list of one or more addresses (either mailbox or group syntax).

```
to              =       "To:" address-list CRLF

cc              =       "Cc:" address-list CRLF

bcc             =       "Bcc:" (address-list / [CFWS]) CRLF
```

The destination fields specify the recipients of the message. Each destination field may have one or more addresses, and each of the addresses indicate the intended recipients of the message. The only difference between the three fields is how each is used.

The "To:" field contains the address(es) of the primary recipient(s) of the message.

The "Cc:" field (where the "Cc" means "Carbon Copy" in the sense of making a copy on a typewriter using carbon paper) contains the addresses of others who are to receive the message, though the content of the message may not be directed at them.

The "Bcc:" field (where the "Bcc" means "Blind Carbon Copy") contains addresses of recipients of the message whose addresses are not to be revealed to other recipients of the message. There are three ways in which the "Bcc:" field is used. In the first case, when a message containing a "Bcc:" field is prepared to be sent, the "Bcc:" line is removed even though all of the recipients (including those specified in the "Bcc:" field) are sent a copy of the message. In the second case, recipients specified in the "To:" and "Cc:" lines each are sent a copy of the message with the "Bcc:" line removed as above, but the recipients on the "Bcc:" line get a separate copy of the message containing a "Bcc:" line. (When there are multiple recipient addresses in the "Bcc:" field, some implementations actually send a separate copy of the message to each recipient with a "Bcc:" containing only the address of that particular recipient.) Finally, since a "Bcc:" field may contain no addresses, a "Bcc:" field can be sent without any addresses indicating to the recipients that blind copies were sent to someone. Which method to use with "Bcc:" fields is implementation dependent, but refer to the "Security Considerations" section of this document for a discussion of each.

When a message is a reply to another message, the mailboxes of the authors of the original message (the mailboxes in the "From:" field) or mailboxes specified in the "Reply-To:" field (if it exists) MAY appear in the "To:" field of the reply since these would normally be the primary recipients of the reply. If a reply is sent to a message that has destination fields, it is often desirable to send a copy of the reply to all of the recipients of the message, in addition to the author. When such a reply is formed, addresses in the "To:" and "Cc:" fields of the original message MAY appear in the "Cc:" field of the reply, since these are normally secondary recipients of the reply. If a "Bcc:" field is present in the original message, addresses in that field MAY appear in the "Bcc:" field of the reply, but SHOULD NOT appear in the "To:" or "Cc:" fields.

Note: Some mail applications have automatic reply commands that include the destination addresses of the original message in the destination addresses of the reply. How those reply commands behave is implementation dependent and is beyond the scope of this document. In particular, whether or not to include the original destination addresses when the original message had a "Reply-To:" field is not addressed here.

3.6.4. Identification fields

Though optional, every message SHOULD have a "Message-ID:" field. Furthermore, reply messages SHOULD have "In-Reply-To:" and "References:" fields as appropriate, as described below.

The "Message-ID:" field contains a single unique message identifier. The "References:" and "In-Reply-To:" field each contain one or more unique message identifiers, optionally separated by CFWS.

The message identifier (msg-id) is similar in syntax to an angle-addr construct without the internal CFWS.

```
message-id      =       "Message-ID:" msg-id CRLF

in-reply-to     =       "In-Reply-To:" 1*msg-id CRLF

references      =       "References:" 1*msg-id CRLF

msg-id          =       [CFWS] "<" id-left "@" id-right ">" [CFWS]

id-left         =       dot-atom-text / no-fold-quote / obs-id-left

id-right        =       dot-atom-text / no-fold-literal / obs-id-right

no-fold-quote   =       DQUOTE *(qtext / quoted-pair) DQUOTE
```



```
no-fold-literal =       "[" *(dtext / quoted-pair) "]"
```

The "Message-ID:" field provides a unique message identifier that refers to a particular version of a particular message. The uniqueness of the message identifier is guaranteed by the host that generates it (see below). This message identifier is intended to be machine readable and not necessarily meaningful to humans. A message identifier pertains to exactly one instantiation of a particular message; subsequent revisions to the message each receive new message identifiers.

Note: There are many instances when messages are "changed", but those changes do not constitute a new instantiation of that message, and therefore the message would not get a new message identifier. For example, when messages are introduced into the transport system, they are often prepended with additional header fields such as trace fields (described in section 3.6.7) and resent fields (described in section 3.6.6). The addition of such header fields does not change the identity of the message and therefore the original "Message-ID:" field is retained. In all cases, it is the meaning that the sender of the message wishes to convey (i.e., whether this is the same message or a different message) that determines whether or not the "Message-ID:" field changes, not any particular syntactic difference that appears (or does not appear) in the message.

The "In-Reply-To:" and "References:" fields are used when creating a reply to a message. They hold the message identifier of the original message and the message identifiers of other messages (for example, in the case of a reply to a message which was itself a reply). The "In-Reply-To:" field may be used to identify the message (or messages) to which the new message is a reply, while the "References:" field may be used to identify a "thread" of conversation.

When creating a reply to a message, the "In-Reply-To:" and "References:" fields of the resultant message are constructed as follows:

The "In-Reply-To:" field will contain the contents of the "Message-ID:" field of the message to which this one is a reply (the "parent message"). If there is more than one parent message, then the "In-Reply-To:" field will contain the contents of all of the parents' "Message-ID:" fields. If there is no "Message-ID:" field in any of the parent messages, then the new message will have no "In-Reply-To:" field.

The "References:" field will contain the contents of the parent's "References:" field (if any) followed by the contents of the parent's "Message-ID:" field (if any). If the parent message does not contain a "References:" field but does have an "In-Reply-To:" field containing a single message identifier, then the "References:" field will contain the contents of the parent's "In-Reply-To:" field followed by the contents of the parent's "Message-ID:" field (if any). If the parent has none of the "References:", "In-Reply-To:", or "Message-ID:" fields, then the new message will have no "References:" field.

Note: Some implementations parse the "References:" field to display the "thread of the discussion". These implementations assume that each new message is a reply to a single parent and hence that they can walk backwards through the "References:" field to find the parent of each message listed there. Therefore, trying to form a "References:" field for a reply that has multiple parents is discouraged and how to do so is not defined in this document.

The message identifier (msg-id) itself MUST be a globally unique identifier for a message. The generator of the message identifier MUST guarantee that the msg-id is unique. There are several algorithms that can be used to accomplish this. Since the msg-id has a similar syntax to angle-addr (identical except that comments and folding white space are not allowed), a good method is to put the domain name (or a domain literal IP address) of the host on which the message identifier was created on the right hand side of the "@", and put a combination of the current absolute date and time along with some other currently unique (perhaps sequential) identifier available on the system (for example, a process id number) on the left hand side. Using a date on the left hand side and a domain name or domain literal on the right hand side makes it possible to guarantee uniqueness since no two hosts use the same domain name or IP address at the same time. Though other algorithms will work, it is RECOMMENDED that the right hand side contain some domain identifier (either of the host itself or otherwise) such that the generator of the message identifier can guarantee the uniqueness of the left hand side within the scope of that domain.

Semantically, the angle bracket characters are not part of the msg-id; the msg-id is what is contained between the two angle bracket characters.

3.6.5. Informational fields

The informational fields are all optional. The "Keywords:" field contains a comma-separated list of one or more words or quoted-strings. The "Subject:" and "Comments:" fields are unstructured fields as defined in section 2.2.1, and therefore may contain text or folding white space.

```
subject         =       "Subject:" unstructured CRLF

comments        =       "Comments:" unstructured CRLF

keywords        =       "Keywords:" phrase *("," phrase) CRLF
```

These three fields are intended to have only human-readable content with information about the message. The "Subject:" field is the most common and contains a short string identifying the topic of the message. When used in a reply, the field body MAY start with the string "Re: " (from the Latin "res", in the matter of) followed by the contents of the "Subject:" field body of the original message. If this is done, only one instance of the literal string "Re: " ought to be used since use of other strings or more than one instance can lead to undesirable consequences. The "Comments:" field contains any additional comments on the text of the body of the message. The "Keywords:" field contains a comma-separated list of important words and phrases that might be useful for the recipient.

3.6.6. Resent fields

Resent fields SHOULD be added to any message that is reintroduced by a user into the transport system. A separate set of resent fields SHOULD be added each time this is done. All of the resent fields corresponding to a particular resending of the message SHOULD be together. Each new set of resent fields is prepended to the message; that is, the most recent set of resent fields appear earlier in the message. No other fields in the message are changed when resent fields are added.

Each of the resent fields corresponds to a particular field elsewhere in the syntax. For instance, the "Resent-Date:" field corresponds to the "Date:" field and the "Resent-To:" field corresponds to the "To:" field. In each case, the syntax for the field body is identical to the syntax given previously for the corresponding field.

When resent fields are used, the "Resent-From:" and "Resent-Date:" fields MUST be sent. The "Resent-Message-ID:" field SHOULD be sent. "Resent-Sender:" SHOULD NOT be used if "Resent-Sender:" would be identical to "Resent-From:".


```
resent-date     =       "Resent-Date:" date-time CRLF

resent-from     =       "Resent-From:" mailbox-list CRLF

resent-sender   =       "Resent-Sender:" mailbox CRLF

resent-to       =       "Resent-To:" address-list CRLF

resent-cc       =       "Resent-Cc:" address-list CRLF

resent-bcc      =       "Resent-Bcc:" (address-list / [CFWS]) CRLF

resent-msg-id   =       "Resent-Message-ID:" msg-id CRLF
```

Resent fields are used to identify a message as having been reintroduced into the transport system by a user. The purpose of using resent fields is to have the message appear to the final recipient as if it were sent directly by the original sender, with all of the original fields remaining the same. Each set of resent fields correspond to a particular resending event. That is, if a message is resent multiple times, each set of resent fields gives identifying information for each individual time. Resent fields are strictly informational. They MUST NOT be used in the normal processing of replies or other such automatic actions on messages.

Note: Reintroducing a message into the transport system and using resent fields is a different operation from "forwarding". "Forwarding" has two meanings: One sense of forwarding is that a mail reading program can be told by a user to forward a copy of a message to another person, making the forwarded message the body of the new message. A forwarded message in this sense does not appear to have come from the original sender, but is an entirely new message from the forwarder of the message. On the other hand, forwarding is also used to mean when a mail transport program gets a message and forwards it on to a different destination for final delivery. Resent header fields are not intended for use with either type of forwarding.

The resent originator fields indicate the mailbox of the person(s) or system(s) that resent the message. As with the regular originator fields, there are two forms: a simple "Resent-From:" form which contains the mailbox of the individual doing the resending, and the more complex form, when one individual (identified in the "Resent-Sender:" field) resends a message on behalf of one or more others (identified in the "Resent-From:" field).

Note: When replying to a resent message, replies behave just as they would with any other message, using the original "From:",

"Reply-To:", "Message-ID:", and other fields. The resent fields are only informational and MUST NOT be used in the normal processing of replies.

The "Resent-Date:" indicates the date and time at which the resent message is dispatched by the resender of the message. Like the "Date:" field, it is not the date and time that the message was actually transported.

The "Resent-To:", "Resent-Cc:", and "Resent-Bcc:" fields function identically to the "To:", "Cc:", and "Bcc:" fields respectively, except that they indicate the recipients of the resent message, not the recipients of the original message.

The "Resent-Message-ID:" field provides a unique identifier for the resent message.

3.6.7. Trace fields

The trace fields are a group of header fields consisting of an

optional "Return-Path:" field, and one or more "Received:" fields. The "Return-Path:" header field contains a pair of angle brackets that enclose an optional addr-spec. The "Received:" field contains a (possibly empty) list of name/value pairs followed by a semicolon and a date-time specification. The first item of the name/value pair is defined by item-name, and the second item is either an addr-spec, an atom, a domain, or a msg-id. Further restrictions may be applied to the syntax of the trace fields by standards that provide for their use, such as [RFC2821].

```
trace           =       [return]
                        1*received

return          =       "Return-Path:" path CRLF

path            =       ([CFWS] "<" ([CFWS] / addr-spec) ">" [CFWS]) /
                        obs-path

received        =       "Received:" name-val-list ";" date-time CRLF

name-val-list   =       [CFWS] [name-val-pair *(CFWS name-val-pair)]

name-val-pair   =       item-name CFWS item-value

item-name       =       ALPHA *(["-"] (ALPHA / DIGIT))

item-value      =       1*angle-addr / addr-spec /
                         atom / domain / msg-id
```


A full discussion of the Internet mail use of trace fields is contained in [RFC2821]. For the purposes of this standard, the trace fields are strictly informational, and any formal interpretation of them is outside of the scope of this document.

3.6.8. Optional fields

Fields may appear in messages that are otherwise unspecified in this standard. They MUST conform to the syntax of an optional-field. This is a field name, made up of the printable US-ASCII characters except SP and colon, followed by a colon, followed by any text which conforms to unstructured.

The field names of any optional-field MUST NOT be identical to any field name specified elsewhere in this standard.

```
optional-field  =       field-name ":" unstructured CRLF

field-name      =       1*ftext

ftext           =       %d33-57 /               ; Any character except
                        %d59-126                ;  controls, SP, and
                                                ;  ":".
```

For the purposes of this standard, any optional field is uninterpreted.

4. Obsolete Syntax

Earlier versions of this standard allowed for different (usually more liberal) syntax than is allowed in this version. Also, there have been syntactic elements used in messages on the Internet whose interpretation have never been documented. Though some of these syntactic forms MUST NOT be generated according to the grammar in section 3, they MUST be accepted and parsed by a conformant receiver. This section documents many of these syntactic elements. Taking the grammar in section 3 and adding the definitions presented in this section will result in the grammar to use for interpretation of messages.

Note: This section identifies syntactic forms that any implementation MUST reasonably interpret. However, there are certainly Internet messages which do not conform to even the additional syntax given in this section. The fact that a particular form does not appear in any section of this document is not justification for computer programs to crash or for malformed data to be irretrievably lost by any implementation. To repeat an example, though this document requires lines in messages to be no longer than 998 characters, silently

discarding the 999th and subsequent characters in a line without warning would still be bad behavior for an implementation. It is up to the implementation to deal with messages robustly.

One important difference between the obsolete (interpreting) and the current (generating) syntax is that in structured header field bodies (i.e., between the colon and the CRLF of any structured header field), white space characters, including folding white space, and comments can be freely inserted between any syntactic tokens. This allows many complex forms that have proven difficult for some implementations to parse.

Another key difference between the obsolete and the current syntax is that the rule in section 3.2.3 regarding lines composed entirely of white space in comments and folding white space does not apply. See the discussion of folding white space in section 4.2 below.

Finally, certain characters that were formerly allowed in messages appear in this section. The NUL character (ASCII value 0) was once allowed, but is no longer for compatibility reasons. CR and LF were allowed to appear in messages other than as CRLF; this use is also shown here.

Other differences in syntax and semantics are noted in the following sections.

4.1. Miscellaneous obsolete tokens

These syntactic elements are used elsewhere in the obsolete syntax or in the main syntax. The obs-char and obs-qp elements each add ASCII value 0. Bare CR and bare LF are added to obs-text and obs-utext. The period character is added to obs-phrase. The obs-phrase-list provides for "empty" elements in a comma-separated list of phrases.

Note: The "period" (or "full stop") character (".") in obs-phrase is not a form that was allowed in earlier versions of this or any other standard. Period (nor any other character from specials) was not allowed in phrase because it introduced a parsing difficulty distinguishing between phrases and portions of an addr-spec (see section 4.4). It appears here because the period character is currently used in many messages in the display-name portion of addresses, especially for initials in names, and therefore must be interpreted properly. In the future, period may appear in the regular syntax of phrase.

```
obs-qp          =       "\" (%d0-127)

obs-text        =       *LF *CR *(obs-char *LF *CR)
```



```
obs-char        =       %d0-9 / %d11 /          ; %d0-127 except CR and
                        %d12 / %d14-127         ;  LF

obs-utext       =       obs-text

obs-phrase      =       word *(word / "." / CFWS)

obs-phrase-list =       phrase / 1*([phrase] [CFWS] "," [CFWS]) [phrase]
```

Bare CR and bare LF appear in messages with two different meanings. In many cases, bare CR or bare LF are used improperly instead of CRLF to indicate line separators. In other cases, bare CR and bare LF are used simply as ASCII control characters with their traditional ASCII meanings.

4.2. Obsolete folding white space

In the obsolete syntax, any amount of folding white space MAY be inserted where the obs-FWS rule is allowed. This creates the possibility of having two consecutive "folds" in a line, and therefore the possibility that a line which makes up a folded header field could be composed entirely of white space.

```
obs-FWS         =       1*WSP *(CRLF 1*WSP)
```

4.3. Obsolete Date and Time

The syntax for the obsolete date format allows a 2 digit year in the date field and allows for a list of alphabetic time zone specifications that were used in earlier versions of this standard. It also permits comments and folding white space between many of the tokens.

```
obs-day-of-week =       [CFWS] day-name [CFWS]

obs-year        =       [CFWS] 2*DIGIT [CFWS]

obs-month       =       CFWS month-name CFWS

obs-day         =       [CFWS] 1*2DIGIT [CFWS]

obs-hour        =       [CFWS] 2DIGIT [CFWS]

obs-minute      =       [CFWS] 2DIGIT [CFWS]

obs-second      =       [CFWS] 2DIGIT [CFWS]

obs-zone        =       "UT" / "GMT" /          ; Universal Time
```



```
                                        ; North American UT
                                        : offsets
```

```
                        "EST" / "EDT" /         ; Eastern:  - 5/ - 4
                        "CST" / "CDT" /         ; Central:  - 6/ - 5
                        "MST" / "MDT" /         ; Mountain: - 7/ - 6
                        "PST" / "PDT" /         ; Pacific:  - 8/ - 7

                        %d65-73 /               ; Military zones - "A"
                        %d75-90 /               ; through "I" and "K"
                        %d97-105 /              ; through "Z", both
                        %d107-122               ; upper and lower case
```

Where a two or three digit year occurs in a date, the year is to be interpreted as follows: If a two digit year is encountered whose value is between 00 and 49, the year is interpreted by adding 2000, ending up with a value between 2000 and 2049. If a two digit year is encountered with a value between 50 and 99, or any three digit year is encountered, the year is interpreted by adding 1900.

In the obsolete time zone, "UT" and "GMT" are indications of "Universal Time" and "Greenwich Mean Time" respectively and are both semantically identical to "+0000".

The remaining three character zones are the US time zones. The first letter, "E", "C", "M", or "P" stands for "Eastern", "Central", "Mountain" and "Pacific". The second letter is either "S" for "Standard" time, or "D" for "Daylight" (or summer) time. Their interpretations are as follows:

EDT is semantically equivalent to -0400
EST is semantically equivalent to -0500
CDT is semantically equivalent to -0500
CST is semantically equivalent to -0600
MDT is semantically equivalent to -0600
MST is semantically equivalent to -0700
PDT is semantically equivalent to -0700
PST is semantically equivalent to -0800

The 1 character military time zones were defined in a non-standard way in [RFC822] and are therefore unpredictable in their meaning. The original definitions of the military zones "A" through "I" are equivalent to "+0100" through "+0900" respectively; "K", "L", and "M" are equivalent to "+1000", "+1100", and "+1200" respectively; "N" through "Y" are equivalent to "-0100" through "-1200" respectively; and "Z" is equivalent to "+0000". However, because of the error in [RFC822], they SHOULD all be considered equivalent to "-0000" unless there is out-of-band information confirming their meaning.

Other multi-character (usually between 3 and 5) alphabetic time zones have been used in Internet messages. Any such time zone whose meaning is not known SHOULD be considered equivalent to "-0000" unless there is out-of-band information confirming their meaning.

4.4. Obsolete Addressing

There are three primary differences in addressing. First, mailbox addresses were allowed to have a route portion before the addr-spec when enclosed in "<" and ">". The route is simply a comma-separated list of domain names, each preceded by "@", and the list terminated by a colon. Second, CFWS were allowed between the period-separated elements of local-part and domain (i.e., dot-atom was not used). In addition, local-part is allowed to contain quoted-string in addition to just atom. Finally, mailbox-list and address-list were allowed to have "null" members. That is, there could be two or more commas in such a list with nothing in between them.

```
obs-angle-addr  =       [CFWS] "<" [obs-route] addr-spec ">" [CFWS]

obs-route       =       [CFWS] obs-domain-list ":" [CFWS]

obs-domain-list =       "@" domain *(*(CFWS / "," ) [CFWS] "@" domain)

obs-local-part  =       word *("." word)

obs-domain      =       atom *("." atom)

obs-mbox-list   =       1*([mailbox] [CFWS] "," [CFWS]) [mailbox]

obs-addr-list   =       1*([address] [CFWS] "," [CFWS]) [address]
```

When interpreting addresses, the route portion SHOULD be ignored.

4.5. Obsolete header fields

Syntactically, the primary difference in the obsolete field syntax is that it allows multiple occurrences of any of the fields and they may occur in any order. Also, any amount of white space is allowed before the ":" at the end of the field name.

```
obs-fields      =       *(obs-return /
                        obs-received /
                        obs-orig-date /
                        obs-from /
                        obs-sender /
                        obs-reply-to /
                        obs-to /
```

```
                        obs-cc /
                        obs-bcc /
                        obs-message-id /
                        obs-in-reply-to /
                        obs-references /
                        obs-subject /
                        obs-comments /
                        obs-keywords /
                        obs-resent-date /
                        obs-resent-from /
                        obs-resent-send /
                        obs-resent-rply /
                        obs-resent-to /
                        obs-resent-cc /
                        obs-resent-bcc /
                        obs-resent-mid /
                        obs-optional)
```

Except for destination address fields (described in section 4.5.3), the interpretation of multiple occurrences of fields is unspecified. Also, the interpretation of trace fields and resent fields which do not occur in blocks prepended to the message is unspecified as well. Unless otherwise noted in the following sections, interpretation of other fields is identical to the interpretation of their non-obsolete counterparts in section 3.

4.5.1. Obsolete origination date field

```
obs-orig-date   =       "Date" *WSP ":" date-time CRLF
```

4.5.2. Obsolete originator fields

```
obs-from        =       "From" *WSP ":" mailbox-list CRLF

obs-sender      =       "Sender" *WSP ":" mailbox CRLF

obs-reply-to    =       "Reply-To" *WSP ":" mailbox-list CRLF
```

4.5.3. Obsolete destination address fields

```
obs-to          =       "To" *WSP ":" address-list CRLF

obs-cc          =       "Cc" *WSP ":" address-list CRLF

obs-bcc         =       "Bcc" *WSP ":" (address-list / [CFWS]) CRLF
```


When multiple occurrences of destination address fields occur in a message, they SHOULD be treated as if the address-list in the first occurrence of the field is combined with the address lists of the subsequent occurrences by adding a comma and concatenating.

4.5.4. Obsolete identification fields

The obsolete "In-Reply-To:" and "References:" fields differ from the current syntax in that they allow phrase (words or quoted strings) to appear. The obsolete forms of the left and right sides of msg-id allow interspersed CFWS, making them syntactically identical to local-part and domain respectively.

```
obs-message-id  =       "Message-ID" *WSP ":" msg-id CRLF

obs-in-reply-to =       "In-Reply-To" *WSP ":" *(phrase / msg-id) CRLF

obs-references  =       "References" *WSP ":" *(phrase / msg-id) CRLF

obs-id-left     =       local-part

obs-id-right    =       domain
```

For purposes of interpretation, the phrases in the "In-Reply-To:" and "References:" fields are ignored.

Semantically, none of the optional CFWS surrounding the local-part and the domain are part of the obs-id-left and obs-id-right respectively.

4.5.5. Obsolete informational fields

```
obs-subject     =       "Subject" *WSP ":" unstructured CRLF

obs-comments    =       "Comments" *WSP ":" unstructured CRLF

obs-keywords    =       "Keywords" *WSP ":" obs-phrase-list CRLF
```

4.5.6. Obsolete resent fields

The obsolete syntax adds a "Resent-Reply-To:" field, which consists of the field name, the optional comments and folding white space, the colon, and a comma separated list of addresses.

```
obs-resent-from =       "Resent-From" *WSP ":" mailbox-list CRLF

obs-resent-send =       "Resent-Sender" *WSP ":" mailbox CRLF
```



```
obs-resent-date =       "Resent-Date" *WSP ":" date-time CRLF

obs-resent-to   =       "Resent-To" *WSP ":" address-list CRLF

obs-resent-cc   =       "Resent-Cc" *WSP ":" address-list CRLF

obs-resent-bcc  =       "Resent-Bcc" *WSP ":"
                         (address-list / [CFWS]) CRLF

obs-resent-mid  =       "Resent-Message-ID" *WSP ":" msg-id CRLF

obs-resent-rply =       "Resent-Reply-To" *WSP ":" address-list CRLF
```

As with other resent fields, the "Resent-Reply-To:" field is to be treated as trace information only.

4.5.7. Obsolete trace fields

The obs-return and obs-received are again given here as template definitions, just as return and received are in section 3. Their full syntax is given in [RFC2821].

```
obs-return      =       "Return-Path" *WSP ":" path CRLF

obs-received    =       "Received" *WSP ":" name-val-list CRLF

obs-path        =       obs-angle-addr
```

4.5.8. Obsolete optional fields

```
obs-optional    =       field-name *WSP ":" unstructured CRLF
```

5. Security Considerations

Care needs to be taken when displaying messages on a terminal or terminal emulator. Powerful terminals may act on escape sequences and other combinations of ASCII control characters with a variety of consequences. They can remap the keyboard or permit other modifications to the terminal which could lead to denial of service or even damaged data. They can trigger (sometimes programmable) answerback messages which can allow a message to cause commands to be issued on the recipient's behalf. They can also effect the operation of terminal attached devices such as printers. Message viewers may wish to strip potentially dangerous terminal escape sequences from the message prior to display. However, other escape sequences appear in messages for useful purposes (cf. [RFC2045, RFC2046, RFC2047, RFC2048, RFC2049, ISO2022]) and therefore should not be stripped indiscriminately.

Transmission of non-text objects in messages raises additional security issues. These issues are discussed in [RFC2045, RFC2046, RFC2047, RFC2048, RFC2049].

Many implementations use the "Bcc:" (blind carbon copy) field described in section 3.6.3 to facilitate sending messages to recipients without revealing the addresses of one or more of the addressees to the other recipients. Mishandling this use of "Bcc:" has implications for confidential information that might be revealed, which could eventually lead to security problems through knowledge of even the existence of a particular mail address. For example, if using the first method described in section 3.6.3, where the "Bcc:" line is removed from the message, blind recipients have no explicit indication that they have been sent a blind copy, except insofar as their address does not appear in the message header. Because of this, one of the blind addressees could potentially send a reply to all of the shown recipients and accidentally reveal that the message went to the blind recipient. When the second method from section 3.6.3 is used, the blind recipient's address appears in the "Bcc:" field of a separate copy of the message. If the "Bcc:" field sent contains all of the blind addressees, all of the "Bcc:" recipients will be seen by each "Bcc:" recipient. Even if a separate message is sent to each "Bcc:" recipient with only the individual's address, implementations still need to be careful to process replies to the message as per section 3.6.3 so as not to accidentally reveal the blind recipient to other recipients.

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Appendix A. Example messages

This section presents a selection of messages. These are intended to assist in the implementation of this standard, but should not be taken as normative; that is to say, although the examples in this section were carefully reviewed, if there happens to be a conflict between these examples and the syntax described in sections 3 and 4 of this document, the syntax in those sections is to be taken as correct.

Messages are delimited in this section between lines of "----". The "----" lines are not part of the message itself.

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A.1. Addressing examples

   The following are examples of messages that might be sent between two individuals.

A.1.1. A message from one person to another with simple addressing

   This could be called a canonical message. It has a single author, John Doe, a single recipient, Mary Smith, a subject, the date, a message identifier, and a textual message in the body.

```
----
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```


   If John's secretary Michael actually sent the message, though John was the author and replies to this message should go back to him, the sender field would be used:

```
----
From: John Doe <jdoe@machine.example>
Sender: Michael Jones <mjones@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```

A.1.2. Different types of mailboxes

   This message includes multiple addresses in the destination fields and also uses several different forms of addresses.

```
----
From: "Joe Q. Public" <john.q.public@example.com>
To: Mary Smith <mary@x.test>, jdoe@example.org, Who? <one@y.test>
Cc: <boss@nil.test>, "Giant; \"Big\" Box" <sysservices@example.net>
Date: Tue, 1 Jul 2003 10:52:37 +0200
Message-ID: <5678.21-Nov-1997@example.com>

Hi everyone.
----
```

   Note that the display names for Joe Q. Public and Giant; "Big" Box needed to be enclosed in double-quotes because the former contains the period and the latter contains both semicolon and double-quote characters (the double-quote characters appearing as quoted-pair construct). Conversely, the display name for Who? could appear without them because the question mark is legal in an atom. Notice also that jdoe@example.org and boss@nil.test have no display names associated with them at all, and jdoe@example.org uses the simpler address form without the angle brackets.

A.1.3. Group addresses

```
----
```

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```
From: Pete <pete@silly.example>
To: A Group:Chris Jones <c@a.test>,joe@where.test,John <jdoe@one.test>;
Cc: Undisclosed recipients:;
Date: Thu, 13 Feb 1969 23:32:54 -0330
Message-ID: <testabcd.1234@silly.example>

Testing.
----
```

In this message, the "To:" field has a single group recipient named A Group which contains 3 addresses, and a "Cc:" field with an empty group recipient named Undisclosed recipients.

A.2. Reply messages

The following is a series of three messages that make up a conversation thread between John and Mary. John firsts sends a message to Mary, Mary then replies to John's message, and then John replies to Mary's reply message.

Note especially the "Message-ID:", "References:", and "In-Reply-To:" fields in each message.

```
----
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```


When sending replies, the Subject field is often retained, though prepended with "Re: " as described in section 3.6.5.

```
----
From: Mary Smith <mary@example.net>
To: John Doe <jdoe@machine.example>
Reply-To: "Mary Smith: Personal Account" <smith@home.example>
Subject: Re: Saying Hello
Date: Fri, 21 Nov 1997 10:01:10 -0600
Message-ID: <3456@example.net>
In-Reply-To: <1234@local.machine.example>
References: <1234@local.machine.example>

This is a reply to your hello.
----
```

Note the "Reply-To:" field in the above message. When John replies to Mary's message above, the reply should go to the address in the "Reply-To:" field instead of the address in the "From:" field.

```
----
To: "Mary Smith: Personal Account" <smith@home.example>
From: John Doe <jdoe@machine.example>
Subject: Re: Saying Hello
Date: Fri, 21 Nov 1997 11:00:00 -0600
Message-ID: <abcd.1234@local.machine.tld>
In-Reply-To: <3456@example.net>
References: <1234@local.machine.example> <3456@example.net>

This is a reply to your reply.
----
```

A.3. Resent messages

Start with the message that has been used as an example several times:

```
----
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```

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Say that Mary, upon receiving this message, wishes to send a copy of the message to Jane such that (a) the message would appear to have come straight from John; (b) if Jane replies to the message, the reply should go back to John; and (c) all of the original information, like the date the message was originally sent to Mary, the message identifier, and the original addressee, is preserved. In this case, resent fields are prepended to the message:

```
----
Resent-From: Mary Smith <mary@example.net>
Resent-To: Jane Brown <j-brown@other.example>
Resent-Date: Mon, 24 Nov 1997 14:22:01 -0800
Resent-Message-ID: <78910@example.net>
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```

If Jane, in turn, wished to resend this message to another person, she would prepend her own set of resent header fields to the above and send that.

A.4. Messages with trace fields

As messages are sent through the transport system as described in [RFC2821], trace fields are prepended to the message. The following is an example of what those trace fields might look like. Note that there is some folding white space in the first one since these lines can be long.

```
----
Received: from x.y.test
   by example.net
   via TCP
   with ESMTP
   id ABC12345
   for <mary@example.net>;  21 Nov 1997 10:05:43 -0600
Received: from machine.example by x.y.test; 21 Nov 1997 10:01:22 -0600
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```

A.5. White space, comments, and other oddities

White space, including folding white space, and comments can be inserted between many of the tokens of fields. Taking the example from A.1.3, white space and comments can be inserted into all of the fields.

```
----
From: Pete(A wonderful \) chap) <pete(his account)@silly.test(his host)>
To:A Group(Some people)
     :Chris Jones <c@(Chris's host.)public.example>,
         joe@example.org,
  John <jdoe@one.test> (my dear friend); (the end of the group)
Cc:(Empty list)(start)Undisclosed recipients  :(nobody(that I know))  ;
Date: Thu,
      13
        Feb
          1969
      23:32
               -0330 (Newfoundland Time)
Message-ID:              <testabcd.1234@silly.test>

Testing.
----
```

The above example is aesthetically displeasing, but perfectly legal. Note particularly (1) the comments in the "From:" field (including one that has a ")" character appearing as part of a quoted-pair); (2) the white space absent after the ":" in the "To:" field as well as the comment and folding white space after the group name, the special character (".") in the comment in Chris Jones's address, and the folding white space before and after "joe@example.org,"; (3) the multiple and nested comments in the "Cc:" field as well as the comment immediately following the ":" after "Cc"; (4) the folding white space (but no comments except at the end) and the missing seconds in the time of the date field; and (5) the white space before (but not within) the identifier in the "Message-ID:" field.

A.6. Obsoleted forms

The following are examples of obsolete (that is, the "MUST NOT generate") syntactic elements described in section 4 of this document.

A.6.1. Obsolete addressing

Note in the below example the lack of quotes around Joe Q. Public, the route that appears in the address for Mary Smith, the two commas that appear in the "To:" field, and the spaces that appear around the "." in the jdoe address.

```
----
From: Joe Q. Public <john.q.public@example.com>
To: Mary Smith <@machine.tld:mary@example.net>, , jdoe@test   . example
Date: Tue, 1 Jul 2003 10:52:37 +0200
Message-ID: <5678.21-Nov-1997@example.com>

Hi everyone.
----
```

A.6.2. Obsolete dates

The following message uses an obsolete date format, including a non-numeric time zone and a two digit year. Note that although the day-of-week is missing, that is not specific to the obsolete syntax; it is optional in the current syntax as well.

```
----
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: 21 Nov 97 09:55:06 GMT
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
```

```
----

A.6.3. Obsolete white space and comments

   White space and comments can appear between many more elements than
   in the current syntax.  Also, folding lines that are made up entirely
   of white space are legal.
```



```
----
From  : John Doe <jdoe@machine(comment).  example>
To    : Mary Smith
__          <mary@example.net>
Subject     : Saying Hello
Date  : Fri, 21 Nov 1997 09(comment):   55  :  06 -0600
Message-ID  : <1234   @   local(blah)  .machine .example>

This is a message just to say hello.
So, "Hello".
----
```

   Note especially the second line of the "To:" field. It starts with
   two space characters. (Note that "__" represent blank spaces.)
   Therefore, it is considered part of the folding as described in
   section 4.2. Also, the comments and white space throughout
   addresses, dates, and message identifiers are all part of the
   obsolete syntax.

Appendix B. Differences from earlier standards

   This appendix contains a list of changes that have been made in the
   Internet Message Format from earlier standards, specifically [RFC822]
   and [STD3]. Items marked with an asterisk (*) below are items which
   appear in section 4 of this document and therefore can no longer be
   generated.

   1. Period allowed in obsolete form of phrase.
   2. ABNF moved out of document to [RFC2234].
   3. Four or more digits allowed for year.
   4. Header field ordering (and lack thereof) made explicit.
   5. Encrypted header field removed.
   6. Received syntax loosened to allow any token/value pair.
   7. Specifically allow and give meaning to "-0000" time zone.
   8. Folding white space is not allowed between every token.
   9. Requirement for destinations removed.
   10. Forwarding and resending redefined.
   11. Extension header fields no longer specifically called out.
   12. ASCII 0 (null) removed.*
   13. Folding continuation lines cannot contain only white space.*
   14. Free insertion of comments not allowed in date.*
   15. Non-numeric time zones not allowed.*
   16. Two digit years not allowed.*
   17. Three digit years interpreted, but not allowed for generation.
   18. Routes in addresses not allowed.*
   19. CFWS within local-parts and domains not allowed.*
   20. Empty members of address lists not allowed.*

   21. Folding white space between field name and colon not allowed.*
   22. Comments between field name and colon not allowed.
   23. Tightened syntax of in-reply-to and references.*
   24. CFWS within msg-id not allowed.*
   25. Tightened semantics of resent fields as informational only.
   26. Resent-Reply-To not allowed.*
   27. No multiple occurrences of fields (except resent and received).*
   28. Free CR and LF not allowed.*
   29. Routes in return path not allowed.*
   30. Line length limits specified.
   31. Bcc more clearly specified.

Appendix C. Notices

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620 captures
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About this capture

Network Working Group
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P. Resnick, Editor
QUALCOMM Incorporated

April 2001

Internet Message Format

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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Abstract

This standard specifies a syntax for text messages that are sent between computer users, within the framework of "electronic mail" messages. This standard supersedes the one specified in Request For Comments (RFC) 822, "Standard for the Format of ARPA Internet Text Messages", updating it to reflect current practice and incorporating incremental changes that were specified in other RFCs.

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1. Introduction

1.1. Scope

This standard specifies a syntax for text messages that are sent between computer users, within the framework of "electronic mail" messages. This standard supersedes the one specified in Request For Comments (RFC) 822, "Standard for the Format of ARPA Internet Text Messages" [RFC822], updating it to reflect current practice and incorporating incremental changes that were specified in other RFCs [STD3].

This standard specifies a syntax only for text messages. In particular, it makes no provision for the transmission of images, audio, or other sorts of structured data in electronic mail messages. There are several extensions published, such as the MIME document series [RFC2045, RFC2046, RFC2049], which describe mechanisms for the transmission of such data through electronic mail, either by extending the syntax provided here or by structuring such messages to conform to this syntax. Those mechanisms are outside of the scope of this standard.

In the context of electronic mail, messages are viewed as having an envelope and contents. The envelope contains whatever information is needed to accomplish transmission and delivery. (See [RFC2821] for a discussion of the envelope.) The contents comprise the object to be delivered to the recipient. This standard applies only to the format and some of the semantics of message contents. It contains no specification of the information in the envelope.

However, some message systems may use information from the contents to create the envelope. It is intended that this standard facilitate the acquisition of such information by programs.

This specification is intended as a definition of what message content format is to be passed between systems. Though some message systems locally store messages in this format (which eliminates the need for translation between formats) and others use formats that differ from the one specified in this standard, local storage is outside of the scope of this standard.

Note: This standard is not intended to dictate the internal formats used by sites, the specific message system features that they are expected to support, or any of the characteristics of user interface programs that create or read messages. In addition, this standard does not specify an encoding of the characters for either transport or storage; that is, it does not specify the number of bits used or how those bits are specifically transferred over the wire or stored on disk.

1.2. Notational conventions

1.2.1. Requirements notation

This document occasionally uses terms that appear in capital letters. When the terms "MUST", "SHOULD", "RECOMMENDED", "MUST NOT", "SHOULD NOT", and "MAY" appear capitalized, they are being used to indicate particular requirements of this specification. A discussion of the meanings of these terms appears in [RFC2119].

1.2.2. Syntactic notation

This standard uses the Augmented Backus-Naur Form (ABNF) notation specified in [RFC2234] for the formal definitions of the syntax of messages. Characters will be specified either by a decimal value (e.g., the value %d65 for uppercase A and %d97 for lowercase A) or by a case-insensitive literal value enclosed in quotation marks (e.g.,

"A" for either uppercase or lowercase A). See [RFC2234] for the full description of the notation.

1.3. Structure of this document

This document is divided into several sections.

This section, section 1, is a short introduction to the document.

Section 2 lays out the general description of a message and its constituent parts. This is an overview to help the reader understand some of the general principles used in the later portions of this document. Any examples in this section MUST NOT be taken as specification of the formal syntax of any part of a message.

Section 3 specifies formal ABNF rules for the structure of each part of a message (the syntax) and describes the relationship between those parts and their meaning in the context of a message (the semantics). That is, it describes the actual rules for the structure of each part of a message (the syntax) as well as a description of the parts and instructions on how they ought to be interpreted (the semantics). This includes analysis of the syntax and semantics of

subparts of messages that have specific structure. The syntax included in section 3 represents messages as they MUST be created. There are also notes in section 3 to indicate if any of the options specified in the syntax SHOULD be used over any of the others.

Both sections 2 and 3 describe messages that are legal to generate for purposes of this standard.

Section 4 of this document specifies an "obsolete" syntax. There are references in section 3 to these obsolete syntactic elements. The rules of the obsolete syntax are elements that have appeared in earlier revisions of this standard or have previously been widely used in Internet messages. As such, these elements MUST be interpreted by parsers of messages in order to be conformant to this standard. However, since items in this syntax have been determined to be non-interoperable or to cause significant problems for recipients of messages, they MUST NOT be generated by creators of conformant messages.

Section 5 details security considerations to take into account when implementing this standard.

Section 6 is a bibliography of references in this document.

Section 7 contains the editor's address.

Section 8 contains acknowledgements.

Appendix A lists examples of different sorts of messages. These examples are not exhaustive of the types of messages that appear on the Internet, but give a broad overview of certain syntactic forms.

Appendix B lists the differences between this standard and earlier standards for Internet messages.

Appendix C has copyright and intellectual property notices.

2. Lexical Analysis of Messages

2.1. General Description

At the most basic level, a message is a series of characters. A message that is conformant with this standard is comprised of characters with values in the range 1 through 127 and interpreted as US-ASCII characters [ASCII]. For brevity, this document sometimes refers to this range of characters as simply "US-ASCII characters".

Note: This standard specifies that messages are made up of characters in the US-ASCII range of 1 through 127. There are other documents, specifically the MIME document series [RFC2045, RFC2046, RFC2047, RFC2048, RFC2049], that extend this standard to allow for values outside of that range. Discussion of those mechanisms is not within the scope of this standard.

Messages are divided into lines of characters. A line is a series of characters that is delimited with the two characters carriage-return and line-feed; that is, the carriage return (CR) character (ASCII value 13) followed immediately by the line feed (LF) character (ASCII value 10). (The carriage-return/line-feed pair is usually written in this document as "CRLF".)

A message consists of header fields (collectively called "the header of the message") followed, optionally, by a body. The header is a sequence of lines of characters with special syntax as defined in

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this standard. The body is simply a sequence of characters that follows the header and is separated from the header by an empty line (i.e., a line with nothing preceding the CRLF).

2.1.1. Line Length Limits

There are two limits that this standard places on the number of characters in a line. Each line of characters MUST be no more than 998 characters, and SHOULD be no more than 78 characters, excluding the CRLF.

The 998 character limit is due to limitations in many implementations which send, receive, or store Internet Message Format messages that simply cannot handle more than 998 characters on a line. Receiving implementations would do well to handle an arbitrarily large number of characters in a line for robustness sake. However, there are so many implementations which (in compliance with the transport requirements of [RFC2821]) do not accept messages containing more than 1000 character including the CR and LF per line, it is important for implementations not to create such messages.

The more conservative 78 character recommendation is to accommodate the many implementations of user interfaces that display these messages which may truncate, or disastrously wrap, the display of more than 78 characters per line, in spite of the fact that such implementations are non-conformant to the intent of this specification (and that of [RFC2821] if they actually cause information to be lost). Again, even though this limitation is put on messages, it is encumbant upon implementations which display messages

to handle an arbitrarily large number of characters in a line (certainly at least up to the 998 character limit) for the sake of robustness.

2.2. Header Fields

Header fields are lines composed of a field name, followed by a colon (":"), followed by a field body, and terminated by CRLF. A field name MUST be composed of printable US-ASCII characters (i.e., characters that have values between 33 and 126, inclusive), except colon. A field body may be composed of any US-ASCII characters, except for CR and LF. However, a field body may contain CRLF when used in header "folding" and "unfolding" as described in section 2.2.3. All field bodies MUST conform to the syntax described in sections 3 and 4 of this standard.

2.2.1. Unstructured Header Field Bodies

Some field bodies in this standard are defined simply as "unstructured" (which is specified below as any US-ASCII characters, except for CR and LF) with no further restrictions. These are referred to as unstructured field bodies. Semantically, unstructured field bodies are simply to be treated as a single line of characters with no further processing (except for header "folding" and "unfolding" as described in section 2.2.3).

2.2.2. Structured Header Field Bodies

Some field bodies in this standard have specific syntactical structure more restrictive than the unstructured field bodies described above. These are referred to as "structured" field bodies. Structured field bodies are sequences of specific lexical tokens as described in sections 3 and 4 of this standard. Many of these tokens are allowed (according to their syntax) to be introduced or end with comments (as described in section 3.2.3) as well as the space (SP, ASCII value 32) and horizontal tab (HTAB, ASCII value 9) characters (together known as the white space characters, WSP), and those WSP characters are subject to header "folding" and "unfolding" as described in section 2.2.3. Semantic analysis of structured field bodies is given along with their syntax.

2.2.3. Long Header Fields

Each header field is logically a single line of characters comprising the field name, the colon, and the field body. For convenience however, and to deal with the 998/78 character limitations per line, the field body portion of a header field can be split into a multiple line representation; this is called "folding". The general rule is

that wherever this standard allows for folding white space (not simply WSP characters), a CRLF may be inserted before any WSP. For example, the header field:

```
        Subject: This is a test
```

can be represented as:

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```
        Subject: This
         is a test
```

Note: Though structured field bodies are defined in such a way that folding can take place between many of the lexical tokens (and even within some of the lexical tokens), folding SHOULD be limited to placing the CRLF at higher-level syntactic breaks. For instance, if a field body is defined as comma-separated values, it is recommended that folding occur after the comma separating the structured items in preference to other places where the field could be folded, even if it is allowed elsewhere.

The process of moving from this folded multiple-line representation of a header field to its single line representation is called "unfolding". Unfolding is accomplished by simply removing any CRLF that is immediately followed by WSP. Each header field should be treated in its unfolded form for further syntactic and semantic evaluation.

2.3. Body

The body of a message is simply lines of US-ASCII characters. The only two limitations on the body are as follows:

- CR and LF MUST only occur together as CRLF; they MUST NOT appear independently in the body.

- Lines of characters in the body MUST be limited to 998 characters, and SHOULD be limited to 78 characters, excluding the CRLF.

Note: As was stated earlier, there are other standards documents, specifically the MIME documents [RFC2045, RFC2046, RFC2048, RFC2049] that extend this standard to allow for different sorts of message bodies. Again, these mechanisms are beyond the scope of this document.

3. Syntax

3.1. Introduction

The syntax as given in this section defines the legal syntax of Internet messages. Messages that are conformant to this standard MUST conform to the syntax in this section. If there are options in this section where one option SHOULD be generated, that is indicated either in the prose or in a comment next to the syntax.

For the defined expressions, a short description of the syntax and use is given, followed by the syntax in ABNF, followed by a semantic analysis. Primitive tokens that are used but otherwise unspecified come from [RFC2234].

In some of the definitions, there will be nonterminals whose names start with "obs-". These "obs-" elements refer to tokens defined in the obsolete syntax in section 4. In all cases, these productions are to be ignored for the purposes of generating legal Internet messages and MUST NOT be used as part of such a message. However, when interpreting messages, these tokens MUST be honored as part of the legal syntax. In this sense, section 3 defines a grammar for generation of messages, with "obs-" elements that are to be ignored, while section 4 adds grammar for interpretation of messages.

3.2. Lexical Tokens

The following rules are used to define an underlying lexical analyzer, which feeds tokens to the higher-level parsers. This section defines the tokens used in structured header field bodies.

Note: Readers of this standard need to pay special attention to how these lexical tokens are used in both the lower-level and higher-level syntax later in the document. Particularly, the white space tokens and the comment tokens defined in section 3.2.3 get used in the lower-level tokens defined here, and those lower-level tokens are in turn used as parts of the higher-level tokens defined later. Therefore, the white space and comments may be allowed in the higher-level tokens even though they may not explicitly appear in a particular definition.

3.2.1. Primitive Tokens

The following are primitive tokens referred to elsewhere in this standard, but not otherwise defined in [RFC2234]. Some of them will not appear anywhere else in the syntax, but they are convenient to refer to in other parts of this document.

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Note: The "specials" below are just such an example. Though the specials token does not appear anywhere else in this standard, it is useful for implementers who use tools that lexically analyze messages. Each of the characters in specials can be used to indicate a tokenization point in lexical analysis.

```
NO-WS-CTL       =       %d1-8 /         ; US-ASCII control characters
                        %d11 /          ;  that do not include the
                        %d12 /          ;  carriage return, line feed,
                        %d14-31 /       ;  and white space characters
                        %d127

text            =       %d1-9 /         ; Characters excluding CR and LF
                        %d11 /
                        %d12 /
                        %d14-127 /
                        obs-text

specials        =       "(" / ")" /     ; Special characters used in
                        "<" / ">" /     ;  other parts of the syntax
                        "[" / "]" /
                        ":" / ";" /
                        "@" / "\" /
                        "," / "." /
                        DQUOTE
```

No special semantics are attached to these tokens. They are simply single characters.

3.2.2. Quoted characters

Some characters are reserved for special interpretation, such as delimiting lexical tokens. To permit use of these characters as uninterpreted data, a quoting mechanism is provided.

```
quoted-pair     =       ("\" text) / obs-qp
```

Where any quoted-pair appears, it is to be interpreted as the text character alone. That is to say, the "\" character that appears as part of a quoted-pair is semantically "invisible".

Note: The "\" character may appear in a message where it is not part of a quoted-pair. A "\" character that does not appear in a quoted-pair is not semantically invisible. The only places in this standard where quoted-pair currently appears are ccontent, qcontent, dcontent, no-fold-quote, and no-fold-literal.

3.2.3. Folding white space and comments

White space characters, including white space used in folding (described in section 2.2.3), may appear between many elements in header field bodies. Also, strings of characters that are treated as comments may be included in structured field bodies as characters enclosed in parentheses. The following defines the folding white space (FWS) and comment constructs.

Strings of characters enclosed in parentheses are considered comments so long as they do not appear within a "quoted-string", as defined in section 3.2.5. Comments may nest.

There are several places in this standard where comments and FWS may be freely inserted. To accommodate that syntax, an additional token for "CFWS" is defined for places where comments and/or FWS can occur. However, where CFWS occurs in this standard, it MUST NOT be inserted in such a way that any line of a folded header field is made up entirely of WSP characters and nothing else.

```
FWS             =       ([*WSP CRLF] 1*WSP) /   ; Folding white space
                        obs-FWS

ctext           =       NO-WS-CTL /     ; Non white space controls

                        %d33-39 /       ; The rest of the US-ASCII
                        %d42-91 /       ;  characters not including "(",
                        %d93-126        ;  ")", or "\"

ccontent        =       ctext / quoted-pair / comment

comment         =       "(" *([FWS] ccontent) [FWS] ")"

CFWS            =       *([FWS] comment) (([FWS] comment) / FWS)
```

Throughout this standard, where FWS (the folding white space token) appears, it indicates a place where header folding, as discussed in section 2.2.3, may take place. Wherever header folding appears in a message (that is, a header field body containing a CRLF followed by any WSP), header unfolding (removal of the CRLF) is performed before any further lexical analysis is performed on that header field according to this standard. That is to say, any CRLF that appears in FWS is semantically "invisible."

A comment is normally used in a structured field body to provide some human readable informational text. Since a comment is allowed to

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contain FWS, folding is permitted within the comment. Also note that since quoted-pair is allowed in a comment, the parentheses and

backslash characters may appear in a comment so long as they appear as a quoted-pair. Semantically, the enclosing parentheses are not part of the comment; the comment is what is contained between the two parentheses. As stated earlier, the "\" in any quoted-pair and the CRLF in any FWS that appears within the comment are semantically "invisible" and therefore not part of the comment either.

Runs of FWS, comment or CFWS that occur between lexical tokens in a structured field header are semantically interpreted as a single space character.

3.2.4. Atom

Several productions in structured header field bodies are simply strings of certain basic characters. Such productions are called atoms.

Some of the structured header field bodies also allow the period character (".", ASCII value 46) within runs of atext. An additional "dot-atom" token is defined for those purposes.

```
atext           =       ALPHA / DIGIT / ; Any character except controls,
                        "!" / "#" /     ;  SP, and specials.
                        "$" / "%" /     ;  Used for atoms
                        "&" / "'" /
                        "*" / "+" /
                        "-" / "/" /
                        "=" / "?" /
                        "^" / "_" /
                        "`" / "{" /
                        "|" / "}" /
                        "~"

atom            =       [CFWS] 1*atext [CFWS]

dot-atom        =       [CFWS] dot-atom-text [CFWS]

dot-atom-text   =       1*atext *("." 1*atext)
```

Both atom and dot-atom are interpreted as a single unit, comprised of the string of characters that make it up. Semantically, the optional comments and FWS surrounding the rest of the characters are not part of the atom; the atom is only the run of atext characters in an atom, or the atext and "." characters in a dot-atom.

3.2.5. Quoted strings

Strings of characters that include characters other than those allowed in atoms may be represented in a quoted string format, where the characters are surrounded by quote (DQUOTE, ASCII value 34) characters.

```
qtext           =       NO-WS-CTL /     ; Non white space controls

                        %d33 /          ; The rest of the US-ASCII
                        %d35-91 /       ;  characters not including "\"
                        %d93-126        ;  or the quote character

qcontent        =       qtext / quoted-pair

quoted-string   =       [CFWS]
                        DQUOTE *([FWS] qcontent) [FWS] DQUOTE
                        [CFWS]
```

A quoted-string is treated as a unit. That is, quoted-string is identical to atom, semantically. Since a quoted-string is allowed to contain FWS, folding is permitted. Also note that since quoted-pair is allowed in a quoted-string, the quote and backslash characters may appear in a quoted-string so long as they appear as a quoted-pair.

Semantically, neither the optional CFWS outside of the quote characters nor the quote characters themselves are part of the quoted-string; the quoted-string is what is contained between the two quote characters. As stated earlier, the "\" in any quoted-pair and the CRLF in any FWS/CFWS that appears within the quoted-string are semantically "invisible" and therefore not part of the quoted-string either.

3.2.6. Miscellaneous tokens

Three additional tokens are defined, word and phrase for combinations of atoms and/or quoted-strings, and unstructured for use in

unstructured header fields and in some places within structured header fields.

```
word            =       atom / quoted-string

phrase          =       1*word / obs-phrase
```



```
utext           =       NO-WS-CTL /     ; Non white space controls
                        %d33-126 /      ; The rest of US-ASCII
                        obs-utext

unstructured    =       *([FWS] utext) [FWS]
```

3.3. Date and Time Specification

Date and time occur in several header fields. This section specifies the syntax for a full date and time specification. Though folding white space is permitted throughout the date-time specification, it is RECOMMENDED that a single space be used in each place that FWS appears (whether it is required or optional); some older implementations may not interpret other occurrences of folding white space correctly.

```
date-time       =       [ day-of-week "," ] date FWS time [CFWS]

day-of-week     =       ([FWS] day-name) / obs-day-of-week

day-name        =       "Mon" / "Tue" / "Wed" / "Thu" /
                        "Fri" / "Sat" / "Sun"

date            =       day month year

year            =       4*DIGIT / obs-year

month           =       (FWS month-name FWS) / obs-month

month-name      =       "Jan" / "Feb" / "Mar" / "Apr" /
                        "May" / "Jun" / "Jul" / "Aug" /
                        "Sep" / "Oct" / "Nov" / "Dec"

day             =       ([FWS] 1*2DIGIT) / obs-day

time            =       time-of-day FWS zone

time-of-day     =       hour ":" minute [ ":" second ]

hour            =       2DIGIT / obs-hour

minute          =       2DIGIT / obs-minute

second          =       2DIGIT / obs-second

zone            =       (( "+" / "-" ) 4DIGIT) / obs-zone
```


The day is the numeric day of the month. The year is any numeric year 1900 or later.

The time-of-day specifies the number of hours, minutes, and optionally seconds since midnight of the date indicated.

The date and time-of-day SHOULD express local time.

The zone specifies the offset from Coordinated Universal Time (UTC, formerly referred to as "Greenwich Mean Time") that the date and time-of-day represent. The "+" or "-" indicates whether the time-of-day is ahead of (i.e., east of) or behind (i.e., west of) Universal Time. The first two digits indicate the number of hours difference from Universal Time, and the last two digits indicate the number of minutes difference from Universal Time. (Hence, +hhmm means +(hh * 60 + mm) minutes, and -hhmm means -(hh * 60 + mm) minutes). The form "+0000" SHOULD be used to indicate a time zone at Universal Time. Though "-0000" also indicates Universal Time, it is used to indicate that the time was generated on a system that may be in a local time zone other than Universal Time and therefore indicates that the date-time contains no information about the local time zone.

A date-time specification MUST be semantically valid. That is, the day-of-the-week (if included) MUST be the day implied by the date, the numeric day-of-month MUST be between 1 and the number of days allowed for the specified month (in the specified year), the time-of-day MUST be in the range 00:00:00 through 23:59:60 (the

time of day MUST be in the range 00:00:00 through 23:59:60 (the number of seconds allowing for a leap second; see [STD12]), and the zone MUST be within the range -9959 through +9959.

3.4. Address Specification

Addresses occur in several message header fields to indicate senders and recipients of messages. An address may either be an individual mailbox, or a group of mailboxes.

```
address         =       mailbox / group

mailbox         =       name-addr / addr-spec

name-addr       =       [display-name] angle-addr

angle-addr      =       [CFWS] "<" addr-spec ">" [CFWS] / obs-angle-addr

group           =       display-name ":" [mailbox-list / CFWS] ";"
                        [CFWS]
```



```
display-name    =       phrase

mailbox-list    =       (mailbox *("," mailbox)) / obs-mbox-list

address-list    =       (address *("," address)) / obs-addr-list
```

A mailbox receives mail. It is a conceptual entity which does not necessarily pertain to file storage. For example, some sites may choose to print mail on a printer and deliver the output to the addressee's desk. Normally, a mailbox is comprised of two parts: (1) an optional display name that indicates the name of the recipient (which could be a person or a system) that could be displayed to the user of a mail application, and (2) an addr-spec address enclosed in angle brackets ("<" and ">"). There is also an alternate simple form of a mailbox where the addr-spec address appears alone, without the recipient's name or the angle brackets. The Internet addr-spec address is described in section 3.4.1.

Note: Some legacy implementations used the simple form where the addr-spec appears without the angle brackets, but included the name of the recipient in parentheses as a comment following the addr-spec. Since the meaning of the information in a comment is unspecified, implementations SHOULD use the full name-addr form of the mailbox, instead of the legacy form, to specify the display name associated with a mailbox. Also, because some legacy implementations interpret the comment, comments generally SHOULD NOT be used in address fields to avoid confusing such implementations.

When it is desirable to treat several mailboxes as a single unit (i.e., in a distribution list), the group construct can be used. The group construct allows the sender to indicate a named group of recipients. This is done by giving a display name for the group, followed by a colon, followed by a comma separated list of any number of mailboxes (including zero and one), and ending with a semicolon. Because the list of mailboxes can be empty, using the group construct is also a simple way to communicate to recipients that the message was sent to one or more named sets of recipients, without actually providing the individual mailbox address for each of those recipients.

3.4.1. Addr-spec specification

An addr-spec is a specific Internet identifier that contains a locally interpreted string followed by the at-sign character ("@", ASCII value 64) followed by an Internet domain. The locally interpreted string is either a quoted-string or a dot-atom. If the string can be represented as a dot-atom (that is, it contains no characters other than atext characters or "." surrounded by atext

characters), then the dot-atom form SHOULD be used and the quoted-string form SHOULD NOT be used. Comments and folding white space SHOULD NOT be used around the "@" in the addr-spec.

```
addr-spec       =       local-part "@" domain

local-part      =       dot-atom / quoted-string / obs-local-part

domain          =       dot-atom / domain-literal / obs-domain

domain-literal  =       [CFWS] "[" *([FWS] dcontent) [FWS] "]" [CFWS]

dcontent        =       dtext / quoted-pair

dtext           =       NO-WS-CTL /     ; Non white space controls

                        %d33-90 /       ; The rest of the US-ASCII
                        %d94-126        ;  characters not including "[",
                                        ;  "]", or "\"
```

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The domain portion identifies the point to which the mail is delivered. In the dot-atom form, this is interpreted as an Internet domain name (either a host name or a mail exchanger name) as described in [STD3, STD13, STD14]. In the domain-literal form, the domain is interpreted as the literal Internet address of the particular host. In both cases, how addressing is used and how messages are transported to a particular host is covered in the mail transport document [RFC2821]. These mechanisms are outside of the scope of this document.

The local-part portion is a domain dependent string. In addresses, it is simply interpreted on the particular host as a name of a particular mailbox.

3.5 Overall message syntax

A message consists of header fields, optionally followed by a message body. Lines in a message MUST be a maximum of 998 characters excluding the CRLF, but it is RECOMMENDED that lines be limited to 78 characters excluding the CRLF. (See section 2.1.1 for explanation.) In a message body, though all of the characters listed in the text rule MAY be used, the use of US-ASCII control characters (values 1 through 8, 11, 12, and 14 through 31) is discouraged since their interpretation by receivers for display is not guaranteed.


```
message         =       (fields / obs-fields)
                        [CRLF body]

body            =       *(*998text CRLF) *998text
```

The header fields carry most of the semantic information and are defined in section 3.6. The body is simply a series of lines of text which are uninterpreted for the purposes of this standard.

3.6. Field definitions

The header fields of a message are defined here. All header fields have the same general syntactic structure: A field name, followed by a colon, followed by the field body. The specific syntax for each header field is defined in the subsequent sections.

Note: In the ABNF syntax for each field in subsequent sections, each field name is followed by the required colon. However, for brevity sometimes the colon is not referred to in the textual description of the syntax. It is, nonetheless, required.

It is important to note that the header fields are not guaranteed to be in a particular order. They may appear in any order, and they have been known to be reordered occasionally when transported over the Internet. However, for the purposes of this standard, header fields SHOULD NOT be reordered when a message is transported or transformed. More importantly, the trace header fields and resent header fields MUST NOT be reordered, and SHOULD be kept in blocks prepended to the message. See sections 3.6.6 and 3.6.7 for more information.

The only required header fields are the origination date field and the originator address field(s). All other header fields are syntactically optional. More information is contained in the table following this definition.

```
fields          =       *(trace
                          *(resent-date /
                            resent-from /
                            resent-sender /
                            resent-to /
                            resent-cc /
                            resent-bcc /
                            resent-msg-id))
                        *(orig-date /
                        from /
                        sender /
                        reply-to /
```



```
                        to /
                        cc /
                        bcc /
                        message-id /
                        in-reply-to /
                        references /
                        subject /
                        comments /
                        keywords /
                        optional-field)
```

optional-field)

The following table indicates limits on the number of times each field may occur in a message header as well as any special limitations on the use of those fields. An asterisk next to a value in the minimum or maximum column indicates that a special restriction appears in the Notes column.

Field	Min number	Max number	Notes
trace	0	unlimited	Block prepended - see 3.6.7
resent-date	0*	unlimited*	One per block, required if other resent fields present - see 3.6.6
resent-from	0	unlimited*	One per block - see 3.6.6
resent-sender	0*	unlimited*	One per block, MUST occur with multi-address resent-from - see 3.6.6
resent-to	0	unlimited*	One per block - see 3.6.6
resent-cc	0	unlimited*	One per block - see 3.6.6
resent-bcc	0	unlimited*	One per block - see 3.6.6
resent-msg-id	0	unlimited*	One per block - see 3.6.6
orig-date	1	1	
from	1	1	See sender and 3.6.2

sender	0*	1	MUST occur with multi-address from - see 3.6.2
reply-to	0	1	
to	0	1	
cc	0	1	
bcc	0	1	
message-id	0*	1	SHOULD be present - see 3.6.4
in-reply-to	0*	1	SHOULD occur in some replies - see 3.6.4
references	0*	1	SHOULD occur in some replies - see 3.6.4
subject	0	1	
comments	0	unlimited	
keywords	0	unlimited	
optional-field	0	unlimited	

The exact interpretation of each field is described in subsequent sections.

3.6.1. The origination date field

The origination date field consists of the field name "Date" followed by a date-time specification.

```
orig-date       =       "Date:" date-time CRLF
```

The origination date specifies the date and time at which the creator of the message indicated that the message was complete and ready to enter the mail delivery system. For instance, this might be the time that a user pushes the "send" or "submit" button in an application program. In any case, it is specifically not intended to convey the time that the message is actually transported, but rather the time at which the human or other creator of the message has put the message into its final form, ready for transport. (For example, a portable computer user who is not connected to a network might queue a message

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for delivery. The origination date is intended to contain the date and time that the user queued the message, not the time when the user connected to the network to send the message.)

3.6.2. Originator fields

The originator fields of a message consist of the from field, the sender field (when applicable), and optionally the reply-to field. The from field consists of the field name "From" and a comma-separated list of one or more mailbox specifications. If the from field contains more than one mailbox specification in the mailbox-list, then the sender field, containing the field name "Sender" and a single mailbox specification, MUST appear in the message. In either case, an optional reply-to field MAY also be included, which contains the field name "Reply-To" and a comma-separated list of one or more addresses.

```
from            =       "From:" mailbox-list CRLF

sender          =       "Sender:" mailbox CRLF

reply-to        =       "Reply-To:" address-list CRLF
```

The originator fields indicate the mailbox(es) of the source of the message. The "From:" field specifies the author(s) of the message, that is, the mailbox(es) of the person(s) or system(s) responsible for the writing of the message. The "Sender:" field specifies the mailbox of the agent responsible for the actual transmission of the message. For example, if a secretary were to send a message for another person, the mailbox of the secretary would appear in the "Sender:" field and the mailbox of the actual author would appear in the "From:" field. If the originator of the message can be indicated by a single mailbox and the author and transmitter are identical, the "Sender:" field SHOULD NOT be used. Otherwise, both fields SHOULD appear.

The originator fields also provide the information required when replying to a message. When the "Reply-To:" field is present, it indicates the mailbox(es) to which the author of the message suggests that replies be sent. In the absence of the "Reply-To:" field, replies SHOULD by default be sent to the mailbox(es) specified in the "From:" field unless otherwise specified by the person composing the reply.

In all cases, the "From:" field SHOULD NOT contain any mailbox that does not belong to the author(s) of the message. See also section 3.6.3 for more information on forming the destination addresses for a reply.

3.6.3. Destination address fields

The destination fields of a message consist of three possible fields, each of the same form: The field name, which is either "To", "Cc", or "Bcc", followed by a comma-separated list of one or more addresses (either mailbox or group syntax).

```
to              =       "To:" address-list CRLF

cc              =       "Cc:" address-list CRLF

bcc             =       "Bcc:" (address-list / [CFWS]) CRLF
```

The destination fields specify the recipients of the message. Each destination field may have one or more addresses, and each of the addresses indicate the intended recipients of the message. The only difference between the three fields is how each is used.

The "To:" field contains the address(es) of the primary recipient(s) of the message.

The "Cc:" field (where the "Cc" means "Carbon Copy" in the sense of making a copy on a typewriter using carbon paper) contains the addresses of others who are to receive the message, though the content of the message may not be directed at them.

The "Bcc:" field (where the "Bcc" means "Blind Carbon Copy") contains addresses of recipients of the message whose addresses are not to be revealed to other recipients of the message. There are three ways in which the "Bcc:" field is used. In the first case, when a message containing a "Bcc:" field is prepared to be sent, the "Bcc:" line is removed even though all of the recipients (including those specified in the "Bcc:" field) are sent a copy of the message. In the second case, recipients specified in the "To:" and "Cc:" lines each are sent a copy of the message with the "Bcc:" line removed as above, but the recipients on the "Bcc:" line get a separate copy of the message containing a "Bcc:" line. (When there are multiple recipient addresses in the "Bcc:" field, some implementations actually send a separate copy of the message to each recipient with a "Bcc:" containing only the address of that particular recipient.) Finally, since a "Bcc:" field may contain no addresses, a "Bcc:" field can be sent without any addresses indicating to the recipients that blind copies were sent to someone. Which method to use with "Bcc:" fields is implementation dependent, but refer to the "Security Considerations" section of this document for a discussion of each.

When a message is a reply to another message, the mailboxes of the authors of the original message (the mailboxes in the "From:" field) or mailboxes specified in the "Reply-To:" field (if it exists) MAY appear in the "To:" field of the reply since these would normally be the primary recipients of the reply. If a reply is sent to a message that has destination fields, it is often desirable to send a copy of the reply to all of the recipients of the message, in addition to the author. When such a reply is formed, addresses in the "To:" and "Cc:" fields of the original message MAY appear in the "Cc:" field of the reply, since these are normally secondary recipients of the reply. If a "Bcc:" field is present in the original message, addresses in that field MAY appear in the "Bcc:" field of the reply, but SHOULD NOT appear in the "To:" or "Cc:" fields.

Note: Some mail applications have automatic reply commands that include the destination addresses of the original message in the destination addresses of the reply. How those reply commands behave is implementation dependent and is beyond the scope of this document. In particular, whether or not to include the original destination addresses when the original message had a "Reply-To:" field is not addressed here.

3.6.4. Identification fields

Though optional, every message SHOULD have a "Message-ID:" field. Furthermore, reply messages SHOULD have "In-Reply-To:" and "References:" fields as appropriate, as described below.

The "Message-ID:" field contains a single unique message identifier. The "References:" and "In-Reply-To:" field each contain one or more unique message identifiers, optionally separated by CFWS.

The message identifier (msg-id) is similar in syntax to an angle-addr construct without the internal CFWS.

```
message-id      =       "Message-ID:" msg-id CRLF

in-reply-to     =       "In-Reply-To:" 1*msg-id CRLF

references      =       "References:" 1*msg-id CRLF

msg-id          =       [CFWS] "<" id-left "@" id-right ">" [CFWS]

id-left         =       dot-atom-text / no-fold-quote / obs-id-left

id-right        =       dot-atom-text / no-fold-literal / obs-id-right

no-fold-quote   =       DQUOTE *(qtext / quoted-pair) DQUOTE
```



```
no-fold-literal =       "[" *(dtext / quoted-pair) "]"
```

The "Message-ID:" field provides a unique message identifier that refers to a particular version of a particular message. The uniqueness of the message identifier is guaranteed by the host that generates it (see below). This message identifier is intended to be machine readable and not necessarily meaningful to humans. A message identifier pertains to exactly one instantiation of a particular message; subsequent revisions to the message each receive new message identifiers.

Note: There are many instances when messages are "changed", but those changes do not constitute a new instantiation of that message, and therefore the message would not get a new message identifier. For example, when messages are introduced into the transport system, they are often prepended with additional header fields such as trace fields (described in section 3.6.7) and resent fields (described in section 3.6.6). The addition of such header fields does not change the identity of the message and therefore the original "Message-ID:" field is retained. In all cases, it is the meaning that the sender of the message wishes to convey (i.e., whether this is the same message or a different message) that determines whether or not the "Message-ID:" field changes, not any particular syntactic difference that appears (or does not appear) in the message.

The "In-Reply-To:" and "References:" fields are used when creating a reply to a message. They hold the message identifier of the original message and the message identifiers of other messages (for example, in the case of a reply to a message which was itself a reply). The "In-Reply-To:" field may be used to identify the message (or messages) to which the new message is a reply, while the "References:" field may be used to identify a "thread" of conversation.

When creating a reply to a message, the "In-Reply-To:" and "References:" fields of the resultant message are constructed as follows:

The "In-Reply-To:" field will contain the contents of the "Message-ID:" field of the message to which this one is a reply (the "parent message"). If there is more than one parent message, then the "In-Reply-To:" field will contain the contents of all of the parents' "Message-ID:" fields. If there is no "Message-ID:" field in any of the parent messages, then the new message will have no "In-Reply-To:" field.

The "References:" field will contain the contents of the parent's "References:" field (if any) followed by the contents of the parent's "Message-ID:" field (if any). If the parent message does not contain a "References:" field but does have an "In-Reply-To:" field containing a single message identifier, then the "References:" field will contain the contents of the parent's "In-Reply-To:" field followed by the contents of the parent's "Message-ID:" field (if any). If the parent has none of the "References:", "In-Reply-To:", or "Message-ID:" fields, then the new message will have no "References:" field.

Note: Some implementations parse the "References:" field to display the "thread of the discussion". These implementations assume that each new message is a reply to a single parent and hence that they can walk backwards through the "References:" field to find the parent of each message listed there. Therefore, trying to form a "References:" field for a reply that has multiple parents is discouraged and how to do so is not defined in this document.

The message identifier (msg-id) itself MUST be a globally unique identifier for a message. The generator of the message identifier MUST guarantee that the msg-id is unique. There are several algorithms that can be used to accomplish this. Since the msg-id has a similar syntax to angle-addr (identical except that comments and folding white space are not allowed), a good method is to put the domain name (or a domain literal IP address) of the host on which the message identifier was created on the right hand side of the "@", and put a combination of the current absolute date and time along with some other currently unique (perhaps sequential) identifier available on the system (for example, a process id number) on the left hand side. Using a date on the left hand side and a domain name or domain literal on the right hand side makes it possible to guarantee uniqueness since no two hosts use the same domain name or IP address at the same time. Though other algorithms will work, it is RECOMMENDED that the right hand side contain some domain identifier (either of the host itself or otherwise) such that the generator of the message identifier can guarantee the uniqueness of the left hand side within the scope of that domain.

Semantically, the angle bracket characters are not part of the msg-id; the msg-id is what is contained between the two angle bracket characters.

3.6.5. Informational fields

The informational fields are all optional. The "Keywords:" field contains a comma-separated list of one or more words or quoted-strings. The "Subject:" and "Comments:" fields are unstructured fields as defined in section 2.2.1, and therefore may contain text or folding white space.

```
subject         =       "Subject:" unstructured CRLF

comments        =       "Comments:" unstructured CRLF

keywords        =       "Keywords:" phrase *("," phrase) CRLF
```

These three fields are intended to have only human-readable content with information about the message. The "Subject:" field is the most common and contains a short string identifying the topic of the message. When used in a reply, the field body MAY start with the string "Re: " (from the Latin "res", in the matter of) followed by the contents of the "Subject:" field body of the original message. If this is done, only one instance of the literal string "Re: " ought to be used since use of other strings or more than one instance can lead to undesirable consequences. The "Comments:" field contains any additional comments on the text of the body of the message. The "Keywords:" field contains a comma-separated list of important words and phrases that might be useful for the recipient.

3.6.6. Resent fields

Resent fields SHOULD be added to any message that is reintroduced by a user into the transport system. A separate set of resent fields SHOULD be added each time this is done. All of the resent fields corresponding to a particular resending of the message SHOULD be together. Each new set of resent fields is prepended to the message; that is, the most recent set of resent fields appear earlier in the message. No other fields in the message are changed when resent fields are added.

Each of the resent fields corresponds to a particular field elsewhere in the syntax. For instance, the "Resent-Date:" field corresponds to the "Date:" field and the "Resent-To:" field corresponds to the "To:" field. In each case, the syntax for the field body is identical to the syntax given previously for the corresponding field.

When resent fields are used, the "Resent-From:" and "Resent-Date:" fields MUST be sent. The "Resent-Message-ID:" field SHOULD be sent. "Resent-Sender:" SHOULD NOT be used if "Resent-Sender:" would be identical to "Resent-From:".


```
resent-date     =       "Resent-Date:" date-time CRLF

resent-from     =       "Resent-From:" mailbox-list CRLF

resent-sender   =       "Resent-Sender:" mailbox CRLF

resent-to       =       "Resent-To:" address-list CRLF

resent-cc       =       "Resent-Cc:" address-list CRLF

resent-bcc      =       "Resent-Bcc:" (address-list / [CFWS]) CRLF

resent-msg-id   =       "Resent-Message-ID:" msg-id CRLF
```

Resent fields are used to identify a message as having been reintroduced into the transport system by a user. The purpose of using resent fields is to have the message appear to the final recipient as if it were sent directly by the original sender, with all of the original fields remaining the same. Each set of resent fields correspond to a particular resending event. That is, if a message is resent multiple times, each set of resent fields gives identifying information for each individual time. Resent fields are strictly informational. They MUST NOT be used in the normal processing of replies or other such automatic actions on messages.

Note: Reintroducing a message into the transport system and using resent fields is a different operation from "forwarding". "Forwarding" has two meanings: One sense of forwarding is that a mail reading program can be told by a user to forward a copy of a message to another person, making the forwarded message the body of the new message. A forwarded message in this sense does not appear to have come from the original sender, but is an entirely new message from the forwarder of the message. On the other hand, forwarding is also used to mean when a mail transport program gets a message and forwards it on to a different destination for final delivery. Resent header fields are not intended for use with either type of forwarding.

The resent originator fields indicate the mailbox of the person(s) or system(s) that resent the message. As with the regular originator fields, there are two forms: a simple "Resent-From:" form which contains the mailbox of the individual doing the resending, and the more complex form, when one individual (identified in the "Resent-Sender:" field) resends a message on behalf of one or more others (identified in the "Resent-From:" field).

Note: When replying to a resent message, replies behave just as they would with any other message, using the original "From:",

"Reply-To:", "Message-ID:", and other fields. The resent fields are only informational and MUST NOT be used in the normal processing of replies.

The "Resent-Date:" indicates the date and time at which the resent message is dispatched by the resender of the message. Like the "Date:" field, it is not the date and time that the message was actually transported.

The "Resent-To:", "Resent-Cc:", and "Resent-Bcc:" fields function identically to the "To:", "Cc:", and "Bcc:" fields respectively, except that they indicate the recipients of the resent message, not the recipients of the original message.

The "Resent-Message-ID:" field provides a unique identifier for the resent message.

3.6.7. Trace fields

The trace fields are a group of header fields consisting of an

optional "Return-Path:" field, and one or more "Received:" fields. The "Return-Path:" header field contains a pair of angle brackets that enclose an optional addr-spec. The "Received:" field contains a (possibly empty) list of name/value pairs followed by a semicolon and a date-time specification. The first item of the name/value pair is defined by item-name, and the second item is either an addr-spec, an atom, a domain, or a msg-id. Further restrictions may be applied to the syntax of the trace fields by standards that provide for their use, such as [RFC2821].

```
trace           =       [return]
                        1*received

return          =       "Return-Path:" path CRLF

path            =       ([CFWS] "<" ([CFWS] / addr-spec) ">" [CFWS]) /
                        obs-path

received        =       "Received:" name-val-list ";" date-time CRLF

name-val-list   =       [CFWS] [name-val-pair *(CFWS name-val-pair)]

name-val-pair   =       item-name CFWS item-value

item-name       =       ALPHA *(["-"] (ALPHA / DIGIT))

item-value      =       1*angle-addr / addr-spec /
                         atom / domain / msg-id
```


A full discussion of the Internet mail use of trace fields is contained in [RFC2821]. For the purposes of this standard, the trace fields are strictly informational, and any formal interpretation of them is outside of the scope of this document.

3.6.8. Optional fields

Fields may appear in messages that are otherwise unspecified in this standard. They MUST conform to the syntax of an optional-field. This is a field name, made up of the printable US-ASCII characters except SP and colon, followed by a colon, followed by any text which conforms to unstructured.

The field names of any optional-field MUST NOT be identical to any field name specified elsewhere in this standard.

```
optional-field  =       field-name ":" unstructured CRLF

field-name      =       1*ftext

ftext           =       %d33-57 /               ; Any character except
                        %d59-126                ;  controls, SP, and
                                                ;  ":".
```

For the purposes of this standard, any optional field is uninterpreted.

4. Obsolete Syntax

Earlier versions of this standard allowed for different (usually more liberal) syntax than is allowed in this version. Also, there have been syntactic elements used in messages on the Internet whose interpretation have never been documented. Though some of these syntactic forms MUST NOT be generated according to the grammar in section 3, they MUST be accepted and parsed by a conformant receiver. This section documents many of these syntactic elements. Taking the grammar in section 3 and adding the definitions presented in this section will result in the grammar to use for interpretation of messages.

Note: This section identifies syntactic forms that any implementation MUST reasonably interpret. However, there are certainly Internet messages which do not conform to even the additional syntax given in this section. The fact that a particular form does not appear in any section of this document is not justification for computer programs to crash or for malformed data to be irretrievably lost by any implementation. To repeat an example, though this document requires lines in messages to be no longer than 998 characters, silently

discarding the 999th and subsequent characters in a line without warning would still be bad behavior for an implementation. It is up to the implementation to deal with messages robustly.

One important difference between the obsolete (interpreting) and the current (generating) syntax is that in structured header field bodies (i.e., between the colon and the CRLF of any structured header field), white space characters, including folding white space, and comments can be freely inserted between any syntactic tokens. This allows many complex forms that have proven difficult for some implementations to parse.

Another key difference between the obsolete and the current syntax is that the rule in section 3.2.3 regarding lines composed entirely of white space in comments and folding white space does not apply. See the discussion of folding white space in section 4.2 below.

Finally, certain characters that were formerly allowed in messages appear in this section. The NUL character (ASCII value 0) was once allowed, but is no longer for compatibility reasons. CR and LF were allowed to appear in messages other than as CRLF; this use is also shown here.

Other differences in syntax and semantics are noted in the following sections.

4.1. Miscellaneous obsolete tokens

These syntactic elements are used elsewhere in the obsolete syntax or in the main syntax. The obs-char and obs-qp elements each add ASCII value 0. Bare CR and bare LF are added to obs-text and obs-utext. The period character is added to obs-phrase. The obs-phrase-list provides for "empty" elements in a comma-separated list of phrases.

Note: The "period" (or "full stop") character (".") in obs-phrase is not a form that was allowed in earlier versions of this or any other standard. Period (nor any other character from specials) was not allowed in phrase because it introduced a parsing difficulty distinguishing between phrases and portions of an addr-spec (see section 4.4). It appears here because the period character is currently used in many messages in the display-name portion of addresses, especially for initials in names, and therefore must be interpreted properly. In the future, period may appear in the regular syntax of phrase.

```
obs-qp          =       "\" (%d0-127)

obs-text        =       *LF *CR *(obs-char *LF *CR)
```



```
obs-char        =       %d0-9 / %d11 /          ; %d0-127 except CR and
                        %d12 / %d14-127         ;  LF

obs-utext       =       obs-text

obs-phrase      =       word *(word / "." / CFWS)

obs-phrase-list =       phrase / 1*([phrase] [CFWS] "," [CFWS]) [phrase]
```

Bare CR and bare LF appear in messages with two different meanings. In many cases, bare CR or bare LF are used improperly instead of CRLF to indicate line separators. In other cases, bare CR and bare LF are used simply as ASCII control characters with their traditional ASCII meanings.

4.2. Obsolete folding white space

In the obsolete syntax, any amount of folding white space MAY be inserted where the obs-FWS rule is allowed. This creates the possibility of having two consecutive "folds" in a line, and therefore the possibility that a line which makes up a folded header field could be composed entirely of white space.

```
obs-FWS         =       1*WSP *(CRLF 1*WSP)
```

4.3. Obsolete Date and Time

The syntax for the obsolete date format allows a 2 digit year in the date field and allows for a list of alphabetic time zone specifications that were used in earlier versions of this standard. It also permits comments and folding white space between many of the tokens.

```
obs-day-of-week =       [CFWS] day-name [CFWS]

obs-year        =       [CFWS] 2*DIGIT [CFWS]

obs-month       =       CFWS month-name CFWS

obs-day         =       [CFWS] 1*2DIGIT [CFWS]

obs-hour        =       [CFWS] 2DIGIT [CFWS]

obs-minute      =       [CFWS] 2DIGIT [CFWS]

obs-second      =       [CFWS] 2DIGIT [CFWS]

obs-zone        =       "UT" / "GMT" /          ; Universal Time
```



```
                                        ; North American UT
                                        : offsets
```

```
                        "EST" / "EDT" /         ; Eastern:  - 5/ - 4
                        "CST" / "CDT" /         ; Central:  - 6/ - 5
                        "MST" / "MDT" /         ; Mountain: - 7/ - 6
                        "PST" / "PDT" /         ; Pacific:  - 8/ - 7

                        %d65-73 /               ; Military zones - "A"
                        %d75-90 /               ; through "I" and "K"
                        %d97-105 /              ; through "Z", both
                        %d107-122               ; upper and lower case
```

Where a two or three digit year occurs in a date, the year is to be interpreted as follows: If a two digit year is encountered whose value is between 00 and 49, the year is interpreted by adding 2000, ending up with a value between 2000 and 2049. If a two digit year is encountered with a value between 50 and 99, or any three digit year is encountered, the year is interpreted by adding 1900.

In the obsolete time zone, "UT" and "GMT" are indications of "Universal Time" and "Greenwich Mean Time" respectively and are both semantically identical to "+0000".

The remaining three character zones are the US time zones. The first letter, "E", "C", "M", or "P" stands for "Eastern", "Central", "Mountain" and "Pacific". The second letter is either "S" for "Standard" time, or "D" for "Daylight" (or summer) time. Their interpretations are as follows:

EDT is semantically equivalent to -0400
EST is semantically equivalent to -0500
CDT is semantically equivalent to -0500
CST is semantically equivalent to -0600
MDT is semantically equivalent to -0600
MST is semantically equivalent to -0700
PDT is semantically equivalent to -0700
PST is semantically equivalent to -0800

The 1 character military time zones were defined in a non-standard way in [RFC822] and are therefore unpredictable in their meaning. The original definitions of the military zones "A" through "I" are equivalent to "+0100" through "+0900" respectively; "K", "L", and "M" are equivalent to "+1000", "+1100", and "+1200" respectively; "N" through "Y" are equivalent to "-0100" through "-1200" respectively; and "Z" is equivalent to "+0000". However, because of the error in [RFC822], they SHOULD all be considered equivalent to "-0000" unless there is out-of-band information confirming their meaning.

Other multi-character (usually between 3 and 5) alphabetic time zones have been used in Internet messages. Any such time zone whose meaning is not known SHOULD be considered equivalent to "-0000" unless there is out-of-band information confirming their meaning.

4.4. Obsolete Addressing

There are three primary differences in addressing. First, mailbox addresses were allowed to have a route portion before the addr-spec when enclosed in "<" and ">". The route is simply a comma-separated list of domain names, each preceded by "@", and the list terminated by a colon. Second, CFWS were allowed between the period-separated elements of local-part and domain (i.e., dot-atom was not used). In addition, local-part is allowed to contain quoted-string in addition to just atom. Finally, mailbox-list and address-list were allowed to have "null" members. That is, there could be two or more commas in such a list with nothing in between them.

```
obs-angle-addr  =       [CFWS] "<" [obs-route] addr-spec ">" [CFWS]

obs-route       =       [CFWS] obs-domain-list ":" [CFWS]

obs-domain-list =       "@" domain *(*(CFWS / "," ) [CFWS] "@" domain)

obs-local-part  =       word *("." word)

obs-domain      =       atom *("." atom)

obs-mbox-list   =       1*([mailbox] [CFWS] "," [CFWS]) [mailbox]

obs-addr-list   =       1*([address] [CFWS] "," [CFWS]) [address]
```

When interpreting addresses, the route portion SHOULD be ignored.

4.5. Obsolete header fields

Syntactically, the primary difference in the obsolete field syntax is that it allows multiple occurrences of any of the fields and they may occur in any order. Also, any amount of white space is allowed before the ":" at the end of the field name.

```
obs-fields      =       *(obs-return /
                        obs-received /
                        obs-orig-date /
                        obs-from /
                        obs-sender /
                        obs-reply-to /
                        obs-to /
```

```
                        obs-cc /
                        obs-bcc /
                        obs-message-id /
                        obs-in-reply-to /
                        obs-references /
                        obs-subject /
                        obs-comments /
                        obs-keywords /
                        obs-resent-date /
                        obs-resent-from /
                        obs-resent-send /
                        obs-resent-rply /
                        obs-resent-to /
                        obs-resent-cc /
                        obs-resent-bcc /
                        obs-resent-mid /
                        obs-optional)
```

Except for destination address fields (described in section 4.5.3), the interpretation of multiple occurrences of fields is unspecified. Also, the interpretation of trace fields and resent fields which do not occur in blocks prepended to the message is unspecified as well. Unless otherwise noted in the following sections, interpretation of other fields is identical to the interpretation of their non-obsolete counterparts in section 3.

4.5.1. Obsolete origination date field

```
obs-orig-date   =       "Date" *WSP ":" date-time CRLF
```

4.5.2. Obsolete originator fields

```
obs-from        =       "From" *WSP ":" mailbox-list CRLF

obs-sender      =       "Sender" *WSP ":" mailbox CRLF

obs-reply-to    =       "Reply-To" *WSP ":" mailbox-list CRLF
```

4.5.3. Obsolete destination address fields

```
obs-to          =       "To" *WSP ":" address-list CRLF

obs-cc          =       "Cc" *WSP ":" address-list CRLF

obs-bcc         =       "Bcc" *WSP ":" (address-list / [CFWS]) CRLF
```


When multiple occurrences of destination address fields occur in a message, they SHOULD be treated as if the address-list in the first occurrence of the field is combined with the address lists of the subsequent occurrences by adding a comma and concatenating.

4.5.4. Obsolete identification fields

The obsolete "In-Reply-To:" and "References:" fields differ from the current syntax in that they allow phrase (words or quoted strings) to appear. The obsolete forms of the left and right sides of msg-id allow interspersed CFWS, making them syntactically identical to local-part and domain respectively.

```
obs-message-id  =       "Message-ID" *WSP ":" msg-id CRLF

obs-in-reply-to =       "In-Reply-To" *WSP ":" *(phrase / msg-id) CRLF

obs-references  =       "References" *WSP ":" *(phrase / msg-id) CRLF

obs-id-left     =       local-part

obs-id-right    =       domain
```

For purposes of interpretation, the phrases in the "In-Reply-To:" and "References:" fields are ignored.

Semantically, none of the optional CFWS surrounding the local-part and the domain are part of the obs-id-left and obs-id-right respectively.

4.5.5. Obsolete informational fields

```
obs-subject     =       "Subject" *WSP ":" unstructured CRLF

obs-comments    =       "Comments" *WSP ":" unstructured CRLF

obs-keywords    =       "Keywords" *WSP ":" obs-phrase-list CRLF
```

4.5.6. Obsolete resent fields

The obsolete syntax adds a "Resent-Reply-To:" field, which consists of the field name, the optional comments and folding white space, the colon, and a comma separated list of addresses.

```
obs-resent-from =       "Resent-From" *WSP ":" mailbox-list CRLF

obs-resent-send =       "Resent-Sender" *WSP ":" mailbox CRLF
```



```
obs-resent-date =       "Resent-Date" *WSP ":" date-time CRLF

obs-resent-to   =       "Resent-To" *WSP ":" address-list CRLF

obs-resent-cc   =       "Resent-Cc" *WSP ":" address-list CRLF

obs-resent-bcc  =       "Resent-Bcc" *WSP ":"
                         (address-list / [CFWS]) CRLF

obs-resent-mid  =       "Resent-Message-ID" *WSP ":" msg-id CRLF

obs-resent-rply =       "Resent-Reply-To" *WSP ":" address-list CRLF
```

As with other resent fields, the "Resent-Reply-To:" field is to be treated as trace information only.

4.5.7. Obsolete trace fields

The obs-return and obs-received are again given here as template definitions, just as return and received are in section 3. Their full syntax is given in [RFC2821].

```
obs-return      =       "Return-Path" *WSP ":" path CRLF

obs-received    =       "Received" *WSP ":" name-val-list CRLF

obs-path        =       obs-angle-addr
```

4.5.8. Obsolete optional fields

```
obs-optional    =       field-name *WSP ":" unstructured CRLF
```

5. Security Considerations

Care needs to be taken when displaying messages on a terminal or terminal emulator. Powerful terminals may act on escape sequences and other combinations of ASCII control characters with a variety of consequences. They can remap the keyboard or permit other modifications to the terminal which could lead to denial of service or even damaged data. They can trigger (sometimes programmable) answerback messages which can allow a message to cause commands to be issued on the recipient's behalf. They can also effect the operation of terminal attached devices such as printers. Message viewers may wish to strip potentially dangerous terminal escape sequences from the message prior to display. However, other escape sequences appear in messages for useful purposes (cf. [RFC2045, RFC2046, RFC2047, RFC2048, RFC2049, ISO2022]) and therefore should not be stripped indiscriminately.

Transmission of non-text objects in messages raises additional security issues. These issues are discussed in [RFC2045, RFC2046, RFC2047, RFC2048, RFC2049].

Many implementations use the "Bcc:" (blind carbon copy) field described in section 3.6.3 to facilitate sending messages to recipients without revealing the addresses of one or more of the addressees to the other recipients. Mishandling this use of "Bcc:" has implications for confidential information that might be revealed, which could eventually lead to security problems through knowledge of even the existence of a particular mail address. For example, if using the first method described in section 3.6.3, where the "Bcc:" line is removed from the message, blind recipients have no explicit indication that they have been sent a blind copy, except insofar as their address does not appear in the message header. Because of this, one of the blind addressees could potentially send a reply to all of the shown recipients and accidentally reveal that the message went to the blind recipient. When the second method from section 3.6.3 is used, the blind recipient's address appears in the "Bcc:" field of a separate copy of the message. If the "Bcc:" field sent contains all of the blind addressees, all of the "Bcc:" recipients will be seen by each "Bcc:" recipient. Even if a separate message is sent to each "Bcc:" recipient with only the individual's address, implementations still need to be careful to process replies to the message as per section 3.6.3 so as not to accidentally reveal the blind recipient to other recipients.

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Appendix A. Example messages

This section presents a selection of messages. These are intended to assist in the implementation of this standard, but should not be taken as normative; that is to say, although the examples in this section were carefully reviewed, if there happens to be a conflict between these examples and the syntax described in sections 3 and 4 of this document, the syntax in those sections is to be taken as correct.

Messages are delimited in this section between lines of "----". The "----" lines are not part of the message itself.

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A.1. Addressing examples

The following are examples of messages that might be sent between two individuals.

A.1.1. A message from one person to another with simple addressing

This could be called a canonical message. It has a single author, John Doe, a single recipient, Mary Smith, a subject, the date, a message identifier, and a textual message in the body.

```
----
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```


If John's secretary Michael actually sent the message, though John was the author and replies to this message should go back to him, the sender field would be used:

```
----
From: John Doe <jdoe@machine.example>
Sender: Michael Jones <mjones@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```

A.1.2. Different types of mailboxes

This message includes multiple addresses in the destination fields and also uses several different forms of addresses.

```
----
From: "Joe Q. Public" <john.q.public@example.com>
To: Mary Smith <mary@x.test>, jdoe@example.org, Who? <one@y.test>
Cc: <boss@nil.test>, "Giant; \"Big\" Box" <sysservices@example.net>
Date: Tue, 1 Jul 2003 10:52:37 +0200
Message-ID: <5678.21-Nov-1997@example.com>

Hi everyone.
----
```

Note that the display names for Joe Q. Public and Giant; "Big" Box needed to be enclosed in double-quotes because the former contains the period and the latter contains both semicolon and double-quote characters (the double-quote characters appearing as quoted-pair construct). Conversely, the display name for Who? could appear without them because the question mark is legal in an atom. Notice also that jdoe@example.org and boss@nil.test have no display names associated with them at all, and jdoe@example.org uses the simpler address form without the angle brackets.

A.1.3. Group addresses

```
----
```

```
From: Pete <pete@silly.example>
To: A Group:Chris Jones <c@a.test>,joe@where.test,John <jdoe@one.test>;
Cc: Undisclosed recipients:;
Date: Thu, 13 Feb 1969 23:32:54 -0330
Message-ID: <testabcd.1234@silly.example>

Testing.
----
```

In this message, the "To:" field has a single group recipient named A Group which contains 3 addresses, and a "Cc:" field with an empty group recipient named Undisclosed recipients.

A.2. Reply messages

The following is a series of three messages that make up a conversation thread between John and Mary. John firsts sends a message to Mary, Mary then replies to John's message, and then John replies to Mary's reply message.

Note especially the "Message-ID:", "References:", and "In-Reply-To:" fields in each message.

```
----
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```


When sending replies, the Subject field is often retained, though prepended with "Re: " as described in section 3.6.5.

```
----
From: Mary Smith <mary@example.net>
To: John Doe <jdoe@machine.example>
Reply-To: "Mary Smith: Personal Account" <smith@home.example>
Subject: Re: Saying Hello
Date: Fri, 21 Nov 1997 10:01:10 -0600
Message-ID: <3456@example.net>
In-Reply-To: <1234@local.machine.example>
References: <1234@local.machine.example>

This is a reply to your hello.
----
```

Note the "Reply-To:" field in the above message. When John replies to Mary's message above, the reply should go to the address in the "Reply-To:" field instead of the address in the "From:" field.

```
----
To: "Mary Smith: Personal Account" <smith@home.example>
From: John Doe <jdoe@machine.example>
Subject: Re: Saying Hello
Date: Fri, 21 Nov 1997 11:00:00 -0600
Message-ID: <abcd.1234@local.machine.tld>
In-Reply-To: <3456@example.net>
References: <1234@local.machine.example> <3456@example.net>

This is a reply to your reply.
----
```

A.3. Resent messages

Start with the message that has been used as an example several times:

```
----
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```

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Say that Mary, upon receiving this message, wishes to send a copy of the message to Jane such that (a) the message would appear to have come straight from John; (b) if Jane replies to the message, the reply should go back to John; and (c) all of the original information, like the date the message was originally sent to Mary, the message identifier, and the original addressee, is preserved. In this case, resent fields are prepended to the message:

```
----
Resent-From: Mary Smith <mary@example.net>
Resent-To: Jane Brown <j-brown@other.example>
Resent-Date: Mon, 24 Nov 1997 14:22:01 -0800
Resent-Message-ID: <78910@example.net>
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```

If Jane, in turn, wished to resend this message to another person, she would prepend her own set of resent header fields to the above and send that.

A.4. Messages with trace fields

As messages are sent through the transport system as described in [RFC2821], trace fields are prepended to the message. The following is an example of what those trace fields might look like. Note that there is some folding white space in the first one since these lines can be long.

```
----
Received: from x.y.test
   by example.net
   via TCP
   with ESMTP
   id ABC12345
   for <mary@example.net>;  21 Nov 1997 10:05:43 -0600
Received: from machine.example by x.y.test; 21 Nov 1997 10:01:22 -0600
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: Fri, 21 Nov 1997 09:55:06 -0600
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
----
```

A.5. White space, comments, and other oddities

White space, including folding white space, and comments can be inserted between many of the tokens of fields. Taking the example from A.1.3, white space and comments can be inserted into all of the fields.

```
----
From: Pete(A wonderful \) chap) <pete(his account)@silly.test(his host)>
To:A Group(Some people)
     :Chris Jones <c@(Chris's host.)public.example>,
         joe@example.org,
  John <jdoe@one.test> (my dear friend); (the end of the group)
Cc:(Empty list)(start)Undisclosed recipients  :(nobody(that I know))  ;
Date: Thu,
      13
        Feb
          1969
      23:32
               -0330 (Newfoundland Time)
Message-ID:              <testabcd.1234@silly.test>

Testing.
----
```

The above example is aesthetically displeasing, but perfectly legal. Note particularly (1) the comments in the "From:" field (including one that has a ")" character appearing as part of a quoted-pair); (2) the white space absent after the ":" in the "To:" field as well as the comment and folding white space after the group name, the special character (".") in the comment in Chris Jones's address, and the folding white space before and after "joe@example.org,"; (3) the multiple and nested comments in the "Cc:" field as well as the comment immediately following the ":" after "Cc"; (4) the folding white space (but no comments except at the end) and the missing seconds in the time of the date field; and (5) the white space before (but not within) the identifier in the "Message-ID:" field.

A.6. Obsoleted forms

The following are examples of obsolete (that is, the "MUST NOT generate") syntactic elements described in section 4 of this document.

A.6.1. Obsolete addressing

Note in the below example the lack of quotes around Joe Q. Public, the route that appears in the address for Mary Smith, the two commas that appear in the "To:" field, and the spaces that appear around the "." in the jdoe address.

```
----
From: Joe Q. Public <john.q.public@example.com>
To: Mary Smith <@machine.tld:mary@example.net>, , jdoe@test   . example
Date: Tue, 1 Jul 2003 10:52:37 +0200
Message-ID: <5678.21-Nov-1997@example.com>

Hi everyone.
----
```

A.6.2. Obsolete dates

The following message uses an obsolete date format, including a non-numeric time zone and a two digit year. Note that although the day-of-week is missing, that is not specific to the obsolete syntax; it is optional in the current syntax as well.

```
----
From: John Doe <jdoe@machine.example>
To: Mary Smith <mary@example.net>
Subject: Saying Hello
Date: 21 Nov 97 09:55:06 GMT
Message-ID: <1234@local.machine.example>

This is a message just to say hello.
So, "Hello".
```

```
----

A.6.3. Obsolete white space and comments

   White space and comments can appear between many more elements than
   in the current syntax.  Also, folding lines that are made up entirely
   of white space are legal.
```



```
----
From  : John Doe <jdoe@machine(comment).  example>
To    : Mary Smith
__          <mary@example.net>
Subject     : Saying Hello
Date  : Fri, 21 Nov 1997 09(comment):   55  :  06 -0600
Message-ID  : <1234   @   local(blah)  .machine .example>

This is a message just to say hello.
So, "Hello".
----
```

   Note especially the second line of the "To:" field. It starts with
   two space characters. (Note that "__" represent blank spaces.)
   Therefore, it is considered part of the folding as described in
   section 4.2. Also, the comments and white space throughout
   addresses, dates, and message identifiers are all part of the
   obsolete syntax.

Appendix B. Differences from earlier standards

   This appendix contains a list of changes that have been made in the
   Internet Message Format from earlier standards, specifically [RFC822]
   and [STD3]. Items marked with an asterisk (*) below are items which
   appear in section 4 of this document and therefore can no longer be
   generated.

   1. Period allowed in obsolete form of phrase.
   2. ABNF moved out of document to [RFC2234].
   3. Four or more digits allowed for year.
   4. Header field ordering (and lack thereof) made explicit.
   5. Encrypted header field removed.
   6. Received syntax loosened to allow any token/value pair.
   7. Specifically allow and give meaning to "-0000" time zone.
   8. Folding white space is not allowed between every token.
   9. Requirement for destinations removed.
   10. Forwarding and resending redefined.
   11. Extension header fields no longer specifically called out.
   12. ASCII 0 (null) removed.*
   13. Folding continuation lines cannot contain only white space.*
   14. Free insertion of comments not allowed in date.*
   15. Non-numeric time zones not allowed.*
   16. Two digit years not allowed.*
   17. Three digit years interpreted, but not allowed for generation.
   18. Routes in addresses not allowed.*
   19. CFWS within local-parts and domains not allowed.*
   20. Empty members of address lists not allowed.*

   21. Folding white space between field name and colon not allowed.*
   22. Comments between field name and colon not allowed.
   23. Tightened syntax of in-reply-to and references.*
   24. CFWS within msg-id not allowed.*
   25. Tightened semantics of resent fields as informational only.
   26. Resent-Reply-To not allowed.*
   27. No multiple occurrences of fields (except resent and received).*
   28. Free CR and LF not allowed.*
   29. Routes in return path not allowed.*
   30. Line length limits specified.
   31. Bcc more clearly specified.

Appendix C. Notices

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