

Network Working Group  
Request for Comments: 2543  
Category: Standards Track

M. Handley  
ACIRI  
H. Schulzrinne  
Columbia U.  
E. Schooler  
Cal Tech  
J. Rosenberg  
Bell Labs  
March 1999

## SIP: Session Initiation Protocol

### 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

Copyright (C) The Internet Society (1999). All Rights Reserved.

### IESG Note

The IESG intends to charter, in the near future, one or more working groups to produce standards for "name lookup", where such names would include electronic mail addresses and telephone numbers, and the result of such a lookup would be a list of attributes and characteristics of the user or terminal associated with the name. Groups which are in need of a "name lookup" protocol should follow the development of these new working groups rather than using SIP for this function. In addition it is anticipated that SIP will migrate towards using such protocols, and SIP implementors are advised to monitor these efforts.

### Abstract

The Session Initiation Protocol (SIP) is an application-layer control (signaling) protocol for creating, modifying and terminating sessions with one or more participants. These sessions include Internet multimedia conferences, Internet telephone calls and multimedia distribution. Members in a session can communicate via multicast or via a mesh of unicast relations, or a combination of these.

SIP invitations used to create sessions carry session descriptions which allow participants to agree on a set of compatible media types. SIP supports user mobility by proxying and redirecting requests to the user's current location. Users can register their current location. SIP is not tied to any particular conference control protocol. SIP is designed to be independent of the lower-layer transport protocol and can be extended with additional capabilities.

## Table of Contents

|       |   |    |
|-------|---|----|
| 1     | Introduction .....                          | 7  |
| 1.1   | Overview of SIP Functionality .....         | 7  |
| 1.2   | Terminology .....                           | 8  |
| 1.3   | Definitions .....                           | 9  |
| 1.4   | Overview of SIP Operation .....             | 12 |
| 1.4.1 | SIP Addressing .....                        | 12 |
| 1.4.2 | Locating a SIP Server .....                 | 13 |
| 1.4.3 | SIP Transaction .....                       | 14 |
| 1.4.4 | SIP Invitation .....                        | 15 |
| 1.4.5 | Locating a User .....                       | 17 |
| 1.4.6 | Changing an Existing Session .....          | 18 |
| 1.4.7 | Registration Services .....                 | 18 |
| 1.5   | Protocol Properties .....                   | 18 |
| 1.5.1 | Minimal State .....                         | 18 |
| 1.5.2 | Lower-Layer-Protocol Neutral .....          | 18 |
| 1.5.3 | Text-Based .....                            | 20 |
| 2     | SIP Uniform Resource Locators .....         | 20 |
| 3     | SIP Message Overview .....                  | 24 |
| 4     | Request .....                               | 26 |
| 4.1   | Request-Line .....                          | 26 |
| 4.2   | Methods .....                               | 27 |
| 4.2.1 | INVITE .....                                | 28 |
| 4.2.2 | ACK .....                                   | 29 |
| 4.2.3 | OPTIONS .....                               | 29 |
| 4.2.4 | BYE .....                                   | 30 |
| 4.2.5 | CANCEL .....                                | 30 |
| 4.2.6 | REGISTER .....                              | 31 |
| 4.3   | Request-URI .....                           | 34 |
| 4.3.1 | SIP Version .....                           | 35 |
| 4.4   | Option Tags .....                           | 35 |
| 4.4.1 | Registering New Option Tags with IANA ..... | 35 |
| 5     | Response .....                              | 36 |
| 5.1   | Status-Line .....                           | 36 |
| 5.1.1 | Status Codes and Reason Phrases .....       | 37 |
| 6     | Header Field Definitions .....              | 39 |
| 6.1   | General Header Fields .....                 | 41 |
| 6.2   | Entity Header Fields .....                  | 42 |
| 6.3   | Request Header Fields .....                 | 43 |

|        |   |    |
|--------|---|----|
| 6.4    | Response Header Fields .....            | 43 |
| 6.5    | End-to-end and Hop-by-hop Headers ..... | 43 |
| 6.6    | Header Field Format .....               | 43 |
| 6.7    | Accept .....                            | 44 |
| 6.8    | Accept-Encoding .....                   | 44 |
| 6.9    | Accept-Language .....                   | 45 |
| 6.10   | Allow .....                             | 45 |
| 6.11   | Authorization .....                     | 45 |
| 6.12   | Call-ID .....                           | 46 |
| 6.13   | Contact .....                           | 47 |
| 6.14   | Content-Encoding .....                  | 50 |
| 6.15   | Content-Length .....                    | 51 |
| 6.16   | Content-Type .....                      | 51 |
| 6.17   | CSeq .....                              | 52 |
| 6.18   | Date .....                              | 53 |
| 6.19   | Encryption .....                        | 54 |
| 6.20   | Expires .....                           | 55 |
| 6.21   | From .....                              | 56 |
| 6.22   | Hide .....                              | 57 |
| 6.23   | Max-Forwards .....                      | 59 |
| 6.24   | Organization .....                      | 59 |
| 6.25   | Priority .....                          | 60 |
| 6.26   | Proxy-Authenticate .....                | 60 |
| 6.27   | Proxy-Authorization .....               | 61 |
| 6.28   | Proxy-Require .....                     | 61 |
| 6.29   | Record-Route .....                      | 62 |
| 6.30   | Require .....                           | 63 |
| 6.31   | Response-Key .....                      | 63 |
| 6.32   | Retry-After .....                       | 64 |
| 6.33   | Route .....                             | 65 |
| 6.34   | Server .....                            | 65 |
| 6.35   | Subject .....                           | 65 |
| 6.36   | Timestamp .....                         | 66 |
| 6.37   | To .....                                | 66 |
| 6.38   | Unsupported .....                       | 68 |
| 6.39   | User-Agent .....                        | 68 |
| 6.40   | Via .....                               | 68 |
| 6.40.1 | Requests .....                          | 68 |
| 6.40.2 | Receiver-tagged Via Header Fields ..... | 69 |
| 6.40.3 | Responses .....                         | 70 |
| 6.40.4 | User Agent and Redirect Servers .....   | 70 |
| 6.40.5 | Syntax .....                            | 71 |
| 6.41   | Warning .....                           | 72 |
| 6.42   | WWW-Authenticate .....                  | 74 |
| 7      | Status Code Definitions .....           | 75 |
| 7.1    | Informational 1xx .....                 | 75 |
| 7.1.1  | 100 Trying .....                        | 75 |
| 7.1.2  | 180 Ringing .....                       | 75 |

|        |   |    |
|--------|---|----|
| 7.1.3  | 181 Call Is Being Forwarded .....             | 75 |
| 7.1.4  | 182 Queued .....                              | 76 |
| 7.2    | Successful 2xx .....                          | 76 |
| 7.2.1  | 200 OK .....                                  | 76 |
| 7.3    | Redirection 3xx .....                         | 76 |
| 7.3.1  | 300 Multiple Choices .....                    | 77 |
| 7.3.2  | 301 Moved Permanently .....                   | 77 |
| 7.3.3  | 302 Moved Temporarily .....                   | 77 |
| 7.3.4  | 305 Use Proxy .....                           | 77 |
| 7.3.5  | 380 Alternative Service .....                 | 78 |
| 7.4    | Request Failure 4xx .....                     | 78 |
| 7.4.1  | 400 Bad Request .....                         | 78 |
| 7.4.2  | 401 Unauthorized .....                        | 78 |
| 7.4.3  | 402 Payment Required .....                    | 78 |
| 7.4.4  | 403 Forbidden .....                           | 78 |
| 7.4.5  | 404 Not Found .....                           | 78 |
| 7.4.6  | 405 Method Not Allowed .....                  | 78 |
| 7.4.7  | 406 Not Acceptable .....                      | 79 |
| 7.4.8  | 407 Proxy Authentication Required .....       | 79 |
| 7.4.9  | 408 Request Timeout .....                     | 79 |
| 7.4.10 | 409 Conflict .....                            | 79 |
| 7.4.11 | 410 Gone .....                                | 79 |
| 7.4.12 | 411 Length Required .....                     | 79 |
| 7.4.13 | 413 Request Entity Too Large .....            | 80 |
| 7.4.14 | 414 Request-URI Too Long .....                | 80 |
| 7.4.15 | 415 Unsupported Media Type .....              | 80 |
| 7.4.16 | 420 Bad Extension .....                       | 80 |
| 7.4.17 | 480 Temporarily Unavailable .....             | 80 |
| 7.4.18 | 481 Call Leg/Transaction Does Not Exist ..... | 81 |
| 7.4.19 | 482 Loop Detected .....                       | 81 |
| 7.4.20 | 483 Too Many Hops .....                       | 81 |
| 7.4.21 | 484 Address Incomplete .....                  | 81 |
| 7.4.22 | 485 Ambiguous .....                           | 81 |
| 7.4.23 | 486 Busy Here .....                           | 82 |
| 7.5    | Server Failure 5xx .....                      | 82 |
| 7.5.1  | 500 Server Internal Error .....               | 82 |
| 7.5.2  | 501 Not Implemented .....                     | 82 |
| 7.5.3  | 502 Bad Gateway .....                         | 82 |
| 7.5.4  | 503 Service Unavailable .....                 | 83 |
| 7.5.5  | 504 Gateway Time-out .....                    | 83 |
| 7.5.6  | 505 Version Not Supported .....               | 83 |
| 7.6    | Global Failures 6xx .....                     | 83 |
| 7.6.1  | 600 Busy Everywhere .....                     | 83 |
| 7.6.2  | 603 Decline .....                             | 84 |
| 7.6.3  | 604 Does Not Exist Anywhere .....             | 84 |
| 7.6.4  | 606 Not Acceptable .....                      | 84 |
| 8      | SIP Message Body .....                        | 84 |
| 8.1    | Body Inclusion .....                          | 84 |

|        |  |     |
|--------|--|-----|
| 8.2    | Message Body Type .....  | 85  |
| 8.3    | Message Body Length .....  | 85  |
| 9      | Compact Form .....   | 85  |
| 10     | Behavior of SIP Clients and Servers .....                        | 86  |
| 10.1   | General Remarks .....  | 86  |
| 10.1.1 | Requests .....   | 86  |
| 10.1.2 | Responses .....  | 87  |
| 10.2   | Source Addresses, Destination Addresses and<br>Connections ..... | 88  |
| 10.2.1 | Unicast UDP .....  | 88  |
| 10.2.2 | Multicast UDP .....  | 88  |
| 10.3   | TCP .....  | 89  |
| 10.4   | Reliability for BYE, CANCEL, OPTIONS, REGISTER<br>Requests ..... | 90  |
| 10.4.1 | UDP .....  | 90  |
| 10.4.2 | TCP .....  | 91  |
| 10.5   | Reliability for INVITE Requests .....                            | 91  |
| 10.5.1 | UDP .....  | 92  |
| 10.5.2 | TCP .....  | 95  |
| 10.6   | Reliability for ACK Requests .....                               | 95  |
| 10.7   | ICMP Handling .....  | 95  |
| 11     | Behavior of SIP User Agents .....                                | 95  |
| 11.1   | Caller Issues Initial INVITE Request .....                       | 96  |
| 11.2   | Callee Issues Response .....                                     | 96  |
| 11.3   | Caller Receives Response to Initial Request .....                | 96  |
| 11.4   | Caller or Callee Generate Subsequent Requests .....              | 97  |
| 11.5   | Receiving Subsequent Requests .....                              | 97  |
| 12     | Behavior of SIP Proxy and Redirect Servers .....                 | 97  |
| 12.1   | Redirect Server .....  | 97  |
| 12.2   | User Agent Server .....  | 98  |
| 12.3   | Proxy Server .....   | 98  |
| 12.3.1 | Proxying Requests .....  | 98  |
| 12.3.2 | Proxying Responses .....   | 99  |
| 12.3.3 | Stateless Proxy: Proxying Responses .....                        | 99  |
| 12.3.4 | Stateful Proxy: Receiving Requests .....                         | 99  |
| 12.3.5 | Stateful Proxy: Receiving ACKs .....                             | 99  |
| 12.3.6 | Stateful Proxy: Receiving Responses .....                        | 100 |
| 12.3.7 | Stateless, Non-Forking Proxy .....                               | 100 |
| 12.4   | Forking Proxy .....  | 100 |
| 13     | Security Considerations .....                                    | 104 |
| 13.1   | Confidentiality and Privacy: Encryption .....                    | 104 |
| 13.1.1 | End-to-End Encryption .....                                      | 104 |
| 13.1.2 | Privacy of SIP Responses .....                                   | 107 |
| 13.1.3 | Encryption by Proxies .....                                      | 108 |
| 13.1.4 | Hop-by-Hop Encryption .....                                      | 108 |
| 13.1.5 | Via field encryption .....                                       | 108 |
| 13.2   | Message Integrity and Access Control:<br>Authentication .....    | 109 |

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.