



ATIS-1000009.2008

IP NETWORK-TO-NETWORK INTERFACE (NNI) STANDARD FOR VOIP

AMERICAN NATIONAL STANDARD FOR TELECOMMUNICATIONS



The Alliance for Telecommunication Industry Solutions (ATIS) is a technical planning and standards development organization that is committed to rapidly developing and promoting technical and operations standards for the communications and related information technologies industry worldwide using pragmatic, flexible and open approach. Over 1,100 participants from more than 350 communications companies are active in ATIS' 23 industry committees and its Incubator Solutions Program.

< <http://www.atis.org/> >

AMERICAN NATIONAL STANDARD

Approval of an American National Standard requires review by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made towards their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

<p>NOTE - The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to the validity of this claim or any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.</p>

ATIS-1000009.2006, IP Network to Network Interface (NNI) Standard for VoIP

Is an American National Standard developed by the **Signaling, Architecture, and Control (SAC) Subcommittee** under the **ATIS Packet Technologies and Systems Committee (PTSC)**.

Published by

Alliance for Telecommunications Industry Solutions
1200 G Street, NW, Suite 500
Washington, DC 20005

Copyright © 2006 by Alliance for Telecommunications Industry Solutions
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher. For information contact ATIS at 202.628.6380. ATIS is online at < <http://www.atis.org/> >.

Printed in the United States of America.

American National Standard for Telecommunications

IP NETWORK-TO-NETWORK INTERFACE (NNI) STANDARD FOR VOIP

Secretariat

Alliance for Telecommunications Industry Solutions

Approved May 16, 2006

American National Standards Institute, Inc.

Abstract

This document defines a standard approach to support IP-IP interconnection for VoIP between carriers.

FOREWORD

The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Packet Technologies and Systems Committee (PTSC) -- formerly T1S1 -- develops and recommends standards and technical reports related to services, architectures, and signaling, in addition to related subjects under consideration in other North American and international standards bodies. PTSC coordinates and develops standards and technical reports relevant to telecommunications networks in the U.S., reviews and prepares contributions on such matters for submission to U.S. ITU-T and U.S. ITU-R Study Groups or other standards organizations, and reviews for acceptability or per contra the positions of other countries in related standards development and takes or recommends appropriate actions.

ANSI guidelines specify two categories of requirements: mandatory and recommendation. The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, PTSC Secretariat, 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time it approved this document, PTSC, which is responsible for the development of this Standard, had the following members:

- B. Hall, PTSC Chair
- J. Zearth, PTSC Vice-Chair
- S. Carioti, ATIS Disciplines
- S. Barclay, ATIS Secretariat
- C. Underkoffler, ATIS Chief Editor
- M. Dolly & V. Shaikh, PTSC Technical Editors

Organization Represented	Name of Representative
AcmePacket	Kevin Klett
Alcatel USA Inc.	Kevin Biholar
AT&T	Bob Hall George Stanek (Alt.)
BellSouth Telecommunications	Rick McNealy
C.S.I. Telecommunications	Michael S. Newman Thomas G. Crouse (Alt.)
Cingular Wireless LLC	Don Zelman Marc Cramer (Alt.)
Cisco Systems	Rajiv Kapoor Mark Hammer (Alt.)
Department of Defense	Chris Fitzgerald Tom Kuleski (Alt.)
Ericsson Incorporated	Susan Sabater-Maroto Stephen Hayes (Alt.)
FBI ESTS	Robert Holman Edward Ignacio(Alt.)
Harris Corporation	Marlis Humphrey
Hewlett-Packard	Steve Mills
Intelsat	Mark T. Neibert
Luce Technologies	Stuart O. Goldman

Organization Represented	Name of Representative
National Communications System	Nicholas Andrew Carol-Lyn Taylor (Alt.)
Neustar	Chris Celiberti
Nokia Telecommunications Inc.	Joyabrata Mukherjee Ed Ehrlich (Alt.)
Nortel	Joseph Zearth
Owest	Steve Showell Michael Fargano(Alt.)
Siemens Communications, Inc.	Ron Franks David E. Francisco(Alt.)
Sprint LTD	Jack Mooningham
Sprint Nextel	Mark L. Jones
Telcordia Technologies	Wesley Downum Cliff Halevi (Alt.)
Tellabs Operations, Inc.	William A. Walker
Tridea Works	Greg Ratta
VerisSign, Inc.	Anthony M. Rutkowski
Verizon Communications	Thomas Helmes Christine Huff

The Signaling, Architecture, and Control (SAC) Subcommittee was responsible for the development of this document.

TABLE OF CONTENTS

FOREWORD	II
TABLE OF CONTENTS	III
TABLE OF FIGURES	V
TABLE OF TABLES	
SUMMARY	
1 SCOPE, PURPOSE, AND APPLICATION	1
1.1 ASSUMPTIONS	2
2 NORMATIVE REFERENCES	3
2.1 ANSI REFERENCES	3
2.2 ITU REFERENCES	4
2.3 IETF REFERENCES	4
2.3.1 Call Control Signaling	4
2.3.2 Media References	5
2.4 OTHER REFERENCES	5
3 DEFINITIONS	5
4 ABBREVIATIONS & ACRONYMS	6
5 REFERENCE MODEL	8
5.1 VoIP INTERCONNECTION ALTERNATIVES	9
6 TRAFFIC MODEL (TYPES OF SERVICES)	11
7 MEDIA AVAILABILITY IN A SIP SESSION	13
8 CALL/SIGNALING FLOWS (INFORMATIVE)	13
8.1 PSTN—IP—(NNI)—IP—PSTN	14
8.1.1 Successful Call Setup (SIP Preconditions Not Used)	14
8.1.2 Normal Call Release without Tone Provision	15
8.2 PSTN—IP—(NNI)—IP—IP	16
8.2.1 Successful Call Setup (SIP Preconditions Not Used)	16
8.2.2 Normal Call Release Initiated from the ISUP Side	17
8.3 IP—IP—NNI—IP—PSTN	18
8.3.1 Successful Call Setup (SIP Preconditions Not Used)	18
8.3.2 Normal Call Release Procedure Initiated from the SIP Side	19
8.4 IP—IP—(NNI)—IP—IP	20
8.4.1 Successful Call Setup (SIP Preconditions Not Used)	20
8.4.2 Normal Call Release	21
8.5 USAGE OF TRUNK GROUP IDENTIFIER CALL FLOW	22
9 QUALITY OF SERVICE	23
9.1 VOICE QUALITY	23
9.1.1 Coexistence	23
9.2 THROUGHPUT	23
9.3 AUTOMATIC LEVEL CONTROL DEVICES	24
9.4 TRANSMISSION PLAN	24
10 MANDATORY SIP URIS TO BE SUPPORTED	24
11 SIGNALING	27
11.1 CALL CONTROL	27
11.1.1 SIP PROFILE	27
11.1.1.1 Introduction	27

11.1.1.2	Overview of SIP Functionality	27
11.1.1.3	Terminology	27
11.1.1.4	Overview of Operation	27
11.1.1.5	Structure of the Protocol	27
11.1.1.6	Definitions	27
11.1.1.7	SIP Messages	27
11.1.1.7.1	Requests	27
11.1.1.7.2	Responses	28
11.1.1.7.3	Header Fields	28
11.1.1.7.4	Bodies	28
11.1.1.7.4.1	Message Body Types	28
11.1.1.7.4.2	Message Body Length	28
11.1.1.7.5	Framing SIP Messages	28
11.1.1.8	General User Agent Behavior	29
11.1.1.8.1	UAC Behavior	29
11.1.1.8.2	Generating the Request	29
11.1.1.8.3	Sending the Request	29
11.1.1.8.4	Processing Responses	29
11.1.1.8.5	UAS Behavior	29
11.1.1.8.6	Redirect Servers	29
11.1.1.9	Canceling a Request	30
11.1.1.10	Registrations	30
11.1.1.11	Querying for Capabilities	30
11.1.1.12	Dialogs	30
11.1.1.12.1	Creation of a Dialog	30
11.1.1.12.2	Requests within a Dialog	30
11.1.1.12.3	Termination of a Dialog	30
11.1.1.13	Initiating a Session	30
11.1.1.14	Modifying an Existing Session	30
11.1.1.15	Terminating a Session	31
11.1.1.16	Proxy Behavior	31
11.1.1.17	Transactions	31
11.1.1.18	Transport	31
11.1.1.19	Common Message Components	31
11.1.1.19.1	SIP and SIPS URI Component	31
11.1.1.20	Header Fields	31
11.1.1.20.1	Accept	31
11.1.1.20.2	Accept-Encoding	31
11.1.1.20.3	Accept-Language	32
11.1.1.20.4	Alert-Info	32
11.1.1.20.5	Allow	32
11.1.1.20.6	Authentication-Info	32
11.1.1.20.7	Authorization	32
11.1.1.20.8	Call-ID	32
11.1.1.20.9	Call-Info	32
11.1.1.20.10	Contact	32
11.1.1.20.11	Content-Disposition	33
11.1.1.20.12	Content-Encoding	33
11.1.1.20.13	Content-Language	33
11.1.1.20.14	Content-Length	33
11.1.1.20.15	Content-Type	33
11.1.1.20.16	CSeq	33
11.1.1.20.17	Date	33
11.1.1.20.18	Expires	33
11.1.1.20.19	Expires	34
11.1.1.20.20	From	34
11.1.1.20.21	In-Reply-To	34
11.1.1.20.22	Max-Forwards	34
11.1.1.20.23	Min-Expires	34
11.1.1.20.24	MIME-Version	34
11.1.1.20.25	Organization	34
11.1.1.20.26	Priority	35
11.1.1.20.27	Proxy-Authenticate	35
11.1.1.20.28	Proxy-Authorization	35
11.1.1.20.29	Proxy-Require	35
11.1.1.20.30	Record-Route	35
11.1.1.20.31	Reply-To	35

11.1.1.20.32	Require.....	35
11.1.1.20.33	Retry-After.....	35
11.1.1.20.34	Route.....	35
11.1.1.20.35	Server.....	36
11.1.1.20.36	Subject.....	36
11.1.1.20.37	Supported.....	36
11.1.1.20.38	Timestamp.....	36
11.1.1.20.39	To.....	36
11.1.1.20.40	Unsupported.....	36
11.1.1.20.41	User-Agent.....	36
11.1.1.20.42	Via.....	36
11.1.1.20.43	Warning.....	36
11.1.1.20.44	WWW-Authenticate.....	37
11.1.1.21	Response Codes.....	37
11.1.1.22	Usage of HTTP Authentication.....	37
11.1.1.23	S/MIME.....	37
11.1.1.24	Examples.....	37
11.1.1.25	Augmented BNF for the SIP Protocol.....	37
11.1.2	Header Support.....	38
11.1.3	Mandatory SIP Extensions Supported ³	40
11.1.4	Informational ³	41
11.1.5	Call Forwarding Information.....	42
11.2	MANDATORY MEDIA-RELATED PROTOCOLS TO BE SUPPORTED.....	42
11.3	CALL CONTROL SIGNALING TRANSPORT.....	43
11.4	IP PROTOCOL VERSION.....	43
12	SECURITY.....	43
A	CONSIDERATIONS FOR SERVICE LEVEL AGREEMENTS (SLAS).....	44
A.1	INTRODUCTION.....	44
A.2	SUGGESTED TOPICS TO ADDRESS IN THE SLA.....	44

TABLE OF FIGURES

FIGURE 1 - SCOPE OF DOCUMENT.....	2
FIGURE 2 - VOIP INTERCONNECTION REFERENCE MODEL.....	9
FIGURE 3 - VOIP INTERCONNECTION ALTERNATIVES.....	10
FIGURE 4 - TRAFFIC TYPE MODEL.....	11
FIGURE 5 - CALL/SIGNALING FLOW LEGEND.....	14
FIGURE 6 - SUCCESSFUL CALL SETUP.....	15
FIGURE 7 - NORMAL CALL RELEASE WITHOUT TONE PROVISION.....	16
FIGURE 8 - SUCCESSFUL CALL SETUP FROM ISUP TO SIP.....	17
FIGURE 9 - NORMAL CALL RELEASE FROM ISUP TO SIP.....	18
FIGURE 10 - SUCCESSFUL CALL SETUP FROM SIP TO ISUP.....	19
FIGURE 11 - NORMAL CALL RELEASE FROM SIP TO ISUP.....	20
FIGURE 12 - SUCCESSFUL CALL SETUP AT IP-IP SIP NNI.....	21
FIGURE 13 - NORMAL CALL RELEASE AT IP-IP SIP NNI.....	22
FIGURE 14 - SUCCESSFUL CALL SETUP USING TRUNK GROUP IDENTIFIER.....	23

TABLE OF TABLES

TABLE 1 - SIP URI FORMATS FOR IP-NNI.....	25
TABLE 2 - IETF RFC 3261 HEADER FIELDS.....	38

American National Standard for Telecommunications –

IP Network-to-Network Interface (NNI) Standard for VoIP

SUMMARY

This document defines a standard approach to support IP-IP interconnection for VoIP between carriers.

1 SCOPE, PURPOSE, AND APPLICATION

This standard defines the IP Network-to-Network Interface (NNI) for VoIP between carriers. It addresses the need for a standard interface as telecom networks migrate the NNI from TDM circuit-switched to IP. The focus of this standard is to support VoIP. This standard defines:

- ◆ Interconnection architecture;
- ◆ SIP call/session control signaling;
- ◆ Signaling and media transport;
- ◆ Quality of Service (QoS);
- ◆ Association between call control and media control; and
- ◆ Mandatory SIP URIs to be Supported.

There is also an informative annex on items for consideration in SLAs.

The following related topics are not defined in this document:

- ◆ Call Routing;
- ◆ Security;
- ◆ Session Border Controller Functions; or
- ◆ Call Admission Control and Traffic Management.

Figure 1 illustrates the relationship of this document to other related IP-NNI documents.