

**The Assignment of the Information Field and Protocol Identifier
in the Q.2941 Generic Identifier and Q.2957 User-to-user Signaling
for the Internet 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 (2001). All Rights Reserved.

Abstract

The purpose of this document is to specify the assignment of the information field and protocol identifier in the Q.2941 Generic Identifier and Q.2957 User-to-user Signaling for the Internet protocol.

The assignment, that is specified in [section 4](#) of this document, is designed for advanced B-ISDN signaling support of the Internet protocol, especially the B-ISDN signaling support for the connection that corresponds to the session in the Internet protocol which is clarified in [section 2](#). This specification provides an indispensable framework for the implementation of long-lived session and QoS-sensitive session transfers over ATM.

[1. Purpose of Document](#)

The purpose of this document is to specify the assignment of the information field and protocol identifier in the Q.2941 Generic Identifier and Q.2957 User-to-user Signaling for the Internet protocol.

The assignment, that is specified in [section 4](#) of this document, is designed for advanced B-ISDN signaling support of the Internet protocol, especially the B-ISDN signaling support for the connection that corresponds to the session in the Internet protocol which is

clarified in [section 2](#). Needless to say, the purpose of this specification is not limited to this support, and it should also be applicable to other purposes.

This specification provides an indispensable framework for the implementation of long-lived session and QoS-sensitive session transfers over ATM. Note that this document only specifies the assignment of the information field and protocol identifier, and that it may not specify complete protocol that enables interoperable implementation. This is because it is beyond the scope of this document and will be specified in a separate document.

2. Session-related ATM Connection

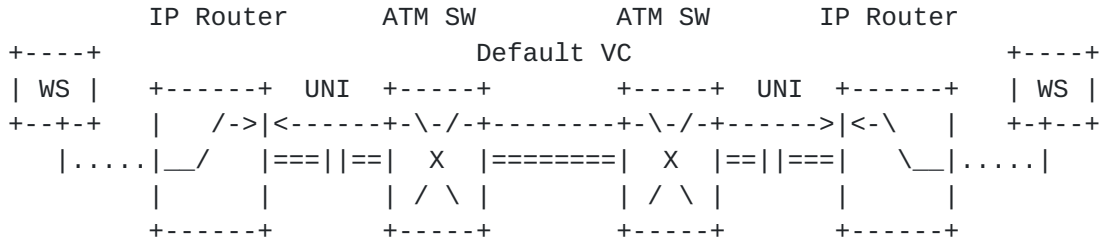
With the development of new multimedia applications on the current Internet, the demands for multimedia support are increasing in the IP network, which currently supports best effort communications. In particular, demands to support QoS guaranteed communications are increasing with the development of voice, audio, and video communications applications. And it may also be necessary to introduce the mechanism that can efficiently transfer the huge volume of traffic expected with these applications.

The major features of B-ISDN are high speed, logical multiplexing with the VP/VC, and flexible QoS management per VC, so it is quite natural to use these distinctive functions of B-ISDN to implement a multimedia support mechanism in the IP network. The flexible QoS management and logical multiplexing functions in B-ISDN are the expected method of implementing the QoS guaranteed communications in the Internet. And when a long-lived session is supported by a particular VC, efficient packet forwarding may be possible using the high speed and logical multiplexing of B-ISDN.

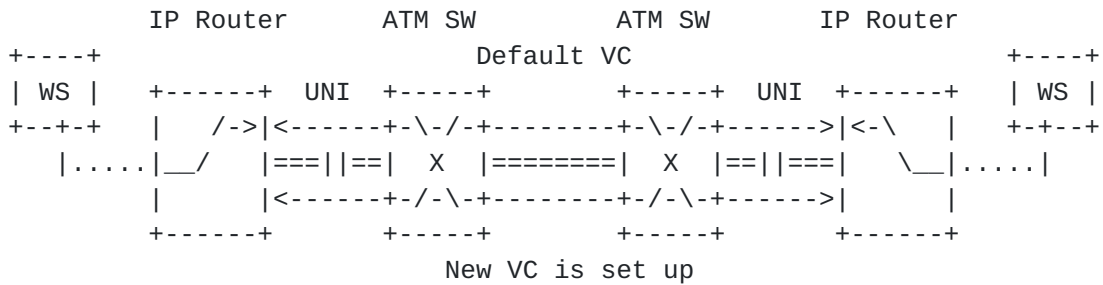
This section clarifies B-ISDN signaling functions that are required when the session is supported by the VC, for advanced B-ISDN signaling support of the Internet protocol.

2.1 Long-lived Session Signaling

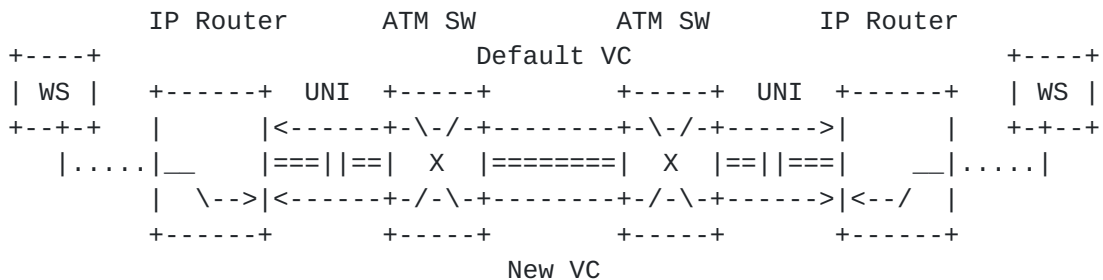
An example scenario for establishing a VC for a long-lived session is shown in Fig. 2.1.



A. New session initially forwarded over a default VC.



B. New VC is set up for the long-lived session.



C. Transfer of the long-lived session to a new VC.

Fig. 2.1: Example scenario for establishing a VC for a long-lived session.

First, a session is multiplexed into the default VC connecting the routers. Then, if a router detects that it is a long-lived session, it sets up a new VC for the session. If the new VC is established successfully, the long-lived session is moved to the new VC.

In this procedure involving an ATM VC setup, the B-ISDN signaling entity in the called side router must detect that the incoming call corresponds to a session of the Internet protocol and notify that fact to the IP layer entity. Based on this information, the IP layer entity moves the session to the new VC.

Therefore, to implement this signaling procedure, the B-ISDN signaling must include a session identifier as an information element. The B-LLI, B-HLI, User-user, and Generic Identifier information elements are all capable of transferring this information. Considering the original purposes of these information elements, the most appropriate one to use is the Generic Identifier information element.

2.2 QoS-sensitive Session Signaling

The major difference between QoS-sensitive session signaling and long-lived session signaling is that call setup is not initiated by the detection of a long-lived session, but is explicitly initiated by the setup protocol such as RSVP. To implement QoS-sensitive session signaling using ATM, the ATM network between the routers must forward not only the session identifier but also the setup protocol.

There are two schemes for forwarding the setup protocol. One is to multiplex the protocol into a default VC connecting the routers, or to forward the protocol through a particular VC. In this case, the QoS-sensitive session and the ATM VC are established sequentially. The second scheme is to forward the setup protocol as an information element in the B-ISDN signaling. In this case, the QoS-sensitive session and the ATM VC are established simultaneously. The latter scheme has the following advantages compared with the former one.

- o Easier to implement.
 - Admission control is simplified, because admission control for the IP and ATM layers can be done simultaneously.
 - Watchdog timer processing is simplified, because there is no need to watch the IP layer establishment and ATM layer establishment sequentially.
- o If the setup protocol supports negotiation, then an ATM VC whose QoS is based on the result of negotiation can be established.

However, the latter scheme, at least, cannot support a case where a PVC is used to support a QoS-sensitive session. Therefore, both procedures should be taken into account.

An example of a message sequence that simultaneously establishes a QoS-sensitive session and an ATM VC is shown in Fig. 2.2.

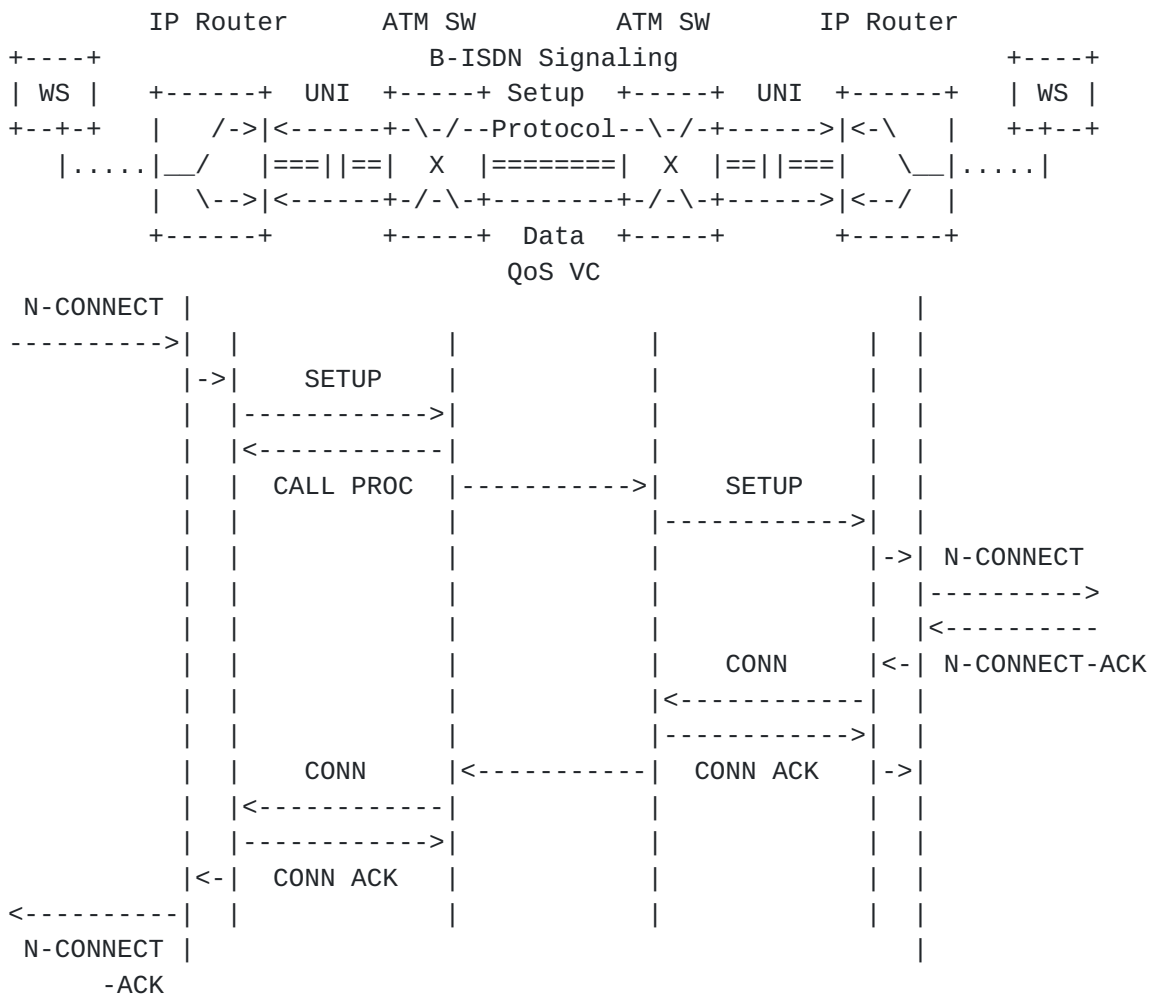


Fig. 2.2: Example procedure for simultaneous QoS-sensitive session and ATM VC establishment.

RSVP is currently proposed for the setup protocol and new setup protocols are likely to be developed in the future. Therefore, to generalize the discussion, the procedure for the setup protocol in this example is the general connection setup procedure using confirmed service.

To implement this signaling procedure, the B-ISDN signaling must include the User-user information element that the capacity is sufficient to forward the setup protocol.

3. Overview of the Generic Identifier and User-to-user Signaling

3.1 Overview of the Generic Identifier

The Generic Identifier enables the transfer of identifiers between end-to-end users in the ATM network, and it is defined in the Q.2941 Part 1 (Q.2941.1) [3] and Part 2 (Q.2941.2) [4] as an optional information element for the Q.2931 [1] and Q.2971 [2] UNI signaling protocol. The SETUP, ALERTING, CONNECT, RELEASE, RELEASE COMPLETE, ADD PARTY, PARTY ALERTING, ADD PARTY ACK, ADD PARTY REJECT, DROP PARTY, and DROP PARTY ACK messages that are transferred between end-to-end users in the ATM network may contain up to three Generic Identifier information elements. The ATM network transfers the Generic Identifier information element transparently if it contains no coding rule errors.

The format of the Generic Identifier information element specified in the Q.2941 is shown in Fig. 3.1.

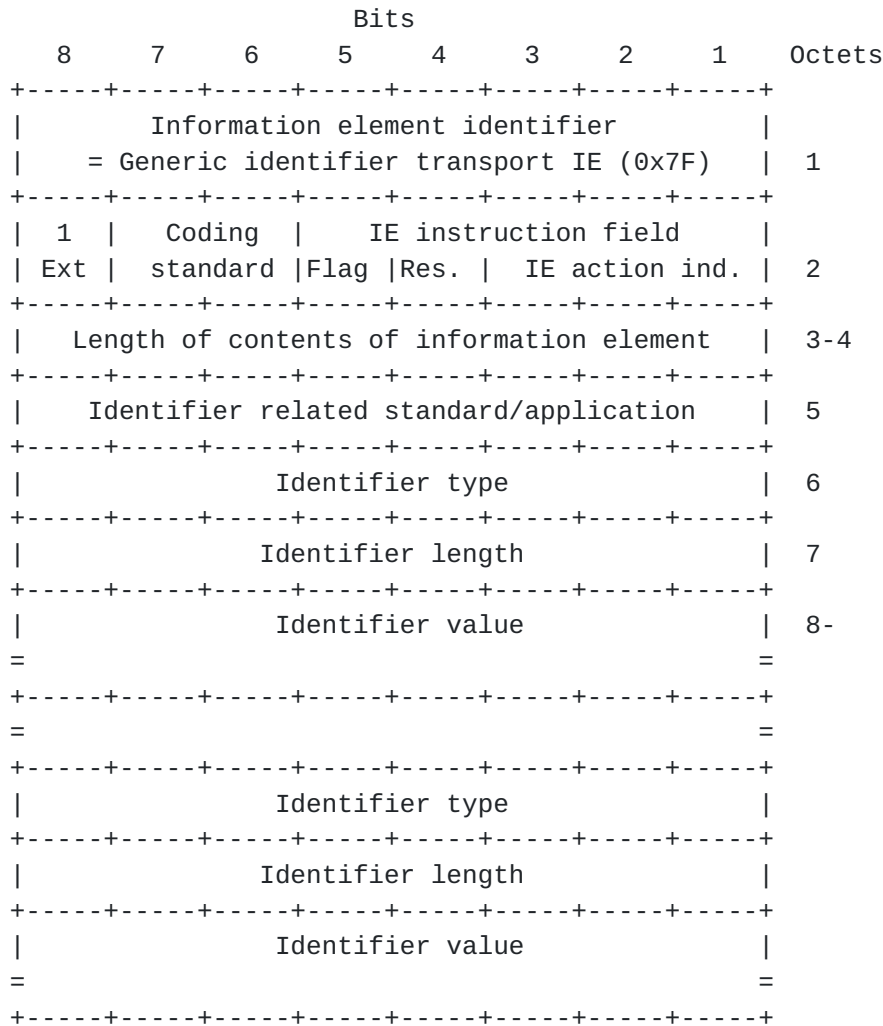


Fig. 3.1: Format of the Generic Identifier information element.

The usage of the first 4 octets of fields is specified in [section 4](#) of the Q.2931.

The Identifier related standard/application field identifies the standard or application that uses the identifier. Assignment of the Identifier related standard/application field for the Internet protocol is as follows. A leading 0x means hexadecimal.

0x03: IPv4.

0x04: ST2+.

0x05: IPv6.

0x06: MPLS.

Note: DSM-CC, H.310/H.321, MPOA, ATM VCC Trunking, AAL2, and H.323/H.245 are also supported.

A transferred identifier is given by the combination of the Identifier type, length and value fields, and a Generic Identifier information element may contain multiple identifiers.

Assignment of the Identifier type field for the Internet protocol is as follows. A leading 0x means hexadecimal.

0x01: Session.

0x02: Resource.

0x10-0xFD: Reserved for IANA assignment.

0xFE: Experiment/Organization specific.

The maximum length of the Generic Identifier information element is 63 octets.

See the Q.2941.1 and Draft Q.2941.2 for detailed protocol specifications of the Generic Identifier.

3.2 Overview of the User-to-user Signaling

The User-to-user Signaling enables the transfer of information between end-to-end users in the ATM network, and it is defined in Q.2957 [5, 6] and in Q.2971 annex D [2] as an optional information element for the Q.2931 [1] and Q.2971 [2] UNI signaling protocol. The SETUP, ALERTING, CONNECT, RELEASE, RELEASE COMPLETE, PROGRESS, ADD PARTY, PARTY ALERTING, ADD PARTY ACK, ADD PARTY REJECT, DROP PARTY, and DROP PARTY ACK messages that are transferred between end-to-end users in the ATM network may contain a User-user information element. The ATM network transfers the User-user information element transparently if it contains no coding rule errors.

From the viewpoint of B-ISDN signaling applications, it seems the Generic Identifier and User-to-user Signaling are similar functions. But their rules for processing exceptions are not completely the same, because their purposes are different. The Generic Identifier is designed for the transfer of identifiers between the c-planes, while the User-to-user Signaling is designed for the transfer of user data via the c-planes. Another difference is that the latter supports interworking with the user-user information element in the

Q.931 N-ISDN signaling, but the Generic Identifier does not. Note that the ATM network may check the contents of the Generic Identifier information element, but does not check the contents of the User-to-user information element.

The format of the User-user information element is shown in Fig. 3.2.

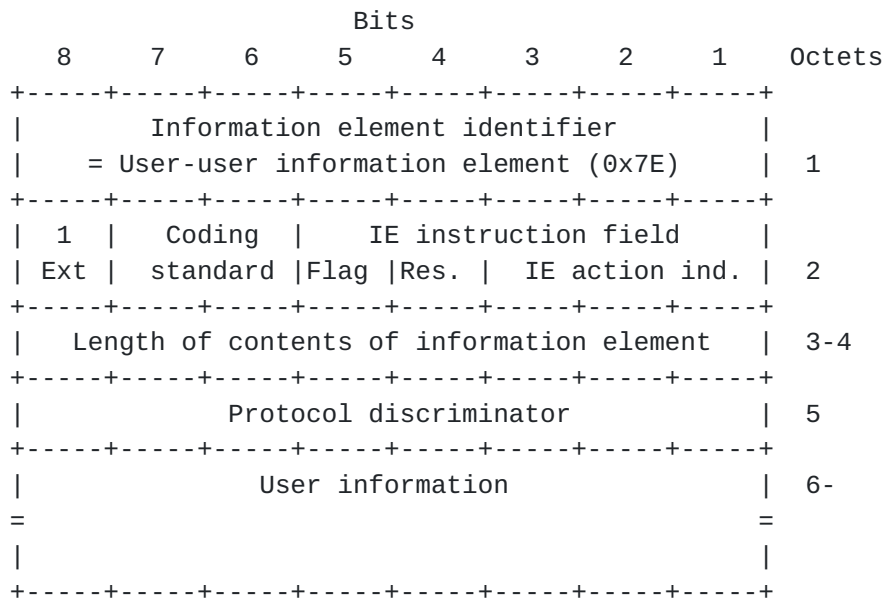


Fig. 3.2: Format of the User-user information element.

The usage of the first 4 octets of fields is specified in [section 4](#) of the Q.2931.

The Protocol discriminator field identifies the upper layer protocol that uses the user-user information.

The User information field contains the user-user information to be transferred.

The maximum length of the User-user information element is 133 octets.

See Q.2957, Draft Q.2957 amendment 1, and Q.2971 annex D for detailed protocol specifications of the User-to-user Signaling.

4. Information Field and Protocol Identifier Assignment

4.1 Assignment in the Generic Identifier Information Element

4.1.1 Use of Generic Identifier

The information field and protocol identifier assignment principle for the Internet protocol in the Generic Identifier information element is shown in Fig. 4.1.

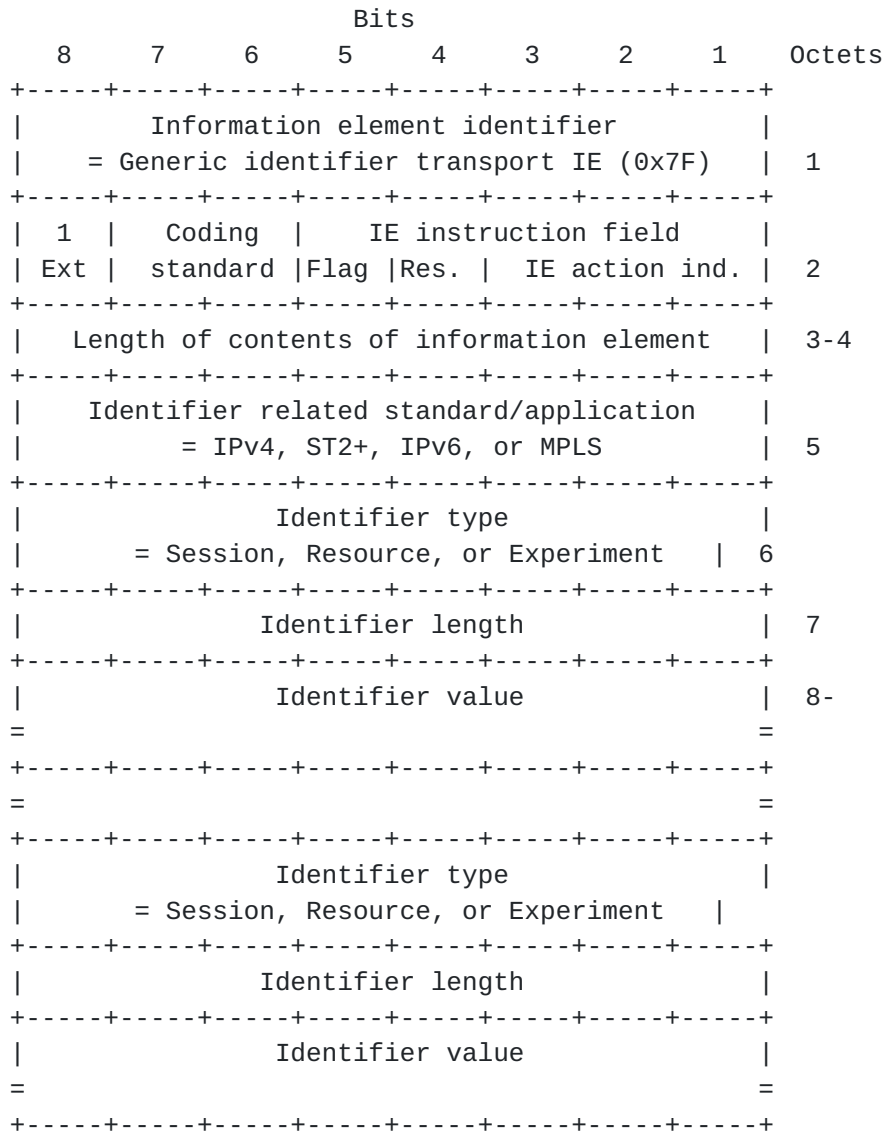


Fig. 4.1: Principle of assignment in the Generic Identifier information element.

The Identifier related standard/application field is the IPv4, ST2+, IPv6, or MPLS.

The Identifier type field is the Session, Resource, or Experiment/Organization specific.

The Identifier value field is assigned to Internet protocol related information which is identified by the Identifier related standard/application field and Identifier type field. The following identifiers are specified.

	Std./app.	Id type
IPv4 session identifier	IPv4	Session
IPv6 session identifier	IPv6	Session
MPLS VCID	MPLS	Resource
Exp./Org. specific	IPv4/ST2+/IPv6/MPLS	Experiment

As described in [section 3.1](#), the B-ISDN signaling message transferred between end-to-end users may contain up to three Generic Identifier information elements. These elements may contain multiple identifiers. This document does not specify the order of identifiers when multiple identifiers appear in a signaling message.

This document also does not specify the semantics when multiple identifiers having the same Identifier type appear in a signaling message, or when a signaling message contains a Generic Identifier information element that does not contain identifiers.

When a B-ISDN signaling message containing a Generic Identifier information element enters an ATM network that does not support the Generic Identifier, the network clears the call, discards the information element, or discards the signaling message. (See sections [4.5.1](#) and [5.6.8.1](#) of Q.2931 and [section 9.3](#) of Q.2941.1 for details.)

To enable reliable Generic Identifier information element transfer, when the calling party sends a SETUP or ADD PARTY message with up to three Generic Identifier information elements, the CONNECT or ADD PARTY ACK message returned by the called party must contain at least one Generic Identifier information element. The called party may not respond with the same identifiers received from the calling party. The calling party should confirm that the response message contains at least one Generic Identifier information element. This rule enables identifier negotiation; this document does not specify the detailed procedure of this negotiation.

4.1.2 IPv4 session identifier

If the Identifier related standard/application field in the Generic Identifier information element is the IPv4, and the Identifier type field in the identifier is the Session, the identifier is the IPv4 session identifier. The format of the IPv4 session identifier is shown in Fig. 4.2.

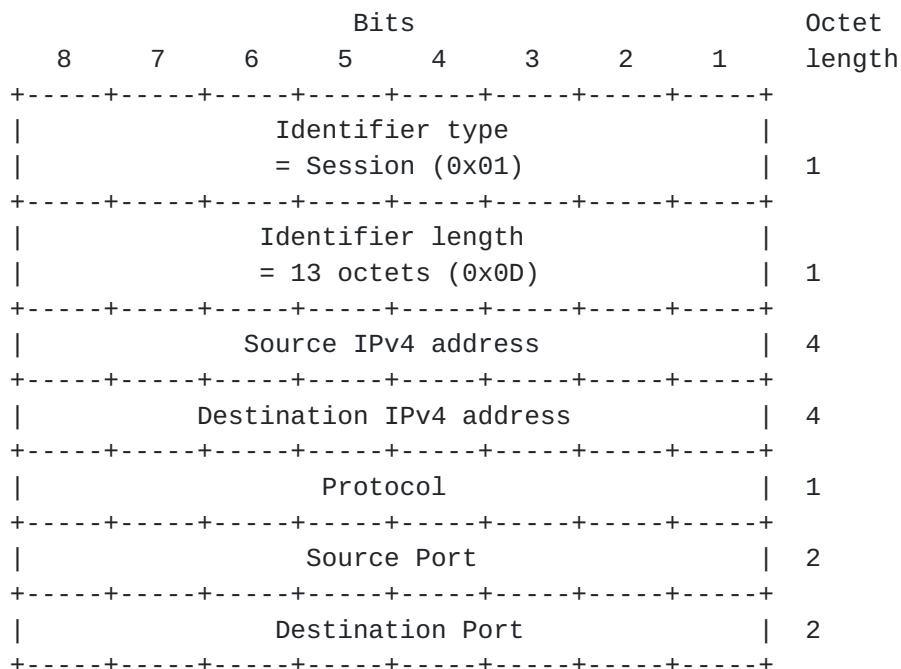


Fig. 4.2: IPv4 session identifier.

The Identifier type field is the Session (0x01).

The Identifier length is 13 octets.

The Source IPv4 address, Destination IPv4 address, Protocol, Source Port, and Destination Port [7, 9, 10] are assigned in that order to the Identifier value field.

Note: This specific session identifier is intended for use only with the explicit reservation. If wild card associations are needed at a later date, another identifier type will be used.

4.1.3 IPv6 session identifier

If the Identifier related standard/application field in the Generic Identifier information element is the IPv6, and the Identifier type field in the identifier is the Session, the identifier is the IPv6 session identifier. The format of the IPv6 session identifier is

shown in Fig. 4.3.

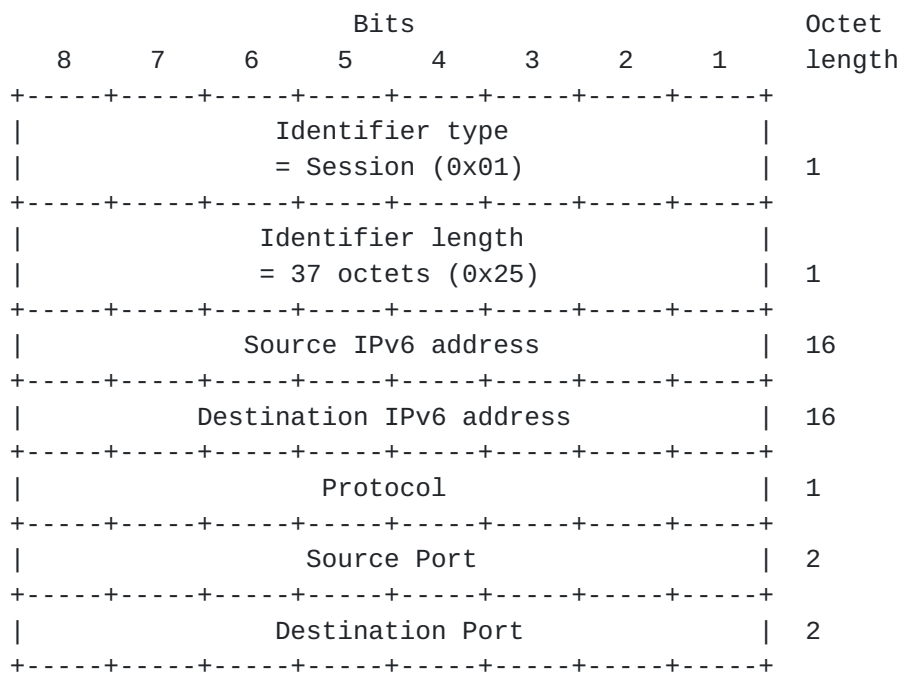


Fig. 4.3: IPv6 session identifier.

The Identifier type field is the Session (0x01).

The Identifier length is 37 octets.

The Source IPv6 address, Destination IPv6 address, Protocol, Source Port, and Destination Port [8, 9, 10] are assigned in that order to the Identifier value field.

Note: This specific session identifier is intended for use only with the explicit reservation. If wild card associations are needed at a later date, another identifier type will be used.

4.1.1.4 MPLS VCID

If the Identifier related standard/application field in the Generic Identifier information element is the MPLS, and the Identifier type field in the identifier is the Resource, the identifier is the MPLS VCID. The format of the MPLS VCID is shown in Fig. 4.4.

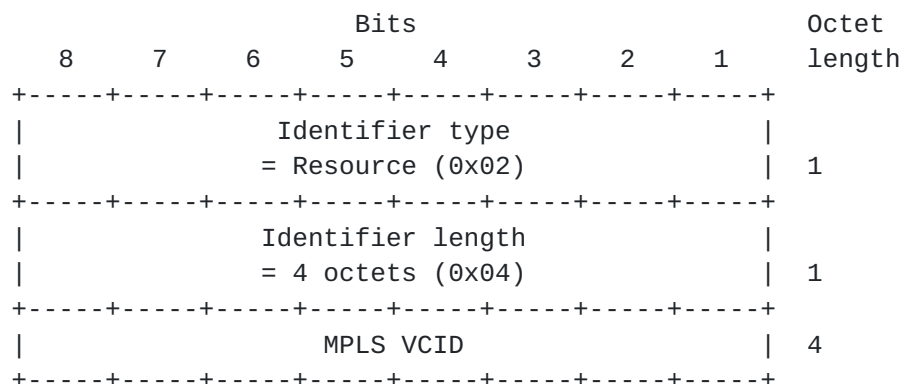


Fig. 4.4: MPLS VCID.

The Identifier type field is the Resource (0x02).

The Identifier length is 4 octets.

The MPLS VCID [[13](#)] is assigned to the Identifier value field.

4.1.1.5 Experiment/Organization specific

If the Identifier related standard/application field in the Generic Identifier information element is the IPv4, ST2+, IPv6, or MPLS, and the Identifier type field in the identifier is the Experiment/Organization specific, the identifier is the Experiment/Organization specific. The format of the Experiment/Organization specific is shown in Fig. 4.5.

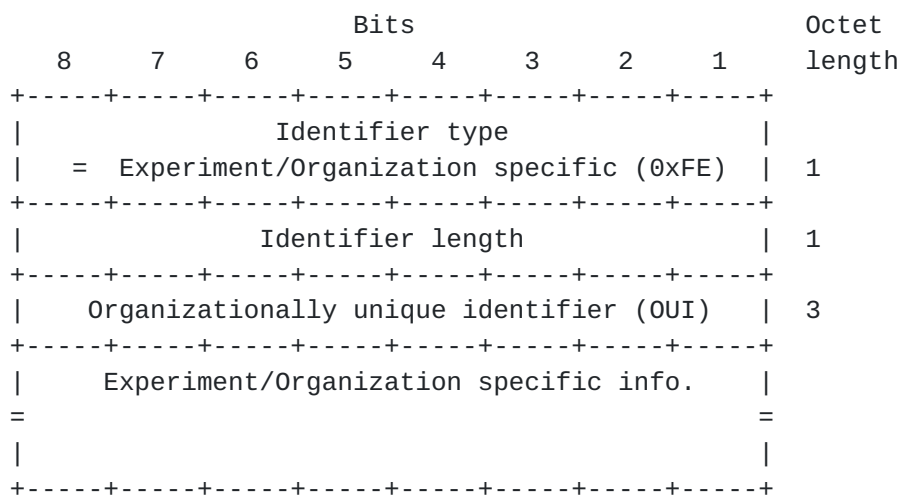


Fig. 4.5: Experiment/Organization specific.

The Identifier type field is the Experiment/Organization specific (0xFE).

The first 3 octets in the Identifier value field must contain the Organizationally unique identifier (OUI) (as specified in IEEE 802-1990; [section 5.1](#)).

4.2 Assignment in the User-user Information Element

4.2.1 Use of User-to-user Signaling

The information field and protocol identifier assignment principle for the Internet protocol in the User-user information element is shown in Fig. 4.6.

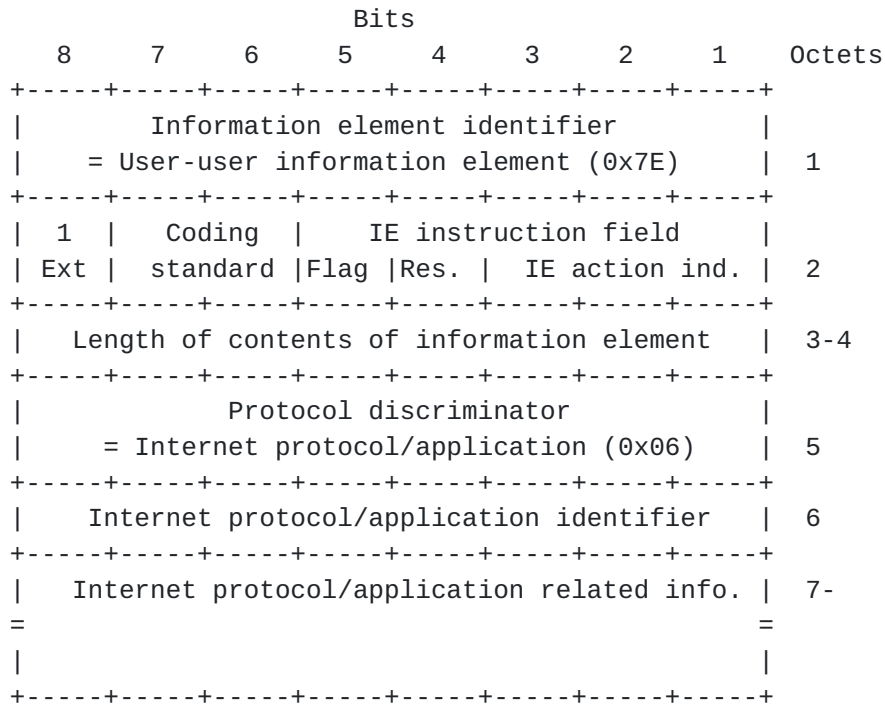


Fig. 4.6: Principle of assignment in the User-user information element.

The Protocol discriminator field is the Internet protocol/application (0x06). In this case, the first 1 octet in the User information field is the Internet protocol/application identifier field.

Assignment of the Internet protocol/application identifier field is as follows. A leading 0x means hexadecimal.

0x00: Reserved.

0x01: Reserved for ST2+.

0x02: RSVP message.

0x03-0xFD: Reserved for IANA assignment.

0xFE: Experiment/Organization specific.

0xFF: Reserved.

The field that follows the Internet protocol/application identifier field is assigned to Internet protocol/application related information that is identified by the Internet protocol/application identifier field.

When a B-ISDN signaling message containing a User-user information element enters an ATM network that does not support the User-to-user Signaling, the network clears the call, discards the information element, or discards the signaling message. (See sections 4.5.1 and 5.6.8.1 of Q.2931, [section 1.9](#) of Q.2957, and Q.2971 annex D for details.)

To enable reliable User-user information element transfer, when the calling party sends a SETUP or ADD PARTY message with a User-user information element, the CONNECT or ADD PARTY ACK message returned by the called party must contain a User-user information element. The called party may not respond with the same user information received from the calling party. The calling party should confirm that the response message contains a User-user information element. This rule enables negotiation; this document does not specify the detailed procedure of this negotiation.

4.2.2 RSVP message

The format of the RSVP message is shown in Fig. 4.7.

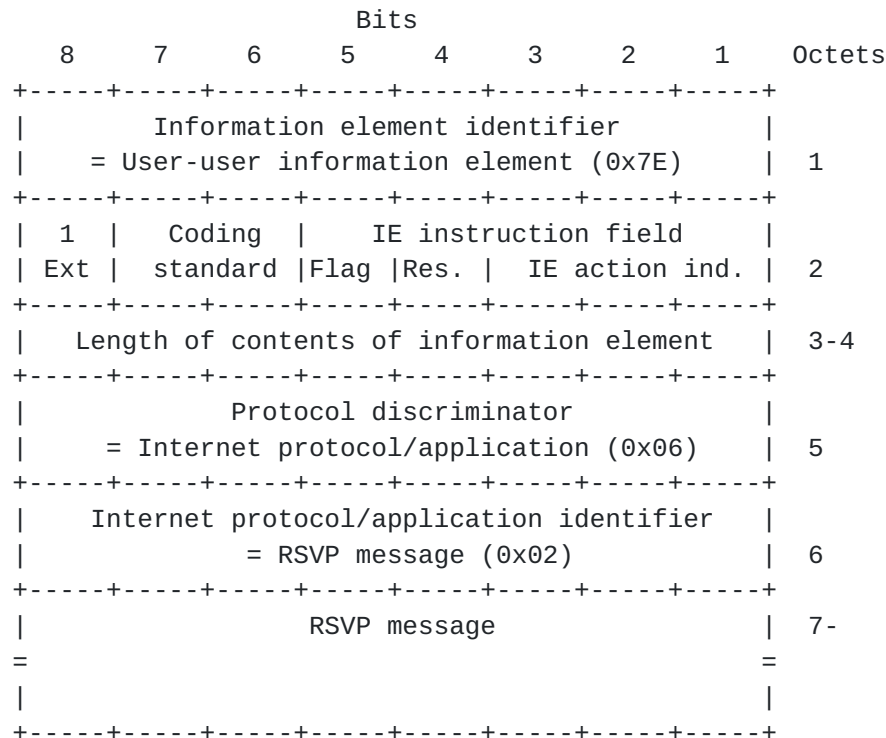


Fig. 4.7: RSVP message.

The Internet protocol/application identifier field is the RSVP message (0x02).

The RSVP message [12] is assigned to the Internet protocol/application related information field. The SETUP message may contain the RSVP Resv message. The CONNECT message may contain the RSVP ResvConf message. The RELEASE message may contain the RSVP ResvErr or ResvTear message.

4.2.3 Experiment/Organization specific

The format of the Experiment/Organization specific is shown in Fig. 4.8.

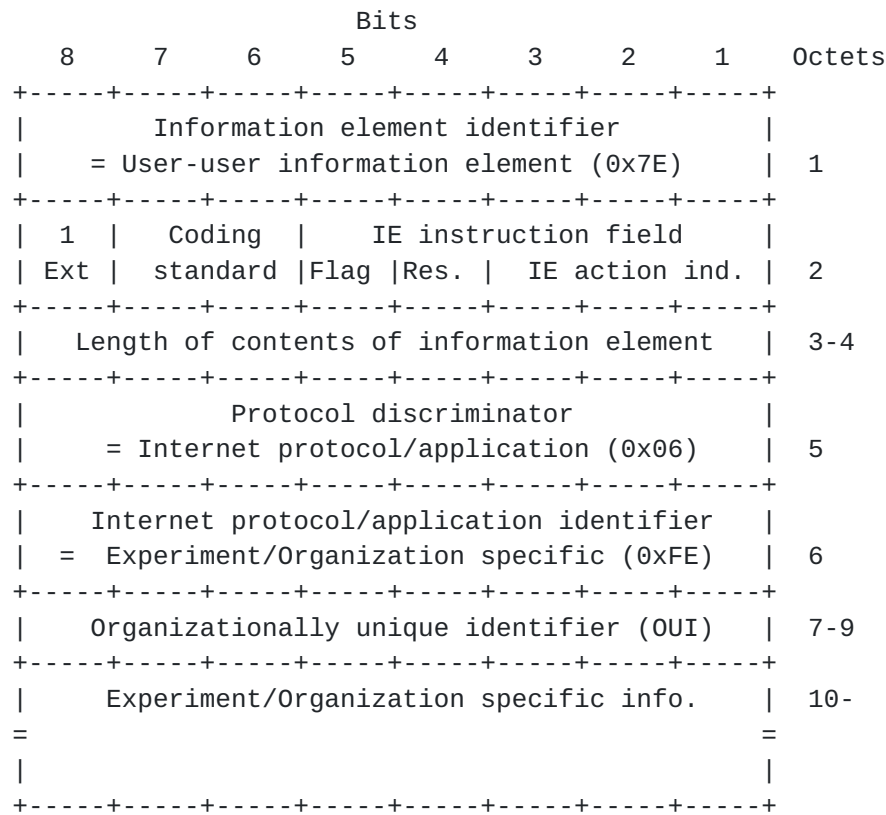


Fig. 4.8: Experiment/Organization specific.

The Internet protocol/application identifier field is the Experiment/Organization specific (0xFE).

The first 3 octets in the Internet protocol/application related information field must contain the Organizationally unique identifier (OUI) (as specified in IEEE 802-1990; [section 5.1](#)).

5. Open Issues

The following issues are still remain in this document.

- o Generic Identifier support for session aggregation.

Session aggregation support may be needed in a backbone environment. Wild card style aggregated session identifier may be feasible. However, before specifying Generic Identifier support for it, session aggregation model in ATM VCs should be clarified.

- o Generic Identifier support for the IPv6 flow label and traffic classes.

The IPv6 flow label and traffic classes support may be needed in future. However, currently their semantics are not clear.

6. IANA Considerations

When the Identifier related standard/application field in the Q.2941.2 Generic Identifier information element is the IPv4, ST2+, IPv6, or MPLS, numbers between 0x10-0xFD in the Identifier type field are reserved for IANA assignment. (See [section 3.1.](#)) Following the policies outlined in [\[14\]](#), these numbers are allocated through an IETF Consensus action.

When the Protocol discriminator field in the Q.2957 User-user information element is the Internet protocol/application, numbers between 0x03-0xFD in the Internet protocol/application identifier field are reserved for IANA assignment. (See [section 4.2.1.](#)) Following the policies outlined in [\[14\]](#), these numbers are allocated through an IETF Consensus action.

7. Security Considerations

This document specifies the information field and protocol identifier assignment in the Q.2941 Generic Identifier and Q.2957 User-to-user Signaling for the Internet protocol, so these do not weaken the security of the B-ISDN signaling.

In a called party of the B-ISDN signaling, if the incoming SETUP message contains the calling party number and if it is verified and passed by the ATM network or it is provided by the network, then it is feasible to use the calling party number for part of the calling party authentication to strengthen security.

Appendix. Information Field and Protocol Identifier Assignment for ST2+

This appendix specifies information field and protocol identifier assignment in the Generic Identifier and User-to-user Signaling for ST2+. Note that this appendix is NOT part of the standard.

A.1 ST2+ session identifier

If the Identifier related standard/application field in the Generic Identifier information element is the ST2+, and the Identifier type field in the identifier is the Session, the identifier is the ST2+ session identifier. The format of the ST2+ session identifier is shown in Fig. A.1.

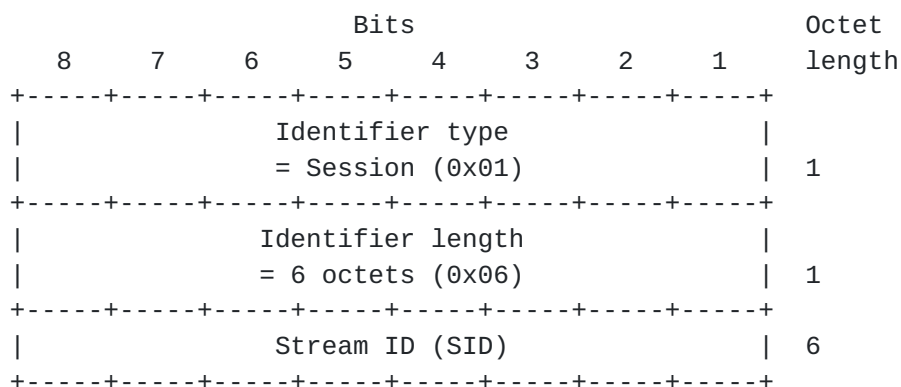


Fig. A.1: ST2+ session identifier.

The Identifier type field is the Session (0x01).

The Identifier length is 6 octets.

The Stream ID (SID) [11] is assigned to the Identifier value field.

A.2 ST2+ SCMP

The format of the User-user information element for the ST2+ SCMP is shown in Fig. A.2.

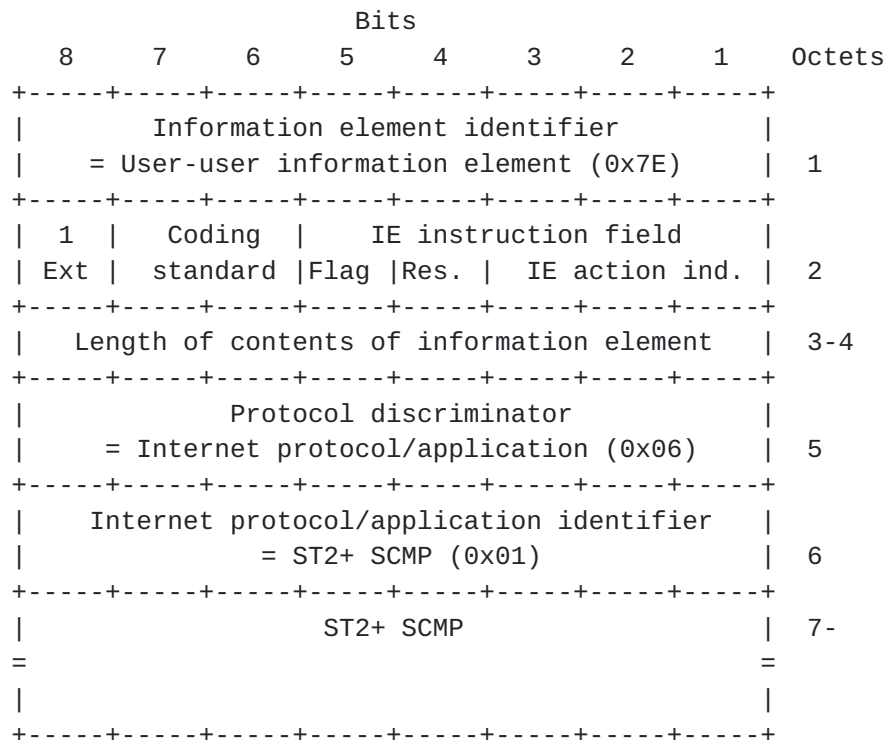


Fig. A.2: ST2+ SCMP.

The Internet protocol/application identifier field is the ST2+ SCMP (0x01).

The ST2+ SCMP [11] is assigned to the Internet protocol/application related information field. The SETUP and ADD PARTY messages may contain the ST2+ SCMP CONNECT message. The CONNECT and ADD PARTY ACK messages may contain the ST2+ SCMP ACCEPT message. The RELEASE and DROP PARTY messages may contain the ST2+ SCMP DISCONNECT message. The RELEASE, RELEASE COMPLETE, ADD PARTY REJECT, and DROP PARTY messages may contain the ST2+ SCMP REFUSE message.

References

- [1] ITU-T, "Broadband Integrated Services Digital Network (B-ISDN)-Digital Subscriber Signaling System No. 2 (DSS 2)-User-Network Interface (UNI) Layer 3 Specification for Basic Call/Connection Control," ITU-T Recommendation Q.2931, September 1995.
- [2] ITU-T, "Broadband Integrated Services Digital Network (B-ISDN)-Digital Subscriber Signaling System No. 2 (DSS 2)-User-Network Interface Layer 3 Specification for Point-to-Multipoint Call/Connection Control," ITU-T Recommendation Q.2971, October 1995.
- [3] ITU-T, "Broadband Integrated Services Digital Network (B-ISDN) Digital Subscriber Signaling System No. 2 (DSS 2): Generic Identifier Transport," ITU-T New Recommendation Q.2941.1, September 1997.
- [4] ITU-T, "Broadband Integrated Services Digital Network (B-ISDN) Digital Subscriber Signaling System No. 2 (DSS 2): Generic Identifier Transport Extensions," ITU-T New Recommendation Q.2941.2, December 1999.
- [5] ITU-T, "Stage 3 Description for Additional Information Transfer Supplementary Service Using B-ISDN Digital Subscriber Signaling System No. 2 (DSS 2)-Basic Call Clause 1-User-to-User Signalling (UUS)," ITU-T Recommendation Q.2957, February 1995.
- [6] ITU-T, "Stage 3 Description for Additional Information Transfer Supplementary Service Using B-ISDN Digital Subscriber Signaling System No. 2 (DSS 2)-Basic Call Clause 1-User-to-User Signalling (UUS)," ITU-T Recommendation Q.2957 Amendment 1, December 1999.
- [7] Postel, J., Ed., "Internet Protocol", STD 5, [RFC 791](#), September 1981.
- [8] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", [RFC 2460](#), December 1998.
- [9] Postel, J., "User Datagram Protocol", STD 6, [RFC 768](#), August 1980.
- [10] Postel, J., Ed., "Transmission Control Protocol", STD 7, [RFC 793](#), September 1981.

- [11] Delgrossi, L. and L. Berger, Ed., "Internet Stream Protocol Version 2 (ST2) Protocol Specification - Version ST2+", [RFC 1819](#), August 1995.
- [12] Braden, R., Ed., "Resource ReSerVation Protocol (RSVP) - Version 1 Functional Specification", [RFC 2205](#), September 1997.
- [13] Nagami, K., Demizu, N., Esaki, H., Katsube, Y. and P. Doolan, "VCID Notification over ATM link for LDP", [RFC 3038](#), January 2001.
- [14] Narten, T., and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", [BCP 26](#), [RFC 2434](#), October 1998.
- [15] P. Newman, T. Lyon, and G. Minshall, "Flow Labelled IP: A Connectionless Approach to ATM," Proc. IEEE Infocom, March 1996.
- [16] S. Damaskos and A. Gavras, "Connection Oriented Protocols over ATM: A case study," Proc. SPIE, Vol. 2188, pp.226-278, February 1994.
- [17] ITU-T, "Integrated Services Digital Network (ISDN) Overall Network Aspects and Functions ISDN Protocol Reference Model," ITU-T Recommendation I.320, November 1993.
- [18] ITU-T, "Digital Subscriber Signaling System No. 1 (DSS 1) Specification of a Synchronization and Coordination Function for the Provision of the OSI Connection-mode Network Service in an ISDN Environment," ITU-T Recommendation Q.923, February 1995.

Acknowledgments

I would like to thank Kenichi Kitami of the NTT Information Sharing Lab. Group, who is also the chair of ITU-T SG11 WP1, Shinichi Kuribayashi of the NTT Information Sharing Platform Labs., Hiroshi Yao and Takumi Ohba of the NTT Network Service Systems Labs., and Noriyuki Takahashi of the NTT Information Sharing Platform Labs., for their valuable comments and discussions.

And I would also like to thank the active members of IETF, ITU-T, and ATM Forum, especially Joel Halpern of Newbridge Networks, Andrew Malis of Ascend Communications, George Swallow and Bruce Davie of Cisco Systems, Rao Cherukuri of IBM, Rajiv Kapoor of AT&T, Greg Ratta of Lucent, Kaoru Kenyoshi of NEC, Hiroto Uno of Hitachi, Hiroshi Esaki and Kenichi Nagami of Toshiba, and Noritoshi Demizu of NAIST for their valuable comments and suggestions.

Also, this specification is based on various discussions during the ST2+ over ATM project at the NTT Multimedia Joint Project with NACSIS. I would like to thank Professor Shoichiro Asano of the National Center for Science Information Systems for his invaluable advice in this area.

Author's Address

Muneyoshi Suzuki
NTT Information Sharing Platform Laboratories
3-9-11, Midori-cho
Musashino-shi, Tokyo 180-8585, Japan

Phone: +81-422-59-2119
Fax: +81-422-37-7691
EMail: suzuki.muneyoshi@lab.ntt.co.jp

Full Copyright Statement

Copyright (C) The Internet Society (2001). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

