                 Interworking ISDN Call Control User Information with SIP

Abstract

   The motivation and use cases for interworking and transporting User-
   to-User Information (UUI) from the ITU-T Digital Subscriber
   Signalling System No. 1 (DSS1) User-user information element within
   SIP are described in RFC 6567. As networks move to SIP, it is
   important that applications requiring this data can continue to
   function in SIP networks as well as have the ability to interwork
   with this ISDN service for end-to-end transparency. This document
   defines a usage (a new package called the ISDN UUI package) of the
   User-to-User header field to enable interworking with this ISDN
   service.

   This document covers interworking with both public ISDN and private
   ISDN capabilities, so the potential interworking with QSIG will also
   be addressed.

   The package is identified by the new value "isdn-uui" of the
   "purpose" header field parameter.

Status of This Memo

Copyright Notice

Table of Contents

1. Overview

   This document describes a usage of the User-to-User header field
   defined in [RFC7433] to enable the transport of UUI in ISDN
   interworking scenarios using SIP [RFC3261]. Specifically, this
   document discusses the interworking of the following items, which are
   call control related: ITU-T Recommendation Q.931 DSS1 User-user
   information element [Q931], ITU-T Recommendation Q.957.1 DSS1 User-
   to-User Signalling (UUS) supplementary service [Q957.1], and ITU-T
   Recommendation Q.763 User-to-User information parameter [Q763] data
   in SIP. Today, UUI is widely used in the Public Switched Telephone
   Network (PSTN) in contact centers and call centers that are
   transitioning away from ISDN to SIP.

   This usage is not limited to scenarios where interworking will occur.
   Rather it describes a usage where interworking is possible if
   interworking is met. That does not preclude its usage directly
   between two SIP terminals.

2. Terminology

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in [RFC2119].

3. Summary of the ISDN User-to-User Service

3.1. The Service

   ISDN defines a number of related services. Firstly, there is a user
   signalling bearer service that uses the information elements /
   parameters in the signalling channel to carry the data and does not
   establish a related circuit-switched connection. For DSS1, this is
   specified in ITU-T Recommendation Q.931, Sections 3.3 and 7 of
   [Q931]. Secondly, it defines a User-to-User Signalling (UUS)
   supplementary service that uses the information elements / parameters
   in the signalling channel to carry additional data but that is used
   in conjunction with the establishment of a related circuit-switched
   connection. This reuses the same information elements / parameters
   as the user signalling bearer service, with the addition of other
   signalling information, and for DSS1 this is specified in ITU-T
   Recommendation Q.957.1 [Q957.1].

ISDN defines three variants of the UUS supplementary service as
follows:

UUS1: User-to-User Information exchanged during the setup and
       clearing phases of a call by transporting DSS1 User-user
       information elements within call control messages. This in itself
       has two subvariants, UUS1 implicit and UUS1 explicit. In UUS1
       implicit, it is the presence of the user signalling data itself
       that constitutes the request for the service. UUS1 explicit uses
       additional supplementary service control information to control
       the request and granting of the service, as in UUS2 and UUS3. As
       a result, UUS1 explicit also allows the requester to additionally
       specify whether the parallel circuit-switched connection should
       proceed if the UUS1 service cannot be provided (preferred or
       required);

UUS2: DSS1 User-user information elements exchanged from the
       sender's point of view during call establishment, between the DSS1
       ALERTING and DSS1 CONNECT messages, within DSS1 USER INFORMATION
       messages; and

UUS3: DSS1 User-user information elements exchanged while a call is
       in the Active state, within DSS1 USER INFORMATION messages.

The service is always requested by the calling user.

This document defines only the provision of the ISDN UUS1 implicit
supplementary service to interworking scenarios, this being the most
widely deployed and used of the various ISDN User-to-User services,
and is indeed the one that matches the requirements specified in
[RFC6567].

The above comes from the ISDN specifications defined for public
networks. There is a parallel set of ISDN specifications defined for
private networks (QSIG). These specifications do not define a UUS1
implicit supplementary service. However, implementation of such a
UUS1 implicit supplementary service for private networks can readily
be constructed in a proprietary fashion based on the specifications
for public networks, and evidence suggests that some vendors have
done so. On this basis, there is no reason why this package cannot
also be used to support interworking with such a private network
service, on the assumption that the constraints are exactly the same
as those for the public network.

   The ISDN UUS1 service has the following additional characteristics as
   to the data that can be transported:

      The maximum number of octets of user information that can be
      transported is 128 octets plus a protocol discriminator. It is
      noted that some early ISDN implementations had a limitation of 32
      octets, but it is understood that these are not currently
      deployed. While this package does not prohibit longer data
      fields, the mechanism at any interworking point discards data
      elements that are too long to handle. The handled length can
      normally be assumed to be 128 octets.

      The content of the user information octets is described by a
      single octet protocol discriminator (see Table 4-26 of ITU-T
      Recommendation Q.931) [Q931]. That protocol discriminator may
      describe the protocol used within the user data, the structure of
      the user data, or leave it entirely open. Note that not all
      values within the protocol discriminator necessarily make sense
      for use in the ISDN User-to-User service, as the content is
      aligned with the protocol discriminator that appears at the start
      of all DSS1 messages (see Table 4-1 of ITU-T Recommendation Q.931)
      [Q931]. The protocol discriminator value has no impact on the
      interworking capability.

      Only a single piece of UUI data can be transported in each
      message.

      The ISDN service works without encryption or integrity protection.
      The user trusts the intermediate network elements, and therefore
      the operator of those elements, not to modify the data and to
      deliver all the data to the remote user. On a link-by-link basis,
      message contents are protected at Layer 2 by standard cyclic
      redundancy check mechanisms -- this allows loss on a link-level
      basis to be detected but does not guard against fraudulent attacks
      on the link itself. This does not prevent the use of additional
      encryption or integrity protection within the UUI data itself,
      although the limit on the size of the UUI data (protocol
      discriminator plus 128 octets) will restrict this.

3.2. Impacts of the ISDN Service on SIP Operation

   The ISDN service has the following impacts that need to be understood
   within the SIP environment.

   Call transfer: ISDN call transfer cancels all ISDN User-to-User
      supplementary services. In the ISDN, if User-to-User data is
      required after call transfer, then UUS3 has to be renegotiated,
      which is not provided by this SIP extension. The impact of this
      restriction on the SIP environment is that UUI header fields
      cannot be exchanged in transactions clearing down the SIP dialog
      after call transfer has occurred.

   Conference: ISDN conferencing allows the user to still exchange
      User-to-User data after the conference is created. As far as UUS1
      is concerned, it is not permitted. The ISDN three-party
      supplementary service is similar in many ways to conferencing but
      is signalled using a different mechanism. This means that on
      clearing, the controller using UUS1 implicit does have the choice
      of sending data to either or both remote users. Because SIP
      conferencing cannot completely emulate the ISDN three-party
      supplementary service at the served user, UUS1 implicit is not
      possible.

   Diversion: When ISDN diversion occurs, any UUS1 User-to-User data is
      sent to the forwarded-to-user (assuming that the call meets
      requirements for providing the service -- this is impacted by the
      explicit service only). If the type of diversion is such that the
      call is also delivered to the forwarding user, they will also
      receive any UUS1 User-to-User data.

4. Relation to SIP-T

   A method of transport of ISDN User-to-User data is to use SIP-T
   [RFC3372] and transport the UUI information end-to-end (as part of an
   ISUP message or QSIG message) as a MIME body. If the SIP-T method of
   encapsulation of ISDN instead of interworking is used, this is a
   reasonable mechanism and does not require any extensions to existing
   SIP-T. However, if true ISDN interworking is being done, and
   therefore SIP-T would not otherwise be used, this approach is not
   reasonable because then implementation of the many elements of the
   ISUP syntax would be required to understand one element of data.
   Instead, the better approach is to interwork the ISDN User-to-User
   data using the native SIP UUI transport mechanism, the User-to-User
   header field. The rest of this document describes this approach.

5. Transition Away from ISDN

   This interworking usage of the SIP UUI mechanism will likely begin
   with one UA as an ISDN gateway while the other UA is a native SIP
   endpoint. As networks transition away from ISDN, it is possible that
   both UAs could become native SIP endpoints. In this case, there is
   an opportunity to transition away from this ISDN usage to a more
   general usage of [RFC7433].

   The SIP UUI mechanism provides a way to achieve this transition. As
   an endpoint moves from being an ISDN gateway to a native SIP
   endpoint, and a future package for some form of enhanced UUI has been
   standardized, the endpoint can carry the UUI data both as ISDN and as
   the future package in parallel and in the same messages or in
   different messages depending on the needs of the application. This
   will permit the other endpoint to use the UUI according to the ISDN
   UUI package if it is an ISDN gateway or according to the future
   package if it is a native SIP endpoint.

6. ISDN Usage of the User-to-User Header Field

   This document defines the package for the ISDN interworking of UUI
   that interoperates with ISDN UUS, a supplementary service in which
   the user is able to send/receive a limited amount of information to/
   from another ISDN user over the signalling channel in association
   with a call to the other ISDN user.

   Two examples of ISDN UUI with redirection (transfer and diversion)
   are defined in [ANSII] and [ETSI].

   One objective of the design of this package has been to keep the
   functionality at the interworking point as simple as possible. As a
   result, there is also only one encoding value specified.

   Responsibility for respecting the limits has been transferred to the
   end UA. If an interworking point is reached, and the limitations of
   the ISDN (see Section 3.1) are not met, then the UUI data will not be
   transferred, although the SIP request will otherwise be interworked.
   This is rather than have the interworking point attempt to resolve
   the non-compliance with the limitations of ISDN.

   The general principals of the UUI mechanism package are, therefore,
   as follows:

      The sending application is expected to limit their sending
      requirements to the subset provided by the ISDN User-to-User
      service.

The SIP UA will not allow the reception of more than one
User-to-User header field relating to the "isdn-uui" package in
the same SIP request or response; it will only allow it in a
request or response of the appropriate method (INVITE or BYE).
What happens to User-to-User header fields relating to other
packages is outside the scope of this document.

An interworking point trying to interwork UUI data that is too
long will discard the UUI data but proceed with the interworking.
There is no notification of such discard back to the sending user.
If the SIP user knows that it is interworking with the ISDN, then
the UUI application at the SIP endpoint should limit its
communication to packets of 128 octets plus the protocol
discriminator, with the knowledge that discard will occur if it
does not. The UUI application at the SIP endpoint has complete
control over what occurs. It should be noted that this was
exactly the envisaged operation when early ISDN implementations
that only supported 32 octets interworked with those supporting
128 octets. It also corresponds to the interworking with ISDNs
that do not support the supplementary service at all, as discard
will occur in these circumstances as well. Note that failure to
include the User-to-User data into the ISDN SETUP message (when
discard occurs) will result in the service being unavailable for
the remainder of the call when UUS1 implicit operation is used.

7. UAC Requirements

The User Agent Client (UAC) MUST meet the requirements of [RFC7433]
in addition to the requirements defined in this document.

The UAC MUST only use this UUI mechanism extension package in
association with the initial INVITE method and the BYE method
relating to an INVITE dialog. Usage on transactions associated with
any other type of dialog, or on methods not associated with a dialog,
is precluded. Usage on other methods within the INVITE dialog, and
on re-INVITE transactions with the INVITE dialog, is also precluded.

If the UAC wishes to use or permit the sending of UUI data at any
point in the dialog, the UAC MUST include in the INVITE request for
that dialog a User-to-User header field. The UAC SHOULD set the
"purpose" header field parameter to "isdn-uui". Non-inclusion of the
"purpose" header field parameter is permitted, but this is primarily
to allow earlier implementations to support this package. This
initial header field constitutes the implicit request to use the UUI
service and is, therefore, included even when there is no data except
the protocol discriminator octet to send at that point in time.

The UAC MUST NOT include the User-to-User header field with a
"purpose" header field parameter set to "isdn-uui", or with no
"purpose" header field parameter, in any message of an INVITE dialog
if the original INVITE request did not include the User-to-User
header field, either with a "purpose" header field parameter set to
"isdn-uui" or with no "purpose" header field parameter included.

When sending UUI for the ISDN UUI package, if the "purpose" header
field is included, the UAC MUST set the User-to-User "purpose" header
field parameter to "isdn-uui". The UAC MUST NOT include more than
one User-to-User header field for this package in any SIP request or
response.

When receiving UUI, when multiple User-to-User header fields are
received in the same response with the "purpose" header field
parameter set to "isdn-uui", or with no "purpose" header field
parameter, or with some combination of these, the UAC MUST discard
all these header fields. There are no mechanisms for determining
which ones are the intended UUI data, so all are discarded.

The application designer will need to take into account the ISDN
service restrictions; failure to do so can result in information
being discarded at any interworking point with the ISDN. This
document makes no further normative requirements based on those
constraints because those constraints may vary from one ISDN to
another. It is reasonable to expect that a limitation of 128 octets
(plus a protocol discriminator) can be imposed by the ISDN;
therefore, UUI data longer than this will never reach the destination
if such interworking occurs. Note that the 128-octet limit (plus a
protocol discriminator) applies before the encoding (or after the
decoding) using the "hex" encoding. The "hex" encoding is defined in
[RFC7433].

A "uui" option tag for use with the UUI mechanism extension is
defined in [RFC7433]. Because the service is UUS1 implicit for the
ISDN User-to-User service, the inclusion of the "uui" option tag in a
Supported header field conveys no additional information over and
above the presence, in the INVITE request, of the User-to-User header
field with the "purpose" header field parameter set to "isdn-uui".
While there is no harm in including the "uui" option tag, and
strictly it should be included if the extension is supported, it
performs no function. The presence of the "uui" option tag in the
Require header field of an INVITE request will cause the request to
fail if it reaches a UAS or ISDN interworking gateway that does not
support this extension; such usage is allowed but will produce
results that are inconsistent with the mechanisms defined in the ISDN
UUS supplementary service.

8. UAS Requirements

   The UAS MUST meet the requirements of [RFC7433] in addition to the
   requirements defined in this document.

   The UAS MUST only use this UUI mechanism extension package in
   association with the initial INVITE method and the BYE method
   relating to an INVITE dialog. Usage on transactions associated with
   any other type of dialog, or on methods not associated with a dialog,
   is precluded. Usage on other methods within the INVITE dialog, and
   on re-INVITE transactions with the INVITE dialog, is also precluded.

   The UAS MUST NOT include the User-to-User header field with a
   "purpose" header field parameter set to "isdn-uui", or with no
   "purpose" header field parameter, in any message of an INVITE dialog
   if the original INVITE request did not include the User-to-User
   header field, either with a "purpose" header field parameter set to
   "isdn-uui" or with no "purpose" header field parameter included.

   The UAS MAY include the User-to-User header field in responses to the
   initial INVITE request, or the BYE requests or responses for the
   dialog, only where the original INVITE request included a
   User-to-User header field with the "purpose" header field parameter
   set to "isdn-uui" or where no "purpose" header field parameter was
   included. When sending UUI for the ISDN UUI package, the UAS SHOULD
   set the User-to-User "purpose" header field parameter to "isdn-uui".
   Non-inclusion of the "purpose" header field parameter is permitted,
   but this is primarily to allow earlier implementations to support
   this package.

   When sending UUI for the ISDN UUI package, if the "purpose" header
   field is included, the UAS MUST set the User-to-User "purpose" header
   field parameter to "isdn-uui". The UAS MUST NOT include more than
   one User-to-User header field for this package in any SIP request or
   response.

   The "isdn-interwork" value for the "purpose" header field parameter
   was used in documents that led to the publication of the present
   document. Although these documents had no other status than "Work in
   Progress", this value is implemented by some vendors. While not
   defined by this document, implementations could find it useful for
   interoperability purposes to support parsing and interpreting
   "isdn-interwork" the same way as "isdn-uui" when receiving messages.

   Where the UAS is acting as a redirect server, the UAS MUST NOT
   include the User-to-User header field in the header URI parameter in
   a 3xx response to an incoming request.

When receiving UUI, when a User-to-User header field is received in a
request that is not from the originating user with the "purpose"
header field parameter set to "isdn-uui", or with no "purpose" header
field parameter, the UAS MUST discard this header field.

When receiving UUI, when multiple User-to-User header fields are
received from the originating user in the same request with the
"purpose" header field parameter set to "isdn-uui", or with no
"purpose" header field parameter, or with some combination of these,
the UAS MUST discard all these header fields. There are no
mechanisms for determining which ones are the intended UUI data, so
all are discarded.

9. UUI Contents

These requirements apply when the "purpose" header field parameter is
set to "isdn-uui" or when there is no "purpose" header field
parameter.

Processing for User-to-User header fields sent or received with
values other than this value are outside the scope of this document,
and the appropriate package document for that value applies.

The default and only content defined for this package is "isdn-uui".
When sending UUI, the sending SIP entity MAY, but need not, include a
"content" header field with a value set to "isdn-uui". A receiving
SIP entity MUST ignore a received User-to-User header field if the
"content" header field parameter is present and the value is some
other value than "isdn-uui".

The default and only encoding defined for this package is "hex".
When sending UUI, the sending SIP entity MAY, but need not, include
an "encoding" header field with a value set to "hex". A receiving
SIP entity MUST ignore a received User-to-User header field if the
"encoding" header field parameter is present and the value is some
other value than "hex".

When sending UUI, the sending application MUST include a protocol
discriminator octet, conforming to Table 4-26 of ITU-T Recommendation
Q.931 [Q931], as the first octet of the UUI data. It is up to the
receiving application what it does with this value. This document
places no other normative requirement on the use of the protocol
discriminator; it is required at interworking gateways to allow
mapping into the appropriate fields in the ISDN protocols; otherwise,
the usage is entirely up to the application and is outside the scope
of this document. Valid values are identified and documented by
ITU-T, and there is no IANA registry for these values.

10. Considerations for ISDN Interworking Gateways

   ISDN interworking gateways MUST support the requirements defined for
   UAS and UAC operation.

   ISDN interworking gateways MUST support only the "isdn-uui" package
   on dialogs that are interworked.

   ISDN interworking gateways will take octet-structured data from the
   ISDN side and encode it using the "hex" encoding scheme defined in
   [RFC7433] for inclusion as the UUI data in the User-to-User header
   field. In the reverse direction, it will take valid UUI data
   according to the "hex" encoding scheme and decode it to octet-
   structured data to send to the ISDN side.

   When mapping data content from the ISDN to SIP signalling, or from
   SIP signalling to the ISDN, the gateway needs to assume that all
   content is octet-structured binary, irrespective of the value of the
   received protocol discriminator. There are no requirements in the
   ISDN to ensure that the content matches the value of the protocol
   discriminator; the application usage sorts out any discrepancy. The
   same applies to the ISDN protocol discriminator as the first octet of
   the UUI data, as defined in Table 4-26 of ITU-T Recommendation Q.931
   [Q931]; the interworking gateway will not perform any additional
   checking of this value.

   A "uui" option tag for use with the UUI mechanism extension is
   defined in [RFC7433]. The option tag is not interworked at an ISDN
   interworking gateway. The ISDN interworking gateways MUST NOT take
   the omission of the "uui" option tag in a received INVITE request to
   indicate that interworking of a received header field is not to be
   performed.

11. Coding Requirements

   This document defines "isdn-uui" as a new value of the User-to-User
   "purpose" header field parameter. The following ABNF adds to the
   production in [RFC7433]:

          pkg-param-value =/ "isdn-uui"

   This document defines "isdn-uui" as a new value of the User-to-User
   "content" header field parameter. A content value of "isdn-uui"
   indicates that the contents have a first octet that is a protocol
   discriminator (see Table 4-26 of ITU-T Recommendation Q.931 [Q931])
   followed by UUI data that can be subject to a length limitation
   (before encoding or after decoding) that is generally 128 octets.

The following ABNF adds to the production in [RFC7433].

        cont-param-value =/ "isdn-uui"

12. Media Feature Tag

This document defines the new media feature tag "sip.uui-isdn". This
feature tag indicates that this ISDN UUI package is supported by the
sender, and its usage is entirely in accordance with [RFC3840]. This
document makes no additional provisions for the use of this feature
tag.

13. IANA Considerations

Per this document, the following row has been added to the "UUI
Packages" subregistry of the SIP parameter registry:

   Value: isdn-uui

   Description: The associated application is being used with
   constraints suitable for interworking with the ISDN User-to-User
   service, and therefore can be interworked at ISDN gateways.

   Reference: RFC 7434

Per this document, the following row has been added to the "UUI
Content" subregistry of the SIP parameter registry:

   Value: isdn-uui

   Description: The associated contents conform to the content
   associated with the ISDN User-to-User service. In the presence of
   the "purpose" header field parameter set to "isdn-uui" (or the
   absence of any "purpose" header field parameter), this is the
   default meaning and therefore need not be included in this case.

   Reference: RFC 7434

This document defines the following media feature tag, which has been
added to the features.sip-tree of the Media feature tags registry:

   Media feature tag name: sip.uui-isdn

   ASN.1 Identifier: 1.3.6.1.8.4.x

Summary of the media feature indicated by this tag: This media
feature tag when used in a Contact header field of a SIP request
or a SIP response indicates that the entity sending the SIP
message supports the package "uui-isdn".

Values appropriate for use with this feature tag: none

Examples of typical use: Indicating that a mobile phone supports
Single Radio Voice call Continuity (SRVCC) for calls in the
alerting phase.

Related standards or documents: RFC 7434

Security Considerations: Security considerations for this media
feature tag are discussed in Section 11.1 of [RFC3840]

14. Security Considerations

This document contains no specific requirements in regard to security
over and above those specified in [RFC7433]. However, since this
capability is designed to interwork with the ISDN, the general
security considerations of SIP to ISDN User Part (ISUP) interworking
defined in [RFC3398] apply. Any SIP/PSTN gateway implementing the
ISDN User-to-User service should not blindly trust ISUP from the
PSTN. In general, the overlying use case will define the security
measures required. The underlying User-to-User header field
extension provides a number of tools that can meet certain security
requirements.

Information that might otherwise reveal private information about an
individual, or where a level of authenticity needs to be guaranteed,
may need a higher level of protection and may indeed not be suitable
for this package, particularly taking into account the statement in
the following paragraph.

As this capability is defined to interwork with the ISDN, if the ISDN
forms part of the route, any usage needs to be aware that the
security level of the ISDN service may be lower than the security of
the SIP service. The ISDN security is itself not definable on an
end-to-end basis and exists on a hop-by-hop basis. This can be high
in some places (e.g., it can require physical access to a secure
building) and in other places it can be low (e.g., the point where an
ISDN access enters a building). If this level of security is not
sufficient, then either a different package or indeed a different
method of data transfer needs to be selected by the application user.

15. References

15.1. Normative References

[Q931]   ITU-T, "ISDN user-network interface layer 3 specification
            for basic call control", ITU-T Recommendation Q.931,
            <http://www.itu.int/rec/T-REC-Q.931-199805-I/en>.

[RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate
            Requirement Levels", BCP 14, RFC 2119, March 1997,
            <http://www.rfc-editor.org/info/rfc2119>.

[RFC3261]   Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston,
            A., Peterson, J., Sparks, R., Handley, M., and E.
            Schooler, "SIP: Session Initiation Protocol", RFC 3261,
            June 2002, <http://www.rfc-editor.org/info/rfc3261>.

[RFC3372]   Vemuri, A. and J. Peterson, "Session Initiation Protocol
            for Telephones (SIP-T): Context and Architectures", BCP
            63, RFC 3372, September 2002,
            <http://www.rfc-editor.org/info/rfc3372>.

[RFC3398]   Camarillo, G., Roach, A., Peterson, J., and L. Ong,
            "Integrated Services Digital Network (ISDN) User Part
            (ISUP) to Session Initiation Protocol (SIP) Mapping", RFC
            3398, December 2002,
            <http://www.rfc-editor.org/info/rfc3398>.

[RFC3840]   Rosenberg, J., Schulzrinne, H., and P. Kyzivat,
            "Indicating User Agent Capabilities in the Session
            Initiation Protocol (SIP)", RFC 3840, August 2004,
            <http://www.rfc-editor.org/info/rfc3840>.

[RFC7433]   Johnston, A. and J. Rafferty, "A Mechanism for
            Transporting User-to-User Call Control Information in
            SIP", RFC 7433, December 2014,
            <http://www.rfc-editor.org/info/rfc7433>.

15.2. Informative References

   [ANSII]   ANSI, "Integrated Services Digital Network (ISDN) -
               Explicit Call Transfer Supplementary Service", ANSI-
               T1.643A - SUP A, December 1996.

   [ETSI]   ETSI, "Integrated Services Digital Network (ISDN);
               Diversion supplementary services; Digital Subscriber
               Signalling System No. one (DSS1) protocol; Part 1:
               Protocol specification", ETSI ETS 300 207-1, Ed. 1,
               December 1994.

   [Q763]   ITU-T, "Signalling System No. 7 - ISDN User Part formats
               and codes", ITU-T Recommendation Q.763,
               <http://www.itu.int/rec/T-REC-Q.763-199912-I/en>.

   [Q957.1]   ITU-T, "Digital subscriber Signalling System No. 1 - Stage
               3 description for supplementary services using DSS 1;
               Stage 3 description for additional information transfer
               supplementary services using DSS 1: User-to-User
               Signalling (UUS)", ITU-T Recommendation Q.957.1,
               <http://www.itu.int/rec/T-REC-Q.957.1-199607-I>.

   [RFC6567]   Johnston, A. and L. Liess, "Problem Statement and
               Requirements for Transporting User-to-User Call Control
               Information in SIP", RFC 6567, April 2012,
               <http://www.rfc-editor.org/info/rfc6567>.

Authors' Addresses

   Keith Drage (editor)
   Alcatel-Lucent
   Quadrant, Stonehill Green, Westlea
   Swindon
   United Kingdom

   EMail: keith.drage@alcatel-lucent.com

   Alan Johnston
   Avaya
   St. Louis, MO
   United States

   EMail: alan.b.johnston@gmail.com