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**Interworking ISDN Call Control User Information with SIP  
draft-ietf-cuss-sip-uui-isdn-02**

**Abstract**

The motivation and use cases for interworking and transporting ITU-T DSS1 User-user information element data in SIP are described in the "Problem Statement and Requirements for Transporting User to User Call Control Information in SIP" document. As networks move to SIP it is important that applications requiring this data can continue to function in SIP networks as well as the ability to interwork with this ISDN service for end-to-end transparency. This document defines a usage of the User-to-User header field to enable interworking with this ISDN service.

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

**Status of this Memo**

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## 1. 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 [BCP 14](#), [RFC 2119](#) [[RFC2119](#)].

## 2. Overview

This document describes a usage of the User-to-User header field defined in [[I-D.ietf-cuss-sip-uui](#)] to enable the transport of User to User Information (UUI) in ISDN interworking scenarios using SIP [[RFC3261](#)]. Specifically, this document discusses the interworking of call control related ITU-T DSS1 User-user information element [[Q931](#)], [[Q957.1](#)] and ITU-T Q.763 User-to-user information parameter [[Q763](#)] data in SIP. UUI is widely used in the PSTN today in contact centers and call centers which 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.

## 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, which 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 [section 3.3](#) and [section 7](#) [[Q931](#)]. It also defines a user-to-user signalling supplementary service, which uses the information elements / parameters in the signalling channel to carry additional data, but which 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 user-to-user signalling supplementary service as follows:



UUS1: User-to-user information exchanged during the setup and clearing phases of a call, by transporting User-to-user information element within call control messages. This in itself has two subvariants, UUS1 implicit and UUS1 explicit. UUS1 explicit uses additional supplementary service control information to control the request and granting of the service, as in UUS2 and UUS3. In UUS1 implicit, it is the presence of the user signalling data itself that constitutes the request for the service. UUS1 explicit as a result 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: User-to-user information 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: User-to-user information 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 indeed the one that matches the requirements specified in [draft-ietf-cuss-sip-uui-reqs](#) [I-D.ietf-cuss-sip-uui-reqs].

The above come from the ISDN specifications defined for public networks. There are 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 in 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 is to discard 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 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 user information 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 CRC 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 payload itself, although the limit on the size of the payload (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 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 UUI 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, this approach is not reasonable. Instead, the better approach is to interwork the ISDN UUI 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 User Agent being an ISDN gateway while the other User Agent is a native SIP endpoint. As networks transition away from ISDN, it is possible that both User Agents 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 [[I-D.ietf-cuss-sip-uui](#)].

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 package for some form of enhanced UUI has been standardized, the endpoint can carry the UUI data both as ISDN and as some other 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 package if it is an ISDN gateway or the enhanced 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 which is to interoperate with ISDN User to User Signaling (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 [\[ANSI\]](#) and [\[ETSI\]](#).

One objective of the design of this package has been to keep the functionality at the interworking point as simple as possible. Therefore responsibility for respecting the limits has been transferred to the end UA. If an interworking point is reached, and the limitations are not met, then the UUI data will not be transferred, although the SIP request will otherwise be interworked. As a result there is also only one encoding value specified.

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

That the sending application is expected to limit their sending requirements to the subset provided by the ISDN UUI service.

That the SIP UA will not allow the reception of more than one User-to-User header field of the "isdn-uui" package in the same SIP request or response, and 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 different packages is outside the scope of this document.

That 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 128 octet packets plus the protocol discriminator, in 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-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 UAC MUST meet the requirements of [[I-D.ietf-cuss-sip-uui](#)] in addition to the requirements defined in this document.

The UAC MUST only use this package of the UUI mechanism extension 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 "package" header field parameter to "isdn-uui". Non-inclusion of the "package" 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 "package" header field parameter set to "isdn-uui", or with no "package" 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 "package" header field parameter set to "isdn-uui", or with no "package" header field parameter included.

When sending UUI for the ISDN package, if the "package" header field is included, the UAC MUST set the User-to-User "package" 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 "package" header field parameter to "isdn-uui", or with no "package" header field parameter, or with some combination of these, the UAS MUST discard all these header fields. There are no mechanisms for determining which was the intended data packet 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, and therefore payloads 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 [[I-D.ietf-cuss-sip-uui](#)].

[[I-D.ietf-cuss-sip-uui](#)] defines a "uui" option tag for use with the UUI mechanism extension. Because for the ISDN UUI service, the service is service 1 implicit, the inclusion of the "uui" option tag in a Supported header field conveys no additional information over and above the presence of the User-to-User header field with the "package" header field parameter to "isdn-uui" in the INVITE request. 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 a usage is not precluded although it does not form part of the package.

## **8. UAS requirements**

The UAS MUST meet the requirements of [[I-D.ietf-cuss-sip-uui](#)] in addition to the requirements defined in this document.

The UAS MUST only use this package of the UUI mechanism extension 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 "package" header field parameter set to "isdn-uui", or with no "package" 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 "package" header field parameter set to "isdn-uui", or with no "package" 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 "package" header field parameter to "isdn-





uui", or where no "package" header field parameter was included. When sending UUI for the ISDN package, the UAS SHOULD set the User-to-User "package" header field parameter to "isdn-uui". Non-inclusion of the "package" header field parameter is permitted, but this is primarily to allow earlier implementations to support this package. The UAS MUST NOT include more than one User-to-User header field for this package in any SIP request or response.

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 "package" header field parameter to "isdn-uui", or with no "package" header field parameter, the UAC 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 "package" header field parameter to "isdn-uui", or with no "package" header field parameter, or with some combination of these, the UAC MUST discard all these header fields. There are no mechanisms for determining which was the intended data packet so all are discarded.

## **9. UUI contents**

These requirements apply when the "package" header field parameter is set to "isdn-uui", or with no "package" 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.

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".

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 payload information. 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, but otherwise the usage is entirely up to the application, and 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-uuu" 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 [\[I-D.ietf-cuss-sip-uuu\]](#) 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 for sending to the ISDN side.

When mapping data content from the ISDN to the 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, and it is for the application usage to sort out any discrepancy. The same applies to the ISDN protocol discrimination defined table 4-26 of ITU-T Recommendation Q.931 [\[Q931\]](#) as the first octet of the payload information; the interworking gateway will not perform any additional checking of this value.

[\[I-D.ietf-cuss-sip-uuu\]](#) defines a "uuu" option tag for use with the UII mechanism extension. The option tag is not interworked at an ISDN interworking gateway. The ISDN interworking gateways MUST NOT take the omission of the "uuu" 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-uuu" as a new value of the User-to-User "package" header field parameter.



This document defines "isdn-uuu" as a new value of the User-to-User "content" header field parameter. A content value of "isdn-uuu" 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.

## **12. Media Feature Tag**

This document defines a new media feature tag "sip.uui-isdn". This feature tag indicates that this UII package is supported by the sender, and its usage is entirely in accordance with [RFC 3840](#) [[RFC3840](#)]. This document makes no additional provisions for the use of this feature tag.

## **13. IANA Considerations**

This document adds the following row to the "UII packages" sub-registry of the SIP parameter registry:

Value: isdn-uuu

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: RFCXXXX

Contact:

This document adds the following row to the "UII content" subregistry of the SIP parameter registry:

Value: isdn-uuu

Description: The associated contents conforms to the content associated with the ISDN user-to-user service. In the presence of the "package" header field parameter set to "isdn-uuu" this is the default meaning and therefore need not be included in this case.

Reference: RFCXXXX

Contact:

This document defines the following media feature tag which is 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 UUI package "uui-isdn".

Values appropriate for use with this feature-tag: none

Examples of typical use: Indicating that a mobile phone supports SRVCC for calls in alerting phase.

Related standards or documents: RFCXXXX

Security Considerations: Security considerations for this media feature-tag are discussed in [section 11.1 of RFC 3840](#) [RFC3840]

Editor's Note: [RFCXXXX] should be replaced with the designation of this document.

## **14. Security Considerations**

This document contains no specific requirements in regard to security over and above those specified in [I-D.ietf-cuss-sip-uui]. The overlying use case will define the security measures required. The underlying user-to-user extension provides a number of tools that can meet certain security requirements. As a level of guidance, data that is used to assist in selecting which SIP UA should respond to the call would not be expected to carry any higher level of security than a media feature tag. 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 assume that the security level of the ISDN is the highest level of security available. As the ISDN security is itself not definable on an end-to-end basis, this can be an unknown quantity. This is because ISDN security exists on a hop-by-hop basis, and is only as secure as the least secure component. 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 user-to-user package, or indeed, a different method of data transfer, needs to be selected by the application user.

## **15. Acknowledgements**

Joanne McMillen was a major contributor and co-author of earlier versions of this document.

Thanks to Spencer Dawkins, Vijay Gurbani, and Laura Liess for their review of earlier versions of this document. The authors wish to thank Francois Audet, Denis Alexeitsev, Paul Kyzivat, Cullen Jennings, Mahalingam Mani and Celine Serrut-Valette for their comments.

## **16. Changes since previous versions**

Note to RFC editor: This section is to be deleted before final publication.

Changes since made in the creation of the [draft-ietf-cuss-sip-uui-isdn-02](#) version from the [draft-ietf-cuss-sip-uui-isdn-01](#) version.

The inclusion of the "package" header field parameter has been downgraded to "RECOMMENDED", with the purpose stated as being for interworking. Changes have been made to the procedures at the receiving side to allow for the non-inclusion of the "package" header field parameter. The effect of this is that the absence of the "package" header field parameter means by default the use of the "uui-isdn" package.

Clarification that the package is not to be used on re-INVITE transactions or on other transactions within an INVITE dialog.

Further clarification on using this package in conjunction with other packages.

Closure of the remaining open issue relating to use of UUS1 in conjunction with the ISDN conference service - UUS1 is not possible after the conference is created.

A number of editorial changes have been made.

Changes since made in the creation of the [draft-ietf-cuss-sip-uui-isdn-01](#) version from the



[draft-ietf-cuss-sip-uui-isdn-00](#) version.

QSIG does not define a UUS service. As such changes are made to indicate that it is possible to support a proprietary service on QSIG based on the public ISDN standards, and interworking with such proprietary versions is supported. The associated contributors note regarding interactions with other QSIG services has therefore been removed with this amendment.

Added additional paragraph above the objectives of the interworking design.

Made clear that the 128 octets apply before encoding in "hex". Reference added to the generic UUI document for the encoding of "hex".

Indicated that it is the "content" header field parameter set to "isdn-uui" that defines the structure of the uui-data, with the first octet being a protocol discriminator and the remaining octets potentially being limited to 128 octets.

Aligned the IANA registration section with the registries created by the generic UUI document.

Added reference to the generic UUI document to the security considerations section.

Changes since made in the creation of the [draft-ietf-cuss-sip-uui-isdn-00](#) version from the [draft-drage-cuss-sip-uui-isdn-01](#) version.

Removed overburdening of the word "application". Changed the name of the "app" header field parameter in the mechanism draft to "package" header field parameter. This had a consequential impact on the ISDN document. The word "application" is now solely reserved for the name of the functionality that passes the UUI to the SIP functionality to send, and to which the UUI is delivered on receipt by the SIP functionality. As well as the change of the name of the header field parameter, this resulted in a number of instances of the word "application" becoming "package". A couple of instances relating to the coding of the "content" header field parameter have become "SIP entity".

[Section 5](#) needed substantial rewording as it no longer applied in this manner. Modified the text to indicate that if one wants to use an enhanced UUI where both endpoints are SIP, but still work with the ISDN, then one will have to same information using two different packages, one the ISDN one, and the other some enhanced



package.

In [section 8](#), a couple of requirements relating to the "content" header field parameter really related to the "package" header field parameter (formerly "app" header field parameter). These are corrected.

Updated references from "[draft-johnston-cuss-sip-uui](#)" to "[draft-ietf-cuss-sip-uui](#)".

Made clear throughout the document that the UUI payload is a protocol discriminator plus 128 octets of data.

Made clearer that it is the initial INVITE request and responses and the BYE request and responses only that carry the information in this package.

Made clear that there are no normative requirements on the protocol discriminator. In particular text is added to the end of [section 9](#).

Removed the following text from [section 7](#), as it is a duplicate of the text in [section 9](#):

" When sending UUI, the sending application MUST include a protocol discriminator octet, conforming to table 4-26 of ITU-T Recommendation Q.931 [[0931](#)] as the first octet of the payload information."

Defined a media feature tag specific for the package. It has been proposed to do this for all packages. "sip.uui-isdn" has been added.

Corrected the short title for the draft.

Changes since made in the creation of the [draft-drage-cuss-sip-uui-isdn-01](#) version from the [draft-drage-cuss-sip-uui-isdn-00](#) version.

Closure of a number of open issues identified in the -00 version and the creation of appropriate procedures for the UAC, the UAS, and the ISDN interworking gateway.

## [17](#). References

### **17.1. Normative References**

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- [RFC3372] Vemuri, A. and J. Peterson, "Session Initiation Protocol for Telephones (SIP-T): Context and Architectures", [BCP 63](#), [RFC 3372](#), September 2002.
- [RFC3840] Rosenberg, J., Schulzrinne, H., and P. Kyzivat, "Indicating User Agent Capabilities in the Session Initiation Protocol (SIP)", [RFC 3840](#), August 2004.
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- [Q931] "ITU-T Recommendation Q.931: Digital subscriber Signalling System No. 1 - Network layer; ISDN user-network interface layer 3 specification for basic call control", <http://www.itu.int/rec/T-REC-Q.931-199805-I/en> .

### **17.2. Informative References**

- [I-D.ietf-cuss-sip-uu-reqs] Johnston, A. and L. Liess, "Problem Statement and Requirements for Transporting User to User Call Control Information in SIP", [draft-ietf-cuss-sip-uu-reqs-09](#) (work in progress), January 2012.
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