**User Requirements for SIP in support of deaf, hard of hearing
and speech-impaired individuals**

Status of this Memo

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[1](#1). Abstract

This document aims to present a set of SIP user requirements that
support communications for deaf, hard of hearing and speech-impaired
individuals. These user requirements address the current difficulties
of deaf, hard of hearing and speech-impaired individuals in using
communications facilities, while acknowledging the multi-functional
potential of SIP-based communications.

A number of issues related to these user requirements are further
raised in this document.

Also included are some real world scenarios and some technical
requirements to show the robustness of these requirements on a
concept-level.

[2](#2). Terminology and Conventions Used in this Document

In this document, the key words "MUST", "MUST NOT","REQUIRED", "SHALL",
"SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and
"OPTIONAL" are to be interpreted as described in [RFC2119](#)[2] and
indicate requirement levels for compliant SIP implementations.

For the purposes of this document, the following terms are considered to
have these meanings:

Abilities: A person's capacity for communicating which could include a
hearing or speech impairment or not. The terms Abilities and Preferences
apply to both caller and call-recipient.

Preferences: A person's choice of communication mode. This could include
any combination of media stream, e.g., text, audio, video.

The terms Abilities and Preferences apply to both caller and call-
recipient.

Relay Service: A third-party or intermediary that enables communications
between deaf, hard of hearing and speech-impaired people, and people
without hearing or speech-impairment. Relay Services form a subset of
the activities of Transcoding Services (see definition).

Transcoding Services: A human or automated third party acting as an

intermediary in any session between two other User Agents (being a User Agent itself), and transcoding one stream into another (e.g., voice to text or vice versa).

Textphone: Sometimes called a TTY (teletypewriter), TDD (telecommunications device for the deaf) or a minicom, a textphone enables a deaf, hard of hearing or speech-impaired person to place a call to a telephone or another textphone. Some textphones use the V18 protocol as a standard for communication with other textphone communication protocols world-wide.

User: A deaf, hard of hearing or speech-impaired individual. A user is otherwise referred to as a person or individual, and users referred to as people.

Note: For the purposes of this document, a deaf, hard of hearing, or speech-impaired person is an individual who chooses to use SIP because it can minimize or eliminate constraints in using common communication devices. As SIP promises a total communication solution for any kind of person, regardless of ability and preference, therefore there is no attempt to specifically define deaf, hard of hearing or speech-impaired in this document.

3. Introduction

The background for this document is the recent developments of SIP and SIP-based communications, and a growing awareness of deaf, hard of hearing and speech-impaired issues in the technical community.

The SIP capacity to simplify setting up, managing and tearing down communication sessions between all kinds of User Agents has specific implications for deaf, hard of hearing and speech-impaired individuals.

As SIP enables multiple sessions with translation between multiple types of media, these requirements aim to provide the standard for recognising and enabling these interactions, and for a communications model that includes any and all types of SIP-networking abilities and preferences.

4. Purpose and Scope

The scope of this document is to first present a current set of user requirements for deaf, hard of hearing and speech-impaired individuals through SIP-enabled communications. These are then followed some real world scenarios in SIP-communications that could be used in a test environment, and some concepts on how these requirements can be developed by service providers and User Agent manufacturers.

These recommendations make explicit the needs of a currently often
disadvantaged user-group and attempts to match them with the capacity of
SIP. It is also not the intention here to prioritise the needs of the
deaf, hard of hearing and speech-impaired in a way that would penalise
other individuals.

These requirements aim to encourage developers and manufacturers
world-wide to consider the specific needs of deaf, hard of hearing and
speech-impaired individuals. This document presents a world-vision
where deafness, hard of hearing or speech impairment are no longer a
barrier to communication.

5. Background

Deaf, hard of hearing and speech-impaired people are currently sometimes
unable to use commonly available communication devices.

Although this is documented[3], this does not mean that developers or
manufacturers are always aware of this. Communication devices for the
deaf, hard of hearing and speech-impaired (e.g., text-phones) are
currently often primitive in design, expensive, and non-compatible with
progressively designed, cheaper and more adaptable communication devices
for other individuals. For example, even though some text- phones use
the V18 protocol to enable communications with other text-phones across
national and regional areas, many are limited in their compatibility
with other communication devices in their particular country or region.

Additionally, non-technical human communications for (sign languages,
lip-reading) are non-standard around the world.

There are intermediary or third-party relay services (e.g. transcoding
services) that facilitate communications, uni- or bi-directional,
for the deaf, hard of hearing and speech-impaired. Currently Relay
services are mostly operator-assisted (manual), although methods of
partial automation are being implemented in some areas. These services
enable full access to modern facilities and conveniences for the deaf,
hard of hearing and speech-impaired. Although these services are
somewhat limited, their value is undeniable as compared to their
previous complete unavailability.

Yet communication methods in recent decades have proliferated: email,
mobile phones, video streaming, etc. These methods are an advance in the
development of data transfer technologies between devices.

Developers and advocates of SIP agree that this is a protocol that not
only anticipates the growth in communications between convergent
networks in real time, but also fulfils the potential of the Internet

as a communications and information forum. Further, that these
developments allow a standard of communication that can be applied
throughout all networking communities, regardless of abilities and
preferences.

6. Deaf, Hard of Hearing and Speech-impaired Requirements for SIP

Introduction

The user requirements in this section are provided for the benefit of
service providers, User Agent manufacturers and any other interested
party in the development of products and services for the deaf, hard of
hearing and speech-impaired.

The user requirements are as follows:

6.1 Connection without Difficulty

This requirement states:

Whatever the preferences and abilities of the user and User Agent, there
SHOULD be no difficulty in setting up SIP sessions. These sessions could
include multiple proxies, call routing decisions, transcoding services,

e.g., the relay service TypeTalk[4] or other media processing, and could
include multiple simultaneous or alternative media streams.

This means that any User Agent in the conversation space (including
transcoding services) MUST be able to add or remove a media stream from
the call without having to tear it down and re-establish it.

6.2 User Profile

This requirement states:

Deaf, hard of hearing and speech-impaired user abilities and preferences
(i.e., user profile) MUST be communicable by SIP, and these abilities
and preferences MUST determine the handling of the session.

The User Profile for a deaf, hard of hearing and speech-impaired person
might include:
- How media streams are received and transmitted (text, voice, video, or
  any combination, uni- or bi-directional)
- Redirecting specific media streams through a transcoding service
  (e.g.,the relay service TypeTalk)
- Roaming (e.g., a deaf person accessing their User Profile from a web-
  interface at an Internet café)
- Anonymity, that is, not revealing that a deaf person is calling, even

through a transcoding service (e.g., some relay services like
TextDirect inform the call-recipient that there is an incoming text
call without saying that a deaf person is calling).

Part of this requirement is to ensure that deaf, hard of hearing and
speech-impaired people can keep their preferences and abilities
confidential from others, to avoid possible discrimination or prejudice,
while still being able to establish a SIP session.

6.3 Intelligent Gateways

This requirement states:

SIP SHOULD support a class of User Agents to perform as gateways for
legacy systems designed for deaf, hard of hearing and speech-impaired
people.

For example, an individual could have a SIP User Agent acting as a
gateway to a PSTN legacy textphone.

6.4 Inclusive Design

This requirement states:

Where applicable, design concepts for communications (devices,
applications, etc.) MUST include the abilities and preferences of deaf,
hard of hearing and speech-impaired people.

Transcoding services and User Agents MUST be able to connect with each
other regardless of the provider or manufacturer. This means that new
User Agents MUST be able to support legacy protocols through appropriate
gateways.

6.5 Resource Management

This requirement states:

User Agents SHOULD be able to identify the content of a media stream in
order to obtain such information as the cost of the media stream, if a
transcoding service can support it, etc.

User Agents SHOULD be able to choose among transcoding services and
similar services based on their capabilities (e.g., whether a
transcoding service carries a particular media stream), and any policy
constraints they impose (e.g., charging for use). It SHOULD be possible
for User Agents to discover the availability of alternative media

streams and to choose from them.

6.6 Confidentiality and Security

This requirement states:

All third-party or intermediaries (transcoding services) employed in a session for deaf, hard of hearing and speech-impaired people MUST offer a confidentiality policy. All information exchanged in this type of session MUST be secure, that is, erased before confidentiality is breached, unless otherwise required by legal intercept[5].

This means that transcoding services (e.g., interpretation, translation) MUST publish their confidentiality and security policies.

7. Some Real World Scenarios

These scenarios are intended to show some of the various types of media streams that would be initiated, managed, directed, and terminated in a SIP-enabled network, and shows how some resources might be managed between SIP-enabled networks, transcoding services and service providers.

To illustrate the communications dynamic of these kinds of scenarios, each one specifically mentions the kind of media streams transmitted, and whether User Agents and Transcoding Services are involved.

7.1 Transcoding Service

In this scenario, a hearing person calls the household of a deaf person and a hearing person.

1. **A voice conversation is initiated between the hearing participants:**
   (Phone A) <-----Voice ---> (Phone B)
2. **During the conversation, the hearing person asks to talk with the deaf person, while keeping the voice connection open so that voice to** voice communications can continue if required.
3. **A Relay Service is invited into the conversation.**
4. **The Relay Service transcodes the hearing person's words into text.**
5. **Text from the hearing person's voice appears on the display of the deaf person's User Agent.**
6. **The deaf person types a response.**
7. **The Relay Service receives the text and reads it to the hearing person:**

```
       (        ) <-----------------Voice----------------> (         )
       (Phone A ) -----Voice---> ( Voice To Text  ) -Text-> (Phone B )
       (        ) <----Voice---- (Service Provider) <-Text- (         )
```

8. **The hearing person asks to talk with the hearing person on the other side.**
9. **The Relay Service withdraws from the call.**

7.2 Media Service Provider

In this scenario, a deaf person wishes to listen to a Radio program through a text stream of the program's audio stream.

1. **The deaf person attempts to establish a connection to the radio broadcast, with User Agent preferences set to receiving audio stream** as text.
2. **The User Agent of the deaf person queries the radio station User Agent on whether a text stream is available, other than the audio** stream.
3. **However, the radio station has no text stream available for a deaf listener, and responds in the negative.**
4. **As no text stream is available, the deaf person's User Agent requests a Voice-To-Text transcoding service (e.g., a real-time captioning** service like TypeTalk) to come into the conversation space.
5. **The transcoding service User Agent identifies the audio stream as a radio broadcast. However, the policy of the transcoding service is** that it does not accept radio broadcasts because it would overload their resources far too quickly.
6. **In this case, the connection fails.**

Alternatively, continuing from 2 above:
3. **The radio station does provide text with their audio streams.**
4. **The deaf person receives a text stream of the radio program.**

Note: To support deaf, hard of hearing and speech-impaired, service
      providers are encouraged to provide text with audio streams.

7.3 Sign Language Interface

In this scenario, a deaf person enables a signing avatar (e.g., VisiCAST[6]) by setting up a User Agent to receive audio streams as XML data that will operate an avatar for sign-language. For outgoing

communications, the deaf person types text that is transcoded into an audio stream for the other conversation participant.

```
 For example:
 (          )-Voice->(Voice To Synthetic Signing) --XMLData-->(         )
 ( hearing )                                             (deaf     )
```

```
( Party A )<-Voice-( Text To Voice  ) <--------Text-------- (Party B )
(         )         (Service Provider)                      (        )
```

7.4 Synthetic Lip-speaking Support for Voice Calls

In order to receive voice calls, a hard of hearing person uses a
synthetic lip-speaking avatar software (e.g., Synface[7]) on a PC. The
synthetic lip-speaking software processes voice (audio) stream data and
displays an animated face that a hard of hearing person may be able to
lip-read. During a conversation, the hard of hearing person uses the
synthetic lip-speaking software as support for understanding the audio
stream.

```
For example:
(          ) <-----Voice-----> ( hard of ) -Voice-> ( PC with     )
( hearing )                    ( hearing )          ( synthetic    )
( Party A )                    ( party B )          ( lip-speaking)
(          )                   (          )         ( software     )
```

7.5 Voice Activated Menu Systems

In this scenario, a deaf person wishing to book cinema tickets with a
credit card, using a text phone to place the call. The cinema employs a
voice-activated menu system for film titles and showing times.

1. **The deaf person places a call to the cinema with a text-phone:**
   (Text-phone) <-----Text ---> (Voice-activated System)
2. **The cinema's voice-activated menu requests an auditory response to
   continue.**
3. **A Relay Service is invited into the conversation.**
4. **The Relay Service transcodes the prompts of the voice-activated menu
   into text.**
5. **Text from the voice-activated menu appears on the display of the deaf
   person's text-phone.**
6. **The deaf person types a response.**
7. **The Relay Service receives the text and reads it to the voice-
   activated system:**
   ```
   (             )          (Relay Service  )          (              )
   (Text-phone ) -Text-> (Provider        ) -Voice-> (Voice-Activated)
   (             ) <-Text- (Text To Voice   ) <-Voice- (System         )
   ```
8. **The transaction is finalised with a confirmed booking time.**
9. **The Relay Service withdraws from the call.**

8. Some Suggestions for Service Providers and User Agent Manufacturers

This section is included to encourage service providers and user agent
manufacturers in developing products and services that can be used by as

wide a range of individuals as possible, including the deaf, hard of
hearing and speech-impaired.

- Service providers and User Agent manufacturers can offer to a deaf,
  hard of hearing and speech-impaired person the possibility of being
  able to hide their specific references and abilities from being made
  public in any transaction.
- If a User Agent performs auditory signalling, for example a pager, it
  could also provide another signalling method; visual (flashing light)
  or tactile (vibration).
- Service providers who allow the user to store specific setting or
  preferences and abilities (i.e., user profile) might consider storing
  these setting in a central repository, accessible no matter the
  location of the user and regardless of the User Agent used at that
  time or location.
- If there are several transcoding services available, the User Agent
  can be set to select the most economical/highest quality service.
- The service provider can show the cost per minute and any minimum
  charge of a transcoding service call before a session starts, allowing
  the user a choice of engaging in the service or not.
- Service providers are encouraged to offer an alternative stream with
  audio streams, for example, text or data streams that operate avatars,
  etc.
- Service providers are encouraged to provide a text alternative to
  voice-activated menus, e.g., answering and voice mail systems.
- Manufacturers of voice-activated software are encouraged to provide an
  alternative visual format for software prompts, menus, messages, and
  status information.
- Manufacturers of mobile phones are encouraged to develop equipment
  design in which radio wave signals do not interfere with hearing aids.
- All services for interpreting, transliterating, or facilitating
  communications for deaf, hard of hearing and speech-impaired people
  are required to:
  - Keep information exchanged during the transaction strictly
    confidential
  - Enable information exchange literally and simply, without deviating
    and compromising the content
  - Facilitate communication without bias, prejudice or opinion
  - Match skill sets to the requirement of the individual
  - Behave in a professional and appropriate manner
  - Be fair in claiming compensation for services
  - Strive to improve the skill-sets used for their services.

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Comments can be sent to the SIPPING mailing list.

References and Notes

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[2](). **S. Bradner, "Key words for use in RFCs to indicate requirement**
   levels". Request for Comments 2119, Internet Engineering Task Force.
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[3](). **Moore, Matthew, et al. "For Hearing People Only: Answers to Some of**
   the Most Commonly Asked Questions About the Deaf Community, Its
   Culture, and the Deaf Reality". MSM Productions Ltd., 2nd Edition,
   September 1993.
[4](). **TypeTalk is a UK based Relay Service with human operators performing**
   text to voice and voice to text transcoding services.
[5](). **This requirement recognises emerging regulatory conditions world-wide**
   that allow for the surveillance and interception of electronic mail
   by legal authorities.

6. For more information on signing avatars, see www.visicast.co.uk.
7. For more information on synthetic lip-reading software, see
   www.speech.kth.se/teleface.

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