Recommendation of the FCC Disability Advisory Committee
RTT-VRS Working Group
RTT Integration with VRS
(Deaf or DeafBlind User on a Relay Call with a Hearing Caller Via a Communications Assistant and Simultaneously Using RTT Directly with the Hearing Caller on the Other End)
Adopted: September 24, 2019

1. WHEREAS the 3rd Generation Partnership Project(3GPP) defines standards for the IP Multimedia Subsystem (IMS), which are based on Internet Engineering Task Force (IETF) Session Initiation Protocol (SIP) standards; and
2. WHEREAS IMS is a closed system - only carriers with interconnection agreements have access to the signaling and data - so no over-the-top (OTT) services can touch IMS; and
3. WHEREAS Video Relay Services (VRS) Providers created the Provider Interworking Profile (PIP) to allow dial around and Point-to-Point calls to work; and
4. WHEREAS the current PIP recommends ITU T.140 and IETF RFC 4103 but does not mandate it; and
5. WHEREAS the Alliance for Telecommunications Industry Solutions (ATIS) has developed standards for wireless Real-Time Text (RTT) interoperability and RTT emergency calls in the United States to complement the 3GPP standards; and
6. WHEREAS the IETF has begun work on defining a user interface specification for an endpoint device to a VRS provider with consideration of RTT (known as "RUM" specifications); and
7. WHEREAS NENA-STA-010 ("next generation 911") has a requirement for Public Safety Answering Points (PSAPs) to support RFC4103 RTT on any 911 call, including full support for multimedia calls (audio, video, RTT), but 911 RTT implementation is almost non-existent; and
8. WHEREAS the IETF RUM Working Group is considering specifications that would require support for the underlying emergency call specification, which is RFC 6881, upon which NENA i3 is based; and
9. WHEREAS VRS Providers, Consumer Groups, and researchers have made numerous filings with the FCC expressing concerns with the identical RUE profile and/or its development, and the timing and resource allocation of its implementation.
10. WHEREAS interworking IMS to VRS would require VRS providers to implement a full IMS call stack - or at the very least interwork with IMS at the edge of their network - and RFC4103 RTT support; and
11. WHEREAS interworking IMS to VRS would require VRS providers to negotiate an interconnection agreement with each carrier separately; and
12. WHEREAS this process would be complex and costly but doable on both the VRS side and the wireless network operator side- and there are questions about how that cost would be recovered; and

13. WHEREAS the VoIP providers for VRS do not support RTT since the SIP standards they are using do not include support for anything other than voice - but RTT could be added into VoIP networks as well; and
14. WHEREAS interworking RTT-supporting VoIP providers to VRS would require VRS providers to negotiate an interconnection agreement with their VoIP provider; and
15. WHEREAS the RTT-supporting VoIP provider would need to negotiate interconnection agreements with carriers and other RTT-supporting VoIP providers; and
16. WHEREAS another option may be OTT solutions rather than using the underlying RMS solutions and implementing the full IMS stack - such as the wireless providers supporting an API that would allow the VRS providers to get access to send and receive RTT (similar to what is done for SMS) with the 3GPP standard; and
17. WHEREAS with the API solution, the telephone number can be queried in a database to determine if there is extra information available - specifically whether both ends of the call are RTT capable; and
18. WHEREAS three VRS providers out of four already support RTT, which greatly benefits DeafBlind users; and
19. WHEREAS for a DeafBlind user participating in a VRS call, the communications assistant (CA) can receive a notification on the screen that RTT is involved - instead of responding with American Sign Language (ASL), the CA will know to respond via text; and
20. WHEREAS RTT sent directly to a hearing user (Text Carry Over) would be similar to Voice Carry Over (VCO) or Hearing Carry Over (HCO); and
21. WHEREAS in several European countries, RTT is already utilized in both video relay services and text relay services.

NOW, THEREFORE, IT IS-

1. RECOMMENDED that the Federal Communications Commission ("Commission") initiate a Notice of Inquiry (NOI) to explore the feasibility of the options outlined above as well as how these costs are to be recovered; and
2. RECOMMENDED further, the NOI consider whether the PIP should mandate ITU T.140 and IETF RFC 4103; and
3. RECOMMENDED further, the NOI consider the need for 911 RTT implementation and explore incorporating appropriate specifications; and
4. RECOMMENDED further, the NOI consider the addition of RTT into VoIP networks; and
5. RECOMMENDED further, the NOI consider the inclusion of RTT in the VRS user's profile - similar to VCO and HCO - so that the (CA) is aware of the user's needs and preferences; and
6. RECOMMENDED further, the NOI consider the impact on research into the possible methods of routing such calls (such as interworking IMS to VRS, via an API, et al.) and the development of such methods as it relates to funding and

resource allocation for both VRS providers and telephone network operators; and

7. RECOMMENDED further, the NOI consider the compensability of a VRS call involving RTT and the impact on per-minute rates; and

8. RECOMMENDED further, the NOI consider the role of the CA in using RTT and the expectations of the deaf and DeafBlind users.

Appendix A:

Use Cases

(for informational purposes)

Introduction

This document lays out use cases for RTT calls over VRS. Some of these loosely draw on use cases written up for the previous DAC Tech Transitions Group as part of the work on wireless RTT and refreshable Braille displays. Bryen Yunashko, who is DeafBlind, also was consulted in the drafting of this document and has provided some input.

The use cases for RTT over VRS fall into three categories:

(1) Point to point calls with two VRS endpoints, no VRS interpreter involved – **cases 1-2**

(2) Relay calls from/to VRS to/from a hearing endpoint with VRS interpreter involvement– **cases 3-7**

(3) NG9-1-1 calls– **case 8**

Note: There are also potential use cases involving chained relay service invocation, such as a sighted VRS call to a TTY/RTT relay service to a DeafBlind user, or a sighted VRS call to IP-CTS to a DeafBlind IP-CTS user. These are not covered in this document.

How to read a use case

Use cases describe **what** the user experiences, not how this is or should be implemented in technology. To this end, use cases are kept technology-neutral to the greatest extent possible, and specifically do not make assumptions about the respective responsibilities of the VRS endpoints, VRS backend, wireless carriers, wireless handsets, other phone endpoints, screen readers, Braille drivers, and refreshable Braille displays.

Each use case follows a common pattern. The short description section states what the interaction is all about. The actors section states who is present in a call, and what type of disability they have, if any, and what their preferred input/output methods are. The pre-conditions state what, at a minimum, needs to be true before a call can succeed, and what user settings and preferences are applicable. The post-

condition states what the expected outcome is. The normal flow explains the most typical call flow scenario for the given use case, step by step. The alternate flow explains what must be changed if there is a slight modification to the use case that, overall, does not materially change the nature of the conversation (for example, if one person mixes voice and RTT). Exceptions describe what happens if the call cannot be completed successfully.

1. Point to point call between two VRS endpoints with RTT involvement, and DeafBlind involvement

Short Description

This use case addresses RTT communication between two VRS users, one of whom is DeafBlind and uses a screen magnifier or refreshable Braille display to read RTT instead of receiving ASL.

This use case also is shown in this video: https://youtu.be/AIATWpjtEUA

Actors

Alice is a DeafBlind person using ASL to express herself, and using a refreshable Braille display to receive information.

Bob is a sighted ASL user.

Pre-Conditions

Both users have VRS videophones (VPs) that support interoperable RTT according to the SIP interoperability profile.

Both users are registered with a VRS provider that supports interoperable RTT according to the SIP interoperability profile.

Alice has her refreshable Braille display paired with her VP.

Post Conditions

The users have completed a call where they used their VPs' RTT functionality, intermixed with ASL, to communicate with each other.

Normal Flow

1. Alice uses her refreshable Braille display to dial Bob's 10-digit VP number.
2. Bob answers the call on his VP.
3. Bob recognizes that Alice is DeafBlind and prefers him to type to her using RTT.
4. Bob pulls up the RTT text entry field on his VP, and types RTT to answer the call: *Hello GA.* His VP sends the typed text in real time to Alice.
5. Alice's VP receives Bob's RTT.

6. Alice's refreshable Braille displays Bob's text.

7. When Alice encounters the *GA* from Bob, she starts signing back to Bob in ASL.

8. Bob's VP shows Alice signing.

9. When Bob sees that Alice has finished her turn, he starts typing back. Alice and Bob continue taking turns until one or both wish to end the call.

10. Alice and/or Bob hang up.

Alternative Flows

Alternative Flow #1

Bob makes a phone call to Alice.

Step 1 changes as follows:

Bob uses his VP's dialer to call Alice's 10-digit number.

Step 2 changes as follows:

Alice answers the call and signs to Bob.

Alternative Flow #2

Alice uses RTT intermixed with ASL, for instance to transmit an address or a confirmation number.

Step 7 changes as follows:

When Alice encounters the *GA* from Bob, she indicates in ASL that she will type some information. She uses her refreshable Braille display or her keyboard to type.

Step 8 changes as follows:

Bob's VP displays Alice's RTT overlaid on or alongside Alice's video.

Alternative Flow #3

Alice has low vision, and sometimes needs to fall back to a high-contrast magnified text display to understand Bob.

Step 6 changes as follows:

Alice uses her screen magnifier and high contrast display to read Bob's text.

Step 9 changes as follows:

Bob intermixes ASL and typing. If he realizes that Alice has trouble following his signing, he types his turn using RTT.

Exceptions

Bob is unable or unwilling to accept an RTT call.

Step 2 changes as follows:

Bob rejects the call or hangs up. Alice receives a rejection/hang up notification on her refreshable Braille display.

2. Point to point call between two VRS endpoints with RTT involvement, and involvement of a person with a mobility impairment

Short Description

This use case addresses RTT communication between two VRS users, one of whom has a mobility impairment that impacts the clarity of their ASL.

Actors

Alice is a sighted ASL user.

Bob is a sighted ASL user with a mobility impairment that affects the clarity of his signing.

Pre-Conditions

Both users have VRS videophones (VPs) that support interoperable RTT according to the SIP interoperability profile.

Both users are registered with a VRS provider that supports interoperable RTT according to the SIP interoperability profile.

Post Conditions

The users have completed a call where they used their VPs' RTT functionality, intermixed with ASL, to communicate with each other.

Normal Flow

1. Alice uses her VP's dialer to call Bob's 10-digit number.
2. Bob answers the call on his VP.
3. Bob signs *Hello how are you* to Alice.
4. Alice indicates in ASL that she has trouble understanding Bob's signing.
5. Bob pulls up the RTT text entry field on his VP, and types RTT: *Hello how are you?* His VP sends the typed text in real time to Alice.
6. Alice's VP receives Bob's RTT.

7. Alice's VP displays Bob's RTT overlaid on or alongside Bob's video.

8. When Bob indicates his end of turn (via typing or ASL), Alice starts signing back to Bob in ASL.

9. Bob's VP shows Alice signing.

10. When Bob sees that Alice has finished her turn, he starts signing or typing back. Alice and Bob continue taking turns until one or both wish to end the call.

11. Alice and/or Bob hang up.

Alternative Flows

Alternative Flow #1

Bob makes a phone call to Alice.

Step 1 changes as follows:

Bob uses his VP's dialer to call Alice's 10-digit number.

Step 2 changes as follows:

Alice answers the call and signs to Bob.

Exceptions

Alice or Bob are unable or unwilling to accept an RTT call.

Step 2 changes as follows:

Bob rejects the call or hangs up.

3. DeafBlind VRS call to PSTN/VoIP/Wireless endpoint with no TTY/RTT capabilities

Short Description

This use case addresses a DeafBlind VRS user calling a hearing person through a VRS interpreter. The VRS supports typing via RTT, but the hearing person's phone does not.

Actors

Alice is a DeafBlind person using a refreshable Braille display.

Bob is a hearing person using a voice phone.

Carol is a VRS interpreter.

Pre-Conditions

Alice has a VRS videophone (VP) that supports interoperable RTT according to the SIP interoperability profile.

Alice is registered with a VRS provider that supports interoperable RTT according to the SIP interoperability profile.

Alice's VRS provider offers interpreters who type back in RTT in lieu of signing ASL.

Alice has her refreshable Braille display paired with her VP.

Post Conditions

The users have completed a call where Alice and Bob completed a call through Carol as an intermediary, and each used their preferred mode of communication.

Normal Flow

1. Alice uses her refreshable Braille display to dial Bob's 10-digit number.
2. The call gets routed into the queue for Alice's VRS provider.
3. Carol answers the call.
4. Carol types to Alice in RTT that she will connect the call to Bob now.
5. Carol places a voice call to Bob using the 10-digit number that Alice provided in Step 1.
6. Bob answers the call as voice call.
7. Bob says *Hello*.
8. Carol types *Hello GA* using RTT.
9. Alice's VP receives Carol's RTT.
10. Alice's refreshable Braille displays Carol's text.
11. When Alice encounters the *GA* from Carol, she starts signing back to Carol in ASL.
12. Carol voices Alice's ASL to Bob.
13. Bob listens to Carol speaking.
14. When Alice has finished her turn, as evidenced through Carol's voicing of her ASL, Bob responds using his voice.
15. Carol types what Bob says in RTT.
16. Alice and Bob continue the conversation until one or both wish to end the call.
17. Alice and/or Bob hang up.

4. User with a mobility impairment makes VRS call to PSTN/VoIP/Wireless endpoint with no TTY/RTT capabilities

Short Description

This use case addresses a VRS user with a mobility impairment calling a hearing person through a VRS interpreter, where the interpreter sometimes struggles with understanding the user's ASL. The VRS supports typing via RTT, but the hearing person's phone does not.

Actors

Alice is a person with a mobility impairment, with sometimes unclear ASL.

Bob is a hearing person using a voice phone.

Carol is a VRS interpreter.

Pre-Conditions

Alice has a VRS videophone (VP) that supports interoperable RTT according to the SIP interoperability profile.

Alice is registered with a VRS provider that supports interoperable RTT according to the SIP interoperability profile.

Post Conditions

The users have completed a call where Alice and Bob completed a call through Carol as an intermediary, and each used their preferred mode of communication.

Normal Flow

1. Alice uses her uses her VP's dialer to call Bob's 10-digit number.
2. The call gets routed into the queue for Alice's VRS provider.
3. Carol answers the call.
4. Carol signs to Alice that she will connect the call to Bob now.
5. Carol places a voice call to Bob using the 10-digit number that Alice provided in Step 1.
6. Bob answers the call as voice call.
7. Bob says *Hello*.
8. Carol signs *Hello* to Alice in ASL.
9. Alice sees Carols' signing on her VP.
10. Alice signs *Hello how are you*.
11. Carol indicates in ASL that she has trouble understanding Alice's signing.

12. Alice pulls up the RTT text entry field on her VP, and types RTT: *Hello how are you?* Her VP sends the typed text in real time to Carol.

13. Carol's station receives and displays Alice's RTT.

14. Carol reads out the received RTT to Bob using her voice.

15. When Alice indicates her end of turn (via typing or ASL), Carol indicates such to Bob.

16. Bob responds using his voice

17. Carol signs what Bob said to Alice in ASL.

18. Alice and Bob continue taking turns until one or both wish to end the call.

19. Alice and/or Bob hang up.

5. DeafBlind VRS call to PSTN/VoIP/Wireless endpoint with RTT capabilities

Short Description

This use case addresses a DeafBlind VRS user calling a hearing person through a VRS interpreter. The VRS supports typing via RTT, and the hearing person's phone also is capable of transmitting and receiving RTT.

Actors

Alice is a DeafBlind person using a refreshable Braille display.

Bob is a hearing person using a voice phone with RTT capabilities.

Carol is a VRS interpreter.

Pre-Conditions

Alice has a VRS videophone (VP) that supports interoperable RTT according to the SIP interoperability profile.

Alice is registered with a VRS provider that supports interoperable RTT according to the SIP interoperability profile.

Alice's VRS provider offers interpreters who type back in RTT in lieu of signing ASL.

Alice's VRS provider has both voice and RTT interconnected and interoperable with Bob's (wireless) carrier.

Alice has her refreshable Braille display paired with her VP.

Bob has a phone plan that supports RTT.

Bob has a phone that supports RTT.

Post Conditions

The users have completed a call where Alice and Bob completed a call through Carol as an intermediary, and Bob and Alice used RTT analogous to hearing carry over.

Normal Flow

1. Alice uses her refreshable Braille display to dial Bob's 10-digit number.

2. The call gets routed into the queue for Alice's VRS provider.

3. Carol answers the call.

4. Alice indicates to Carol that she would like RTT connected directly (Text Carry Over - analogous to asking for Hearing Carry Over).

5. Carol types to Alice in RTT that she will connect the call to Bob now.

6. Carol places a voice+RTT call to Bob using the 10-digit number that Alice provided in Step 1.

7. Bob answers the call using RTT.

8. Bob types *Hello GA*.

9. Alice's VP receives Bob's RTT.

10. Alice's refreshable Braille displays Bob's text.

11. Carol is able to read Bob's text to provide her with context.

12. When Alice encounters the *GA* from Bob, she starts signing back to Carol in ASL.

13. Carol voices Alice's ASL to Bob.

14. Bob listens to Carol speaking.

15. When Alice has finished her turn, as evidenced through Carol's voicing of her ASL, Bob responds using RTT.

16. Alice receives what Bob says in RTT.

17. Alice and Bob continue the conversation until one or both wish to end the call.

18. Alice and/or Bob hang up.

Alternative Flows

Alternative Flow #1

Bob mixes voice and RTT.

Step 14 changes as follows:

When Alice has finished her turn, as evidenced through Carol's voicing of her ASL, Bob responds intermixing voice and typing. His RTT typing is directly transmitted to Alice. If Bob uses his voice, Carol types what Bob says in RTT to Alice.

6. VRS call to PSTN/VoIP/Wireless endpoint with RTT and Speech to Text capabilities

Short Description

This use case addresses a VRS user calling a hearing person through a VRS interpreter. The VRS supports typing via RTT, and the hearing person's phone also is capable of transmitting and receiving RTT. The hearing person uses voice, but supplements it by RTT for hard-to-pronounce terms.

Actors

Alice is a VRS user proficient in both ASL and written English

Bob is a hearing person using a voice phone with RTT capabilities.

Carol is a VRS interpreter.

Pre-Conditions

Alice has a VRS videophone (VP) that supports interoperable RTT according to the SIP interoperability profile.

Alice is registered with a VRS provider that supports interoperable RTT according to the SIP interoperability profile.

Alice's VRS provider has both voice and RTT interconnected and interoperable with Bob's (wireless) carrier.

Bob has a phone plan that supports RTT.

Bob has a phone that supports RTT.

Post Conditions

The users have completed a call where Alice and Bob completed a call through Carol as an intermediary, and Bob and Alice used RTT analogous to hearing carry over, alongside with voice to the interpreters.

Normal Flow

1. Alice uses her VP to dial Bob's 10-digit number.
2. The call gets routed into the queue for Alice's VRS provider.
3. Carol answers the call.
4. Alice indicates to Carol that she would like RTT connected directly (Text Carry Over - analogous to asking for Hearing Carry Over).
5. Carol signs to Alice that she will connect the call to Bob now.
6. Carol places a voice+RTT call to Bob using the 10-digit number that Alice provided in Step 1.

7. Bob answers the call using voice+RTT.

8. Bob speaks *Hello, this is agent XYZ/0003A-007*.

9. Carol signs to Alice what Bob spoke, but indicates that she missed some digits.

10. Alice signs back to Carol to repeat the agent designation.

11. Carol voices Alice's request to Bob.

12. Bob types *agent XYZ/0003A-007* using his phone's RTT capabilities.

13. Alice's VP receives Bob's RTT.

14. Alice's VPs displays Bob's text alongside the video of Carol, or overlaid.

15. Alice starts signing back to Carol in ASL.

16. Carol voices Alice's ASL to Bob.

17. Bob listens to Carol speaking.

18. When Alice has finished her turn, as evidenced through Carol's voicing of her ASL, Bob responds using spoken English, optionally intermixed with RTT that gets transmitted to Alice's VP.

19. Alice and Bob continue the conversation until one or both wish to end the call.

20. Alice and/or Bob hang up.

Alternative Flows

Alternative Flow #1

Alice has to provide a hard-to-fingerspell confirmation number.

Step 15 changes as follows:

Alice uses her VP's RTT input capabilities to transmit the confirmation number directly to Bob's phone.

Step 16 changes as follows:

Bob receives Alice's RTT on his phone.

Step 17 changes as follows:

Bob reads Alice's RTT.

7. VRS call to PSTN/VoIP/Wireless endpoint with RTT and Speech to Text capabilities

Short Description

This use case addresses a VRS user calling a hearing person through a VRS interpreter. The VRS supports typing via RTT, and the hearing person's phone also is capable of transmitting and receiving RTT. The

hearing person uses speech to text to transmit what they are saying, as a more efficient alternative to typing, without relying on English to ASL interpretation.

Actors

Alice is a VRS user proficient in both ASL and written English

Bob is a hearing person using a voice phone with RTT capabilities.

Carol is a VRS interpreter.

Pre-Conditions

Alice has a VRS videophone (VP) that supports interoperable RTT according to the SIP interoperability profile.

Alice is registered with a VRS provider that supports interoperable RTT according to the SIP interoperability profile.

Alice's VRS provider has both voice and RTT interconnected and interoperable with Bob's (wireless) carrier.

Bob has a phone plan that supports RTT.

Bob has a phone that supports RTT.

Bob has a phone that supports speech to text as an input method.

Post Conditions

The users have completed a call where Alice and Bob completed a call through Carol as an intermediary, and Bob and Alice used RTT analogous to hearing carry over, with Bob's speech getting converted to text.

Normal Flow

1. Alice uses her VP to dial Bob's 10-digit number.
2. The call gets routed into the queue for Alice's VRS provider.
3. Carol answers the call.
4. Alice indicates to Carol that she would like RTT connected directly (Text Carry Over - analogous to asking for Hearing Carry Over).
5. Carol signs to Alice that she will connect the call to Bob now.
6. Carol places a voice+RTT call to Bob using the 10-digit number that Alice provided in Step 1.
7. Bob answers the call using voice+RTT.
8. Bob speaks *Hello GA*.

9. Bob's speech to text engine converts the spoken English to RTT, and transmits *Hello GA* as RTT, and simultaneously displays the transmitted RTT on his phone screen.

10. Alice's VP receives Bob's RTT.

11. Alice's VPs displays Bob's text alongside the video of Carol, or overlaid.

12. When Alice encounters the *GA* from Bob, she starts signing back to Carol in ASL.

13. Carol voices Alice's ASL to Bob.

14. Bob listens to Carol speaking.

15. When Alice has finished her turn, as evidenced through Carol's voicing of her ASL, Bob responds using spoken English, converted to RTT through speech to text.

16. If Bob spots a mistake in the transmitted RTT that he reads on his phone screen, he speaks or types a correction, transmitted as RTT. This correction is communicated in plain English; e.g. Bob types or says:"Correction: I meant to say apples, not oranges."

17. Alice receives what Bob says in RTT.

18. Alice and Bob continue the conversation until one or both wish to end the call.

19. Alice and/or Bob hang up.

Alternative Flows

Alternative Flow #1

Alice is a DeafBlind person who uses a refreshable Braille display.

Step 1 changes as follows:

Alice uses her refreshable Braille display to dial Bob's 10-digit number.

Step 5 changes as follows:

Carol types to Alice in RTT that she will connect the call to Bob now.

8. NG9-1-1 call complying with NENA i3, EAAC recommendations, and EAAC MCLS report

See this video for the general idea:

https://amara.org/mn/videos/zgBRiI8mfyH1/info/reach112-demo-movie/

EAAC homepage: https://www.fcc.gov/general/emergency-access-advisory-committee-eaac

EAAC report: https://docs.fcc.gov/public/attachments/DOC-312161A1.doc

EAAC MCLS report: https://docs.fcc.gov/public/attachments/DOC-319394A1.doc