

MTAS 17A Technical Product Description NW AS Communication Interworking Communication IWF



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1 Introduction

1.1 Scope

This document is part of MTAS TPD document series and describes the Communication Interworking in Network Application Server (hence forth called NW AS), which provides the communication Interworking Functions.

Current version support Originating Precondition Interworking Function and Forking Interworking Function as communication Interworking Functionality.

1.2 Change History

Table 1 - Revision History

Revision	Date	Comments/Changes
A	2016-09-06	Final Version for 17A
B	2017-08-23	Update for vMTAS Licensing
PC1	2018-08-14	Update for Forking Interworking function
PC2	2018-08-24	Update with Comments

2 Network AS Communication IWF Features

2.1 NW AS Communication IWF Overview

There are cases in VoLTE network when some connected SIP entities missing some standard SIP capability (e.g Precondition negotiation for QoS, or calling side lacks support for multiple early dialogs). This missing capability can result in the communication failure.

The Ericsson NW AS Communication Interworking Function works as B2BUA and fulfills missing SIP signaling between two SIP entities of network so that communication can be successful.

NW AS precondition function (PrIWF) sits in the originating network.

NW AS forking interworking function (FoIWF) sits in both originating and terminating network.

NW AS can be deployed on MTAS as standalone node or collocated with MMTEL AS.

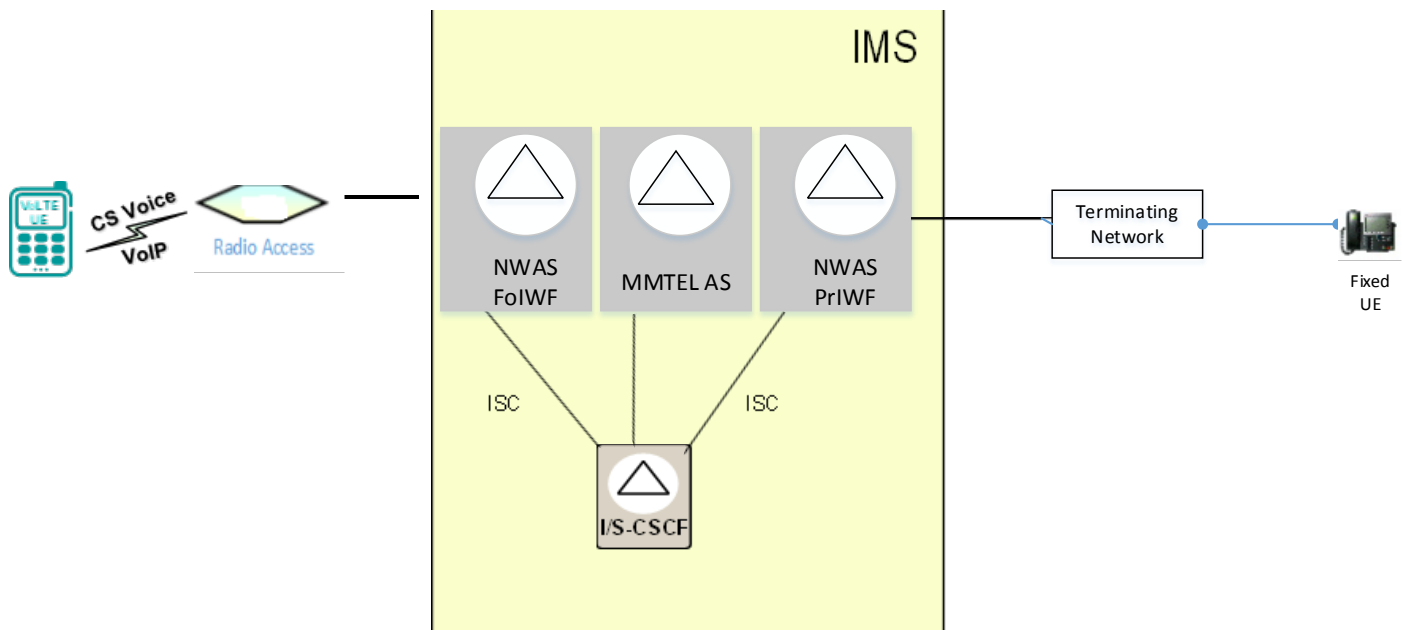


Figure 1 NWAS in solution

2.2 QoS Precondition

When the VoLTE device is calling a SIP end point which does not support QoS precondition negotiation, multiple issues may arise:

Ghost ringing: As the terminating SIP end point lacking in the QoS precondition negotiation support, the caller will not have the network resources reserved and which will result in “Ghost Ringing”.

Misrepresentation of call success: For the terminals not supporting the QoS precondition negotiation the rejection of resource reservation will be known only after receiving 200 OK, the call shall be released using BYE. This may be shown as a successful call which can have charging implications as well as incorrect performance counter results.

Media clipping: Even if the resources are available at the caller side, the bearer setup will be delayed relative to the answer as no QoS precondition negotiation is done, so the first media packets from the called party can be lost.

2.3 QoS Precondition procedures

2.3.1 Description

The QoS precondition negotiation is important for network resource reservation and bearer setup.

The NW AS supports Precondition Interworking by acting as B2BU between the Originating and terminating UE.



NW AS uses MRFP to generate the SDP Answer for the offer received in INVITE for QoS Preconditions.

NW AS identifies lack of Precondition Support by

- 1) Predefined List of terminating Number ranges in SIP domain.
- 2) On receipt of 18x Message from Termination UE without Support of precondition.

.

2.3.2 Example Call Flow

2.3.2.1 Precondition Trigger based on 18x Response from UE-B.

Preconditions:

A valid license for Communication IWF NW AS is present.

NW AS Administrative State is UNLOCKED.

The CM attribute mtasPrlwAdministrativeState is UNLOCKED.

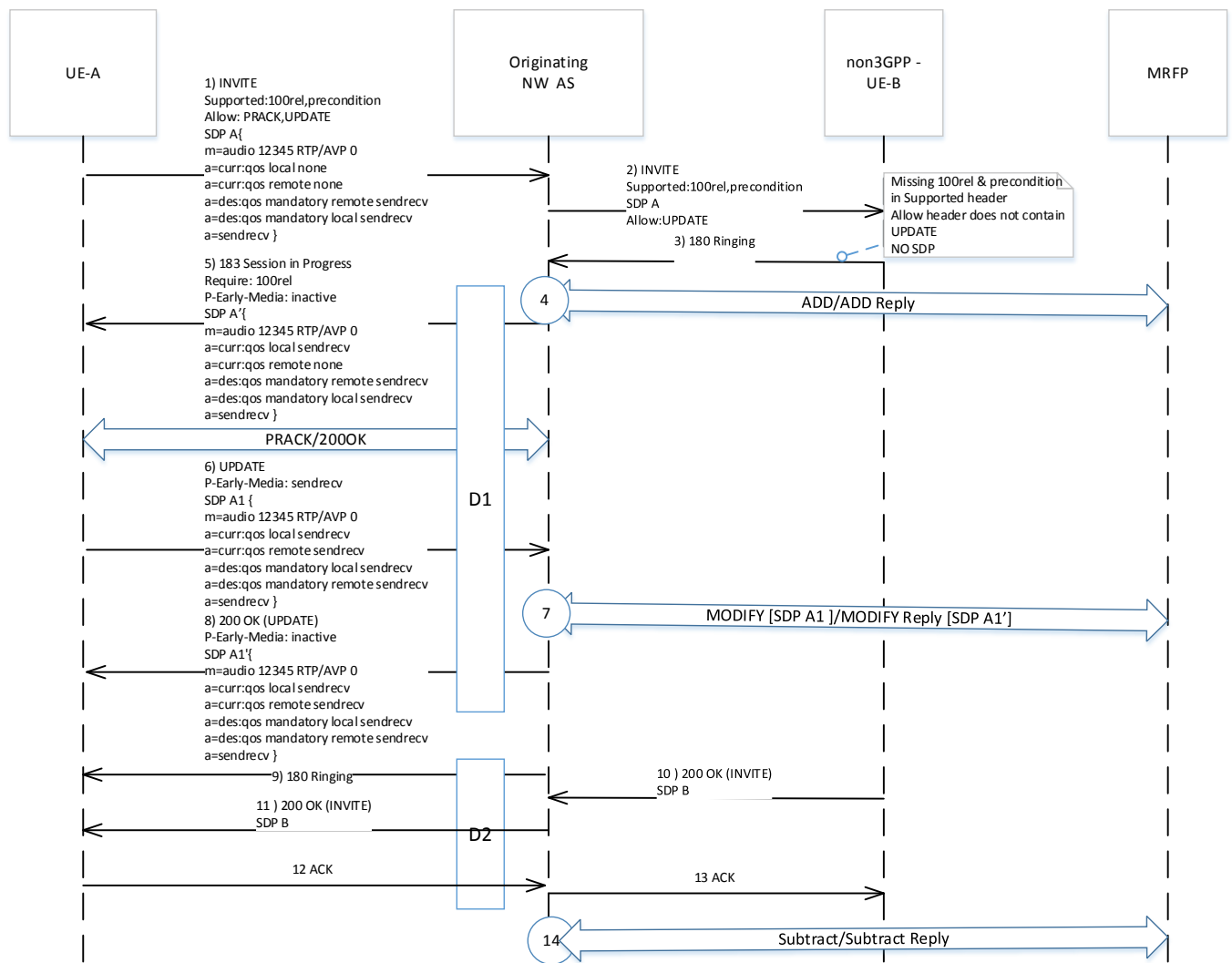


Figure 2 : Remote End does not support 100rel, precondition and UPDATE

1. UE-A sends an INVITE message in order to establish communication with UE-B. The INVITE contains header “Supported: precondition”, the SDP contains QoS preconditions where local preconditions haven’t been fulfilled and media direction line is sendrecv:

```
m=audio 12345 RTP/AVP 0
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory remote sendrecv
a=des:qos mandatory local sendrecv
a=sendrecv
```

2. NW AS sends INVITE message towards UE-B.
3. UE-B sends “180 Ringing” without SDP and Supported header do not contain precondition and 100rel and Allow Header do not contain UPDATE.



4. NW AS sends ADD request towards MRFP. MRFP Replies back with Add Reply. Reply Timer is stopped.
5. NW AS creates and sends a 183 Session in Progress to UE-A containing a SDP indicating that it has reserved. P-E-M is kept inactive.

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory remote sendrecv
a=des:qos mandatory local sendrecv
a=sendrecv
```

UE-A confirms the reception of “183 Session in Progress” with PRACK.

PRACK is answered with 200 OK.

6. UE-A has allocated the necessary resources and sends UPDATE message containing SDP indicating that preconditions are fulfilled:

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=sendrecv
```

7. NW AS sends MODIFY towards MRFP with SDP A1 and receives SDP A1' from MRFP in modify REPLY.
8. NW AS sends 200 OK (UPDATE) with SDP A1', with P-E-M as inactive:

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=sendrecv
```

9. NW AS sends 180 Ringing towards UE-A, received at step 3.
10. NW AS receives 200 OK of INVITE from UE-B with SDP.
11. NW AS sends 200 OK towards UE-A.
12. UE-A sends ACK towards NW AS.
13. NW AS sends ACK towards UE-B.
14. NW AS sends Subtract towards MRFP.



2.3.2.2 Precondition Trigger based on Pre-configured called party Numbers.

Preconditions:

A valid license for Communication IWF NW AS is present on the NW AS.

NW AS Administrative State is UNLOCKED.

The CM attribute `mtasPrlwAdministrativeState` is UNLOCKED.

The CM attribute `mtasPrlwBnumRangeWithoutPrecond` is configured with Number ranges in SIP Domain not supporting precondition. E.g "613*", "6174".

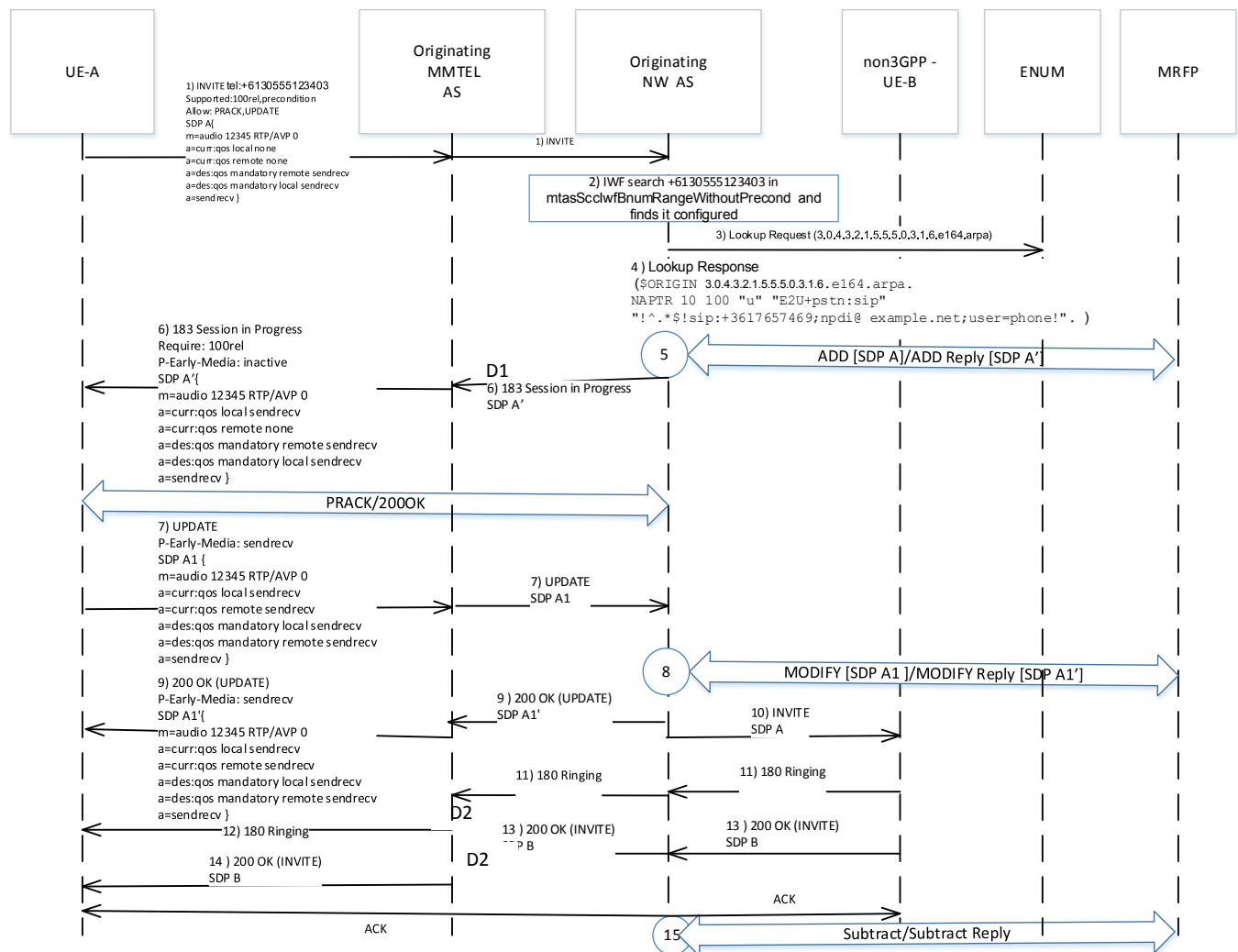


Figure 3 : Originating NW AS, Preconfigured Called Party Number.



NOTE: Number range must start in global format. Intl access prefix '+' not included in configured number range

1. UE-A sends an INVITE (+6130555123403) message in order to establish communication with UE-B. The INVITE contains header "Supported: precondition", the SDP contains QoS preconditions where local preconditions haven't been fulfilled and media direction line is sendrecv:

```
m=audio 12345 RTP/AVP 0
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory remote sendrecv
a=des:qos mandatory local sendrecv
a=sendrecv
```

2. NW AS checks it is telephone subscriber and fetch the called party Number +6130555123403 (normalised). NW AS searches the dialled number in configured MtasPrlwBnumRangeWithoutPrecond.parameter and finds it configured (matches against configured 613).
3. NW AS sends ENUM query using the dialled number +6130555123403 towards ENUM server.
4. ENUM server replies back with response. NW AS finds the result URI in SIP domain (looking at returned URI sip prefix).
5. NW AS sends ADD request towards MRFP. MRFP Replies back with Add Reply. Reply Timer is stopped.
6. NW AS creates and sends a 183 Session in Progress to UE-A containing a SDP indicating that it has reserved

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory remote sendrecv
a=des:qos mandatory local sendrecv
a=sendrecv
```

UE-A confirms the reception of "183 Session in Progress" with PRACK.

PRACK is answered with 200 OK.

7. UE-A has allocated the necessary resources and sends UPDATE message containing SDP indicating that preconditions are fulfilled:

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=sendrecv
```

8. NW AS sends MODIFY towards MRFP with SDP A1 and receives SDP A1' from MRFP in modify REPLY.



9. NW AS sends 200 OK (UPDATE) with SDP A1':

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=sendrecv
```

10. NW AS sends INVITE message towards UE-B.

11. UE-B sends "180 Ringing" towards NW AS

12. NW AS sends 180 Ringing towards UE-A.

13. NW AS receives 200 OK of INVITE from UE-B with SDP.

14. NW AS sends 200 OK towards UE-A.

NW AS sends ACK towards UE-A.

NW AS sends ACK towards UE-B.

15. NW AS sends Subtract towards MRFP.

2.3.2.3 Precondition fulfillment from SRVCC Handover based.

Preconditions:

A valid license for Communication IWF NW AS is present on the NW AS.

NW AS Administrative State is UNLOCKED.

The CM attribute mtasPrlwAdministrativeState is UNLOCKED.



```

m=audio 12345 RTP/AVP 0
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory remote sendrecv
a=des:qos mandatory local sendrecv
a=sendrecv

```

2. SCC AS sends INVITE message towards NW AS, NW AS forwards INVITE towards UE-B.
3. UE-B sends “180 Ringing” without SDP and Allow Header do not contain UPDATE.
4. NW AS sends ADD request towards MRFP. MRFP Replies back with Add Reply.
5. NW AS creates and sends a 183 Session in Progress to SCC AS and SCC AS forwards it to UE-A containing a SDP indicating that it has completed the reservation:

```

m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory remote sendrecv
a=des:qos mandatory local sendrecv
a=sendrecv

```

UE-A confirms the reception of “183” with PRACK.

PRACK is answered with 200 OK.

6. UE-A sends UPDATE confirming the resource reservation.
 - 6-a NW AS Sends MODIFY towards MRFP with SDP A1 received in UPDATE and receives A1' in the MODIFY RESPONSE.
7. NW AS replies back with 200 OK for UPDATE with QoS reservation confirmation.
8. NW AS sends 180 Ringing received in step 3, towards UE-A.
9. UE-A moves to CS access and MSC sends INVITE STN-SR, PAI:C-MSISDN, Contact:g.3gpp.srvcc-alerting, SDP towards SCC AS.
10. SCC AS SRVCC service generated UPDATE message which is handled by NW AS.
11. NW AS sends MODIFY with SDP A2 towards MRFP and receives SDP A2' from MRFP in MODIFY REPLY.
12. NW AS sends 200 OK for UPDATE to SCC-AS SRVCC service.
13. SCC-AS sends 183 Session in Progress towards UE-A.



14. UE-B sends 200 OK for INVITE towards NW AS. NW AS forwards it towards SCC AS.

MSC responds with a PRACK.

200 OK on PRACK sent from SCC AS.

15. For the first received PRACK, SCC AS sends a SIP INFO request to MSC in the dialog created by the SIP INVITE request due to static STN with application/vnd.3gpp.state-and-event-info content that the call is in alerting state.
16. MSC acknowledges with 200 OK and enters Call delivered state.
17. SCC AS sends 200 OK for INVITE received in step 14 from UE-B.
18. MSC sends ACK towards SCC AS.
19. SCC AS sends ACK towards NW AS. NW AS sends ACK towards UE-B.
20. NW AS sends REINVITE without SDP towards B.
21. UE-B sends 200 OK for REINVITE with SDP offer B1.
22. NW AS sends REINVITE towards MSC with SDP B1.
23. MSC replies with SDP A3 in 200 OK for REINVITE.
24. NW AS sends ACK towards MSC.
25. NW AS appends the SDP A3 in ACK and sends towards UE-B.
26. NW AS sends Subtract towards MRFP.

2.4 Forking Interworking

When the calling side lacks support for multiple early dialogues, the IMS provides a Forking Interworking Function. The Forking IWF aggregate multiple early dialogues to a single dialogue, keep track of the media state on multiple-dialog-side and map the authorized media towards the single dialog.

2.5 Forking Interworking procedures

2.5.1 Description

When the originating UE/network does not support multiple early dialogs:

a)- F-IWF aggregate multiple early dialogs to a single dialog.

b)- F-IWF keep track of the media state on multiple-dialog-side and map the authorized media towards the single dialog.



c)- Originating UE/network are expected to support 100rel and SIP UPDATE. F-IWF reject the session establishment attempt if:

- 100rel is missing both in Require and Supported header.
- there is no UPDATE in the Allow header

d)- F-IWF have a flexible invocation mechanism to trigger its execution based on the presence of a SIP header or an attribute in a SIP header in the initial INVITE. When the F-IWF trigger condition is missing in the initial INVITE; F-IWF is transparent to the SIP signalling.

e)- It is possible to configure the F-IWF function to be executed on all traffic. When configured in this mode; F-IWF execute independent of the invocation mechanism as defined by d).

f)- F-IWF propagate the caller precondition fulfilled to all remote ends.

2.5.2 Example Call Flow

2.5.2.1 Early Dialog Aggregation and Media Mapping

Preconditions:

- mtasFolwMode set to 3 (DYNAMIC)
- mtasFolwInvocationHeaderName set to Request-Disposition
- mtasFolwInvocationHeaderValue set to no-fork
- mtasFolwInvocationHeaderValueHandling set to 0 (REMOVE)

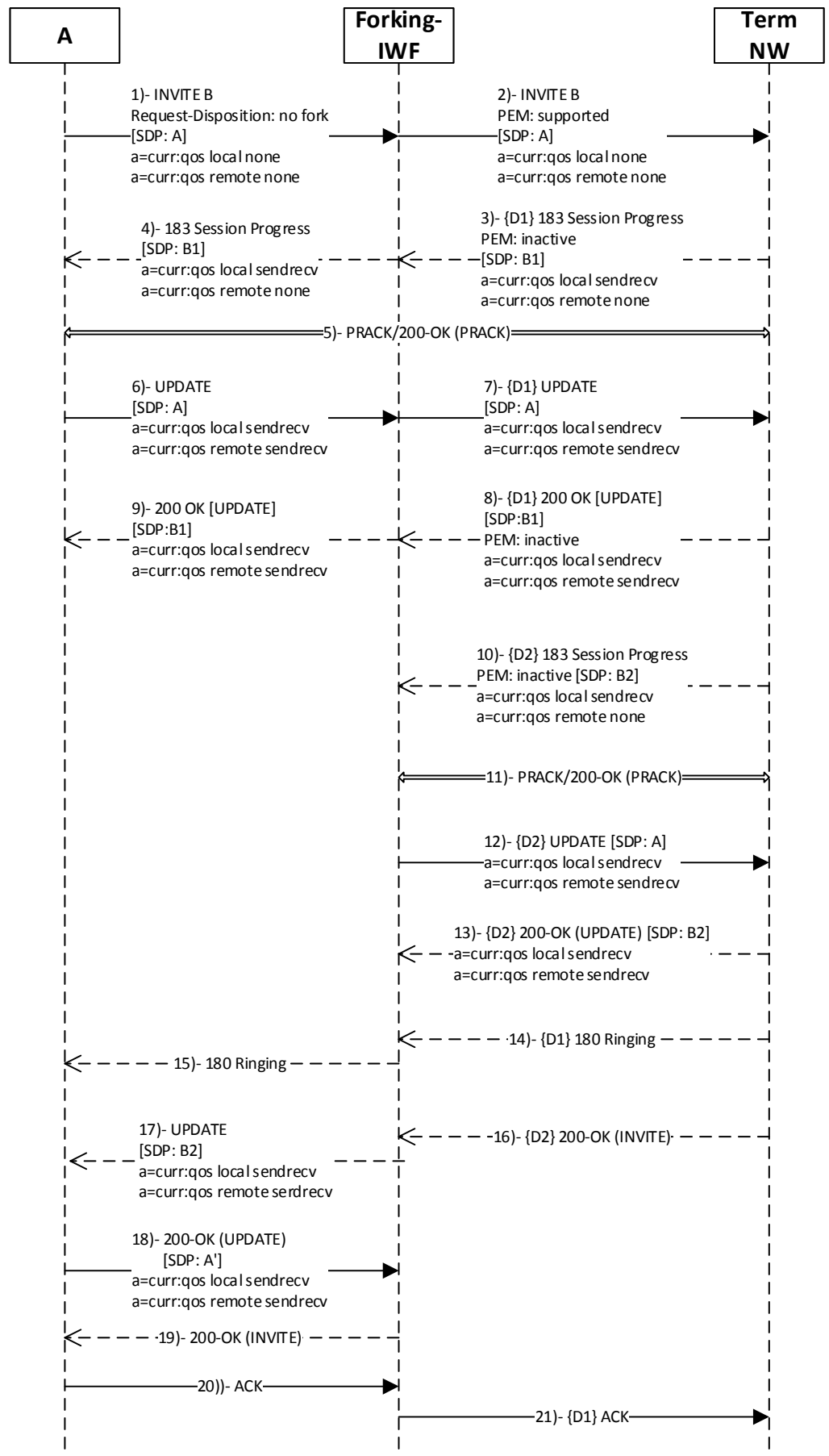




Figure 5 Early Dialog Aggregation and Media Mapping

1. UE-A sends an INVITE message in order to establish communication with UE-B. The INVITE contains header “Supported: 100rel, precondition”, the SDP contains QoS preconditions where local preconditions haven’t been fulfilled and media direction line is sendrecv:

```
m=audio 12345 RTP/AVP 0
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory remote sendrecv
a=des:qos mandatory local sendrecv
a=sendrecv
```

2. Forking-IWF is enabled and triggered on NWAS to remove the “Request-Disposition: no-fork”, add support for 199 (199 in Supported header) and PEM to the INVITE and routes the INVITE towards the terminating network on early dialog 1 (D1)
3. Terminating network sends 183 requiring 100rel and precondition with SDP answer (B1) on D1. PEM is inactive.

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory remote sendrecv
a=des:qos mandatory local sendrecv
a=sendrecv
```

4. Forking-IWF maps the first SDP answer towards UE-A and forwards 183 to UE-A.
5. Forking-IWF forwards PRACK and 200 OK for PRACK transparently between UE-A and the terminating network.
6. UE-A has allocated the necessary resources and sends UPDATE message containing SDP indicating that preconditions are fulfilled:

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=sendrecv
```

7. Forking-IWF send UPDATE with SDP:A to terminating network D1
8. Terminating network D1 send 200 OK as answer with SDP:B1
9. Because the first SDP answer B1 on D1 has been forwarded to UE-A, Forking-IWF forward the 200 OK to UE A.



10. Terminating network sends 183 requiring 100rel and precondition with SDP answer (B2) on D2. PEM: inactive

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory remote sendrecv
a=des:qos mandatory local sendrecv
a=sendrecv
```

11. Forking-IWF checks that the 183 is not for this ongoing media. As a result, NWAS decides NOT to forward this to UE-A and buffers SDP:B2.
12. Evaluating B2 SDP answer, Forking-IWF detects that the latest precondition state of UE-A is not known by B2. Forking-IWF consequently sends an UPDATE to B2 with the latest SDP state of UE-A (from initial INVITE in step 1) to terminating network D2, the local precondition is based on step 6, remote is based on step 10.

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=sendrecv
```

13. Terminating network D2 send 200 OK as answer with SDP:B2
14. 180 Ringing on D1 arrives at NWAS.
15. NWAS forwards 180 Ringing transparently to UE-A.
16. Terminating network answers the call with 200 OK on D2.
17. Because the current negotiated media is the announcement on D1, Forking-IWF decides to update UE A with the buffered SDP:B2 (received on step 13).
Forking-IWF sends UPDATE with SDP:B2 offer to UE-A.
18. User A answers 200 OK for UPDATE with SDP answer A2.
19. Forking-IWF sends 200 OK for INVITE to UE-A.
20. User A answers 200 OK for INVITE with ACK.
21. Forking-IWF forwards ACK to terminating network on D1.

The call is established.

2.5.2.2 Caller Precondition Propagation

Preconditions:

- F-IWF function license present



- mtasFolwAdministrativeState: Unlocked
- mtasFolwMode: ORIGINATING_AND_TERMINATING (2)

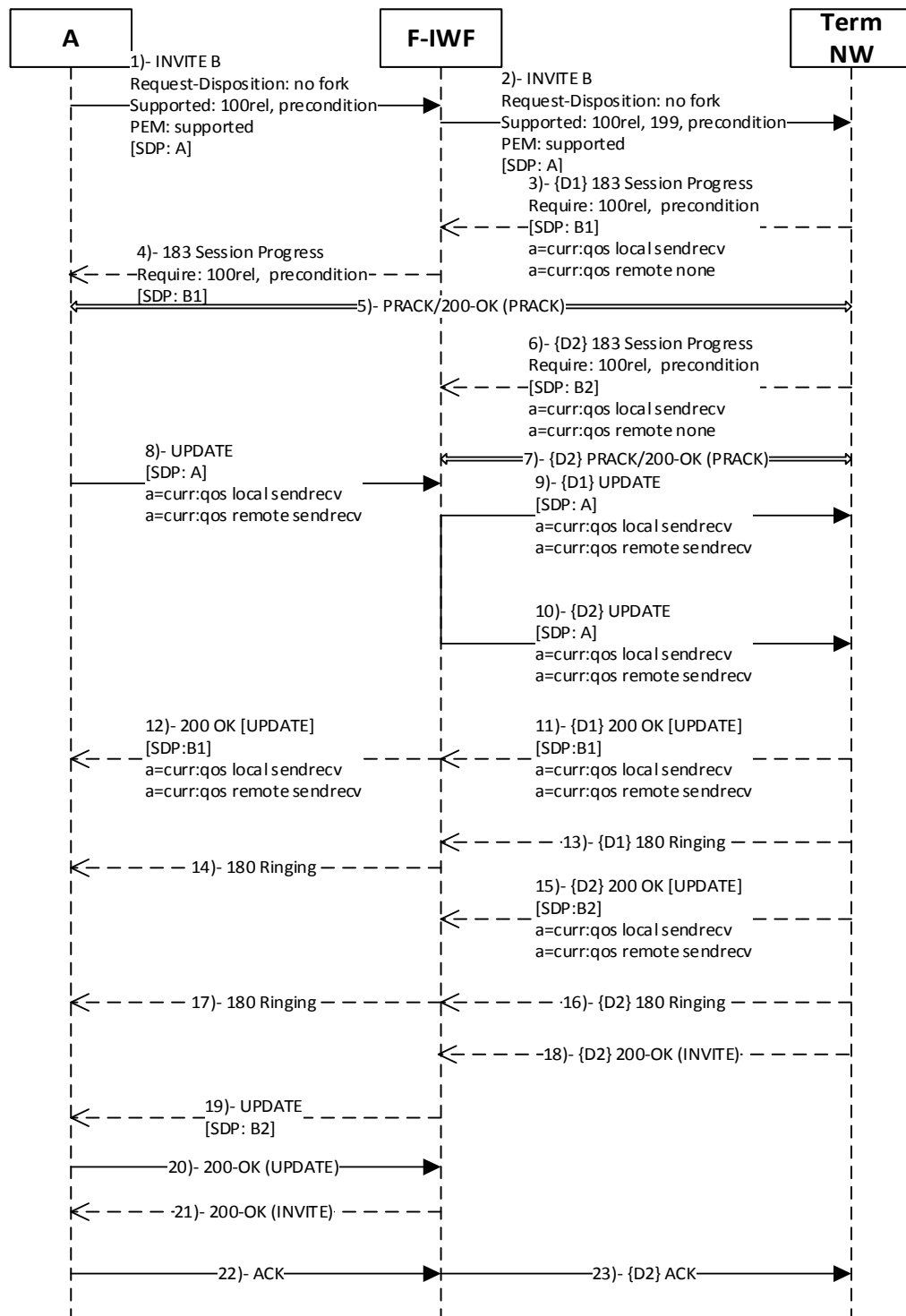


Figure 6 Caller Precondition Propagation



1. UE-A sends an INVITE message in order to establish communication with UE-B. The INVITE contains header "Supported: 100rel, 199, and precondition", the SDP contains QoS preconditions where local preconditions haven't been fulfilled and media direction line is sendrecv
2. Forking-IWF is enabled and triggered on NWAAS and routes the INVITE towards the terminating network on early dialog 1 (D1)
3. Terminating network sends 183 requiring 100rel and precondition with SDP answer (B1) on D1.
4. NWAAS maps the first SDP answer towards UE-A and forwards 183 to UE-A.
5. NWAAS forwards PRACK and 200 OK for PRACK transparently between UE-A and the terminating network.
6. Terminating network sends 183 (Require: 100rel, precondition) with SDP answer (B2) on early dialog 2 (D2) and reaches NWAAS.
7. Because the first SDP answer B1 on D1 has been forwarded to UE-A and the 183 on D2 does not contain an authorized media, NWAAS stops 183 on D2, buffers the SDP and handles the negotiation on D2 on behavior of UE-A.
8. UE-A has allocated the necessary resources and sends UPDATE message containing SDP indicating that preconditions are fulfilled:

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=sendrecv
```

NWAAS propagate A's precondition to all remote users

9. NWAAS send UPDATE with SDP:A to terminating network D1,

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=sendrecv
```

10. NWAAS send UPDATE with SDP:A to terminating network D2,

```
m=audio 12345 RTP/AVP 0
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=sendrecv
```

11. Terminating network D1 send 200 OK of UPDATE as answer with SDP:B1



12. NWAS send 200 OK with SDP:B1 to UE-A
13. 180 Ringing on D1 arrives at NWAS.
14. NWAS forwards 180 Ringing transparently to UE-A.
15. Terminating network D2 send 200 OK as answer with SDP:B2. NWAS checks that there is an ongoing authorized media and UPDATE is not for this ongoing media. As a result, NWAS decides NOT to forward this UPDATE to A and buffers SDP:B2
16. 180 Ringing on D1 arrives at NWAS.
17. NWAS forwards 180 Ringing transparently to UE-A.
18. Terminating network answers the call with 200 OK on D2.
19. Because the current negotiated media is the announcement on D1, NWAS decides to update UE A with the buffered SDP:B2 (received on step 11).

NWAS sends UPDATE with SDP:B2 offer to UE-A.
20. UE-A answers 200 OK for UPDATE with SDP answer A2.
21. NWAS sends 200 OK for INVITE to UE-A.
22. UE-A answers 200 OK for INVITE with ACK.
23. NWAS forwards ACK to terminating network on D1.

The call is established.

2.5.2.3 Media Perservation

Preconditions:

- F-IWF function license present
- mtasFolwAdministrativeState: Unlocked
- mtasFolwMode: ORIGINATING_AND_TERMINATING (2)

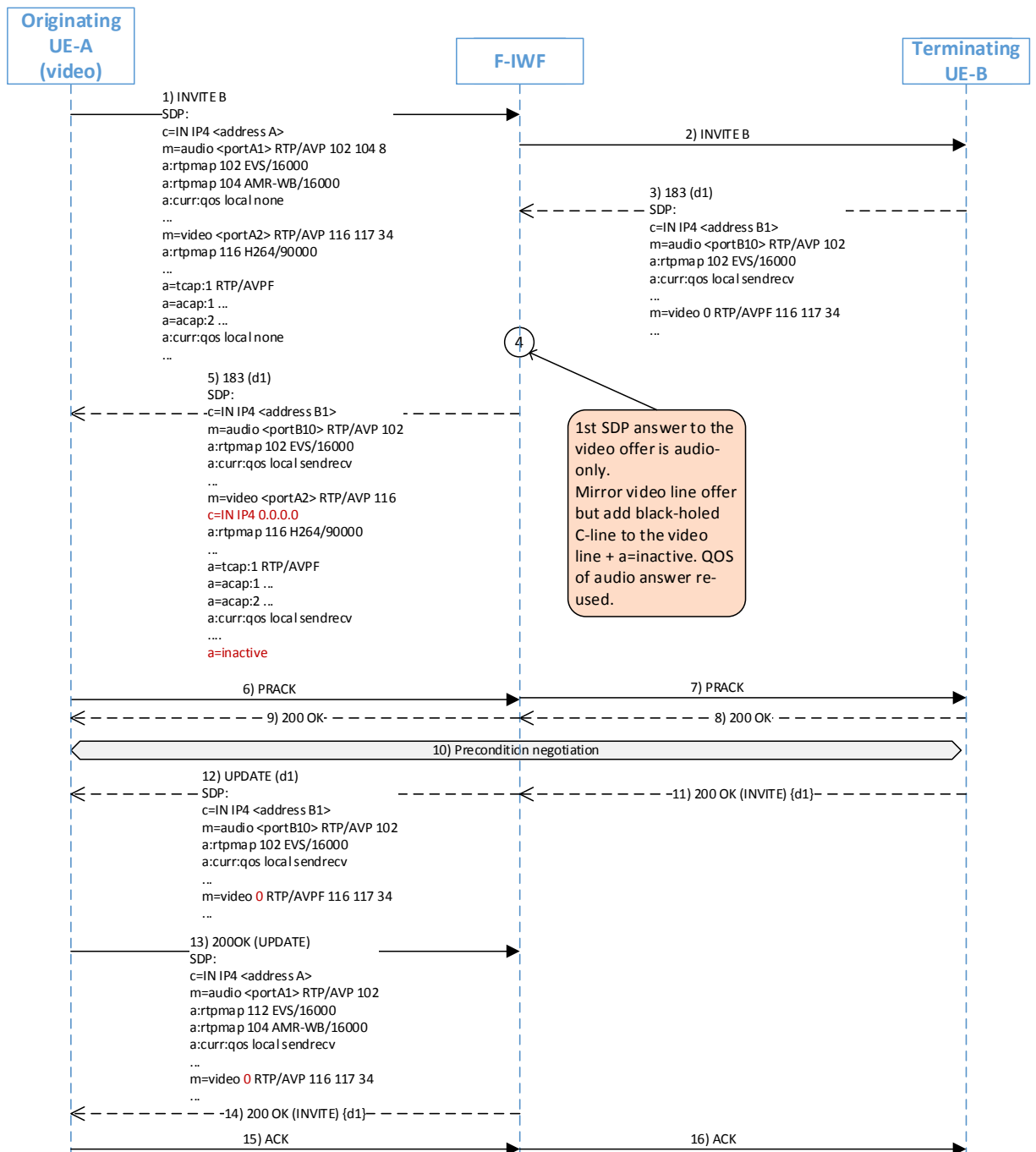


Figure 7 Media Preservation

1. INVITE from originating UE offering both audio and video
2. INVITE forwarded to terminating NW
3. Provisional response from audio-only terminating UE



4. F-IWF service determines that the first SDP answer is audio-only. The video media stream of the originating offer is mirrored and added to the SDP answer but with a black-holed c-line with media state 'inactive'. The QOS state of the audio stream in the SDP answer is re-used for the video stream. If there is more than one m-line in response, take the QOS from the 1st m-line.

Note: when mirror the video line, remove every codec except the preferred one (1st one).

5. 183 send to originating UE including an audio+video SDP offer.
6. PRACK from originating UE
7. PRACK relayed to terminating UE
8. 200OK(PRACK) from the terminating UE
9. 200OK(PRACK) relayed to originating UE
10. Precondition negotiation might be performed between the endpoints. If UPDATE from UE-A will contain video again, blackhole it.
11. D1 send 200OK to answer the call
12. F-IWF send UPDATE to UE-A, since the 200 OK is from audio-only device, set the port of video line to 0.
13. UE-A send 200 OK UPDATE to F-IWF
14. F-IWF forward the 200 OK (INVITE) from D1 to UE-A
15. UE-A send ACK
16. F-IWF forward ACK to D1

3 Network AS Known Limitation

- 1) Current release supports only QoS preconditions fulfillment on behalf of terminating UE.
- 2) Media direction sendrecv is only supported in Initial INVITE with QoS precondition negotiation request.

3.1 Geographical Redundancy

3.1.1 Description

NW AS supports geographical redundancy meaning that the IMS system can be configured with two NW ASs. If the primary NW AS is restarting or unavailable, the secondary NW AS can be used in the system.



4 Acronyms and Abbreviations

NW AS	Network Application Server
B2BUA	Back to Back User Agent
Communication IWF	Communication Interworking Function
AS	Application Server
QoS	Quality of Service
MMTel	Multi-Media Telephony
QoS	Quality of Service
S-CSCF	Serving-CSCF
SR-VCC	Single Radio Voice Call Continuity
UA	User Agent
UE	User Equipment
VoLTE	Voice over LTE
MRFP	Media Resource Function Point



5 Reference Documents

- [1] MTAS Technical Product Description Common Features 1/221 02-FGC 101 2990
- [2] MTAS Technical Product Description MMTel AS 2/221 02-FGC 101 2990