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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

    is   (or any other verb in the indicative mood) indicates a statement of fact

    is not   (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document provides the protocol details for enhancements to IMS multimedia telephony communication services enabled by supporting the IMS data channel and for AR communication which is one of the applications based on IMS data channel capability, based on stage 1 requirements in 3GPP TS 22.261 [2] and stage 2 requirements in 3GPP TS 23.228 [3].

The present document is applicable to User Equipment (UE), Application Servers (AS)and IP Multimedia (IM) Core Network (CN) subsystem which are intended to support IMS multimedia telephony communication services supporting the IMS data channel and AR communication which is one of the applications based on IMS data channel capability.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2]   3GPP TS 22.261: "Service requirements for the 5G system; Stage 1".

[3]   3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

[4]   3GPP TS 26.114: "IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

[5]   IETF RFC 5688: "A Session Initiation Protocol (SIP) Media Feature Tag for MIME Application Subtype".

[6]   IETF RFC 6809: "Mechanism to Indicate Support of Features and Capabilities in the Session Initiation Protocol (SIP)".

[7]   IETF RFC 3264: "An Offer/Answer Model with the Session Description Protocol (SDP)".

[8]   3GPP TS 22.173: "IP Multimedia Core Network Subsystem (IMS) Multimedia Telephony Service and supplementary services; Stage 1".

[9]   3GPP TS 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".

[10]   3GPP TS 24.173: "IMS Multimedia telephony communication service and supplementary services; Stage 3".

[11]   3GPP TS 24.275: "Management Object (MO) for Basic Communication Part (BCP) of IMS Multimedia Telephony (MMTEL) communication service".

[12]   3GPP TS 24.629: "Explicit Communication Transfer (ECT) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification".

[13]   3GPP TR 22.873: "Study on evolution of the IP Multimedia Subsystem (IMS) multimedia telephony service".

[14]   IETF RFC 8864: "Negotiation Data Channels Using the Session Description Protocol (SDP)".

[15]   3GPP TS 24.147: "Conferencing using the IP Multimedia (IM) Core Network (CN) subsystem".

[16]   3GPP TS 24.604: "Communication Diversion (CDIV) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification".

[17]   3GPP TS 24.615: "Communication Waiting (CW) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification".

[18]   3GPP TS 29.175: "IP Multimedia Subsystem; IP Multimedia Subsystem (IMS) Application Server (AS) Services; Stage 3".

[19]   3GPP TS 29.176: "IP Multimedia Subsystems (IMS); Media Function (MF) Services; Stage 3".

[20]   3GPP TS 32.260: "Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging".

[21]   3GPP TS 32.255: "Telecommunication management; Charging management; 5G data connectivity domain charging; stage 2".

[22]   3GPP TS 24.647: "Advice Of Charge (AOC) using IP Multimedia (IM) Core Network (CN) subsystem".

[23]   3GPP TS 24.239: "Flexible Alerting (FA) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification".

[24]   3GPP TS 24.174: "Support of multi-device and multi-identity in the IP Multimedia Subsystem (IMS); Stage3.

[25]   3GPP TS 24.642: " Completion of Communications to Busy Subscriber (CCBS) and Completion of Communications by No Reply (CCNR) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification".

[26]   3GPP TS 24.183: "IP Multimedia Subsystem (IMS) Customized Ringing Signal (CRS); Protocol specification".

[27]   3GPP TS 24.182: "IP Multimedia Subsystem (IMS) Customized Alerting Tones (CAT); Protocol specification".

[28]   3GPP TS 24.628: "Common Basic Communication procedures using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification".

[29]   3GPP TS 26.264: "IMS-based AR Real-Time Communication".

[30]   3GPP TS 31.103: "Characteristics of the IP multimedia services identity module (ISIM) application".

[31]   3GPP TS 31.102: "Characteristics of the Universal Subscriber Identity Module (USIM) application".

[32]   3GPP TS 24.610:" Communication HOLD (HOLD) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification".

3   Definitions of terms, symbols and abbreviations

3.1   Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

IMS data channel application: An IMS data channel application is an application using IMS data channel capability to provide IMS services.

AR anchor: AR anchor is meant to identify a point in the user space to be used to anchoring a visual object. It is kind of metadata allowing accurate overlaying/rendering of text, graphics or video contents.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.228 [3] apply:

> **Bootstrap data channel**
> **Application data channel**
> **IMS communication service**
> **IMS Communication Service Identifier (ICSI)**

The following terms and definitions given in 3GPP TS 26.264 [29] apply:

> **AR media**
> **Split rendering**

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

AR	Augmented Reality
AOC	Advice Of Charge
AS	Application Server
CAT	Customized Alerting Tones
CB	Communication Barring
CCBS	Completion of Communications to Busy Subscriber
CCNL	Completion of Communications on Not Logged-in
CCNR	Completion of Communications by No Reply
CD	Communication Deflection
CDIV	Communication DIVersion
CFB	Communication Forwarding Busy
CFNL	Communication Forwarding on Not Logged-in
CFNR	Communication Forwarding No Reply
CFNRc	Communication Forwarding on subscriber Not Reachable
CFU	Communication Forwarding Unconditional
CN	Core Network
CONF	Conference
CRS	Customized Ringing Signal
CW	Communication Waiting
DC	Data Channel
DCSF	Data Channel Signalling Function
CUG	Closed User Group
eCNAM	Enhanced Calling Name
ECT	Explicit Communication Transfer
FA	Flexible Alerting
HOLD	Communication Hold
ICSI	IMS Communication Service Identifier
IM	IP Multimedia
IMS	IP Multimedia Core Network Subsystem
ISIM	IM Subscriber Identity Module
MF	Media Function
MiD	Multi-iDentity
MMTel	Multimedia Telephony
MuD	Multi-Device
MWI	Message Waiting Indication
OIP	Originating Identification Presentation
OIR	Originating Identification Restriction

TIP	Terminating Identification Presentation
TIR	Terminating Identification Restriction
UE	User Equipment
UICC	Universal Integrated Circuit Card
URN	Uniform Resource Name
USIM	Universal Subscriber Identity Module

4   General

According to 3GPP TS 23.228 [3], IMS multimedia telephony service supporting IMS data channel includes IMS data channel capability negotiation and IMS data channel setup. AR communication which is application based on IMS data channel capability, provisioned to the UE as an IMS data channel application, includes respective application domain specific media capability negotiation and media processing (e,g. AR communication).

5   Functional entities

5.1   General

This clause specifies the functionalities of the functional entities for IMS data channel.

5.2   UE

An UE supporting IMS data channel has the following functionalities:

-    support IMS data channel capability negotiation; and

-    support bootstrap data channel and application data channel establishment and management.

Additionally, the UE supporting the IMS data channel capability and provisioned with AR communication, which is an application having IMS data channel capability, supports the following functionalities:

-    support application's domain specific media capability exchange; and

-    support application's domain specific media processing.

5.3   IMS AS

The IMS AS interacts with the DCSF and the MF.

For functionalities of the IMS AS supporting IMS data channel refer to 3GPP TS 23.228 [3] clause AC.2.2.4.

For the IMS AS interaction with the Media Function (MF) refer to 3GPP TS 29.176 [19].

For the IMS AS interaction with the Data Channel Signalling Function (DCSF) refer to 3GPP TS 29.175 [18].

6   Operational requirements

6.1   Provision/withdrawal

IMS Multimedia Telephony communication service enhanced to support IMS data channel is provided after prior arrangement with the service provider.

IMS Multimedia Telephony communication service enhanced to support IMS data channel is withdrawn at the user's request or for administrative reasons.

7 Basic communication

7.1 IMS Session Control

The IMS multimedia telephony communication enhanced to support the IMS data channel applications shall support data channel media specified in clause 6.2.10 of 3GPP TS 26.114 [4] in addition to MMTel media types listed in 3GPP TS 22.173 [8]. The session control procedures for the different media types shall be in accordance with 3GPP TS 24.229 [9], 3GPP TS 24.173 [10] and clause 9.

The usage of IMS data channel media streams in MMTel session is negotiated using the SDP offer/answer procedures defined in IETF RFC 3264 [7]. If the received SDP offer contains IMS data channel media stream(s) and if the receiving entity does not want to use the IMS data channels, the receiving entity shall reject the offered data channel media stream(s) by setting the port number of the rejected data channel media stream(s) to zero in created SDP answer.

7.2 IMS communication service identifier (ICSI)

The MMTel service enhanced to support IMS Data Channel shall use the ICSI value defined in 3GPP TS 24.173 [10] clause 5.1. The UE and IMS AS shall handle the ICSI value as specified in 3GPP TS 24.229 [9].

NOTE: Based on the operator policy, the subclass identifier ".imsdc" can be used within the MMTel ICSI URN.

8 IMS data channel applications

8.1 Procedures at the UE

Once the bootstrap data channels have been established, if the IMS data channel applications are available, based on the IMS data channel applications list received via the established bootstrap data channel, the UE shall download through the established bootstrap data channel the IMS data channel applications. The UE shall follow the procedures in clause 9.3.2.1.3 to set up an application data channel and include in the re-INVITE request the updated SDP offer with negotiated bootstrap data channel media description, the requested application data channel media description as well as the associated data channel application binding information (provided within the "a=3gpp-req-app" SDP attribute), according to 3GPP TS 23.228 [3] and 3GPP TS 26.114 [4].

8.2 Procedures at the IMS AS

After the bootstrap data channels have been established, if the IMS AS received a re-INVITE request with an SDP offer containing application data channels media descriptions (identified by "dcmap" attribute lines containing "stream-id" parameter set to values starting at 1000 and associated "a=3gpp-req-app" attribute lines as specified in 3GPP TS 26.114 [4]), the IMS AS shall notify the DCSF, may trigger the reservation or update of corresponding application data channel media resources upon the instruction from the DCSF and shall send re-INVITE request with the SDP offer containing the requested application data channel and related bootstrap data channel media descriptions according to the specific data channel application use case (e.g. P2P/P2A/P2A2P), following the procedures in 3GPP TS 23.228 [3] and clauses 9.3.2.2 and 9.3.3.2.2.

9 Signalling Procedures

9.1 General

This clause provides the following signalling procedures for IMS data channel:

- IMS data channel capability negotiation or indication during IMS initial registration, re-registration and session establishment;

- IMS data channel establishment which includes both bootstrap data channel and application data channel establishment during session establishment and modification;

- IMS data channel shutdown which includes both bootstrap data channel and application data channel; and

- abnormal cases.

9.2 IMS data channel capability negotiation

9.2.1 IMS data channel capability negotiation during IMS initial registration

9.2.1.1 Procedure at the UE

The policy related to the UE supporting the IMS data channel can be provided by the network to the UE using e.g. OMA-DM with the management objects specified in 3GPP TS 24.275 [11], ISIM with EF_{IMSDCI} file specified in 3GPP TS 31.103 [30] or USIM with EF_{IMSDCI} file specified in 3GPP TS 31.102 [31]. When the UE is configured as specified in 3GPP TS 24.275 [11], 3GPP TS 31.103 [30] or 3GPP TS 31.102 [31] with configuration for IMS data channel allowed then the UE determines support for IMS data channel according to the configuration. If the UE is configured with both IMS_DC_configuration node and EF_{IMSDCI} file, then the EF_{IMSDCI} file shall take precedence.

If the UE is configured with IMS_DC_configuration node specified in 3GPP TS 24.275 [11] or EF_{IMSDCI} file specified in 3GPP TS 31.103 [30] or 3GPP TS 31.102 [31], and the DC_allowed leaf of the IMS_DC_configuration node or IMS DC Establishment Indication of the EF_{IMSDCI} file indicates that IMS data channel is allowed, then a UE supporting IMS data channel on sending an unprotected REGISTER request shall include the media feature tag defined in IETF RFC 5688 [5] for supported streaming media type. For the IMS data channel capability indication, the UE shall use +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4].

   NOTE: Precedence for EF_{IMSDCI} file configured on both the USIM and ISIM is defined in 3GPP TS 31.102 [31].

On receiving the 200 (OK) response to the REGISTER request, if the 200 (OK) response includes a Feature-Caps header field containing feature-capability indicator "g.3gpp.datachannel", the UE shall determine that the home network supports the IMS data channel capability as specified in 3GPP TS 23.228 [3].

9.2.1.2 Procedure at the IMS AS

Upon receipt of a third-party REGISTER request, if the Contact header field of the REGISTER request in the body including a media feature tag for supported streaming media type containing +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4], the IMS AS shall store this IMS data channel capability indication and determine the UE supports the IMS data channel capability.

9.2.2 IMS data channel capability negotiation during IMS re-registration

9.2.2.1 Procedure at the UE

If the UE is allowed to use IMS data channel, on reception of Re-REGISTER request, for user-initiated reregistration, the UE supporting IMS data channel shall include the media feature tag defined in IETF RFC 5688 [5] for supported streaming media type. For the IMS data channel capability indication, the UE shall use +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4].

NOTE: The policy related to the IMS data channel allowed at the UE, can be provided by the network to the UE using e.g., OMA-DM with the management objects specified in 3GPP TS 24.275 [11] or UICC configuration, as specified in clause 9.2.1.1.

On receiving the 200 (OK) response to the Re-REGISTER request, if the 200 (OK) response includes a Feature-Caps header field containing feature-capability indicator "g.3gpp.datachannel", the UE shall determine that the home network supports the IMS data channel capability as specified in 3GPP TS 23.228 [3].

The UE shall continue to indicate its IMS data channel capability as specified in the above procedure when the UE has successfully done the IMS data channel capability negotiation during IMS initial registration or re-registration.

On receiving the 200 (OK) response to the REGISTER request, if the 200 (OK) response does not include a Feature-Caps header field containing feature-capability indicator "g.3gpp.datachannel", the UE shall keep established data channel media of the UE's existing IMS session.

9.2.2.2   Procedure at the IMS AS

Upon receipt of a third-party REGISTER request, if the Contact header field of the REGISTER request in the body including a media feature tag for supported streaming media type containing +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4], the IMS AS shall store this IMS data channel capability indication and determine the UE supports the IMS data channel capability.

9.2.3   IMS data channel capability indication during IMS session establishment and modification

9.2.3.1   Procedure at the UE

Upon generating an initial INVITE request or a re-INVITE request, the UE supporting IMS data channel and is allowed to use IMS data channel and if the UE determined its home network supports the IMS data channel capability, the UE shall include the media feature tag defined in IETF RFC 5688 [5] for supported streaming media type in the Contact header field to the remote UE and use +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4], regardless of IMS data channel media description being part of the SDP or not. The UE may include in the initial INVITE request an Accept-Contact header field containing the "sip.app-subtype" media feature tag defined in IETF RFC 5688 [5] with a value of "webrtc-datachannel" as specified in 3GPP TS 24.173 [10].

Upon receiving an initial INVITE request or a re-INVITE request, the UE supporting IMS data channel and configured with IMS data channel is allowed shall use +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] when including the media feature tags defined in IETF RFC 5688 [5] for supported streaming media type in the Contact header field in the SIP response, regardless of IMS data channel media description being part of the SDP or not.

9.3   MMTel session procedures

9.3.1   General

The support of the IMS data channel is optional.

The session control procedures for IMS multimedia telephony communication service with IMS data channel shall be in accordance with 3GPP TS 24.173 [10] with the additions defined in the present document.

9.3.2   Originating side

9.3.2.1   Procedures at the UE

9.3.2.1.1   General

The UE shall only initiate an MMTel session with an IMS data channel if the UE has determined that the UE and the home network supports the IMS data channel capability.

The policy related to the UE supporting the IMS data channel can be provided by the home network to the UE using e.g. OMA-DM with the management objects specified in 3GPP TS 24.275 [11] or UICC configuration, as specified in clause 9.2.1.1. When the UE is configured by home network with configuration for IMS data channel, then the UE may setup the IMS data channel.

If the UE is configured with IMS_DC_configuration node specified in 3GPP TS 24.275 [11] and:

a) DC_allowed leaf indicates that IMS data channel is not allowed, the UE shall not include data channel capability indication and data channel related media description in SDP offer;

b) DC_allowed leaf indicates that IMS data channel is allowed, and:

  1) if DC_Setup_Option leaf is configured and indicates the IMS data channel is allowed to be setup simultaneously while establishing an MMTel session, the UE:

    - shall include the bootstrap data channel related media description in SDP offer within the initial INVITE request as described in clause 9.3.2.1.2 to setup the bootstrap data channel;

  NOTE 1: If the bootstrap data channel was not established during the MMTel session establishment, the UE can try to setup the bootstrap data channel as described in clause 9.3.2.1.3.

  2) if DC_Setup_Option leaf is configured and indicates the IMS data channel is not allowed to be setup simultaneously while establishing an MMTel session, the UE shall generate a re-INVITE request for the bootstrap data channel setup and include the bootstrap data channel related media description in SDP offer as described in clause 9.3.2.1.3 to setup the bootstrap data channel; and

  3) if the UE receives an initial INVITE or a re-INVITE request including the bootstrap data channel related media description in SDP offer, the UE shall generate an SDP answer as described in clause 9.3.3.1.

If the UE is configured with EF$_{IMSDCI}$ file specified in 3GPP TS 31.103 [30] or 3GPP TS 31.102 [31] and:

a) if IMS DC Establishment Indication indicates that IMS data channel is not allowed, the UE shall not include data channel capability indication and data channel related media description in SDP offer;

b) if IMS DC Establishment Indication indicates that IMS data channel is allowed and allowed to be setup simultaneously while establishing an MMTel session, the UE shall include the bootstrap data channel related media description in SDP offer within the initial INVITE request as described in clause 9.3.2.1.2 to setup the bootstrap data channel;

  NOTE 2: If the bootstrap data channel was not established during the MMTel session establishment, the UE can try to setup the bootstrap data channel as described in clause 9.3.2.1.3.

c) if IMS DC Establishment Indication indicates that IMS data channel is allowed but not allowed to be setup simultaneously while establishing an MMTel session, the UE shall generate a re-INVITE request for the bootstrap data channel setup and include the bootstrap data channel related media description in SDP offer as described in clause 9.3.2.1.3 to setup IMS data channel; and

d) if IMS DC Establishment Indication indicates that IMS data channel is allowed, if the UE receives an initial INVITE or a re-INVITE request including the bootstrap data channel related media description in SDP offer, the UE shall generate an SDP answer as described in clause 9.3.3.1.

9.3.2.1.2 IMS bootstrap data channel setup in conjunction with MMTel session setup

If the UE initiates an MMTel session with IMS data channels, the UE:

1) shall generate an initial INVITE request in accordance with 3GPP TS 24.229 [9] and 3GPP TS 24.173 [10];

2) shall include the media feature tag defined in IETF RFC 5688 [5] for supported streaming media type with +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] in the Contact header field;

3) may include an Accept-Contact header field containing the "sip.app-subtype" media feature tag defined in IETF RFC 5688 [5] with a value of "webrtc-datachannel" as specified in 3GPP TS 26.114 [4]; and

4) if the configuration described in clause 9.3.2.1.1, allows the establishment of bootstrap data channels simultaneously with the setup of the MMTel session, shall include an SDP offer containing the media descriptions for the MMTel media according 3GPP TS 24.173 [10] and data channel media descriptions for both the local and remote bootstrap data channels in accordance with 3GPP TS 26.114 [4].

9.3.2.1.3 IMS data channel setup in conjunction with MMTel session modification

9.3.2.1.3.1 IMS bootstrap data channel establishment

If the UE wants to establish a bootstrap data channel, the UE shall take into account the data channel configuration as specified in clause 9.3.2.1.1, and if the UE determines that the configuration allows the establishment of IMS data channels after the establishment of the MMTel session, the UE shall:

1) generate a re-INVITE request in accordance with 3GPP TS 24.229 [9] and 3GPP TS 24.173 [10];

2) include the media feature tag defined in IETF RFC 5688 [5] for supported streaming media type with +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] in the Contact header field; and

3) include an updated SDP offer that contains data channel media descriptions for both the local and remote bootstrap data channels according to 3GPP TS 26.114 [4].

Upon receiving a re-INVITE request to establish a bootstrap data channel, the procedure defined in clause 9.3.3.1.3.1 applies.

9.3.2.1.3.2 IMS application data channel establishment

If a UE wants to establish an application data channel within an existing MMTel session and if the UE has an established bootstrap data channel associated with the MMTel session available, the UE:

1) shall generate a re-INVITE request in accordance with 3GPP TS 24.229 [9] and 3GPP TS 24.173 [10];

2) shall include the media feature tag defined in IETF RFC 5688 [5] for supported streaming media type with +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] in the Contact header field; and

3) shall include an updated SDP offer that contains the data channel media descriptions for the bootstrap data channels, as well as the requested application data channel and the associated DC application binding information (provided within the "a=3gpp-req-app" SDP attribute), according to 3GPP TS 26.114 [4].

If the UE has an established bootstrap data channel associated with the MMTel session available and if the UE receives the re-INVITE request with an SDP offer which includes data channel media descriptions for the bootstrap data channel, as well as the requested application data channel, the procedure defined in clause 9.3.3.1.3.2 applies.

9.3.2.1.4 Closing IMS application data channel in conjunction with MMTel session modification

If the UE wants to close an established application data channel during the session modification by sending re-INVITE request with the subsequent SDP offer, the UE shall remove the "a=dcmap" attribute line associated with the closed application data channel and, if the associated "a=3gpp-req-app" attribute references only the closed application data channel, the "a=3gpp-req-app" attribute line from the data channel media description as defined in IETF RFC 8864 [14] clause 6.6.1 or set the UDP port number of the data channel media description to zero if no other "a=dcmap" attribute line associated with an application data channel existed in this data channel media description.

If the UE receives a re-INVITE request with an SDP offer in which the UDP port number of the data channel media description was set to zero or the "a=dcmap" line associated with an application data channel was removed from the data channel media description, and the UE accepts the application data channel termination, it shall return a 200 (OK) response to the re-INVITE request with the generated SDP answer based on the IETF RFC 8864 [14].

The UE shall not close the bootstrap data channel during MMTel session modification procedure.

NOTE: The application data channel termination during the session modification does not impact the ongoing audio, video or other data channels within the MMTel session.

9.3.2.1.5 Closing IMS data channel in conjunction with MMTel session release

When the UE releases an MMTel session that has associated bootstrap and application data channels, the UE shall apply procedures defined in 3GPP TS 24.229 [9] clause 5.1.5 and shall close bootstrap and application data channels.

9.3.2.2 Procedure at the IMS AS

9.3.2.2.1 IMS bootstrap data channel establishment in conjunction with MMTel session setup

Based on served user service specific data which is enhanced with IMS data channel specific service details, if the IMS AS received an initial INVITE request with an SDP offer containing media description for IMS data channels, the IMS AS shall determine whether the served user is authorized to use IMS data channel.

If the served user is not authorized to use IMS data channel, then based on the operator policy the IMS AS shall determine whether to remove from the SDP offer media lines related to the IMS data channels:

- If the operator policy indicates removal of media lines related to the IMS data channels, the IMS AS shall remove media lines describing the bootstrap data channel(s) i.e. "dcmap" attribute lines containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 0, 10, 100 and 110, and associated with the "m=" line containing the media set to "application", the UDP port number, the proto value set to "UDP/DTLS/SCTP" and the fmt value set to "webrtc-datachannel". If there are no other "dcmap" attribute lines that contain a subprotocol parameter set to value other than "http", the IMS AS shall remove any other SDP media attribute lines associated with that m line e.g., "sctp-port", "max-message-size", "tls-id", "a=setup", "a=3gpp-qos-hint" SDP attribute lines from the received SDP offer, and send the initial INVITE request with the modified SDP offer to the S-CSCF.

- If the operator policy does not indicate removal of media lines related to the IMS data channels, the IMS AS may forward media description describing the bootstrap data channel with "dcmap" attribute lines containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 100 and 110, and send the initial INVITE request to the S-CSCF.

Otherwise, if the served user is authorized to use IMS data channel and the DCSF is not selected, the IMS AS shall select a DCSF and notify the DCSF about the session establishment request event, and shall not send the initial INVITE request to the S-CSCF until receiving an acknowledgement to the corresponding notification from the DCSF.

Based on the received Media instruction set from the DCSF, the IMS AS shall select a MF and request the MF to allocate required data channel media resources. Based on the response of the reserved media resource from the MF, the IMS AS shall:

1) delete the bootstrap data channel media description terminated locally, i.e. local bootstrap data channel for the originating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 0 and 10);

2) replace the IP address represented in the attribute lines "c=" line, the UDP port number in the "m=application" line, as well as the DC endpoint information represented as the attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" within the remote bootstrap data channel media description for the originating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 100 and 110), i.e. the remote bootstrap data channel between the originating UE and terminating network, received in the SDP offer with the media resource information for the termination towards the remote network allocated on the MF if the media is anchored on the originating MF, and add "a=3gpp-bdc-used-by:" attribute line containing "bdc-used-by" parameter set to value "sender" if not present; and

3) generate and add the remote bootstrap data channel media description for the terminating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 100 and 110 and "a=3gpp-bdc-used-by:" attribute with "bdc-used-by" parameter set to value "receiver"), i.e. remote bootstrap data channel between the originating network and the terminating UE.

Upon the reception of the successful acknowledgement to the corresponding notification from the DCSF, the IMS AS shall send the initial INVITE request with audio, video and modified data channel SDP offer to the S-CSCF towards the terminating network.

Upon receipt the 18x or 2xx response on the initial INVITE request including the SDP answer which includes the data channel media description, the IMS AS shall notify the DCSF about corresponding session event (session establishment progress (i.e. receiving the 183 (Session Progress) response), session establishment alerting (i.e. receiving the 180 (Ringing) response) or session establishment success (i.e. receiving 200 (OK) response) event) and shall request the MF to update the media resource. Based on the media resource update response from the MF, the IMS AS shall:

1) delete the remote bootstrap data channel media description for the terminating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 100 and 110 and "a=3gpp-bdc-used-by" attribute with "bdc-used-by" parameter set to value "receiver"), i.e. the remote bootstrap data channel between terminating UE and originating network from the SDP answer;

2) replace the IP address represented in the "c=" line, the UDP port number in the "m=application" line, as well as the DC endpoint information represented as the attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" within the remote bootstrap data channel media description for originating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 100 and110 and "a=3gpp-bdc-used-by" attribute with "bdc-used-by" parameter set to value "sender") in the SDP answer if the media is anchored on the MF, i.e. the remote data channel for the originating UE between originating UE and terminating network, with the media resource information for the termination towards the originating UE to the terminating network allocated by the MF; and

3) generate and add the local bootstrap data channel media description for the originating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 0 and10), i.e. the local bootstrap data channel between originating UE and originating network in the SDP answer.

Upon the reception of an acknowledgement from the DCSF to the corresponding notification, the IMS AS shall include the modified SDP answer for data channel in the 18x or 2xx response and send 18x or 2xx response to S-CSCF towards the originating UE.

Upon receipt of a CANCEL request to the initial INVITE request, the IMS AS shall notify the DCSF about the session establishment cancellation, request the MF to release the corresponding data channel media resources, and forward the CANCEL request to the S-CSCF towards the terminating network.

Upon receipt of a 4xx, 5xx or 6xx response on the initial INVITE request from the terminating network, the IMS AS shall notify the DCSF about session establishment failure, and request the MF to release the data channel media resources.

9.3.2.2.2 MMTel session modification

9.3.2.2.2.1 IMS bootstrap data channel establishment

If the IMS AS received from the originating UE a re-INVITE request with the SDP offer containing data channel media description for the bootstrap data channel establishment, the IMS AS shall determine whether the served user is authorized to use IMS data channel or not as specified in clause 9.3.2.2.1.

- if the served user is not authorized to use IMS data channel, the procedure defined in clause 9.3.2.2.1 applies; and

- if the served user is authorized to use IMS data channel, the IMS AS shall select a DCSF and notify the DCSF about the media change request event and modify the data channel media description in the SDP offer and send the re-INVITE request as per clause 9.3.2.2.1. Upon receipt of the 183 (Session Progress) or 200 (OK) response to the re-INVITE request, the IMS AS shall send notify the DCSF about the media change success if the data channel media is accepted or media change failure if the data channel media is rejected and modify the data channel media description in the SDP answer and send the 183 (Session Progress) or 200(OK) response to S-CSCF as per clause 9.3.2.2.1. Upon receipt of a CANCEL request to the re-INVITE request, the IMS AS shall notify the DCSF about the media change cancellation, request the MF to release the corresponding data channel media resources, and forward the CANCEL request as per clause 9.3.2.2.1. Upon receipt of a 4xx, 5xx or 6xx response on the re-INVITE request, the IMS AS shall notify the DCSF about the media change failure and forward the response to the originating UE.

If the IMS AS received from the terminating network a re-INVITE request with the SDP offer containing data channel media description for the bootstrap data channel establishment, the procedure of the IMS AS in the terminating network on receipt of a re-INVITE request from the originating network defined in clause 9.3.3.2.2.1 applies.

9.3.2.2.2.2 IMS application data channel establishment

After the DCSF is selected, upon receipt of the re-INVITE request with an SDP offer which contains

- a new application data channel media description (the media line with the "dcmap" attribute containing "stream-id" parameter set to values starting at 1000) along with the video, audio, and bootstrap data channel media descriptions, the IMS AS shall notify to DCSF about a media change request event and request the MF to allocate media resources for the application data channels based on the instruction from the DCSF if the media is anchored on the MF, and shall not send a re-INVITE request to the S-CSCF until receiving an acknowledgement to the corresponding notification from the DCSF.

- Based on the response on the data channel media resource update from the MF as specified in 3GPP TS 29.176 [19] and media instruction from the DCSF as specified in 3GPP TS 29.175 [18], the IMS AS shall:

  1) delete the data channel media description (media line with the "dcmap" attribute containing "stream-id" parameter set to values starting at 1000 and "a=3gpp-req-app " attribute with "endpoint" parameter set to value "server") if the media instruction from the DCSF is to terminate that media;

  2) delete the data channel media description if the media instruction from the DCSF is to reject the media;

  3) replace the IP address represented in the "c=" line, the UDP port number in the "m=application"in the data channel media description in the SDP offer with the media resource information for the termination towards the terminating network which is allocated by the MF if the media instruction from the DCSF is to terminate and originate the media; and also replace the DC endpoint information represented as the attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" when the media proxy configuration is HTTP proxy; and

  4) generate and add a data channel media description (media line with the "dcmap" attribute containing "stream-id" parameter set to values starting at 1000 and "a=3gpp-req-app " attribute with "endpoint" parameter set to value "server") by using the DC stream information provided by the DCSF in the attribute lines "a=dcmap" and "a=3gpp-req-app", DC endpoint information of the DC AS in the attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup", IP address and UDP port number allocated on the termination towards to the terminating network on the MF in the "c=" line and "m=application" line when the media proxy configuration is UDP proxy, or using the DC stream information provided by the DCSF in the attribute lines "a=dcmap" and "a=3gpp-req-app", IP address, UDP port number and DC endpoint information (e.g. tlsId, sctp-port) allocated on the termination towards to the terminating network on the MF in other attribute lines above when the media proxy configuration is HTTP proxy, if the media instruction from the DCSF is to originate a new media.

- an existing application data channel media description in which a new "a=dcmap" line containing the "stream-id" parameter set to values starting at 1000 is added, the IMS AS shall notify the DCSF about media change request event, and request MF to update the media resource when receiving the media instruction from DCSF is to update the media.

Upon the reception of an acknowledgement from the DCSF to the media change request event notification, the IMS AS shall send the re-INVITE request with the modified SDP offer with the modified application data channel media description or the original application data channel media description if no media instruction received from DCSF, as well as the media description of established video, audio and bootstrap data channels.

Upon receipt of the 183 (Session Progress) or 200 (OK) response on the re-INVITE request with the SDP answer which contains media description of the requested application data channel from the terminating network,

- if the application data channel is accepted, the IMS AS shall notify the DCSF about the media change success and request the MF to update the media resources. Based on the response of the MF, the IMS AS shall:

  a) generate and add a data channel media description in the SDP answer by using the DC endpoint information of the DC AS provided by the DCSF in the attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" and IP address and UDP port number media information allocated on the termination towards to the originating UE on the MF in the "c=" and "m=application" line when the media proxy configuration is UDP proxy, or using IP address, UDP port number and DC endpoint information (e.g. tlsId, sctp-port) allocated on the termination towards to the originating UE on the MF in the attribute lines when the media proxy configuration is HTTP proxy, if the instruction from the DCSF is to terminate the media;

b) add the rejected media description and set the port number to 0 in the "m=application" line if the instruction from the DCSF is to reject the media;

c) replace the IP address represented in the "c=" line, the UDP port number in the "m=application" in the media description in the SDP answer with the media resource information on the termination towards to the originating UE allocated by the MF, if the instruction from the DCSF is to terminate and originate the media; and also replace the DC endpoint information as attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" when the media proxy configuration is HTTP proxy; and

d) delete the media description in the SDP answer if the instruction from the DCSF is to originate a new media;

and send the 183 (Session Progress) or 200 (OK) response with the modified SDP answer on the re-INVITE request to the S-CSCF towards to the originating UE after the receipt of an acknowledgement from the DCSF to the corresponding notification.

- if the application data channel is rejected, the IMS AS shall notify the DCSF about the media change failure event and request the MF to release the media resources. Then, the IMS AS shall send 183 (Session Progress) or 200 (OK) response to S-CSCF after the receipt of an acknowledgement from the DCSF to the corresponding notification.

Upon receipt of a CANCEL request to the re-INVITE request, the IMS AS shall notify the DCSF about the media change cancellation, request the MF to release the corresponding data channel media resources, and forward the CANCEL request as per clause 9.3.2.2.1.

Upon receipt of a 4xx, 5xx or 6xx response on the re-INVITE request from the terminating network, the IMS AS shall notify the DCSF about media change failure, request the MF to release the corresponding data channel media resources and forward the response to the originating UE.

Upon receiving the re-INVITE request from the terminating network to setup data channels and the corresponding response from the originating UE, the procedure in clause 9.3.3.2.2 applies.

9.3.2.2.2.3 Closing application data channel

Upon receipt of the re-INVITE request with an SDP offer which contains an existing application data channel media description in which an existing "a=dcmap" is removed, the IMS AS shall notify the DCSF about media change request event, and request MF to update the media resource when receiving the media instruction from DCSF is to update the media.

Upon receipt of the re-INVITE request with an SDP offer which contains an existing application data channel media description in which the UDP port number is set to 0, the IMS AS shall notify the DCSF about media change request event, and request the MF to release the corresponding media resource when receiving the media instruction from the DCSF is to delete the media.

Upon receipt of the 200 (OK) response on the re-INVITE message with the SDP answer, the procedure in clause 9.3.2.2.2.2 applies.

Upon receiving the re-INVITE request from the terminating network to close data channels and the corresponding 200 (OK) response from the originating UE, the procedure in clause 9.3.3.2.2.3 applies.

9.3.2.2.3 MMTel session release

Upon initiation or receipt of a BYE request matching an existing MMTel session with IMS data channel, the IMS AS shall notify session release event to the DCSF and follow the call release procedure as per 3GPP TS 24.229 [9].

IMS AS shall send media resource management request to MF to release the allocated data channel media resources for this MMTel session.

9.3.3 Terminating side

9.3.3.1 Procedures at the UE

9.3.3.1.1 General

The terminating UE can also setup or terminate data channels during the session modification.

9.3.3.1.2 IMS bootstrap data channel setup in conjunction with MMTel session setup

If the terminating UE determines that the UE and the network supports the IMS data channel, on the reception of SIP initial INVITE request, the terminating UE shall include the media feature tags defined in IETF RFC 5688 [5] for supported streaming media type with +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] in the Contact header field of SIP 18x and 2xx responses to the SIP INVITE request.

If the terminating UE receives the initial INVITE request with an SDP offer which includes the data channel media descriptions, i.e. the "m=" line containing the media set to "application", the UDP port number, the proto value set to "UDP/DTLS/SCTP" and the fmt value set to "webrtc-datachannel" and with associated "dcmap" attribute lines containing a subprotocol parameter set to "http" and any "stream-id" parameter set to values 0, 10, 100 or 110, and the terminating UE:

1) is not configured with IMS_DC_configuration node as specified in 3GPP TS 24.275 [11] and EF$_{IMSDCI}$ file specified in 3GPP TS 31.103 [30] or 3GPP TS 31.102 [31], and the terminating UE:

    a) accepts the offered bootstrap data channel(s), it shall generate the SDP answer based on the 3GPP TS 26.114 [4] and IETF RFC 8864 [14]; or

    b) does not accept the offered bootstrap data channel(s), it shall set the port number(s) of the rejected data channel media stream(s) to zero in the generated SDP answer; or

2) is configured with IMS_DC_configuration node as specified in 3GPP TS 24.275 [11] and the DC_allowed leaf indicates that IMS data channel:

    a) is allowed and if the terminating UE accepts the offered bootstrap data channel(s), it shall generate the SDP answer based on the 3GPP TS 26.114 [4] and IETF RFC 8864 [14]; or

    b) is not allowed, it shall reject the offered bootstrap data channel media stream(s) by setting the port number of the rejected data channel media stream(s) to zero in the generated SDP answer,

3) is configured with EF$_{IMSDCI}$ file specified in 3GPP TS 31.103 [30] or 3GPP TS 31.102 [31] and the IMS DC Establishment Indication indicates that IMS data channel:

    a) is allowed and if the terminating UE accepts the offered bootstrap data channel(s), it shall generate the SDP answer based on the 3GPP TS 26.114 [4] and IETF RFC 8864 [14]; or

    b) is not allowed, it shall reject the offered bootstrap data channel media stream(s) by setting the port number of the rejected data channel media stream(s) to zero in the generated SDP answer,

and the terminating UE shall return a 18x or 2xx response to the INVITE request with the above generated the SDP answer.

9.3.3.1.3 IMS data channel setup in conjunction with MMTel session modification

9.3.3.1.3.1 IMS bootstrap data channel establishment

If the terminating UE determines that the UE and the network supports the IMS data channel, when the UE receives the re-INVITE request with an SDP offer, which includes the bootstrap data channel media descriptions, i.e. the "m=" line containing the media set to "application", the UDP port number, the proto value set to "UDP/DTLS/SCTP" and the fmt value set to "webrtc-datachannel" and with associated "dcmap" attribute lines containing a subprotocol parameter set to "http" and any "stream-id" parameter set to values 0, 10, 100 or 110, the procedure defined in clause 9.3.3.1.2 applies.

If the terminating UE wants to setup a bootstrap data channel during the session modification by sending SIP re-INVITE request, the procedure defined in clause 9.3.2.1.3.1 applies.

9.3.3.1.3.2 IMS application data channel establishment

If the terminating UE has an established bootstrap data channel associated with the MMTel session available and if the UE receives the re-INVITE request with an SDP offer which includes data channel media descriptions for the bootstrap data channel, as well as the requested application data channel and the associated data channel application binding information (provided within the "a=3gpp-req-app" SDP attribute), and the terminating UE accepts the offered application data channel, it shall return a 183 (Session Progress) or 200 (OK) response to the re-INVITE request with the generated the SDP answer based on the 3GPP TS 26.114 [4] and IETF RFC 8864 [14].

If the terminating UE wants to setup an application data channel, the procedure defined in clause 9.3.2.1.3.2 applies.

9.3.3.1.4 Closing IMS application data channel in conjunction with MMTel session modification

If the terminating UE receives a re-INVITE request including an SDP offer in which the UDP port number of the data channel media description was set to zero or the "a=dcmap" line associated with an application data channel was removed from the data channel media description, and the terminating UE accepts the application data channel termination, it shall return a 200 (OK) response to the re-INVITE request with the generated SDP answer based on the IETF RFC 8864 [14].

If the terminating UE wants to close an established application data channel during the session modification by sending re-INVITE request, the procedure defined in clause 9.3.2.1.4 applies.

> NOTE: The application data channel termination during the session modification does not impact the ongoing audio, video or other data channels within the MMTel session.

9.3.3.1.5 Closing IMS data channel in conjunction with MMTel session release

When the UE releases an MMTel session that has associated bootstrap and application data channels, the UE shall apply procedures defined in 3GPP TS 24.229 [9] clause 5.1.5 and shall close bootstrap and application data channels.

9.3.3.2 Procedures at the serving IMS AS for the terminating UE

9.3.3.2.1 IMS bootstrap data channel establishment in conjunction with MMTel session setup

Upon receipt of a SIP initial INVITE request with the SDP offer including IMS data channel media descriptions from the originating network, if the IMS AS determined that the terminating registered UE:

1) supports IMS data channel capabilities and is authorized to use IMS data channel, the IMS AS shall notify the DCSF about a session establishment request event and shall not send a INVITE request to the S-CSCF until receiving an acknowledgement from the DCSF. Based on the received Media instruction set from the DCSF, the IMS AS shall select the MF and request the MF to allocate required data channel media resources. Based on the response of the reserved media resource from the MF, the IMS AS shall

   - delete the remote bootstrap data channel media description for the originating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 100 and 110 and "a=3gpp-bdc-used-by" attribute with "bdc-used-by" parameter set to value "sender"), i.e. the remote bootstrap data channel between originating UE and terminating network in the SDP offer.

   - replace the IP address represented in the "c=" line, the UDP port number in the "m=application" line as well as the DC endpoint information represented as the attribute lines including the "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" line in the remote bootstrap data channel media description for the terminating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 100 and 110 and "a=3gpp-bdc-used-by" attribute with "bdc-used-by" parameter set to value "receiver"), i.e. the remote bootstrap data channel between terminating UE and originating network, with the media resource information for the termination towards the terminating UE if the media in anchored on the MF; and

- generate and add the local bootstrap data channel media description for the terminating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 0 and 10), i.e. the local bootstrap data channel between the terminating network and terminating UE to the SDP offer.

upon the reception of a successful acknowledgement from the DCSF to the session establishment request event notification, the IMS AS shall send the initial INVITE request with the modified SDP offer via the S-CSCF towards the terminating registered UE of the served user, which support the IMS data channel capabilities; or

2) does not support IMS data channel capabilities or is not authorized to use IMS data channel, then based on the operator policy the IMS AS shall determine whether to remove from the SDP offer media lines related to the IMS data channels:

a) if the operator policy indicates removal of media lines related to the IMS data channels, the IMS AS shall not trigger the DC media resource reservation and the IMS AS shall remove from the received SDP offer media lines describing the bootstrap data channel(s) i.e.:

- "dcmap" attribute lines containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 0, 10, 100 and 110; and

- if present, "a=3gpp-bdc-used-by:" attribute lines,

associated with the "m=" line containing the media set to "application", the UDP port number, the proto value set to "UDP/DTLS/SCTP" and the fmt value set to "webrtc-datachannel". If there are no other "dcmap" attribute lines that contain a subprotocol parameter set to value other than "http", the IMS AS shall remove any other SDP media attribute lines associated with that m line e.g., "sctp-port", "max-message-size", "tls-id", "a=setup", "a=3gpp-qos-hint" SDP attribute lines. The IMS AS shall send the SIP initial INVITE request with the modified SDP offer to the S-CSCF towards the terminating registered UE of the served user.

Upon receipt of the 18x or 2xx response on the initial INVITE message including the SDP answer which includes the data channel media description, the IMS AS shall notify the DCSF about corresponding session event (session establishment progress (i.e. receiving the 183 (Session Progress) response), session establishment alerting (i.e. receiving the 180 (Ringing) response) or session establishment success (i.e. receiving the 200 (OK) response on the INVITE request) event) and shall request the MF to update the media resources. Based on the response from the MF, the IMS AS shall:

- generate and add the remote bootstrap data channel media description for the originating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 100 and 110 and "a=3gpp-bdc-used-by" attribute with "bdc-used-by" parameter set to value "sender") in the SDP answer, i.e. the remote bootstrap data channel between originating UE and terminating network;

- replace the IP address represented in the "c=" line, the UDP port number in the "m=application" line as well as the DC endpoint information represented as the attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" line within the remote bootstrap data channel media description for the terminating UE (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 100 and 110 and "a=3gpp-bdc-used-by" attribute with "bdc-used-by" parameter set to value "receiver"), i.e. the remote data channel between terminating UE and originating network, with the DC endpoint information for the termination towards the originating network allocated by the MF; and

- delete the bootstrap data channel media description (the media line with the "dcmap" attribute containing a subprotocol parameter set to "http" and "stream-id" parameter set to values 0 and 10) in the SDP answer, i.e. the bootstrap data channel between terminating UE and terminating network;

Upon the reception of an acknowledgement from the DCSF to the corresponding notification, the IMS AS shall include the modified SDP answer for data channel to originating network and send the 18x or 2xx response on the initial INVITE request to the S-CSCF.

Upon receipt of a CANCEL request the initial INVITE request, the IMS AS shall notify the DCSF about the session establishment cancellation, request the MF to release the corresponding data channel media resources, and forward the CANCEL request to the S-CSCF towards the terminating UE.

Upon receipt of a 4xx, 5xx or 6xx response on the initial INVITE request from the terminating UE, the IMS AS shall notify the DCSF about session establishment failure, and request MF to release the data channel media resources.

9.3.3.2.2 MMTel session modification

9.3.3.2.2.1 IMS bootstrap data channel establishment

If the IMS AS received from the originating network a re-INVITE request with the SDP offer containing data channel media description for the bootstrap data channel establishment, if the IMS AS determined that the terminating registered UE:

- supports IMS data channel capabilities and is authorized to use IMS data channel, the IMS AS shall notify the DCSF about the media change request, and modify the data channel media description in the SDP offer and send the re-INVITE request as per clause 9.3.3.2.1. Upon receipt of the 183 (Session Progress) or 200 (OK) response to the re-INVITE request, the IMS AS shall send notify the DCSF about the media change success if the data channel media is accepted or media change failure if the data channel media is rejected and modify the data channel media description in the SDP answer and send the 183 (Session Progress) or 200 (OK) response to S-CSCF as per clause 9.3.2.2.1. Upon receipt of a CANCEL request to the re-INVITE request, the IMS AS shall notify the DCSF about the media change cancellation, request the MF to release the corresponding data channel media resources, and forward the CANCEL request as per clause 9.3.2.2.1. Upon receipt of a 4xx, 5xx or 6xx response on the re-INVITE request, the IMS AS shall notify the DCSF about the media change failure and forward the response to the originating network; and

- does not support IMS data channel capabilities or is not authorized to use IMS data channel, the procedure defined in clause 9.3.3.2.1 applies.

If the IMS AS received from the served user a re-INVITE request with the SDP offer containing data channel media description for the bootstrap data channel establishment, the procedure of the IMS AS in the originating network on receipt of a re-INVITE request from the originating UE defined in clause 9.3.2.2.2.1 applies.

9.3.3.2.2.2 IMS application data channel establishment

Upon receipt of a re-INVITE request with the SDP offer including:

- a new application data channel media description (the media line with the "dcmap" attribute containing "stream-id" parameter set to values starting at 1000) along with the video, audio, and bootstrap data channel media descriptions from the originating network, the IMS AS shall notify the DCSF about the media change request and request MF to update the media resources.

- Based on the response on the data channel media resource update from the MF as specified in 3GPP TS 29.176 [19] and media instruction from DCSF as specified in 3GPP TS 29.175 [18], the IMS AS shall:

  1) delete the data channel media description (media line with the "dcmap" attribute containing "stream-id" parameter set to the values starting at 1000 and "a=3gpp-req-app " attribute with "endpoint" parameter set to value "server") if the media instruction from DCSF is to terminate the media;

  2) delete the data channel media description if the media instruction from DCSF is to reject the media as specified in 3GPP TS 29.175 [18];

  3) replace the IP address represented in the "c=" line, the UDP port number in the "m=application" line in the data channel media description in the SDP offer with the media resource information for the termination towards the terminating UE allocated by the MF if the media instruction from DCSF is to terminate and originate the media, and also replace the DC endpoint information represented as the attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" when the media proxy configuration is HTTP proxy; and

  4) generate and add a data channel media description (media line with the "dcmap" attribute containing "stream-id" parameter set to values starting at 1000 and "a=3gpp-req-app " attribute with "endpoint" parameter set to value "server") by using the DC stream information provided by the DCSF in the attribute lines "a=dcmap" and "a=3gpp-req-app", DC endpoint information of the DC AS provided by the DCSF in the attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup", IP address and UDP port number allocated on the termination towards to the terminating UE on the MF in the "c=" line and "m=application" when the media proxy configuration is UDP proxy, or using the DC stream information provided by the DCSF in the attribute lines "a=dcmap" and "a=3gpp-req-app" and the IP address, UDP port number and DC endpoint information (e.g. tlsId, sctp-port) allocated on the termination towards to the terminating UE on the MF in the other

attribute lines above when the media proxy configuration is HTTP proxy, if the media instruction from DCSF is to originate a new media as specified in 3GPP TS 29.175 [18].

- an existing application data channel media description in which the a new "a=dcmap" line containing the "stream-id" parameter value set to values starting at 1000 is added, the IMS AS shall notify the DCSF about media change request, and request MF to update the media resource if the media instruction from DCSF is to update the media.

The IMS AS shall send the re-INVITE request to the S-CSCF with the modified SDP offer including the modified application data channel media description or the original application data channel media description if no media instruction received from DCSF as well as the media descriptions of established video, audio and bootstrap data channels, to the terminating UE.

Upon receipt of the 183 (Session Progress) or 200 (OK) response on the re-INVITE request with the SDP answer which contains media description of the requested application data channel from the terminating UE,

- if the application data channel is accepted, the IMS AS shall notify DCSF about the media change success and request the MF to update the media resources. Based on the response of the MF, the IMS AS shall

   a) generate and add a data channel media description in the SDP answer by using DC endpoint information of the DC AS provided by the DCSF in the attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" and the IP address and the UDP port number the media information allocated on the termination towards to the originating network UE on MF in the lines "c=" and "m=application", or using the IP address, the UDP port number and the DC endpoint information (e.g. tlsId, sctp-port) allocated on the termination towards to the originating network on the MF in the attribute lines above when the media proxy configuration is HTTP proxy, if the instruction from the DCSF is to terminate the media;

   b) add the rejected media description and set the port number to 0 in the "m=application" line if the instruction from the DCSF is to reject the media;

   c) replace the IP address represented in the "c=" line, the UDP port number in the "m=application" line in the media description in the SDP answer with the media resource information on the termination towards to the originating network allocated by the MF if the instruction from the DCSF is to terminate and originate the media and also replace the DC endpoint information as attribute lines "a=tlsId", "a=sctp-port", "a=fingerprint" and "a=setup" when the media proxy configuration is HTTP proxy; and

   d) delete the media description in the SDP answer if the instruction from the DCSF is to originate a new media;

   and send the 183 (Session Progress) or 200 (OK) response with the modified SDP answer on the re-INVITE request to the S-CSCF towards to the originating network after the receipt of an acknowledgement from the DCSF to the corresponding notification.

- if the application data channel is rejected, the IMS AS shall notify the DCSF about media change failure and request the MF to release the media resources. The IMS AS shall send the 183 (Session Progress) or 200 (OK) response to S-CSCF with the modified SDP answer for the requested application data channel as well as the media descriptions of established video, audio, and bootstrap data channels after the receipt of an acknowledgement from the DCSF to the corresponding notification.

Upon receipt of a CANCEL request to the re-INVITE request, the IMS AS shall notify the DCSF about the media change cancellation, request the MF to release the corresponding data channel media resources and forward the CANCEL request to the S-CSCF towards the terminating UE.

Upon receipt of a 4xx, 5xx or 6xx response on the re-INVITE request from the terminating UE, the IMS AS shall notify the DCSF about media change failure, request the MF to release the corresponding data channel media resources and forward the response to the originating network.

Upon receiving the re-INVITE request from the terminating UE to setup an application data channels and the corresponding response form the originating network, the procedure in clause 9.3.2.2.2.2 applies.

9.3.3.2.2.3 Closing application data channel

Upon receipt of the re-INVITE request with an SDP offer which contains an existing application data channel media description in which the UDP port number is set to 0, the IMS AS shall notify the DCSF about media change request,

and request the MF to release the corresponding media resource if the media instruction from DCSF is to delete the media.

Upon receipt of the re-INVITE request with an SDP offer which contains an existing application data channel media description in which an existing "a=dcmap" line is removed, the IMS AS shall notify the DCSF about media change request, and request MF to update the media resource if the media instruction from DCSF is to update the media.

Upon receipt of the 200 (OK) response on the re-INVITE message with the SDP answer, the procedure in clause 9.3.3.2.2.2 applies.

Upon receiving the re-INVITE request from the terminating UE to close an application data channels and the corresponding 200 (OK) response form the originating network, the procedure in clause 9.3.2.2.2.3 applies.

9.3.3.2.3   MMTel session release

Upon initiation or receipt of a BYE request matching an existing MMTel session with IMS data channel, the procedure defined in clause 9.3.2.2.3 applies.

9.4   Abnormal cases

9.4.1   General

Abnormal cases on IMS data channel include the following:

- The IMS AS has sent a data channel resource reservation/update request and does not receive a response to that request.

- The IMS AS has sent a data channel resource reservation/update request, and receives an error response to that request due to no sufficient data channel resource.

- The IMS AS hasn't received QoS parameters when generating SDP offer or answer for the application data channel media.

- The IMS AS has notified a session event to the DCSF and does not receive a response or receives a failure.

- The re-INVITE request collision in the IMS AS during IMS data channel establishment and closing.

The failures during IMS data channel establishment and maintenance shall not impact any other ongoing media which are associated with the same IMS session (e.g. audio, video, etc.).

9.4.2   No response on DC2 interface

9.4.2.1 Actions at the IMS AS

If the IMS AS does not receive a response to a bootstrap data channel resource reservation/update request, the IMS AS shall:

- remove the data channel media description from the SDP offer for the INVITE/re-INVITE request; and

- set the port number of the "m=" lines for data channel as zero in the SDP answer of the response to the INVITE/re-INVITE request.

If the IMS AS does not receive a response to an application data channel resource reservation/update request, the IMS AS shall:

- remove from the SDP offer for the re-INVITE request:

  1) the "a=dcmap" line associated to this requested application data channel; or

  2) the data channel media description containing this requested application data channel if no other "a=dcmap" attribute line existed in this media description; and

- set the port number of the "m=" lines for the data channel media description containing this requested application data channel as zero in the SDP answer of the response to the re-INVITE request in the case 2).

9.4.3 Insufficient data channel resource

9.4.3.1 Actions at the IMS AS

If the IMS AS receives an error response message to a bootstrap data channel resource reservation/update request, the IMS AS shall:

- remove the data channel media description from the SDP offer for the INVITE/re-INVITE request;

- continue the ongoing session procedure; and

- set the port number of the "m=" lines for data channel as zero in the SDP answer of the response to the INVITE/re-INVITE request.

If the IMS AS receives an error response message to an application data channel resource reservation/update request, the IMS AS shall:

- remove from the SDP offer for the re-INVITE request:

  1) the "a=dcmap" line associated to this requested application data channel; or

  2) the data channel media description containing this requested application data channel if no other "a=dcmap" attribute line existed in this media description; and

- set the port number of the "m=" lines for the data channel media description containing this requested application data channel as zero in the SDP answer of the response to the re-INVITE request in the case 2).

9.4.4 No response or failure response on DC1 interface

9.4.4.1 Actions at the IMS AS

If the IMS AS does not receive a response to a session event notification or receives a failure response to a session event notification, the IMS AS shall:

- in the case of notifying IMS data channel session establishment request or media change request on bootstrap data channel setup, remove the IMS data channel SDP media description from the SDP offer for the INVITE/re-INVITE request and continue the ongoing session procedure;

- in the case of notifying media change request on application data channel setup,

  - remove from the SDP offer for the re-INVITE request:

  1) the "a=dcmap" line associated to this requested application data channel; or

  2) the data channel media description containing this requested application data channel if no other "a=dcmap" attribute line existed in this media description; and

  - continue the ongoing session procedure;

- set the port number of the "m=" lines for IMS data channel as zero in the SDP answer of the response to the INVITE/re-INVITE request;

- in the case of notifying IMS data channel session establishment failure, media change failure, and session termination request, continue the ongoing session procedure9.4.5 QoS parameters not received

9.4.5.1 Actions at the IMS AS

If new SDP offer generated by the UE includes the application data channel media description containing "a=3gpp-req-app" attribute with "endpoint" parameter set to "server" and:

- "a=3gpp-qos-hint" attribute but no QoS parameters received in the media instruction from the DCSF, the IMS AS of the served UE shall generate "a=3gpp-qos-hint" attribute with the default values based on the configuration, if available; or

- updated "a=3gpp-qos-hint" attribute but no QoS parameters received in the media instruction from the DCSF, the IMS AS of the served UE shall generate "a=3gpp-qos-hint" attribute with the values previously negotiated within SDP offer and SDP answer,

  for the corresponding application data channel media description before forwarding the SDP offer and the associated SDP answer.

9.4.6 Re-INVITE request collision

9.4.6.1 Actions at the IMS AS

The IMS AS shall handle re-INVITE request collisions as specified in 3GPP TS 24.229 [9] with the clarification in this subclause.

When a re-INVITE request including an SDP offer containing IMS data channel media description is received while a re-INVITE is progressing as per 9.3.2.2.2 and 9.3.3.2.2, or while a re-INVITE has already been sent out, the IMS AS shall not notify the DCSF about the media change request including the information of the received re-INVITE request and shall return 491 (Request Pending) response to the received re-INVITE request.

10 Interaction with supplementary services

10.1 Originating Identification Presentation (OIP)

No interaction with IMS data channel.

10.2 Terminating Identification Presentation (TIP)

No interaction with IMS data channel.

10.3 Originating Identification Restriction (OIR)

No interaction with IMS data channel.

10.4 Terminating Identification Restriction (TIR)

No interaction with IMS data channel.

10.5   Message Waiting Indication (MWI)

No interaction with IMS data channel.

10.6   Conferencing (CONF)

10.6.1   Procedure at UE

When a user is participating in two or more SIP sessions, established SIP session's data channel media streams are specific to each SIP session. The user is handling multiple SIP sessions, but only one SIP session shall be active at a time.

The user (conference creator) creates SIP session with the conference focus by sending an INVITE request as described in clause 5.3.1.3 3GPP TS 24.147 [15], and a new SIP session is established between the user (conference creator) and the conference focus.

The user (conference creator) decides and perform the procedures as described in clause 5.3.1.4 3GPP TS 24.147 [15] for inviting a user (conference participant) to a conference by sending an REFER request for each of the active sessions that are requested to be joined to the three-way session, and new SIP sessions are established between the users (conference participants) and the conference focus.

At the establishment of the SIP session with the conference focus, the conference creator and conference participants, shall terminate the existing call session including data channel media streams as per 3GPP TS 24.147 [15] and clause 9.3.

If the user (conference creator or conference participant) wants to use IMS data channel in the SIP session established with the conference focus, the user shall follow procedure specified in clause 9.3.2.1.

   NOTE: In this Release of the present document an IMS data channel establishment with the conference focus is not supported.

10.6.2   Procedure at IMS AS serving the user

On reception of the SIP INVITE request in conjunction with IMS data channel setup as per clause 9.3.2.1.2 and request URI set to the conference factory URI in accordance with clause 5.3.1.3 3GPP TS 24.147 [15], the IMS AS serving the user shall follow procedure specified in clause 9.3.2.2.1.

   NOTE 1: The served user can be a conference creator or conference participant.

   NOTE 2: For each served user which is authorized to use IMS data channel a local bootstrap data channel will be established (i.e., IMS data channels with stream ID 0 or 10 between the user and the DCSF serving the user).

   NOTE 3: In this Release of the present document an IMS data channel establishment with the conference focus is not supported, therefore the data channels with the conference focus will not be established. The IMS AS will discover this upon reception of the response to SIP INVITE request with the SDP answer and the port number value of the data channel media stream(s) is zero.

10.7   Communication Diversion (CDIV)

10.7.1   Communication Forwarding Unconditional (CFU)

10.7.1.1   Actions at the AS of the diverting User

On reception of incoming session setup INVITE request in the IMS AS of the diverting user with the media feature tag +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] in the Contact header field and SDP offer containing the media descriptions for the MMTel media according 3GPP TS 24.173 [10] and a data channel media description for the bootstrap data channel in accordance with 3GPP TS 26.114 [4], if a CFU service condition is satisfied based on the diverting user subscription data, the IMS AS of the diverting user shall not send session event

notification to the DCSF. The IMS AS of the diverting user shall route the incoming session setup INVITE request towards a diverted-to user as defined in 3GPP TS 24.604 [16].

There will be no media negotiation between the originating user and the diverting user, including data channel media negotiation. The data channel media session setup shall be performed between originating user and the diverted-to user together with audio, video media negotiation as per procedures defined in clause 9.3.

10.7.2 Communication Forwarding on Busy user (CFB)

10.7.2.1 Actions at the AS of the diverting User

On reception of incoming session setup INVITE request in the IMS AS of the diverting user with the media feature tag +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] in the Contact header field and SDP offer containing the media descriptions for the MMTel media according 3GPP TS 24.173 [10] and a data channel media description for the bootstrap data channel in accordance with 3GPP TS 26.114 [4], diverting user's network functions shall reserve the data channel media resources before routing the session setup request to the diverting user.

On reception of SIP response 486 (User Busy) from the diverting user, if CFB has been triggered as defined in 3GPP TS 24.604 [16], the diverting user's network functions shall release the reserved data channel media as per procedures defined in clause 9.3 and route the incoming session setup INVITE request towards a diverted-to user as defined in 3GPP TS 24.604 [16]. The data channel media session setup shall be performed between originating user and the diverted-to user together with audio, video media negotiation as per procedures defined in clause 9.3.

In case of failure of data channel media resources reservations at serving network functions of diverting user, the IMS AS of diverting user shall proceed with setup of the MMTel session without performing data channel bootstrapping, by deleting data channel media description (m lines) from SDP offer of incoming INVITE request and route the updated INVITE request to the diverted-to user.

For the CFB under Network Determined User Busy as defined in 3GPP TS 24.604 [16], the CFB behaviour will be same with CFU as specified in clause 10.7.1.

10.7.3 Communication Deflection (CD)

10.7.3.1 Actions at the AS of the diverting User

The CD service can only be triggered before the 200 OK SIP response reception from the diverting user as defined in 3GPP TS 24.604 [16].

On reception of 302(Moved Temporarily) SIP response at IMS AS, the IMS AS:

- shall trigger the close of the established data channel media on early dialog of the MMTel session between the originating and the diverting user's network by interacting with the DCSF and the MF of the user-B as per procedures defined in clause 4.5.2.6.3 3GPP TS 24.604 [16] and in clause 9.3; and

- shall route the incoming session setup INVITE request towards a diverted-to user as defined in 3GPP TS 24.604 [16]. The data channel media negotiation shall be performed between the originating user and the diverted-to user together with audio, video media negotiation as per procedures defined in clause 9.3.

10.7.4 Communication Forwarding on No Reply (CFNR)

10.7.4.1 Actions at the AS of the diverting User

The CFNR service no-reply timer at IMS AS shall be started at the reception of 180 (Ringing) SIP response reception. On no-reply timer expiry, the IMS AS:

- shall trigger the close of the established data channel media on early dialog of the MMTel session between the originating and the diverting user's network by interacting with the DCSF and the MF of the user-B as per procedures defined in clause 4.5.2.6.3 3GPP TS 24.604 [16] and in clause 9.3; and:

- shall route the incoming session setup INVITE request towards a diverted-to user as defined in 3GPP TS 24.604 [16]. The data channel media negotiation shall be performed between originating user and the diverted-to user together with audio, video media negotiation as per procedures defined in clause 9.3.

10.7.5 Communication Forwarding on Not Reachable (CFNRc)

10.7.5.1 Actions at the AS of the diverting User

There's no data channel media session setup between the originating and the diverting user's network, hence the CFNRc behavior shall be same as CFU service in clause 10.7.1.

10.7.6 Communication Forwarding on Not Logged-in (CFNL)

10.7.6.1 Actions at the AS of the diverting User

When the AS of the diverting user receives an incoming session setup INVITE request for an unregistered served user with the media feature tag +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] in the Contact header field and SDP offer containing the media descriptions for the MMTel media according 3GPP TS 24.173 [10] and a data channel media description for the bootstrap data channel in accordance with 3GPP TS 26.114 [4], and a CFNL condition is determined at the IMS AS, there's no data channel media negotiation between the originating user and the diverting user, hence the CFNL service behavior shall be same as CFU service in clause 10.7.1.

In case of a late CFNL detection by the network (e.g., the terminating S-CSCF of a diverting user), the network shall send 480 (Temporarily Unavailable) response to the IMS AS, for the incoming INVITE request to the diverting user. On reception of a 480 (Temporarily Unavailable) response, the IMS AS of the diverting user shall trigger the release of reserved DC media resources and route the incoming INVITE request towards the diverted-to user. Hence for this use case, CFNL service behavior shall be same as CFB service in clause 10.7.2

10.8 Communication Waiting (CW)

10.8.1 Actions at AS of user B

If a network-based CW ("approaching NDUB") or terminal based CW condition is determined, after a CW service execution, the serving IMS AS will interact with the serving DCSF and the MF of the user B, to reserve the DC media resources for waiting communication, based on the served user B subscription data. The serving IMS AS shall forward or send the INVITE request to the user B, as per 3GPP TS 24.615 [17].

    NOTE: Bandwidth usage by active session DC media and the requested bandwidth usage in a waiting communication, can be one of the conditions to evaluate "approaching NDUB".

The user B may proceed with below actions when a communication waiting indication is to be given to the user B:

- the user B may accept the waiting communication and holds the active communication or releases the active communication (per procedures in 3GPP TS 24.615 [17]):

  - on reception of a Re-INVITE request, which is meant for holding the active communication, the IMS AS interaction with DCSF and MF for DC media handling is not required; or

  - on reception of a BYE request for the active communication, the serving IMS AS of the user B, will trigger the release of reserved DC Media resources of active communication by interacting with the serving DCSF and the MF of the user B. The serving IMS AS of the user B, shall follow the session release procedure as specified in 3GPP TS 24.229 [9].

- the user B may reject the waiting communication:

  - on reception of an unsuccessful response for waiting communication from the user B, the serving IMS AS of the user B will trigger the release the reserved DC Media resources of waiting communication by interacting with the DCSF and the MF of the user B and shall reject the communication by sending unsuccessful response to the user C.

Upon expiry of the T_{AS-CW} timer, the serving IMS AS of the user B will trigger the release of the reserved DC Media resources of waiting communication by interacting with the DCSF and the MF of the user B before sending a CANCEL request for waiting communication towards the user B.

10.8.2 Actions at UE of user B

If the user B accepts the waiting communication and holds the active communication (as per procedures in 3GPP TS 24.615 [17]), the hold invoking UE of the user B shall perform the hold procedure.

10.9 Advice Of Charge (AOC)

The Advice Of Charge (AOC) service specified in 3GPP TS 24.647 [22] shall allow the served user to be informed of IP Multimedia session related charging information even if the session is accompanying with data channel media.

According to 3GPP TS 32.260 [20] and 3GPP TS 32.255 [21], duration-based charging and volume-based charging are used for IMS data channel, which does not introduce specific requirements on charging information element specified in Annex C of 3GPP TS 24.647 [22]. So, AOC service has no interaction with IMS data channel.

10.10 Flexible Alerting (FA)

10.10.1 Actions at the AS serving the pilot identity

The flexible alerting telecommunication service with IMS data channel, procedures for the IMS AS serving user B identified by the FA pilot identity, shall be in accordance with 3GPP TS 24.239 [23] with the additions defined in the present document.

Upon reception of an incoming SIP INVITE request with DC media destined to the FA pilot identity of the user B, served by the IMS AS, the IMS AS:

- shall not trigger the IMS data channel resource reservation; and

- shall execute the FA procedures and route the incoming SIP INVITE request with DC media along with other MMTel media towards the FA group member identities, by sending the SIP INVITE request to S-CSCF in accordance with clause 4.5.5.2 3GPP TS 24.239 [23].

  NOTE: The data channel media negotiation will be performed between the originating user and the FA group member together with audio, video media negotiation as per procedures defined in clause 9.3.

10.11 Multi-Device (MuD)

10.11.1 Actions at the AS serving user B

The multi-device service with IMS data channel, procedures for the IMS AS serving the user B having federated UEs, shall be in accordance with 3GPP TS 24.174 [24] with the additions defined in the present document.

On reception of a SIP initial INVITE request with an SDP offer containing IMS data channel media descriptions, the IMS AS of the user B, shall execute multi-device service procedure, which branch the call into several call legs to alert the federated UEs of the user B. The IMS AS shall determine whether the served user B is authorized to use IMS data channel. If the served user is authorized to use IMS data channel, then for each federated UE of the user B the IMS AS shall determine if the federated UE supports IMS data channel capabilities. For each created call leg towards the federated UE:

1) if the served user B is authorized to use IMS data channel and if the federated UE supports IMS data channel capabilities, the IMS AS shall follow procedure specified in clause 9.3.3.2.1, bullet 1); and

2) if the served user B is authorized to use IMS data channel but the federated UE does not support IMS data channel capabilities or if the served user B is not authorized to use IMS data channel, the IMS AS shall follow procedure specified in clause 9.3.3.2.1, bullet 2).

10.11.2 Call pull, actions at the AS serving user A

On reception of an INVITE request from the UE of the user A who has triggered the call pull request, to establish new partial dialog with the IMS AS of the user A in accordance with 3GPP TS 24.174 [24] clause 4.5.3.2.3:

1) the IMS AS shall update existing partial dialog towards the remote network in accordance with 3GPP TS 24.174 [24] clause 4.5.3.2.3 and 3GPP TS 24.229 [9], containing media descriptions to close established data channels associated with the UE of the user A whose call is getting pulled; and

2) after the successful session acknowledgement between the UE of the user A who has triggered the call pull request and the remote network, the IMS AS shall notify the DCSF about the session release event for the call leg towards the UE of the user A whose call is getting pulled and the established data channels associated with the UE of the user A whose call is getting pulled are closed as part of a partial dialog termination in accordance with clause 9.3.2.1.5.

10.11.3 Call push, actions at the AS serving user A

On reception of a SIP REFER request for call push request from the UE of the user A involved in ongoing call:

1) the IMS AS shall establish new partial dialog with the target UE of the user A in accordance with 3GPP TS 24.174 [24] clause 4.5.3.2.4 and 3GPP TS 24.628 [28] clause 4.4.a;

2) the IMS AS shall update existing partial dialog towards the remote network in accordance with 3GPP TS 24.174 [24] clause 4.5.3.2.4 and 3GPP TS 24.229 [9], containing media descriptions to close established data channels associated with the UE of the user A who has triggered the call push request in accordance with clause 9.3.3.1.4 of this specification; and

3) after a successful session acknowledgement between the target UE of the user A and the remote network, the IMS AS shall notify the DCSF about the session release event for the call leg towards the UE of the user A who has initiated the call push request and the established data channels associated with the UE of the user A who has initiated the call push request are closed as part of a partial dialog termination in accordance with clause 9.3.2.1.5.

10.12   Multi-iDentity (MiD)

No interaction with IMS data channel.

10.13   Completion of Communications to Busy Subscriber (CCBS), Completion of Communications by No Reply (CCNR) and Completion of Communications on Not Logged-in (CCNL)

10.13.1   General

The CCBS, CCNR and CCNL services enable a user, encountering a destination that is busy, does not answer or is not logged-in, to have the communication completed at a later point in time without the user having to manually initiate a new communication attempt, which is defined in 3GPP TS 24.642 [25].

10.13.2   Action at the UE

When the UE initiates the initial IMS session before the CC services activation, the IMS data channel media description can be included in the INVITE along with other MMTel medias. The procedure defined in clause 9.3.2.1.2 applies.

On reception of the 486 Busy in case of CCBS or the 480 Temporarily in case of CCNL or on sending the 487 Request in case of CCNR, the UE shall terminate the existing call session including data channel media.

When the CC call is initiated, the IMS data channel media description can be included in initial INVITE message along with other MMTel medias.

10.13.3 Action at the IMS AS serving the originating UE

Upon reception of the incoming sessions setup INVITE request in the IMS AS serving the originating UE with the media feature tag +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] in the Contact header field and SDP offer containing the media descriptions for the MMTel media according 3GPP TS 24.173 [10] and a data channel media description for the bootstrap data channel in accordance with 3GPP TS 26.114 [4], the AS will trigger the DC media resources reservation according to 3GPP TS 23.228 [3] and route the INVITE message to the S-CSCF towards the terminating UE.

In case of CCBS activation, on reception of SIP response 486 (User Busy) from the terminating network, the IMS AS will release the reserved data channel media offered to the terminating network as per procedures defined in clause 9.3. On sending the SIP response 486 (User Busy) to the originating UE, the AS will release the reserved data channel media terminated from the originating UE as per procedures defined in clause 9.3.

In case of CCNL activation, on reception of SIP response 480 (Temporarily Unavailable) from the terminating network, the IMS AS will release the reserved data channel media offered to the terminating network as per procedures defined in clause 9.3. On sending the SIP response 480 (Temporarily Unavailable) to the originating UE, the IMS AS will release the reserved data channel media terminated from the originating UE as per procedures defined in clause 9.3.

In case of CCNR activation, upon reception a 180 (Ringing) response from the terminating network, the IMS AS will notify to DCSF and update the data channel media resources. Upon reception the SIP response 487 (Request Terminated) from the terminating network, the IMS AS will release the data channel media resources along with the session release.

10.14 Enhanced Calling Name (eCNAM)

No interaction with IMS data channel.

10.15 Closed User Group (CUG)

No interaction with IMS data channel.

10.16 Communication Barring (CB)

No interaction with IMS data channel.

10.17 Customized Ringing Signal (CRS)

10.17.1 General

The CRS service is an operator specific service specified in 3GPP TS 24.183 [26], which describes three models of CRS service:

- Download and play model: it has no interaction with IMS data channel.

- Gateway model: it has no impact to IMS data channel.

- Early session model: it has no impact to IMS data channel.

As specified in 3GPP TS 24.183 [26], the CRS media can consist of music, voice, text, video or other customized ringing signals.

10.17.2 Actions on the originating UE

When the originating UE is configured with IMS_DC_configuration node specified in 3GPP TS 24.275 [11] and the DC_Setup_Option leaf indicates that the IMS data channel is to be setup simultaneously while establishing an IMS session, the data channel media can be negotiated in the initial INVITE request and its corresponding response.

In early session model, if the originating UE initiates an MMTel session with an IMS data channel, the UE shall include the data channel media description in the SDP offer of the initial SIP INVITE, as specified in the clause 9.3.2.1.2.

10.17.3 Actions on the CRS AS

Upon receiving the SIP requests and responses containing data channel SDP media descriptions, the CRS AS shall ignore them and just transmit them transparently.

10.18 Customized Alerting Tones (CAT)

10.18.1 General

The CAT service is an operator specific service specified in 3GPP TS 24.182 [27], which describes three models of CAT service as follows:

- forking model: it has no impact to IMS data channel.

- gateway model: it has no impact to IMS data channel.

- early session model: it has no impact to IMS data channel.

As specified in 3GPP TS 24.182 [27], the CAT media can consist of favourable songs, multi-media clips or other customized alerting tones.

10.18.2 Actions at the originating UE

When the originating UE is configured with IMS_DC_configuration node specified in 3GPP TS 24.275 [11] and the DC_Setup_Option leaf indicates that the IMS data channel is to be setup simultaneously while establishing an IMS session, the data channel media can be negotiated in the initial INVITE request and its corresponding response.

In early session model, if the originating UE initiates MMTel session with an IMS data channel, the UE shall include the data channel media description in the SDP offer of initial SIP INVITE message, as specified in clause 9.3.2.1.2.

10.18.3 Actions at the CAT AS

Upon receiving the SIP requests and responses containing data channel SDP media descriptions, the CAT AS shall ignore them and just transmit them transparently.

10.19 Explicit Communication Transfer (ECT)

10.19.1 General

The explicit communication transfer (ECT) service provides a party involved in a communication to transfer that communication to a third party as defined in 3GPP TS 24.629 [12].

There are three actors active in a transfer, they are acting in the following roles:

transferor: the party that initiates the transfer of the active communication that it has with the transferee;

transferee: the party which stays in the communication which is transferred;

transfer target: the party which the communication is transferred to and which replaces the transferor in the communication.

10.19.2 Actions at the AS serving the transferor

On reception of REFER message, if ECT has been triggered as defined in 3GPP TS 24.629 [12], the IMS AS serving the transferor:

- shall trigger the closing of all the established data channels on the transferor's network (including the data channel between the transferor's network and the transferor, the data channel between the transferor's network and the transferee, the data channel between transferor's network and the transfer target) as per procedures defined in clause 9.3.

- route the session setup INVITE request which includes audio, video and data channel media towards a REFER-TO user as defined in 3GPP TS 24.629 [12]. The data channel media set up shall be performed between the transferee and the transfer target together with audio, video media negotiation as per procedures defined in clause 9.3.

10.19.3 Actions at the AS serving the transferee

If the transferee's network has established data channel media with the transferor before the transfer happens, the transferee's network shall release the data channel between transferor and transferee's network. After establishment of an IMS session towards the transfer target data channels may be established towards the transfer target as per procedures defined in clause 9.3.

10.19.4 Actions at the AS serving the transfer target

In case of blind transfer, if the transfer target's network provides data channel service, on reception of incoming INVITE request from transferor's network, the transfer target's network shall send the INVITE message to transfer target. On reception of the 18x response or 200 (OK) response on the INVITE message from the transfer target, the transfer target's network shall trigger the reservation of the data channel media resources to establish the data channel for the transfer target and the transferee, together with audio, video media negotiation as per procedures defined in clause 9.3 and then sends the 18x response or 200 (OK) response to transferor's network.

In case of consultative transfer, if the transfer target's network provides data channel service, on reception of incoming re-INVITE request with the SDP offer of transferee's network from transferor's network, the transfer target's network shall update the established data channel between transfer target's network and transferor to data channel between transfer target's network and transferee.

10.20 Communication Hold (HOLD)

10.20.1 Actions at the invoking UE

If the UE want to put some media stream on hold, then in addition to the application of procedures according to 3GPP TS 24.610 [32], the following procedures shall be applied at the invoking UE.

The invoking UE shall include in the generated SDP offer as specified in 3GPP TS 26.114 [4]:

1) for each data channel media that was previously active (i.e. the SDP direction attribute "a=sendrecv" was present in the last SDP body or no SDP direction attribute was included), the SDP direction attribute "a=inactive" associated with the corresponding "m=application" line if the invoking UE wants to suspend the data channel media;

2) for each data channel media that was previously suspended (i.e. the SDP direction attribute "a=inactive" was present in the last SDP body), the SDP direction attribute "a=sendrecv" associated with the corresponding "m=application" line (or to omit the SDP direction attribute) if the invoking UE wants to resume the suspended data channel media;

and as specified in 3GPP TS 24.610 [32], the invoking UE shall send the generated SDP offer in a re-INVITE request to the remote UE.

10.20.2 Actions at the AS serving the invoking UE

10.20.2.1 General

In addition to the application of procedures according to 3GPP TS 24.610 [32], the following procedures shall be applied at the AS serving the invoking UE.

NOTE: The AS serving the invoking UE can be the AS in the originating IMS network and/or the terminating IMS network, depending on by which network the media to be suspended is managed.

10.20.2.2 Event report

On reception of the SIP re-INVITE request with the SDP offer that contains an "a=inactive" SDP direction attribute in data channel media description and data channel media was previously active, the AS shall notify the DCSF that data channel media is to be suspended as specified in 3GPP TS 29.175 [18].

On reception of the SIP re-INVITE request with the SDP offer that contains an "a=sendrecv" SDP direction attribute (or the SDP direction attribute is omitted) in data channel media description and data channel media was previously suspended, the AS shall notify the DCSF that data channel media is to be resumed as specified in 3GPP TS 29.175 [18].

Based on the instruction from the DCSF, the AS serving the invoking UE shall modify the SDP offer where:

1) for each data channel media towards the remote UE that was previously active (i.e. the SDP direction attribute "a=sendrecv" was present in the last SDP body or no SDP direction attribute was included), the SDP direction attribute "a=inactive" associated with the corresponding "m=application" line;

2) for each data channel media towards the remote UE that was previously suspended (i.e. the SDP direction attribute "a=inactive" was present in the last SDP body), the SDP direction attribute "a=sendrecv" associated with the corresponding "m=application" line (or to omit the SDP direction attribute);

and as specified in 3GPP TS 24.610 [32], the IMS AS shall send the modified SDP offer in a re-INVITE request to the remote UE.

10.20.3 Actions at the held UE

In addition to the application of procedures according to 3GPP TS 24.610 [32], the held UE shall generate an SDP answer for the held data channel media as specified as 3GPP TS 26.114 [4].

Annex A (informative):
Signalling flows

This annex provides the signalling flows related to clause10.

A.1 Interaction with supplementary services

Below sections depict signalling flow diagram for IMS data channel service interaction with existing MMTel supplementary services.

A.1.1 Communication Diversion

A.1.1.1 Communication Forwarding unconditional

Figure A.1.1.1-1 shows an example signalling flow for a successful communication forwarding unconditional based on an AS providing the forwarding and initial communication setup request consist of DC media session setup request along with other MMTel media session setup request.
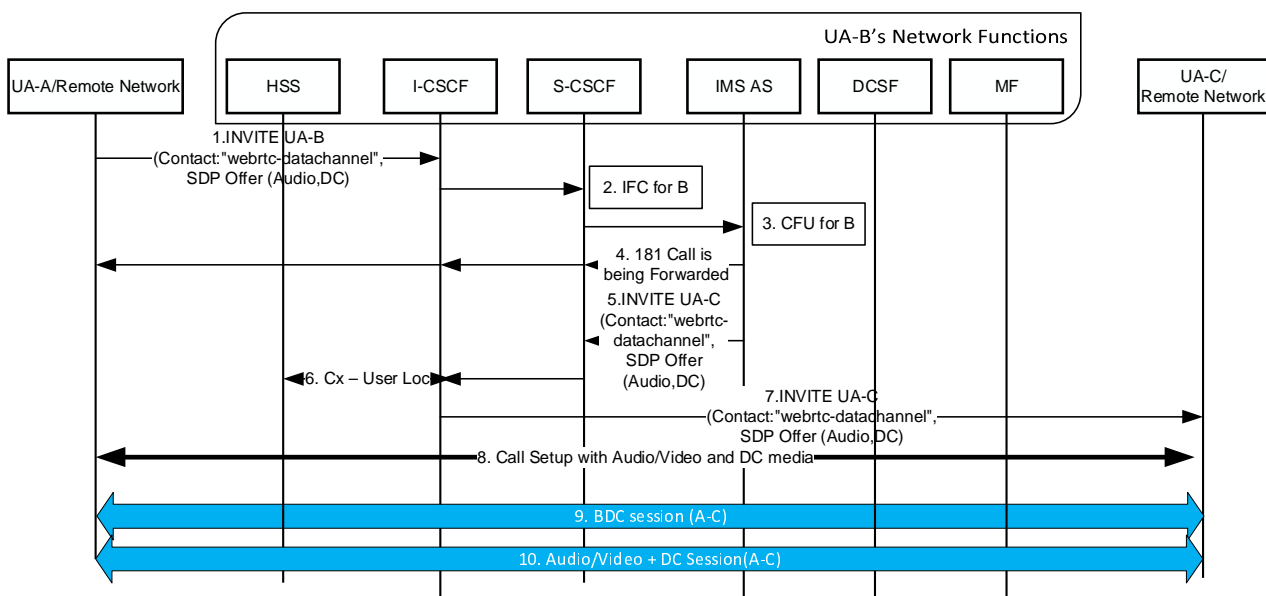

Figure A.1.1.1-1: Call Forwarding Unconditional

The description of the steps mentioned in the figure A.1.1.1-1 is in accordance with the 3GPP TS 24.604 [16] with the additions defined in the present document:

1. in step 1), user A(UA-A) sends initial INVITE request towards the user B(UA-B), which contains:

   - the media feature tag defined in IETF RFC 5688 [5] for supported streaming media type with +sip.app-subtype="webrtc-datachannel" as specified in 3GPP TS 26.114 [4] in the Contact header field;

   - optionally the Accept-Contact header field containing the "sip.app-subtype" media feature tag defined in IETF RFC 5688 [5] with a value of "webrtc-datachannel" as specified in 3GPP TS 26.114 [4]; and

   - the SDP offer containing the media descriptions for the MMTel media according 3GPP TS 24.173 [10] and a data channel media description for the bootstrap data channel in accordance with 3GPP TS 26.114 [4];

2. in step 3), the IMS AS serving the user B(UA-B) receives SIP INVITE request with DC media. CFU service condition is satisfied based on the diverting user B(UA-B) subscription data. Depending on the diverting user B

(UA-B) IMS data channel subscription, the IMS AS of the diverting user does not send session event notification to the DCSF for data channel setup. Procedures for CFU are executed;

3. in step 5) the IMS AS sends SIP INVITE request with data channel media towards the diverted-to-user C(UA-C);

4. in step 7) the communication is routed towards the diverted-to-user C(UA-C) along with data channel media;

5. in step 9) bootstrap data channel is established for the originating user A(UA-A)/network and the diverted-to-user C(UA-C)/network; and

6.   in step 10) application data channel is established along with other MMTel media.

A.1.1.2   Communication Forwarding on Busy

Figures A.1.1.2-1 shows an example signalling flow for a successful communication forwarding on busy based on an AS providing the forwarding and initial communication setup request consist of DC media session setup request along with other MMTel media session setup request.
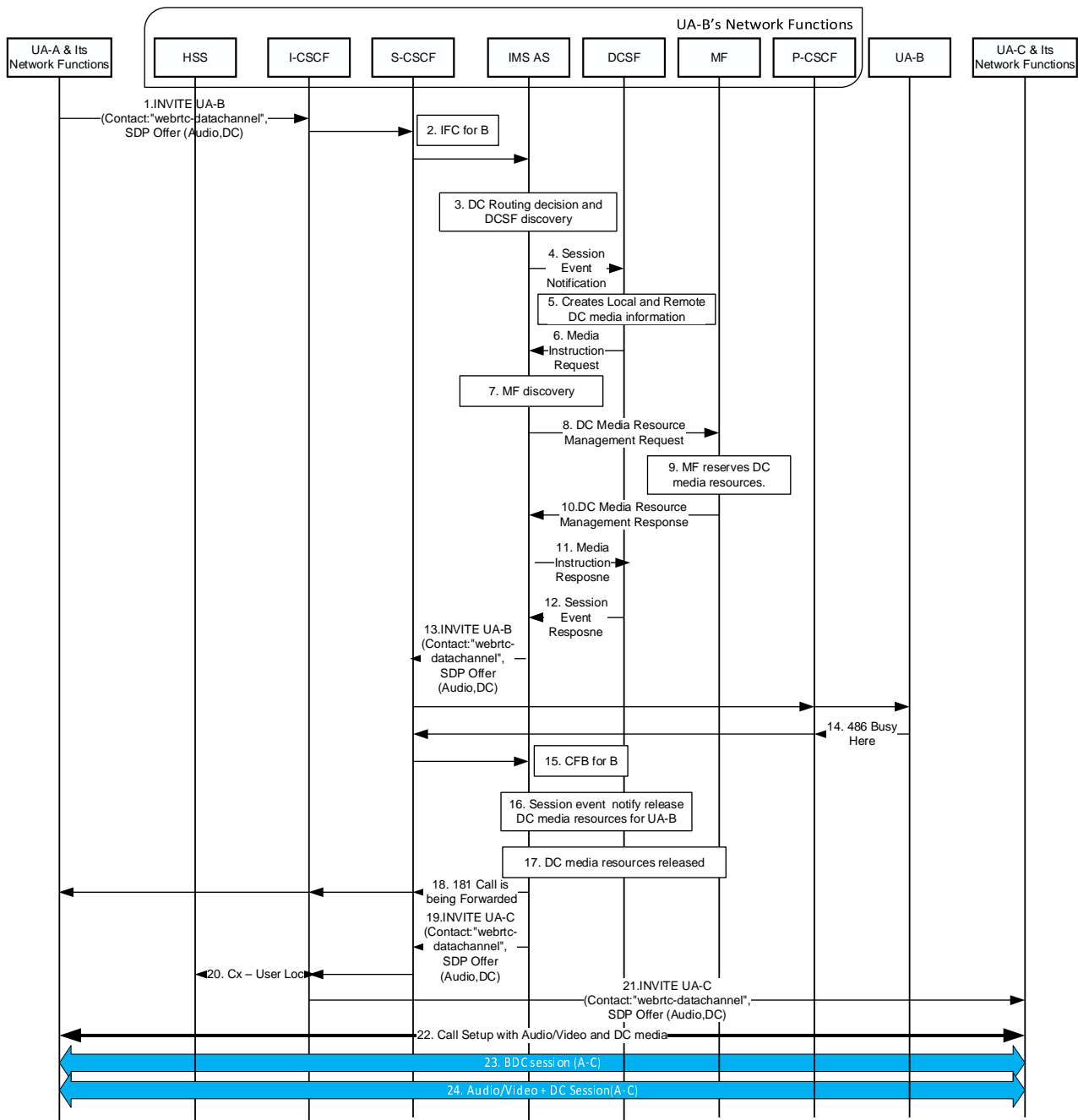
Figure A.1.1.2-1: Call Forwarding on Busy

The description of the steps mentioned in the figure A.1.1.2-1 is in accordance with the 3GPP TS 24.604 [16] with the additions defined in the present document:

1. in step 1) user A(UA-A) sends initial INVITE request towards the user B(UA-B) in accordance with clause A.1.1.1 step 1);

2. in step 3) to step 12) the IMS AS serving the user B(UA-B) receives SIP INVITE request with DC media. Depending on the user B(UA-B) IMS data channel subscription, the IMS AS of the user B(UA-B) triggers the reservation of resources for data channel setup in accordance with clause 9.3.3.2.1 and clause AC.7.1 3GPP TS 23.228 [3];

3. in step 13) the initial INVITE request is sent to the user B(UA-B) along with data channel media due to normal communication procedures;

4. in step 15) to step 17) on reception of the 486 (Busy Here) response for the initial INVITE request, in the IMS AS, CFB service condition is satisfied based on the diverting user B(UA-B) subscription data. Procedures for CFB are executed. The IMS AS notifies session reject event to the DCSF and as per media instruction request from the DCSF, the IMS AS sends media resource management request to the MF to release the allocated data channel media resources for this SIP Session. The IMS AS notifies the DCSF about the DC media release as part of the media instruction response;

5. in step 19) the IMS AS sends SIP INVITE request with data channel media towards the diverted-to-user C(UA-C);

6. in step 21) the communication is routed towards the diverted-to-user C(UA-C) along with data channel media;

7. in step 23) bootstrap data channel is established between the originating user A(UA-A)/network and the diverted-to-user C(UA-C)/network; and

8. in step 24) application data channel is established along with other MMTel media.

A.1.2   Communication Waiting (CW)

A.1.2.1   Network based CW flows

Figure A.1.2.1-1 shows an example of network-based communication waiting signalling flow at the terminating side and successful communication establishment. Waiting communication request contains DC media session along with other MMTel media sessions.
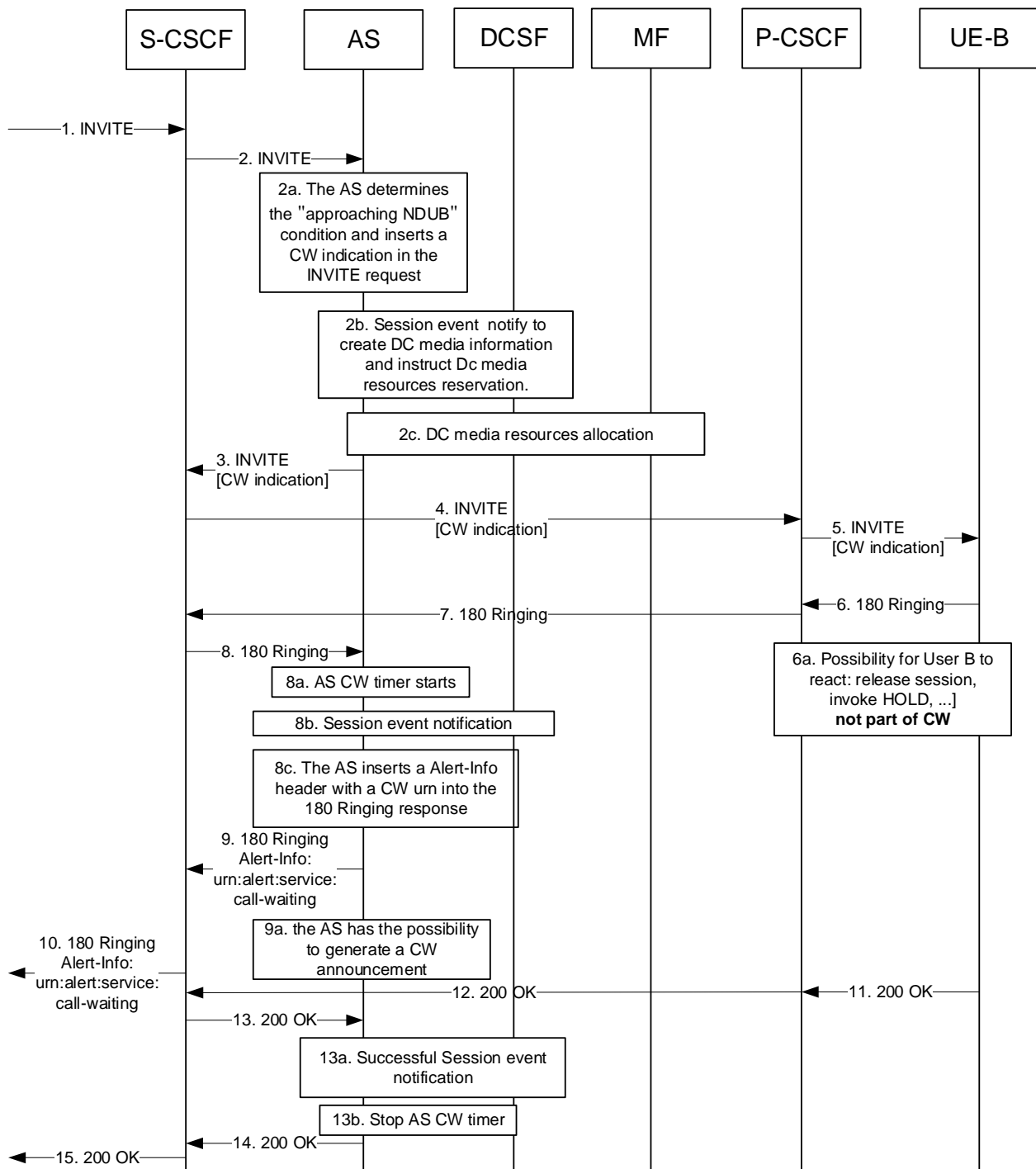
Figure A.1.2.1-1: Network based CW flow: Successful communication establishment.

The description of the steps mentioned in the figure A.1.2.1-1 is in accordance with the 3GPP TS 24.615 [17] with the additions defined in the present document:

1. in step 1) initial INVITE request with data channel media is received for the user B(UA-B) in accordance with clause A.1.1.1 step 1);

2. in step 2) the IMS AS serving the user B(UA-B) receives SIP INVITE request with data channel media;

3. in step 2a) to step 2c) the IMS AS of user B(UA-B) executes network-based CW procedures. Depending on the user B(UA-B) IMS data channel subscription, the IMS AS of the user B(UA-B) triggers the reservation of resources for data channel setup for waiting communication in accordance with clause 9.3.3.2.1 and clause AC.7.1 3GPP TS 23.228 [3];

4. in step 3) the IMS AS of the user B(UA-B) sends SIP INVITE request with data channel media and call waiting indication for waiting communication, towards the user B(UA-B);

5. in step 13) the IMS AS of the user B(UA-B) receives 200OK response with data channel media from user B(UA-B) for the waiting communication; and

6. in step 13a) the IMS AS of the user B(UA-B) sends successful session establishment event notification for waiting communication to the DCSF serving the user B(UA-B).

A.1.2.2 Terminal based CW flows

A.1.2.2.1 Successful communication establishment

Figure A.1.2.2.1-1 shows an example of terminal-based communication waiting signalling flow at the terminating side and successful communication establishment. Waiting communication request contains DC media session along with other MMTel media sessions.
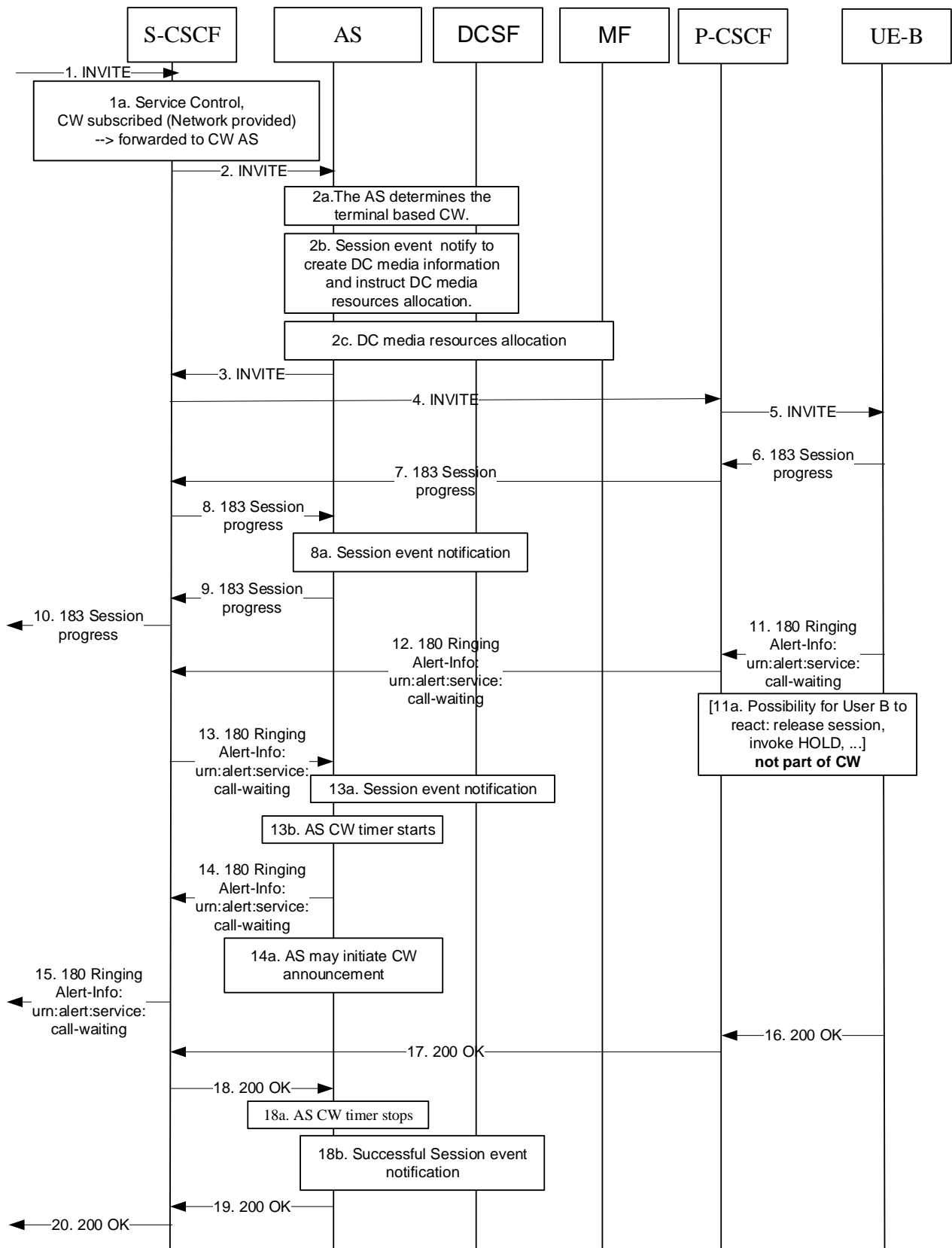
Figure A.1.2.2.1-1 Terminal based CW: Successful communication establishment.

The description of the steps mentioned in the figure A.1.2.2.1-1 is in accordance with the 3GPP TS 24.615 [17] with the additions defined in the present document:

1. in step 1) initial INVITE request with data channel media is received for the user B(UA-B) in accordance with clause A.1.1.1 step 1);

2. in step 2) the IMS AS serving the user B(UA-B) receives SIP INVITE request with data channel media;

3. in step 2a) to step 2c) the IMS AS of user B(UA-B) determines and executes terminal-based CW procedures. Depending on the user B IMS data channel subscription, the IMS AS of the user B(UA-B) triggers the reservation of resources for data channel setup for waiting communication in accordance with clause 9.3.3.2.1 and clause AC.7.1 3GPP TS 23.228 [3];

4. in step 3) the IMS AS of the user B(UA-B) sends SIP INVITE request with data channel media for waiting communication, towards the user B(UA-B);

5. in step 8a), step 13a) on reception of 18x responses with call waiting indication from user B(UA-B) for waiting communication, the IMS AS of the user B(UA-B) sends session progress event notification to the DCSF serving the user B(UA-B);

6. in step 18) the IMS AS of the user B(UA-B) receives 200OK response with data channel media from user B(UA-B) for the waiting communication; and

7. in step 18b) the IMS AS of the user B(UA-B) sends successful session establishment event notification for waiting communication, to the DCSF serving the user B(UA-B).

A.1.2.2.2   AS CW Timer expires

Figure A.1.2.2.2-1 shows an example of terminal-based communication waiting signalling flow at the terminating side and CW timer expires at IMS AS. Waiting communication request contains DC media session along with other MMTel media sessions.

Figure A.1.2.2.2-1 Terminal based CW: CW timer expires at AS.

The description of the steps mentioned in the figure A.1.2.2.1-1 is in accordance with the 3GPP TS 24.615 [17] with the additions defined in the present document:

1. in step 1) initial INVITE request with data channel media is received for the user B(UA-B) in accordance with clause A.1.1.1 step 1);

2. in step 2) the IMS AS serving the user B(UA-B) receives SIP INVITE request with data channel media;

3.   in step 2a) to step 2c) the IMS AS of user B(UA-B) determines and executes terminal-based CW procedures. Depending on the user B(UA-B) IMS data channel subscription, the IMS AS of the user B(UA-B) triggers the reservation of resources for data channel setup for waiting communication in accordance with clause 9.3.3.2.1 and clause AC.7.1 3GPP TS 23.228 [3];

4.   in step 3) the IMS AS of the user B(UA-B) sends SIP INVITE request with data channel media for waiting communication, towards the user B(UA-B);

5.   in step 8a), 13a) on reception of 18x responses with call waiting indication from user B(UA-B) for waiting communication, the IMS AS of the user B(UA-B) sends session progress event notification to the DCSF serving the user B(UA-B); and

6. in step 14c) to step 14d) upon CW timer expiry for waiting communication, the IMS AS of the user B(UA-B) notifies session failure event to the DCSF of the user B(UA-B) and as per media instruction request from the DCSF, the IMS AS sends media resource management request to the MF to release the allocated data channel media resources for this waiting communication SIP session. The IMS AS notifies the DCSF about the DC media release as part of the media instruction response.

A.1.2.2.3   UE CW timer expires

Figure A.1.2.2.3-1 shows an example of terminal-based communication waiting signalling flow at the terminating side and CW timer expires at UE-B. Waiting communication request contains DC media session along with other MMTel media sessions.
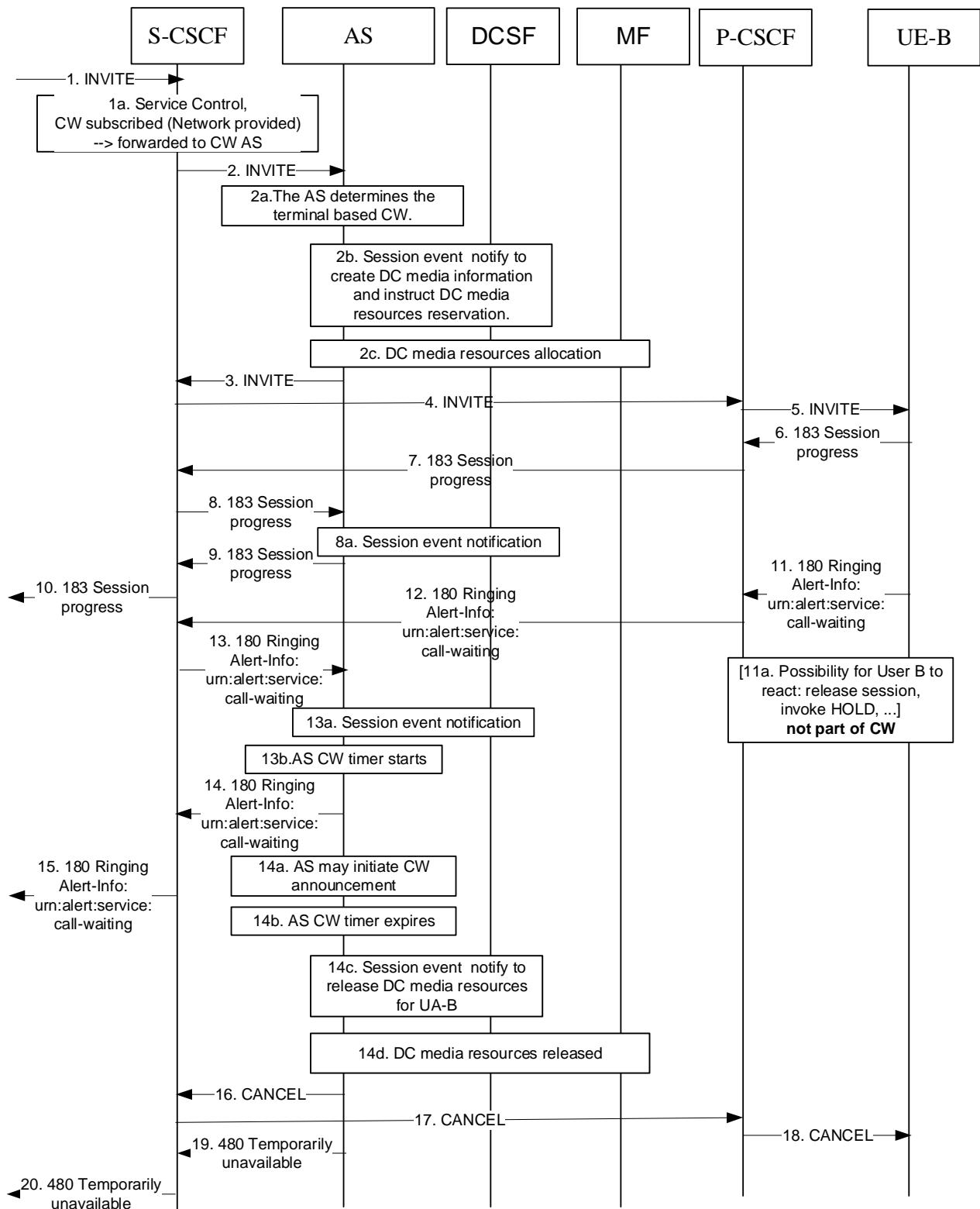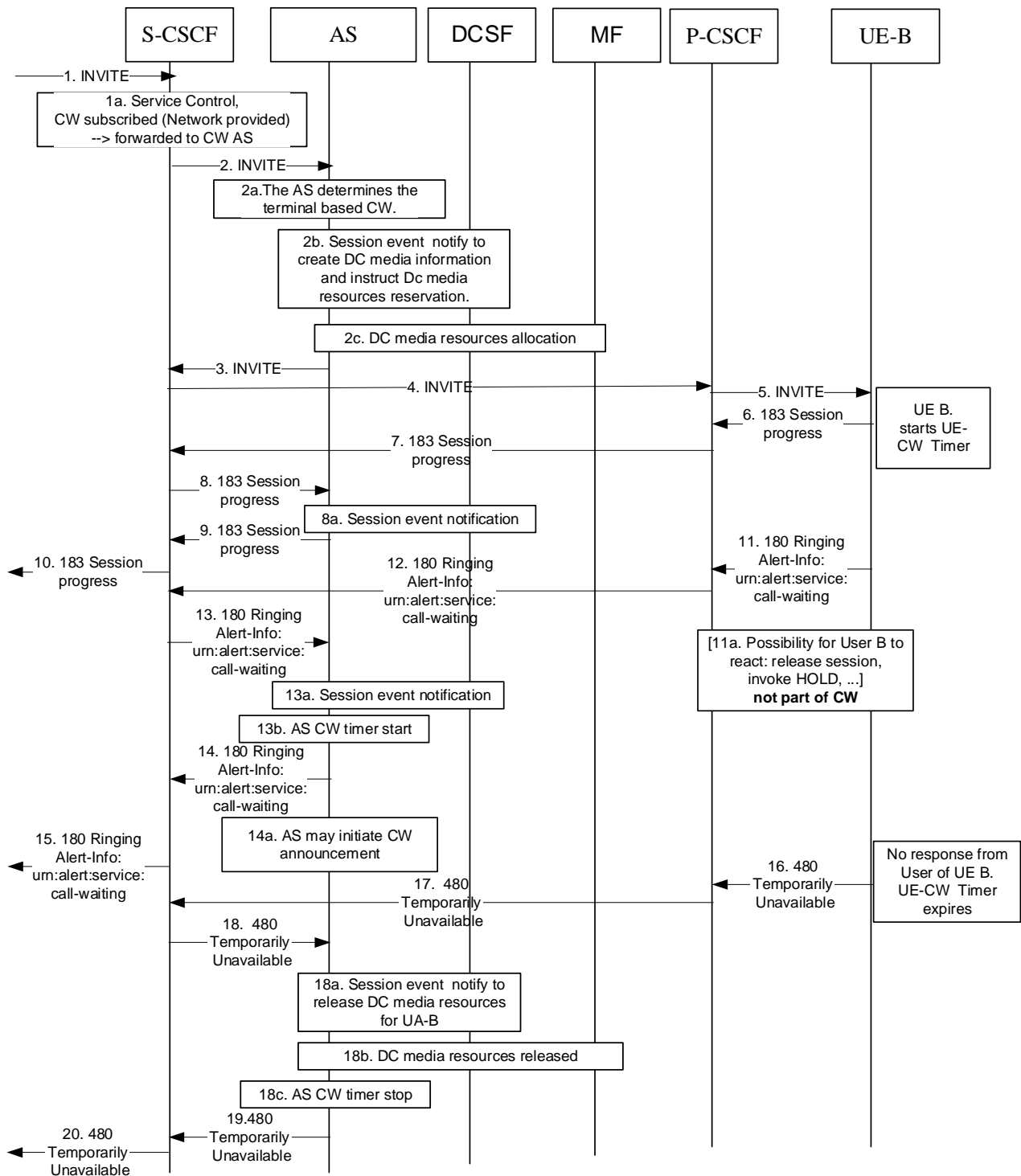
Figure A.1.2.2.3-1 Terminal based CW: CW timer expires at UE-B.

The description of the steps mentioned in the figure A.1.2.2.3-1 is in accordance with the 3GPP TS 24.615 [17] with the additions defined in the present document:

1. in step 1) initial INVITE request with data channel media is received for the user B(UA-B) in accordance with clause A.1.1.1 step 1);

2. in step 2) the IMS AS serving the user B(UA-B) receives SIP INVITE request with data channel media;

3. in step 2a) to step 2c) the IMS AS of user B(UA-B) determines and executes terminal-based CW procedures. Depending on the user B(UA-B) IMS data channel subscription, the IMS AS of the user B(UA-B) triggers the reservation of resources for data channel setup for waiting communication in accordance with clause 9.3.3.2.1 and clause AC.7.1 3GPP TS 23.228 [3];

4. in step 8a, step 13a) on reception of 18x responses with call waiting indication from user B(UA-B) for waiting communication, the IMS AS of the user B(UA-B) sends session progress event notification to the DCSF serving the user B(UA-B); and

5. in step 18a) to step 18b) upon reception of 480 (Temporarily Unavailable) SIP response for waiting communication, the IMS AS of the user B(UA-B) notifies session failure event to the DCSF of the user B(UA-B) and as per media instruction request from the DCSF, the IMS AS sends media resource management request to the MF to release the allocated data channel media resources for this waiting communication SIP session. The IMS AS notifies the DCSF about the DC media release as part of the media instruction response.

A.1.3 Explicit Communication Transfer

A.1.3.1 IMS serving the transferee provides data channel service
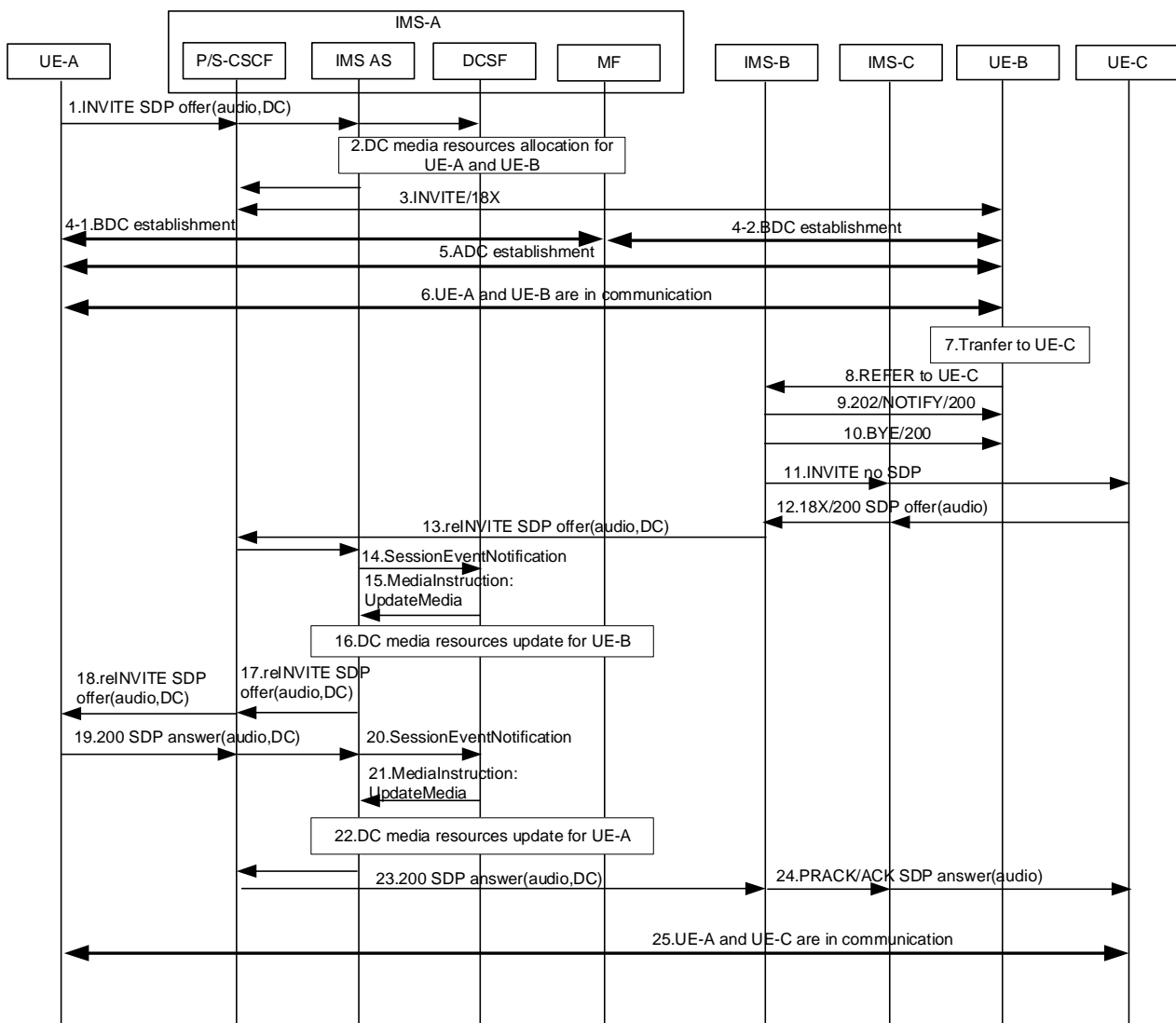
A.1.3.1.1 Blind Transfer

Figure A.1.3.1.1-1: Blind Transfer when IMS serving the transferee provides data channel service

Figure A.1.3.1.1-1 shows a call flow for blind transfer when IMS serving the transferee provides data channel service.

Step1: UE-A calls UE-B, UE-A sends an INVITE request towards the UE-B.

Step2: DC media resource is allocated by IMS-A for UE-A and UE-B.

Step3-6: UE-B answers the call, session connection is established between UE-A and UE-B. IMS-A establishes BDC connection for UE-A and UE-B. And then IMS-A establishes ADC connections between UE-A and UE-B.

Step7: UE-B starts transfer process.

Step8: UE-B sends a REFER message to transfer the call to UE-C.

Step9-10: IMS-B sends 202/NOTIFY to UE-B to accept the transfer request, and then sends BYE message to UE-B. UE-B releases reserved DC media resources of established BDC and ADC between UE-B and IMS-A/UE-A for A-B call.

Step11-12: IMS-B sends an initial INVITE message to UE-C without SDP, UE-C replies SDP offer with audio media in 18X/200 response.

Step13: IMS-B sends re-INVITE message to IMS-A and release the data channels between the IMS-B and UE-A.

Step14-16: IMS AS of IMS-A notifies session modify event to the DCSF and as per media instruction request from the DCSF, the IMS AS sends media resource management request to MF to update the data channel media resources for UE-B. IMS-A releases reserved DC media resources of established BDC and ADC between IMS-A and UE-B for A-B call.

Step17-19: IMS AS of IMS-A sends a re-INVITE message carrying SDP offer with data channel media towards UE-A. In SDP offer of re-INVITE message, the IMS AS of IMS-A adds previously established BDC and ADC between IMS-A and UE-A for A-B call with UDP ports set to zero. Earlier established BDC between UE-A and IMS-A (in step 4-1) can remain as it is or re-established as per operator policy. IMS-A releases the earlier established DC media resources between IMS-A and UE-A. UE-A releases the earlier established DC media resources between UE-A and IMS-A/UE-B and prepare SDP answer with earlier established DC media with UDP port zero. UE-A replies with the SDP answer with data channel media included in the 200 OK response.

Step20-22: IMS AS of IMS-A notifies session modify event to the DCSF and as per media instruction request from the DCSF, the IMS AS sends media resource management request to MF to update the data channel media resources for UE-A.

Step23: IMS AS of IMS-A sends a 200 OK message with updated data channel media to IMS-B.

Step24: IMS-B sends PRACK/ACK message towards UE-C with no DC media in SDP answer.

Step25: The session connection is established between UE-A and UE-C.

A.1.3.1.2 Consultation Transfer

Figure A.1.3.1.2-1: Consultative Transfer when IMS serving the transferee provides data channel service

Figure A.1.3.1.2-1 shows a call flow for consultative transfer when IMS serving the transferee provides data channel service.

Step1: UE-A calls UE-B, UE-A sends an INVITE request towards the UE-B.

Step2: DC media resource is allocated by IMS-A for UE-A and UE-B.

Step3-6: UE-B answers the call, session connection is established between UE-A and UE-B. IMS-A establishes BDC connection for UE-A and UE-B. And then IMS-A establishes ADC connections between UE-A and UE-B.

Step7-8: UE-B holds UE-A, and then calls UE-C.

Step9: When UE-C sends 180 ringing or 200 response, UE-B starts transfer process.

Step10: UE-B sends a REFER message to transfer the call to UE-C.

Step11-12: IMS-B sends 202/NOTIFY to UE-B to accept the transfer request, and then sends BYE message to UE-B.

Step13-15: IMS-B sends a media re-negotiation request to UE-A, UE-A replies SDP offer with data channel media description.

Step16-18: IMS AS of IMS-A notifies session modify event to the DCSF and as per media instruction request from the DCSF, the IMS AS sends media resource management request to MF to update the data channel media resources for UE-A.

Step19: IMS AS sends a 200 OK response for re-INVITE to the IMS-B with updated data channel media.

Step20-21: IMS-B sends a re-INVITE message carrying SDP offer with data channel media towards UE-C, and receives 200 OK response for reINVITE carrying SDP answer with data channel media from UE-C.

Step22: IMS-B sends an ACK message carrying SDP answer with data channel media towards IMS-A.

Step23-25: IMS AS of IMS-A notifies session modify event to the DCSF and as per media instruction request from the DCSF, the IMS AS sends media resource management request to MF to update the data channel media resources for UE-C.

Step26: IMS AS of IMS-A sends an ACK message carrying SDP answer with data channel media towards UE-A.

Step27: The BDC media connection is established between IMS-A and UE-C.

Step28: The ADC media connections are established between UE-A and UE-C.

Step29: The session connection is established between UE-A and UE-C.

A.1.3.2 IMS serving the transferor provides data channel service

A.1.3.2.1 Blind Transfer

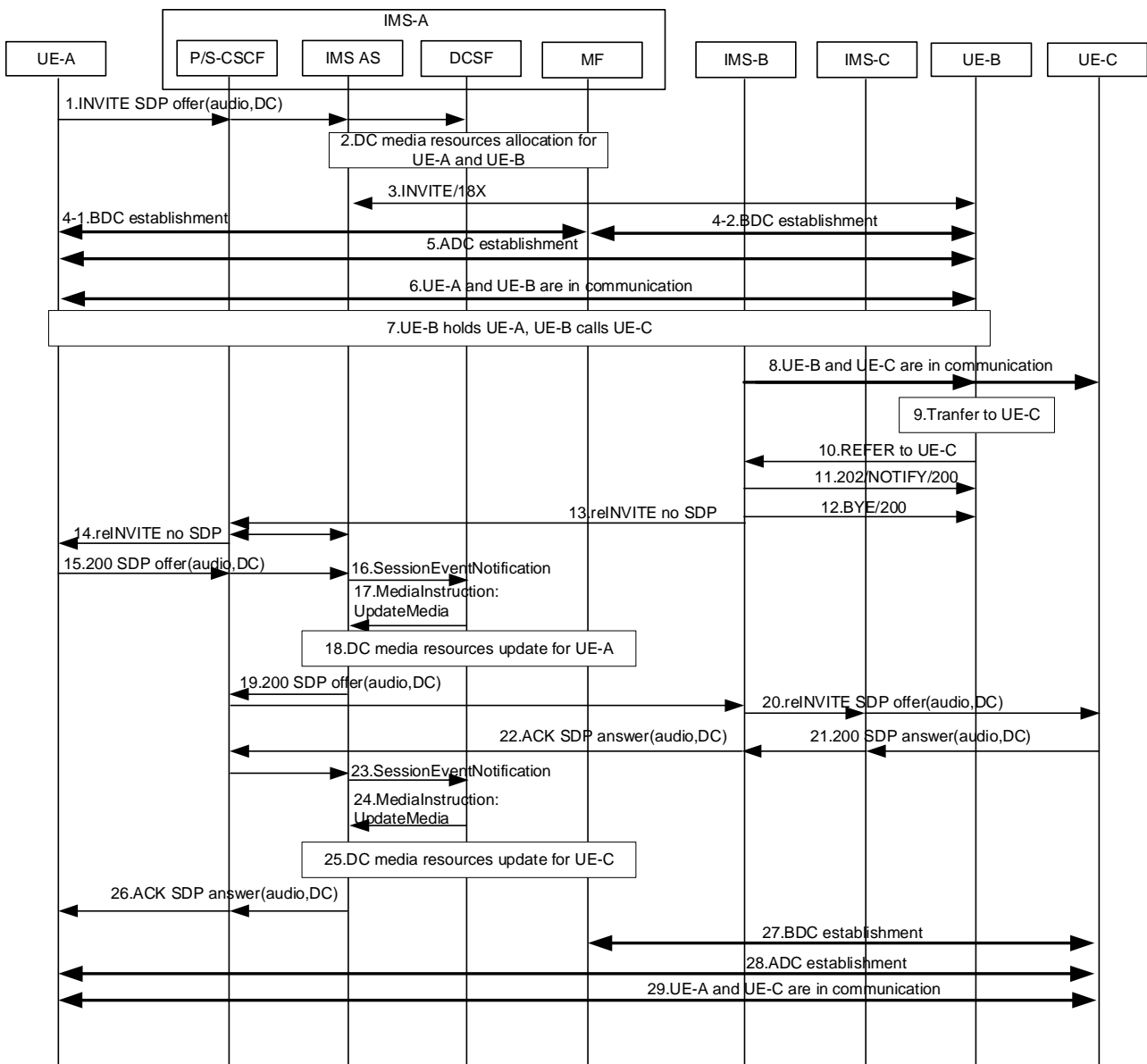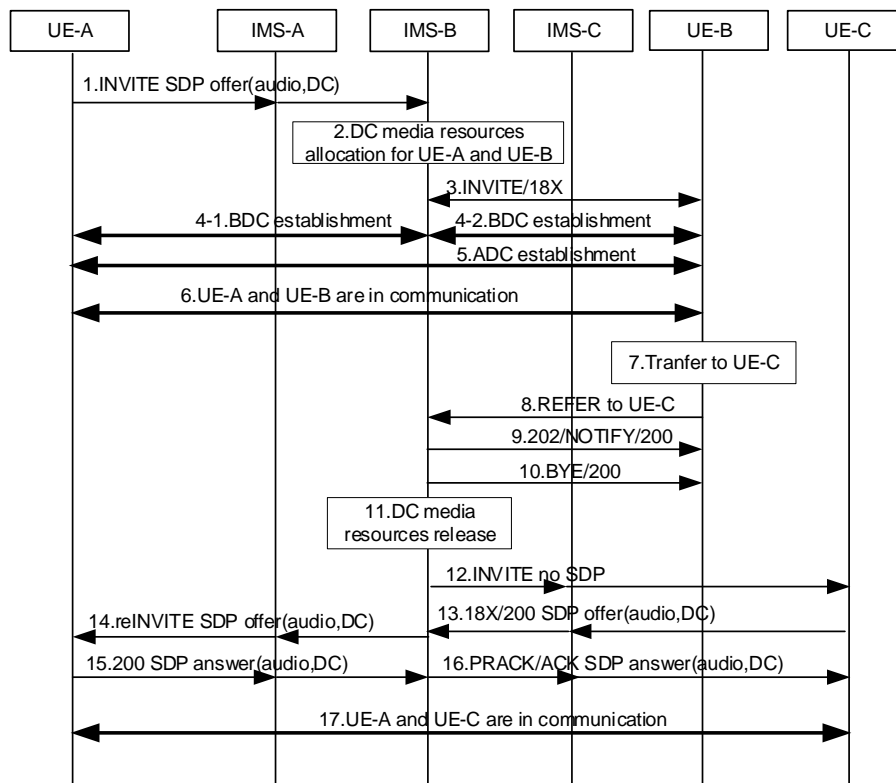**Figure A.1.3.2.1-1: Blind Transfer when IMS serving the transferor provides data channel service**

Figure A.1.3.2.1-1 shows a call flow for blind transfer when IMS serving the transferor provides data channel service.

Step1: UE-A calls UE-B, UE-A sends an INVITE request towards the UE-B.

Step2: DC media resource is allocated by IMS-B for UE-A and UE-B.

Step3-6: UE-B answers the call, session connection is established between UE-A and UE-B. IMS-B establishes BDC connection for UE-A and UE-B. And then IMS-B establishes ADC connections between UE-A and UE-B.

Step7: UE-B starts transfer process.

Step8: UE-B sends a REFER message to transfer the call to UE-C.

Step9-10: IMS-B sends 202/NOTIFY to UE-B to accept the transfer request, and then sends BYE message to UE-B.

Step11: IMS-B releases all the allocated data channel media resources on MF for UE-A, UE-B.

Step12-17: IMS-B sends an INVITE message to UE-C, the audio along with data channel media connections are established between UE-A and UE-C, the data channel media can be provided either by IMS-A or IMS-C or both.

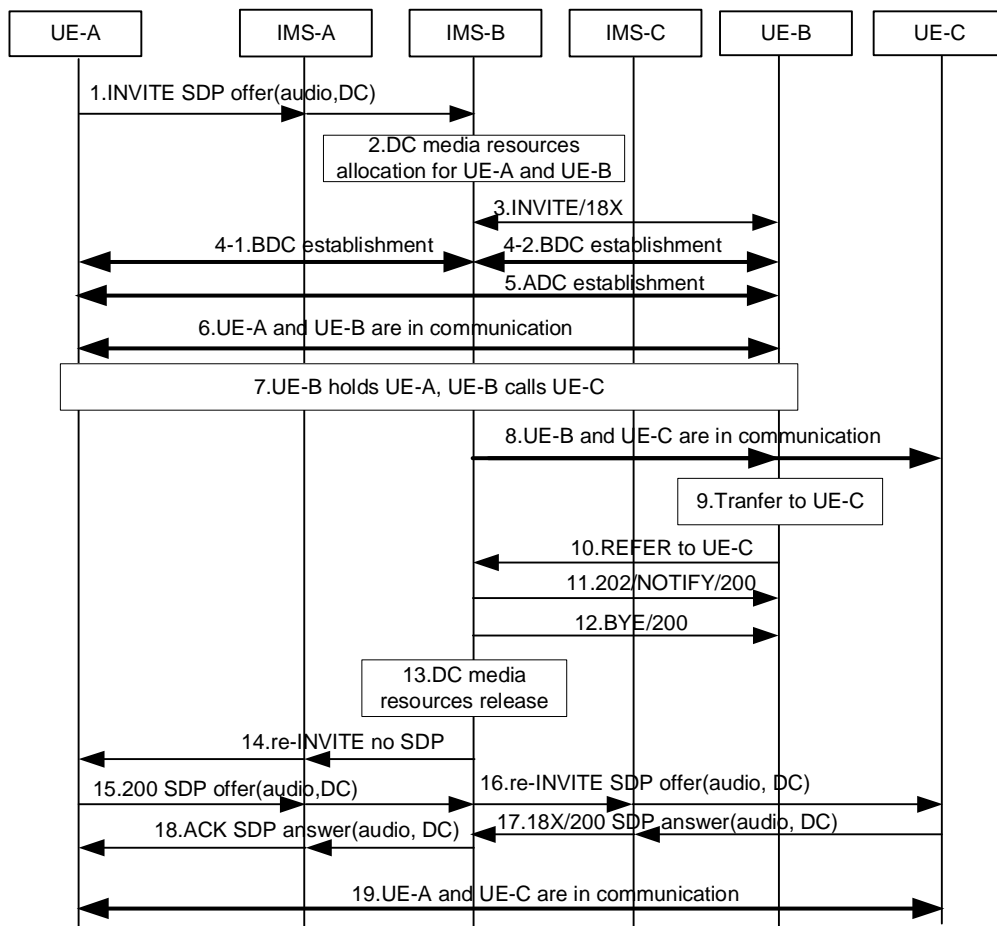## A.1.3.2.2 Consultation Transfer

Figure A.1.3.2.2-1: Consultative Transfer when IMS serving the transferor provides data channel service

Figure A.1.3.2.2-1 shows a call flow for consultative transfer when IMS serving the transferor provides data channel service.

Step1: UE-A calls UE-B, UE-A sends an INVITE request towards the UE-B.

Step2: DC media resource is allocated by IMS-B for UE-A and UE-B.

Step3-6: UE-B answers the call, session connection is established between UE-A and UE-B. IMS-B establishes BDC connection for UE-A and UE-B. And then IMS-B establishes ADC connections between UE-A and UE-B.

Step7-8: UE-B holds UE-A, and then calls UE-C.

Step9: When UE-C sends 180 ringing or 200 response, UE-B starts transfer process.

Step10: UE-B sends a REFER message to transfer the call to UE-C.

Step11-12: IMS-B sends 202/NOTIFY to UE-B to accept the transfer request, and then sends BYE message to UE-B.

Step13: IMS-B releases all the allocated data channel media resources on MF for UE-A, UE-B and UE-C.

Step14-18: IMS-B sends a media re-negotiation request with to establish the connection between UE-A and UE-C.

Step19: The audio along with data channel media connections are established between UE-A and UE-C, the data channel media can be provided either by IMS-A or IMS-C or both.

A.1.3.3   IMS serving the transfer target provides data channel service

A.1.3.3.1   Blind Transfer

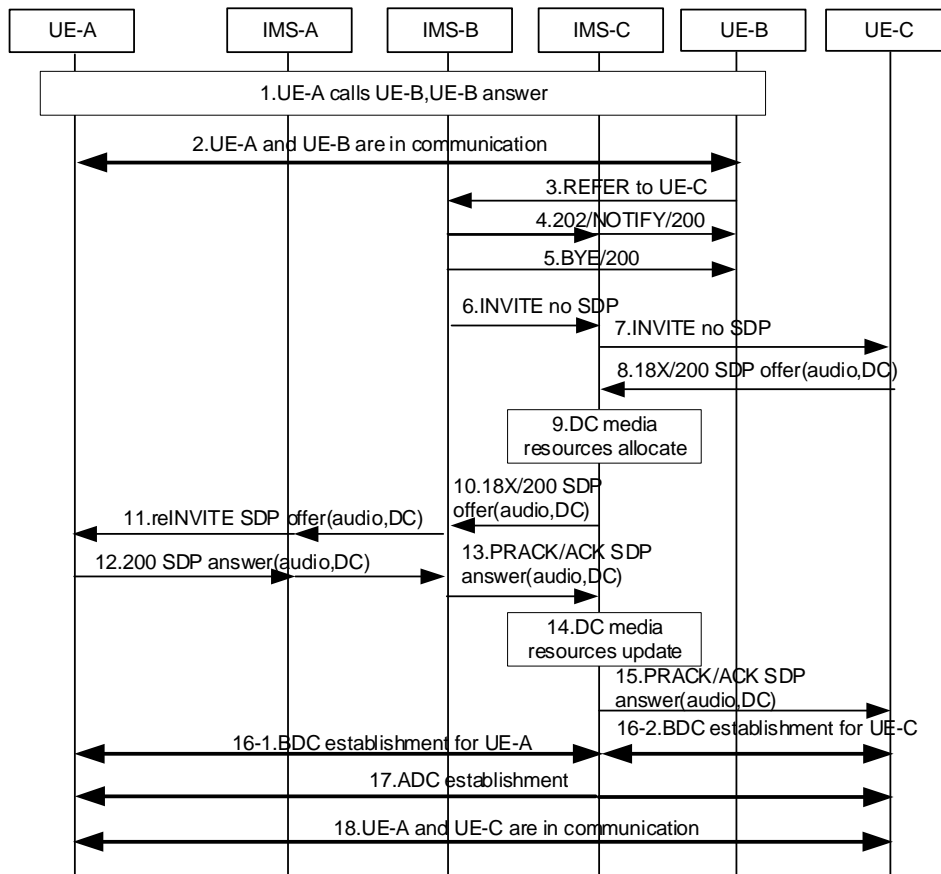**Figure A.1.3.3.1-1: Blind Transfer when IMS serving the transfer target provides data channel service**

Figure A.1.3.3.1-1 shows a call flow for consultative transfer when IMS serving the transfer target provides data channel service.

Step1: UE-A calls UE-B, UE-A sends an INVITE request towards the UE-B.

Step2: UE-B answers the call, session connection is established between UE-A and UE-B.

Step3: UE-B starts transfer process. UE-B sends a REFER message to transfer the call to UE-C.

Step4-5: IMS-B sends 202/NOTIFY to UE-B to accept the transfer request, and then sends BYE message to UE-B.

Step6: IMS-B sends an INVITE message towards UE-C.

Step7-9: IMS-C forwards the INVITE message to UE-C. On reception of 18X/200 message with data channel media from UE-C, IMS-C allocates the data channel media resources on MF for UE-A and UE-C.

Step10.: IMS-C sends the 18X/200 message to IMS-B.

Step11-12: IMS-B transfers the 18X/200 message to reINVITE message and sends it towards UE-A, UE-A responses 200 OK with data channel media answer to IMS-B.

Step13-14: IMS-B transfers the 200 OK message to PRACK/ACK message and sends it to IMS-C. IMS-C update data channel media on MF. Then IMS-C sends the PRACK/ACK message to UE-C.

Step16: The BDC media connections are established on MF of IMS-C for both UE-A and UE-C.

Step17: The ADC media connections are established between UE-A and UE-C.

Step18: The session connection is established between UE-A and UE-C.

A.1.3.3.2 Consultation Transfer
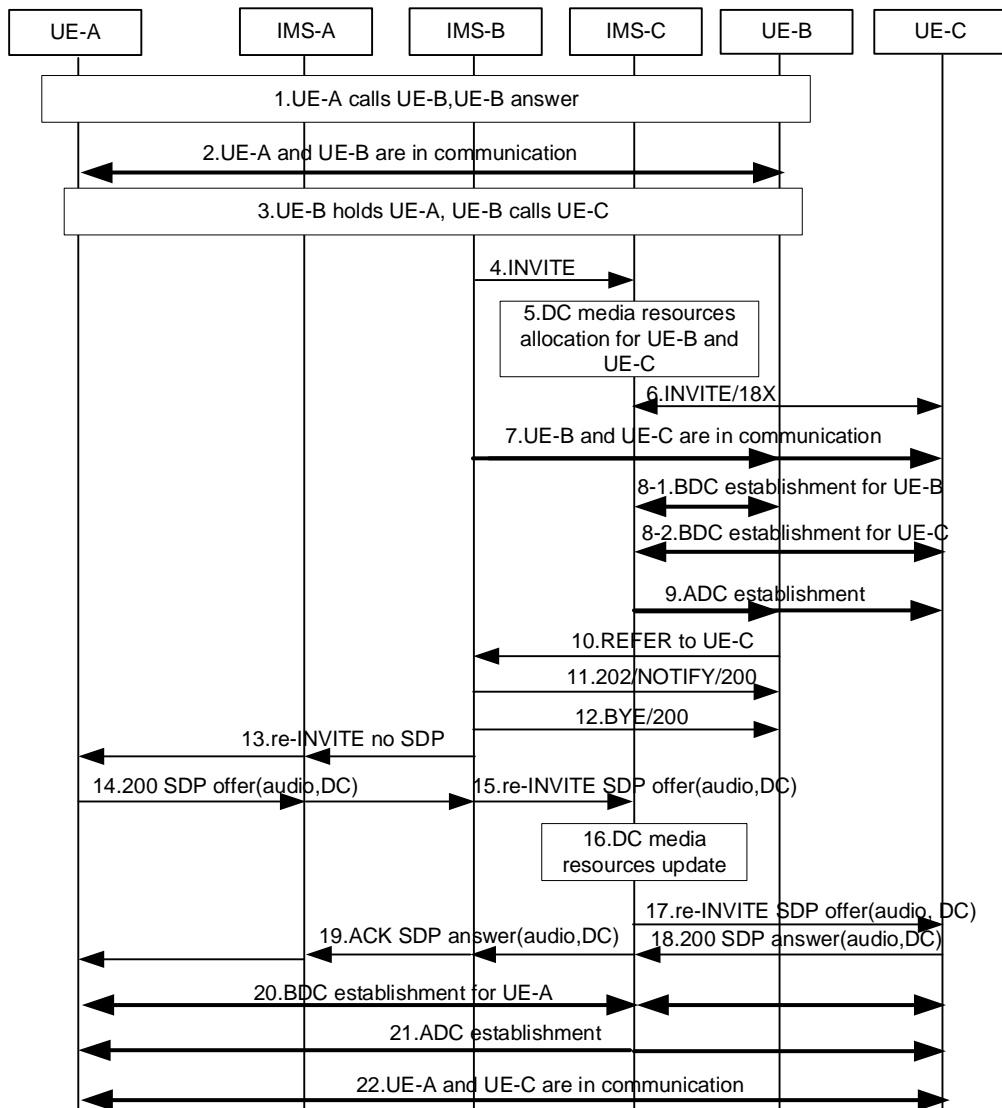
Figure A.1.3.3.2-1: Consultative Transfer when IMS serving the transfer target provides data channel service

Figure A.1.3.3.2-1 shows a call flow for consultative transfer when IMS serving the transfer target provides data channel service.

Step1: UE-A calls UE-B, UE-A sends an INVITE request towards the UE-B.

Step2: UE-B answers the call, session connection is established between UE-A and UE-B.

Step3-9: UE-B holds UE-A, and then calls UE-C, session connection is established between UE-B and UE-C. IMS-C establishes BDC connection for UE-B and UE-C. And then IMS-C establishes ADC connections between UE-B and UE-C.

Step10: UE-B starts transfer process. UE-B sends a REFER message to transfer the call to UE-C.

Step11-12: IMS-B sends 202/NOTIFY to UE-B to accept the transfer request, and then sends BYE message to UE-B.

Step13-15: IMS-B sends a re-INVITE request to establish the connection between UE-A and UE-C.

Step16: IMS-C updates the DC media connection for UE-A when receiving the updated data channel media from UE-A.

Step17-19: The media re-negotiation finished between UE-A and UE-C.

Step20: The BDC media connection is established on MF of IMS-C for UE-A.

Step21: The ADC media connections are established between UE-A and UE-C.

Step22: The session connection is established between UE-A and UE-C.

Annex B (normative):
Extensions within the present document

B.1 Feature-capability indicators defined in the present document

This clause describes the feature-capability indicators definitions, according to IETF RFC 6809 [6], that are applicable for the 3GPP IM CN subsystem.

B.1.1 Definition of feature-capability indicator g.3gpp.datachannel

Feature-capability indicator name: g.3gpp.datachannel

Summary of the feature indicated by this feature-capability indicator:

This feature-capability indicator indicates the support of data channel capability in the network, and can be included in a Feature-Caps header field as specified in IETF RFC 6809 [6] in a 200 (OK) response to the REGISTER request.

Feature-capability indicator specification reference:

3GPP TS 24.186, http://www.3gpp.org/ftp/Specs/archive/24_series/24.186/

Values appropriate for use with this feature-capability indicator: Not applicable

Examples of typical use: Indicating the support of data channel capability in the network.

Security Considerations: Security considerations for this feature-capability indicator are discussed in clause 9 of IETF RFC 6809[6].

Annex C (normative):
Applications based on IMS data channel

C.1 General

The present annex depicts the applications based on the IMS data channel, including the corresponding procedures.

C.2 AR communication

C.2.1 AR Remote Cooperation

C.2.1.1 General Description

According to clause 6.39.2 of 3GPP TS 22.261 [2], the IMS network should support AR media processing. AR Remote Cooperation is a typical AR call service and the detailed user experience of AR Remote Cooperation is described in clause 5.3 of 3GPP TR 22.873 [13].

It's assumed that the local UE shares the camera to the remote UE for assistance, and the remote UE displays the shared camera and provides assistances. A voice call is established between local UE and remote UE, and then AR Remote Assistance application is triggered by local UE.

The overall solution is based on IMS DC architecture specified in Annex AC of 3GPP TS 23.228 [3] and shown as follows:

- The local UE triggers the media renegotiation for AR Remote Cooperation based on user actions to establish a new video stream to transmit local video content (see A002 in figure C.2.1.1-1) and an application data channel to transmit AR anchors (see A001 in figure C.2.1.1-1).

- After the DCSF recognizes the AR Remote Cooperation service, it anchors the video stream and application data channel to MF. Then the DCSF initiates media renegotiation with remote UE to establish a new video stream to transmit local video content (see B002 in figure C.2.1.1-1) and an application data channel to transmit AR anchors (see B001 in figure C.2.1.1-1).

- - The local UE may decide to start AR media split rendering negotiation as specified in 3GPP TS 26.264 [29] and 3GPP TS 23.228 [29].

- The local UE or remote UE extract the original AR anchors input from the user and transmits the anchors to the MF through the application data channel.

- The local UE and remote UE receives the updated AR anchors from the MF, displays it on the video stream.

Figure C.2.1.1-1 illustrates the media connection model of the AR Remote Cooperation.
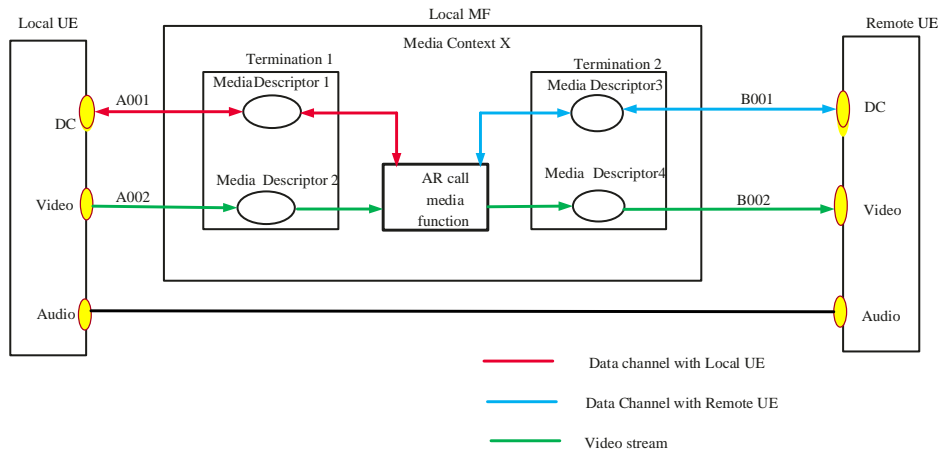
Figure C.2.1.1-1: Media Connection model of AR Remote Cooperation

Table C.2.1.1-1 lists the media streams for the AR Remote Cooperation.

Table C.2.1.1-1 Media stream list for the AR Remote Cooperation

Media ID (Example)	Media Resource Type	Direction	Description
A001	DC	bi-directional	Transmit upstream and downstream AR anchors between MF and local UE and the split rendering messages.
A002	Video	unidirectional	Transmit video content from local UE to the MF.
B001	DC	bi-directional	Transmit upstream and downstream AR anchors between the MF and remote UE.
B002	Video	unidirectional	Transmit local UE's video content to remote UE.

C.2.2 Procedures

C.2.2.1 Data Channel Setup

C.2.2.1.1 Procedure at the UE

Once AR remote cooperation application is launched, the local UE sends a SIP re-INVITE request with an SDP offer which includes a video media description with an "a=sendonly" attribute line to establish a video stream (see B001 in Figure C.2.1.1-1) as specified in 3GPP TS 24.229 [9] and 3GPP TS 24.173 [10] and a data channel media description with "a=dcmap" attribute line containing "stream-id" parameter set to the values starting at 1000 and "a=3gpp-req-app " attribute line to establish an application data channel (see A001 in Figure C.2.1.1-1) as specified in clause 9.3. The "a=3gpp-req-app " attribute line indicates that the newly established application data channel is used for AR Remote Cooperation application.

After application data channel and video stream established, the local UE may decide to start split rendering. If the local UE decides to split rendering, the UE shall use the procedure defined in 3GPP TS 26.264 [29].

After split rendering negotiation procedure finished, both the local UE or remote UE extracts the original AR anchors input by the user and transmits it to MF through the established application data channel.

When receiving the updated AR anchors transmitted via application data channel from the MF, both the local UE and the remote UE displays the updated AR anchors based on video stream.

C.2.2.1.2 Procedure at the IMS AS

When receiving the SIP re-INVITE request from local UE, IMS AS shall notify the DCSF about media change request related to local UE requesting to setup an application data channel and a new video.

When receiving media reservation instruction from DCSF, the IMS AS shall convert the media instructions to the corresponding media resource operations and request MF to create or update media resources, and reserve media processing resources for AR Remote Cooperation.

When receiving response from MF on the media resources reservation or update, IMS AS sends media reservation response to DCSF, indicating the URL addresses of each stream involved AR Remote Cooperation service control, which is specified in 3GPP TS 29.175 [18].

C.2.2.2   Closing Data Channel

If the UE wants to close the AR remote cooperation related application data channels, the procedure defined in clause 9.3 applies.

3GPP

Annex <D> (informative):
Change history

Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
						Change history	
2023-04	CT1#141					Draft skeleton provided by the rapporteur.	0.0.0
2023-04	CT1#141					Implementing the agreed pCR: C1-232932, C1-232933, C1-232934	0.1.0
2023-05	CT1#142					Implementing the agreed pCR: C1-234121, C1-234122, C1-234123, C1-234124	0.2.0
2023-08	CT1#143					Implementing the agreed pCR: C1-236169, C1-236178, C1-236184, C1-236188, C1-236189, C1-236191, C1-236544	0.3.0
2023-10	CT1#144					Implementing the agreed pCR: C1-238296, C1-238298, C1-238299, C1-238303, C1-238306, C1-238310, C1-238313, C1-238320, C1-238321, C1-238322, C1-238323	0.4.0
2023-11	CT1#145					Implementing the agreed pCR: C1-238764, C1-238928, C1-239524, C1-239525, C1-239526, C1-239527, C1-239528, C1-239530, C1-239531, C1-239532, C1-239534, C1-239535, C1-239536, C1-239539, C1-239542, C1-239543, C1-239544, C1-239545, C1-239546, C1-239555	0.5.0
2023-12	CT#102					Presentation to TSG CT for information	1.0.0
2024-01	CT1#146					Implementing the agreed pCR: C1-240115, C1-240131, C1-240137, C1-240193, C1-240195, C1-240281, C1-240283, C1-240343, C1-240344, C1-240345, C1-240346, C1-240347, C1-240348, C1-240349, C1-240352, C1-240377, C1-240378, C1-240379, C1-240380, C1-240383, C1-240384, C1-240385, C1-240386, C1-240387	1.1.0
2024-03	CT1#147					Implementing the agreed pCR: C1-240623, C1-240733, C1-241409, C1-241428, C1-241432, C1-241435, C1-241437, C1-241439, C1-241450, C1-241452, C1-241454, C1-241455, C1-241456, C1-241464, C1-241470, C1-241471, C1-241472, C1-241474, C1-241476, C1-241477, C1-241478	1.2.0
2024-03	CT#103	CP-240231				Presentation to TSG CT for approval	2.0.0
2024-06	CT#104	CP-241186	0012	-	B	Abnormal case for DC1 interface	18.1.0
2024-06	CT#104	CP-241186	0001	1	B	The requirement of the IMS AS during registration	18.1.0
2024-06	CT#104	CP-241186	0006	1	F	Correction to TS 24.186	18.1.0
2024-06	CT#104	CP-241186	0008	1	F	Clarification on the procedure of IMS AS during session setup and session modification	18.1.0
2024-06	CT#104	CP-241186	0007	1	F	Add the handling of SDP answer in the procedure of IMS AS	18.1.0
2024-06	CT#104	CP-241186	0010	1	F	Support of AR media split rendering negotiation	18.1.0
2024-06	CT#104	CP-241186	0015	1	F	Removal of CONF related EN	18.1.0
2024-06	CT#104	CP-241186	0009	2	F	Clarification on the capability negotiation	18.1.0
2024-06	CT#104	CP-241186	0003	2	F	Update the abnormal case on DC2	18.1.0
2024-06	CT#104	CP-241186	0004	3	C	Solve the EN on UICC configuration	18.1.0
2024-06	CT#104	CP-241186	0005	2	C	Clarification on DC setup policy	18.1.0
2024-06	CT#104	CP-241186	0027	-	F	Update the DC setup policy according to the new definition of DC setup option	18.1.0
2024-06	CT#104	CP-241186	0011	3	B	Interaction with CH supplementary service	18.1.0
2024-06	CT#104	CP-241186	0023	1	F	Correction on the procedure of IMS AS	18.1.0
2024-06	CT#104	CP-241186	0018	1	F	Procedure of orginating IMS AS on receiving the BDC estabilishement request	18.1.0
2024-06	CT#104	CP-241186	0025	1	F	The remote BDC setup requested by the UE	18.1.0
2024-06	CT#104	CP-241186	0026	1	B	Abnormal case for DC QoS negotiation in P2A and P2A2P scenarios	18.1.0
2024-06	CT#104	CP-241186	0017	2	F	Delete MRF from the spec	18.1.0
2024-09	CT#105	CP-242191	0024	3	F	DC resource release due to a CANCEL request	18.2.0
2024-09	CT#105	CP-242191	0031	1	F	DC related re-INVITE request collision	18.2.0
2024-09	CT#105	CP-242191	0032	1	F	Correct the IMS AS procedure on handling IP and port number	18.2.0
2024-12	CT#106	CP-243193	0036	-	F	Correction on the SDP handling for ADC setup	18.3.0
2024-12	CT#106	CP-243193	0034	2	F	Correction on the BDCs and ADCs in a m line	18.3.0
2024-12	CT#106					One change from CR#0036 was missed in the previous version	18.3.1
2025-03	CT#107	CP-250172	0066	1	F	ECT corrections: AS serving the transferee and blind call flow	18.4.0

History

Document history		
V18.0.0	May 2024	Publication
V18.1.0	August 2024	Publication
V18.2.0	October 2024	Publication
V18.3.1	January 2025	Publication
V18.4.0	March 2025	Publication