GMI 2008 Xc Implementation Agreement between UE and Video Media Server (SS-MCF)

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Abstract:

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I. The MultiService Forum

The MultiService Forum (MSF) is a global association of service providers, system suppliers and other organizations committed to developing and promoting open-architecture, multiservice communication systems. Founded in 1998, the MSF is an open-membership organization comprised of the world's leading telecommunications companies.

The MSF's activities include developing implementation agreements, promoting worldwide compatibility and interoperability, and encouraging input to appropriate national and international standards bodies.

As part of MSF’s effort to drive and promote interoperability, the MSF has created a number of programs geared toward accelerating real world network deployments:

1. Global MSF Interoperability (GMI) events. GMI events provide a real-world setting for vendors to test their solutions and provide evidence that vendor products meet the interoperability standards set forth by MSF Implementation Agreements. Each MSF GMI event is built around a set of capabilities defined for a given release of the MSF Architecture.

2. Next Generation Network (NGN) Test Bed. The NGN test bed provides a facility to enable carriers and vendors to perform in-depth testing of a specific interface as defined in a given release of the MSF architecture.

3. Certification Programs. For more mature technologies the MSF can provide Certification of compliance to a given Implementation Agreement where MSF members believe that it is of value to the industry to do so.

II. An introduction to MSF documentation and GMI 2008

This document is part of the MSF Release 4 set of architectural, protocol and test documentation.

The MSF Release 4 Architecture is a physical implementation of the functional architectures that have been proposed by the key Standards Development Organizations. As such the MSF Release 4 Architecture represents the current state of the industry and it identifies current open interfaces between physically separate network elements.

MSF Implementation Agreements define the protocols to be used over specific open interfaces. Where possible MSF Implementation Agreements are based on industry standard protocols augmented with additional information so as to ensure interoperability between communicating network elements. This level of interoperability is achieved by closing any gaps and tightening any optional capabilities in those industry standards to remove the danger of mutually incompatible selections by vendors. An MSF Implementation Agreement is targeted at a given

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release of the MSF architecture but can be used in any circumstance where an operator wishes to deploy the open interface and its functionality within their own network.

The MSF Release 4 architecture and its associated implementation agreements are used as the basis for GMI 2008. GMI 2008 is a global test event executed to demonstrate multi-vendor, multi-service interoperability based around IMS and includes IPTV and web based services.

As part of GMI 2008 a number of detailed test scenarios have been developed and a number of test plans defined. Test plans contain the set of test cases required to demonstrate a given MSF Release 4 capability and serve to exercise and validate the set of Implementation Agreements required to realize the capability.

Following the completion of GMI 2008 the MSF Release 4 architecture and individual implementation agreements will be updated if the testing identifies any deficiencies in the documents.

For more information about the scope of GMI2008 please go to http://www.msforum.org

III. Impact on previously published MSF documents

This is a new specification for MSF release 4 and GMI 2008.

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Scope of this document

The Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN) selected RTSP as the protocol to use on Xc interface, which is media control interface for the IMS based IPTV [5]. The MSF have adopted the Xc interface for the media control interface of the Release 4 architecture [9]. This Implementation agreement provides details of Xc interface, as used in the MSF R4 architecture.

Note: BC service other than trick-play mode services is out of scope, while trick-play mode of BC service is in scope.
Note: Refer the relating documents about NGN[1], IMS[2] and SIP[3] for details.

1. Definitions and abbreviations

1.1. Definitions

“method 1”	The playback control method, e.g. in the VoD Service, which uses a subset of the RTSP methods defined in RFC 2326 [7], interpreting SIP INVITE and SIP BYE as triggers for RTSP Session Initiation and termination.
“method 2”	The playback control method, e.g. in the VoD Service, which follows RFC 2326 [7].

1.2. Abbreviations

BC	Broadcast
BCG	Broadband Content Guide
CoD	Content on Demand
DVB	Digital Video Broadcasting
DVBSTP	DVB SD&S Transport Protocol
ESG	Electronic Service Guide
IGMP	Internet Group Management Protocol
IMS	IP Multimedia Subsystem
MCF	Media Control Function
MDF	Media Delivery Function
NGN	Next Generation Network
nPVR	network-side Personal Video Recorder
OMA	Open Mobile Alliance
SCF	Service Control Function
SD&S	Service Discovery and Selection
SDF	Service Discovery Function
SIP	Session Initiation Protocol
SSF	Service Selection Function
TsTV	Time shift TV
UE	User Equipment

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UPSF	User Profile Server Function
URI	Uniform Resource Identifier
VoD	Video on Demand

2. Applicability

The scope of the interface described in this IA is shown in the figure below.

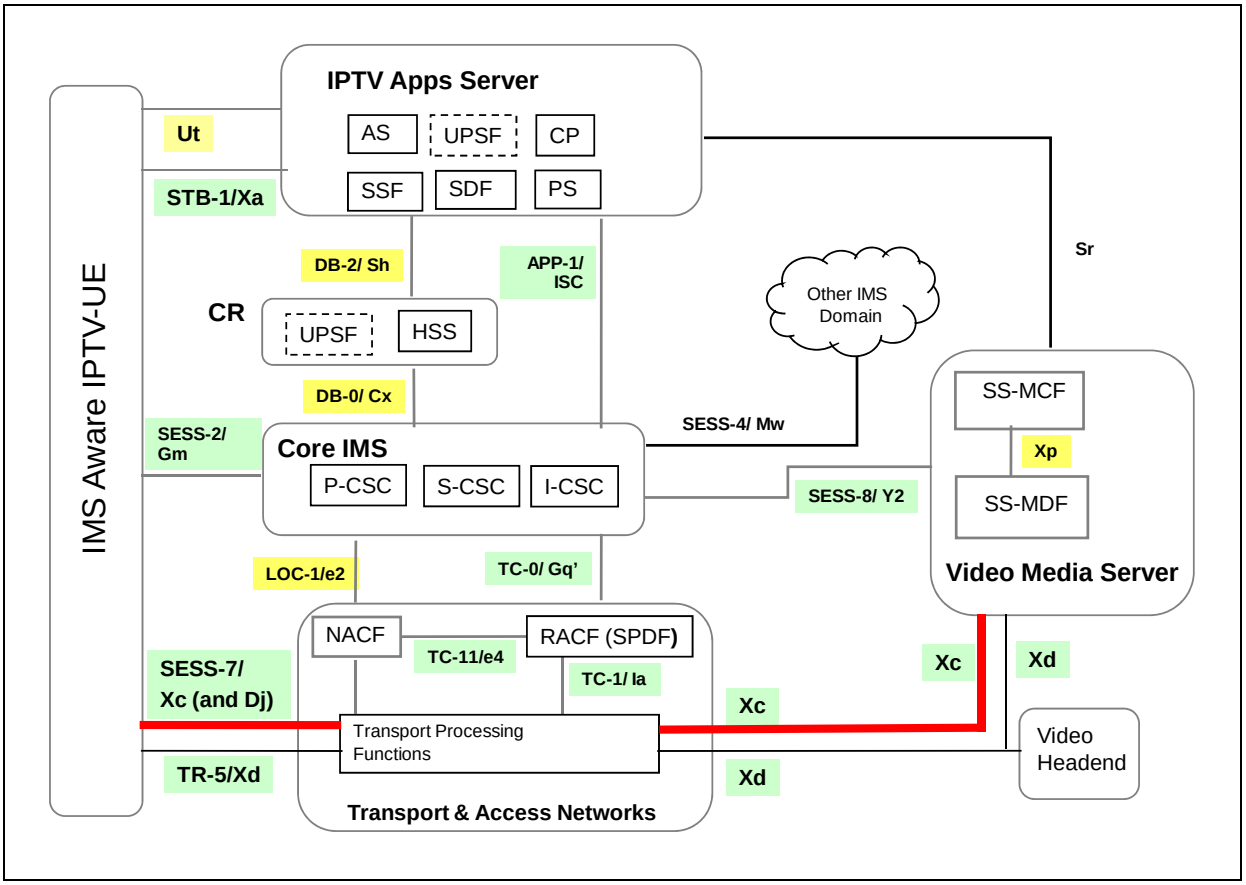

Figure 1 Xc Interface in the MSF R4 Architecture [9]

Media control in the MSF R4 architecture can be applied between the IMS aware IPTV UE and the SS-MCF-IPTV.

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2.1. RTSP Functionality

2.1.1. Media Description Retrieval

The DESCRIBE method retrieves the description of a presentation or media object identified by the request URL from a server. The server responds with a description of the requested resource. The DESCRIBE reply-response pair constitutes the media initialization phase of RTSP.

2.1.2. Media Setup

The SETUP request for a URI specifies the transport mechanism to be used for the streamed media.

2.1.3. Media Playback Initiation

The PLAY method tells the server to start sending data via the mechanism specified in SETUP. According to RFC2326 [7], a client MUST NOT issue a PLAY request until any outstanding SETUP requests have been acknowledged as successful.

2.1.4. Media Playback Modification

The PAUSE request causes the stream delivery to be interrupted (halted) temporarily. The PLAY request causes the stream to modify the position, speed and/or direction of playback.

2.1.5. Media Teardown

The TEARDOWN request stops the stream delivery for the given URI, freeing the resources associated with it.

2.1.6. Media Information Retrieval and Setting

The GET_PARAMETER request retrieves the value of a parameter of a presentation or stream specified in the URI. The SET_PARAMETER requests to set the value of a parameter for a presentation or stream specified by the URI.

2.1.7. Handling of Media Events

The ANNOUNCE method for RTSP servers to asynchronously announce clients about end of stream or end of RTSP session with a reason code.

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2.2. RTSP session initiation and termination methods

There are two methods using RTSP for playback control. “Method 1” uses a subset of the RTSP methods defined in RFC 2326 [7], interpreting SIP INVITE and SIP BYE as triggers for RTSP Session Initiation and termination. On the other hand, ”Method 2” use RTSP methods defined in RFC2326 [7].
For clear description, sections 4.1 and 4.2 describe method 1 and 2 respectively.

3. Xc Interface

This Implementation Agreement builds upon the IETF RTSP 1.0 [7] and the TISPAN 183 063 [6]. This IA highlights additional requirements and differences from the IETF RTSP 1.0 and defines the behavior of IMS aware IPTV UE and SS-MCF-IPTV.

Note: TISPAN has been studying the series of protocols for IMS based IPTV including Xc interface [6]. Even though the working document from TISPAN has never been published in public at this moment, this IA refers the working document from TISPAN according to the guide to refer the unpublished documents from other standards bodies as discussed in IPTV working group phone meeting on February 21, since the working document looks almost stable and feasible.

Note: This IA is subject to change, because of based on the current working draft.

This IA refers current working draft about IMS based IPTV protocol of TISPAN [6]. The differences from the working draft are summarized as follows:

- This IA focuses on Xc only, even though [6] treats other interfaces.
- This IA uses texts and figures replacing some key words, such as VoD, SS-MCF-IPTV and IMS aware IPTV UE from originally named CoD, MCF and UE in order to conform to MSF R4 architecture.

According to TISPAN [6], there are two methods using RTSP for playback control.
- “Method 1”: uses a subset of the RTSP methods defined in RFC 2326 [7], interpreting SIP INVITE and SIP BYE as triggers for RTSP Session Initiation and termination.
- ”Method 2”: use RTSP methods defined in RFC2326 [7].

3.1. Procedures for RTSP playback control (Method 1)

For method 1, after the RTSP session and media channel are setup by SIP, RTSP is used to medial playback control. The IMS aware IPTV UE shall support the following RTSP methods for RTSP playback control:
- PLAY(UE to SS-MCF-IPTV)
- PAUSE(UE to SS-MCF-IPTV)
- GET_PARAMETER (UE to SS-MCF-IPTV)

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- SET_PARAMETER (UE to SS-MCF-IPTV)
- ANNOUNCE (SS-MCF-IPTV to UE)

All other methods will result in “405 Method not allowed” reply from the SS-MCF-IPTV.

The methods shall use the same session id as specified in the SDP h-session attribute.

3.1.1. Media Playback Initiation Procedure

3.1.1.1. IMS aware IPTV UE view

Upon a request to start playback the UE shall send an RTSP PLAY message to the SS-MCF-IPTV using the h-uri attribute received in the SDP. If a domain address is used in the RTSP URL the UE shall not perform DNS lookup. The IP header for the RTSP PLAY message shall be set to the IP address from the connection line ("c=") in the SDP answer and the port from the media line ("`m=`").

NOTE: The UE does not perform DNS lookup in order to avoid misaligning the information conveyed in the SDP.

The RTSP fields in the RTSP PLAY message shall be filled as follows:
The RTSP URL shall be set to the value retrieved from the SDP h-uri attribute in the case of an absolute URI. If the value of h-uri is a relative URI that is in the form of a media path, then the RTSP absolute URL is constructed by the UE using the SDP IPAddress (from c-line) and port (from m-line) as the base followed by h-uri value for the media path.
(ex. `rtsp://10.5.1.72:22554/TV3/823527`)

The Range parameter in the first RTSP PLAY message shall be set to the value retrieved from the SDP h-offset attribute.
(ex. `Range: npt=<OFFSET>-`)

3.1.1.2. SS-MCF-IPTV view

Upon successful RTSP PLAY request the MCF responds with a 200 OK message except for the cases as follows:

If the requested content is not ready for playing, the MCF shall reply with an RTSP error code 404 Not Found.

The contents of the 200 OK response shall be as follows:

- CSeq shall be set to the same value as that in the request.
- Date header may be generated by the MCF. It represents the date and time at which the message was originated.
- RTP-Info header may be generated by the MCF when the media packets are transported over the RTP layer. It indicates the RTP-specific parameters. The parameters url and rtptime shall be present. The parameter seq is recommended to be present. For non-

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MPEG2TS streams, the UE uses the parameter rtptime to calculate the mapping of RTP timestamp to NPT, and the UE may also use the parameter rtptime for inter-media synchronization.

3.1.2. Media Playback Modification Procedure

3.1.2.1. IMS aware IPTV UE view

Upon a request to modify playback the UE shall send an RTSP PLAY message with a request to modify the position, speed and/or direction of playback. The UE changes the direction and/or speed of playback by including a `Scale` header or change the position of playback by including a `Range` header.

- Scale header is set as follows :
  - 1 indicates normal play;
  - If not 1, the value corresponds to the rate with respect to normal viewing rate;
  - A negative value indicates reverse direction.

If the request is to pause playback, the UE shall send an RTSP PAUSE message.

3.1.2.2. SS-MCF-IPTV view

Upon successful RTSP PLAY or PAUSE request the SS-MCF-IPTV responds with a 200 OK message.
The contents of the 200 OK response shall be as follows:

- CSeq shall be set to the same value as that in the request.
- Date header may be generated by the MCF. It represents the date and time at which the message was originated.
- RTP-Info header may be generated by the MCF when the media packets are transported over the RTP layer. It indicates the RTP-specific parameters. The parameters url and rtptime shall be present. The parameter seq is recommended to be present. For non-MPEG2TS streams, the UE uses the parameter rtptime to calculate the mapping of RTP timestamp to NPT, and the UE may also use the parameter rtptime for inter-media synchronization.

3.1.3. Media Playback Information Retrieval and Setting Procedure

3.1.3.1. IMS aware IPTV UE view

Upon a request to retrieve playback information the UE shall send an RTSP GET_PARAMETER message. The UE may retrieve the following information:

position
The position in the media in seconds.

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scales
The allowed scales that can be used in the PLAY request.

Any other parameter that is used in GET_PARAMETER request will be rejected by the MCF.
An empty body is allowed for RTSP keep alive.
The UE may also set the position parameter (ex. to jump to a bookmark position within a video) by sending the RTSP SET_PARAMETER message. Any other parameter that is used in SET_PARAMETER request will be rejected by the MCF.

3.1.3.2. SS-MCF-IPTV view

Upon successful RTSP GET_PARAMETER or SET_PARAMETER request the MCF responds with a 200 OK message with the requested values or with the successful setting of a parameter.

3.1.4. Handling of Media Events

3.1.4.1. IMS aware IPTV UE view

Upon the reception of the RTSP ANNOUNCE with indication of end-of-stream the UE may take relevant actions to handle the end of stream event (eg. Terminating session, rewinding the media stream etc.). The UE shall respond with a 200 OK.
In case of BC sessions with trick-play, if the UE receives an RTSP ANNOUNCE request with an end-of-stream indication, the UE may initiate a session modification procedure in order to go back to a normal BC session in multicast mode or may alternatively take other actions (eg., rewind, pause, terminate session etc.).
If the UE does not understand any of the headers or the notice-code value in the ANNOUNCE request, it simply shall ignore the request.

3.1.4.2. SS-MCF-IPTV view

Upon receipt of the end-of-stream indication from SS-MDF-IPTV, SS-MCF-IPTV may send an RTSP ANNOUNCE to the UE with an indication that the end-of-stream has been reached.
The "Notice" header shall be included with the notice code value set to "2101 End-of-Stream Reached".

NOTE: The header and code are based draft-stiemerling-rtsp-announce-01 [10]. The use of other event types is outside scope of release 2.

3.2. Procedures for RTSP content control (Method 2)

3.2.1. RTSP

After VoD session setup, RTSP as defined in [7] is used to control media delivery. It includes media setup, media control and media teardown. RTSP header fields shall conform to ETSI TS 102034 [4], clause 6.3.2.

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The IMS aware IPTV UE shall support the following RTSP methods:

- DESCRIBE (IMS aware IPTV UE to SS-MCF-IPTV)
- SETUP (IMS aware IPTV UE to SS-MCF-IPTV)
- PLAY (IMS aware IPTV UE to SS-MCF-IPTV)
- PAUSE (IMS aware IPTV UE to SS-MCF-IPTV)
- TEARDOWN (IMS aware IPTV UE to SS-MCF-IPTV)
- ANNOUNCE (SS-MCF-IPTV to IMS aware IPTV UE)

The SS-MCF-IPTV shall act as a media server as defined in [7]. RTSP header fields shall conform to ETSI TS 102034 [4], clause 6.3.2. The SS-MCF-IPTV shall not redirect the RTSP methods using either the REDIRECT method or Redirection status code (3xx).

Note The SS-MCF-IPTV shall not perform redirection to avoid misaligning the information conveyed in the SDP. The problem occurs if the redirected URI differs from the ones conveyed in the SDP connection and media line is that SIP is used for opening proxies and firewalls for the content control and the content delivery paths.

3.2.2. Media Description Procedure

IMS aware IPTV UE view

In case the IMS aware IPTV UE did not get content delivery description information (from the SSF or from the AS-IPTV/SS-MCF-IPTV during the SIP session initiation), it shall request description of the media via the DESCRIBE message. The RTSP URL to send the DESCRIBE message to is retrieved from the SSF data or from the AS-IPTV/SS-MCF-IPTV during the SIP session initiation.
If a domain address is used in the RTSP URL the IMS aware IPTV UE shall not perform DNS lookup. The IP header for the RTSP DESCRIBE message shall be set to the IP address from the connection line (“*c=*”) in the SDP answer and the port from the media line (“*m=*”).
Note-The IMS aware IPTV UE shall not perform DNS lookup in order to avoid misaligning the information conveyed in the SDP.

The IMS aware IPTV UE shall include an Accept header in the request with “application/sdp” and “text/xml”.

SS-MCF-IPTV view

Upon successful RTSP DESCRIBE request the SS-MCF-IPTV responds with a 200 OK message.

The DESCRIBE response sent by the SS-MCF-IPTV shall have:

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- Content-type header set to “application/sdp”

  or

- Content-type header set to “text/xml” and Content-encoding set to “utf8”, conforming to ETSI TS 102 034 clause 6.3.1.2.

3.2.3. Media Setup Procedure

IMS aware IPTV UE view

On sending a SETUP request, the IMS aware IPTV UE shall populate the header fields as follows:

- RTSP URL header shall be set to the *a*=control parameter if present in the answer to the DESCRIBE sent by the SS-MCF-IPTV. If not present, RTSP URL shall be set to the corresponding media RTSP URL which has been obtained from the SSF data, or from the VoD session initiation. If a domain address is used in the RTSP URL the IMS aware IPTV UE shall not perform DNS lookup. The IP header for the RTSP SETUP message shall be set to the IP address from the connection line (“*c*=”) in the SDP answer and the port from the media line (“*m*=”).
- *CSeq* header shall be generated by the IMS aware IPTV UE.

On receiving a *200OK* response to the SETUP request, the IMS aware IPTV UE shall retrieve and store the Session header for issuing the PLAY request later.

SS-MCF-IPTV view

Upon successful RTSP SETUP request the SS-MCF-IPTV responds with a *200 OK* message. The contents of *200 OK* response shall be as follows:

- *CSeq* shall be set to the same value as that in the SETUP request
- Date header may be generated by the SS-MCF-IPTV. It represents the date and time at which the message was originated.
- Session header is generated by the SS-MCF-IPTV.
- Transport header contains the transport parameters selected by the SS-MCF-IPTV.

3.2.4. Media Playback Initiation Procedure

IMS aware IPTV UE view

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After SETUP request has been acknowledged as successful, IMS aware IPTV UE shall start the playback of the content by sending an RTSP PLAY request.

The IMS aware IPTV UE shall populate the header fields as follows:

- RTSP URL header shall be set to the *a*=control parameter if present in the answer to the DESCRIBE sent by the SS-MCF-IPTV. If not present, RTSP URL shall be set to the corresponding media RTSP URL which has been obtained from the SSF data, or from the VoD session initiation. If a domain address is used in the RTSP URL the IMS aware IPTV UE shall not perform DNS lookup. The IP header for the RTSP SETUP message shall be set to the IP address from the connection line ("*c*=") in the SDP answer and the port from the media line ("*m*=").
- CSeq header shall be generated by the IMS aware IPTV UE.
- Session header shall be set to the same value as that in the SETUP request.
- If Range header was present in the DESCRIBE response, then the IMS aware IPTV UE shall use it. Otherwise, the IMS aware IPTV UE may include a Range header. If Range header is not sent by the IMS aware IPTV UE, the stream will play from the beginning.

SS-MCF-IPTV view

Upon successful RTSP PLAY request the SS-MCF-IPTV responds with a *200 OK* message. The contents of the *200 OK* response shall be as follows:

- *CSeq* shall be set to the same value as that in the request.
- Date header may be generated by the SS-MCF-IPTV. It represents the date and time at which the message was originated.
- RTP-Info header may be generated by the SS-MCF-IPTV when the media packets are transported over the RTP layer. It indicates the RTP-specific parameters. The parameters *url* and *rtptime* shall be present. The parameter *seq* is recommended to be present. For non-MPEG2TS streams ,the IMS aware IPTV UE uses the parameter *rtptime* to calculate the mapping of RTP timestamp to NPT, and the IMS aware IPTV UE may also use the parameter *rtptime* for inter-media synchronization.

3.2.5. Media Playback Modification Procedure

IMS aware IPTV UE view

Upon a request to modify playback the IMS aware IPTV UE shall send an RTSP PLAY message with a request to modify the position, speed and/or direction of playback. The IMS aware IPTV UE changes the direction and/or speed of playback by including a Scale header or change the position of playback by including a Range header.
The IMS aware IPTV UE shall populate the header fields conforming to 4.4 with the following additions:

- Range header is optional.
- Scale header is optional : it is set as follows :

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- 1 indicates normal play;
- If not 1, the value corresponds to the rate with respect to normal viewing rate;
- A negative value indicates reverse direction.

If the request is to pause playback, the IMS aware IPTV UE shall send an RTSP PAUSE message.
On sending a PAUSE request, the IMS aware IPTV UE shall populate the header fields as follows:

- RTSP URL header shall be set to the same value as that in the previous PLAY request.
- *CSeq* header shall be set to the same value as that in the previous PLAY request.
- Session header shall be set to the same value as that in the PLAY request.

SS-MCF-IPTV view

Upon successful RTSP control (PLAY, PAUSE) request the SS-MCF-IPTV responds with a 200 OK message.
The contents of the 200 OK response shall be as follows:

- *CSeq* shall be set to the same value as that in the request.
- Date header may be generated by the SS-MCF-IPTV. It represents the date and time at which the message was originated.
- RTP-Info header may be generated by the SS-MCF-IPTV when the media packets are transported over the RTP layer. It indicates the RTP-specific parameters. The parameters *url* and *rtptime* shall be present. The parameter *seq* is recommended to be present. For non-MPEG2TS streams ,the IMS aware IPTV UE uses the parameter *rtptime* to calculate the mapping of RTP timestamp to NPT, and the IMS aware IPTV UE may also use the parameter *rtptime* for inter-media synchronization.

3.2.6. Media Teardown Procedure

IMS aware IPTV UE view

On sending TEARDOWN request, the IMS aware IPTV UE shall populate the header fields as follows:

- RTSP URL header shall be set to the *a*=control parameter if present in the answer to the DESCRIBE sent by the SS-MCF-IPTV. If not present, RTSP URL shall be set to the corresponding media RTSP URL which has been obtained from the SSF data, or from the VoD session initiation. If a domain address is used in the RTSP URL the IMS aware IPTV UE shall not perform DNS lookup. The IP header for the RTSP SETUP message shall be set to the IP address from the connection line (“*c*=”) in the SDP answer and the port from the media line (“*m*=”).
- *CSeq* header shall be generated by the IMS aware IPTV UE.
- Session header shall be set to the same value as that in the SETUP request.

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SS-MCF-IPTV view

Upon successful RTSP TEARDOWN request the SS-MCF-IPTV responds with a 200 OK message.
The contents of 200OK response shall be as follows:
- *CSeq* shall be set to the same value as that in the TEARDOWN request.

3.2.7. Handling of Media Events

IMS aware IPTV UE view

Upon the reception of the RTSP ANNOUNCE with indication of end-of-stream the IMS aware IPTV UE may take relevant actions to handle the end of stream event (eg. Terminating session, rewinding the media stream etc.). The IMS aware IPTV UE shall respond with a 200 OK.
In case of BC sessions with trick-play, if the IMS aware IPTV UE receives an RTSP ANNOUNCE request with an end-of-stream indication, the IMS aware IPTV UE may initiate a session modification procedure in order to go back to a normal BC session in multicast mode or may alternatively take other actions (eg., rewind, pause, terminate session etc.).

If the IMS aware IPTV UE does not understand any of the headers or the notice-code value in the ANNOUNCE request, it simply shall ignore the request.

SS-MCF-IPTV view

Upon receipt of the end-of-stream indication from MDF, SS-MCF-IPTV shall send an RTSP ANNOUNCE to the IMS aware IPTV UE with an indication that the end-of-stream has been reached.
The “Notice” header shall be included with the notice code value set to "2101 End-of-Stream Reached".
Note-The header and code are based draft-stiemerling-rtsp-announce-00. The use of other event types is outside scope of release2

4. References

[1] ETSI ES 282 001: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture Release 2".

[2] ETSI ES 282 007: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Subsystem (IMS); Functional architecture".

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[3] ETSI ES 283 003 R2: Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN);IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP) Stage 3

[4] ETSI TS 102 034 V1.3.1: "Digital Video Broadcasting (DVB); Transport of MPEG-2 Based DVB Services over IP Based Networks".

[5] ETSI TS 182 027: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IPTV functions supported by the IMS subsystem".

[6] ETSI TS 183 063 V0.1.0 (2008-2): “Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); IMS based IPTV Stage 3 Specification”

[7] IETF RFC 2326: Real Time Streaming Protocol (RTSP)

[8] MSF contribution, “GMI 2008 Y2 Implementation Agreement between S-CSCF and SS-MCF”, msf2008.097.02

[9] MSF contribution, “MSF IMS-IPTV Physical Architecture for GMI08”, msf2008.139.01

[10] IETF, draft-stiemerling-rtsp-announce-01.txt

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Appendix A Example Signaling Flows of VoD operation using method 1

A.1 Session Initiation

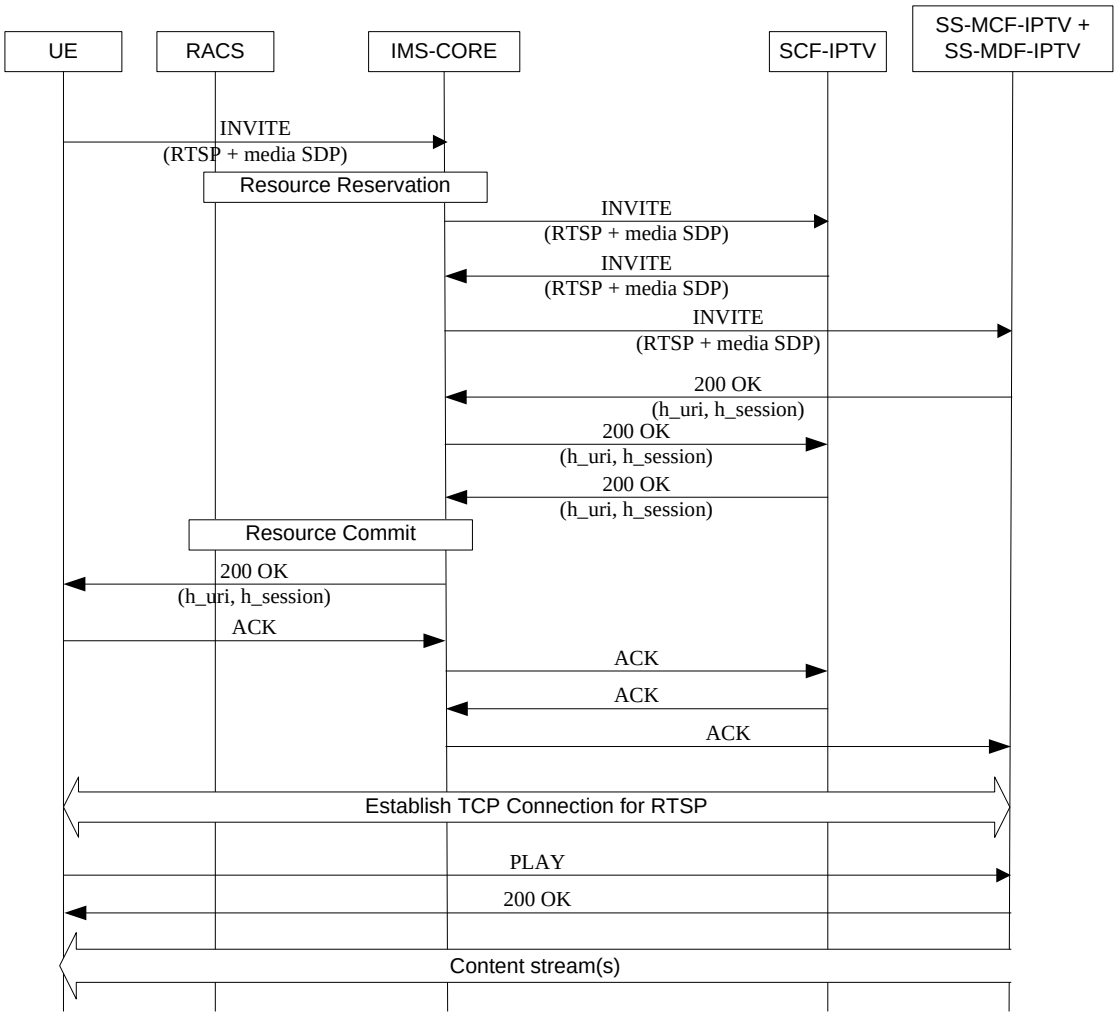

Figure 2 Example signaling flow for session initiation for method 1

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A.2 Session termination

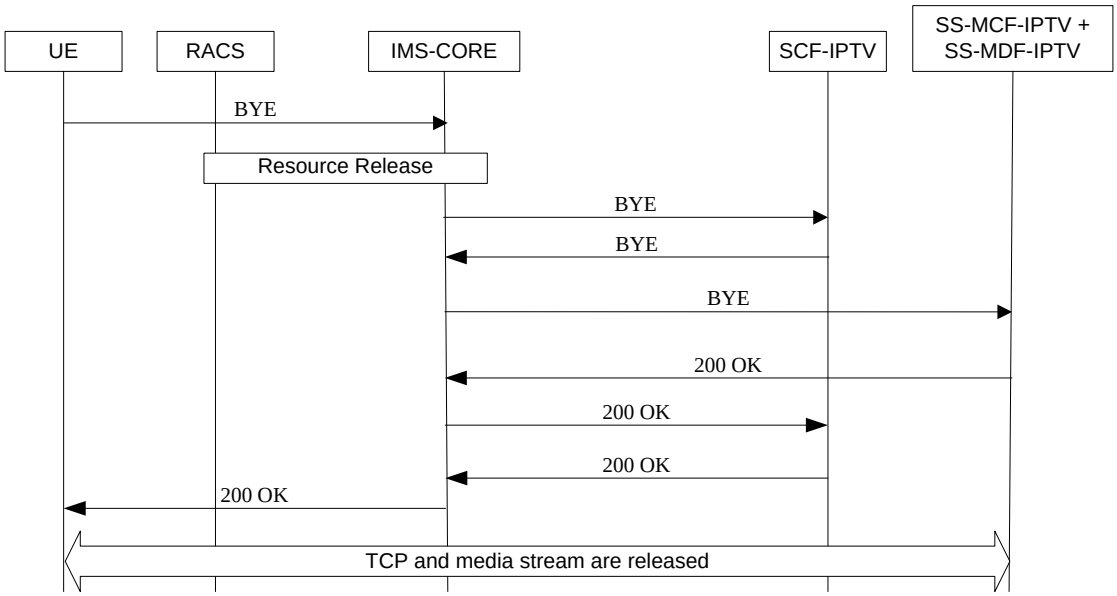

Figure 3 Example signaling flows of session termination for method 1

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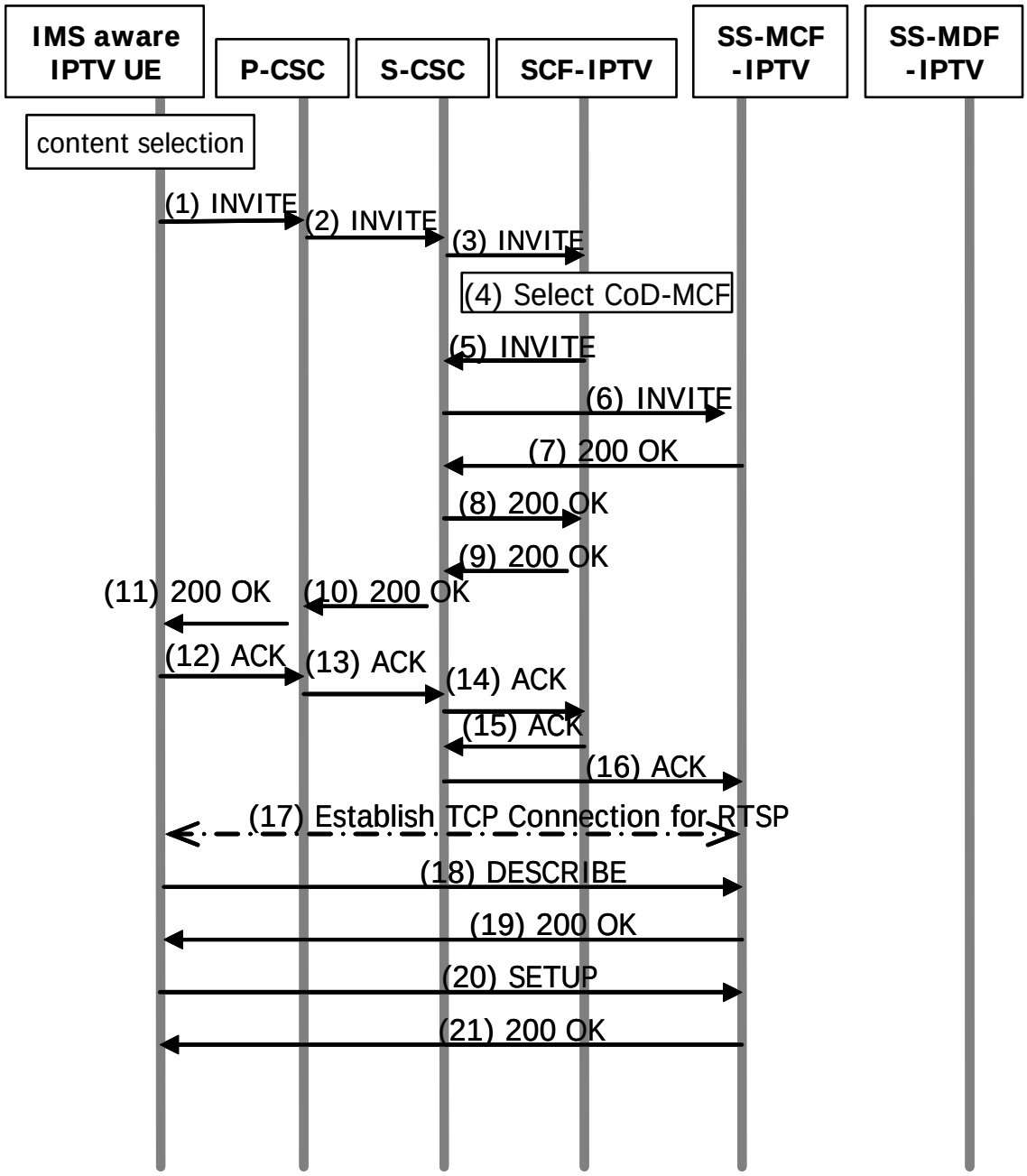
Appendix B Example Signaling Flows of VoD operation using method 2

B.1 Session Initiation

B.1.1 Session initiation flows for case of establishing content control channel and content delivery channels separately



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(to be continued to the next page)

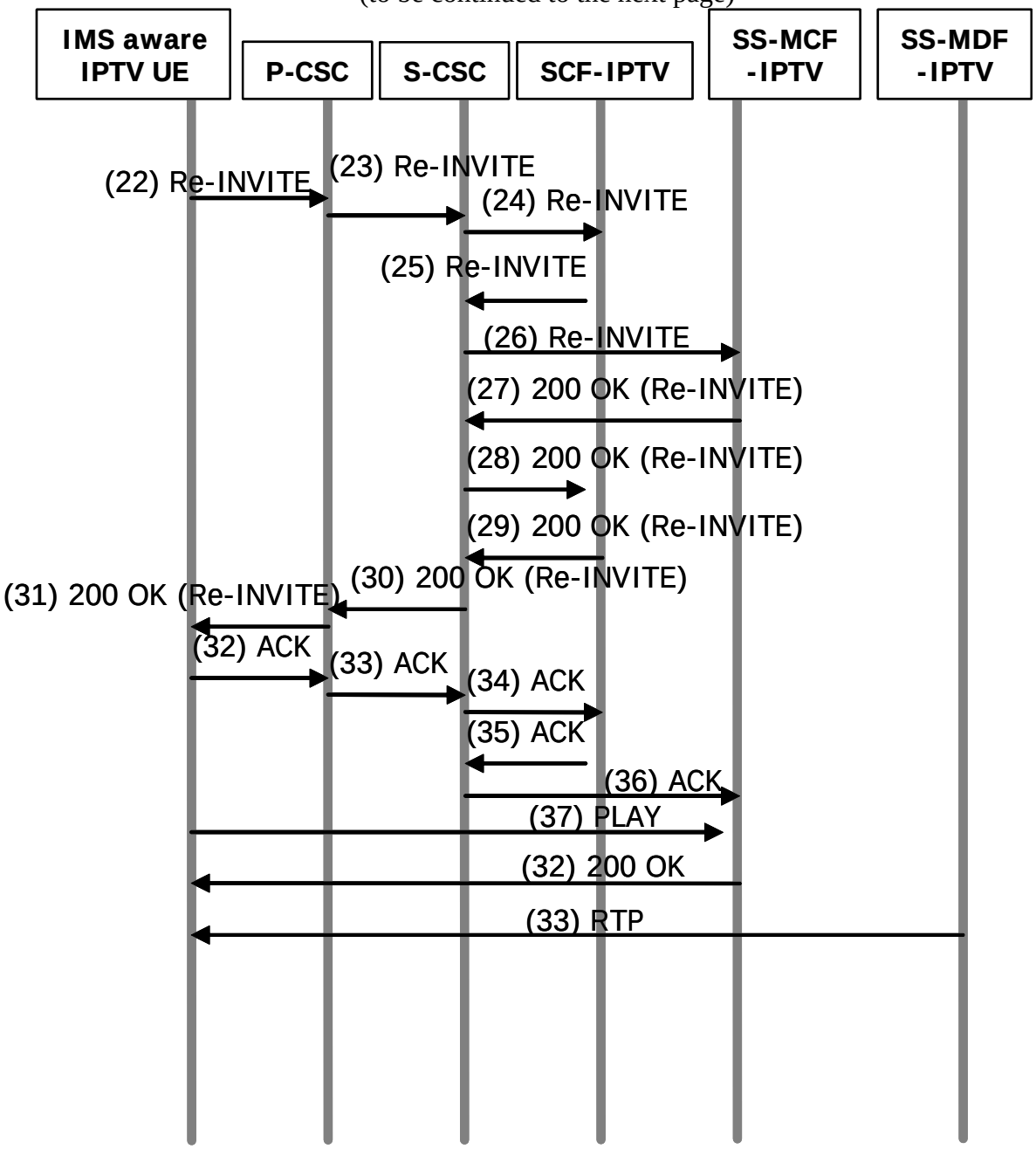

Figure 4 Example signaling flow for session initiation for case of establishing content control channel and content delivery channels separately

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B.1.2 Session initiation flows for case of establishing content control channel and content delivery channels using RTSP method 2

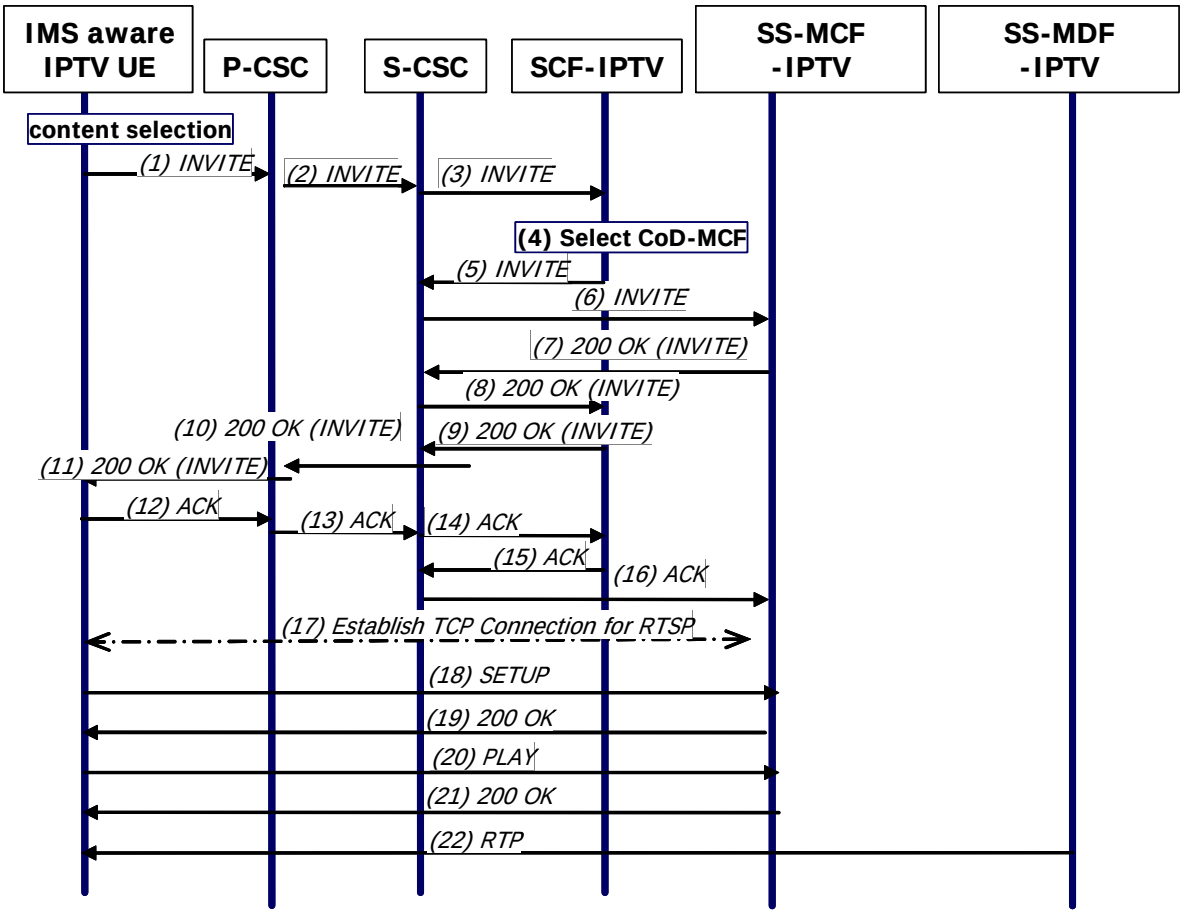

Figure 5 Example signaling flow for session initiation for case of establishing content control channel and content delivery channels using RTSP method 2

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B.2 Session Termination

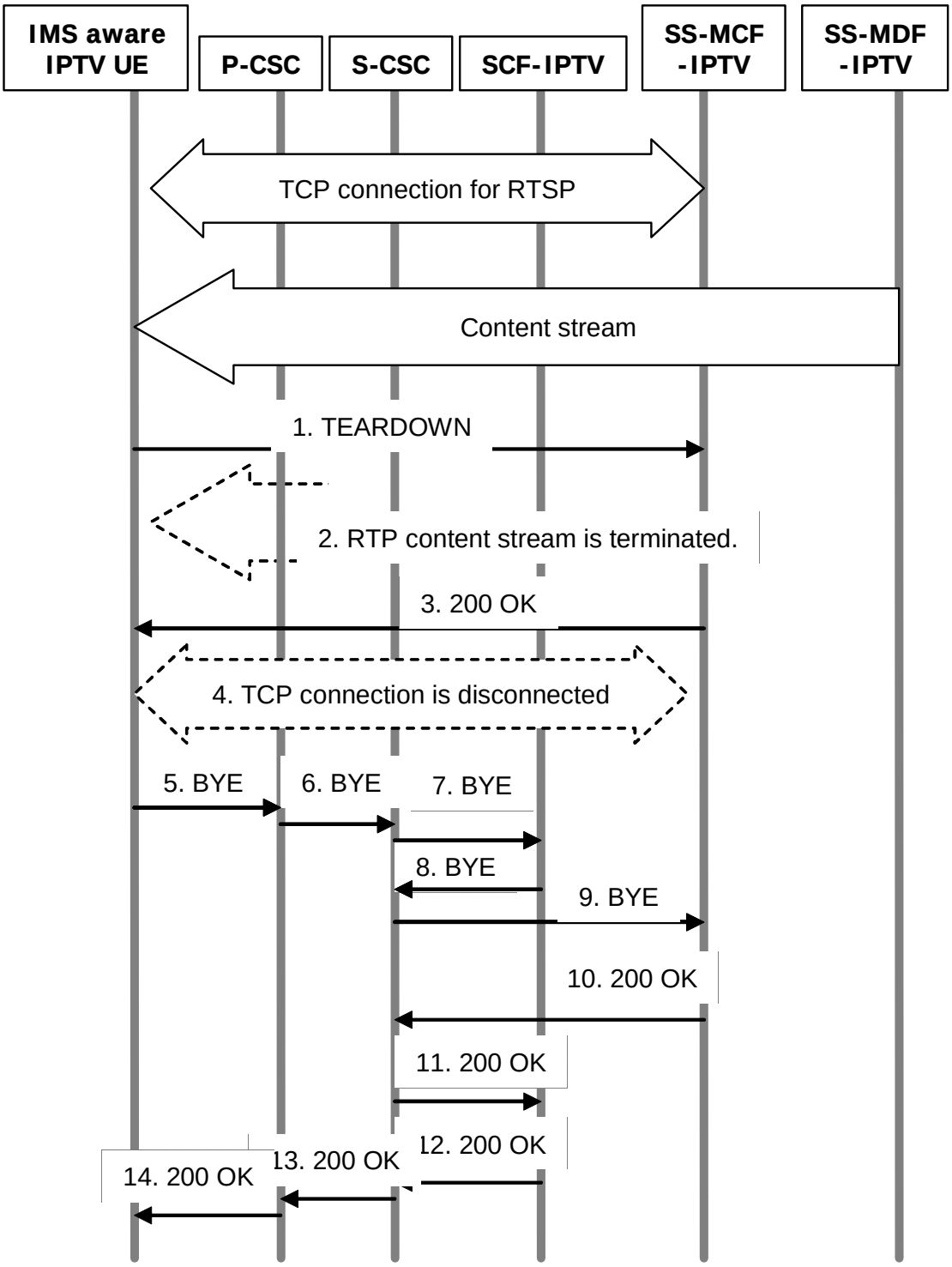

Figure 6 Example signaling flows of session termination

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