MSF Implementation Agreement for Gm for IMS-based IPTV

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Abstract:

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To date the MSF has defined a number of detailed Implementation Agreements and detailed Test Plans for the signaling protocols between network components and is developing additional Implementation Agreements and Test Plans addressing some of the other technical issues such as QoS and Security to assist vendors and operators in deploying interoperable solutions.

The MSF welcomes feedback and comment and would encourage interested parties to get involved in this work program. Information about the MSF and membership options can be found on the MSF website http://www.msforum.org/

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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 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.

Contents

1 Scope

The IA lists the Gm interface for IMS based IPTV service based on TISPAN 183 063[3] and MSF R4 architecture [1].

This document details the extra messaging requirements needed on the Gm interface in order to realize IPTV service. This messaging is in addition to that already specified in the existing MSF IA for ISC [5].

2 References

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

[1] MSF Release 4 Architecture (MSF-ARCH-004.00-FINAL)

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

[3] ETSI TS 183 063: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN);IMS based IPTV Stage 3 Specification"

[4] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2"

[5] MSF-IA-SIP.016: "SIP IA for MSFR4 / GMI2008"

[6] ETSI ES 283 003: "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"

[7] MSF2008.043.xx: "MSF R4 IPTV Network/Service Element Supplier List (for GMI08)"

[8] MSF2008.139.01 "MSF IMS-IPTV Physical Architecture for GMI08"

[9] RFC 4145 "TCP-Based Media Transport in the Session Description Protocol (SDP) "

[10] MSF2008.127 “GMI 2008 ISC Implementation Agreement for IMS-based IPTV”

[11] draft-channabasappa-sipping-app-profile-type-02

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in the following apply.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", “NOT RECOMMENDED”, "MAY", "OPTIONAL", “CONDITIONAL” and “IF” in this document are to be interpreted as described in the MSF Technical Committee Operating Procedures ([28]).

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in the following apply.

AS-IPTV Application Server for IPTV

BC Broadcast

CoD	Content on Demand
IGMP	Internet Group Management Protocol
IMS	IP Multimedia Subsystem
ISC	IMS Service Control
IP	Internet Protocol
MCF	Media Control Function
MDF	Media Delivery Function
nPVR	network-side Personal Video Recorder
PSI	Public Service Identifier
RTSP	Real Time Streaming Protocol
S-CSC	Serving Call Session Control
SCF	Service Control Function
SDF	Service Discovery Function
SDP	Session Description Protocol
SIP	Session Initiation Protocol
TV	Television
UE	User Equipment
URI	Uniform Resource Identifier

4 Applicability and Scope

4.1 Overview

Figure 4.1 illustrates the architecture diagram showing the Gm interface for IMS based IPTV system.

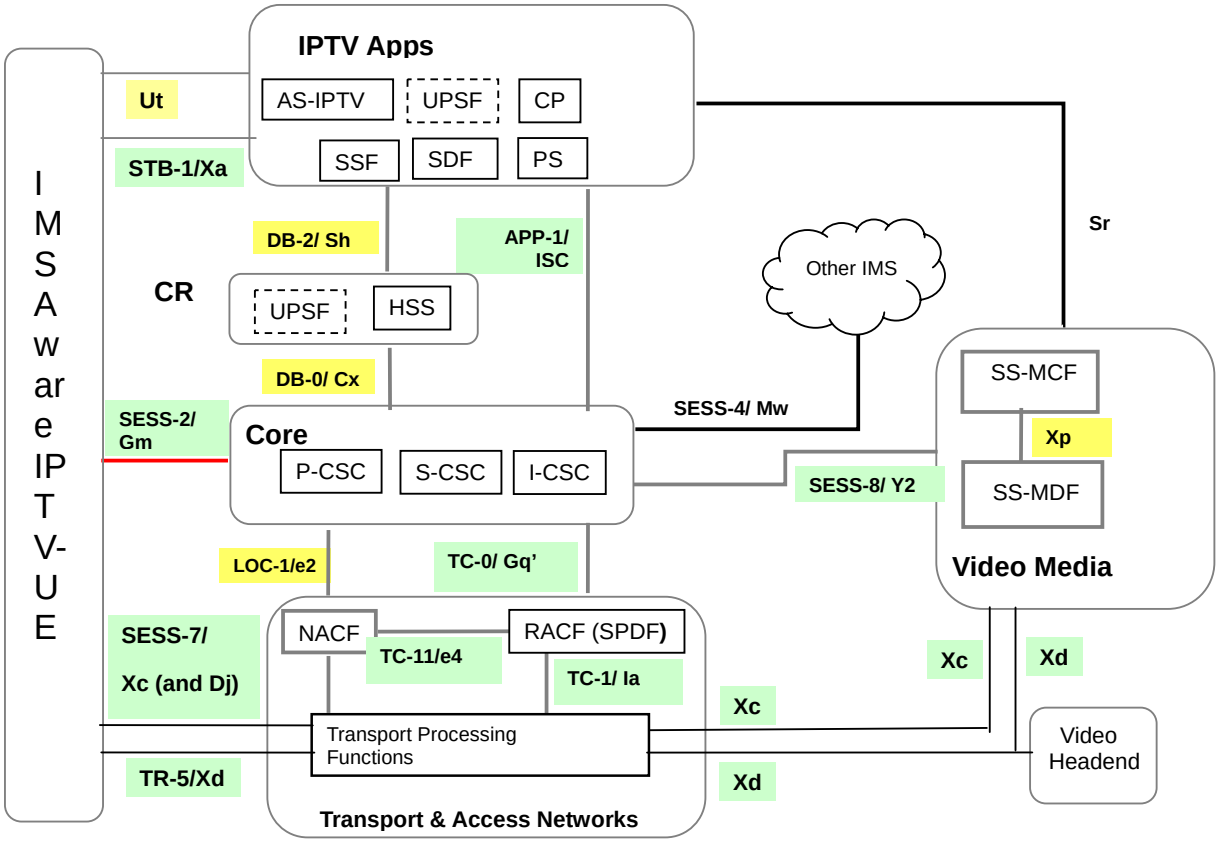

Figure 4.1: Gm Interface between UE and P-CSC

SIP protocol is selected to use on the Gm interface. This Implementation Agreement provides enhancement of the Gm interface above and beyond that already specified to fulfill the requirement for IMS based IPTV service. This IA is dedicated for IMS-based IPTV, for other requirements refer to the existing SIP IA[5].

This IA is based on TISPAN TS 183 063 [3]. The different key words title mapping list bellow:

TISPAN TS 183 063	MSF
CoD	VoD
SCF	AS-IPTV
MCF	SS-MCF-IPTV
MDF	SS-MDF-IPTV
UE	IMS aware IPTV UE

4.2 Functional Entities Involved in the Gm Interface

4.2.1 Proxy-Call Session Control (P-CSC)

The functionalities of P-CSC are indicated in the MSF-ARCH-004.00-FINAL [1].

4.2.2 IMS aware IPTV UE

MSF IMS aware IPTV UE is equivalent to UE defined in TISPAN TS 183 063 [3].4.2.3

5 Protocol

5.1 Gm Interface between P-CSC and IMS aware IPTV UE

5.1.1 Procedure for IMS registration

As specified in TS 182 027 [2], clause 8.2 the UE shall perform IMS registration before launching a service attachment procedure.

The behaviour of the UE with regards to IMS registration shall comply with ES 283 003 [6].

5.1.2 Procedure for service attachment

If the SDF is known as per [3] annex I the Pull mode as in clause 5.1.2.2 shall be used, else the UE shall be preconfigured to use the public user identity of the user to send a SIP SUBSCRIBE request according to the Pull mode or to expect a SIP MESSAGE request according to Push mode as in clause 5.1.2.1.

5.1.2.1 Push mode

Upon receipt of a SIP MESSAGE request from the SDF, the UE shall parse the XML document as described in clause 5.1.2.2.2.

5.1.2.2 Pull mode

Service Attachment, the UE shall generate a SUBSCRIBE request. The behaviour of the UE when processing a SUBSCRIBE request shall conform to ES 283 003 [6], clause 5.1.2A.1.

5.1.2.2.1 Subscription

When the UE intends to retrieve service attachment information from the SDF, it shall generate a SUBSCRIBE request for the "ua-profile" event package defined in draft-channabasappa-sipping-app-profile-type-02 [11].

The contents of the SUBSCRIBE request shall be as follows:

- The value of the Request-URI shall be set to one of following:
  - the PSI of the SDF which is retrieved using SDF Discovery procedures specified in annex I.
  - or when the SDF identify is not present the public user identity of the IPTV end user
- The From and To header shall be set to the public user identity of the IPTV end user.
- The Accept header shall include the content-type identifier that corresponds to the registered MIME type of XML documents representing IPTV profiles: "application/vnd.etsi.iptvdiscovery+xml".
- The Event header shall be set to the "ua-profile" event package.
- The Event parameters shall be set as follows:
  - The "profile-type" parameter shall be set to "application".
  - The "vendor", "model" and "version" parameter values shall be set to values specified by the implementer of the user equipment, as specified in ES 283 003 [6].
  - The "appids" parameter shall be set to " urn:org:etsi:ngn:applications:ims-iptv-service-discovery".

The UE may include a SIP SUBSCRIBE message body associated with the appid " urn:org:etsi:ngn:applications:ims-iptv-service-discovery ". The message body includes the capabilities of the UE which is sent to the SDF.

NOTE: Process of registering the appid is aligned with IETF specification draft-channabasappa-sipping-app-profile-type-02 [11].

If the SIP SUBSCRIBE contains a message body, the details of the SIP SUBSCRIBE are as follows:

- Content Type header shall be set to "application/vnd.etsi.iptvueprofile+xml".
- A message body shall be present for conveying UE-specific information as defined in annex P. This includes:
  - UserEquipment ID.
  - User Equipment Class: Specifies the type of UE. The currently defined types are "STB", "Mobile" and "PC".
  - UE Capabilities: This defines the set of UE capabilities and could include:
    - Physical resolution of the screen of the rendering device (defined in vertical and horizontal number of pixels).
    - Supported coding formats (defined using the Coding XML element from TV-Anytime (TS 102 822-3-1), and using the classification schemes from MPEG7 and DVB).
    - Optionally, supported Video Frame Rates (defined as per TS 101 154) associated with the encoding format.
    - Supported transport protocols (MPEG2TS over UDP, MPEG2TS over RTP, direct RTP).

Upon receipt of a 2xx response to the SUBSCRIBE request, the UE shall store the information for the established dialog and the expiration time as indicated in the Expires header of the received response.

The UE shall automatically refresh the subscription, either 600 seconds before the expiration time if the initial subscription was for greater than 1 200 seconds, or when half of the time has expired if the initial subscription was for 1 200 seconds or less. If a SUBSCRIBE request to refresh a subscription fails with a non-481 response, the UE shall still consider the original subscription valid for the duration of the most recently known "Expires" value according to ES 283 003 [6]. Otherwise, the UE shall consider the subscription invalid and start a new initial subscription according to ES 283 003 [6].

5.1.2.2.2 Receiving notifications

Upon receipt of a NOTIFY request on the dialog which was generated during subscription, the UE shall look for a message body with a content-type header indicating "application/vnd.etsi.iptvdiscovery+xml ". The IPTV application within the UE shall parse the XML document contained in the message body.

The list of parameters which are described in [3] clause 5.2.2.3 shall be used for service selection information retrieval according to [3] clause 6.1.1 in unicast mode and [3] clause 8.1.1 in multicast mode.

When parsing the list of parameters the UE shall take the following action:

- information relates to SSF whom the UE has already an entree.
  - If the "@version" attribute is present and has not the same value or if not present, then the UE performs the following actions:
    - for parameters related to this SSF already present in the UE: the UE shall update these parameters with the new values sent by the SSF. If the Segment@Version has not the same value, the UE shall update service selection information from the SSF before using it,
    - for parameters related to this SSF not present in the UE: the UE shall store the new parameters.
  - If the "@version" attribute is present and has the same value, the UE shall not update the stored SSF information.
- information relates to an SSF not known by the UE: the UE creates a new entry for this SSF with all indicated parameters.

After all elements have been processed, the UE shall return a 200 OK response to the NOTIFY request.

Failure to perform subscription refresh does not imply that there is a loss of communication to SSF or SCF. The UE has an option to continue using the lists of parameters from the last NOTIFY.

After deregistration, the UE may keep stored information on per user basis. As for subscription refresh, the UE may use the stored information if initial subscription fails after a new registration.

5.1.3 Procedure for BC service

5.1.3.1 Session initiation

The UE shall support the procedures specified in ES 283 003 [6] for originating sessions.

Upon a request for a BC session initiation, the UE shall generate an initial INVITE request as specified in ES 283 003 [6] for an originating UE. The Request-URI in the INVITE request shall be the well known PSI (Public Service Identifier) of the BC Service.

An SDP Offer shall be included in the request. The SDP offer shall be done in accordance with the parameters received during UE service selection procedure and with media capabilities and required bandwidth available for the BC session. If the user desires to join a BC service outside of this negotiated set of channels, a session modification is required.

The SDP offer at media level shall include the following elements:

- The m-line(s) shall be set according to the mapping defined in clause L.2 for the BC service which the UE intends to join first.
- The c-line(s) shall be set according to the mapping defined in clause L.2 for the BC service which the UE intends to join first.
- An a=bc_service:BCServiceId line to indicate the BC service which the UE intends to join first.
- Optionally one or more a=bc_service_package attributes (see below) as defined in annex N. In the first initial offer it shall not contain mult_list and bc_service_id list parameters. If the initiation is the result of a previously denied initiation the UE may restrict the BC services by including mult_list.
- If the UE has knowledge of the largest bandwidth of all the BC services included in the session, the b-line shall be included and set to this value.
- An a=recvonly line.

Additionally, FEC streams may be defined, as described in clause 5.1.3.1.1.

When the UE receives any SIP request or response, the UE shall examine the media parameters in the received SDP. The UE shall restrict the BC services that it joins according to the a=bc_service_package parameters received from the SCF. If the user desires to join a BC service outside of this negotiated set, a session modification is required.

If the UE receives a 488 error code with warning 370 Insufficient Bandwidth the UE may perform a new SIP INVITE with a lower maximum bandwidth for BC service the UE intends to join. This procedure may be repeated. If no agreement can be reached the UE may display a failure message to the user.

When the UE receives the SIP final response, the UE shall joins the multicast channel according to the a=bc_service line.

5.1.3.1.1 Additional SDP lines for FEC streams

When the UE decides to connect to FEC stream(s) associated to the original BC stream(s), it shall include additional SDP lines in the SDP offer as follows:

- One or more m line(s) for each FEC stream exposed through the SSF:
  - it shall be set according to the mapping defined in clause L.2;
  - it shall contain a c-line according to the mapping defined in clause L.2.

If the BC content is defined through a single m-line, a grouping line may be included.

If the BC content is defined through several m-lines, grouping line(s) shall be included, one for each BC m-line that is associated to a FEC stream.

The grouping line uses the "FEC" semantic as defined in RFC 4756:

- a=group:FEC:<original stream id> <FEC stream id>
  The present document supports only the DVB-IP AL-FEC Base layer, so there can be only one <FEC stream id> associated to an original stream.

  - The original stream id shall reflect the value hold by the media description of one stream in its a=mid attribute.

  - The FEC stream id shall reflect the value hold by the media description of the DVB-IP AL-FEC Base layer FEC stream (associated to the original stream) in its a=mid attribute.

Furthermore, when grouping line is included, there shall be an additional media identification attribute within the m-line of the original stream that is within the grouping:

- a=mid:<original stream id>.

5.1.3.2 Session modification

When there is a need for BC session modification, the UE shall generate a re-INVITE request or an UPDATE request, depending on the dialogue state, as specified in ES 283 003 [6] for an originating UE.

The UE shall include SDP offer in session modification request. When the modified session is also a broadcast session the format of the SDP shall be the same as for a session initiation.

Upon receipt of a re-INVITE request or an UPDATE request, the UE shall follow the procedures defined in ES 283 003 [6] for an originating UE.

When receiving SDP offer, the SDP answer shall reflect the media capabilities and required bandwidth as available for the BC session. The selection of the channels that are above the negotiated bandwidth may require a new session modification in accordance with the behaviour of the UE.

5.1.3.3 BC service with trick-play mode

In case of supporting BC service with trick play, the BC session can observe two special cases:

- The Broadcast session is modified to change from Multicast to unicast flow. This is the case in which the UE activates the trick play mode.

- The Broadcast session with trick play mode is modified to return to normal Broadcast TV. This is the case in which the UE deactivates the trick play mode by, e.g. switching channels from a paused channel to another live Broadcast TV channels.

5.1.3.3.1 Trick-play mode activation

Upon activation of trick-play mode, the UE shall perform session modification as described in clause 5.1.3.2.

The UE shall include an SDP offer with previously negotiated media descriptions with the port set to zero and two or more additional media descriptions: one for RTSP control and one or more for the unicast streams. The RTSP control media descriptor shall follow ES 283 003 [6]. The SDP offer for media delivery shall be identical to the previous SDP offer done for broadcast in term of codecs and transport protocol.

The UE shall also include the following Service Action Data:

- IPTVActionDataCommand shall be set to "SwitchtoTM".

- SwitchToTM shall be set to "IPTVBcActionData".

BCServiceId shall present only if the UE has not informed the SCF of the selected channel prior to this procedure (as defined in clause 5.1.3.5) and set to the value of the current channel.

When the UE acknowledges the 200 OK with an ACK message, the UE may start playback (see Xc IA).

5.1.3.3.2 Trick-play mode deactivation

Upon deactivation of trick-play mode, the UE shall perform session modification as described in clause 5.1.3.2.

The UE shall include an SDP offer with previously negotiated RTSP and unicast media descriptions with the port set to zero. The SDP corresponding to the broadcast session shall be reactivated (i.e. port not set to zero).

The UE shall also include the following Service Action Data:

- IPTVActionDataCommand shall be set to "SwitchtoBC".
- SwitchToBC shall be set to "IPTVBcActionData".
- BCServiceId is set to the value of the selected channel.

The UE deactivates trick-play mode when it receives an indication from the network that it has caught up with the live BC service.

The UE shall go back to normal BC session if it does not receive any delivery data anymore and has not paused playback.

5.1.3.4 Session termination

Upon a request for a BC session termination, the UE shall generate a BYE request as specified in ES 283 003 [6] for an originating UE.

Upon receipt of a BYE request the UE shall follow the procedure specified in ES 283 003 [6] for an originating UE.

5.1.3.5 Session Information

During the procedures for join multicast group ([3] clause 8.1.1) the UE may inform SCF of the selected channel.

If the UE informs the SCF of the selected channel it shall reset a delay timer after successfully viewing a new channel using the procedure for joining multicast group ([3] clause 8.1.1). The delay timer is a preconfigured value in the UE with a default value of 10 seconds. When the delay timer expires, the network shall be informed of the currently viewed channel with a SIP INFO message.

- The SIP INFO message shall be sent by the UE on the same dialogue as the Broadcast TV session initiation and shall contain an XML file with the channel change information. The message body carries the service action data: the matching "BC Bookmarks" object shall be created so that:
  - IPTVActionDataCommand shall be set to "Notify";
  - Notify shall be set to "IPTVBcActionData";
  - BCServiceId is set to the value of the current channel;
  - ProgrammeId is optionally set to the value of the current programme.
- Bookmark is set to the current timestamp if the UE has the knowledge of such timestamp (e.g. through SNTP). If the UE is not aware of such current timestamp, Bookmark is set to a default value: "NOW".

The Content-Type header shall be set to "application/vnd.etsi.iptvcommand +xml". The body content of the message is described in [3] annex D.

5.1.4 Procedure for VoD service

5.1.4.1 Procedure for retrieving missing parameters before session initiation

In case of procedure for establishing the content control and content delivery at the same time see clause 5.1.4.2.1, if the UE does not have all transport parameters (RTP or UDP transport for MPEG2TS encapsulation or direct RTP, FEC layers addresses and ports) the UE shall send a SIP OPTIONS message,

NOTE: it is an operator choice to provide preconfigured transport parameters values, manual configuration mechanisms, etc., if the transport information is not retrieved from the SSF.

The "Request-URI" is related to the VoD session that the user wants to activate. The Request-URI shall be composed of a user and domain part as defined as follows:

- The user part contains the content identifier in a free string format, as defined in TS 182 027 [2].
- The domain part is the Service Provider domain name, obtained from SSF.

The content identifier shall be retrieved from service selection information (cf. annex L concerning the mapping between service selection information and SIP/SDP parameters).

The TO header shall contain the same URI as in the "Request-URI" parameter.

The FROM header shall indicate the public user identity of the user.

Upon reception of the 200 OK including SDP, the UE shall initiate COD session as described in clause 5.1.4.2.

5.1.4.2 Session initiation

The UE shall support the procedures specified in ES 283 003 [6] for originating sessions.

Upon a request for a COD session initiation, the UE shall generate an initial INVITE request as specified in ES 283 003 [6] for an originating UE.

The "Request-URI" is related to the VoD session that the user wants to activate. The Request-URI shall be composed of a user and domain part as defined as follows:

- The user part contains the content identifier in a free string format, as defined in TS 182 027 [2].
- The domain part is the Service Provider domain name, obtained from SSF.

The content identifier shall be retrieved from service selection information (cf. annex L concerning the mapping between service selection information and SIP/SDP parameters).

The TO header shall contain the same URI as in the "Request-URI" parameter.

The FROM header shall indicate the public user identity of the user.

5.1.4.2.1 Procedure for establishing the RTSP content control and content delivery channel

5.1.4.2.1.1 UE as SDP offerer

An SDP Offer shall be included in the initial INVITE request. the SDP offer shall be done in accordance with media capabilities and policies available for the VoD session and with the parameters received from the SSF during UE service selection procedure (cf. annex L concerning the mapping between service selection information and SIP/SDP parameters) or from the SIP OPTIONS response.

The SDP offer from the UE shall contain a media description for the RTSP content control channel and one for the content delivery channel.

SDP session level parameters shall be used as specified in ES 283 003 [6].

The RTSP content control media description shall be carried by TCP and follow ES 283 003 [6]. The SDP parameters for the RTSP content control channel shall be set as follows:

- a "m" line for an RTSP stream of format: m=<media> <port> <transport> <fmt>:
  - The media field shall have a value of "application".
  - The port field shall be set to a value of 9, which is the discard port.

  - The transport field shall be set to TCP or TCP/TLS. The former is used when RTSP runs directly on top of TCP and the latter is used when RTSP runs on top of TLS, which in turn runs on top of TCP.

  - The fmt parameter shall be included and shall be set to *iptv_rtsp* (ex. `m=application 9 tcp iptv_rtsp`).

- An "a=setup" attribute shall be present and set to "active" as defined in ES 283 003 [6] (ex. `a=setup:active`).

- An "a= connection" attribute shall be present and set as "new" as defined in ES 283 003 [6] (ex. `a=connection:new`).

- A "c" line shall include the network type with the value set to IN, the address type set to IP4 or IP6 and IP address of the flow of the related RTSP content control (ex. `c=IN IP4 <IP_ADDRESS>`).

NOTE: RTSP over UDP is out of scope of the present document.

For each media stream controlled by the RTSP content control channel the SDP offer shall include a content delivery channel media description set as follows:

- the "m=" line indicates the type of the media, the transport protocol and the port of the related content delivery channel. It may also include a fmt parameter which shall indicate the format given by the SSF, a subset of them or the format offered by the UE if none is given by the SSF;

- the "c=" line shall include the network type with the value set to IN, the address type set to IP4 or IP6 and unicast address of the flow of the related content delivery channel, `(ex. c=IN IP4 <IP_ADDRESS>);`

- the "b=" line shall contain the proposed bandwidth. If the user has fetched the bandwidth required for this particular content delivery channel during service selection procedure, the bandwidth attribute at media level shall be set to this value. Otherwise, this attribute shall be set to a pre-configured value `(ex. b=AS:15000);`

- A "a=" line with a "recvonly" (ex. `a=recvonly`);

Additionally, FEC streams may be defined, as described in clause 5.1.4.2.3.

When receiving any SIP response, the UE shall examine the media parameters in the received SDP: the UE shall fetch the RTSP session ID from the "fmtp:iptv_rtsp h-session" attribute if present in the received in the SDP answer contained in the SIP response. This RTSP session ID shall be used for in RTSP media control messages and the UE shall subsequently use RTSP Method 1 for VoD playback control as described in MSF Xc IA. If fmtp:iptv_rtsp h-offset is specified in the SDP from MCF, the UE may use this as appropriate in subsequent RTSP media control messages.

In case no "fmtp:iptv_rtsp h-session" parameter was received in the SDP answer, the UE shall use RTSP method 2 for VoD playback control as described in MSF Xc IA.

SDP answer shall carry "fmtp:iptv_rtsp h-uri" attribute and UE shall get RTSP URL to be used in the RTSP requests from "fmtp:iptv_rtsp h-uri" attribute in SDP. The h-uri can be in form of absolute or relative URI. If absolute URI is specified then it is used as-is in subsequent RTSP requests. If relative URI is specified in form of a media path, then the RTSP absolute URL could be constructed by the UE using the IPAddress (from c-line) and port (from m-line) as the base followed by h-uri value for the media path.

(a=fmtp:rtsp h-uri=<request-uri>)

Editor Notes: in TISPAN 183 063, "fmtp:iptv_rtsp h-uri" is described in RTSP and MCF section. But for convince of reference and clearly define of UE behavior, I copy it to here.

5.1.4.2.2 Procedure for establishing the RTSP channel separately

5.1.4.2.2.1 UE as SDP offerer

The INVITE request shall contain an SDP offer of media description only for the RTSP channel.

The SDP session level parameters shall be used as specified in ES 283 003 [6].

The SDP parameters for the RTSP channel shall be set as follows:

- A "m" line for an RTSP stream of format: m=<media> <port> <transport> <fmt>
  - The media field shall have a value of "application".
  - The port field shall be set to a value of 9, which is the discard port.
  - The transport field shall be set to TCP or TCP/TLS. The former is used when RTSP runs directly on top of TCP and the latter is used when RTSP runs on top of TLS, which in turn runs on top of TCP.
    - The fmt parameter shall be set to iptv_rtsp.
- An "a=setup" attribute shall be present and set to "active" as defined in ES 283 003 [6].
- An "a= connection" attribute shall be present and set as "new" as defined in ES 283 003 [6].

NOTE: RTSP over UDP is out of scope of the present document.

5.1.4.2.3 Additional SDP lines for FEC streams

When the UE decides to connect to FEC stream(s) associated to the COD original stream, it shall include additional SDP lines in the SDP offer as follows:

- One or more m-line(s) for each FEC stream exposed through the SSF:
  - it shall be set according to the mapping defined in clause L.3;
  - it shall contain a c-line according to the mapping defined in clause L.3.

If the COD content is defined through a single m-line, a grouping line may be included.

If the COD content is defined through several m-lines, grouping line(s) shall be included, one for each COD m-line that is associated to a FEC stream.

- a=group:FEC:<original stream id> <FEC stream id>
  The present document supports only the DVB-IP AL-FEC Base layer, so there can be only one <FEC stream id> associated to an original stream:
  - The original stream id shall reflect the value hold by the media description of one stream in its a=mid attribute.
  - The FEC stream id shall reflect the value hold by the media description of the DVB-IP AL-FEC Base layer FEC stream (associated to the original stream) in its a=mid attribute.

Furthermore, when grouping line is included, there shall be an additional media identification attribute within the m-line of the original stream that is within the grouping:

- a=mid:<original stream id>.

5.1.4.3 Session modification

In order to modify the session from the UE side, the UE shall send a re-INVITE or an UPDATE request as specified in ES 283 003 [6] for an originating UE.

The UE shall not modify RTSP channel m-line description in the SDP if the media delivery streams controlled by RTSP are not removed (port not set to zero in m-lines) in the SDP.

Upon receipt of a re-INVITE request or an UPDATE request, the UE shall modify the session as specified in ES 283 003 [6] if the request is acceptable to the UE.

5.1.4.3.1 Procedure for establishing the content delivery channel

5.1.4.3.1.1 UE as SDP offerer

The UE shall send a re-INVITE or an UPDATE request containing SDP offer after acquiring the network parameters via RTSP DESCRIBE as specified in [3] clause 7.1.2.2 in order to establish the content delivery channels. The media descriptions of content delivery channels shall be populated as follows:

- media descriptions acquired by DESCRIBE response are appended after the media description of RTSP channel.
- the port number in "m=" line shall be replaced by the real receiving port of the UE.
- "a=recvonly" attribute shall be inserted if the attribute is not specified.
- remove "a=" lines specific to RTSP (a=control, a=range, and a=etag).
- if "c=" lines are specified in media descriptions, the addresses of "c=" lines shall be replaced by the address of the UE.

The SDP parameters for the RTSP channel shall be set to the same parameters as specified in clause 5.1.4.2.2.1 except for the "a=connection" attribution. The attribution shall be set to "existing" as defined in ES 283 003 [6].

The SDP offer shall include one or more media description sets as follows:

- the "m=" line indicates the type of the media, the transport protocol the port on which the UE has to received the flows of the related content delivery channel. It may also include a fmt parameter which shall indicate the format given by the network parameters.
- the "c=" line shall include the network type with the value set to IN, the address type set to IP4 or IP6, and unicast address of the flow of the related content delivery channel. These values are given by the network parameters.
- the "b=" line shall contain the bandwidth. The bandwidth attribute shall be set to this value given by the network parameters.
- a "a=" line with a "recvonly".

Additionally, FEC streams may be defined, as described in clause 5.1.4.3.2.

5.1.4.3.2 Additional SDP lines for FEC streams

When the UE decides to connect to FEC stream(s) associated to the COD original stream, it shall include additional SDP lines in the SDP offer as follows:

- One or more m-line(s) for each FEC stream exposed through the SSF:
  - it shall be set according to the mapping defined in clause L.3;
  - it shall contain a c-line according to the mapping defined in clause L.3.
- If the COD content is defined through a single m-line, a grouping line may be included.

If the COD content is defined through several m-lines, grouping line(s) shall be included, one for each COD m-line that is associated to a FEC stream.

The grouping line uses the "FEC" semantic as defined in RFC 4756:

- a=group:FEC:<original stream id> <FEC stream id>.
  The present document supports only the DVB-IP AL-FEC Base layer, so there can be only one <FEC stream id> associated to an original stream:

- The original stream id shall reflect the value hold by the media description of one stream in its a=mid attribute.
- The FEC stream id shall reflect the value hold by the media description of the DVB-IP AL-FEC Base layer FEC stream (associated to the original stream) in its a=mid attribute.

Furthermore, when grouping line is included, there shall be an additional media identification attribute within the m-line of the original stream that is within the grouping:

- a=mid:<original stream id>

5.1.4.4 Session termination

The session termination will differ when using RTSP "Method 1" or RTSP "Method 2" as described in the following clauses. The different RTSP methods are described in [3] clause 7 and annex Q.

5.1.4.4.1 Session termination using RTSP Method 1

In order to terminate the session, the UE shall first close the RTSP session that was established during session initiation by closing the underlying TCP connection and then send a BYE request as specified in ES 283 003 [6].

Upon receipt of a BYE request, the UE shall then terminate the session as specified in ES 283 003 [6].

5.1.4.4.2 Session termination using RTSP Method 2

In order to terminate the session, the UE shall send a BYE request as specified in ES 283 003 [6]. The media teardown procedures using RTSP TEARDOWN as described in [3] clause 7.1.2.6 shall be executed before the BYE is sent out. This would ensure that the BYE request does not close the RTSP content control channel ports at transport layer before RTSP TEARDOWN is sent.

Upon receipt of a BYE request, the UE shall send a TEARDOWN request to terminate the RTSP session if non-persistent RTSP connection is used or if the TCP connection is open. The UE shall then send a 200 OK response to the BYE request as specified in ES 283 003 [6].

NOTE: The UE may not be able to send TEARDOWN or receive a response for TEARDOWN when the resource in the network for RTSP session have been released when of receiving SIP BYE.

5.1.4.5 Procedures for handling COD Service action data

When a user requests to stop viewing a VoD with the intention of resuming it later, the UE may send a SIP INFO request to the SCF. The content of that INFO request shall be as follows:

- The value of the Request-URI shall be set to the one used in the related session.
- From and To headers shall be set to the one defined during the session initiation procedure.
- Call-ID shall be set to the same value as that of the VoD session.
- CSeq shall be generated by UE following rules defined in ES 283 003 [6] for request within a dialog.
- The Content-type header shall include the registered MIME type of XML documents representing IPTV service action data: "application/vnd.etsi.iptvcommand+xml".
- The message body carries the service action data:
  - IPTVActionDataCommand shall be set to "Notify".
  - Notify shall be set to "IPTVCodActionData".
  - The matching "Available CoD" object shall be updated so that CoDDeliveryStatus is set to "Parked" and CoDOffset is set to the current reading cursor of the content.

5.1.5 Procedure for NPVR Service

5.1.5.1 Procedures for NPVR Service Capture Request

The SIP MESSAGE method is used here to achieve what is described in the architectural document (TS 182 027 [2]) as "N-PVR content capture request". This request may be done in an impulsive way or offline.

5.1.5.1.1 Procedures for Impulsive Request

This use case is itself divided in two sub-cases:

Case 1: The user do not specify any end date and time for the recording. This can be seen as a case of "Park and pickup TV' as described in TS 182 027 [2]:

In this case the UE shall send a SIP MESSAGE request to SCF requiring Bookmark setting. The contents of the SIP MESSAGE request shall be as follows:

- The Request-URI in the MESSAGE request shall be the well known PSI (Public Service Identifier) of the BC Service.

NOTE 1: This is the same value as the Request-URI for BC service session initiation.

- From and To headers shall be set to the public identity of the user issuing the MESSAGE message.
- Call-ID shall be generated by UE.
- CSeq shall be generated by UE.
- The Content-type header shall include the registered MIME type of XML documents representing IPTV service action data: "application/vnd.etsi.iptvcommand+xml".
- The message body carries the service action data: the matching "BC Bookmarks" object shall be created so that:
  - IPTVActionDataCommand shall be set to "Record".
  - Record shall be set to "IPTVBcActionData".
  - BCServiceId is set to the value of the current channel.
  - ProgrammeId is optionally set to the value of the current programme.
  - Bookmark is set to the current timestamp if the UE has the knowledge of such timestamp (e.g. through SNTP). If the UE is not aware of such current timestamp, Bookmark is set to a default value: "NOW" which implies that the content capture is initiated as soon as the NPVR SCF gets the request.

NOTE 2: BookmarkExpiryTime may be updated in two ways. It can be updated according to the user preference pre-set by the user, or according to the service policy defined by the service provider.

Case 2: The user specifies an end date and time for the recording:

In this case the UE shall send a MESSAGE request to the SCF. The contents of the SIP MESSAGE request shall be as follows:

- The user-part value of the Request-URI shall be set to the BC Service Package ID that the BC service to be recorded belongs to.
- From and To headers shall be set to the public identity of the user issuing the MESSAGE message.
- Call-ID shall be generated by UE.
- CSeq shall be generated by UE.
- The Content-type header shall include the registered MIME type of XML documents representing IPTV service action data: "application/vnd.etsi.iptvcommand+xml".

- The message body carries the service action data: the matching "NPVR item" object shall be created so that:
  - IPTVActionDataCommand shall be set to "Record";
  - Record shall be set to "IPTVNpvrActionData";
  - NPVRContentId is not set;
  - BCServiceId is set to the BC Service to be recorded;
  - RecordStartDate is set to the current timestamp if the UE has the knowledge of such timestamp (e.g. thanks to SNTP). If the UE is not aware of such current timestamp, RecordStartDate should be set to a default value: "NOW" which implies that the content capture is started as soon as the NPVR SCF gets the request;
  - RecordEndDate is set to the end date/time when the recording should stop and would correspond to what the user has specified;

NOTE: NPVRContentExpiryTime may be updated in two ways. It can be updated according to the user preference pre-set by the user, or according to the service policy defined by the service provider.

5.1.5.1.2 Procedures for Offline Request

A user may request to record a live programme that has not started yet. In this case the UE shall send a SIP MESSAGE request to the SCF. The content of the SIP MESSAGE request shall be as follows:

- The user-part of the Request-URI shall be set to the BC Service Package ID that the BC service belongs to.
- From and To headers shall be set to the public identity of the user issuing the MESSAGE message.
- CSeq shall be generated by UE.
- The Content-type header shall include the registered MIME type of XML documents representing IPTV service action data: "application/vnd.etsi.iptvcommand+xml".
- The message body carries the service action data: the matching "NPVR item" object shall be created so that:
  - IPTVActionDataCommand shall be set to "Record";
  - Record shall be set to "IPTVNpvrActionData";
  - If the recording is requested on a specific entry in the EPG:
    - NPVRContentId is set to the matching ProgrammeId.
  - If the recording do not match a specific entry in the EPG:
    - NPVRContentId is not set.
    - BCServiceId is set to the BC Service to be recorded.
    - RecordStartDate is set to the date/time when the recording has to start as specified by the user.
    - RecordEndDate is set to the date/time when the recording has to be terminated and is specified by the user.

NOTE: NPVRContentExpiryTime may be updated in two ways. It can be updated according to the user preference pre-set by the user, or according to the service policy defined by the service provider.

5.1.5.2 Procedures for NPVR Session

The UE follows procedures outlined in clause 5.1.4 for COD to stream a previously captured NPVR content.

The user part of the "Request-URI" parameter shall contain the NPVRContentId retrieved from the SSF as defined in [3] clause 6.1.1.5 and shall correspond to the content that was captured via impulsive or offline request.

The UE shall build the SDP offer as defined in clause 5.1.4.2 for VoD session initiation and shall include media control line for RTSP control channel. The SDP offer for the media delivery lines shall specify the transport and codec parameters for the corresponding BC ServiceId .