ETSI TR 104 094 V1.1.1 (2024-12)



Digital Video Broadcasting (DVB); Adaptive media streaming over IP multicast; Implementation guidelines and worked examples

Document Preview

<u>ETSI TR 104 094 V1.1.1 (2024-12)</u>

https://standards.iteh.ai/catalog/standards/etsi/93db8810-b1fd-4eae-8ed3-1fffda24c8e3/etsi-tr-104-094-v1-1-1-2024-12

EBU D/B

2

Reference DTR/JTC-DVB-415

.....

Keywords Broadcast, broadband, DVB, internet

ETSI

650 Route des Lucioles F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B Association à but non lucratif enregistrée à la Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from the ETSI Search & Browse Standards application.

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on ETSI deliver repository.

Users should be aware that the present document may be revised or have its status changed, this information is available in the <u>Milestones listing</u>.

If you find errors in the present document, please send your comments to the relevant service listed under <u>Committee Support Staff</u>.

If you find a security vulnerability in the present document, please report it through our <u>Coordinated Vulnerability Disclosure (CVD)</u> program.

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI. The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2024. © European Broadcasting Union 2024. All rights reserved.

Contents

Intell	ectual Property Rights	5
Forev	vord	5
Moda	l verbs terminology	6
Intro	luction	6
1	Scope	7
2	References	7
2.1	Normative references	7
2.2	Informative references	7
3	Definition of terms, symbols, abbreviations and convention	8
31	Terms	8 8
3.1	Symbols	8 8
33	Abbreviations	8
3.4	Notational convention for diagrams	8
5.1		-
4	Implementation guidelines	8
4.1	Multicast server implementation guidelines	8
4.1.1	Using macro expansion in the multicast server configuration to generate multiple in-band multica	st
	gateway configurations	8
4.1.2	Analysing generated multicast transport objects	9
4.1.3	Dynamic service component transmission	9
4.2	Multicast rendezvous service implementation guidelines	10
4.2.1	Operation in absence of multicast transport session	10
4.3	Multicast gateway implementation guidelines	10
4.3.1	Operation in absence of multicast transport session	10
5	Fully worked examples	10
5.0	Introduction	10
5.1	Pull ingest with Multicast gateway in the consumer premises equipment	13
5.1.0	Introduction	13
sta 5 .1.1r	ds iteh Provisioning sequence	
5.1.2	Multicast server transmission sequence	16
5.1.3	Multicast gateway playback sequence	17
5.1.4	Multicast reception sequence	20
5.2	Pull ingest from a third-party Content hosting function with Multicast gateway in the network edge	22
5.2.0	Introduction	22
5.2.1	Provisioning sequence	23
5.2.2	Multicast server transmission sequence	24
5.2.3	Multicast gateway playback sequence	26
5.2.4	Multicast reception sequence	29
5.3	Push ingest with fused edge Multicast gateway	31
5.3.0	Introduction	31
5.3.1	Provisioning sequence	32
5.3.2	Multicast server transmission sequence	34
5.3.3	Multicast gateway playback sequence	36
5.3.4	Multicast reception sequence	
5.4	Push ingest with multiple consumers	41
5.4.0	Introduction	41
5.4.1	Provisioning sequences	
5.4.1.	Content Provider and Service Provider A provisioning sequence	
5.4.1.2	2 Multicast gateway provisioning sequence for fixed-line consumer	44
5.4.1.	3 Multicast gateway provisioning sequence for satellite consumer	45
5.4.2	Multicast server transmission sequence	46
5.4.3	Multicast gateway playback sequences	48
5.4.3.	Fixed-line customer playback sequence	48
5.4.3.2	2 Satellite customer playback sequence	52

5.4.4	Multicast reception sequence	
Anne	x A: Baseline procedures and call flows	56
A.0	Overview	56
A.1	Architecture	56
A.2	Procedures and call flows	
A.2.1	System provisioning procedure	
A.2.2	System configuration procedure	
A.2.3	Service discovery procedure	
A.2.4	Service operation procedures	60
A.2.4.0	0 General	60
A.2.4.	1 Multicast transmission procedure	60
A.2.4.2	2 Multicast gateway registration procedure	61
A.2.4.3	3 Service selection procedure	
A.2.4.4	4 Metrics reporting procedure	
Anne	x B: Change history	66
Histor	-у	67

iTh Standards (https://standards.it DocumeenvtiePwr

<u>ETTSRI 1V014.10.9</u>14 (2024-12) https://standards.iteh.aff/dcaa2t4ael & Og 3//s & tasat

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards", which is available from the ETSI Secretariat. Latest updates are available on the ETSI IPR online database.

5

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECTTM, **PLUGTESTSTM**, **UMTSTM** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPPTM**, **LTETM** and **5GTM** logo are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2MTM** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM[®]** and the GSM logo are trademarks registered and owned by the GSM Association.

Foreword (https://standards.iteh.ai)

This Technical Report (TR) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

https://stancNOTE: h The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the -1-1-2024-12 specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

European Broadcasting Union CH-1218 GRAND SACONNEX (Geneva) Switzerland Tel: +41 22 717 21 11 Fax: +41 22 717 24 81

The DVB Project is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulators and others from around the world committed to designing open, interoperable technical specifications for the global delivery of digital media and broadcast services. DVB specifications cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993.

Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the <u>ETSI Drafting Rules</u> (Verbal forms for the expression of provisions).

"must" and "must not" are NOT allowed in ETSI deliverables except when used in direct citation.

Introduction

ETSI TS 103 769 [i.1] defines a functional architecture for delivering live and on-demand adaptive streaming media to a large audience in a highly efficient and scalable way by leveraging IP multicast for media object delivery.

ETSI TS 103 769 [i.1] does not itself prescribe a single system design, giving a large degree of flexibility in implementation options, which the present document explores with some informative worked examples to aid the development of individual implementations.

i Teh Standards (https://standards.it DocumeenvtiePwr

<u>ETTSRI 1 V0 14. 10.9</u>14 (2024-12) https://standards.iteh.aff/dcaa2t4ael 80 0g 3//s 6t 19. saft

1 Scope

The present document provides implementation guidelines for the system specified in ETSI TS 103 769 [i.1] and describes some example implementations of it. These examples are non-exhaustive, and as such do not detail every possible combination of configuration that is possible with ETSI TS 103 769 [i.1].

The baseline procedures and illustrative call flows for such a system are documented in annex A.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long-term validity.

The following referenced documents are not necessary for the application of the present document, but they assist the user with regard to a particular subject area.

- [i.1] ETSI TS 103 769: "Digital Video Broadcasting (DVB); Adaptive media streaming over IP multicast".
- [i.2] ISO/IEC 23009-1: "Information technology Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats".

https://stand[i.3].iteh.ai/cat Broadband Forum TR-069: "CPE WAN Management Protocol".4c8e3/etsi-tr-104-094-v1-1-1-2024-12

- [i.4] Broadband Forum TR-369: "User Services Platform (USP)".
- [i.5] IETF RFC 950: "Internet Standard Subnetting Procedure", August 1985.
- [i.6] IETF RFC 4291: "IP Version 6 Addressing Architecture", February 2006.
- [i.7] Fielding, Roy Thomas: "Chapter 5: Representational State Transfer (REST)", from "Architectural Styles and the Design of Network-based Software Architectures" (Ph.D. dissertation), University of California, Irvine, 2000.
- [i.8] IETF RFC 6266: "Use of the Content-Disposition Header Field in the Hypertext Transfer Protocol (HTTP)", June 2011.
- [i.9] ETSI TS 103 770: "Digital Video Broadcasting (DVB); Service Discovery and Programme Metadata for DVB-I".
- [i.10] ETSI TS 103 876: "Digital Video Broadcasting (DVB); Native IP Broadcasting".

3 Definition of terms, symbols, abbreviations and convention

3.1 Terms

For the purposes of the present document, the terms defined in ETSI TS 103 769 [i.1] apply.

3.2 Symbols

For the purposes of the present document, the symbols defined in ETSI TS 103 769 [i.1] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations defined in ETSI TS 103 769 [i.1] apply.

3.4 Notational convention for diagrams

The diagrams in the present document conform to the following conventions adopted from ETSI TS 103 769 [i.1]:

- Interactions with a single solid line are in-scope interactions fully specified in ETSI TS 103 769 [i.1], and any associated clauses that define that interaction are indicated in the text that follows the diagram.
- Interactions with a dashed line are defined by the reference architecture in clause 5 of ETSI TS 103 769 [i.1] but are declared out of scope by it, and are therefore implementation-specific.
- Interactions with a double solid line are not defined by ETSI TS 103 769 [i.1] and are entirely implementation-specific.

4 Implementation guidelines

4.1 Multicast server implementation guidelines

4.1.1 Using macro expansion in the multicast server configuration to generate multiple in-band multicast gateway configurations

The macro expansion mechanism specified in clause 10.2.5.2 of ETSI TS 103 769 [i.1] allows a *Multicast server* to generate multiple distinct multicast gateway configuration instance documents from a single multicast server configuration instance document.

In one example usage of this feature a *Multicast server* under the control of a Content Provider distributes a common set of multicast transport sessions to multiple different Service Provider networks. Each Service Provider network has a distinct sub-population of deployed *Multicast gateway* instances all configured using the in-band configuration method described in clause 10.1.2 of ETSI TS 103 769 [i.1]. Each Service Provider network has deployed its own *Content hosting* function as part of a tiered Content Delivery Network, to provide a better quality of service by hosting repair objects closer to the consumer.

Using the macro expansion mechanism allows the UnicastRepairParameters/BaseURL element(s) carried in the different multicast gateway configurations provided over reference point **M** to refer to the local *Content hosting* function appropriate for each sub-population of *Multicast gateway* instances.

To achieve this outcome, the multicast server configuration instance document declares one multicast gateway configuration transport session for each of the target Service Provider networks, including appropriate macro expansions for each one. As a result, the *Multicast server* creates a set of multicast gateway configuration instance documents by expanding the macros, and includes the correct resulting multicast transport object in each multicast gateway configuration transport session that it generates.

4.1.2 Analysing generated multicast transport objects

The in-band configuration method described in clause 10.1.2 of ETSI TS 103 769 [i.1] specifies that the *Multicast* server has the capability to generate multicast gateway configuration transport objects for transmission at reference point **M** rather than fetching or receiving them directly via reference point **C**_{MS}. Using the macro expansion mechanism specified in clause 10.2.5.2 of ETSI TS 103 769 [i.1], the *Multicast server* can potentially create multiple different multicast gateway configuration instance documents from a single multicast server configuration.

To ensure that these generated multicast gateway configuration documents conform to the system operator's desired configuration, the *Multicast server* may allow the multicast transport objects it creates to be analysed and debugged before or after the updated multicast server configuration is published to the live *Multicast server* instance. This could take multiple forms. For example:

- 1. An (undefined) logical function could subscribe to the output of the *Multicast server* at reference point **M** and observe the output of the *Multicast server*. This could then allow the system operator to view the output of both the live output and potentially any testing multicast interfaces exposed by the *Multicast server* as it runs.
- 2. The *Multicast server* could expose a RESTful resource [i.7] that allows the system operator to interrogate the set of multicast gateway configuration instance document(s) currently being transmitted at reference point **M**.

In the case where one multicast server configuration generates multiple multicast gateway configuration instance documents, these could be returned as a single HTTP multipart response using the *Content-Disposition* header specified in IETF RFC 6266 [i.8].

3. The *Multicast server* could expose a RESTful resource [i.7] that allows the system operator to upload a test multicast server configuration, returning the set of multicast gateway configuration instance document(s) that the *Multicast server* would create from that test multicast server configuration.

An HTTP multipart response could be used in cases where multiple multicast gateway configuration instance documents are generated, as above: TR $|04\ 094\ V|$ |1| (2024-12)

4. The *Multicast server* could expose a full web application that allows an operator to upload a test multicast server configuration and inspect the resulting multicast gateway configuration instance document(s) in a web browser. This web application could also be extended to have some form of authoring and live debugging interface to aid analysis by the operator.

4.1.3 Dynamic service component transmission

Transmission of multicast packets by the *Multicast server* at reference point **M** may be (de)activated by the *Provisioning* function for individual multicast transport sessions or for all multicast transport sessions in the scope of a parent multicast session using the reference point **C**_{MS} procedures specified in clause 10.4.3 of ETSI TS 103 769 [i.1].

The decision to (de)activate one or more multicast transport sessions is taken by the *Provisioning* function based, for example, on:

- 1. Current audience size, using reporting information provided to the *Service reporting capture* subfunction of *Provisioning* function at reference point **R**_s by a sample of deployed *Multicast gateway* instances, as specified in clause 11 of ETSI TS 103 769 [i.1].
- 2. Current available transmission bit rate budget, using feedback collated by the *Provisioning* function from the access *Network* by means beyond the scope of ETSI TS 103 769 [i.1].

The implications on the operation of the *Multicast gateway* are described in clause 4.3.1.

4.2 Multicast rendezvous service implementation guidelines

4.2.1 Operation in absence of multicast transport session

When the *Content playback* request for a presentation manifest to the *Multicast rendezvous service* at reference point **B** includes the *Ori* query parameter (see clause 7.5.1 of ETSI TS 103 769 [i.1]) but the *Multicast rendezvous service* is aware (through private means) that the requested content is not available from a multicast transport session, the *Multicast rendezvous service* may redirect the *Content playback* function's presentation manifest request directly to the *Content hosting* function.

In this case, the redirection URL is built by replacing the authority in the request URL with the authority signalled in the Ori query parameter.

The *Content playback* function then consumes a regular unicast MPEG-DASH presentation with no further interaction with the *Multicast gateway*.

4.3 Multicast gateway implementation guidelines

4.3.1 Operation in absence of multicast transport session

The *Multicast gateway* is expected to switch to unicast retrieval of media objects if a multicast transport session that is currently being consumed is deactivated as described in clause 4.1.3. In the case of unidirectional operation, where no unicast path exists, the *Multicast gateway* may use an implementation-dependent mechanism, for example to maintain continuous playback.

iTeh Standards

5 Fully worked examples and s.iteh.ai)

5.0 Introduction

ETSI TS 103 769 [i.1] defines the functional architecture of a system for delivering linear content in a scalable manner over multicast IP. It defines several logical functions and the reference points which carry interactions between them. These logical functions may have different operating modes which affects how they interoperate with other logical functions over the named reference points.

The system specified in ETSI TS 103 769 [i.1] is designed to be modular and flexible: not all logical functions described are required to build a compliant deployment. For example, in a unidirectional deployment where unicast repair is not possible, the *Multicast server* may be configured in push-based ingest mode, in which case the *Content hosting* function is omitted from the system since it serves no purpose. It is useful when describing deployments to group the logical function into logical domains. The present document defines the following logical domains:

- Functions deployed in the **content provider** domain are under the control of the owner of the linear service that is being delivered by a multicast session. This may be a broadcaster or an over-the-top media streaming service.
- The **third-party** domain is that of a content delivery network. The *Content hosting* function may be embedded within a service provider's domain, but the function is still under the logical ownership of the third-party content delivery network.
- Functions deployed in the **service provider** domain are under the control of an Internet Service Provider (or similar entity) and provide the connectivity for a consumer to receive the multicast session. The service provider may receive a raw stream from a content provider and then encode, package and distribute the media, in which case it would own functions such as the *Content preparation* function and not the content provider.

• The **customer premises** domain encompasses any equipment under the control of the consumer of the content. This may include the terminal device such as a set-top box, mobile phone or connected television set, and the home gateway device referred to in clause 6 of ETSI TS 103 769 [i.1]. The terminal device or home gateway may be provided by a content provider or service provider, or they may be purchased off the shelf by the consumer.

Table 5.0-1 below shows a matrix of all the logical functions defined in clause 5.3 of ETSI TS 103 769 [i.1] against the applicable deployment domains described in the present document.

Logical function	Content Provider domain	Third-party domain	Service Provider domain	Customer premises domain
Content preparation	√		√	
Content hosting	√	✓	✓	
Multicast server	✓		✓	
Unicast repair service	✓		✓	✓
Multicast gateway			✓	✓
Provisioning	✓		✓	
Content provider control	✓		✓	
Content playback				✓
Multicast rendezvous service	✓		✓	✓
DRM licence management	✓		✓	
Application				✓
Service directory	✓	✓	✓	✓

Table 5.0-1: Matrix of logical functions mapped to applicable domains

The present document describes four possible implementation options:

- Clause 5.1 describes a bidirectional deployment incorporating unicast repair, where a *Multicast server* deployed in the service provider's network pulls content from a *Content hosting* function also deployed in the service provider's network, and a *Multicast gateway* is deployed in the home gateway device within the consumer premises.
- Clause 5.2 describes a bidirectional deployment incorporating unicast repair, where a *Multicast server* deployed in the service provider's network pulls content from a *Content hosting* function hosted by a third-party commercial content delivery service provider, and a *Multicast gateway* is deployed in the service provider's network edge.
- Clause 5.3 describes a bidirectional deployment incorporating unicast repair, where a content owner's *Content* preparation function pushes content into both a *Multicast server* and *Content hosting* function hosted in the
 - preparation function pushes content into both a Multicast server and Content hosting function hosted in the service provider's network, and a Multicast gateway deployed in the service provider's network edge is co-located with the Multicast rendezvous service.
 Clause 5.4 describes a deployment with two separate operator networks; one fixed line hidiractional
 - Clause 5.4 describes a deployment with two separate operator networks: one fixed line bidirectional deployment incorporating unicast repair, and another unidirectional satellite-based deployment with no unicast repair capability. In both delivery networks, the content provider owns the *Content preparation* and *Multicast server* functions, as well as an origin *Content hosting* function. A third-party commercial operator provides a content delivery network to the fixed-line operator to support unicast repair with network edge caching, fed by the content provider's *Content hosting* (origin) function. In the fixed line delivery path, the *Multicast gateway* is deployed in the home gateway device within the consumer premises. In the satellite delivery network path, the *Multicast gateway* is deployed within the satellite Set-Top Box (STB) alongside the *Content playback* and *Application* functions.

Table 5.0-2 below shows a matrix of how the four clauses described in the present document map to the identified possible configuration options, including the availability of reference point **A** for unicast repair, whether the multicast gateway configuration is delivered over the control plane reference point **C**_{MR} or carried in a multicast gateway configuration transport session over reference point **M** as described in clause 8.3.5 of ETSI TS 103 769 [i.1], the use of push or pull ingest mode as described in clauses 8.3.1 and 8.3.2 of ETSI TS 103 769 [i.1] respectively, and finally if only media objects or both media objects and presentation manifests are sent over reference point **M**.

Availability of unicast repair	Multicast gateway	Multicast server ingest	Delivery over IP multicast		e 5.1	5.2	e 5.3	e 5.4
(bidirectional / unidirectional)	configuration delivery method	mode	Manifest	Media objects	Clause	Clause	Clause	Clause
	Смк Смк Ріп' (рі М Ріп' (рі Ріп' (рі	O in (pull)	No	Yes	~			
			Yes	Yes				
		P _{in} ' (push)	No	Yes				✓
Pidiroctional			Yes	Yes				
Didirectional		O in (pull)	No	Yes				
			Yes	Yes		✓		
		D (nuch)	No	Yes				
		rin (push)	Yes	Yes			✓	
Unidirectional	м	O in (pull)	Yes	Yes				
Uniunectional		P _{in} ' (push)	Yes	Yes				✓

Table 5.0-2: Matrix of object delivery options

iTeh Standards (https://standards.iteh.ai) Document Preview

<u>ETSI TR 104 094 V1.1.1 (2024-12)</u>

nttps://standards.iteh.ai/catalog/standards/etsi/93db8810-b1fd-4eae-8ed3-1fffda24c8e3/etsi-tr-104-094-v1-1-1-2024-12

5.1 Pull ingest with Multicast gateway in the consumer premises equipment

5.1.0 Introduction

Figure 5.1.0-1 below illustrates a vertically integrated deployment in which the system is configured entirely within the service provider's domain.



Figure 5.1.0-1: Deployment architecture diagram for vertically integrated deployment

Table 5.1.0-1 below shows example fully-qualified domain names for the key functions.

Table 5.1.0-1: Logical function owners and FQDNs for vertically integrated deployment

Logical function	Domain	FQDN
Provisioning	Service provider	dvb-provisioning.isp.net
Multicast rendezvous service		dvb-rv.isp.net
Content hosting		content-provider.cdn.isp.net
Multicast server		mcast-srv.isp.net
Multicast gateway		mg.subscriber9876.isp.net
Content playback	Customer premises	N/A

In this example, the following assumptions are made:

- The multicast service carries an MPEG-DASH media presentation, with media segment URIs generated using the substitution rules applied to a SegmentTemplate element in the MPEG-DASH MPD as specified in clause 5.3.9.4 of ISO/IEC 23009-1 [i.2].
- The *Multicast server* operates the pull-based content ingest method specified in clause 8.3.2 of ETSI TS 103 769 [i.1].
- The presentation manifest and initialization segments are delivered over unicast reference point **A**, with only media segments delivered via reference point **M**.
- The service provider allows consumers to subscribe to sufficient numbers of multicast groups that each service component is carried on its own multicast group.
- The multicast gateway is configured according to the out-of-band pulled configuration method as specified in clause 10.1.2 of ETSI TS 103 769 [i.1]. The multicast gateway configuration transport session described in clause 10.2.5 of ETSI TS 103 769 [i.1] is therefore not used.
- The *Multicast gateway* is deployed in the customer premises as a service on the home gateway device as described in clause 6.2 of ETSI TS 103 769 [i.1]. It behaves as an HTTP(S) reverse caching proxy, and the *Asset storage* subfunction of the *Multicast gateway* acts as a HTTP object cache.
- It is assumed that the public-facing address of the *Multicast gateway* does not change during the playback sequence.



Figure 5.1.1-1: Provisioning sequence

The steps in the provisioning sequence are as follows:

- 1. The *Content Provider control* function provides a list of available linear services to be delivered over multicast to the service provider's *Provisioning* function via reference point **C**_{CP}.
- 2. The *Provisioning* function configures the *Content hosting* function to make the media presentation available.
- 3. The *Provisioning* function uses the out-of-band pushed multicast server configuration method defined in clause 10.4.2.2 of ETSI TS 103 769 [i.1] over reference point **C**_{MS} to supply a multicast server configuration instance document to the *Multicast server* that describes the set of multicast sessions and multicast transport sessions that it is to transmit.

This configuration references the presentation manifests needed to fetch ingest media objects and start transmitting multicast transport objects over reference point \mathbf{M} .