

ETSI TS 126 517 V17.4.0 (2023-10)



**LTE;
5G;
5G Multicast-Broadcast User Services;
Protocols and Formats
(3GPP TS 26.517 version 17.4.0 Release 17)**



Reference

RTS/TSGS-0426517vh40

Keywords

5G,LTE

ETSI

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Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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Foreword

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

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- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

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

- shall** indicates a mandatory requirement to do something
- shall not** indicates an interdiction (prohibition) to do something

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

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

- should** indicates a recommendation to do something
- should not** indicates a recommendation not to do something
- may** indicates permission to do something
- need not** indicates permission not to do something

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

- can** indicates that something is possible
- cannot** indicates that something is impossible

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

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

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

In addition:

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

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

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

1 Scope

The present document defines protocols and formats for User Services as defined in TS 26.502 [6] and conveyed using the 5G multicast–broadcast capabilities of the 5G System defined in TS 23.501 [2], TS 23.502 [3] and TS 23.247 [5].

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
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- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 23.501: "System architecture for the 5G System (5GS)".
- [3] 3GPP TS 23.502: "Procedures for the 5G System (5GS)".
- [4] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".
- [5] 3GPP TS 23.247: "Architectural enhancements for 5G multicast-broadcast services; Stage 2".
- [6] 3GPP TS 26.502: "5G multicast–broadcast services; User Service architecture".
- [7] 3GPP TS 26.346: "MBMS; Protocols and Codecs".
- [8] IETF RFC 8866: "Session Description Protocol".
- [9] W3C: "XML Schema Part 2: Datatypes".
- [10] 3GPP TS 23.003: "Numbering, addressing and identification".
- [11] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".
- [12] IETF RFC 3926: "FLUTE - File Delivery over Unidirectional Transport".
- [13] IETF RFC 2616: "Hypertext Transfer Protocol -- HTTP/1.1".
- [14] OpenAPI: "OpenAPI 3.0.0 Specification", <https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md>.
- [15] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".
- [16] 3GPP TS 29.501: "5G System: Principles and Guidelines for Services Definition; Stage 3".
- [17] 3GPP TS 29.580: "5G System; Multicast/Broadcast Service Function services; Stage 3".
- [18] 3GPP TS 29.581: "5G System; Multicast/Broadcast Service transport services; Stage 3".
- [19] IETF RFC 9110: "HTTP Semantics", June 2022.
- [20] IETF RFC 9111: "HTTP Caching", June 2022.
- [21] IETF RFC 9112: "HTTP/1.1", June 2022.
- [22] IETF RFC 9113: "HTTP/2", June 2022.
- [23] Reserved for future use.

- [24] IETF RFC 8446: "The Transport Layer Security (TLS) Protocol Version 1.3", August 2018.
- [25] Open Mobile Alliance: "OMNA BCAST Service Class Registry",
<https://technical.openmobilealliance.org/OMNA/bcast/bcast-service-class-registry.html>.

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1], TS 23.501 [2], TS 23.502 [3], TS 23.247 [5], TS 26.502 [6] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1], TS 23.501 [2], TS 23.502 [3], TS 23.247 [4] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

CMAF	Common Media Application Format
FLUTE	File Delivery over Unidirectional Transport
MBS	Multicast–Broadcast Services
MB-SMF	Multicast–Broadcast Session Management Function
MB-UPF	Multicast–Broadcast User Plane Function
MBSF	Multicast–Broadcast Service Function
MBSTF	Multicast–Broadcast Service Transport Function
PCF	Policy and Charging Function
NEF	Network Exposure Function
SDP	Session Description Protocol
TMGI	Temporary Mobile Group Identity
UE	User Equipment
UML	Unified Markup Language
XML	eXtensible Markup Language

4 System overview

5 MBS User Service Announcement

5.0 Overview

MBS User Service Announcement is needed in order to advertise MBS User Services in advance of, and potentially during, the MBS User Service Sessions described. MBS User Service Announcement (as defined in clauses 4.5.7 and 4.5.8 of TS 26.502 [3]) is provided by means of an *MBS User Service Description*, the syntax of which is defined in this clause.

5.1 MBS User Service Description data model

5.1.1 General

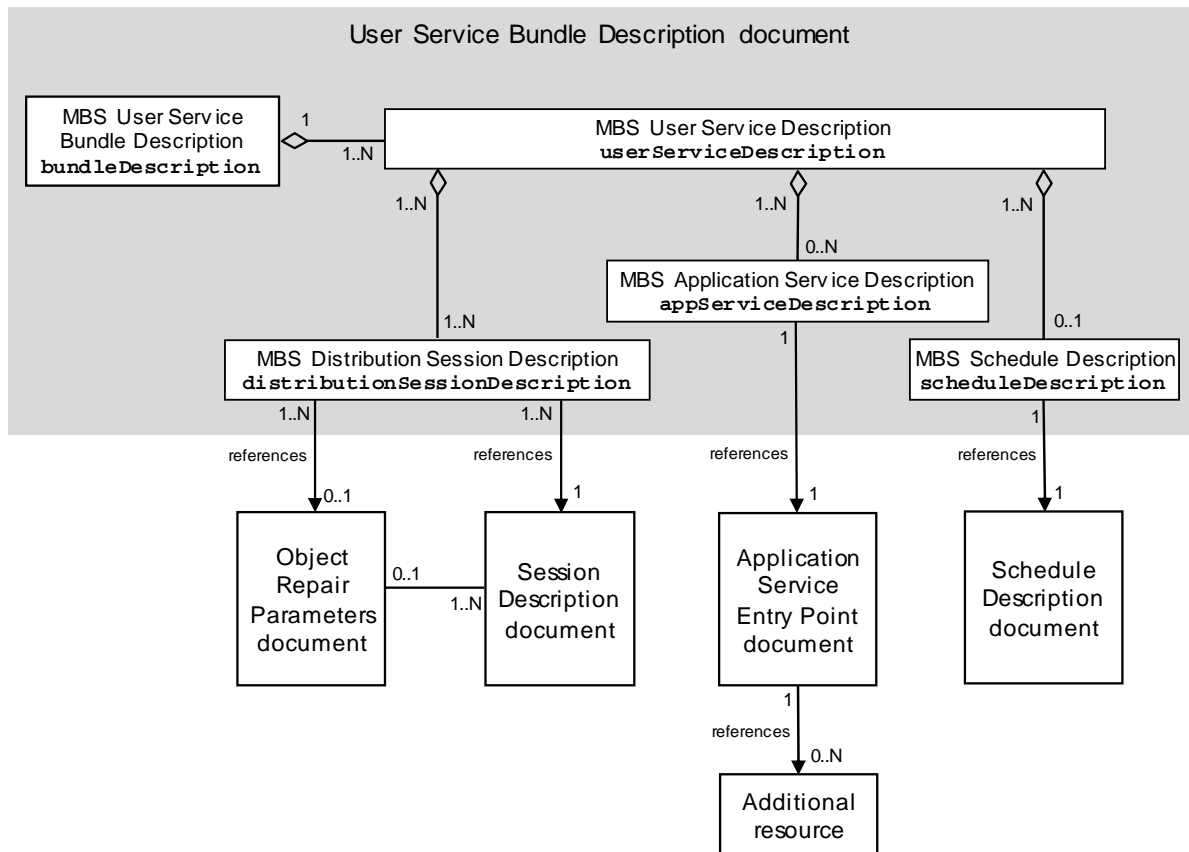
An MBS User Service Description is described by a set of metadata documents that are delivered as described in clause 4.3.2 of TS 26.502 [3]. The data model defined in this clause subdivides the parameters defined in [3] and groups them into a set of *metadata documents*.

Each metadata document is divided into *metadata units*. A metadata unit is a single uniquely identifiable block of metadata. The metadata itself describes details of services. An obvious example of a metadata unit would be a single SDP document [8].

The metadata consists of:

- An *MBS User Service Bundle Description* metadata unit (see clause 5.2.2) describing a bundle of one or more MBS User Services, and containing one or more:
 - *MBS User Service Description* metadata unit (see clause 5.2.3) describing an MBS User Service Session that is associated with:
 - One or more *MBS Distribution Session Description* metadata units (see clause 5.2.4), each of which references a Session Description document [8] that may be packaged with the MBS User Service Bundle Description, and each of which may optionally reference an Object Repair Parameters document (see clause 5.2.7) describing the object repair parameters for the MBS Distribution Session.
 - Zero or more *MBS Application Service Description* metadata units (see clause 5.2.5), each of which references an Application Service Entry Point document that may be packaged with the MBS User Service Bundle Description. Additional resources referenced by the entry point document may also be packaged with the MBS User Service Bundle Description.
 - Zero or one *MBS Schedule Description* metadata unit (see clause 5.2.6) advertising the delivery schedule for the MBS User Service Session.

Figure 5.1-1 illustrates the relationships between these metadata units using UML for a single MBS User Service Bundle.



NOTE: "N" means any number in each instance.

Figure 5.1-1: User Service Data Model simple description

An MBS User Service Bundle Description document shall contain one or more instances of the MBS User Service Description metadata unit, each of which describes a single MBS User Service Session within the MBS User Service Bundle.

Each instance of the MBS User Service Description metadata unit shall include at least one *MBS Distribution Service Description* metadata unit describing the set of MBS Distribution Sessions currently associated with the MBS User Service Session.

- The MBS Distribution Session Description metadata unit shall refer to one *Session Description document*.
- Each MBS Distribution Session Description metadata unit may contain a reference to an *Object Repair Parameters document*.

Each instance of the MBS User Service Description metadata unit may include zero or more *MBS Application Service Description* metadata units, each one referencing an Application Service Entry Point document (e.g. a DASH MPD, HLS Master Playlist or HTML document) which describes the root of the Application Service associated with this MBS User Service. When multiple Application Service Entry Point documents are referenced, an MBS Client shall select only one on the basis of a distinct MIME content type indicated in the Application Service Description.

Each instance of the MBS User Service Description metadata unit may include an *MBS Schedule Description* metadata unit. If included, the MBS Schedule Description shall refer to a *Schedule Description document*, and the UE can expect to receive MBS User Service data during the time periods described in the Schedule Description document.

In the case of the Object Distribution Method, the Schedule Description document may include an object transmission schedule for objects associated with the MBS User Service Session. The UE may select which objects to receive based on the object transmission schedule information published in the Schedule Description document.

5.2 Semantics

5.2.1 General

The following description in this clause presumes XML encoding of the metadata units comprising the MBS User Service Announcement.

5.2.2 MBS User Service Bundle Description metadata unit

The root element of the MBS User Service Bundle Description metadata unit is **bundleDescription**. This element is of type *bundleDescriptionType*. The **bundleDescription** element contains one or several **userServiceDescription** child elements.

5.2.3 MBS User Service Description metadata unit

The root element of the MBS User Service Description metadata unit is the **userServiceDescription** element. Each **userServiceDescription** element shall signal a unique identifier in its @serviceId attribute and this shall be of URI format.

The **userServiceDescription** element may contain one or more **name** child elements. The purpose of a **name** element is to communicate a human-readable title of the MBS User Service. For each **name** element, the language shall be specified according to XML datatypes (XML Schema Part 2 [9]).

The **userServiceDescription** element may contain one or more **serviceLanguage** child elements. Each **serviceLanguage** element represents the available languages of the MBS User Service. The language shall be specified according to XML datatypes (XML Schema Part 2 [9]) using the xml:lang attribute.

5.2.4 MBS Distribution Session Description metadata unit

Each MBS User Service Description metadata unit shall reference at least one MBS Distribution Session Description.

The **distributionSessionDescription** element shall contain a @conformanceProfile attribute indicating the set of features that the MBS Distribution Session conforms to and which the MBS Client needs to support in order to fully receive the MBS Distribution Session. The value of this attribute shall be a fully-qualified term identifier URI from the controlled vocabulary defined in annex C.

The **distributionSessionDescription** element shall contain a **@sessionDescriptionURI** attribute which references a Session Description document. The element may also contain an **@objectRepairParametersURI** attribute referencing an Object Repair Parameters document.

The **distributionSessionDescription** element may contain a **@dataNetworkName** attribute indicating a Data Network Name (DNN) as defined in TS 23.003 [10]. When this attribute is present, the MBS Client shall use the given DNN for interactions with the MBSF at reference point MBS-5 and with the MBS AS at reference point MBS-4-UC. If this attribute is not present, the MBS UE shall use a default PDU Session for these network interactions.

The **userServiceDescription** element may include an **availabilityInfo** child element providing additional information pertaining to the availability of the MBS Distribution Session within the 5G Network. If present, the **availabilityInfo** element shall include one or more **infoBinding** child elements. The **infoBinding** element shall contain the child elements **serviceArea**, **mbsFSAId** and **radiofrequency**:

- The **serviceArea** element declares the one or more service areas in which the MBS Session corresponding to this MBS Distribution Session is currently available.
- In the case of a broadcast MBS Session corresponding to this MBS Distribution Session, the **mbsFSAId** element identifies a preconfigured area within which, and in proximity to, the cell(s) announce the MBS FSA ID and its associated frequency.

NOTE: This is used to guide frequency selection by the UE for a broadcast MBS Session.

- The **radioFrequency** element indicates the one or more radio frequencies in the NG-RAN downlink which transmit the MBS Session corresponding to this MBS Distribution Session in the service area(s) identified by the **serviceArea** element.

5.2.5 Session Description metadata unit

The **@sessionDescriptionURI** attribute of the MBS User Service Bundle Description references a Session Description metadata unit. Each Session Description metadata unit shall describe one MBS Distribution Session. The Session Description metadata unit is conveyed in a Session Description document that shall be formatted according to RFC 8866 [8]. The Session Description document may be packaged in the same MBS User Service Bundle.

- The session description for the MBS Object Distribution Method is specified in clause 6.2.3
- The session description for the MBS Packet Distribution Method is specified in clause 7.2.3.

5.2.6 MBS Application Service Description metadata unit

In order to support application services in MBS, the MBS User Service Bundle Description metadata unit shall contain an **appServiceDescription** element referencing an *Application Service Entry Point* document which contains the descriptive information of the resources delivered via MBS and/or unicast distribution. That Application Service Entry Point document shall be formatted according to the value of the **@mimeType** attribute.

If the MBS User Service Description contains a reference to an Application Service Entry Point document, then:

- 1) At least one MBS Distribution Session Description of type Object Distribution Method shall be present, i.e. the MBS User Service Description shall include at least one **distributionSessionDescription** element referencing a Session Description Document that describes an Object Distribution Method as defined in clause 7.
- 2) When multiple MBS Distribution Session Descriptions of type Object Distribution Method are present, the **appServiceDescription** element shall define a mapping between the Application Service Entry Point document and the associated MBS Distribution Session.
- 3) The MBS Distribution Session described by the Session Description document shall deliver objects that are directly or indirectly referenced by the Application Service Entry Point document.
- 4) When the Application Service Entry Point document is a DASH MPD, then all of the following shall hold:
 - a) The MBS Distribution Session shall deliver the objects such that the last packet of the delivered object is available to the MBS Client by no later than its availability time as announced in the DASH MPD.

- b) The **Content-Location** element in the FLUTE File Delivery Table for the delivered object shall match the URL in the DASH MPD.

Editor's Note: Bullets 4 and 5 should be moved to Clause 7.

- 4) If an update to the Application Service Entry Point document is delivered as a FLUTE transmission object then the **Content-Location** element in the FLUTE File Delivery Table for the delivered object shall match the URL of the referenced Application Service Entry Point document.

In the case of 3GP-DASH formatted content, the **appServiceDescription** element may refer to a unified media manifest document which describes Representations available for both MBS reception and unicast retrieval, and this shall be used by MBS Clients compliant with this specification. In practical deployments, different subsets of the Representations described by the unified manifest document and referenced by such **appServiceDescription** may be specified for:

- Availability via MBS delivery only,
- Availability via both unicast and MBS delivery,
- Availability via unicast only, and the Representation is redundant in MBS area coverage, i.e. the usage of these resources does not provide an improved user experience. As an example, this may be a lower bitrate Representation of a media component for which a higher bitrate is available over MBS distribution, and
- Availability always via unicast, and the Representation is supplementary in MBS area coverage, i.e. even in MBS area coverage these resources provide an improved user experience. As an example, this may be a secondary language that is only accessible over unicast.

All resources that are directly or indirectly referenced in the Application Service Entry Point document of this metadata unit that are expected to be retrieved by HTTP GET shall be delivered by at least one of the MBS Distribution Sessions associated with the MBS User Service Description.

5.2.7 MBS Schedule Description metadata unit

Availability of the Schedule Description metadata unit is indicated by the presence of the **scheduleDescription** element in the MBS User Service Bundle Description metadata unit. The URI of the Schedule Description instance document is provided by the **@scheduleDescriptionURI** attribute in the **scheduleDescription** element.

A Schedule Description instance document describes the distribution schedule of the MBS Distribution Session and the availability of content via unicast delivery for an MBS User Service in terms of:

- Start/stop lists,
- Recurrence information,
- The service ID or service class to which the schedule may apply,

An MBS User Service containing multiple content components may be carried on a single MBS Distribution Session, or on multiple MBS Distribution Sessions. The MBS Client can expect to receive MBS data during the described time period(s) when at least one of the MBS Distribution Sessions for the MBS User Service is active.

A Schedule Description instance document may also include a schedule of when the objects are intended to be transmitted as part of an MBS Distribution Session using the Object Distribution Method. The object schedule information is defined in terms of:

- The service ID or service class to which the object schedule applies,
- An object transmission schedule listing for each object:
 - Object URI,
 - A list of start and end times for distribution of the object via MBS,

A Schedule Description instance document may be delivered to the MBS Client:

- prior to the MBS Distribution Session as part of the MBS User Service Announcement along with the Session Description metadata unit (out-of-band of that session); or
- in band within an MBS Distribution Session; or
- via an MBS Distribution Session dedicated to the transport of Schedule Description instance documents.

The most recently delivered Schedule Description instance document shall take priority, such that schedule parameters received prior to – and out-of-band of – the MBS Distribution Session they apply to are regarded as "initial defaults", and schedule parameters received in-band with the MBS Distribution Session overwrite the earlier received schedule parameters.

The Schedule Description instance document is clearly identified using a URI, to enable cross-referencing by the MBS Client of instance documents delivered in band and out of band.

The session schedule and object transmission schedule are described in the Schedule Description instance document respectively by the **sessionSchedule** and **objectSchedule** elements.

- The start and stop time of a single **sessionSchedule** is specified by the **start** and **stop** elements.
- The start and stop time of a single **objectSchedule** is specified by the @start and @end attributes.

In both cases the time is specified as the absolute date and UTC time. The duration may be determined by subtracting the start time from the stop time.

The MBS Distribution Session shall be available to the MBS Client during the time interval(s) announced by the session schedule (i.e. **scheduleDescription/serviceSchedule/sessionSchedule** element of the Schedule Description instance document), for either unicast or MBS reception. In particular, for unicast reception, the Schedule Description is indicative of the time availability for unicast access of an MBS User Service while the TMGI for the MBS Distribution Session is not activated, as well as for unicast fallback reception when the MBS Client is not located in the MBS coverage area for the service.

The MBS Client may activate reception of that MBS Distribution Session only within the **sessionSchedule** (and the **objectSchedule** if present) time window.

When an **objectSchedule** element is present in a **serviceSchedule** element, then:

- The MBS Client should not expect that an object described by an **objectSchedule** will be updated during a time window instance, defined by @start and @end attributes, within a **deliveryInfo** element of that **objectSchedule**.
- There shall be only one object version (as defined in the @File-ETag attribute in the FLUTE File Delivery Table) transmitted in a time window defined by the @start and @end attributes within a **deliveryInfo** element for a given **objectSchedule** element.
- If objectETag attribute is not present, the objects transmitted in the time windows from different **deliveryInfo** elements in an **objectSchedule** should not be expected to be the same object version.
- If the @objectETag attribute is present, there shall be only one object version transmitted in all of the time windows delimited by the start and end attributes of each of the one or more **deliveryInfo** elements.
- In-band Schedule Description instance document updates can be used to provide a dynamic schedule update to override the existing delivery schedule, such as using the @cancelled attribute mechanism specified in this clause.
- A **sessionSchedule** element in the same **serviceSchedule** element shall be present, and its **start** and **stop** elements shall specify a time window that completely overlaps the time windows specified in each of the **objectSchedule** elements of the same **serviceSchedule**.

When a **sessionSchedule** is present and there are no **objectSchedule** child elements in a **serviceSchedule**, then the MBS Client should download each new object, independently of whether the MBS Distribution Session uses the MBS Object Distribution Method or the MBS Packet Distribution Method.

The **objectSchedule** element specifies details about the objects to be delivered during an MBS Distribution Session. The **@sessionId** attribute, if present, identifies the MBS Distribution Session for each object. If not present, an MBS Client shall instead determine the MBS Distribution Session by examining the Session Description metadata unit for the MBS Distribution Session. The **@objectETag** attribute of the **objectSchedule** element is the version identifier of the object. If present, the purpose of this entity tag is to enable an MBS Client to determine if an object has changed since a prior reception without having to download the object.

The **scheduleUpdate** element specifies a time after which MBS Client shall seek to update its schedule information by acquiring the latest available Schedule Description instance document.

An **@index** attribute is included as a child of the **sessionSchedule** element. If the **sessionSchedule** does not describe any session reoccurrence, then the index corresponds to the single session occurrence. If the **sessionSchedule** describes one or more reoccurrences the **@index** is the starting index of the first session occurrence with the index value increased by one for each session reoccurrence.

A **@cancelled** attribute is defined as a child of the **objectSchedule/objectURI** element.

- If the **@cancelled** attribute is set to *"true"* or *"1"*, then the transmission of the object identified by the **objectURI** element is cancelled, and the MBS Client shall cancel any applicable repair and/or reception reporting procedures for that object.

If this object schedule-level cancellation indication in the updated schedule description is received after the associated object has already been delivered, then any related repair or reception reporting for that object (associated with its parent service), either in progress or yet to occur, shall be aborted.

- If the **@cancelled** attribute is set to *"false"* or *"0"* or is absent, then normal object transmission and associated delivery procedures, if applicable, shall occur.

A **sessionScheduleOverride** element is defined as a child of the **serviceSchedule** element. If present, the **sessionScheduleOverride** element indicates either the cancellation of the session occurrence, or schedule override, as follows:

- If the **@cancelled** attribute (a child of **sessionScheduleOverride** element) is set to *"true"* or *"1"*, then the transmission of the MBS Distribution Session identified by the **index** attribute (a child of **sessionScheduleOverride** element) is cancelled, and the MBS Client shall cancel any applicable repair and/or reception reporting for all objects belonging to that MBS Distribution Session.

If this session schedule-level cancellation indication in the updated schedule description is received after any of the associated objects have already been delivered, then any related repair or reception reporting for those objects (associated with their parent service(s)), either in progress or yet to occur, shall be aborted.

- If the **@cancelled** attribute (a child of **sessionScheduleOverride** element) is set to *"false"* or *"0"* or is absent, then the **start** and **stop** time elements (children of **sessionScheduleOverride** element) shall override the nominal start and stop time of the transmission schedule of the session as identified by the **@index** attribute (a child of **sessionScheduleOverride** element).

The value of the **@index** attribute in the **sessionScheduleOverride** element corresponds to any of the value of the **index** element in the **reoccurrenceStartStopType** in the **sessionSchedule** element.

Schedule information received in the Schedule Description metadata unit shall take precedence over timing information that may have been received in the Session Description metadata unit (*t* and/or *r* lines in the SDP).

5.2.8 MBS Object Repair Parameters metadata unit

An Object Repair Parameters document for the object repair procedures may be delivered to MBS Clients:

- Prior to the MBS Distribution Session becoming active, along with the MBS Distribution Session Description metadata unit (out of band of that session); or
- in band within an MBS Distribution Session.

The most recently delivered Object Repair Parameters document shall take priority, such that configuration parameters received prior to – and out-of-band of – the MBS Distribution Session they apply to are regarded as "initial defaults",

and configuration parameters received during – and in band with – the MBS Distribution Session, override the earlier received parameters. Thus, a method to update parameters dynamically on a short timescale is provided but, as would be desirable where dynamics are minimal, is not mandatory.

During the User Service Discovery/Announcement Procedure, the Object Repair Parameters document is clearly identified using a URI, to enable UE cross-referencing by the MBS Client of instance documents delivered in band and out of band.

5.3 Delivery of User Service Description

5.3.1 General

An MBS User Service Description may be delivered to the MBS Client via MBS Distribution Sessions at reference point MBS-4-MC (see clause 5.3.2) and/or via a regular unicast PDU Session at reference point MBS-5 (see clause 5.3.3) and/or via application-private means at reference point MBS-8.

The syntax of the User Service Description is specified in clause A.2.

The MIME content type of the MBS User Service Description bundle is specified in clause E.2.

5.3.2 Delivery of User Service Description in object carousel

In this case, a bundle of MBS User Service Descriptions is delivered repeatedly by the MBSTF to the MBSTF Client via a suitable MBS Distribution Session at reference point MBS-4-MC using the Object Distribution Method, as defined in clause 4.2.4 of TS 26.502 [6]. The operating mode of this MBS Distribution Session shall be set to *OBJECT_CAROUSEL* and relies on an object manifest to characterize the repetition and the update pattern of the MBS User Service Announcement information. The object manifest is specified in clause 6.1.2.

As defined in clause 5.4 of TS 26.502 [6], the MBSTF Client announces the arrival of an MBS User Service Description to the MBSF Client using a suitable notification at internal reference point MBS-7', and the MBSF Client may subsequently retrieve the MBS User Service Description from the MBSTF Client via internal reference point MBS-6'. It may do so using procedures equivalent to those specified for unicast retrieval at reference point MBS-5 (see clause 5.3.3). In this case, the MBSTF Client acts as a proxy for the MBS AF.

5.3.3 Delivery of User Service Description via unicast PDU Session

In this case, a bundle of one or more MBS User Service Descriptions is retrieved by the MBSF Client from the MBS AF at reference point MBS-5 via a regular unicast PDU Session.

The API at this reference point is specified in clause 9.2. The OpenAPI [14] specification of the User Service Description retrieval API can be found in clause A.2.

6 Object Distribution Method

6.1 General

6.1.1 Overview

The Object Distribution Method supports the transmission of media segments, e.g. CMAF media segments [7] and also non-real-time objects.

The MBS Distribution Session shall be provisioned to accommodate the bit rate of the aggregated object flow, accounting for in-band carriage of metadata units, protocol header overheads, and FEC redundancy (if configured).

6.1.2 Object manifest

An object manifest document describes a list of objects to be distributed in an MBS Distribution Session. The syntax of the object manifest is specified in clause D.1. The semantics of the document are specified in table 6.1.2-1 below.

For each object to be delivered in the MBS Distribution session, the attributes under the *objects* property in table 6.1.2-1 shall be maintained by the MBSTF.

Table 6.1.2-1: Properties of object manifest

Property name	Cardinality	Description
<i>updateInterval</i>	Optional	The time interval, expressed in seconds, according to which the MBSTF attempts to re-acquire the object manifest when pull-based object acquisition is provisioned. Ignored by the MBSTF for push-based object acquisition.
<i>objects</i>	Mandatory	The list of objects to be carouselled from the MBSTF to the MBSTF Client.
<i>locator</i>	Mandatory	The URL from which the object is to be ingested by the MBSTF.
<i>repetitionInterval</i>	Optional	The time interval, expressed in milliseconds, according to which the MBSTF will periodically send the object to the MBSTF Client. If omitted, the MBSTF determines the repetition interval for the object. Ignored by the MBSTF in Object Collection operating mode.
<i>keepUpdatedInterval</i>	Optional	The time interval, expressed in seconds, according to which the MBSTF is expected to check for updates made to the object at its origin (as indicated by <i>locator</i> or a redirect from there to another location). In case of conflicting information, the MBSTF should give precedence in determining the update interval to the HTTP cache control metadata included in the HTTP response from the object origin. Any changes to the origin object that are detected by the MBSTF shall be reflected in the MBS Distribution Session at the earliest opportunity and the replacement of one object with another shall be signalled to the MBSTF Client by means of the object transport protocol provisioned at reference point MBS-4-MC. If omitted, the MBSTF shall not attempt to check for updates to the object. Ignored by the MBSTF in Object Collection operating mode.
<i>earliestFetchTime</i>	Optional	The MBSTF shall fetch the object no sooner than this UTC timestamp. If absent, then the object shall be present at its origin (as indicated by <i>locator</i> or a redirect from there to another location) and the MBSTF may fetch it at a time of its choosing.
<i>latestFetchTime</i>	Optional	The MBSTF shall fetch the object no later than this UTC timestamp. If absent, then the object shall be present at its origin (as indicated by <i>locator</i> or a redirect from there to another location) and the MBSTF may fetch it at a time of its choosing.

6.2 Usage of FLUTE for Object Distribution Method

6.2.1 General

If FLUTE [12] is used to realise the Object Distribution Method, the MBS Distribution Session shall conform to the MBMS Download Profile as defined in clause L.4 of TS 26.346 [7] with the additional requirements in clause 6.2 of the present document.

The usage of this distribution method is identified in the MBS Session Description metadata unit as defined in clause 6.2.3, in particular by the indication of the protocol FLUTE/UDP in combination with the MBS service type.

The MBSTF shall use the Profiled FDT Schema according to clause L.6 of TS 26.346 [7] to describe the object list currently being transmitted in the MBS Distribution Session.

Generally, the end of transmission of an object is the expiry time for the latest FDT instance describing the object. Objects shall be described in an FDT Instance with the *Expires* attribute. Depending on the operating mode (clause 6.2.4), different settings of the expiry time and different numbers of objects per FDT Instance are recommended.

Inclusion of the @Content-MD5 and @File-ETag FDT Instance attributes is optional.

- The @File-ETag represents the value of the HTTP entity tag as defined in section 3.11 of RFC 2616 [13] which may also serve as the version identifier of the **File** object described by the FDT Instance.

In order to fetch missing portions of an object, the MBS Client may use the Object Repair services. The Object Repair service is realized as a Byte-Range based File Repair, as specified in clause 9.3.6.2 of TS 26.346 [7].

NOTE: The use of Alternate-Content-Location-1 and Alternate-Content-Location-2 is not supported.

6.2.2 Session Description metadata unit

6.2.2.1 General

The Session Description metadata unit contains the needed information to activate the reception of an Object Distribution Method. The Session Description metadata unit is formatted according to the Session Description Protocol [8]. The Session Description metadata unit for the Object Distribution Method is based on the Session Description parameters as defined in clause 7.3 of TS 26.346 [7] with the following restrictions and extensions.

Restrictions:

- The *Mode of MBMS bearer per media* parameter (clause 7.3.2.7 of [7]) shall not be used.
- The *QoE Metrics* (as defined in clauses 7.3.2.0 of [7]) shall not be used
- The *Service-language(s) per media* (clause 7.3.2.9 of [7]) shall not be used. It is assumed that the service languages are described within an application manifest.
- The *Alternative TMGI* (clause 7.3.2.12 of [7]) shall not be used.
- The *Start time* and *End time* of the session (SDP *t*-line) shall indicate a superset of the active times specified in the MBS Schedule Description metadata unit, if present. If there is no schedule specified, both values should be set to zero indicating undefined times.

Extensions:

- When an MBS Session is of MBS Service Type *Broadcast* or when the Multicast MBS Session Type uses a TMGI as MBS Session ID, the *MBS service type of MBS Session* declaration attribute as defined in clause 6.2.2.2 shall be present in the Session Description.

6.2.2.2 MBS service type of MBS Session

A new MBS service type declaration attribute is defined which results in, e.g.:

- *a=mbs-servicetype:broadcast 123869108302929*

or:

- *a=mbs-servicetype:multicast 123869108302929*

The MBS service type declaration attribute shall be used in Session Description metadata to indicate the type of the corresponding MBS Distribution Session as defined in table 6.2.2.2-1.

Table 6.2.2.2-1: Assignment of mbs-servicetype attribute value

Attribute value	Meaning
<i>multicast</i>	The MBS Distribution Session is delivered using a Multicast MBS Session.
<i>broadcast</i>	The MBS Distribution Session is delivered using a Broadcast MBS Session.

The MBS service type attribute shall be declared at session level in the Session Description metadata unit. The session level attribute applies to all media entries without a media-level occurrence of the *mbs-servicetype* attribute. The Session Description metadata unit shall include only a single instance of MBS service type declaration attribute.

Definition:

- *mbs-service-type-declaration-line* = "a=mbs-servicetype:" ("broadcast"/"multicast" SP *tmgi*) CRLF
- *tmgi* = 1*15DIGIT

EXAMPLE:

UK MCC = 234 (*MCC Digit 1* = 2; *MCC Digit 2* = 3 and *MCC Digit 3* = 4)

Vodafone UK MNC = 15

and, with padding, Vodafone UK MNC = 15F (*MNC Digit 1* = 1; *MNC Digit 2* = 5 and *MNC Digit 3* = F)

MBS Service ID = 70A886

Therefore, TMGI = 70A886 32F451 (Hex) or 123869108302929 (Decimal)

The Temporary Mobile Group Identity (*tmgi*) information element is defined in TS 24.008 [11] including the coding of the fields. Octets 3 to 8 (MBS Service ID, MCC and MNC) shall be placed in the *tmgi* attribute of the MBS service type declaration line, and are encoded as a decimal number. Octet 3 is the most significant octet. Because this is encoded as a decimal number, leading zeros of the MBS Service ID field may be omitted.

6.2.2.3 SDP examples for FLUTE Session

Listing 6.2.2.3-1 provides a full example of an SDP description describing a FLUTE-based MBS Distribution Session using the Object Distribution Method with a TMGI as MBS Session Id:

Listing 6.2.2.3-1: Session Description metadata unit for FLUTE-based MBS Distribution Session with TMGI

```
v=0
o=user123 2890844526 2890842807 IN IP6 2201:056D::112E:144A:1E24
s=Object Distribution session example
i=More information
t=2873397496 2873404696
a=mbs-servicetype:broadcast 123869108302929
a=FEC-declaration:0 encoding-id=1
a=source-filter: incl IN IP6 * 2001:210:1:2:240:96FF:FE25:8EC9
a=flute-tsi:3
m=application 12345 FLUTE/UDP 0
c=IN IP6 FF1E:03AD::7F2E:172A:1E24/1
b=1000
a=lang:EN
a=FEC:0
```

Listing 6.2.2.3-2 provides a second example of an SDP description describing a FLUTE-based MBS Distribution Session using the Object Distribution Method and which indicates that 25% redundant FEC protection is applied to the FEC encoding of the video Segments of the associated DASH-formatted content:

Listing 6.2.2.3-2: Session Description metadata unit for FLUTE-based MBS Distribution Session with TMGI and 25% FEC redundancy

```
v=0
o=user123 2890844526 2890842807 IN IP6 2201:056D::112E:144A:1E24
s=Object Distribution session carrying 2-hour DASH-packaged programme
i=More information
t=3615124600 3615131800
a=mbs-servicetype:broadcast 123869108302929
a=FEC-declaration:0 encoding-id=1
a=FEC-redundancy-level:0 redundancy-level=25
a=source-filter: incl IN IP6 * 2001:210:1:2:240:96FF:FE25:8EC9
a=flute-tsi:5
m=video 10111 FLUTE/UDP 0
c=IN IP6 FF1E:03AD::7F2E:172A:1E24/1
b=2048
a=lang:EN
```

6.2.3 Operating modes for Object Distribution Method

6.2.3.1 Introduction

The operating modes for the Object Distribution Method are defined in clause 6.1 of TS 26.502 [6]. Operating modes primarily describe the operation of the MBSTF to convert ingest data into an MBS Distribution Session. The following clauses specify how FLUTE is used for each operating mode.

6.2.3.2 Single object operating mode

Single object operating mode (*OBJECT_SINGLE*) refers to the case in which a single object is distributed via the Object Distribution Method.

No specific aspects beyond the general provisions in clauses 6.1, 6.2.1 and 6.2.2 apply to this operating mode.

6.2.3.3 Object collection operating mode

Object collection operating mode (*OBJECT_COLLECTION*) refers to the case in which multiple objects are distributed via the Object Distribution Method. The list of objects to be distributed is described by an object manifest document as specified in clause 6.1.2. The objects listed in the manifest are distributed only once. Each object listed in the manifest is pulled by the MBSTF from the location indicated prior to inclusion in the FLUTE Session corresponding to the MBS Distribution Session.

In this operating mode, the FDT Instance should describe all objects that are part of the collection.

6.2.3.4 Object carousel operating mode

Object carousel operating mode (*OBJECT_CAROUSEL*) refers to the case in which one or multiple objects are distributed via the Object Distribution Method in a repeated fashion. The list of objects to be distributed is described by an object manifest document as specified in clause 6.1.2. Each object listed in the manifest is pulled by the MBSTF from the location indicated prior to inclusion in the FLUTE Session corresponding to the MBS Distribution Session.

The list of objects described in the manifest may be updated over time by providing a replacement object manifest.

In this operating mode, the FDT Instance should describe all objects that are currently available in the FLUTE Session, considering the potential object update interval.

6.2.3.5 Segment streaming operating mode

Segment streaming operating mode (*OBJECT_STREAMING*) refers to the case for which a sequence of objects, typically representing timed segments from a timed presentation, are distributed using the Object Distribution Method. The sequence of objects is referred to as an *object flow*. This operating mode is recommended for streaming DASH or HLS content to a Media Player in the UE using MBS User Services.

NOTE: This operating mode may also be used for non-media object flows, e.g. in the absence of an Application Service Description.

For each object associated with the object flow to be delivered in the MBS distribution session the following information shall be maintained by the MBSTF in an object list:

- The URL used by the MBS-Aware Application to request the object, derived from the object ingest URL.
- The object's *latest availability start time* at the MBS Client. After this time, the MBS-Aware Application may request the full object from the MBSTF Client by using the URL of the object.

This value is determined for each object based on an availability start time at the point of ingest (i.e. reception of first byte of the object) combined with a configured distribution offset.

- The object's *availability end time* from the MBSTF Client. After this time, the object may no longer be requested by the MBS-Aware Application.

This value is determined for each object based on an availability start time at the point of ingest (i.e. reception of first byte of the object) combined with a configured clean-up time.

The object list is typically extended over time, for example as new objects (e.g. media segments) become available.

The object list may, for example, be provided by an explicit object distribution manifest.

NOTE: An object distribution manifest format is not defined in the present document.

The object list may also be defined by a presentation manifest (e.g. DASH MPD), for example in the case of an Application Service, for which the manifest is provided as part of the User Service Description.

When the Application Service Entry Point document is a DASH MPD, this document is used by the MBSTF to update the object list. The DASH MPD may itself be included in the object list, and hence be delivered in band with the media segment objects it describes on the same MBS Distribution Session. If the content of the Application Service Entry Point document changes during an MBS User Data Ingest Session, the updated document shall be reflected in the MBS Distribution Session at the soonest opportunity.

For the segment streaming operating mode, the MBSTF acts as follows based on the object list:

- The MBSTF shall transmit each object in the object list such that the last packet of the delivered FLUTE transmission object (including any FEC recovery packets, when configured) is available at the MBSTF Client latest at its latest availability start time.
- An FDT Instance object should be sent frequently by the MBSTF, describing all objects of the object list that are not yet fully transmitted.
- The **Content-Location** element in the FDT Instance shall match the URL of the corresponding object in the object list. The URL may be rewritten by the MBSTF using the Object distribution base URL property of the MBS Distribution Session.
- The **File@Expires** attribute for each object shall be set such that it is equal to or earlier than its *latest availability start time*.
- The **Cache-Control@Expires** attribute shall be used to indicate the *availability end time of the object*.
- **Content-MD5** and **File-ETag** may optionally be used.

7 Packet Distribution Method

7.1 General

The Packet Distribution Method reuses different delivery concepts from TS 26.346 [7]. Additional distribution methods may be defined in future.

7.2 Re-using MBMS Delivery Method as Packet Distribution Method

7.2.1 General

The Packet Distribution Method combines three different delivery methods of TS 26.346 [7] (namely the MBMS Streaming Delivery Method, Group Communication Delivery Method and Transparent Delivery Method) into a single distribution method, with a set of modifications.

For the Packet Distribution Method, the MBSTF may handle the ingested content on three different protocol layers according to the operating mode provisioned for the MBS Distribution Session:

- *Proxy mode*: The MBSTF handles UDP packet payloads and forwards UDP packet payloads from ingest into the MBS Distribution Session. The MBSTF may use different UDP ports for the MBS Distribution Session. The MBSTF re-uses the Proxy Mode of the Transparent Delivery Method as defined in clause 8B of [7].
- *Forward-only mode*: The MBSTF receives complete IP packets and forwards the ingested packets as MBS PDUs. The MBSTF re-uses the Group Communication Delivery Method as defined in clause 8A of [7] and the Forward-Only Mode of the Transparent Delivery Method as defined in clause 8B of [7].

7.2.3 Session Description

7.2.3.1 General

The Session Description metadata unit contains the needed information to activate the reception of a Packet Distribution Method. The Session Description metadata unit is formatted according to the Session Description Protocol [8]. The Session Description metadata unit for the Packet Distribution Method is based on the Session Description parameters as defined in clauses 8.3, 8A.3 and 8B.3 of TS 26.346 [7] with the following restrictions and extensions.

Restrictions:

- The *Mode of MBMS bearer per media* parameter (clauses 8.3.1.5 and 8B.3.2 of [7]) shall not be used.
- The *QoE Metrics* (as defined in clauses 8.3.2.1 and 8.4 of [7]) shall not be used.
- ROHC header compression (as defined in clauses 8A.4 and 8B.4 of [7]) shall not be used.

NOTE: ROHC is handled by RAN in 5MBS.

- The *Alternative TMGI* (clause 7.3.2.12 of [7]) shall not be used.
- The *Start time* and *End time* of the session (SDP *t* line) shall indicate a superset of the active times specified in the MBS Schedule Description metadata unit, if present. If there is no schedule specified, both values should be set to zero indicating undefined times.

Extensions:

- When the MBS User Service is of MBS Service Type *Broadcast* or when an MBS User Service of type *Multicast* uses a TMGI as its MBS Session ID, the *MBS service type of MBS Session* declaration attribute as defined in clause 6.2.2.2 shall be present in the Session Description.

7.2.3.2 SDP examples for Packet Distribution Method

Below is a full example of SDP description describing the media streams part of an MBS Packet Distribution session for RTP streaming:

Listing 7.2.3.2-1: Session description for RTP streaming

```
v=0
o=ghost 2890844526 2890842807 IN IP4 192.168.10.10
s=3GPP MBS Packet Distribution SDP Example
i=Example of MBS Packet Distribution SDP file
u=http://www.infoserver.example.com/ae600
e=ghost@mailserver.example.com
c=IN IP6 FF1E:03AD::7F2E:172A:1E24
t=0 0
b=AS:77
a=mbs-mode:broadcast 123869108302929
a=source-filter: incl IN IP6 * 2001:210:1:2:240:96FF:FE25:8EC9
m=video 4002 RTP/AVP 96
b=TIAS:62000
b=RR:0
b=RS:600
a=maxprate:17
a=rtpmap:96 H264/90000
a=fmtp:96 profile-level-id=42A01E; packetization-mode=1; sprop-parameter-sets=Z0IACpZTBYmI,aMljiA==
```

The following is a full example of SDP description for transparent streaming with two MPEG-2 Transport Streams:

Listing 7.2.3.2-2: Session description for MPEG-2 Transport Stream

```
v=0
o=ghost 2890844526 2890842807 IN IP4 192.168.10.10
s=3GPP MBS Transport-only SDP Example
i=Example of MBS transport-only SDP file
u=http://www.infoserver.example.com/ae600
e=ghost@mailserver.example.com
c=IN IP6 FF1E:03AD::7F2E:172A:1E24
t=3034423619 3042462419
b=AS:8000000
a=mbs-mode:broadcast 123869108302929

a=source-filter: incl IN IP6 * 2001:210:1:2:240:96FF:FE25:8EC9
m=video 4002 UDP/RTP/AVP 96
b=TIAS:4000000
a=mms-framing-header:0 2
a=rtpmap:100 MP2T/90000
m=video 4002 RTP/AVP 98
b=TIAS:4000000
a=rtpmap:100 MP2T/90000
a=MBS-framing-trailer:0 2
```

8 General aspects of APIs for MBS User Services

8.1 HTTP resource URIs and paths

The resource URI used in each HTTP request to the API provider shall have the structure defined in subclause 4.4.1 of TS 29.501 [16], i.e.:

{apiRoot}/ {apiName}/ {apiVersion}/ {apiSpecificResourceUriPart}

with the following components:

- *{apiRoot}* shall be set as described in TS 29.501 [16].
- *{apiName}* shall be set as defined by the following clauses.
- *{apiVersion}* shall be set to "v1" in this release.
- *{apiSpecificResourceUriPart}* shall be set as described in the following clauses.

8.2 Usage of HTTP

8.2.1 HTTP protocol version

8.2.1.1 General

Content interfaces at reference points specified in the present document shall expose an HTTP/1.1 [21] endpoint to API clients. They may additionally expose an HTTP/2 [22] endpoint, including support for the HTTP/2 starting mechanisms specified in section 3 of [22]. The API client may choose any supported HTTP protocol version. TLS [24] shall be supported on these interfaces and, where the option to use cleartext HTTP is available in the version of HTTP selected by the API client, it should opt for HTTPS interactions in preference.

8.2.1.2 MBSF

The HTTP protocol version used to invoke *Nmbsf* service operations on the MBSF at reference point Nbm10 is specified in clauses 6.1.2.1 and 6.2.2.1 of TS 29.580 [17].

8.2.1.3 MBSTF

The HTTP protocol version used to invoke *Nmbstf* service operations on the MBSTF at reference point Nmb2 is specified in clause 6.1.2.1 of TS 29.581 [18].

The endpoint exposed to the MBSF at reference point Nmb2 for the purpose of pushing object manifests into the MBSTF shall comply with the general provisions specified in clause 8.2.1.1.

The endpoint exposed to the MBS Application Provider (AF/AS) at reference point Nmb8 for the purpose of pushing objects into the MBSTF shall comply with the general provisions specified in clause 8.2.1.1.

8.2.1.4 MBS AF

The endpoint exposed to the MBSF Client at reference point MBS-5 for the purpose of retrieving User Service Descriptions using the API specified in clause 9.2 shall comply with the general provisions specified in clause 8.2.1.1.

Editor's Note: Possibly add MBS-10 here to specify the use of HTTP in the User Plane security procedure, or else specify the use of this reference point in a new clause 8.2.1.6 specifically for the MBSSF.

The endpoint exposed to the MBSTF at reference point MBS-11 for the purpose of retrieving object manifests and User Service Descriptions shall comply with the general provisions specified in clause 8.2.1.1.

All responses from the MBS AF that carry a message body shall include a strong entity tag in the form of an *ETag* response header field and a modification timestamp in the form of a *Last-Modified* response header per section 8.8 of RFC 9110 [19].

All endpoints exposed by the MBS AF shall support conditional HTTP requests using the header fields *If-none-Match* and *If-Modified-Since* per section 13 of RFC 9110 [19].

8.2.1.5 MBS AS

The endpoint exposed to the MBSTF Client at reference point MBS-4-UC for the purpose of unicast object repair shall comply with the general provisions specified in clause 8.2.1.1.

Byte range requests per section 14 of RFC 9110 [19] shall be supported by the MBS AS at reference point MBS-4-UC for the purpose of efficient unicast object repair by the MBSTF Client.

8.2.2 HTTP message bodies for API resources

Individual APIs in the present document specify the syntax and encoding of HTTP request and response message bodies. MIME content types for a subset of these are registered in annex E.

8.2.3 Usage of HTTP headers

8.2.3.1 General

Standard HTTP headers shall be used in accordance with clause 5.2.2 of TS 29.500 [15], encoded appropriately for the version of HTTP in use.

8.2.3.2 User Agent identification

8.2.3.2.1 General

When one of the MBS User Services functions defined in TS 26.502 [6] makes requests to an HTTP endpoint specified in the present document, it shall identify itself to the HTTP server using a *User-Agent* request header field (see section 10.1.5 of RFC 9110 [19]) that includes a *product* identifier indicating the type of client function making the request in its *token* element.

The optional *product-version* suffix shall be present and should indicate the version number of the present document (without the leading "V") with which the client implementation complies and shall, at minimum, indicate the 3GPP release number with which the implementation complies.

The *User-Agent* request header field may also include *comment* elements (see section 5.6.5 of RFC 9110 [19]) following the above specified *product* identifier, as well as additional vendor-specific *product* identifiers and *comment* elements compliant with the syntax and guidance provided in section 10.1.5 of RFC 9110 [19].

EXAMPLE 1: MBSTF/17.4.0 (build2114) libhttp/1.23.2

EXAMPLE 2: MBSFClient/17

8.2.3.2.2 MBSF identification

When invoking the *Nmbstf* service at reference point Nmb2, the MBSF identifies itself to the MBSTF using a *User-Agent* request header as specified in clauses 6.1.2.2.1 and 6.2.2.2.1 of TS 29.580 [17].

8.2.3.2.3 MBSTF identification

When ingesting content using the pull-based object acquisition method (see table 4.5.6-2 of TS 26.502 [6]), the MBSTF shall identify itself to the MBS Application Provider (AF/AS) at reference point Nmb8 and to the MBS AF at reference point MBS-11 using a *User-Agent* request header field that complies with the general provisions specified in clause 8.2.3.2.1. The product identifier *token* shall be set to the value MBSTF.

8.2.3.2.4 MBSF Client identification

The MBSF Client shall identify itself to the MBS AF at reference point MBS-5 and to the MBSSF at reference point MBS-10 using a *User-Agent* request header field that complies with the general provisions specified in clause 8.2.3.2.1. The product identifier *token* shall be set to the value MBSFClient.

8.2.3.2.5 MBSTF Client identification

The MBSTF Client shall identify itself to the MBS AS at reference point MBS-4-UC using a *User-Agent* request header field that complies with the general provisions specified in clause 8.2.3.2.1. The product identifier *token* shall be set to the value MBSTFClient.

8.2.3.3 Server identification

8.2.3.3.1 General

When one of the MBS User Services functions defined in TS 26.502 [6] responds to an HTTP request, it shall identify itself to the requesting client using a `Server` response header (see section 10.2.4 of RFC 9110 [19]) that includes a *product* identifier indicating the type and host name of the responding server in its *token* element. The server type and host name shall be separated by a single hyphen ('-') character.

The optional *product-version* suffix shall be present and should indicate the version number of the present document (without the leading "V") with which the server implementation complies and shall, at minimum, indicate the 3GPP release number with which the implementation complies.

The `Server` response header field may also include *comment* elements (see section 5.6.5 of RFC 9110 [19]) following the above specified *product* identifier, as well as additional vendor-specific *product* identifiers and *comment* elements compliant with the syntax and guidance provided in section 10.2.4 of RFC 9110 [19].

EXAMPLE 1: `MBSTF-vm10665.mno.net/17.4.0 (api=1.0.0) libsbi/2.1 libnf/1.2`

EXAMPLE 2: `MBSAF-vm10240.mno.net/17 (api=1.0.0) libsbi/2.1 libnf/1.2`

8.2.3.3.2 MBSF identification

When responding to *Nmbssf* service operations made by the MBS Application Provider (AF/AS) at reference point Nmb10, the MBSF's `Server` response header is set as specified in clauses 6.1.2.2.1 and 6.2.2.2.1 of TS 29.580 [17].

8.2.3.3.3 MBSTF identification

When responding to *Nmbstf* service operations made by the MBSF at reference point Nmb2, the MBSTF's `Server` response header is set as specified in clause 6.1.2.2.1 of TS 29.581 [18].

When acknowledging objects published using the push-based object acquisition method by the MBSF at reference point Nmb2 or by the MBS Application Provider (AF/AS) at reference point Nmb10, the MBSTF shall identify itself using a `Server` response header field that complies with the general provisions specified in clause 8.2.3.3.1. The product identifier token shall be set to the value MBSTF.

8.2.3.3.4 MBS AF identification

The MBS AF shall identify itself to the MBSF Client at reference point MBS-5 and to the MBSTF at reference point MBS-11 using a `Server` response header field that complies with the general provisions specified in clause 8.2.3.3.1. The product identifier token shall be set to the value MBSAF.

8.2.3.3.5 MBS AS identification

The MBS AS shall identify itself to the MBSTF Client at reference points MBS-4-UC using a `Server` response header field that complies with the general provisions specified in clause 8.2.3.3.1. The product identifier token shall be set to the value MBSAS.

8.2.3.4 Support for conditional HTTP GET requests

The provisions in clause 5.2.2 of TS 29.500 [15] relating to conditional GET requests using the `If-None-Match` and `If-Modified-Since` request headers apply to all Network Functions in the MBS System. In particular:

- This is specified for invocations of the *Nmbssf* service at reference point Nmb10 in clauses 6.1.2.2.1 and 6.2.2.2.1 of TS 29.580 [17].
- This is specified for invocations of the *Nmbstf* service at reference point Nmb2 in clause 6.1.2.2.1 of TS 29.581 [18].

All responses from the MBS AF at reference points MBS-5 and MBS-11 that carry a resource message body shall include:

- a strong entity tag for the resource, conveyed in an `ETag` response header per section 8.8.3 of RFC 9110 [19],
- a resource modification timestamp, conveyed in a `Last-Modified` response header per section 8.8.2 of RFC 9110 [19], and
- a predicted time-to-live period for the resource, conveyed in a `Cache-Control: max-age` response header per section 5.2 of RFC 9111 [20].

All API endpoints on the MBS AF that expose the HTTP `GET` method shall support conditional requests using the `If-None-Match` and `If-Modified-Since` request headers per section 13.1.2 and 13.1.3 respectively of RFC 9110 [19]. API clients should not attempt to revalidate their cached copy of a resource using a conditional `GET` request before the indicated time-to-live period has elapsed.

8.2.3.5 Support for conditional HTTP POST, PUT, PATCH and DELETE requests

The provisions in clause 5.2.2 of TS 29.500 [15] relating to conditional `POST`, `PUT`, `PATCH` and `DELETE` requests using the `If-Match` request header apply to all Network Functions in the MBS System. In particular:

- This is specified for invocations of the *Nmbssf* service at reference point Nmb10 in clauses 6.1.2.2.1 and 6.2.2.2.1 of TS 29.580 [17].
- This is specified for invocations of the *Nmbstf* service at reference point Nmb2 in clause 6.1.2.2.1 of TS 29.581 [18].

8.3 HTTP response codes

Guidelines for error responses to the invocation of APIs of NF services are specified in clause 4.8 of TS 29.501 [16]. API-specific error responses are specified in the respective technical specifications.

9 MBS AF APIs

9.1 General

This clause specifies the network APIs exposed by the MBS AF with reference to the general provisions of clause 8 as they apply to the reference point in question.

9.2 User Service Description retrieval API

9.2.1 General

In the case where *Service announcement modes* (see table 4.5.3-1 of TS 26.502 [6]) indicates that the MBS User Service Announcement for an MBS User Service is advertised at reference point MBS-5, the User Service Description retrieval API is used by the MBSF Client to retrieve a User Service Description document (or a set of User Service Description documents) from the MBS AF that enable reception of the MBS User Service(s) to be initiated by the MBSF Client.

In the case where *Service announcement modes* (see table 4.5.3-1 of TS 26.502 [6]) indicates that the MBS User Service Announcement for an MBS User Service is advertised via the User Service Announcement Channel at reference point MBS-4-MC, the User Service Description retrieval API is used by the MBSF Client at reference point MBS-7' to retrieve a User Service Description document (or a set of User Service Description documents) from the MBSTF Client that enable reception of the MBS User Service(s) to be initiated by the MBSF Client.

In the absence of prior knowledge about which Service announcement mode(s) are configured for currently provisioned MBS User Services, an MBSF Client may use either or both of the above procedures to proactively discover MBS User Service Announcements.

9.2.2 Resource structure

The User Service Description retrieval API is accessible from the MBS AF at reference point MBS-5 and from the MBSTF Client at reference point MBS-7' through the following URL base path:

{apiRoot}/3gpp-mbs-user-service-discovery/{apiVersion}/

The operations and the corresponding HTTP methods in table 9.2.2-1 are supported through the above API base path. In each case, the sub-resource path specified in the second column shall be appended to the URL base path.

Table 9.2.2-1: Operations supported by the User Service Description retrieval API

Operation	Sub-resource path	Allowed HTTP method(s)	Description
Discover User Service Descriptions	<i>user-service-descriptions?{queryParameters}</i>	GET	Used to discover a set of User Service Descriptions that match a set of filtering criteria corresponding to at least one of the query parameters specified in table 9.2.2-2. Multiple query parameters may be concatenated using the ampersand ('&') character as a separator with the resulting semantics of logical conjunction (i.e., Boolean AND). It is an error to invoke this operation with no query parameters. A <i>UserServiceDescriptions</i> bundle resource (see clause 9.2.3.1) is returned containing User Service Descriptions matching all of the specified filtering criteria, which may be empty if none match all of the criteria.
Retrieve User Service Description	<i>user-service-descriptions/{externalServiceId}</i>	GET	The <i>{externalServiceId}</i> uniquely identifies a single User Service Description resource in the MBS AF. If the requested User Service is known to the MBS AF, a <i>UserServiceDescription</i> resource (see clause 9.2.3.2) is returned. Otherwise, a suitable HTTP error response code is returned.

Table 9.2.2-2 specifies the query parameters that may be combined with the operations specified in table 9.2.2-1.

Table 9.2.2-2: Query parameters supported by the User Service Description retrieval API

Applicable operation	Filter name	Query parameter	Description
Discover User Service Descriptions	Service class	<i>service-class={serviceClassTermId}</i>	Used to select User Service Descriptions that are tagged with the supplied service class term identifier (see table 4.5.3-1 of TS 26.502 [6]), which is expressed as a fully-qualified URI string from a controlled vocabulary (e.g., OMNA BCASST Service Class [25]) with appropriate URL encoding applied.

9.2.3 Data model

9.2.3.1 UserServiceDescriptions resource type

The data model for the *UserServiceDescriptions* bundle resource is specified in clause 5.2.2 and clause A.2.

9.2.3.2 UserServiceDescription resource type

The data model for the *UserServiceDescription* resource is specified in clause 5.2.3 and clause A.2.

Annex A (normative): Syntax for Service Announcement

A.1 XML-based representation

A.1.1 MBS User Service Description schema

The following schema shall have the filename "mbs_user_service_description.xml".

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns="urn:3GPP:metadata:2022:MBS:userServiceDescription"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="urn:3GPP:metadata:2022:MBS:userServiceDescription"
elementFormDefault="qualified">
  <xs:element name="bundleDescription" type="BundleDescriptionType"/>

  <xs:complexType name="BundleDescriptionType">
    <xs:sequence>
      <xs:element name="userServiceDescription" type="UserServiceDescriptionType"
maxOccurs="unbounded"/>
      <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded"
processContents="lax"/>
    </xs:sequence>
    <xs:anyAttribute processContents="skip"/>
  </xs:complexType>

  <xs:complexType name="UserServiceDescriptionType">
    <xs:sequence>
      <xs:element name="name" type="NameType" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="serviceLanguage" type="xs:language" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="distributionSessionDescription"
type="DistributionSessionDescriptionType" maxOccurs="unbounded"/>
      <xs:element name="appService" type="ApplicationServiceDescriptionType" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="scheduleDescriptionURI" type="xs:anyURI" minOccurs="0"/>
      <xs:element name="availabilityInfo" type="AvailabilityInformationType" minOccurs="0"/>
      <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded"
processContents="lax"/>
    </xs:sequence>
    <xs:attribute name="serviceId" type="xs:anyURI" use="required"/>
    <xs:anyAttribute processContents="skip"/>
  </xs:complexType>

  <xs:complexType name="DistributionSessionDescriptionType">
    <xs:sequence>
      <xs:element name="mbsAppService" type="MbsApplicationServiceType" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="unicastAppService" type="UnicastApplicationServiceType"
minOccurs="0"/>
      <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded"
processContents="lax"/>
    </xs:sequence>
    <xs:attribute name="conformanceProfile" type="xs:anyURI" use="required"/>
    <xs:attribute name="sessionDescriptionURI" type="xs:anyURI" use="required"/>
    <xs:attribute name="objectRepairParametersURI" type="xs:anyURI" use="optional"/>
    <xs:attribute name="dataNetworkName" type="xs:anyURI" use="optional" />
    <xs:anyAttribute processContents="skip"/>
  </xs:complexType>

  <xs:complexType name="NameType">
    <xs:simpleContent>
      <xs:extension base="xs:string">
        <xs:attribute name="lang" type="xs:language" use="optional"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>

  <xs:complexType name="ApplicationServiceDescriptionType">
    <xs:sequence>
```



```

        <xs:element name="identicalContent" minOccurs="0" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="basePattern" type="xs:anyURI" minOccurs="2"
maxOccurs="unbounded" />
              <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded" />
            </xs:sequence>
            <xs:anyAttribute processContents="skip" />
          </xs:complexType>
        </xs:element>
        <xs:element name="alternativeContent" minOccurs="0" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="basePattern" type="xs:anyURI" minOccurs="2"
maxOccurs="unbounded" />
              <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded" />
            </xs:sequence>
            <xs:anyAttribute processContents="skip" />
          </xs:complexType>
        </xs:element>
        <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded" />
      </xs:sequence>
      <xs:attribute name="mediaManifestDescriptionURI" type="xs:anyURI" use="required" />
      <xs:attribute name="mimeType" type="xs:string" use="required" />
      <xs:anyAttribute processContents="skip" />
    </xs:complexType>

    <xs:complexType name="MbsApplicationServiceType">
      <xs:sequence>
        <xs:element name="basePattern" type="xs:anyURI" maxOccurs="unbounded" />
        <xs:element name="serviceArea" type="xs:unsignedShort" minOccurs="0"
maxOccurs="unbounded" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
      </xs:sequence>
      <xs:anyAttribute processContents="skip" />
    </xs:complexType>

    <xs:complexType name="UnicastApplicationServiceType">
      <xs:sequence>
        <xs:element name="basePattern" type="xs:anyURI" maxOccurs="unbounded" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
      </xs:sequence>
      <xs:anyAttribute processContents="skip" />
    </xs:complexType>

    <xs:complexType name="AvailabilityInformationType">
      <xs:sequence>
        <xs:element name="infoBinding" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="mbsServiceArea" type="MbsServiceAreaType" minOccurs="0"
maxOccurs="unbounded" />
              <xs:element name="mbsFSAIId" type="xs:unsignedShort" minOccurs="0" />
              <xs:element name="radioFrequency" type="xs:unsignedInt" maxOccurs="unbounded" />
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>

    <xs:complexType name="MbsServiceAreaType">
      <xs:sequence>
        <xs:element name="tailList" minOccurs="0" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="tai" type="TrackingAreaIdentityType" maxOccurs="unbounded" />
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="ncgiList" minOccurs="0" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="ncgiTai" type="NrCellGlobalIdentityType" maxOccurs="unbounded" />
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>

```

```

        </xs:element>
      </xs:sequence>
    </xs:complexType>

    <xs:complexType name="TrackingAreaIdentityType">
      <xs:sequence>
        <xs:element name="plmnId">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="mcc" type="xs:string"/>
              <xs:element name="mnc" type="xs:string"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="tac" type="xs:string"/>
        <xs:element name="nid" type="xs:string" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>

    <xs:complexType name="ncgiTai">
      <xs:sequence>
        <xs:element name="tai" type="TrackingAreaIdentityType"/>
        <xs:element name="ncgi" type="NrCellGlobalIdentityType"/>
      </xs:sequence>
    </xs:complexType>

    <xs:complexType name="NrCellGlobalIdentityType">
      <xs:sequence>
        <xs:element name="plmnId">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="mcc" type="xs:string"/>
              <xs:element name="mnc" type="xs:string"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="nrCellId" type="xs:string"/>
        <xs:element name="nid" type="xs:string" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>

  </xs:schema>

```

A.1.2 Object Repair Parameters schema

Below is the formal XML syntax of associated distribution procedure description instances. Documents following this schema can be identified with the MIME type "application/mbs-object-repair-parameters+xml". The schema filename of distribution procedure description is objectrepairparameters.xsd.

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema
  xmlns="urn:3gpp:metadata:2020:MBS:objectRepairParameters"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="urn:3gpp:metadata:2022:MBS:objectRepairParameters"
  elementFormDefault="qualified"
  version="1">
  <xs:element name="objectRepairParameters" type="ObjectRepairParametersType"/>
  <xs:complexType name="ObjectRepairParametersType">
    <xs:sequence>
      <xs:element name="postObjectRepair" type="basicProcedureType" minOccurs="0"/>
      <xs:element name="mbsObjectRepair" type="mbsObjectRepairType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="skip" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:complexType name="basicProcedureType">
  <xs:sequence>
    <xs:element name="serviceURI" type="xs:anyURI" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:attribute name="offsetTime" type="xs:unsignedLong" use="optional"/>
  <xs:attribute name="randomTimePeriod" type="xs:unsignedLong" use="required"/>
</xs:complexType>
<xs:complexType name="mbsObjectRepairType">
  <xs:attribute name="sessionDescriptionURI" type="xs:anyURI" use="required"/>

```

```
</xs:complexType>
</xs:schema>
```

A.1.3 Schedule Description schema

Below is the formal XML syntax of schedule information procedure. Documents following this schema can be identified with the MIME type "application/mbms-schedule+xml". The file name of XML schema for schedule description is Schedule-Description.xsd.

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns="urn:3gpp:metadata:2022:MBS:scheduleDescription"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="urn:3gpp:metadata:2022:MBS:scheduleDescription" elementFormDefault="qualified"
version="1">
  <xs:complexType name="scheduleDescriptionType">
    <xs:sequence>
      <xs:element name="serviceSchedule" maxOccurs="unbounded">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="sessionSchedule" type="reoccurrenceStartStopType" minOccurs="0"
maxOccurs="unbounded"/>
            <xs:element name="sessionScheduleOverride" minOccurs="0" maxOccurs="unbounded">
              <xs:complexType>
                <xs:sequence minOccurs="0">
                  <xs:element name="start" type="xs:dateTime"/>
                  <xs:element name="stop" type="xs:dateTime"/>
                </xs:sequence>
                <xs:attribute name="index" type="xs:unsignedInt" use="required"/>
                <xs:attribute name="cancelled" type="xs:boolean"/>
              </xs:complexType>
            </xs:element>
            <xs:element name="objectSchedule" minOccurs="0" maxOccurs="unbounded">
              <xs:complexType>
                <xs:sequence>
                  <xs:element name="objectURI">
                    <xs:complexType>
                      <xs:simpleContent>
                        <xs:extension base="xs:anyURI">
                          <xs:attribute name="cancelled" type="xs:boolean"/>
                        </xs:extension>
                      </xs:simpleContent>
                    </xs:complexType>
                  </xs:element>
                  <xs:element name="deliveryInfo" minOccurs="0" maxOccurs="unbounded">
                    <xs:complexType>
                      <xs:attribute name="start" type="xs:dateTime"/>
                      <xs:attribute name="end" type="xs:dateTime"/>
                      <xs:anyAttribute processContents="skip"/>
                    </xs:complexType>
                  </xs:element>
                  <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
                </xs:sequence>
                <xs:attribute name="sessionId" type="xs:string" use="optional"/>
                <xs:attribute name="objectEtag" type="xs:string" use="optional"/>
                <xs:attribute name="unicastOnly" type="xs:boolean" use="optional"
default="false"/>
                <xs:anyAttribute processContents="skip"/>
              </xs:complexType>
            </xs:element>
            <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
          </xs:sequence>
          <xs:attribute name="serviceId" type="xs:anyURI"/>
          <xs:attribute name="serviceClass" type="xs:string" use="optional"/>
          <xs:anyAttribute processContents="skip"/>
        </xs:complexType>
      </xs:element>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="scheduleUpdate" type="xs:dateTime"/>
    <xs:anyAttribute processContents="skip"/>
  </xs:complexType>
  <xs:complexType name="reoccurrenceStartStopType">
    <xs:sequence>
```

```

<xs:element name="start" type="xs:dateTime"/>
<xs:element name="stop" type="xs:dateTime"/>
<xs:element name="reoccurrencePattern" type="xs:string" minOccurs="0"/>
<xs:element name="numberOfTimes" type="xs:unsignedInt" minOccurs="0"/>
<xs:element name="reoccurrenceStopTime" type="xs:dateTime" minOccurs="0"/>
<xs:element name="index" type="xs:unsignedInt" minOccurs="0"/>
<xs:element name="FDTInstanceURI" type="xs:anyURI" minOccurs="0"/>
<xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
</xs:sequence>
<xs:attribute name="sessionDescriptionURI" type="xs:anyURI" use="optional"/>
<xs:anyAttribute processContents="skip"/>
</xs:complexType>
<xs:element name="scheduleDescription" type="scheduleDescriptionType"/>
</xs:schema>

```

A.2 JSON-based representation

A.2.1 MBS User Service Announcement schema

The following schema shall have the filename "TS26517_MBSUserServiceAnnouncement.yaml".

```

openapi: 3.0.0

info:
  title: 'MBS User Service Announcement'
  version: 1.2.0
  description: |
    MBS User Service Announcement Element units.
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    All rights reserved.

externalDocs:
  description: 3GPP TS 26.517 V17.4.0; 5G Multicast-Broadcast User Services; Protocols and Formats
  url: http://www.3gpp.org/ftp/Specs/archive/26_series/26.517/

paths:
  /user-service-descriptions:
    get:
      operationId: discoverUserServiceDescriptions
      summary: 'Discover User Service Descriptions'
      description: 'Discover User Service Descriptions that match the supplied query filter(s). At
least one filter query parameter must be included in the request URL.'
      parameters:
        - in: query
          name: service-class
          schema:
            type: string
            required: true
            description: 'Filter for User Service Descriptions tagged with the supplied service
class term identifier expressed as a fully-qualified URI string from a controlled vocabulary'
      responses:
        '200':
          # OK
          description: "Success"
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/UserServiceDescriptions'
        '204':
          # No Content (no matching User Service Descriptions)
          description: "No Matches Found"
        '500':
          # Internal Server Error
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          # Service Unavailable
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /user-service-descriptions/{externalServiceId}:
    get:
      operationId: retrieveUserServiceDescription
      summary: 'Retrieve User Service Description'

```

```

    description: 'Retrieve the User Service Description of a single service by supplying its
external service identifier.'
    parameters:
      - name: externalServiceId
        in: path
        required: true
        schema:
          type: string
        description: 'The external service identifier of a User Service provisioned in the
MBSF.'
    responses:
      '200':
        # OK
        description: "Success"
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/UserServiceDescription'
      '404':
        # Not Found
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '500':
        # Internal Server Error
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '503':
        # Service Unavailable
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  schemas:
    UserServiceDescriptions:
      type: array
      items:
        $ref: '#/components/schemas/UserServiceDescription'
      minItems: 1

    UserServiceDescription:
      type: object
      properties:
        name:
          type: array
          items:
            type: string
        serviceLanguage:
          type: array
          items:
            type: string
        serviceId:
          type: string
        distributionSessionDescription:
          $ref: '#/components/schemas/DistributionSessionDescription'
        appServiceDescription:
          $ref: '#/components/schemas/AppServiceDescription'
        scheduleDescription:
          $ref: '#/components/schemas/ScheduleDescription'
        availabilityInfo:
          $ref: '#/components/schemas/AvailabilityInformation'
      required:
        - serviceId

    DistributionSessionDescription:
      type: object
      properties:
        distributionMethod:
          $ref: '#/components/schemas/DistributionMethod'
        conformanceProfile:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        sessionDescriptionLocator:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        objectRepairParameters:
          $ref: '#/components/schemas/AssociatedProcedureDescription'
        dataNetworkName:
          type: string
        mbsAppService:
          type: array
          items:

```

```

    $ref: '#/components/schemas/ApplicationService'
  unicastAppServices:
    type: array
    items:
      type: object
      properties:
        unicastAppService:
          type: array
          items:
            $ref: '#/components/schemas/ApplicationService'
  required:
  - distributionMethod
  - sessionDescriptionLocator

DistributionMethod:
  anyOf:
  - type: string
    enum: [OBJECT, PACKET]
  - type: string
    description: >
      This string provides forward-compatibility with future
      extensions to the enumeration but is not used to encode
      content defined in the present version of this API.

AppServiceDescription:
  type: object
  properties:
    mediaEntryPointLocator:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    mimeType:
      type: string
    identicalContents:
      type: array
      items:
        type: object
        properties:
          unicastAppService:
            type: array
            items:
              $ref: '#/components/schemas/ApplicationService'
            minItems: 2
    alternativeContents:
      type: array
      items:
        type: array
        items:
          $ref: '#/components/schemas/ApplicationService'

ApplicationService:
  type: object
  properties:
    basePattern:
      type: string
  required:
  - basePattern

AvailabilityInformation:
  type: array
  items:
    $ref: '#/components/schemas/AvailabilityInformationBinding'

AvailabilityInformationBinding:
  type: object
  properties:
    mbsServiceArea:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/MbsServiceArea'
    mbsFSAId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/MbsFsaId'
    radioFrequency:
      type: array
      items:
        type: integer
        minimum: 0

AssociatedProcedureDescription:
  type: object

```

```

properties:
  postObjectRepair:
    $ref: '#/components/schemas/PostObjectRepair'
  mbsObjectRepair:
    $ref: '#/components/schemas/MbsObjectRepair'

PostObjectRepair:
  type: object
  properties:
    serviceLocators:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    offsetTime:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
    randomTimePeriod:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'

MbsObjectRepair:
  type: object
  properties:
    sessionDescriptionURI:
      type: string

ScheduleDescription:
  type: array
  items:
    $ref: '#/components/schemas/ServiceSchedule'

ServiceSchedule:
  type: object
  properties:
    sessionSchedule:
      $ref: '#/components/schemas/SessionSchedule'
    sessionScheduleOverride:
      $ref: '#/components/schemas/SessionScheduleOverride'
    objectSchedule:
      $ref: '#/components/schemas/ObjectSchedule'
    serviceId:
      type: string
    serviceClass:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
  required:
    - sessionSchedule
    - serviceId
    - serviceClass

SessionSchedule:
  type: array
  items:
    type: object
    properties:
      start:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      stop:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      recurrencePattern:
        type: string
      numberOfTimes:
        type: integer
        minimum: 1
      recurrenceStopTime:
        type: string
      index:
        type: integer
      fDTInstanceLocator:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    required:
      - start
      - stop

SessionScheduleOverride:
  type: array
  items:
    type: object
    properties:
      start:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'

```

```
    stop:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    index:
      type: integer
    cancelled:
      type: boolean
    sessionDescriptionLocator:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'

ObjectSchedule:
  type: array
  items:
    type: object
    properties:
      objectLocator:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      sessionId:
        type: string
      objectEtag:
        type: string
      unicastOnly:
        type: boolean
      deliveryInfo:
        type: array
        items:
          type: object
          properties:
            start:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
            stop:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
```


Annex B (informative): Service Announcement examples

B.1 XML-based representation

B.2 JSON-based representation

```

{
  "bundleDescription": [
    {
      "userServiceDescription": {
        "name": [
          "test1"
        ],
        "serviceLanguage": [
          "en-us"
        ],
        "serviceId": "urn:test:test:D4-Service:D4-SB:D4-US",
        "distributionSessionDescription": {
          "conformanceProfile": "urn:3gpp:...",
          "sessionDescriptionURI": "http://www.test.com/D4-Service/D4-SB/D4-US.sdp",
          "dataNetworkName": "media-dnn",
          "mbsAppService": [
            { "basePattern": "http://www.test.com/D4-Service/D4-SB/D4-US/video/2048/" },
            { "basePattern": "http://www.test.com/D4-Service/D4-SB/D4-US/audio/1/" }
          ],
          "unicastAppServices": [
            { "unicastAppService": [
              { "basePattern": "http://www.test.com/D4-Service/D4-SB/D4-US/video/1024/" },
              { "basePattern": "http://www.test.com/D4-Service/D4-SB/D4-US/audio/1/" }
            ] },
            { "unicastAppService": [
              { "basePattern": "http://www.test.com/D4-Service/D4-SB/D4-US/video/2048/" },
              { "basePattern": "http://www.test.com/D4-Service/D4-SB/D4-US/audio/1/" }
            ] }
          ]
        },
        "mbsAppService": {
          "MediaManifestDescriptionURI": "http://www.test.com/D4-Service/D4-SB/D4-US/adpd.xml",
          "mimeType": "application/dash+xml;profiles=urn:3GPP:PSS:profile:DASH10",
          "identicalContents": [
            {
              "identicalContent": [
                { "basePattern": "http://www.test.com/D4-Service/D4-SB/D4-US/video/1024/" },
                { "basePattern": "http://www.test.com/D4-Service/D4-SB/D4-US/video/2048/" }
              ],
            },
            {
              "identicalContent": [
                { "basePattern": "http://www.test.com/D4-Service/D4-SB/D4-US/audio/1/" }
              ]
            }
          ]
        }
      ]
    },
    {
      "availabilityInfo": [
        {
          "infoBinding": {
            "mbsServiceArea": [
              {
                "ncgiList": [
                  {
                    "NcgiTai": {
                      "tai": {
                        "plmnId": {
                          "mcc": "860",
                          "mnc": "15"
                        },
                        "tac": "0fa0"
                      },
                    },
                  ],
                  "cellList": [

```

```
{
  "Ncgi":{
    "plmnId":{
      "mcc":"860",
      "mnc":"15"
    },
    "nrCellId":"999999999"
  },
  "Ncgi":{
    "plmnId":{
      "mcc":"860",
      "mnc":"15"
    },
    "nrCellId":"999999998"
  }
],
"taiList":[
  {
    "tai":{
      "plmnId":{
        "mcc":"860",
        "mnc":"15"
      },
      "tac":"0fa0"
    }
  },
  {
    "tai":{
      "plmnId":{
        "mcc":"860",
        "mnc":"15"
      },
      "tac":"0fa0"
    }
  }
],
"mbsFSAId":["25532"],
"radioFrequency":["9410"]
}
```

Annex C (normative): Controlled vocabulary of conformance profiles

The controlled vocabulary is for future study.

Annex D (normative): Syntax for object manifest

D.1 Object manifest schema

Below is the formal syntax of the object manifest for use with the Object Collection or Object Carousel operating mode. The schema shall have the filename "TS26517_MBSObjectManifest.yaml".

```

openapi: 3.0.0
info:
  title: MBS User Services Object Manifest
  version: 1.0.0
  description: |
    MBS User Services Object Manifest syntax
    © 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
tags:
  - name: MBS User Services Object Manifest
    description: '5G Media Streaming: Common Data Types'
externalDocs:
  description: 'TS 26.517 V17.3.0; 5G Multicast-Broadcast User Services; Protocols and Formats'
  url: 'https://www.3gpp.org/ftp/Specs/archive/26_series/26.517/'
paths: {}
components:
  schemas:
    ObjectManifest:
      type: object
      description: A manifest describing a set of binary objects to be transmitted by the MBSTF as
      part of the MBS Distribution Session.
      required:
        - objects
      properties:
        updateInterval:
          type: integer
          format: int32
          description: The time period (in seconds) after which the MBSTF attempts to re-acquire
          the object manifest when pull-based object acquisition is provisioned.
        objects:
          type: array
          description: The list of binary objects to be carouselled from the MBSTF to the MBSTF
          Client.
          items:
            $ref: '#/components/schemas/Object'
        Object:
          type: object
          description: A binary object to be transmitted by the MBSTF as part of the MBS
          Distribution Session.
          required:
            - locator
          properties:
            locator:
              $ref: 'TS26512_CommonData.yaml#/components/schemas/AbsoluteUrl'
            repetitionInterval:
              type: integer
              format: int32
              description: The MBSTF sends the object repeatedly to the MBSTF Client with the given
              interval (in milliseconds). This parameter is ignored in the case of Object Collection operating
              mode.
            keepUpdatedInterval:
              type: integer
              format: int32
              description: The MBSTF checks for changes to the object with the given interval (in
              seconds). This parameter is ignored in the case of Object Collection operating mode.
            earliestFetchTime:
              type: string
              format: date-time
              description: The MBSTF shall pull each object from its origin location no sooner than
              this time or, if this parameter is omitted, at a time of its choosing.
            latestFetchTime:
              type: string
              format: date-time

```

description: The MBSTF shall pull each object from its origin location no later than this time, or, if this parameter is omitted, at a time of its choosing.

Annex E (normative): IANA registration

E.1 General

This annex provides the formal registrations of MIME media types for different resources specified in the present document. It is referenced from the IANA registry at <http://www.iana.org/>.

E.2 Registration of MIME media type "application/mbs-user-service-description+json"

E.2.1 General

The MIME media type *application/mbs-user-service-description+json* denotes that the message body is an MBS User Service Description instance document compliant with the YAML schema specified in clause A.2.1.

Table E.2.1-1 provides the MIME media type registration for *application/mbs-user-service-description+json*.

Table E.2.1-1: MIME media type registration for *application/mbs-user-service-description+json*

Parameter	Value
MIME media type name	<i>application</i>
MIME subtype name	<i>mbs-user-service-description+json</i>
Required parameters	None
Optional parameters	The ' <i>profiles</i> ' parameter as specified in clause E.2.2.
Encoding considerations	This is a JSON document, and the encoding considerations are the same as for media type <i>application/json</i> defined in IETF RFC 8259.
Security considerations	This media format is used to configure the receiver on how to participate in a service. This format is highly susceptible to manipulation or spoofing for attacks desiring to mislead a receiver about a session. Both integrity protection and source authentication are recommended to prevent misleading of the receiver.
Interoperability considerations	The specification defines a platform-independent expression of an entry point document, and it is intended that wide interoperability can be achieved.
Published specification	3GPP TS 26.517
Applications which use this media type	3GPP MBS-based applications and services
Additional information	File extension(s): <i>json</i> Intended usage: COMMON
Other information/general comment	None
Person & email address to contact for further information	Thomas Stockhammer (tsto@qti.qualcomm.com) 3GPP TSG SA WG4
Restrictions on usage	None
Author/Change controller	3GPP TSG SA WG4

E.2.2 Profiles parameter

Table D.2.2-1 provides the definition of the *profiles* parameter to be used with the MBS User Service Description instance document as defined in clause D.5.1.

Table E.2.2-1: Definition of profiles parameter

Parameter	Value
Parameter name	<i>profiles</i>
Parameter value	Optional attribute indicating one or more profiles to which the resource representation claims conformance. The contents of this attribute shall conform to either the <i>pro-simple</i> or <i>pro-fancy</i> productions specified in section 4.5 of IETF RFC 6381. The set of profile identifiers indicated in this parameter should match the set indicated in the profiles attribute of the corresponding User Service Description.

EXAMPLE:

```
application/mbs-user-service-description+json;profiles="1,2"
```

Annex F (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2022-02	SA4#117-e	S4-200141				Initial skeleton document.	0.0.1
		S4-220285				Revised skeleton document	0.1.0
2022-03	SA4#117-e	SP-220249				Presentation for information at SA#95-e	1.0.0
2022-04	SA4#118-e	S4-220521				S4-220570: Service Announcement specification and schemas. S4-220470: Packet Distribution Method initial specification. S4-220471: Object Distribution Method initial specification	1.1.0
2022-05	SA4#119-e	S4-220867				S4-220864: Service Announcement corrections. S4-220865: Object Distribution Method updates. S4-220866: Packet Distribution Method updates.	1.2.0
2022-06	SA#96	SP-220605				For presentation to Plenary	2.0.0
2022-06	SA#96	SP-220605				Under Change Control	17.0.0
2022-12	SA#98-e	SP-221059	0003	3	F	[5MBP3] Alignment of User Service Announcement with Stage 2	17.1.0
2023-03	SA#99	SP-230254	0006	1	F	[5MBP3] Corrections on Headings and Terms	17.2.0
2023-06	SA#100	SP-230744	0007	7	F	[5MBP3] Manifest format for Object Collection and Carousel	17.3.0
2023-09	SA#101	SP-230916	0010	3	F	[5MBP3] API for unicast retrieval of MBS User Service Announcement	17.4.0

History

Document history		
V17.0.0	July 2022	Publication
V17.1.0	January 2023	Publication
V17.2.0	April 2023	Publication
V17.3.0	July 2023	Publication
V17.4.0	October 2023	Publication