**3GPP TSG- Meeting #**

**, , - revision of S4-251510 and S4aI250118**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
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| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | 1. Provide relevant extensions for MBS protocols:a. For *Key Issue #8: In-session unicast repair for MBS Object Distribution* as introduced in clause 5.9 of TR 26.802, address Gaps #2, #3, #4, and #5 in clause 5.9.5 by the candidate solution in clause 5.9.6 in TS 26.517 and possibly in TS 26.346:i. On gap #2 identified in clause 5.9.5 of TR 26.802, both of the following signalling options are expected to be supported:- Using FDT parameters to signal the time when repairs can be requested using the Expires attribute).- Using LCT header information to signal the time when repairs can be requested using the B-Flag.ii. On Gap #3 identified in clause 5.9.5 of TR 26.802, the following signalling options exist in the FLUTE File Delivery Table (FDT):- Defining a new FDT extensions parameter to signal the availability time when the object needs to be released.iii. On gap #4 identified in clause 5.9.5 of TR 26.802, the execution of MBS object delivery and in-session unicast repair can run in parallel in the MBS Client. However, this should be validated if there are cases this is not the case and whether these cases need to be explicitly stated, for example reduced capability (RedCaP) UEs.iv. On gap #5 identified in clause 5.9.5 of TR 26.802, time synchronization can reuse functionalities defined in TS 26.346, but tighter synchronization that 1 second. This work is aligned with the findings and work in clause 5.11.3.6 of TR 26.802.v. Support other relevant aspects resulting from stage-2.3. For key topic address the following aspects:a. Specify the required protocols or protocol extensionsb. Define relevant APIsc. Specify the OpenAPIs YAML as well as other stage-3 API.e. Address remaining stage-3 aspects.4. Coordinate work with other 3GPP groups as needed. For details see clause 8.5. Coordinate work with external organizations such as SVTA (primarily the DASH-IF WG), CTA WAVE, ISO/IEC JTC29 WG3 (MPEG Systems), 5G-MAG, DVB and/or IETF, as needed.This document initiates the work topic for unicast repair. It is also considered to support the development of the unicast repair feature with parallel implementation in 5G-MAG Reference Tools. |
|  |  |
| ***Summary of change:*** | * Define Procedures
* Define parameters

Define Protocols |
|  |  |
| ***Consequences if not approved:*** | Feature not supported |
|  |  |
| ***Clauses affected:*** | 5.1.1, 5.2.1, 5.2.4, 5.2.8, 6.2.4.3, 10.1, 10.2, 10.3, A.2.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 26.346 CR 0677 |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |

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| --- | --- | --- | --- |
| [**S4aI250118**](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI250118.zip) | [AMD\_PRO-MED] In-session Unicast Repair for MBS Object Distribution | Qualcomm Incorporated, BBC, LG Electronics Inc. | Thomas Stockhammer |

**E-mail Discussion**: none**Revisions**: * <https://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Inbox/Drafts/S4aI250118_BBC.docx>

**Presenter**: Thomas Stockhammer**Online Discussion**: (September 3/4/5 2025)Richard: randomTime is MBS specific parameter, while in this clause you are using generic names. Thomas: We need to check MBS spec whether that is a case. We add a note.Thomas: OpenAPI implementation would be deferred.Thorston: I found the CR that added expiry.Thomas: Let’s fix for R19 and we can fix them laster for R17 and R18.**Decision**:[S4aI250118](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI250118.zip) is **revised to 149, to be reviewed in the wash up**. |

## ===== CHANGE =====

# 2 References

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

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

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

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

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

[2] 3GPP TS 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] Void.

[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] Void.

[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.

[26] IETF RFC 3629: "UTF-8, a transformation format of ISO 10646".

[27] IETF RFC 8141: "Uniform Resource Names (URNs)".

[28] ISO 639-2: "Codes for the representation of names of languages - Part 2: Alpha-3 code".

[29] IETF RFC 6381: "The 'Codecs' and 'Profiles' Parameters for "Bucket" Media Types".

[30] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[31] 3GPP TS 26.512: "5G Media Streaming (5GMS); Protocols".

[32] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[33] 3GPP TS 33.246: "3G Security; Security of Multimedia Broadcast/Multicast Service (MBMS)".

[34] IETF RFC 3986: "Uniform Resource Identifier (URI): Generic Syntax".

[35] 3GPP TR 26.946: "Multimedia Broadcast/Multicast Service (MBMS) user service guidelines".

[36] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".

[37] IETF RFC 2046, "Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types".

[38] IETF RFC 2387: "The MIME Multipart/Related Content-type".

[39] IETF RFC 2557: "MIME Encapsulation of Aggregate Documents, such as HTML (MHTML)".

[40] IETF RFC 2017: "Definition of the URL MIME External-Body Access-Type".

[41] IETF RFC 1952: "GZIP file format specification version 4.3".

[42] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".

[43] 3GPP TS 26.510: "Media delivery; interactions and APIs for provisioning and media session handling".

## ===== CHANGE =====

### 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*.

The metadata consists of:

- A *User Service Descriptions* document (see clause 5.2.2) describing a set of one or more MBS User Services, and containing:

- One of more *User Service Description* objects (see clause 5.2.3), each describing an MBS User Service Session that is associated with:

- One or more *Distribution Session Description* objects (see clause 5.2.4), each of which references a Session Description document [8] (see clause 5.2.5) that may be packaged with the User Service Descriptions document for delivery to the MBS Client in the same User Service Bundle (see clause 5.3.4), and each of which may optionally reference an Object Repair Parameters object (see clause 5.2.8) describing the object repair parameters for the MBS Distribution Session in question. Both in-session and post-session repair are supported.

- Zero or more alternative *Application Service Description* objects (see clause 5.2.5), each of which references an Application Service Entry Point document (see clause 5.2.6) that may be packaged with the User Service Description document for delivery to the MBS Client in the same User Service Bundle (see clause 5.3.4). Additional resources referenced by the Application Service Entry Point document may also be packaged into the User Service Bundle.

- Zero or more *Service Schedule Description* objects (see clause 5.2.7) advertising the delivery schedule for the MBS User Service Session.

Figure 5.1-1 illustrates the relationships between these metadata entities using UML for a User Service Descriptions document.



NOTE: “N” means any number in each instance.

Figure 5.1-1: User Service Data Model simple description

A *User Service Description* document shall contain one or more *User Service Description* objects, each of which describes a single MBS User Service Session.

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

- The Distribution Session Description object shall refer to one *Session Description document*.

- Each Distribution Session Description object may include *Object Repair Parameters* objects for in-session repair and for post-session repair.

- Each Distribution Session Description object may include zero or more alternative *Application Service Description* object, optionally 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 Distribution Session. When multiple Application Service Entry Point documents are referenced by the same Distribution Session Description (not permitted in this release), an MBS Client shall select only one on the basis of a distinct MIME content type indicated in the Application Service Description object.

Each User Service Description object may include *Service Schedule Description* objects. If included, the UE can expect to receive MBS User Service data during the time periods described in the Service Schedule Description object.

## ===== CHANGE =====

### 5.2.1 General

The following description in this clause presumes a JSON encoding of the information comprising the MBS User Service Announcement as specified in clause 5.1A.

The data types in table 5.2.1-1 from other 3GPP specifications are reused in the remainder of the present document.

Table 5.2.1 1: Externally defined data types used by User Service Description schema

|  |  |  |
| --- | --- | --- |
| Data type | Comments | Reference |
| Uri | A Uniform Resource Locator | TS 29.571 [30] |
| DateTime | A date–time value. |  |
| MbsServiceArea | An MBS Service Area. |  |
| MbsFsaId | An MBS Frequency Selection Area identifier. |  |
| DurationSec | A time duration expressed in seconds. |  |
| AbsoluteUrl | An absolute URL | TS 26.510 [43] |
| *Percentage* | A proportion out of 100. | TS 26 510 [43] |

The data types in table 5.2.1-2 are defined in the present document.

Table 5.2.1 2: User Service Description schema data types defined in the present document

|  |  |
| --- | --- |
| Data type | Clause |
| User‌Service‌Descriptions | 5.2.2 |
| User‌Service‌Description | 5.2.3 |
| Distribution‌Session‌Description | 5.2.4 |
| Application‌Service‌Description | 5.2.6 |
| Service‌Schedule‌Description | 5.2.7 |
| Object‌Repair‌Parameters | 5.2.8 |
| Availability‌Information | 5.2.9 |
| NrParameterSet | 5.2.9 |
| Security‌Description | 5.2.10 |

## ===== CHANGE =====

### 5.2.4 Distribution Session Description data type

The DistributionSessionDescription data type describes one *MBS Distribution Session* associated with an MBS User Service and carries the MBS Distribution Session Parameters as defined in clause 4.5.8 of TS 26.502 [6]. Table 5.2.4-1 provides the detailed semantics of this data type.

Table 5.2.4-1: Semantics of DistributionSessionDescription data type

| Property name | Data Type | P | Cardinality | Description |
| --- | --- | --- | --- | --- |
| distribution‌Method | Distribution‌Method | M | 1 | The distribution method used for this MBS Distribution Session.For details, refer to table 5.2.4‑2. |
| conformance‌Profiles | array(Uri) | O | 1..N | A list of profiles indicating the set of features that this MBS Distribution Session conforms to and which the MBS Client needs to support in order to fully decode the MBS Distribution Session. For details refer to clause 12.If not present, the MBS Distribution Session is assumed to conform to the "Baseline MBS Distribution Session Profile" specified in clause C.2. |
| session‌Description‌Locator | AbsoluteUrl | M | 1 | URL to a Session Description document carrying the *Session Description parameters* for this MBS Distribution Session as defined in table 4.5.8‑1 of TS 26.502 [6].For details, refer to clause 5.2.5. |
| application‌Service‌Descriptions | array(Application‌Service‌Description) | O | 1..1 | If present, an array containing a set of one or more Application Service Descriptions for the MBS User Service (see clause 5.2.6 and text below this table). |
| inSession‌Object‌Repair‌Parameters | ObjectRepair‌Parameters | O | 0..1 | Parameters to be used by the MBSTF Client at reference point MBS‑4‑UC for in-session unicast object repair of this MBS Distribution Session, as defined in table 4.5.8‑2 of TS 26.502 [6].For details, refer to clause 5.2.8. |
| post‌Session‌Object‌Repair‌Parameters | ObjectRepair‌Parameters | O | 0..1 | Parameters to be used by the MBSTF Client at reference point MBS‑4‑UC for post-session unicast object repair of this MBS Distribution Session, as defined in table 4.5.8‑2 of TS 26.502 [6].For details, refer to clause 5.2.8. |
| availability‌Infos | array(Availability‌Information) | O | 1..N | Additional information pertaining to the availability of this MBS Distribution Session within the MBS System.For details, refer to clause 5.2.9. |
| security‌Description | Security‌Description | O | 0..1 | The security parameters for this MBS Distribution Session, as defined in table 4.5.8-1 of TS 26.502 [6].For details, refer to clause 5.2.10. |

Table 5.2.4‑2: Semantics of DistributionMethod enumeration

|  |  |
| --- | --- |
| Enumerated value | Description |
| OBJECT | The Object Distribution Method. |
| PACKET | The Packet Distribution Method. |

If the application‌Service‌Descriptions array is present:

1. The distributionMethod property of the DistributionSessionDescription shall be set to OBJECT.

2. All members of the application‌Service‌Description array shall reference an Application Service Entry Point document (see clause 5.2.6A) that describes an MBS Distribution Session using the Object Distribution Method as specified in clause 6.

3. The sessionDescriptionLocator property shall point to a Session Description document (see clause 5.2.5) describing an MBS Distribution Session according to clause 6 delivering objects that are directly or indirectly referenced by the Application Service Entry Point document.

## ===== CHANGE =====

### 5.2.8 Object Repair Parameters data type

Object Repair Parameters configure the Object Repair as defined in clause 6.2.4.

Table 5.2.8-1 provides the detailed semantics for the ObjectRepairParameters data type.

Table 5.2.8‑1: Semantics of ObjectRepairParameters data type

| Property name | Data Type | P | Cardinality | Description |
| --- | --- | --- | --- | --- |
| repair‌Limit‌Percentage | Percentage | C | 0..1 | The maximum number of incomplete transmission objects that the MBS Client is allowed to repair out of the last 100 objects received on this session.If not present, the value is assumed to be 100.0.Not present for post-session Object Repair. |
| backOffParameters | BackOffParameters | O | 0..1 | The back-off behaviour of the MBSTF Client when using the Object Repair mechanism (see clause 10.3 for in-session repair and clause 10.2.2.3 for post-session repair).If present, at least one of the contained parameters shall be present.If omitted for in-session repair, default parameter values apply.If omitted for post-session repair, no back-off delay is required. |
|  | offsetTime | DurationSec | C | 1..1 | The minimum time that an MBSTF Client shall wait before making an Object Repair request.- For in-session repair: delay after receiving a packet for an object in the object delivery session. If not present the value is determined by the FDT Instance associated with each transmission object.- For post-session repair: delay after completion of the download delivery session. If not present the value is assumed to be zero. |
|  | randomTimePeriod | DurationSec | C | 1..1 | The maximum time window length over which an MBSTF Client shall calculate the value of *RandomTime* to be used as a delay to its Object Repair request in addition to offsetTime.If not present the value is assumed to be zero. |
| object‌Distribution‌BaseLocator | Uri | O | 0..1 | The *Object distribution base URL* of the MBS Distribution as defined in table 4.5.6‑2 of TS 26.502 [6]. |
| object‌Repair‌BaseLocators | array(AbsoluteUrl) | M | 0..1 | The *Object repair base URL* of the MBS Distribution as defined in table 4.5.6‑2 of TS 26.502 [6]. |

## ===== CHANGE =====

#### 6.2.4.3 In-session object repair procedure

##### 6.2.4.3.1 Introduction

The generic terms "object delivery client" and "object repair server" are used in the following clauses to refer to the MBSTF Client and the MBS AS respectively.

NOTE: This system-independent terminology allows the procedures to be referenced by delivery systems other than MBS User Services.

The mapping of these procedures to MBS User Services protocols is specified in clause 10.3.

##### 6.2.4.3.2 Parameters

It is assumed that a FLUTE File Delivery Table (FDT) Instance document as defined in clauses L.4 and L.6 of TS 26.346 [7] is available in the object delivery client that contains at least the following information:

- FDT@Expires attribute indicating the expiry date of the FDT Instance.

- For one or multiple transmission objects in the FLUTE Session, a File element with:

- File@TOI attribute indicating the ALC Transport Object Identifier of the transmission object.

- File@Content-Location attribute indicating the URI of the transmission object.

- File@Content-Length attribute indicating the size (in bytes) of the transmission object.

- File@File-ETag attribute indicating the entity tag value of the transmission object.

NOTE: Object Repair without the FDT as, for example, defined in clause 9.3.9 of TS 26.346 [7], is not specified by the present document.

In addition, the following parameters are assumed to be available:

- File@FEC-Redundancy-Level: indicating the level of FEC redundancy used for the delivery of this transmission object.

- *repairStartTime*: provides the the wallclock time at which the object delivery client is permitted to initiate repair requests for a specific object. The value is the sum of *OffsetTime* and *RandomTime* defined as follows:

- a wallclock time *OffsetTime* defined as:

- the value of the File@RepairStart attribute in the FDT Instance, if present, else

- the sum of (i) the reception time of the first packet of this transmission object and (ii) the value of a parameter in the service announcement *offsetTime* associated with this FLUTE Session in milliseconds, if the *offsetTime* parameter is present, or else

- the value of the FDT@Expiry time.

- and, a time period *RandomTime* defined by the following:

- if the *randomTimePeriod* parameter is present, it is used as the *Random Time Period* to determine *RandomTime* as defined in clause 9.3.4.2 of TS 26.346 [7], or else

- the value is 0.

*- repairLimitPercentage*: the maximum number of unicast repairs that the object delivery client is permitted to attempt over the last 100 objects received on this session. The value is obtained as follows:

- the value of the File@RepairMaxAttempts attribute in the FDT Instance for the associated transmission object, if present, else

- the value of a parameter *repairLimitPercentage* in the service announcement, if present, or else

- set to 100, i.e. no restrictions.

- *object distribution base locator*: the base locators for the distribution to be used to map the URL in the File@Content-Location to construct the repair URL request.

- *object repair base locators*: a list of absolute URLs corresponding to the object distribution base locator that can be used to construct the URL for the repair object requests.

##### 6.2.4.3.3 General procedure

While the object delivery client is receiving a FLUTE Session and is configured for in-band session repair, it shall act as follows based on the parameters summarised in clause 6.2.4.3.2:

1. When the object delivery client receives an FDT Instance document that includes at least one File element, it shall parse the FDT Instance and, together with information potentially provided externally, it has access to the parameters specified in clause 6.2.4.3.2 above.

2. The transmission objects described by File elements in the FDT Instance are received from the FLUTE Session. Once the *repairStartTime* for a particular transmission object has been reached, and the object delivery client determines that reception of the object from the FLUTE Session is not complete according to clause 6.2.4.3.4, unicast repair of this transmission this object may be initiated. In particular, if the object delivery client has made fewer than *repairLimitPercentage* unicast Object Repair requests over the last 100 transmission objects received on this session, it shall initiate unicast requests according to the following steps. Otherwise, the repair procedure for this transmission object shall terminate.

3. The object delivery client shall select a *repair base URL* randomly from the list of *object repair base locators*.

4. For an incomplete FLUTE transmission object defined by a File element in the FDT Instance document and as identified in step 2:

a) The object delivery client shall form the network location (URL) *location* of the repair object according to the relevant procedures using (i) the value of the File@Content-Location attribute, (ii) the *repair base URL* selected in step 3 (if any) and (iii) the value of *object distribution base locator* as *distribution URL* if present.

b) The object delivery client shall either:

- define an appropriate *list of byte ranges* Range[M] with M the number of independent ranges and Range[m].start the start of the mth range and Range[m].end the end of the mth range from the repair object using the list of received symbols and additional information from the FDT as defined in clause 6.2.4.5, or

- determine to request a copy of the entire transmission object from the object repair server.

NOTE: requesting the entire transmission object may be a preferred choice by the object delivery client to avoid processing partially received objects and delaying the completion of the object for the application.

5. The object delivery client shall then use the unicast repair procedure specified in clause 6.2.4.3.5. The object delivery client shall use from the corresponding FDT File entry the network location *location* formed in step 4a, the size of the transmission object (in bytes), the entity tag valueand the minimal *list of byte ranges* Range[M] or the full object as determined in step 4b.

6. The object delivery client shall either:

- use the received data *list of byte ranges* and the received data in the FLUTE Session to recover the missing transmission object as defined in clause 6.2.4.3.5, or

- use the complete received object via unicast and dismiss the received data in the FLUTE Session for this transmission object. In this case, the data while received may be proxied to the application.

7. If the unicast repair is unsuccessful within the time to provide the object to the application, the object delivery client should terminate the unicast repair procedure for this object.

##### 6.2.4.3.4 Determining non-completion

While receiving the FLUTE Session, the object delivery client may determine that the data received up to *repair-time* are not sufficient to complete object reception.

Any of the following indicate that no more packets will be received for a particular transmission object:

- The FDT Instance describing the transmission object has expired.

- A Close Object signal (B-flag) is received in an ALC/FLUTE header in the ongoing FLUTE Session.

- A FLUTE packet with a TOI different from the current object and different from 0 is received and the SDP indicates that the *sequential sending* FLUTE sending rule for multiple objects is in use for the object streaming session per clause 7.3.2.5 of TS 26.346 [7], in particular rule 2 or 3.

- A FLUTE packet with a TOI *TOInew* higher than the TOI of the latest object *TOIcurrent* and different from 0 is received (indicating that no more packets will be received for all objects with TOI in between *TOIcurrent* and *TOInew −* 1 inclusive) and the SDP indicates that both the *object sequence number* and *sequential sending* FLUTE sending rules for multiple objects are in use for the object streaming session per clause 7.3.2.5 of TS 26.346 [7], i.e. rule 3.

If at this time the received symbols are not sufficient to complete the recovery of the object, non-completion shall be declared by the object delivery client.

In addition, if the attribute File@FEC-Redundancy-Level is included within the File element of the FDT Instance to indicate the FEC redundancy level for the file, and together with the information in the File@FEC-Content-Length, the object delivery client may determine that the number of packets received is insufficient to recover the object.

##### 6.2.4.3.5 Unicast Repair requests

The object delivery client sends one or more requests to an object repair server (as specified in the URLs) requesting transmission of data that allows recovery of missing object data.

Object repair requests and responses for a particular object shall take place in a single HTTP session [19]. HTTP sessions may be reused to repair multiple objects but should be terminated after some idle timeout period.

The object delivery client shall start the initial request immediately. If there is more than one repair request to be made for a particular object, these are sent one straight after another without further delay.

The object delivery client shall send separate HTTP GET requests for each object to be repaired.

For each object to be repaired, based on the parameters in clause 6.2.4.3.2, the object delivery client shall act as follows:

1. If the requested range is the entire object, i.e. M = 1, Range[0].start = 0 and Range[0].end = F, where F is the value of the *content length*, then the HTTP GET method shall be used.

2. If the requested range is only a subset of the object, a HTTP partial GET request shall be used with the Range request header (as specified in section 14.1.2 of RFC 9110 [19]) present.

- If M >1, the object delivery client shall include multiple byte range requests within a single partial GET request. In particular, the object delivery client shall include as many byte ranges as possible in a single HTTP request message without exceeding 2048 bytes for all request headers. If this length is exceeded, the request shall be split into as few requests as possible without any of those exceeding the 2048-byte limit.

3. If the *entity tag* for the damaged object is available to the object delivery client, it shall be used as the entity tag value in the If-Match or If-Range header of a conditional byte-range request.

4. If the *entity tag* for the damaged object is not available to the object delivery client, it may omit the If-Match or If-Range header from its byte-range request.

NOTE 1: The nominal objective of the object delivery client using the If-Match header is to receive the requested range(s) of the HTTP resource representation associated with the entity tag, or no repair data if the request cannot be satisfied by the object repair server.

NOTE 2 The nominal objective of the object delivery client using the If-Range header is to receive the latest version of the entire HTTP resource representation in case the version associated with the entity tag that was transmitted in the FLUTE Session and partially received by the object delivery client is no longer available on the object repair server.

## ===== CHANGE =====

## 10.1 General

This clause specifies the protocols between the MBSTF Client and the MBS AS with reference to the general provisions of clause 8 as they apply to these functional entities at reference point MBS‑4‑UC.

The following protocols are defined in this release:

- Unicast Object Repair protocol for post-session (clause 10.2) between the MBSTF Client and the MBS AS when the delivery of one of several objects in an MBS download delivery session using the Object Distribution Method was not completely successful.

- Unicast Object Repair protocol for in-session (clause 10.2) between the MBSTF Client and the MBS AS when the delivery of objects in an MBS object delivery session using the Object Distribution Method was not completely successful and completion is done during the ongoing session.

## ===== CHANGE =====

## 10.2 Post-session unicast Object Repair protocol

### 10.2.1 Overview

This clause defines the unicast Object Repair retrieval protocol between the MBSTF Client and the MBS AS at reference point MBS‑4‑UC when the delivery of one of several objects in an MBS User Service Session was not completely successful and repairs are made after the session has finished. The unicast Object Repair protocol is based on HTTP [19] and the general requirements specified in clause 8.2 and 8.3 of the present document shall apply to all interactions between these two functional entities at this reference point.

- An MBSTF Client shall implement the procedures defined in clause 10.2.2 to support the object repair protocol.

- An MBS AS shall implement the procedures defined in clause 10.2.3 to support the object repair protocol.

#### 10.2.2.4 MBSTF Client unicast repair request

The MBSTF Client sends one or more requests to an MBS AS instance requesting transmission of data that allows recovery of missing object data. All unicast Object Repair requests and responses for a particular MBS Distribution Session shall take place in a single HTTP session [19].

The MBSTF Client shall start the initial request once initiated after the back-off time, if any, has elapsed (see clause 10.2.2.3). If there is more than one repair request to be made, these are sent one straight after another without further delay.

The MBSTF Client shall send separate HTTP GET requests for each damaged object.

For each damaged object, based on the parameters in clause 10.2.2.2, the MBSTF Client shall act as follows:

1. If the requested range is the entire object, i.e. M = 1, Range[0].start = 0 and Range[0].end = F, with F the value of the *content length*, then the HTTP GET method shall be used.

2. If the requested range is only a subset of the object, a HTTP partial GET request shall be used with the Range request header (as specified in section 14.1.2 of RFC 9110 [19]) present.

- If M >1, the MBSTF Client shall include multiple byte range requests within a single partial GET request. In particular, the MBSTF Client shall include as many byte ranges as possible in a single HTTP request message without exceeding 2048 bytes for all request headers. If this length is exceeded, the request shall be split into as few requests as possible without any of those exceeding the 2048-byte limit.

3. If the *entity tag* is available to the MBSTF Client for the damaged object, it shall be used as the entity tag value in the If-Match or If-Range header of a conditional byte-range file request.

4. If the *entity tag* is not available to the MBSTF Client for the damaged object, the MBSTF Client may omit the If-Match or If-Range header from its byte range request.

NOTE 1: The nominal objective of the MBSTF Client using the If-Match header is to receive the requested range(s) of the HTTP resource representation associated with the entity tag, or no repair data if the request cannot be satisfied by the MBS AS.

NOTE 2 The nominal objective of the MBSTF Client using the If-Range header is to receive the latest version of the entire HTTP resource representation in case the version associated with the entity tag that was transmitted in the MBS User Service Session and partially received by the MBSTF Client is no longer available on the MBS AS.

## ===== CHANGE =====

## 10.3 In-Session unicast Object Repair protocol

### 10.3.1 Overview

This clause defines the unicast Object Repair retrieval protocol between the MBSTF Client and the MBS AS at reference point MBS‑4‑UC when the delivery of an object in an MBS User Service Session was not completely successful during the session and repairs are made before the end of the session. The unicast Object Repair protocol is based on HTTP [19] and the general requirements specified in clause 8.2 and 8.3 of the present document shall apply to all interactions between these two functional entities at this reference point.

- The mapping of the In-session object repair procedure parameters to the MBS User Service Parameters

- An MBSTF Client shall implement the procedures defined in clause 10.3.3 to support the in-session unicast Object Repair protocol.

- An MBS AS shall implement the procedures defined in clause 10.3.4 to support the in-session unicast Object Repair protocol.

### 10.3.2 Parameter mapping to MBS

Clause 6.2.4.3.2 defines generic parameters for the in-session Object Repair procedure. Table 10.3.2-1 provides a mapping of these abstract parameters to the properties included in the Object Repair Parameter data type specified in clause 5.2.8.

Table 10.3.2‑1: Mapping of abstract in-session repair parameters
to ObjectRepairParameters data type

| Abstract parameter | ObjectRepairParameters property |
| --- | --- |
| *offsetTime* | backoffParameters.offsetTime |
| *randomTimePeriod* | backoffParameters.randomTimePeriod |
| *repairLimitPercentage* | repairLimitPercentage |
| *object distribution base locator* | object‌Distribution‌BaseLocator |
| *object repair base locations* | object‌Repair‌BaseLocators |

### 10.3.3 MBSTF Client procedures

This clause defines the MBSTF Client procedures for the unicast Object Repair protocol for in-session repair.

The MBSTF Client shall follow the requirements and recommendations of the object delivery client defined in clause 6.2.4.3.

### 10.3.4 MBS AS requirements

A commonly addressable set of deployed MBS AS instances is assigned to an MBS User Service Session and hosts all objects at a location as specified in clause 6.2.4.4.

An MBS AS shall be an HTTP server that complies with the general provisions in clause 8.2 and 8.3 of the present document and shall respond to all requests as specified in clause 10.3.3.

When used for in-session repair, the MBS AS shall follow the requirements and recommendations of the object repair server defined in clause 6.2.4.3.

## ===== CHANGE =====

## A.2.1 MBS User Service Announcement schema

Editor’s Note: This needs to be updated and OpenAPI needs to be added to 3GPP forge..

Below is the schema specifying the format of User Service Descriptions instance documents using a JSON-based representation. The schema filename is "TS26517\_MBSUserServiceAnnouncement.yaml".

Documents following this schema shall be identified with the MIME media type application/3gpp-mbs-user-service-descriptions+json as registered in clause E.2.1 including the following parameters:

- The profiles parameter (see clause E.2.2) shall include a fully-qualified term identifier from the controlled vocabulary specified in clause C.2.

- The version parameter (see clause E.2.3) shall contain the value "Rel19" to indicate conformance with this version of the present document.

|  |
| --- |
| openapi: 3.0.0info: title: 'MBS User Service Announcement' version: 2.2.0 description: | MBS User Service Announcement Element units. © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC). All rights reserved.externalDocs: description: 3GPP TS 26.517 V19.0.0; 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: $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri' 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: multipart/related: schema: type: string '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: multipart/related: schema: type: string '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: description: 'A document announcing one or more MBS User Services.' type: object properties: version: type: integer minimum: 1 userServiceDescriptions: type: array items: $ref: '#/components/schemas/UserServiceDescription' minItems: 1 required: - userServiceDescriptions UserServiceDescription: description: 'A description of a single MBS User Service.' type: object properties: serviceIds: type: array items: $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri' minItems: 1 class: $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri' names: type: array items: type: object properties: name: type: string lang: type: string pattern: '^[a-zA-Z]{3}$' example: 'eng' required: - name - lang minItems: 1 descriptions: type: array items: type: object properties: description: type: string lang: type: string pattern: '^[a-zA-Z]{3}$' example: 'eng' required: - description - lang minItems: 1 serviceLanguage: type: string pattern: '^[a-zA-Z]{3}$' example: 'eng' distributionSessionDescriptions: type: array items: $ref: '#/components/schemas/DistributionSessionDescription' minItems: 1 serviceScheduleDescriptions: type: array items: $ref: '#/components/schemas/ServiceScheduleDescription' minItems: 1 required: - serviceIds - class - distributionSessionDescriptions DistributionSessionDescription: type: object properties: distributionMethod: $ref: '#/components/schemas/DistributionMethod' conformanceProfiles: type: array items: $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri' minItems: 1 sessionDescriptionLocator: $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri' applicationServiceDescriptions: type: array items: $ref: '#/components/schemas/ApplicationServiceDescription' minItems: 1 postSessionObjectRepairParameters: $ref: '#/components/schemas/ObjectRepairParameters' availabilityInfos: type: array items: $ref: '#/components/schemas/AvailabilityInformation' minItems: 1 securityDescription: $ref: '#/components/schemas/SecurityDescription' 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. ApplicationServiceDescription: type: object properties:  entryPointLocator: $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri' contentType: type: string pattern: '^[a-zA-Z]+\/[a-zA-Z]+$' example: 'application/dash+xml' required: - entryPointLocator - contentType AvailabilityInformation: type: object properties: mbsServiceAreas: type: array items: $ref: 'TS29571\_CommonData.yaml#/components/schemas/MbsServiceArea' minItems: 1 mbsFSAId: $ref: 'TS29571\_CommonData.yaml#/components/schemas/MbsFsaId' nrParameters: type: array items: $ref: '#/components/schemas/NrParameterSet' minItems: 1 nrRedCapUEInfo: $ref: 'TS29571\_CommonData.yaml#/components/schemas/NrRedCapUeInfo' NrParameterSet: type: object properties: freqBandIndicator: $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger' aRFCNValue: $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uinteger' required: - freqBandIndicator - aRFCNValue ObjectRepairParameters: type: object properties: backOffParameters: $ref: '#/components/schemas/BackOffParameters' objectDistributionBaseLocator: $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri' objectRepairBaseLocator: $ref: 'TS26510\_CommonData.yaml#/components/schemas/AbsoluteUrl' BackOffParameters: type: object properties: offsetTime: $ref: 'TS29571\_CommonData.yaml#/components/schemas/DurationSec' randomTimePeriod: $ref: 'TS29571\_CommonData.yaml#/components/schemas/DurationSec' anyOf: - required: [offsetTime] - required: [randomTimePeriod] ServiceScheduleDescription: type: object properties: id: type: string version: type: integer minimum: 1 start: $ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime' stop: $ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime' repetitionRule: $ref: '#/components/schemas/RepetitionRule' required: - id - version oneOf: - required: [start, stop] - required: [repetitionRule] RepetitionRule: type: object properties: startTime: $ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime' duration: $ref: 'TS29571\_CommonData.yaml#/components/schemas/DurationSec' repetitionInterval: $ref: 'TS29571\_CommonData.yaml#/components/schemas/DurationSec' required: - startTime - duration - repetitionInterval SecurityDescription: type: object properties: mBSSFAddresses: type: array items: $ref: 'TS26510\_CommonData.yaml#/components/schemas/AbsoluteUrl' minItems: 1 mBSServiceKeyInfo: type: object properties: mBSId: type: string mBSDomainId: type: string required: - mBSId - mBSDomainId uICCKeyManagement: type: boolean 2GGBAallowed: type: boolean backOffParameters: $ref: '#/components/schemas/BackOffParameters' required: - mBSSFAddresses - mBSSessionKeyInfo |