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Contents

Foreword

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

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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Introduction

The Framework for Live Uplink Streaming (FLUS) is an enabler for live media streaming from a source entity to a sink entity. FLUS offers an IMS-based and a non-IMS-based instantiation. The IMS/MTSI-based instantiation enables the establishment of live media streaming between two UEs or between a source entity and a sink entity, within and across operator networks. Compared with MTSI, where limited types of QoS for speech or video media are used, FLUS can provide a wider range of QoS operation, e.g., in the maximum delay, available bandwidth or target packet loss rate.

In the non-IMS-based instantiation, it is possible to operate FLUS as a more generic framework that is controlled through a RESTful API and that supports other media plane protocols (i.e. not based on IMS or MTSI).

In addition to providing a wider range of QoS operation over radio links, other advanced functionalities of FLUS, such as the signalling of immersive media, can be used to complement existing 3GPP services.

1 Scope

The present document defines a FLUS source entity and a FLUS sink entity that can support point-to-point transmission of speech/audio, video, and text. It defines media handling (e.g., signalling, transport, packet-loss handling, and adaptation). The goal is to ensure a reliable and interoperable service with a predictable media quality while allowing for flexibility in the service offerings.

A FLUS source entity, which may be embedded in a single UE, or distributed among a UE and separate audio-visual capture devices, may support all or a subset of the features specified in this document.

When used as a generic framework, only the F-C procedures for establishing the FLUS session are required to be supported by the FLUS source and the FLUS sink entities, and no other feature or procedure specified in this document is mandated. Impact on the service quality and network capacity is left to the discretion of the implementation and the service utilizing the framework. For example, configuration of media formats and codecs follows the requirements of the respective service.

When offered as part of a 3GPP IMS/MTSI service, the FLUS source and the FLUS sink entities are required to support the IMS control plane and media plane procedures, and the service quality is determined by the MTSI service policy.

The specification is written in a forward-compatible way in order to allow additions of media components and functionality in releases beyond Release 15.

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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] Recommendation ITU-R BS.2051-1 (06/2017): "Advanced Sound System for Programme Production".

[3] ISO/IEC 23090-2:2019: "Information technology - Coded representation of immersive media - Part 2: Omnidirectional media format".

[4] 3GPP TS 26.114: "IP Multimedia Subsystem (IMS); Multimedia telephony; Media handling and interaction".

[5] 3GPP TS 26.235: "Transparent end-to-end Packet-switched Streaming Service (PSS); Protocols and codecs".

[6] 3GPP TS 24.147: "Conferencing using the IM Multimedia (IM) Core Network (CN) subsystem; Stage 3".

[7] 3GPP TS 23.003: "Numbering, addressing and identification".

[8] 3GPP TS 33.203: "3G security; Access security for IP-based services".

[9] 3GPP TS 33.210: "3G security; Network Domain Security (NDS); IP network layer security".

[10] 3GPP TS 33.328: "IP Multimedia Subsystem (IMS) media plane security".

[11] IETF RFC 7231: "Hypertext transfer protocol (HTTP/1.1): Semantics and Content" (June 2014).

[12] 3GPP TS 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".

[13] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[14] 3GPP TS 23.682: " Architecture enhancements to facilitate communications with packet data networks and applications".

[16] 3GPP TS 26.501: "5G Media Streaming (5GMS); General description and architecture".

[17] ISO/IEC DIS 23090-8: "Information technology -- Coded representation of immersive media -- Part 8: Network based media processing" (under development).

[18] IETF RFC 4574: "The Session Description Protocol (SDP) Label Attribute" (August 2006).

[19] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".

[20] 3GPP TS 38.321,: "NR; Medium Access Control (MAC) protocol specification".

[21] OMA-ERELD-DM-V1_2-20070209-A: "Enabler Release Definition for OMA Device Management, Approved Version 1.2".

[22] 3GPP TR 26.939: " Guidelines on the Framework for Live Uplink Streaming (FLUS)".

[23] 3GPP TS 26.511: "5G Media Streaming (5GMS); Profiles, codecs and formats".

[24] IETF RFC 7798 (2016): "RTP Payload Format for High Efficiency Video Coding (HEVC)"

[25] 3GPP TS 26.445: "Codec for Enhanced Voice Services (EVS); Detailed Algorithmic Description".

[26] IETF RFC 4867 (2007): "RTP Payload Format and File Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multi-Rate Wideband (AMR-WB) Audio Codecs".

[27] IETF RFC 6416 (2011): "RTP Payload Format for MPEG-4 Audio/Visual Streams".

[28] OASIS Standard, MQTT Version 5.0, https://docs.oasis-open.org/mqtt/mqtt/v5.0/mqtt-v5.0.html

[29] 3GPP TS 24.147, Conferencing using the IP Multimedia (IM); Core Network (CN) subsystem;

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] 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].

FLUS session: A logical association between a FLUS source and a FLUS sink within which media content can be sent from the source to the sink.

Media session: A subset or part of a FLUS session between a FLUS source and a FLUS sink including the duration to establish the Media Media session, the time period during which media content can be sent from the FLUS source to the FLUS sink and the duration to terminate the MMedia session. One or more MMedia sessions are delivered during a FLUS session. A MMedia session may be established and controlled by a well-defined control protocol.

Media stream: The content sent from a FLUS source to a FLUS sink within a MMedia session.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] 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].

FLUS	Framework for Live Uplink Streaming
HMD	Head Mounted Display
IMS	IP Multimedia Subsystem
MO	Management Object
NBMP	Network Based Media Processing

4 System architecture

4.1 General

This clause introduces the system architecture for FLUS.

4.2 System

4.2.1 General

Figure 4.2-1 depicts the architecture showing the relevant entities for providing an uplink streaming service.

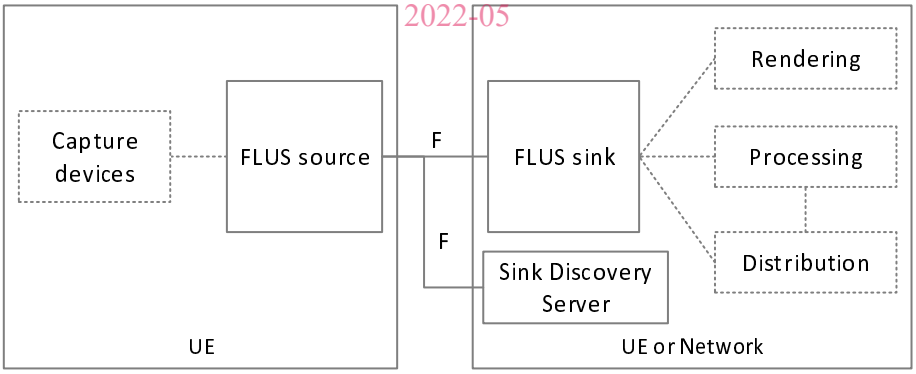


Figure 4.2-1: FLUS architecture

The uplink streaming service architecture is based on a FLUS source located in a UE and a FLUS sink located in either another UE or the network.

The FLUS source receives media content from one or more capture devices. In the context of this specification, the capture devices are considered as parts of a UE or are connected to it.

When the FLUS sink is located in a UE, the FLUS sink shall forward media content to a decoding and rendering function.

When the FLUS sink is located in the network,

the FLUS sink may forward media content to a processing or distribution sub-function. The processing and distribution sub-functions are not in scope of the present specification. The FLUS sink may act as a Media Gateway Function (MGW) and/or an Application Function (AF).

- an optional Sink Discovery Server offers functionality that allows to discover available FLUS sinks.
- each FLUS sink provides functionality to query its capabilities and FLUS sessions.

The F reference point connects a FLUS source to a FLUS sink and optionally to the Sink Discovery Server. The F reference point enables the discovery of available FLUS sinks. In addition,. the F reference point enables the establishment and control of a single FLUS session between the FLUS source and FLUS sink.

The F reference point also enables the FLUS sink and the FLUS source to mutually authenticate and authorize each other.

FLUS source and FLUS sink are each split into:

- Media Source and Sink (F-U end-points),
- Control Source and Sink (F-C end-points),
- Remote Controller and Remote Control Target (F-RC end-points) and

The UE, the FLUS source and the FLUS sink are considered to be logical functions. Functions are not required to be located in the same physical device; they can be spread over multiple physical devices and interconnected via other interfaces.

Multiple F-RC end-points can exist in a single FLUS source. F-RC end-points are independent of a FLUS sink and depend on the offered service.

The F reference point shall support security functionality for confidentiality protection for all subfunctions.

Details of the functions are shown in Figure 4.2-2.

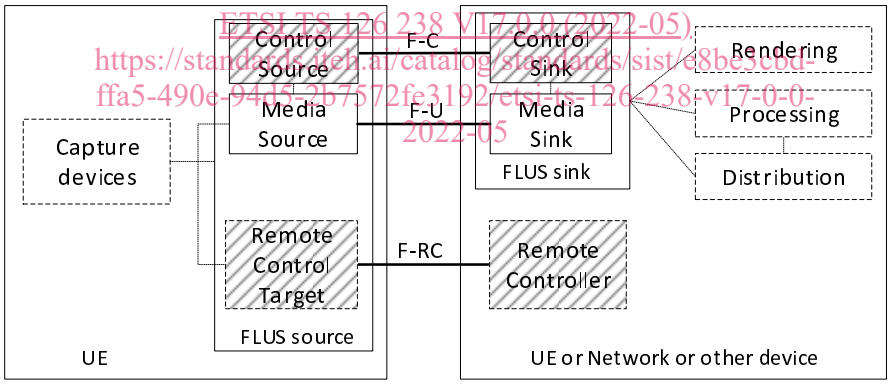


Figure 4.2-2: Sub-functions of FLUS

Note that in the above diagram, hatched-filled boxes represent FLUS control plane functionality, solid line boxes represent mandatory functionality, and dashed-line boxes corresponds to optional functionality. Also, note that F-C and F-U denote FLUS control and FLUS user plane interactions, respectively, and do not represent reference points.

Control Source and Sink (F-C): FLUS control plane functionality including the associated processing by the FLUS sink of the uploaded media for subsequent downstream distribution, plus FLUS media instantiation selection. F-C may also support configuration of static metadata for the Media session.

Remote Controller and Remote Control Target (F-RC): The Remote Control Target on the FLUS source receives control messages. The messages affect the behaviour of the Media Source in the FLUS source. Examples of commands issued to the Remote Control Target are start or stop of the media upstreaming process in the FLUS source.

Media Source and Sink (F-U): FLUS user plane functionality which includes setup of one or more Media sessions and subsequent media data transmission via Media streams. In some cases, a Media session establishment protocol (e.g. IMS session set-up for MTSI-based FLUS instantiation) is necessary.

NOTE: F-C is not needed when the FLUS sink is an MTSI client that is only capable of rendering. In such event, logical control plane functions such as media and session descriptions and support for a FLUS session establishment are encapsulated in FLUS user plane functionality.

F-C represents the interactions associated with the creation and modification of the configuration of the FLUS sink. F-C allows the Control Source to:

- select a FLUS media instantiation,

- provision static metadata associated with each Media session present in the FLUS session,

- discover, select and configure the processing and distribution sub-functions.

In addition to the delivery of control messages, F-RC represents the interactions associated with the discovery, creation, modification and selection of the FLUS sink configuration by the Remote Controller. F-RC allows the Remote Controller to:

- provide the Media Sink information to the FLUS source,

- select a FLUS media instantiation,

- determine capture device settings and other FLUS source parameters.

The FLUS media instantiation is defined as part of the FLUS session. The user plane (F-U) may also contain the Media stream establishment procedures when needed. Multiple Media streams may be established for one FLUS session.

A Media stream may contain media components of a single content type, e.g., audio, or media components of different content types, e.g., audio and video. A FLUS session may be composed of more than one Media stream containing the same content type, e.g., multiple Media streams of video.

4.2.2 Uplink streaming for MTSI

The architecture of uplink streaming for MTSI is depicted in Figure 4.2-3.

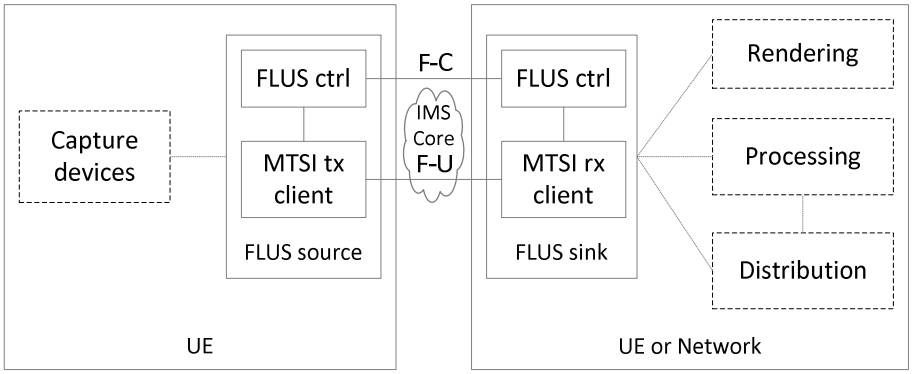


Figure 4.2-3: Uplink streaming for MTSI

The reception function of an MTSI client, i.e., the "MTSI rx client" as shown in Figure 4.2-3, is used to realize the Media Sink in the FLUS sink. The FLUS sink may be instantiated as another UE or as an MTSI rx client function in the network.

F-U contains all MTSI-related signalling.

The transmission function of an MTSI client, MTSI tx client, is used to realize the Media Source in the FLUS source.

4.2.3 Uplink streaming for PSS-based distribution

Figure 4.2-4a shows the most important interfaces for Evolved Packet System (EPS) and 5G System (5GS) for Live Uplink Streaming Services.

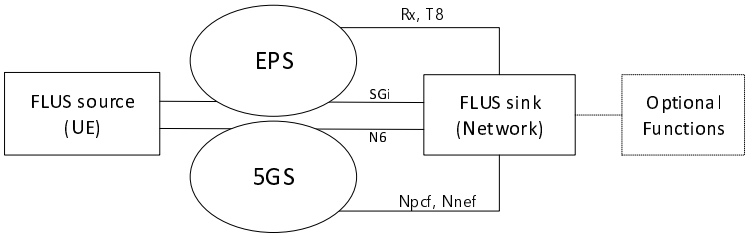


Figure 4.2-4a: Architecture for Live Uplink Streaming

An uplink streaming service requires at least a FLUS source and a FLUS sink. A FLUS sink is located at the SGi reference point in case of EPS [13] and at the N6 reference point in case of 5GS [15]. When QoS support is needed, the FLUS sink may request QoS support using Rx [13] or T8 [14] reference points in case or EPS and using Nnef or Npcf [15] reference points in case of 5GS.

The architecture of uplink streaming for subsequent PSS distribution is depicted in Figure 4.2-4b.

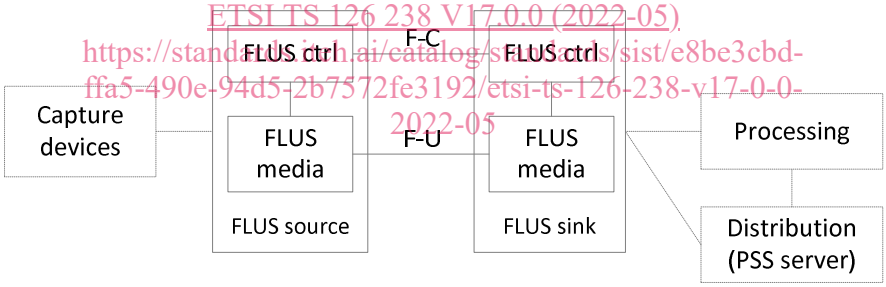
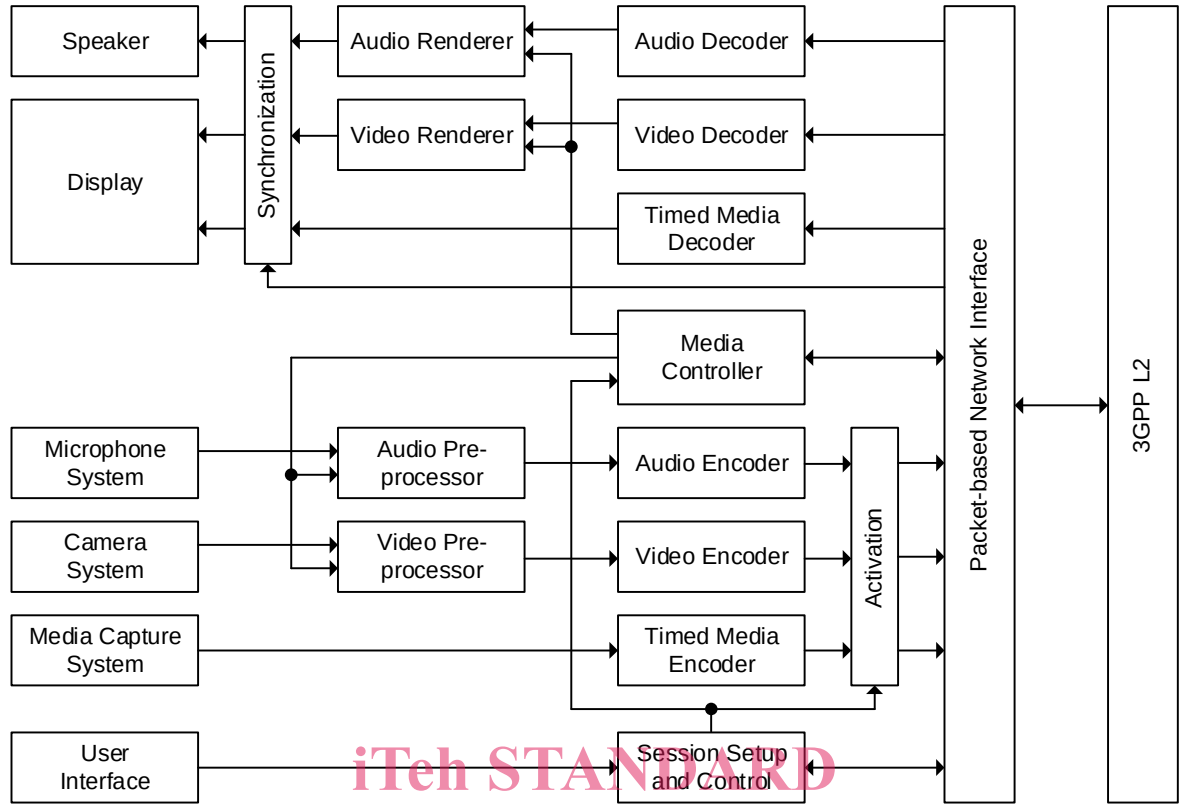


Figure 4.2-4b: Uplink streaming for PSS

The PSS Content Source is located on the UE side and contains the FLUS source.

4.3 Terminal

The functional components of a terminal including both a FLUS source and a FLUS sink that uses 3GPP access are shown in figure 4.3-1.



NOTE 1: It is not required that all components of a FLUS source or a FLUS sink are included in a terminal.

Figure 4.3-1: Functional components of a FLUS source and a FLUS sink

The scope of the present document is to specify media handling and interaction, which includes media control, as well as transport of media and control data.

As indicated in figure 4.3-1, whether or not to employ or how to realize the audio/video renderer, media controller, or audio/video pre-processor is left to the configuration of a FLUS source and a FLUS sink, and their implementation. For these functional components, this document only defines the signalling of the media controller, which will be used to define the handling of media.

Timed media may include text, graphics, etc.

If a terminal including a FLUS source uses 3GPP access only for uplink media transmission, its functional components are shown in figure 4.3-2.

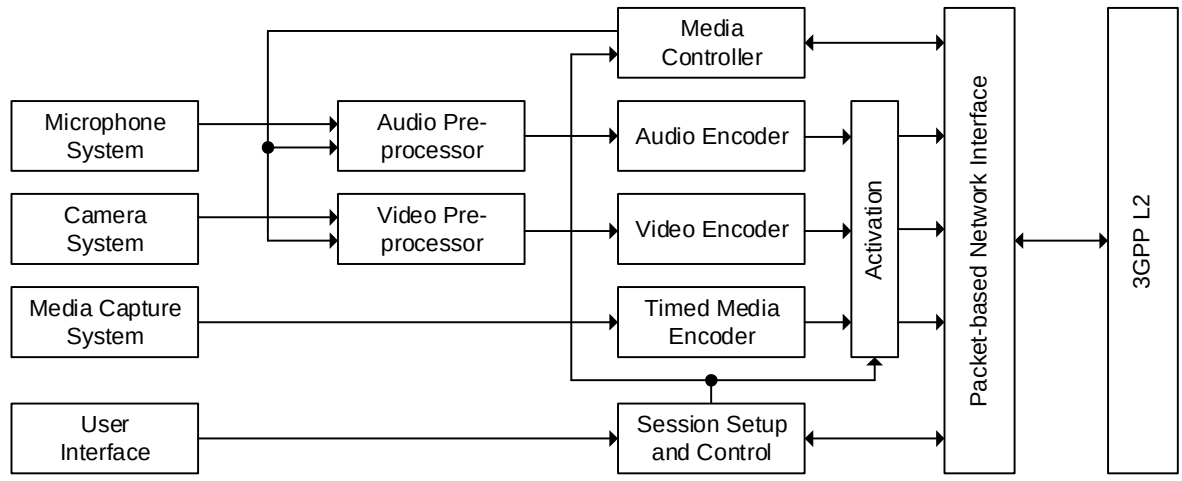


Figure 4.3-2: Functional components of a FLUS source for uplink media transmission

4.4 Procedures

4.4.1 General

A FLUS session may include one or more media streams. Media streams are time-bound to the FLUS session to which they belong to. When a media stream is active, the FLUS source can send media content to the FLUS sink.

The establishment and / or teardown of a Media session can be remotely controlled / influenced using remote control and / or assistance messaging.

Figure 4.4-1 depicts an example relationship of a FLUS session with a single Media session containing two media streams. The FLUS Session is established once the FLUS source and the FLUS sink contain matching configurations.

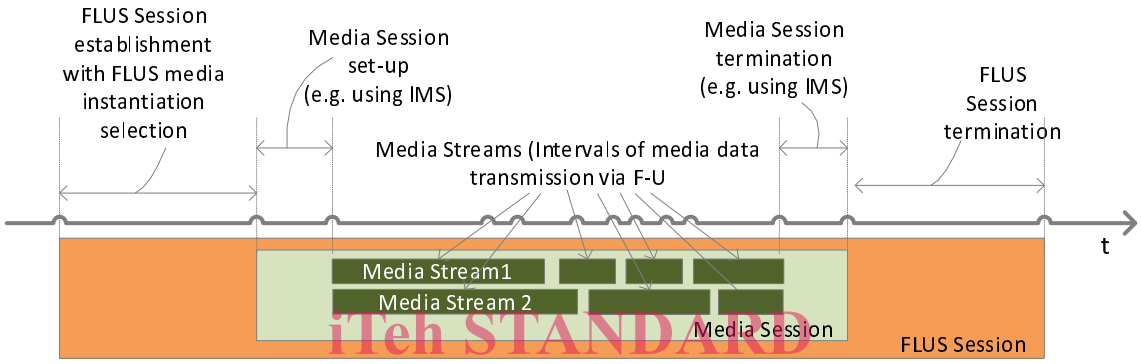


Figure 4.4-1: FLUS, Media sessions and Media streams

When the FLUS sink is located in a UE and the UE renders the received media content directly, the FLUS session may be implicitly present, e.g. it may be realized through IMS/MTSI.

When the FLUS sink is located on the network side and provides Media Gateway functionality, the FLUS session is used to select the Media session instantiation and to configure any processing and distribution related sub-functions.

The MPEG NBMP [17] Workflow Description Document may be used to describe the media processing tasks at FLUS sink to be performed on received media components from the FLUS source. See Annex B for further details.

4.4.2 FLUS session establishment

It is assumed that the FLUS source has the necessary information to establish an F-C connection to a FLUS sink, e.g., in terms of a SIP-URI or an HTTP URL.

4.4.3 FLUS session update

The FLUS session establishment procedure creates a FLUS session resource, which is then configured through the FLUS session update procedure, for example, resulting in the selection of the Media session instantiation.

The FLUS session update procedure includes the following FLUS session configuration parameters:

- Selection of the Media session instantiation
- Provision of session specific metadata,
- Setting a description of the processing of the media data that the FLUS sink is to perform,
- Configuration of the distribution and storage options for the media data