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Contents

Foreword

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Introduction

Timed graphics is a media type that enables advanced subtitle like services in parallel to video. It enables high quality text and graphics at a low cost.

In low bit-rate video, the areas which are often perceived as the worst are subtitles and graphics or tables (encoded as part of the video). Encoding subtitles as timed text instead of as part of the video can increase the perceived quality of the video substantially. Timed Text [4] solves the problem of subtitles and when used gives a perceptual quality much higher that encoding the text as part of the video stream. DIMS [5] allows the placement of vector graphics on top of video - but from an application perspective and requires DIMS to control the media. Timed Graphics works together with these abovementioned specifications, or independently, to enable better "video" quality.

1 Scope

The present document defines a timed graphics media type which reuses components from existing media types. A transport system is defined as is a storage format.

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

It enhances the user experience by enabling graphics to be encoded as graphics (as opposed to video) and without requiring an umbrella system such as SMIL or DIMS.

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] W3C Recommendation: "Scalable Vector Graphics (SVG) Tiny 1.2 Specification".

[3] 3GPP TS 26.234: "Transparent end-to-end Packet-switched Streaming Service (PSS); Protocols and codecs".

[4] 3GPP TS 26.245: "Transparent end-to-end Packet-switched Streaming Service (PSS); Timed text format".

[5] 3GPP TS 26.142: ""Dynamic and Interactive Multimedia Scenes (DIMS")".

[6] ITU-T Recommendation T.81 (1992) | ISO/IEC 10918-1:1993: "Information technology – Digital compression and coding of continuous-tone still images – Requirements and guidelines".

[7] CompuServe Incorporated: "GIF Graphics Interchange Format: A Standard defining a mechanism for the storage and transmission of raster-based graphics information", Columbus, OH, USA, 1987.

[8] CompuServe Incorporated: "Graphics Interchange Format: Version 89a", Columbus, OH, USA, 1990.

[9] IETF RFC 2083: "PNG (Portable Networks Graphics) Specification Version 1.0", Boutell T., et al., March 1997.

[10] IETF RFC 4396: "RTP Payload Format for 3rd Generation Partnership Project (3GPP) Timed Text", Rey J, Matsui Y, February 2006

[11] ETSI EN 300 743 v1.4.1"Digital Video Broadcasting (DVB); Subtitling systems".

3 Definitions and abbreviations

3.1 Definitions

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

Timed Graphics Entity: A byte aligned, network independent unit containing timed graphics data

3.2 Abbreviations

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

DIMS Dynamic and Interactive Multimedia Scenes

4 Overview and architecture

Timed graphics has two main components: The graphics description, i.e. the actual images, and the layout, i.e. a coordinate system describing the placement of the images.

Timed graphics is designed in as a media type. It can coexist with umbrella systems (e.g. DIMS or SMIL) just as other media types do, yet contains components from DIMS or other media types.

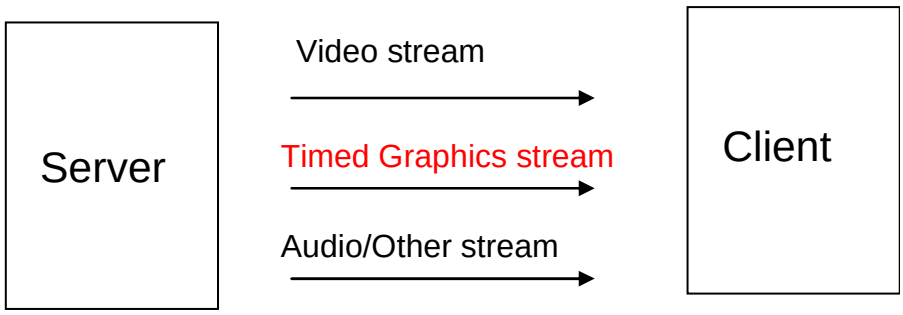

Figure 1: Example of a Timed Graphics stream, in parallel to an audio and video stream. No "umbrella" scene description is present.

Timed graphics may be realized in one of two ways: SVG-based timed graphics or simple timed graphics mode. In the SVG-based timed graphics, the layout and timing are controlled by the SVG scene. The transport and storage are inherited from DIMS. In the simple timed graphics mode, a binary representation format is defined to enable simple embedding of graphics elements. The transport over RTP and the storage in the 3GP file format are defined by this specification.

5 SVG-based Timed Graphics

5.1 Introduction

SVG-based Timed Graphics is defined as a profile of DIMS with certain restrictions and a layout mechanism for rendering timed graphics with external continuous media (i.e. video). Similarly to DIMS, SVG-based Timed Graphics consists of a multimedia scene. The multimedia scene is described using SVG Tiny 1.2 [2] and may consist of any combination of still pictures and animated graphics. In SVG-based Timed Graphics, continuous media such as audio and video are not allowed and shall be ignored by the receiver. The profile limitations are described in the following sections.

5.2 Scene Description Restrictions

SVG Tiny 1.2 shall be used for the description of SVG-based Timed Graphics. The base scene description shall not contain any references to continuous media such as audio or video.

The following restrictions to SVG Tiny 1.2 apply to the SVG scene of SVG-based Timed Graphics:

- Timed Media Elements: audio, video, and animation elements shall not be present in a timed graphics scene and should be ignored by the timed graphics client.
- Interactivity: scripting and handling of events is not allowed and shall be ignored by the timed graphics client.

Furthermore, SVG-based Timed Graphics scenes should not contain any elements or attributes from DIMS scene extensions.

5.3 Scene Commands

Timed Graphics does not support scene commands. In a Timed Graphics scene, DIMS scene commands should not be present and shall be ignored by a terminal that conforms to this specification.

5.4 Timed Graphics Media Unit Restrictions

SVG-based Timed Graphics media units are DIMS media units that are restricted to complete SVG documents. The DIMS compression method may be applied to Timed Graphics unit body.

For Timed Graphics the Unit header fields shall be set as follows:

S: is-Scene:	shall be set to 1 and may be ignored by a Timed Graphics decoder.
M: is-RAP:	shall be set to 1 and may be ignored by a Timed Graphics decoder.
I: is-redundant:	shall be set to 0 and may be ignored by a Timed Graphics decoder.
D: redundant-exit:	shall be to 0 and may be ignored by a Timed Graphics decoder.
P: priority	shall be set to 1 and may be ignored by a Timed Graphics decoder.
C: compression:	indicates the compression applied; 0 indicates no compression (textual format); 1 indicates that the content is compressed using the encoding signalled in stream setup.
X: reserved:	shall be set to 0 and shall be ignored by the receiver

5.5 Timing model

Timed Graphics consists of a sequence of SVG scenes where each incurs a reset of the scene time to 0. The synchronization to external continuous media is achieved using the transport protocol (RTP) timestamps and the sample timestamps in the 3GP file format.

The SVG scene itself defines its own timeline, which has as origin the time that corresponds to the presentation time given by the RTP or sample timestamp. The usage of internal timelines should be limited to timing the presentation and removal of the graphics content. This is ensured by disallowing continuous media components including the animation element in the SVG scene for timed graphics.

5.6 Processing Model

In SVG-based Timed Graphics, a Scene Description is a random access point (RAP) and is processed as a complete replacement for the current scene tree. That is, the entire DOM is discarded and replaced with the result of parsing the newly received SVG element.

The following state diagram illustrates the states. The state diagram should be implemented by timed graphics terminals.

In the state diagram, the terminal may be processing a stream under one of two conditions:

a) normal processing, 'normal';

b) after tuning in, performing random access, or when loss is detected, 'tune-in'.

Tune-in state is entered under any of the following circumstances:

a) after opening a stream;

b) after performing random access;

c) after loss of a timed graphics Unit in normal processing.

The terminal transfers to 'normal' state after processing any received timed graphics sample.

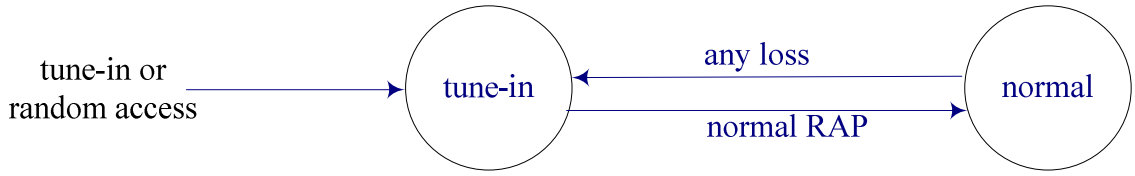

Figure 2

5.7 Rendering Model

The <svg> root element of the Timed Graphics scene shall be rendered on the parent canvas (provided by the media player) originating at the upper left corner. The <svg> element shall be completely transparent and should contain the attribute "viewport-fill" that shall be set to "none".

Timed Graphics media shall have a higher rendering order than other continuous media such as video and timed text. In case multiple Timed Graphics streams co-exist in the same multimedia session, the rendering order shall be established based on the media identifiers, or, if not present, the order of appearance in the 3GP file or the SDP.

5.8 Transport

SVG-based Timed Graphics uses from the same transport mechanisms as DIMS. It may be downloaded using HTTP, as part of a file format or it may be streamed over RTP.

Timed Graphics reuses the DIMS RTP payload format and the 3GP file format extensions. The Timed Graphics also reuses the SDP syntax and media type parameters defined for DIMS. The profile shall indicate Timed Graphics by carrying the value 5.

5.9 Timed Graphics Profile

A new Profile Indicator with value 5 is allocated for the Timed Graphics profile.

Support for the following media types shall also be supported in Timed Graphics Profile:

- The Still Image media formats and the Bitmap Graphics formats of [3].

As required in the SVG specification, SVG fonts shall be supported. The lack of hinting in SVG fonts means that small text which is anti-aliased may become unreadable. This problem is even more evident when text is rotated or animated. Recommendation: SVG fonts should be used with care.

The Open Font Format [4] should be supported at advanced simple text profile, level 2, with the following constraints: if Open Type fonts are supported, the DIMS Timed Graphics Profile client shall support downloadable OpenType fonts

with TrueType outlines, TrueType hinting shall be supported for improved text readability, and advanced typographic features may be supported.

NOTE: When OpenType fonts are supported, download of them may be initiated using the font-face-uri element from [1].

Device-native fonts and fonts identified by generic family names may be used.

5.10 Timed Graphics Level 5

This level contains the following restrictions:

Table 1: Timed Graphics Level 5 Limits

	Level 5
Scene bitrate (includes the static media embedded within the scene/commands and referenced media payloads)	200 kbit/sec
Simultaneous video playing	0
Simultaneous audio playing	0
Simultaneous active Timed Graphics scenes	1
Minimum pixel output buffer size	16 wide by 16 tall
Maximum path segments across all paths	3000
Maximum text content size (this refers to the number of characters and does not include the glyph)	10k bytes
Maximum dash array size	16
Maximum number of gradient stops	32
Maximum recommended DOM tree size	20 nodes
Minimum recommended screen refresh rate Note: Depending on the DOM tree size, the recommended screen refresh rate value may not be feasible and a lower screen refresh rate might be expected.	0.2 frames/sec

6 Simple Timed Graphics

6.1 Media definition

6.1.1 Introduction

Simple Timed Graphics does not define any new media components, but instead refers to components from existing graphics and image formats. Each format has its own units which are described below. A Simple Timed Graphics "stream" may contain a combination of units of different types, some possibly containing basic interactivity.

This section defines media component entities that together make simple Timed Graphics.

6.1.2 Media component entities

6.1.2.1 JPEG

A JPEG image, as specified in [JPEG], is a timed graphics media entity. The support requirement for ISO/IEC JPEG only applies to the following two modes:

- baseline DCT, non-differential, Huffman coding, as defined in table B.1, symbol 'SOF0' in [6];
- progressive DCT, non-differential, Huffman coding, as defined in table B.1, symbol 'SOF2' [6].

6.1.2.2 GIF and PNG

GIF87a [7], GIF89a [8] and PNG [9] images are timed graphics media entities.

6.1.2.3 Timed Text

A timed text sample, as defined in section 5.17 of [4], is a timed graphics media entity.

6.2 Layout definition

6.2.1 Introduction

In Simple Timed Graphics, each graphic is given a position on the rendering surface.

6.2.2 Rendering position and composition

Graphics are rendered with a region (a concept derived from SMIL). A graphics box is then set within that region. This permits the terminal to position the graphics within the overall presentation. In the case that the graphic contains internal layout information e.g. an SVG graphic, the explicit layout mode defines the point which the graphic treats as an origin.

A Simple Timed Graphics region is defined which is a rendering area defined using the following attributes:

tx: Translation value from the coordinate origin (x component)
ty: Translation value from the coordinate origin (y component)
width: Width of the Timed Graphics Region
height: Height of the Timed Graphics Region

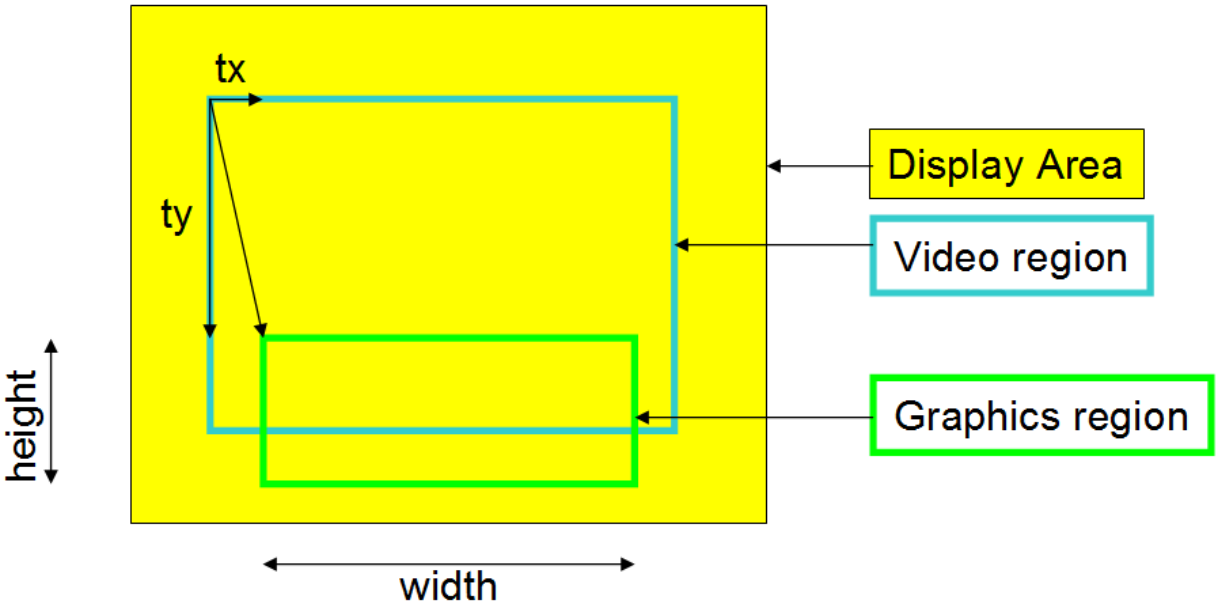

Figure 3: Illustration of graphics region using with a video being origin.

Graphics regions may be layered, in a similar way to the z-index in SMIL, using the 'layer' attribute.

Layer: Specifies the front-to-back ordering of the graphics region; lower numbers are closer to the viewer. 0 is the normal value, and -1 would be in front of track 0, and so on.

The actual representation of the abovementioned attributes is dependent on the transport/storage format and defined elsewhere.

If the content is provided along with stereoscopic 3D video, the disparity of the timed graphics may be signalled in order for it to be displayed at an appropriate depth thus avoiding any perceptual depth conflicts with the video. The disparity is the difference between the horizontal positions of a pixel representing the same point in space in the right and left views of a stereoscopic 3D image. Positive disparity values move the timed graphics away from the viewer

whilst negative values move it towards the viewer. A value of zero places the timed graphics in the plane of the display screen. When rendering timed graphics accompanying stereo video, the UE shall make use of the disparity information so as to render the timed graphics appropriately.

NOTE: The disparity is measured in the same units as the track dimensions.

6.3 Random access

All Timed graphics samples are random access points (RAPs) and RAPs are processed by terminals in all states.

A RAP contains the entire content of a timed graphics sample and replaces the corresponding previous data.

There may be multiple timed graphics contents with the same timestamp. When received, the RAP replaces the corresponding previous data per content.

6.4 Timing and processing model

6.4.1 Timing model

Timed Graphics inherits the timing model from timed text [4]. This section defines the timing model of Timed Graphics samples.

The timed graphics samples are associated with the following parameters:

the media timestamp. The time when the timed graphics sample is applied;

the sample duration.

When multiple timed graphics contents are received simultaneously, the timing model is maintained separately for each content.

The actual representation of the abovementioned attributes is dependent on the transport/storage format and defined elsewhere.

6.4.2 Processing model

A RAP is processed as a complete replacement to the previous data of the corresponding contents. The same process is applied during tune-in and standard decoding.

Two RAPs with the same timestamp, and in the same flow (i.e. with the same content_ID) are considered redundant alternatives to each other. Upon reception of two such RAPs, it is not required to process both.

When multiple timed graphics contents are received simultaneously, the terminal processes each content separately.

6.5 Transport and Storage

6.5.1 Overview

6.5.2 Storage in ISO base media file format files

6.5.2.1 Track Header

A track header box with the following data is used for Timed Graphics tracks:

```
aligned(8) class TrackHeaderBox
    extends FullBox('tkhd', version, flags){
    if (version==1) {
    unsigned int(64)    creation_time;
```

```
    unsigned int(64)    modification_time;
    unsigned int(32)    track_ID;
    const unsigned int(32)  reserved = 0;
    unsigned int(64)    duration;
    } else { // version==0
    unsigned int(32)    creation_time;
    unsigned int(32)    modification_time;
    unsigned int(32)    track_ID;
    const unsigned int(32)  reserved = 0;
    unsigned int(32)    duration;
    }
    const unsigned int(32)[2]   reserved = 0;
    int(16) layer;
    template int(16) alternate_group = 0;
    template int(16)    volume = 0;
    const unsigned int(16)  reserved = 0;
    template int(32)[9] matrix=
    { 0x00010000,0,0,0,0x00010000,0,tx,ty,0x40000000 };
    // unity matrix
    unsigned int(32) width;
    unsigned int(32) height;
}
```

The values tx, ty, width, height and layer are defined in section 6.2. All other values are defined as per the ISO base file format.

NOTE: This track header is identical to its use in [4].

6.5.2.2 Media component specific configurations

6.5.2.2.1 Introduction

Within the sample entry there are one or more boxes. Each box has two functions:

a) it declares that samples of that type may occur in the track;

b) it contains the setup information for samples of that type.

6.5.2.2.2 Timed Text

```
class TG3gttConfiguration extends Box('3gtt') {
{
    unsigned int(32)    displayFlags;
    signed int(8)   horizontal-justification;
    signed int(8)   vertical-justification;
    unsigned int(8) background-color-rgba[4];
    BoxRecord   default-text-box;
    StyleRecord default-style;
    FontTableBox    font-table;
    DisparityBox    default-disparity;
}
```

The TimedText configuration contains the boxes defined for 3GPP Timed Text in clause 5.16 of [4], and that specification also defines which boxes are mandatory and which are optional.

6.5.2.2.3 JPEG, GIF and PNG

```
class TG3gttConfiguration extends Box('jpeg')

{
    BoxRecord   default-box;
    unsigned int(32)    displayFlags;
}
class TG3gttConfiguration extends Box('gif ')

{
    BoxRecord   default-box;
    unsigned int(32)    displayFlags;
}
class TG3gttConfiguration extends Box('png ')
{
```

```
    BoxRecord   default-box;
    unsigned int(32)    displayFlags;
}
```

The graphics configurations all include a default-box, as a boxrecord and displayFlags as defined in clause 5.16 of [4]. The displayFlags declare transition/appearance behaviour and the fields continuous karaoke, write text vertically and fill text region shall be set to zero for non-text sample types.

6.5.2.3 Timed Graphics ContentID Box

```
class TG3gCIDBox extends FullBox('cid ') {
    Uint(4) content_ID;
    Uint(4) reserved = 0;
}
```

The TG3gCIDBox distinguishes Timed Graphics content. The default value (and recommended value for text flows) is zero.

Each stream of units with the same content_ID is a logically separate streams and should be processed independently.

6.5.2.4 Sample Entry Name and Format

The sample entry four-character code for timed graphics is 'tigr'. One or more configuration boxes shall be present in the sample entry. A timed graphics ContentID box may be present in the sample entry.

6.5.2.5 Sample Format

The sample structure is very similar to that defined in section 5.17 of [4]. In that specification, the text string is preceded by a length field, and is followed by modifier boxes. In this specification, the text string or graphics element is enclosed in a box, whose type MUST match one of the configuration boxes in the sample entry. Modifier boxes are specific to the sample type.

The modifier boxes for a text sample are defined in [4].

The modifier boxes for a JPEG, PNG or GIF sample are as follows.

6.5.2.6 Sample Modifier Boxes

6.5.2.6.1 Appearance Delay

'dlay' - Specifies a delay after a Scroll or fade In and/or before Scroll or fade Out. A 32-bit integer specifying the delay, in the units of the timescale of the track. The default delay, in the absence of this box, is 0.

```
class ScrollDelayBox() extends SampleModifierBox ('dlay') {
    unsigned int(32)    scroll-delay;
}
```

6.5.2.6.2 HyperText

'clik' – Click-through link.

This box contains these values:

URLLength:– the number of bytes in the following URL

URL: UTF-8 characters – the linked-to URL

altLength:– the number of bytes in the following "alt" string

altstring: UTF-8 characters – an "alt" string for user display

The URL should be an absolute URL, as the context for a relative URL may not always be clear.

The "alt" string may be used as a tool-tip or other visual clue, as a substitute for the URL, if desired by the terminal, to display to the user as a hint on where the link refers.

Hypertext-linked graphics should not be scrolled. It is hard for the user to interact with moving graphics.

```
class TextHyperTextBox() extends TextSampleModifierBox ('href') {   unsigned int(8) URLLength;
    unsigned int(8) URL[URLLength];
    unsigned int(8) altLength;
    unsigned int(8) altstring[altLength];
}
```

6.5.2.6.3 Box Over-ride

'tbox' –box over-ride. This over-rides the default box set in the sample description.

```
class BoxBox() extends SampleModifierBox ('tbox') {
    BoxRecord   the-box;
}
```

6.5.2.6.4 Stereo Disparity

'disp' - Specifies the disparity shift for presenting the contents of this sample on a stereo display. The value expresses the pixel shift applied to each of the left and right views so the total disparity is twice the disparity-shift. A negative disparity indicates that the graphics appear closer to the viewer than the screen plane (the left image is shifted right and the right image is shifted left), a positive disparity is the opposite. The default disparity, in the absence of this box, is specified in the sample entry; if there is no disparity information in the sample entry, the disparity is inferred to be 0.

```
class DisparityBox() extends SampleModifierBox ('disp') {
   signed int(16) disparity-shift-in-16th-pel;
}
```

`disparity-shift-in-16th-pel` represents 16 times the shift to be applied to the left on the left view and to the right on the right view.

NOTE: It allows for a 1/16th pixel accuracy which can be suitable when scaling the video scene to another resolution. Any processing (either at the encoder or the decoder) which needs to implement only integer values of disparity shift should round the values "towards the viewer" (i.e. that positive values of disparity are rounded down and negative values rounded up). The indication of the disparity value is similar to that of the DVB subtitles [11].

6.5.3 RTP payload format for Timed Graphics

6.5.3.1 General

The RTP payload format for Simple Timed Graphics is laid out the same as, and uses for the most part the same definition as, the RTP payload format for Timed Text (RFC 4396). The differences are:

a) that a new MIME type is used, to identify this as a Timed Graphics stream rather than simply Timed Text;

b) multiple Timed Graphics Streams my be packed into one RTP session, using the content_ID to distinguish them;

c) where the payload format talks about 'the text string' and a graphic element is in use, then the graphic element (e.g. JPEG picture) should be understood;

d) The U bit is specific to text and should be set to 0 for graphics.

Flows are identified in the content_ID in the 4 bits following the U bit in the common header; replace

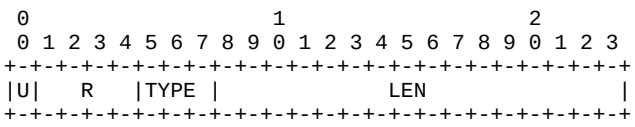

Figure 4a. Common payload header fields

o R (4 bits) "Reserved bits": for future extensions. This field MUST be set to zero (0x0) and MUST be ignored by receivers.

With:

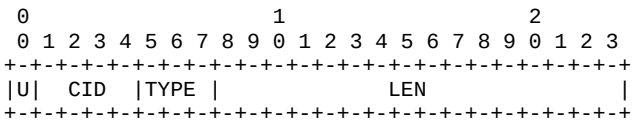

Figure 4b. Common payload header fields

o F (4 bits) contentID. This field distinguishes flows. The default value (and recommended value for text flows) is zero.

Each stream of units with the same contentID is a logically separate stream in the RTP session and should be processed independently.

6.6 Registered Types

6.6.1 RTP Payload format MIME Type

Type name: video

Subtype name: timedgraphics

Required parameters:

- As defined in [10]

Optional parameters:

- As defined in [10]

Encoding considerations:

- This media type is currently only defined for transport via RTP.

Security considerations:

- RTP packets using the payload format defined in the present document are subject to the security considerations discussed in the RTP specification [15] and any applicable RTP profile, e.g. AVP [21].

Interoperability considerations:

- None.

Published specification:

- 3GPP TS 26.430

Applications that use this media type:

- Timed Graphics Streaming applications.

Additional information:

- Magic number(s): None.
- File extension(s): None.
- Macintosh file type code(s): None.

Person and email address to contact for further information:

- John Meredith.
- john.meredith@3gpp.org

Intended usage:

- COMMON.

Restrictions on usage:

- None.

Author:

- 3GPP SA4 WG.

Change controller:

- 3GPP TSG SA.

6.6.2 'Codecs' Parameter for 3GP files

When timed graphics content is supplied in 3GP files which are identified by MIME type, the 'codecs' parameter defined in [14] may be used to indicate that Timed Graphics content is present. The codecs parameter takes the sample entry name as defined above (that is, 'tigr').

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2010-03	47	SP-100027			Approved TSG SA#47		9.0.0
2011-03	51				Version for Release 10	9.0.0	10.0.0
2012-09	57				Version for Release 11	10.0.0	11.0.0
2013-09	61	SP-130354	0002	1	3D timed graphic	11.0.0	12.0.0
2015-12	70				Version for Release 13	12.0.0	13.0.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-03	75					Version for Release 14	14.0.0
2018-06	80					Version for Release 15	15.0.0
2020-07	88-e					Version for Release 16	16.0.0
2020-08	Post SA#88-e					Editorial	16.0.1
2020-10	Post SA#88-e					Updated Change History Table to include the changes	16.0.2
2022-04	-	-	-	-	-	Update to Rel-17 version (MCC)	**17.0.0**
2024-03	-	-	-	-	-	Update to Rel-18 version (MCC)	**18.0.0**
2025-10	-	-	-	-	-	Update to Rel-19 version (MCC)	**19.0.0**

History

Document history		
V19.0.0	October 2025	Publication