TECH 3380

EBU-TT-D SUBTITLING DISTRIBUTION FORMAT

VERSION: 1.0

SOURCE: SP/MIM – XML SUBTITLES

Geneva
March 2015

Conformance Notation

This document contains both normative text and informative text.

All text is normative except for that in the Introduction, any section explicitly labelled as 'Informative' or individual paragraphs which start with 'Note:'.

Normative text describes indispensable or mandatory elements. It contains the conformance keywords 'shall', 'should' or 'may', defined as follows:

'Shall' and 'shall not':	Indicate requirements to be followed strictly and from which no deviation is permitted in order to conform to the document.
'Should' and 'should not':	Indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others.
	OR indicate that a certain course of action is preferred but not necessarily required.
	OR indicate that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.
'May' and 'need not':	Indicate a course of action permissible within the limits of the document.

Default identifies mandatory (in phrases containing "shall") or recommended (in phrases containing "should") presets that can, optionally, be overwritten by user action or supplemented with other options in advanced applications. Mandatory defaults must be supported. The support of recommended defaults is preferred, but not necessarily required.

Informative text is potentially helpful to the user, but it is not indispensable and it does not affect the normative text. Informative text does not contain any conformance keywords.

A conformant implementation is one which includes all mandatory provisions ('shall') and, if implemented, all recommended provisions ('should') as described. A conformant implementation need not implement optional provisions ('may') and need not implement them as described.

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Contents

Errata

E0-1 Extensibility of tt:metadata elements

Description: tt:metadata elements may be extended by "foreign namespace" elements.

Resolution: The following text was added to Section 2.2 Extensibility, (page 10), after the sentence "If an element has a tt:metadata as child element, tt:metadata shall appear before all other child elements ...":

"Every tt:metadata element may be extended by zero or more elements as children. These elements, their attributes and their XML Content shall neither be in a namespace defined by the TTML 1.0 specification nor in a namespace defined in the EBU-TT specification."

E0-2 Cardinality of tt:br in tt:p and tt:span

Description: The cardinality of the tt:br as child of the tt:p and tt:span element shall be zero to many (0..*) instead of zero to one (0..1).

Resolution: The cardinality of tt:br in section 3.2.1.1 (page 31) and in section 3.2.1.1.1 (page 34) was changed from: 0..1 to: 0..*

Editor's note: Exceptionally, for consistency throughout this document the American English spellings 'color' and 'center' have been used.

Status of this document (Informative)

This document is a stable document and may be used as reference material or cited from another document.

This document is part of a series of EBU-TT (EBU Timed Text) documents. The full list of published and planned EBU-TT documents is given below.

Part 1: EBU-TT Subtitling format definition (EBU Tech 3350)

Introduction to EBU-TT and definition of the XML based format.

Part 2: STL (Tech 3264) Mapping to EBU-TT (EBU Tech 3360)

How EBU-TT provides backwards compatibility with EBU STL.

EBU-TT Live - Authoring and Contribution

How to use EBU-TT for the production and contribution of live subtitles.

EBU-TT Annotation

How EBU-TT can be used in future scenarios for 'authoring of intent'.

EBU-TT User Guide

General guide ('How to use EBU-TT').

EBU-TT-D (EBU Tech 3380)

EBU-TT content profile for TTML that can be used for the distribution of subtitles over IP based networks.

Carriage of EBU-TT-D in ISOBMFF (EBU Tech 3381)

How EBU-TT-D can be stored using the storage format of the ISO Base Media File Format (ISO/IEC 14496-12).

Definition of terms

Captions and subtitles

The term "captions" describes on screen text for use by deaf and hard of hearing audiences. Captions include indications of the speakers and relevant sound effects.

The term "subtitles" describes on screen text for translation purposes.

For easier reading only the term "subtitles" is used in this specification as the EBU-TT-D representation of captions and subtitles is identical.

In this specification the term "captions" may be used interchangeably for the term "subtitles" (except where noted).

Root Container Region

The term "root container region" in TTML 1.0 defines a logical region that establishes a coordinate system into which content regions are placed.

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EBU-TT-D
Subtitling Distribution Format

EBU Committee	First Issued	Revised	Re-issued
TC	2014		

Keywords: subtitling, STL, XML, W3C, TTML, DFXP, captions, EBU Timed Text.

1.   Scope (Informative)

This publication specifies an XML based format for the distribution of subtitles. It is based on the W3C Timed Text Markup Language 1 (TTML1) (Second Edition) [1], hereafter referred to as TTML 1.0, and informed by EBU-TT Part 1 (EBU Tech 3350) [5]. EBU-TT Part 1 was specified as an archiving and interchange format while the principal use case for EBU-TT-D is the distribution of subtitles over IP based networks.

EBU-TT-D has been created by taking into account expertise from users, distribution parties, hybrid TV organizations and CE manufacturers. One main requirement underlying the format's specification is that EBU-TT-D should be easy to stream with existing technologies, such as MPEG DASH [7].

The current draft of EBU-TT-D only covers the constraints on the content structure of a TTML 1.0 document structure. Further constraints on segmentation and transport in specific carriage mechanisms are covered by other EBU publications as for example EBU Tech 3381 "Carriage of EBU-TT-D in ISOBMFF".

2.   Generic constraints

The EBU-TT-D format defines constraints for an XML document instance. A valid EBU-TT-D XML document has to comply with the generic constraints in § 2 and the document structure defined in § 3.

TTML elements and attributes shall be defined by TTML 1.0 subject to any constraints specified within this document.

2.1   Namespaces

The following namespaces from TTML 1.0 shall be used for the TTML elements and attributes in EBU-TT:

Name	Prefix	Value
TT	`tt:`	http://www.w3.org/ns/ttml
TT Parameter	`ttp:`	http://www.w3.org/ns/ttml#parameter
TT Style	`tts:`	http://www.w3.org/ns/ttml#styling
TT Metadata	`ttm:`	http://www.w3.org/ns/ttml#metadata

The following namespaces shall be used for the assignment of XML Schema datatypes:

Name	Prefix	Value
XML Schema	xs:	http://www.w3.org/2001/XMLSchema

The following namespaces shall be used for the EBU-TT specific vocabulary:

Name	Prefix	Value
EBU-TT Metadata	ebuttm:	urn:ebu:tt:metadata
EBU-TT Styling	ebutts:	urn:ebu:tt:style
EBU-TT Datatypes	ebuttdt:	urn:ebu:tt:datatypes

> Note: Although any prefix can be used to bind the namespaces in an XML document the use of the prefixes listed above is recommended.

If attributes in this document are defined without prefix they are not in any namespace.

2.2   Extensibility

The following EBU-TT-D elements may contain zero or one `tt:metadata` child element(s):

- `tt:head`
- `tt:styling`
- `tt:style`
- `tt:layout`
- `tt:region`
- `tt:body`
- `tt:div`
- `tt:p`
- `tt:span`
- `tt:br`

If an element has a `tt:metadata` as child element, `tt:metadata` shall appear before all other child elements that are defined for this element by EBU-TT-D (see § 3 "Document Structure").

Every `tt:metadata` element may be extended by zero or more elements as children. These elements, their attributes and their XML Content shall neither be in a namespace defined by the TTML 1.0 specification nor in a namespace defined in the EBU-TT specification.

Elements or attributes from the TTML or EBU-TT namespace shall appear only as descendants or attributes of descendants of the `tt:metadata` element when all of the following conditions are met:

They are defined in the "http://www.w3.org/ns/ttml#metadata" or "urn:ebu:tt:metadata" namespace.

They are defined in a valid (not deprecated) version of an EBU-TT specification.

They are explicitly defined and allowed as descendants or attributes of descendants of the `tt:metadata` element.

2.3   *Initial values*

TTML 1.0 defines initial values for certain attributes that act as fallback values in case a value cannot be computed from a specified value in the document. The EBU-TT-D specification does not override these initial values and for any TTML 1.0 attribute that is used in an EBU-TT-D document the initial value as specified in TTML 1.0 shall apply. For the style attribute `tts:color` where TTML 1.0 does not set an initial value, a presentation processor may follow the recommendation provided in § 3.1.2.1 "Style", `tts:color`.

Note: A document wide override can be achieved through the specification of a default style that is applied to a `tt:body` element.

Note: To clarify the intention of the author of an EBU-TT-D document it is recommended that attributes and their values be explicitly specified rather than relying on their initial values.

Note: When translating documents that conform to EBU-TT Part 1 version 1.0 special attention has to be paid to initial values. EBU-TT Part 1 overwrites the initial values defined in TTML 1.0 for the attributes `ttp:cellResolution`, `tts:fontSize` and `tts:displayAlign`. If therefore EBU-TT Part 1 documents rely on the initial values of these attributes, then the intended settings have to be specified explicitly in EBU-TT-D documents by using the appropriate attribute with the corresponding value.

2.4   *Generic Layout constraints*

A document shall not contain overlapping regions that are active at the same time.

Note: It is recommended that decoders support at least eight regions that are active at the same time.

2.5   *Rendering Plane*

The implementation shall provide a rendering plane which shall be coincident with the root container region of the EBU-TT document.

If the related media object is a video media object then the rendering plane shall be coincident with the rendering plane of the video media object. In the absence of a related video media object the implementation shall supply a suitable rendering plane.

Note: EBU-TT-D does not permit pixel-based length values and defines font sizes relatively. Therefore the EBU-TT-D document does not have an intrinsic spatial extent and may be scaled arbitrarily.

2.6   *Rendering Model*

Note: EBU-TT-D does not define a rendering model. Some TTML presentation processors will expect TTML documents to comply with the constraints of a specific rendering model[1]. It is out of scope of this spec to make a normative reference to these

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[1] See for example CFF [6], § 6.6

models but it is recommended that authors are aware that the external context in which EBU-TT-D will be used may do this.

2.7 Document Encoding

An EBU-TT-D document shall be concretely encoded as a well-formed XML 1.0 document and should use the UTF-8 character encoding, when other requirements do not apply.

2.8 Error Handling

If documents are not well formed or contain errors, the results may be unpredictable. Documents shall therefore strictly conform to this specification.

Decoding implementations should attempt to recover gracefully in the event of something not being understood, be it a 'feature' or a fault.

Implementations should, but may not, implement EBU-TT extension features (such as `ebutts:multiRowAlign` and `ebutts:linePadding`) that are not part of TTML 1.0; these are designed so that the default TTML 1.0 behaviour in the absence of those features is inferior but still acceptable.

If a processor chooses to prune part of a document to work around an error, it should attempt to prune the smallest part of the document needed to result in a processable document.

A processor may complete an apparently incomplete document in order to generate a processable document in accordance with this specification.

Note: It is not expected that presentation decoders will validate a document with an XML schema.

3. Document Structure

The order of content in this specification of the EBU-TT-D format follows the structure of an EBU-TT-D document instance. The levels within this specification document reflect the nested structure of an EBU-TT-D document.

The formal definition of how the EBU-TT-D specification uses EBU-TT- ,TTML- and XML- vocabulary is presented in tabular form. When using this specification, the definition of the use of an element or attribute shall be interpreted relative to its position in the document instance.

Example:

The definition of the `xml:id` attribute in § 3.1.2.1 "Style" only specifies the use of the `xml:id` attribute on the `tt:style` element.

Definitions used within this specification:

Type: Constraints of the information structure of an XML element or XML attribute. The type can be further constrained through Enumerations and normative text in the description.

Enumeration: Enumerated values that shall be used for certain elements or attributes of type `xs:string`.

Cardinality: How often an element or attribute may be used inside the corresponding parent element. If the lower bound is greater than 0 (e.g. "1..1" or "1..*") the element or attribute is mandatory at this position of the document structure. If the lower bound is equal to 0 (e.g. "0..1" or "0..*") the element or attribute is optional at this position in the document structure.

Every EBU-TT-D document instance shall start with the `tt:tt` element. In XML terms this element is the root element of the document.

tt:tt (element)

Type	Element content
Cardinality	1..1
Description	Root element.

The following attributes may be specified on the `tt:tt` element.

To indicate the authors' intent in the use of white space (spaces, tabs, and blank lines) the `xml:space` attribute may be added.

xml:space (attribute)

Type	`xs:string`
Enumeration	"default" | "preserve"
Cardinality	0..1
Description	Indicates the author's intent in the handling of white space within the content of the EBU-TT-D document.

EBU-TT-D uses the `ttp:timeBase` attribute to give information on how the timing information in an EBU-TT-D document shall be interpreted. The `ttp:timeBase` attribute shall always be set to "media".

ttp:timeBase (attribute)

Type	`xs:string`
Enumeration	"media"
Cardinality	1..1
Description	The timebase defines the time coordinate system for all time expressions in EBU-TT-D. With the timebase set to "media" all time expressions of begin and end attributes of the subtitle content shall denote a coordinate on the time line of a

	related media object and shall be of type ebuttdt:distributionMediaTimingType.
	Note: The timebase "media" is intended to use the playtime of any associated video or other related media object as a synchronisation reference.
	Note: It is recommended that when rendering the subtitle content an implementation avoids re-aligning begin and end times with the presentation times of the displayed frames of any related media object. This recommendation is intended to prevent quantisation of the presentation time of individual subtitles, thus avoiding unintended increases in required reading speeds or misalignment between subtitles and audio. Subtitle presentation is expected to continue at the nominal rate of progression while video and audio presentations are occurring even if the displayed video frame rate changes (see **Annex E** for more details).

ttp:cellResolution (attribute)

Type	ebuttdt:cellResolutionType
Cardinality	0..1
Description	Expresses a virtual visual grid composed of horizontal and vertical cells. This grid divides the root container region (see "Definition of terms") in rows and columns. The first value defines the number of columns and the second value defines the number of rows. The ttp:cellResolution should be set explicitly. Otherwise the default value of "32 15" shall apply. Note: The resulting grid is intended for the purpose of measuring length and expressing coordinates. It does not imply a "pigeonhole" grid where one character is placed into one cell. This is possible but would require the use of a monospaced font and a font size that exactly matches the cell size.

To identify the language that the subtitles are prepared for, the xml:lang attribute shall be specified on the tt:tt element.

xml:lang (attribute)

Type	xs:language | ""
Cardinality	1..1
STL mapping	Language Code (LC)
Description	The language in which the EBU-TT-D document is prepared unless specified more locally within the document content.

	The empty string may be used to indicate that no language information is available. The `xml:lang` attribute shall be used as defined in XML 1.0 § 2.12, "Language Identification" [3] (both values and semantics).
	Sample Values: "en", "en-US" or "de".
	Presentation processors should apply appropriate rendering for text that is identified as belonging to specific languages or language groups.
	`xml:lang` should not be used by a mechanism in the external context to identify the purpose or role of the document. For example a different mechanism would be required to distinguish between a "hard of hearing" and a "translation" subtitle document in the same language.[1]
	Note: The principal discussion of internationalization is out of scope of this specification but it is recommended that authors follow the internationalization recommendation by the W3C.[2]

3.1   Head

The head section of an EBU-TT-D document carries information needed by an implementation to correctly present or render the contained subtitles. Specific layout and styling information shall be defined in the head of an EBU-TT-D document. The subtitle content elements in the body reference this information.

Furthermore, the head section may contain metadata information.

tt:head (element)

Type	Element content
Cardinality	1..1
Description	Container element that groups styling, layout and metadata information.

3.1.1   Metadata in tt:head

ttm:copyright (element)

Type	Element content
Cardinality	0..1
Description	The copyright of the document. Sample Value: "© EBU 2014". The use of the metadata element `ebuttm:documentCopyright` as defined in EBU Tech 3350 EBU-TT Part 1 [5] is deprecated and `ttm:copyright` as defined in TTML 1.0 shall be used instead.

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[1] See http://www.w3.org/International/questions/qa-when-xmllang.en

[2] See http://www.w3.org/TR/xml-i18n-bp/, "Best Practice 1: Defining markup for natural language labelling"

The `tt:metadata` element inside the `tt:head` element is used as a generic container for metadata information that applies to the whole document. The content model defined in this section shall apply only to the use of the `tt:metadata` element inside the `tt:head` element.

tt:metadata (element)

Type	xs:string
Cardinality	0..1
Description	Generic metadata container.

3.1.1.1   Document metadata

The `ebuttm:documentMetadata` element is used for EBU-TT-D specific metadata that applies to the whole EBU-TT-D document. The `ebuttm:documentMetadata` element and all the children elements of `ebuttm:documentMetadata` shall be used only in the head section of an EBU-TT-D document.

ebuttm:documentMetadata (element)

Type	Element content
Cardinality	0..1
Description	Container of the EBU-TT-D metadata.

In accordance with the constraint on extensibility in § 2 all metadata elements that are defined in EBU-TT Part 1 [5] for the `ebuttm:documentMetadata` may also be part of the content model of that element in an EBU-TT-D instance. Please note that the following metadata elements should not be used in an EBU-TT-D document, because they have no meaning in the context of the distribution of subtitles:

- `ebuttm:documentReadingSpeed`
- `ebuttm:binaryData`[1]
- `ebuttm:documentOriginalProgrammeTitle`
- `ebuttm:documentOriginalEpisodeTitle`
- `ebuttm:documentTranslatedProgrammeTitle`
- `ebuttm:documentTranslatedEpisodeTitle`
- `ebuttm:documentTotalNumberOfSubtitles`
- `ebuttm:documentMaximumNumberOfDisplayableCharacterInAnyRow`
- `ebuttm:documentSubtitleListReferenceCode`
- `ebuttm:documentStartOfProgramme`

In addition the metadata element `ebuttm:documentCopyright` is deprecated and should not be used (see `ttm:copyright`).

The following additional metadata elements are defined by this specification. If used these

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[1] Please note that the list of not recommended metadata is based on the assumption that EBU-TT-D is only used for the distribution of subtitle text and is not used to embed subtitles as images.

elements shall be the first children of the `ebuttm:documentMetadata` element in the order documented below.

ebuttm:conformsToStandard(element)

Type	xs:anyURI
Cardinality	0..*
Description	Indicates the conformance with a specific standard that is derived from TTML. For EBU-TT-D the following URI shall be used: "urn:ebu:tt:distribution:2014-01"

ebuttm:authoredFrameRate (element)

Type	xs:positiveInteger
Cardinality	0..1
Description	The `ebuttm:authoredFrameRate` element is used to specify the frame rate that was assumed (or measured) by the author of the document for the related media object when the EBU-TT document was created. That rate may be assumed or measured and may have been used to calculate the begin and end times within the document based on the frame count within the related media object, even though the document does not itself express times using frames. The `ebuttm:authoredFrameRate` value is informative and should only be used for conformance and quality checking purposes for example to determine when the video playback rate of the related media object may differ from the expected playback rate when the subtitle document was authored (e.g. 24fps video played at 25fps by speeding up the playback rate by 1.0466%). Note: The semantics of this attribute are based upon those defined by `ttp:frameRate` in TTML 1.0.

ebuttm:authoredFrameRateMultiplier (element)

Type	ebuttdt:framerateMultiplierType
Cardinality	0..*
Description	The `ebuttm:authoredFrameRateMultiplier` element is used to specify a multiplier to be applied to the frame rate specified by an `ebuttm:authoredFrameRate` element in order to compute the effective frame rate. A frame rate multiplier is used when the desired frame rate cannot be expressed as an integral number of frames per second. The initial value is "1 1". Note: The semantics of this attribute are based upon those defined by `ttp:frameRateMultiplier` in TTML 1.0.

3.1.2   Styling in tt:head

The head section of an EBU-TT-D document shall contain one `tt:styling` element. The

`tt:styling` element is the container for styling information. It shall contain at least one `tt:style` child element.

tt:styling (element)

Type	Element content
Cardinality	1..1
Description	Container for styling information.

3.1.2.1   Style

A `tt:style` element defines a set of style information through style attributes. The `tt:div`, `tt:p` and `tt:span` elements in the body section, that enclose subtitle content, shall only use references to these specific style definitions.

> Note: EBU-TT-D uses referenced styling. EBU-TT-D does not use the direct specification of style attributes in the subtitle content elements (also known as inline styling).

tt:style (element)

Type	Element content
Cardinality	1..*
Description	Set of style information.

The `tt:style` element shall have an *ID* that is unique in the entire document instance. This *ID* is used by subtitle content elements and regions to reference the style element.

xml:id (attribute)

Type	xs:ID
Cardinality	1..1
Description	*ID* of a `tt:style` element that is used by other elements for reference.

> Note: The XML attribute `xml:id` (type `xs:ID`) is not only used by the `tt:style` element, but also by the `tt:region`, `tt:div`, `tt:p` and `tt:span` elements. By definition, a value of type `xs:ID` must be unique in the entire document. (See the W3C Specification Extensible Markup Language (XML) 1.0 and XML Schema Part 2: Datatypes [4]).
>
> This means, for example, that a `tt:style` element and a `tt:region` element must not have the same `xml:id` attribute value (e.g. "id1").

Style information is set using attribute values of the `tt:style` element.

> Note: The style attributes used in EBU-TT-D are a limited subset of TTML 1.0. An EBU-TT-D processor is not required to support TTML 1.0 style attributes that are not used in the EBU-TT-D specification.
>
> Style attributes that are not used in EBU-TT-D are amongst others `tts:display`,

> `tts:opacity`, `tts:visibility`, `tts:textOutline` and `tts:zIndex`.

In addition to the TTML 1.0 style attributes for the tt:style element, EBU-TT-D also defines style attributes for the `tt:region` element (see § 3.1.3.1 "Region"). The style attributes of the `tt:style` element as well as the style attributes of the `tt:region` element shall only appear inside the parent element they are defined for. This means that a style attribute that is defined for the `tt:style` element shall not appear in a `tt:region` element and vice versa

EBU-TT-D supports the following style information attributes in the `tt:style` element.

tts:direction (attribute)

Type	`xs:string`
Enumeration	"ltr" | "rtl"
Cardinality	0..1
Description	Directionality if bi-directional text is used.
	Note: Bi-directional text is text containing text in both text directions, right-to-left ("rtl") and left-to-right ("ltr").
	The Arabic and Hebrew scripts, notably, are written in a form known as right-to-left ("rtl"), in which writing begins at the right-hand side of a page and concludes at the left-hand side. This is different from the left-to-right ("ltr") direction used by most languages in the world.

tts:fontFamily (attribute)

Type	`ebuttdt:fontFamilyType`
Cardinality	0..1
Description	Font-family from which glyphs are selected.

tts:fontSize (attribute)

Type	`ebuttdt:distributionFontSizeType`
Cardinality	0..1
Description	The font-size of a glyph. Only one percentage value shall be specified.

tts:lineHeight (attribute)

Type	`ebuttdt:distributionLineHeightType`
Cardinality	0..1
Description	Inter-baseline separation between line areas. Only a percentage value or the string "normal" shall be specified.
	The semantics are defined as in TTML 1.0.
	Note: Authors should be aware that at the time of specification there is

	no uniform implementation of the value "normal" by CSS based rendering processors. It has been observed that different processors create different line heights for the same font specification.

tts:textAlign (attribute)

Type	`xs:string`
Enumeration	"left"	"center"	"right"| "start" |"end"
Cardinality	0..1
Description	Alignment of inline areas in a containing block. The alignment values "start" and "end" depend on the writing direction of the text which may be specified on a `tt:region` element with the attribute `tts:writingMode`. Example: In a left-to-right inline writing direction "start" has the same meaning as "left" alignment while in the top-to-bottom inline writing direction the alignment value "start" expresses "top-alignment".

tts:color (attribute)

Type	`ebuttdt:distributionColorType`
Cardinality	0..1
Description	Foreground color of an area. Note: In TTML 1.0 the initial value for `tts:color` is implementation dependent. In addition, EBU-TT-D recommends that in the absence of end-user preference information, a conformant presentation processor choose a color that is highly contrastive with the color of the video or other background behind the subtitle foreground rendering plane, to ensure readability. White or yellow are commonly used initial values for foreground color when displaying subtitles with a dark background color, but care must be taken to ensure sufficient contrast to maintain readability in case the background color is not specified and is therefore transparent.

tts:backgroundColor (attribute)

Type	`ebuttdt:distributionColorType`
Cardinality	0..1
Description	Background color of a region, a block area generated by a `tt:p` element or an inline area generated by a `tt:span` element.

tts:fontStyle (attribute)

Type	xs:string
Enumeration	"normal"	"italic"
Cardinality	0..1
Description	Font style that applies to glyphs.

tts:fontWeight (attribute)

Type	xs:string
Enumeration	"normal"	"bold"
Cardinality	0..1
Description	Font weight that applies to glyphs.

tts:textDecoration (attribute)

Type	xs:string
Enumeration	"none"	"underline"
Cardinality	0..1
Description	Whether a glyph is underlined.

tts:unicodeBidi (attribute)

Type	xs:string
Enumeration	"normal"	"embed"	"bidiOverride"
Cardinality	0..1
Description	Directional embedding or override according to the Unicode bidirectional algorithm. (see [2])

tts:wrapOption (attribute)

Type	xs:string
Enumeration	"wrap"	"noWrap"
Cardinality	0..1
Description	Defines whether or not automatic line wrapping (breaking) applies within the context of the affected element. If the value is "wrap" automated line-breaking shall occur if the line overflows the extent of the region that contains the corresponding content. If the value is "noWrap" no automated line-breaking shall occur. In the case when lines are longer than the available width of the region and "noWrap" is set, the overflow shall be treated in accordance with the specified value of the

	`tts:overflow` attribute of the corresponding region. If the value of the `tts:wrapOption` is set to "noWrap" the region that corresponds to the affected content should have the attribute `tts:overflow` set to "visible".

In addition to the style attributes from TTML 1.0 the new style attribute `ebutts:multiRowAlign` may be used as defined by EBU-TT Part 1. The `ebutts:multiRowAlign` attribute defines how multiple 'rows' of inline areas are aligned within a containing block area. See **Annex C** for a detailed description of how the attribute can be used.

ebutts:multiRowAlign (attribute)

Type	`xs:string`
Enumeration	"start" | "center" | "end" | "auto"
Cardinality	0..1
Description	Alignment of multiple 'rows' of inline areas within a containing block area. The initial values shall be "auto".

The style attribute `ebutts:linePadding` as applied to line areas is defined by EBU-TT-D. This attribute is used to apply padding (or inset space) on the start and end edges of rendered line areas.

See **Annex D** for a detailed description.

ebutts:linePadding (attribute)

Type	`ebuttdt:linePaddingType`
Cardinality	0..1
Description	Padding (or inset) space on the start and end edges of each rendered line-area It may be specified by the block-level elements `tt:body`, `tt:div` and `tt:p` by reference to a style element and is inherited. Background color applies to the area including the line padding. The initial value is "0c". Note: The application of padding affects the layout of text, for example by reducing the maximum width available in which to render text on a single line. It is recommended that document authors ensure that this is taken into account when calculating how much text can fit horizontally and vertically within a region.

3.1.3   Layout in tt:head

The EBU-TT-D head section shall contain one `tt:layout` element. The `tt:layout` element is a container element for layout information and shall contain at least one `tt:region` child element.

tt:layout (element)

Type	Element content
Cardinality	1..1
Description	Container for region elements.

3.1.3.1   Region

A `tt:region` element defines a space or an area in which subtitle content is to be placed. It specifies a set of layout information through attributes. To apply this layout information, `tt:div` or `tt:p` elements shall reference a region.

tt:region (element)

Type	Element content
Cardinality	1..*
Description	Defines a space or area for the display of subtitle content.

The `tt:region` element shall have an *ID* that is unique in the entire document instance. It shall be used by subtitle blocks (`tt:div` element or `tt:p` element) to refer to a particular layout.

xml:id (attribute)

Type	`xs:ID`
Cardinality	1..1
Description	*ID* of a region. This *ID* is used by `tt:div` and `tt:p` elements to reference a region. Layout and style information of the referenced region shall be applied to these elements.

The position and size of the region shall be set through the attributes `tts:extent` and `tts:origin`. The reference for `tts:extent` and `tts:origin` shall be the root container region (see "Definition of terms"). The region shall not extend outside the root container region.

> Note: The coordinates used when specifying `tts:extent` and `tts:origin` are expressed in percentages. Presentation implementations are expected to map these to device characteristics for optimum display of text. It is not expected that they are mapped to pixels in any associated encoded video.

tts:origin (attribute)

Type	ebuttdt:distributionOriginType
Cardinality	1..1
Description	The x and y coordinates of the top left corner of a region with respect to the root container region. The (0, 0) coordinate shall be assumed to be the top left corner of the root container region.
	Only percentage values shall be specified. The values shall be relative to the width and height of the root container region.
	The region shall not extend outside the root container region therefore the following constraints apply:
	• the sum of the value for the x-coordinate of the region and the value for the width of the region (specified by `tts:extent`) shall not be greater than 100%
	• the sum of the value for the y-coordinate of the region and the value for the height of the region (specified by `tts:extent`) shall not be greater than 100%
	Example:
	With `tts:origin=”20% 80%”` the top left corner of the region is shifted 20% of the root container region width to the right and 80% of the root container region height to the bottom.

tts:extent (attribute)

Type	ebuttdt:distributionExtentType
Cardinality	1..1
Description	Width and height of a region area. Only percentage values shall be specified. The values shall be relative to the width and height of the root container region.
	The region shall not extend outside the root container region therefore the following constraints apply:
	• the sum of the value for the x-coordinate of the region (specified by `tts:origin`) and the value for the width of the region shall not be greater than 100%
	• the sum of the value for the y-coordinate of the region (specified by `tts:origin`) and the value for the height of the region shall not be greater than 100%
	Example:
	With `tts:extent=”100% 20%”` the width of the region is 100% of the width of the root container region and the height of the region is 20% of the height of the root container region.

The `tt:region` element may also be used to apply style information to subtitles presented in this region. Therefore the `tt:region` element may reference zero or more `tt:style` elements from the styling section. The *ID*s of the referenced `tt:style` elements are specified in the `style` attribute of the `tt:region` element.

style (attribute)

Type	xs:IDREFS
Cardinality	0..1
Description	*ID*(s) of one or more style element(s). The style information shall be applied to `tt:div` or `tt:p` elements that reference the region. If multiple styles are referenced the *ID*s shall be delimited by space characters (e.g. "styleId1 styleId2 styleId3").

The `tt:region` element may also specify some layout-specific style information:

tts:displayAlign (attribute)

Type	xs:string
Enumeration	"before" | "center" | "after"
Cardinality	0..1
Description	Alignment in the block progression direction. Note: In the writing mode "Left to Right Top to Bottom" this will result in the vertical alignment of lines of text. The value "before" will result in "top" alignment and the value "after" will result in "bottom" alignment.

tts:padding (attribute)

Type	ebuttdt:distributionPaddingType
Cardinality	0..1
Description	Padding (or inset) space on all sides of a region area.

tts:writingMode (attribute)

Type	xs:string
Enumeration	"lrtb" | "rltb" | "tbrl" | "tblr" | "lr" | "rl" | "tb"
Cardinality	0..1
Description	Writing mode of subtitle content. "lrtp": "Left to Right Top to Bottom" "rltb": "Right to Left Top to Bottom" "tbrl": "Top to Bottom Right to Left" "tblr": "Top to Bottom Left to Right" "lr": Shorthand for "Left to Right Top to Bottom" "rl": Shorthand for "Right to Left Top to Bottom" "tb": Shorthand for "Top to Bottom Right to Left"

tts:showBackground (attribute)

Type	xs:string
Enumeration	"always" | "whenActive"
Cardinality	0..1
Description	Constraints on when the background color of a region is intended to be presented. If the value of this attribute is "always", then the background color of a region is always rendered when performing presentation processing on a visual medium; if the value is "whenActive", then the background color of a region is rendered only when some content is flowed into the region. Note: This attribute only needs to be specified if a non-transparent background color is applied to the region and the initial value of "always" needs to be overwritten. This attribute does not have an effect on the background color that is applied to a tt:p or a tt:span element. The background-color of these content elements is only rendered if the enclosed content is active.

tts:overflow (attribute)

Type	xs:string
Enumeration	"visible" | "hidden"
Cardinality	0..1
Description	Defines whether a region area is clipped if the content of the region overflows the specified extent of the region. If the value of this attribute is "visible", then content should not be clipped. If the value is hidden, then content that goes outside of the affected region should be clipped and is not visible. If the author intents to avoid truncated content the tts:overflow attribute should always be specified and be set to "visible". Note: Setting the feature to "visible" does not guarantee that content that overflows the region will be presented, e.g. if the content would need to overflow the root container region.

3.2   *Body*

The body section of an EBU-TT-D document carries the content of the subtitle and the timing information. Styling and layout shall be applied through references to `tt:style` and `tt:region` elements defined in the header section.

The `tt:body` element shall be the container for subtitle and timing information.

tt:body (element)

Type	Element content
Cardinality	0..1
Description	Container for subtitle and timing information. Note: An EBU-TT-D document with no body element could be used to transport just metadata, style- or layout information without subtitle content. An EBU-TT-D document with no body element can be considered as a TTML 1.0 document with no content.

Subtitle content shall be contained within the following elements of the body-section:

- `tt:p` (logical paragraph) as a child of a `tt:div` element
- `tt:span` (inline element to apply local style information or metadata) as a child of a `tt:p` element

Timing information shall be set using the following attributes:

- `begin`
- `end`

Timing information shall be specified on the `tt:p` or `tt:span` elements.

To apply style information a `tt:body` element may reference one or more `tt:style` element(s) with a `style` attribute.

style (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Description	*ID*(s) of one or more style element(s). The style information shall be applied to the enclosed content of the `tt:body` element. If multiple styles are referenced the *ID*s shall be delimited by space characters (e.g. "styleId1 styleId2 styleId3").

The `tt:body` element may have the attributes `ttm:role` and `ttm:agent`.

The semantics and the use of the `ttm:role` and `ttm:agent` attributes are defined in TTML 1.0 [1].

3.2.1   Div

The `tt:div` element shall be a logical container of textual content.

tt:div (element)

Type	Element content
Cardinality	1..*
Description	Container for textual content.

xml:id (attribute)

Type	`xs:ID`
Cardinality	0..1
Description	*ID* of a `tt:div` element that may be used by an external application.

To apply layout- and style-information the `tt:div` element may reference a `tt:region` element using a `region` attribute.

region (attribute)

Type	`xs:IDREF`
Cardinality	0..1
Description	Application of layout and style information through reference of a region. A region shall not be referenced by a `tt:div` element if a `tt:p` child of that `tt:div` references a region.

To apply style information a `tt:div` element may also reference one or more `tt:style` element(s) directly with a `style` attribute.

style (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Description	*ID*(s) of one or more style element(s). The style information shall be applied to the enclosed content of the `tt:div` element.
	If multiple styles are referenced the *ID*s shall be delimited by space characters (e.g. "styleId1 styleId2 styleId3").

The `tt:div` element may have the attributes `ttm:role` and `ttm:agent.`

The semantics and the use of the `ttm:role` and `ttm:agent` attributes are defined in TTML 1.0 [1].

The `xml:lang` attribute may be specified in the `tt:div` element to overwrite the language identification of the enclosed subtitle content.

xml:lang (attribute)

Type	xs:language | ""
Cardinality	0..1
Description	Language identifier for the enclosed subtitle content. The empty string may be used to indicate that no language information is available. The xml:lang attribute shall be used as defined in XML 1.0 § 2.12, Language Identification (both values and semantics) [3]. Sample Values: "en", "en-US" or "de". Presentation processors should apply appropriate rendering for text that is identified as belonging to specific languages or language groups. Consequently authors should correctly identify the language of the text at all places in the document when it is known.

3.2.1.1   Paragraph

A tt:p element shall represent a logical paragraph. The tt:p element may have textual content and zero or more tt:span elements.

tt:p (element)

Type	Mixed content.
Cardinality	1..*
Description	Logical paragraph.

The tt:p element shall have an *ID* that is unique in the entire document. This *ID* shall represent the unique *ID* of a subtitle. No meaningful subtitle sequence should be inferred from the value of this *ID*.

> Note: Typically this *ID* will be a monotonically (logically) increasing value through the EBU-TT-D document (e.g. sub1, sub2, sub3 or sub1, sub2, sub2a, sub2b, sub3).

xml:id (attribute)

Type	xs:ID
Cardinality	1..1
Description	Unique *ID* of a subtitle.

To indicate the authors intention of the use of white space (spaces, tabs, and blank lines) the `xml:space` attribute may be added.

xml:space (attribute)

Type	`xs:string`
Enumeration	"default" | "preserve"
Cardinality	0..1
Description	Indicates the author's intention of white space handling within the content of the `tt:p` element.

To overwrite the language identification of the enclosed subtitle content the `xml:lang` attribute may be specified on the `tt:p` element.

xml:lang (attribute)

Type	`xs:language | ""`
Cardinality	0..1
Description	Language identifier for the enclosed subtitle content. The empty string may be used to indicate that no language information is available. The `xml:lang` attribute shall be used as defined in XML 1.0 §2.12, Language Identification (both values and semantics) [3]. Sample Values: "en", "en-US" or "de". Presentation processors should apply appropriate rendering for text that is identified as belonging to specific languages or language groups. Consequently authors should correctly identify the language of the text at all places in the document when it is known.

To apply layout and style information the `tt:p` element may reference a `tt:region` element using a `region` attribute.

region (attribute)

Type	`xs:IDREF`
Cardinality	0..1
Description	Application of layout information through reference of a region. A `tt:p` element shall not reference a region if its parent `tt:div` element references a region.

To apply style information a `tt:p` element may reference one or more `tt:style` element(s) directly with a `style` attribute.

style (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Description	*ID*(s) of one or more style element(s). The style information shall be applied to the enclosed content of the `tt:p` element. If multiple styles are referenced the *ID*s shall be delimited by space characters (e.g. "styleId1 styleId2 styleId3").

The timing information of a `tt:p` element is set through the attributes `begin` and `end`.

If timing information is specified on a `tt:p` element, a `tt:span` child element of that `tt:p` element shall not specify timing information as well.

begin (attribute)

Type	`ebuttdt:distributionMediaTimingType`
Cardinality	0..1
Description	Start point of a temporal interval associated with a `tt:p` element. The syncbase on the timeline of the related media shall be specified by the external context.

end (attribute)

Type	`ebuttdt:distributionMediaTimingType`
Cardinality	0..1
Description	End point of a temporal interval associated with a `tt:p` element. The syncbase on the timeline of the related media shall be specified by the external context.

The `tt:p` element may have the attributes `ttm:role` and `ttm:agent`.

The semantics and the use of the `ttm:role` and `ttm:agent` attributes are defined in TTML 1.0 [1].

A `tt:br` element may be used to insert a forced line break.

tt:br (element)

Type	Element content
Cardinality	0..*
Description	Forced line break.

The `tt:br` element may have the TTML 1.0 attribute `ttm:role`.

The semantics and the use of the `ttm:role` attribute is defined in TTML 1.0 [1].

3.2.1.1.1 *Span*

The `tt:p` element may have zero or more `tt:span` element(s). The `tt:span` element may be used to apply style information to the enclosed textual content. This style information is added to or overwrites style information from the currently active context.

tt:span (element)

Type	Mixed content.
Cardinality	0..*
Description	Inline element to allow the application of local style information, annotation or metadata.

xml:id (attribute)

Type	`xs:ID`
Cardinality	0..1
Description	*ID* of a `tt:span` element that may be used by an external application.

To indicate the author's intent in the use of white space (spaces, tabs, and blank lines) the `xml:space` attribute may be added to the `tt:span` element.

xml:space (attribute)

Type	`xs:string`
Enumeration	"default" | "preserve"
Cardinality	0..1
Description	Indicates the authors' intention for white space handling within the content of the `tt:span` element.

To overwrite the language identification of the enclosed subtitle content the `xml:lang` attribute may be specified in the `tt:span` element.

xml:lang (attribute)

Type	`xs:language | ""`
Cardinality	0..1
Description	Language identifier for the enclosed subtitle content. The empty string may be used to indicate that no language information is available. The `xml:lang` attribute shall be used as defined in XML 1.0 §2.12, Language Identification (both values and semantics) [3].

	Sample Values: "en", "en-US" or "de". Presentation processors should apply appropriate rendering for text that is identified as belonging to specific languages or language groups. Consequently authors should correctly identify the language of the text at all places in the document when it is known.

To apply style information the `tt:span` element may reference one or more `tt:style` element(s) in the styling section of the document through the `tt:style` attribute.

style (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Description	*ID*(s) of one or more style element(s). The style information shall be applied to the enclosed content of the `tt:span` element. If multiple styles are referenced the *ID*s shall be delimited by space characters (e.g. "styleId1 styleId2 styleId3").

Timing information may be applied in a `tt:span` element through the attributes `begin` and `end`.

If timing information is specified on the `tt:span` element no timing information shall be present on the parent `tt:p` element.

begin (attribute)

Type	`ebuttdt:distributionMediaTimingType`
Cardinality	0..1
Description	Start point of a temporal interval associated with a `tt:span` element. The syncbase on the timeline of the related media shall be specified by the external context.

end (attribute)

Type	`ebuttdt:distributionMediaTimingType`
Cardinality	0..1
Description	End point of a temporal interval associated with a `tt:span` element. The syncbase on the timeline of the related media shall be specified by the external context.

The `tt:span` element may have the attributes `ttm:role` and `ttm:agent.`

The semantics and the use of the `ttm:role` and `ttm:agent` attributes are defined in TTML 1.0 [1].

A `tt:br` element may be used to insert a forced line break.

tt:br (element)

Type	Element content
Cardinality	0..*
Description	Forced line break.

The `tt:br` element may have the attribute `ttm:role`.

The semantics and the use of the `ttm:role` is defined in TTML 1.0 [1].

4. Datatypes

EBU-TT-D defines specific datatypes to restrict the content of attributes or textual Element content.

> Note: If a datatype is applied to an attribute that was taken from TTML 1.0 the restriction of the datatype is equal to the definition in TTML 1.0 or it is a further restriction of the content as defined in TTML 1.0. Therefore all values that conform to the EBU-TT-D datatypes also conform to the values allowed in TTML 1.0. However it is possible to create a value that conforms to the TTML 1.0 definitions but does not conform to the EBU-TT-D datatypes.

4.1 ebuttdt:cellResolutionType

The content shall be constrained to two numbers of type `xs:positiveInteger` delimited by a space. The first value shall define the number of columns and the second value shall define the number of rows.

4.2 ebuttdt:distributionColorType

The content shall be constrained to a hex notated RGB color triple or a hex notated RGBA color tuple.

> Note: The color black can, for example, be expressed as:

- "#000000" (RGB color triple in hex notation)
- "#000000FF" (RGBA color tuple in hex notation)

4.3 ebuttdt:distributionExtentType

The content shall be constrained to two values of type `ebuttdt:distributionLengthType` delimited by a space. The first value shall express the width and the second value the height.

4.4   ebuttdt:fontFamilyType

Note: The constraints of the `ebuttdt:fontFamilyType` are the same as the constraints defined by the TTML 1.0 style value expressions <familyName> and <genericFamilyName>.

The content shall be constrained to one or more comma separated font family- and/or generic family-names.

Any name may be used for a font family name (e.g. "Arial" or "Verdana").

The *generic* family name shall be selected from the following list:

- "default"
- "monospace"
- "sanserif"
- "serif"

- "monospaceSansSerif"
- "monospaceSerif"
- "proportionalSansSerif"
- "proportionalSerif"

The typographic characteristics of the generic family name "default" may be implementation dependent; however the default generic font family should be mapped to a monospaced, sans-serif font.

4.5   ebuttdt:distributionFontSizeType

The content shall be constrained to one value of type `ebuttdt:distributionLengthType`.

4.6   ebuttdt:framerateMultiplierType

The content shall be constrained to two numbers of type `xs:positiveInteger` delimited by a space. The value shall represent a fraction. The first number shall be the numerator and the second number shall be the denominator.

4.7   ebuttdt:distributionLengthType

The content shall be constrained to a non-negative number of type `xs:decimal` appended by the percentage sign "%". The metrics "c" (for cells) and "px" (for pixels) shall not be used.

4.8   ebuttdt:distributionLineHeightType

The value shall be the string "normal" or of type `ebuttdt:distributionLengthType`.

4.9   ebuttdt:distributionOriginType

The content shall be constrained to two values of type `ebuttdt:distributionLengthType` delimited by a space. The first value shall express a x-coordinate and the second value a y-coordinate.

4.10   ebuttdt:distributionPaddingType

The content shall be constrained to one or four values of type `ebuttdt:distributionLengthType` delimited by a space.

If only one value is specified the value shall apply to all four edges of an area.

If two values are specified, the first value applies to the before and after edges and the second applies to the start and end edges.

If three values are specified, the first value applies to the before edge, the second value applies to the start and end edges, and the third value applies to the after edge.

If four values are specified, the first value shall apply to the before edge, the second value to the end edge, the third value to the after edge and the fourth value to the start edge of an area.

Example

Padding on the start and end edges of a region can be expressed as:

- "0% 1%"
- "0% 1% 0%"
- "0% 1% 0% 1%"

4.11   ebuttdt:linePaddingType

The content shall be constrained to one non-negative number of type `xs:decimal` appended by the metric "c".

The reference for the metric "c" (for cells) is the virtual grid that is defined by `ttp:cellResolution`. 1c corresponds to one cell in this grid.

The value shall apply to the start and end edges of each rendered line area.

Example

Padding on the start and end edges of line-areas can be expressed as:

- "0.5c"

4.12   ebuttdt:distributionMediaTimingType

The content shall have the format *hours:minutes:seconds* followed by an optional *fraction*.

The number of hours shall not be restricted, minutes shall be constrained to [0..59] and seconds (including any fractional part) shall be constrained to the closest interval [0,60] where 60 applies only to leap seconds.

The *fraction* shall have a leading "." followed by a non-negative integer.

Example

- 01:00:10.250 = 1 hour, 10 seconds and 250 milliseconds

The fraction should be limited to three digits, when other requirements do not apply.

5.   Bibliography

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[3] **XML 1.0**   Tim Bray, et al. Extensible Markup Language (XML) 1.0 (Fifth Edition), W3C
                           Recommendation, 26 November 2008.
                           http://www.w3.org/TR/2008/REC-xml-20081126/

[4] **XML Schema   Paul Biron and Ashok Malhotra, XML Schema Part 2: Datatypes, W3C
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                           Media presentation description and segment formats

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Annex A: List of supported TTML features (Informative)

Please find below a list of TTML 1.0 features a presentation processor needs to support. Please note that this listing is for informative use only and is intended to simplify the comparison of EBU-TT-D with other specifications that are derived from TTML 1.0. EBU-TT-D extensions are not listed.

```
================================================================================
TTML 1.0 Profile Summary
================================================================================
Full Name of Profile: EBU-TT Distribution
Short Name of Profile: EBU-TT-D
Version: 1.0
Status of profile version: stable
================================================================================
Fully supported TTML 1.0 features
================================================================================
#bidi                                    #timeBase-media
#cellResolution                          #unicodeBidi
#content                                 #wrapOption
#direction                               #writingMode-horizontal-lr
#displayAlign                            #writingMode-horizontal-rl
#extent-region                           #writingMode-horizontal
#fontFamily-non-generic                  #writingMode-vertical
#fontFamily                              #writingMode
#fontSize-isomorphic
#fontStyle-italic
#fontWeight-bold
#fontWeight
#layout
#length-integer
#length-percentage
#length-positive
#length-real
#overflow-visible
#overflow
#padding-1
#padding-2
#padding-3
#padding-4
#showBackground
#structure
#styling-inheritance-content
#styling-inheritance-region
#styling-referential
#styling
#textAlign-absolute
#textAlign-relative
```

Constrained TTML 1.0 features

#backgroundColor-block
>   * The color shall be specified according to the constraints defined for
>   the feature color.

#backgroundColor-inline
>   * The color shall be specified according to the constraints defined for
>   the feature color.

#backgroundColor
>   * The color shall be specified according to the constraints defined for
>   the feature color.

#color
>   * The color shall be specified in hex notation.

#core
>   * The xml:lang attribute shall not be a child of an element other than
>   tt, div, p or span.
>   * The xml:id attribute shall not be a child of an element other than
>   style, region, div, p or span.
>   * The xml:id attribute shall be mandatory for the elements style,
>   region and p.
>   * The xml:space attribute shall not be a child of an element other than
>   tt, p and span.

#extent
>   * The value 'auto' shall not be used.

#fontSize
>   * The font-size shall be specified in percentage only. The metrics EM
>   ('em'), pixel ('px') and cell ('c') shall not be used.

#lineHeight
>   * Only the value 'normal' or percentage values shall be used.

#metadata
>   * Restrictions as defined EBU-TT-D and EBU-TT Tech 3350 apply.

#origin
>   * tts:origin shall not be child of an element other than region.
>   * The tts:origin attribute shall not have a value of 'auto'.

#padding
>   * The padding shall be specified in percentage only. The metrics EM
>   ('em'), pixel ('px') and cell ('c') shall not be used.

#presentation
>   * The TTML element profile shall not be used.

#textDecoration-under
>   * The value 'noUnderline' shall not be used.

#timing
>   * The attribute @dur shall not be used.
>   * If timing is specified on a tt:span the parent tt:p shall not specify
>   any timing as well.
>   * If timing is specified on a tt:p a child tt:span shall not specify
>   any timing as well.

#transformation
>   * The attribute @profile shall not be used.

Annex B: Overview Document structure (Informative)

The following is a syntactic representation of the EBU-TT-D document model. It is derived from the syntactic representation TTML 1.0 and the definition of the reduced XML Infoset in TTML 1.0.

ELEMENT INFORMATION ITEMS

```
<tt:tt
    ttp:timeBase = ( 'media' ) #REQUIRED
    xml:lang = ('' | <xs:language>) #REQUIRED
    ttp:cellResolution = [1-9][0-9]*<whiteSpace>[1-9][0-9]*
    xml:space = ('default'|'preserve')>
    Content: tt:head, tt:body?
</tt:tt>

<tt:head>
    Content: ttm:copyright?, tt:metadata?, tt:styling, tt:layout
</tt:head>

<ttm:copyright>
    Content: <xs:string>
</ttm:copyright>

<ttm:metadata>
    Content: As defined in section 2.2 of EBU-TT-D
</ttm:metadata>

<tt:styling>
    Content: tt:metadata?, tt:style+
</tt:styling>

<tt:style
    xml:id = <xs:ID> #REQUIRED
    tts:backgroundColor = <ebuttdt:distributionColorType>
    tts:color = <ebuttdt:distributionColorType>
    tts:direction = ( 'ltr' | 'rtl' )
    tts:fontFamily = As defined in TTML 1.0 [1], section 8.2.8
    tts:fontSize = <ebuttd:distributionLengthType>
    tts:fontStyle = ( 'normal' | 'italic' )
    tts:lineHeight = ('normal' | <ebuttd:distributionLengthType>)
    tts:fontWeight = ( 'normal' | 'bold' )
    tts:textAlign = ( 'left' | 'center' | 'right' | 'start' | 'end' )
    tts:textDecoration = ( 'none' | 'underline' )
    tts:unicodeBidi = ( 'normal' | 'embed' | 'bidiOverride' )
    tts:wrapOption = ( 'wrap' | 'noWrap' )
    ebutts:multiRowAlign = ('start' | 'center' | 'end' | 'auto')
    ebutts:linePadding = <ebuttdt:linePaddingType> >
    Content: tt:metadata?
</tt:style>
```

```
<tt:layout>
    Content: tt:metadata?, tt:region+
</tt:layout>

<tt:region
    xml:id = <xs:ID> #REQUIRED
    tts:origin = <ebuttd:distributionOriginType> #REQUIRED
    tts:extent = <ebuttd:distributionExtentType> #REQUIRED
    style = <xs:IDREFS>
    tts:displayAlign = ( 'before' | 'center' | 'after' )
    tts:overflow = ( 'visible' | 'hidden' )
    tts:padding = <ebuttdt:distributionPaddingType>
    tts:showBackground = ('always' | 'whenActive' )
    tts:writingMode = ('lrtb'| 'rltb' | 'tbrl' | 'tblr' | 'lr' | 'rl' | 'tb')>
    Content: tt:metadata?
</tt:region>

<tt:body
    style = <xs:IDREFS>
    ttm:agent = <xs:IDREFS>
    ttm:role = As defined in TTML 1.0 [1], section 12.2.2>
    Content: tt:metadata?, tt:div+
</tt:body>

<tt:div
    xml:id = <xs:ID>
    style = <xs:IDREFS>
    region = <xs:IDREF>
     xml:lang = ('' | <xs:language>)
    ttm:agent = <xs:IDREFS>
    ttm:role = As defined in TTML 1.0 [1], section 12.2.2>
    Content: tt:metadata?, tt:p+
</tt:div>

<tt:p
    xml:id = <xs:ID> #REQUIRED
    begin = <ebuttd:distributionTimingType>
    end = <ebuttd:distributionTimingType>
    style = <xs:IDREFS>
    region = <xs:IDREF>
    xml:lang = ('' | <xs:language>)
    xml:space = ('default'|'preserve')
    ttm:agent = <xs:IDREFS>
    ttm:role = As defined in TTML 1.0 [1], section 12.2.2>
    Content (Mixed): tt:metadata?, (tt:span|tt:br)*
</tt:p>
```

```
<tt:span
    xml:id = <xs:ID>
    begin = <ebuttd:distributionTimingType>
    end = <ebuttd:distributionTimingType>
    style = <xs:IDREFS>
    xml:lang = ('' | <xs:language>)
    xml:space = ('default'|'preserve')
    ttm:agent = <xs:IDREFS>
    ttm:role = As defined in TTML 1.0 [1], section 12.2.2>
    Content (Mixed): tt:metadata?, tt:br*
</tt:span>

<tt:br
    ttm:role = As defined in TTML 1.0 [1], section 12.2.2>
    Content: tt:metadata?
</tt:br>
```

EXPRESSIONS

```
<ebuttd:distributionOriginType>
    : <ebuttd:distributionLengthType> <whiteSpace> <ebuttd:distributionLengthType>

<ebuttd:distributionExtentType>
    : <ebuttd:distributionLengthType> <whiteSpace> <ebuttd:distributionLengthType>

<ebuttd:distributionLengthType>
    : non-negative-number "%"

    non-negative-number
        : non-negative-integer | non-negative-real

    non-negative-integer
        : [0-9]+

    non-negative-real
        : [0-9]* "." [0-9]+

<ebuttdt:distributionPaddingType>
    : ( dlt |
        dlt   dlt |
        dlt   dlt   dlt |
        dlt   dlt   dlt   dlt)
    dlt
        : <ebuttd:distributionLengthType>


<ebuttdt:linePaddingType >
    : non-negative-number "c"

    non-negative-number
        : non-negative-integer | non-negative-real
```

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```
non-negative-integer
    : [0-9]+

non-negative-real
    : [0-9]* "." [0-9]+


<ebuttd:distributionColorType>
    : "#" rrggbb
    | "#" rrggbbaa

    rrggbb
        : hexDigit{6}

    rrggbbaa
        : hexDigit{8}

    hexDigit
        : [0-9] | [a-f] | [A-F]

<ebuttd:timingType>
    : hours ":" minutes ":" seconds  fraction?

    hours
        : [0-9][0-9] | [0-9][0-9][0-9]+

    minutes
        : [0-5][0-9]

    seconds
        : [0-5][0-9] | 60

    fraction
        : "." [0-9]+

<whiteSpace> /*(space, carriage return, line feed, tab)*/
    : (#x20 | #x9 | #xD | #xA)+
```

Annex C: Use of ebutts:multiRowAlign

The `ebutts:multiRowAlign` attribute may be used to specify a style property that defines how multiple 'rows' of inline are aligned within a containing block area. This attribute shall act as a 'modifier' to the action defined by the `tts:textAlign` attribute value, whether that value is explicitly or implicitly defined. This attribute shall effectively create additional alignment points for multiple rows of text, thus it shall have no effect if only a single row of text is present.

This modifier shall act as follows: For multiple 'rows' of inline blocks, 3 additional multi-row alignment points ("start", "center", "end") are created by the rendered dimensions of the longest row within the `tt:p` element. 'Rows' that are shorter than the longest row shall be each aligned against the longest row using the multi-row alignment point identified by the `ebutts:multiRowAlign` attribute value. The longest 'row' shall always be aligned within the region in accordance with the value of the `tts:textAlign` attribute.

> Note: The combination of `tts:textAlign="start"` with `ebutts:multiRowAlign="start"` acts identically to the use of `tts:textAlign="start"` without the `ebutts:multiRowAlign` attribute.
>
> Or more simply, if the `ebutts:multiRowAlign` attribute has the same value as `tts:textAlign`, the `ebutts:multiRowAlign` attribute has no effect.

If the term "auto" is used the basic behaviour of `tts:textAlign` shall be maintained unmodified (i.e. the presentation shall be as if `ebutts:multiRowAlign` would have the same computed value as `tts:textAlign`).

The use of `tts:textAlign` together with `ebutts:multiRowAlign` provides combinations of text alignment as tabled below, where the highlighted combinations may be specified by the use of just the `tts:textAlign` attribute from TTML 1.0.

tts:textAlign	ebutts:multiRowAlign	Presentation
"start"	"start"	Start justified text. All 'rows' shall be aligned at start.
"start"	"center"	The longest 'row' shall be start aligned. Shorter 'rows' shall be center aligned against the center alignment point created by the longest 'row'.
"start"	"end"	The longest 'row' shall be start aligned. Shorter 'rows' shall be end aligned against the end alignment point created by the longest 'row'.
"left"	"start"	The longest 'row' shall be left aligned. Shorter 'rows' shall be start aligned against the start alignment point created by the longest 'row'.
"left"	"center"	The longest 'row' shall be left aligned. Shorter 'rows' shall be center aligned against the center alignment point created by the longest 'row'.
"left"	"end"	The longest 'row' shall be left aligned. Shorter 'rows' shall be end aligned against the end alignment point created by the longest 'row'.
"center"	"start"	The longest 'row' shall be center aligned. Shorter 'rows' shall be start aligned against the start alignment point created by the longest 'row'.
"center"	"center"	Center justified text. All 'rows' shall be individually center aligned.
"center"	"end"	The longest 'row' shall be center aligned. Shorter 'rows' shall be end aligned against the end alignment point created by the longest 'row'.
"right"	"start"	The longest 'row' shall be right aligned. Shorter 'rows' shall be start aligned against the start alignment point created by the longest 'row'.
"right"	"center"	The longest 'row' shall be right aligned. Shorter 'rows' shall be center aligned against the center alignment point created by the longest 'row'.
"right"	"end"	The longest 'row' shall be right aligned. Shorter 'rows' shall be end aligned against the end alignment point created by the longest 'row'.
"end"	"start"	The longest 'row' shall be end aligned. Shorter 'rows' shall be start aligned against the start alignment point created by the longest 'row'.
"end"	"center"	The longest 'row' shall be end aligned. Shorter 'rows' shall be center aligned against the center alignment point created by the longest 'row'.
"end"	"end"	End justified text. All 'rows' shall be aligned at end.

If a specified value of this attribute is not supported, then a presentation processor shall interpret the attribute as if the attribute has the value "auto" (i.e. the basic behaviour of `tts:textAlign` shall be maintained unmodified).

The `ebutts:multiRowAlign` style is illustrated by the following example.

```
 …
<tt:styling>
        <tt:style xml:id="baseStyle" tts:backgroundColor="#000000" tts:color="#FFFFFF" />
        <tt:style xml:id="startEnd" tts:textAlign="start" ebutts:multiRowAlign="end"/>
        <tt:style xml:id="centerStart" tts:textAlign="center" ebutts:multiRowAlign="start"/>
</tt:styling>

<tt:layout>
        <tt:region xml:id="regionTop" …./>
        <tt:region xml:id="regionBottom" …./>
</tt:layout>
 …
<tt:div style="baseStyle"">
 …
 <tt:p xml:id="subtitle1" region="regionTop" style="startEnd" begin="00:00:00" end="00:00:03">
        Beware the Jabberwock, my son!<tt:br/>
        The jaws that bite, the claws that catch!
 </tt:p>
 <tt:p xml:id=" subtitle2" region="regionBottom" style="centerStart" begin="00:00:00" end="00:00:03">
        Beware the Jubjub bird, and shun<tt:br/>
        The frumious Bandersnatch!
 </tt:p>
 …
</tt:div>
```
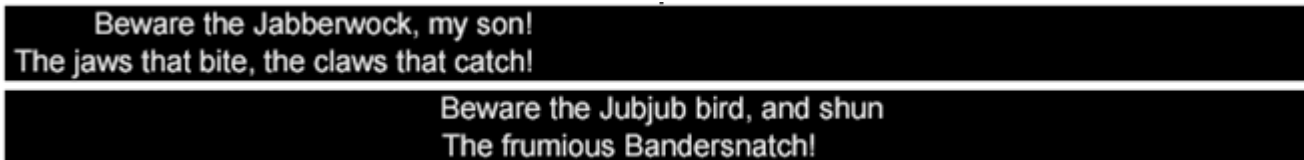
Produces:

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Annex D: Use of ebutts:linePadding

The `ebutts:linePadding` attribute extends the dimensions and therefore the 'background color' of a rendered line area. The 'line area' shall be a box that has boundaries set by the text rendered on one line (see rendered line area [foreground] in Figure 1).

The `ebutts:linePadding` attribute may be used to define a desired effect as shown below:

The background color shall be rendered by a presentation processor behind the foreground text content of the target, and extended to either side, in the inline progression, by the extent defined by the line padding attribute. The 'background color' used is the effective background color that applies to the text at the adjacent edge of the 'line area'.

The line padding extends the computed dimensions of the target line area and therefore reduces the available maximum width in which foreground text may be rendered, in the inline progression.

Note: One strategy is to make the start and end padding values equivalent to the width or half the width of a space character from the largest font used in the p element on which padding is applied, according to stylistic preference[1].

The use of the `ebutts:linePadding` attribute shall not result in the background color extending beyond the boundaries of a region. It may conversely result in fewer characters fitting on each line; therefore authors should ensure that the region is sized appropriately to fit the text including any line padding.
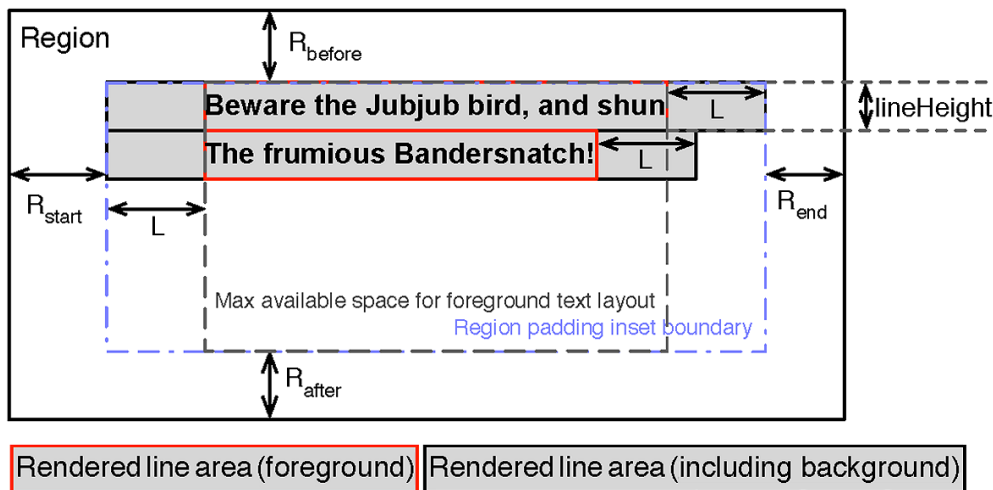
`tts:padding` as applied to `<region>` defines the R_{before}, R_{after}, R_{start} and R_{end} values.

`ebutts:linePadding` as applied to line areas defines the value L.

Figure 1: The application of `tts:padding` to regions and `ebutts:linePadding` to rendered line areas.

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[1] For example the YouView specification requires that implementations add background of the width of one space character to the left and right of the subtitle text.

The use of `ebutts:linePadding` is illustrated by the following EBU-TT-D example.

```xml
<tt xmlns ="http://www.w3.org/ns/ttml">
  <head>
      <styling>
              <style xml:id="defaultStyle" tts:color="#FFFFFF" tts:textAlign="center"/>
              <style xml:id="noPadding" ebutts:linePadding="0c"/>
              <style xml:id="withLinePadding" ebutts:linePadding="0.5c"/>
              <style xml:id="bgBlack" tts:backgroundColor="#000000">
              <style xml:id="yellowText" tts:color="#FFFF00">
      </styling>
      <layout>
              <region xml:id="region1" tts:extent="100% 20%" …/>
              <region xml:id="region2" tts:extent="100% 20%" …/>
      </layout>
  </head>
  <body style="defaultStyle">
      <div>
              <p xml:id="sub1" region="region1" style="noPadding">
                      <span style="bgBlack">Some </span>
                      <span style="yellowText bgBlack">centered </span>
                      <span style="bgBlack">text</span>
                      <br/>
                      <span style="bgBlack">on two lines.</span>
              </p>

              <p xml:id="sub1" region="region2" style="withLinePadding">
                      <span style="bgBlack">Some </span>
                      <span style="yellowText bgBlack">centered </span>
                      <span style="bgBlack">text</span>
                      <br/>
                      <span style="bgBlack">on two lines.</span>
              </p>
      </div>
  </body>
</tt>
```
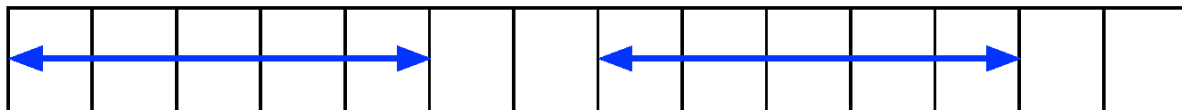
Produces:

## Annex E: Time alignment of subtitles relative to video frames (Informative)

Subtitles for video are typically authored against video at a nominal frame rate, e.g. 25 frames per second. When a viewer plays back associated video with the subtitles the actual frame rate might change. The distribution mechanism will use an encoded frame rate that could be the same as the original, or, if network conditions are insufficient, it could select a lower encoded frame rate. Then the display device might use interpolation to create the appearance of more frames per second than were actually received.

In most cases the subtitles are an accessible version of the audio that accompanies the video. If that audio can be played back smoothly the display device is expected to attempt to render and remove subtitles as close as possible to their respective begin and end times, regardless of the actual displayed frame rate. The progression of time through the media and the subtitles, as experienced by the viewer, remains the same even if the video frame refresh rate changes.

Subtitle duration timed to coincide with original frame rate

Half frame rate related video media object
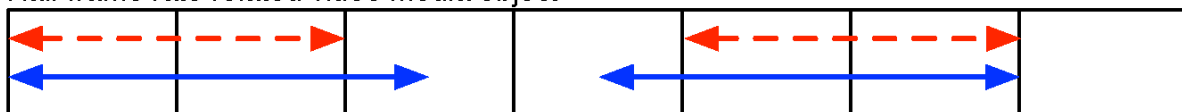
One third frame rate related video media object

Incorrect subtitle duration   Correct subtitle duration

Figure 2: The potential temporal display errors that could be introduced by frame-based subtitle time quantisation.

Rendering devices that do not honour the begin and end times, for example if they attempt to quantise those times to the nearest appropriate encoded video frame, will cause temporal display errors. See Figure 2 above which shows in principle how those quantisation errors could lead to reduced display duration for a subtitle, which in turn would increase the required reading speed.