EBU

OPERATING EUROVISION AND EURORADIO

TECH 3350

EBU-TT, PART 1
SUBTITLING FORMAT DEFINITION

VERSION 1.2

SOURCE: SP/MIM – XML SUBTITLES

Geneva
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There are blank pages throughout this document. This document is paginated for two sided printing

Conformance Notation

This document contains both normative text and informative text.

All text is normative except for that in the Introduction, Examples, 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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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.

Part 3: EBU-TT in Live Subtitling applications: system model and content profile for authoring and contributions (EBU Tech 3370)
How to use EBU-TT for the production and contribution of live subtitles.

EBU-TT WebSocket Carriage Specification (EBU Tech 3370s1)
Carriage of EBU-TT Part 3 over WebSocket

EBU-TT, Part 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).

EBU-TT, Part M: Metadata Definitions (EBU Tech 3390)
Definition of metadata elements and attributes for use in EBU-TT documents

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').

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

EBU-TT Part 1
Subtitling Format Definition

EBU Committee	*First Issued*	*Revised*	*Re-issued*
TC	Jan. 2012	Sept. 2012, 2017	

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

Scope (Informative)

Subtitles are created, edited, exchanged and archived in many different ways. At one extreme subtitles may be closely linked to the video, e.g. as burned-in (so-called open, or forced) subtitles in the video, at the other extreme they may be loosely coupled to the audio/video essence (e.g. stored on an external storage medium and associated with the video at the moment of playout/viewing).

The aim of this publication is to specify an XML based archiving and interchange format for subtitles as follow-up to the currently widely used EBU STL format (EBU Tech 3264) [1]. The EBU has developed a recommendation on transport of subtitles using MXF in an IT-Based Television Production Environment (EBU R 133) [2] and has been investigating implementations that are in use today. Harmonization is needed to obtain predictable and reliable results when interchanging subtitle files and when integrating new products into TV production environments.

Version 1.2 of EBU Tech 3350 (EBU-TT Part 1) is the second update since the Version 1.0 publication in August 2012. The main requirements that have been resolved by this revision are:

- Alignment with the EBU specifications Tech 3360 [3], Tech 3370 [4] and Tech 3390 (Part M) [5].
- Extraction of the EBU-TT metadata elements and attributes which are now defined in EBU-TT Part M.
- Deprecation of `tts:padding` for `tt:p` and `tt:span`.
- Relaxation of the extensibility options for custom attributes.
- Relaxation of the allowance for EBU-TT and TTML metadata vocabulary.
- Allowance of the value continuous for the `ttp:markerMode` attribute.
- Allowance of begin and end attributes on body and div elements.
- Make begin and end attributes optional for `tt:p`.
- Integration of Errata for issues identified in Version 1.1.
- Clarification on different topics.

This update keeps backward compatibility with the previous versions 1.0 and 1.1:

Every document that is valid against the Version 1.0 or 1.1 specifications is also valid against the Version 1.2 specification; however the reverse may not be true. Please also not that the following has been deprecated in version 1.1 and may be removed from future version of EBU-TT Part 1:

- The use of `ebuttm:documentMetadata` (see also Section 4 of Part M)
- The use of `tts:padding` for `tt:p` and `tt:span`.

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 file representation for captions and subtitles is identical.

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

Active video

The term "active video" (known alias: Production Aperture) refers to the portion of the video signal that is used to carry picture information, as specified in SMPTE ST 2016-1:2009 Chapter 4 [6].[1]

Active image

The term "active image" refers to the portion of the video picture area that is being utilized for programme content, as specified in SMPTE ST 2016-1:2009 Chapter 4. The active image excludes letter-box bars and pillar-box bars.

1. Introduction

1.1 Background

The introduction of higher resolution television formats (HDTV), user demands for improved presentation, the switch to file-based production workflows and the multiplication of web-based distribution mechanisms, require a new XML based subtitling format that can retain its timing characteristics during the creation and transport of subtitles.

The introduction of HDTV has created new expectations, including displaying subtitles in different and more user-friendly ways. This recommendation aims to support these new requirements.

To enhance the quality of the subtitler's work more efficient automation processes are needed, allowing a subtitler to add value to the subtitles by using his contextual knowledge, cultural awareness and special skills.

Reliable exchange mechanisms are especially important for the creation of subtitles, which often takes place in external production houses or at home using a wide variety of different platforms and applications.

1.2 EBU-TT as exchange format

EBU-TT is intended as general purpose exchange format for subtitles and supports Unicode characters. As an exchange format EBU-TT intrinsically also is an archiving format (see Figure 1).[2] EBU-TT can also be used as a production format. Whilst it is good practice to validate EBU-TT documents for their conformance against this specification, especially at interchange points, it is likely that additional validation requirements will be needed for specific workflows.

[1] Note that in EBU Tech 3380 (EBU-TT Part D) [7] the reference for calculation of spatial values when rendering over a related video media object is not the active video but the rendering plane of the video object.

[2] The streaming of subtitles that may be created live in real time for live broadcast programmes is covered by EBU-TT Part 3.

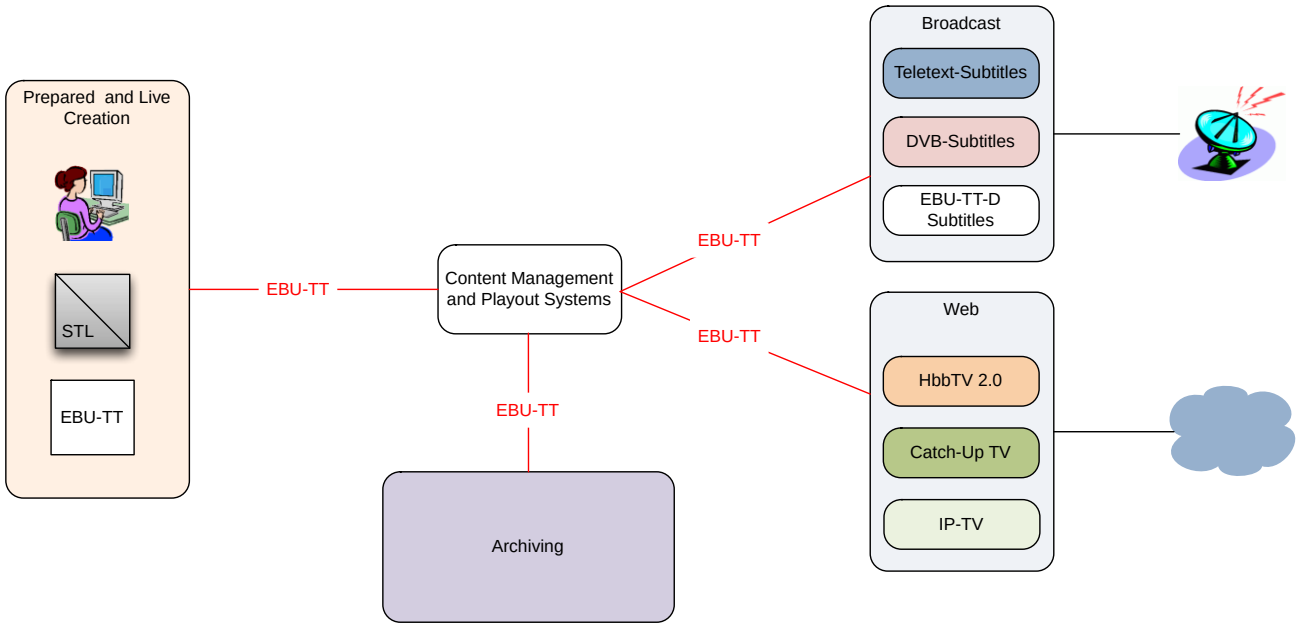

Figure 1: Subtitle workflow with EBU-TT

1.3 Relation to other specifications

EBU-TT uses a subset of the vocabulary provided by the W3C Timed Text Markup Language 1 (TTML1) (Second Edition) [8], hereafter referred to as TTML 1.0. This W3C standard was formerly known as “Timed Text (TT) Authoring Format 1.0 – Distribution Format Exchange Profile (DFXP)”.

The EBU-TT format is intended to constrain the features provided by TTML1.0, especially to make EBU-TT more suitable for the use with broadcast video and web video applications.

Valid EBU-TT documents are, by definition of TTML 1.0, valid W3C TTML documents. Note however that it is possible to construct valid W3C TTML documents that are not valid EBU-TT documents.

Like the EBU-TT specification, the SMPTE Standard ST 2052-1:2010 (SMPTE-TT) [9] is derived from TTML too. Valid EBU-TT documents are, by the definition of the SMPTE-Standard, valid SMPTE-TT documents but it is possible to construct valid SMPTE-TT documents that are not valid EBU-TT documents.

2. Generic constraints

The EBU-TT format defines constraints for an XML document instance. A valid EBU-TT 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.

To indicate conformance to this spec an `ebuttm:conformsToStandard` element shall be specified as child of a `tt:metadata` element of `tt:head`. The value of the element should be “urn:ebu:tt:exchange:2017-05”.

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 Metadata and extensibility

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 (see § 3 “Document Structure”).

`tt:metadata` may be used as extension point for custom metadata elements. Arbitrary foreign namespace elements may be added as child elements. A foreign namespace is any XML namespace not defined by an EBU-TT specification and not defined by TTML 1.

The content model of the `tt:metadata` element shall be as defined in TTML 1.0 unless further constraint by this specification.

Attributes in the EBU-TT metadata namespace ("urn:ebu:tt:metadata") may appear on any element although they shall be significant only on elements defined by an EBU-TT specification.

Attributes defined by EBU-TT which are not in the EBU-TT metadata namespace (e.g. `ebutts:multiRowAlign`) shall not appear on any other element as defined in EBU-TT.

Attributes in the TTML metadata namespace ("http://www.w3.org/ns/ttml#metadata") may appear on any TTML element where TTML 1 permits the use of attributes in that namespace. The content models of the elements `tt:body`, `tt:div`, `tt:p`, `tt:span` and `tt:br` allow the use of attributes in the TTML metadata namespace.

Attributes in a namespace not defined by an EBU-TT specification and not defined by TTML 1 may appear on any element defined by EBU-TT or TTML1.

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 specification does not override these initial values and for any TTML 1.0 attribute that is used in an EBU-TT document the initial value as specified in TTML 1.0 shall apply.

For completeness, all initial values that are used by EBU-TT are listed in **Annex C** "Initial Values of TTML 1.0 and EBU-TT attributes".

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 document it is recommended that attributes and their values be explicitly specified rather than relying on their initial values.

Note: Version 1.0 of EBU-TT Part 1 overrides the initial values for the following TTML attributes: `ttp:cellResolution`, `tts:fontSize`,`tts:displayAlign` and `tts:textAlign`. To achieve better interoperability with other TTML profiles in Version 1.1 of EBU-TT Part 1 and later versions the initial values from TTML 1.0 apply for these attributes. Users are advised that documents that rely on initial values can appear differently when presented according to Version 1.0 vs Version 1.1 and later.

2.4 Compatibility with TTML 1.0 timing model

With the constraints defined in EBU-TT the time containers `tt:body` and `tt:div` have, according to the TTML 1.0 event based timing model, no specified duration. However, in EBU-TT the time expressions in the `begin` and `end` attributes of their children elements (`tt:p` and `tt:span`) may nonetheless activate and deactivate the enclosed subtitle content.

2.5 Unicode support

EBU-TT processing and transformation engines should support Unicode characters and the Unicode bidirectional algorithm (UAX9) [10].

2.6 White space handling

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

In accordance with the W3C XML 1.0 Specification [11], the value "default" signals that the default white-space processing modes of the processing application are acceptable for this element; the value "preserve" indicates the intent that applications preserve all the white space.

This declared intent is considered to apply to all elements within the content of the element where it is specified, unless overridden with another instance of the `xml:space` attribute.

2.7 Fonts (Informative)

The correct, or expected, rendering of text is dependent on several factors, including the display resolution, the font layout algorithm and the font selected, for example. It is not always reasonable to expect that all presentation processors will find the same glyph for every Unicode code point in content with a given value of `tts:fontFamily`, and that any particular line of text will always occupy the same size block of pixels.

However it is important that the author's intent in the presentation of a specific piece of subtitle text is honoured as closely as possible. In particular, text ought not to occupy more space than has

been allocated, lest there be unwanted line breaks or overflows, and all glyphs should be presented accurately.

In a broadcast context the creation point of an EBU-TT Part 1 document is likely to be an authoring station of some sort, and the primary consumption point is typically an encoder, for example a processor that creates an EBU-TT-D output, or one that rasterises the input into a bitmap graphic. To varied extents, the organisations involved can arrange some shared resources or knowledge to minimise the differences in behaviour between author and encoder. They may for example agree a specific font or set of fonts in which the output is permitted to be presented.

Put simply, each font resource (which could be stored as a font 'file') describes a set of glyphs, each corresponding to a code point, with instructions on how to draw each glyph and metrics such as size and spacing. Different variants of font can exist, each with a different font resource for different font weights (normal or bold), or for different font styles (normal, italic). The font therefore defines a substantial set of the information that could usefully be shared between author and encoder to minimise those differences in behaviour.

When rendering an EBU-TT document every implementation needs to map the processed set of styles for any content, including `tts:fontFamily`, `tts:fontWeight`, `tts:fontStyle` and the computed font size into a set of glyphs and metrics obtained from an appropriate font resource. The `tts:fontFamily` name does not have to map directly to the file name of an installed font, for example. EBU-TT Part 1 does not specify an executive mechanism to direct processors in exactly how they must do this. However it does offer some metadata that can be used to identify when there is a mismatch between author and processor in which font resources are to be, or have been, used.

The `ebuttm:font` element can be used to specify a URI to indicate which font resource was used when authoring the document, for a given combination of font family name, weight and style, and for bitmap fonts, size. This URI could be a filename, an address on a local server, or perhaps a URL pointing to a globally available resource. If a downstream processor needs to render the content and is not able to recognise or dereference that URI, it could present a warning that there is a potential problem that needs to be addressed. This therefore can be used operationally as a check to help ensure that authored documents are likely to be presented correctly.

Of course there remain other variables that could differ, and that have an impact here, such as the text layout algorithm, however those variables are likely to remain static for any particular chain of equipment and can therefore be managed at setup time rather than on a document by document basis.

2.8 Document Structure

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

The formal definition of how the EBU-TT 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 the position in the document instance.

Example:

The definition of `xml:id` attribute in § 3.1.3.2 "`tt: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.
Position	The position of an element or attribute in an EBU-TT Document as XPATH expression starting with the document root "/". A default namespace of "http://www.w3.org/ns/ttml" is assumed and the prefix "tt" is omitted in the XPATH expression.
TTML	The URL to the specific chapter in the TTML 1.0 specification where the attribute or element is defined. The normative constraints of TTML 1.0 apply unless they are further constrained by this specification.[3]

3. tt:tt

Type	Element content
Cardinality	1..1
Position	/
TTML	http://www.w3.org/TR/ttml1/#document-structure-vocabulary-tt
Description	Root element. Every EBU-TT document instance shall start with the `tt:tt` element. In XML terms this element is the root element of the document.

xml:space (attribute)

Type	`xs:string`
Enumeration	"default" | "preserve"
Cardinality	0..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#content-attribute-space
Description	Indicates the author's intent in the handling of white space (spaces, tabs, and blank lines) within the content of the EBU-TT document.

[3] At time of publication the links are based on the TTML version specified at [8].

ttp:timeBase (attribute)

Type	`xs:string`
Enumeration	"smpte" | "media" | "clock"
Cardinality	1..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#parameter-attribute-timeBase
Description	The timebase defines the time coordinate system for all time expressions in EBU-TT. If the timebase is "smpte" time expressions of `begin` and `end` attributes of the subtitle content shall be interpreted in the time coordinate system of SMPTE 12M-1-2008 and shall be of type `ebuttdt:smpteTimingType`. Additionally if the timebase is "smpte" the attributes `ttp:markerMode` and `ttp:dropMode` shall be specified on the `tt:element`. If the timebase is "media" then all time expressions of `begin` and `end` attributes of the subtitle content shall denote a coordinate on the time line of a media object and shall be of type `ebuttdt:mediaTimingType`. Note: The timebase "media" is intended to use the playtime of any associated video or other related media object as a synchronisation reference. If the timebase is "clock" then all `begin` and `end` attributes of the subtitle content shall denote a coordinate in some real-world time line and shall be of type `ebuttdt:clockTimingType`. Note: The value "clock" does not refer to specific semantics of "wallclock". The term "wallclock" is sometimes used within broadcasting environments to refer to a shared source of SMPTE timecode; if time expressions are intended to match such a clock it is reasonable to set `ttp:timeBase`="smpte".

ttp:frameRate (attribute)

Type	`xs:positiveInteger`
Cardinality	0..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#parameter-attribute-frameRate
Description	The frame rate used to interpret time expressions of type `ebuttdt:smpteTimingType` . The frame rate applies to the entire document instance. The positive sign ("+") shall not be used. If the timebase is "smpte" the `ttp:frameRate` shall be specified. Sample Value: "25"

ttp:frameRateMultiplier (attribute)

Type	`ebuttdt:frameRateMultiplierType`
Cardinality	0..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#parameter-attribute-frameRateMultiplier
Description	Multiplier that shall be applied to the frame rate specified by a `ttp:frameRate` attribute in order to compute the effective frame rate. If the frame rate is a whole number of frames per second the value for the `ttp:frameRateMultiplier` attribute shall be "1 1". If the timebase is "smpte" the `ttp:frameRateMultiplier` shall be specified. Example: The frame rate multiplier used for synchronizing with video objects at 30 frames per second is nominally 1000:1001. The value for the `ttp:frameRateMultiplier` attribute would accordingly be "1000 1001".

ttp:markerMode (attribute)

Type	`xs:string`
Enumeration	"continuous" | "discontinuous"
Cardinality	0..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#parameter-attribute-markerMode
Description	If the timebase is "smpte" `ttp:markerMode` shall be specified. If the parameter's value is "continuous", then time expressions shall be assumed to be coordinates on a monotonically increasing timeline. The value "discontinuous" implies that this EBU-TT document is using the marker mode of operation and no assumption may be made regarding linearity or monotonicity of time coordinates. Note: The value "discontinuous" does not necessarily imply non-linearities in the timeline of the associated video. It is meant as a reminder that time expressions must be understood as markers and that there are no guarantees that calculations of duration and intervals between markers based on the timecode values alone are correct.

ttp:dropMode (attribute)

Type	`xs:string`
Enumeration	"nonDrop" | "dropNTSC" | "dropPAL"
Cardinality	0..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#parameter-attribute-dropMode
Description	`ttp:dropMode` specifies constraints on the interpretation and use of frame

	counts that correspond with time expressions of type `ebuttdt:smpteTimingType`. The attribute shall be specified when the value of the `ttp:timebase` attribute is "smpte". When the timebase is "smpte" and the calculation of the framerate from the `ttp:frameRate` and `ttp:frameRateMultiplier` results in an integer framerate then `ttp:dropMode` shall always be "nonDrop". The semantics of the values "nonDrop", "dropNTSC" and "dropPAL" are defined in the W3C Timed Text Markup Language (TTML) 1.0.

ttp:clockMode (attribute)

Type	`xs:string`
Enumeration	"local" | "gps" | "utc"
Cardinality	0..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#parameter-attribute-clockMode
Description	`ttp:clockMode` specifies the interpretation of time expressions when `ttp:timebase` is set to clock. The attribute shall be specified when the value of the `ttp:timebase` attribute is "clock". The semantics of the values "local", "gps" and "utc" are defined in TTML 1.0.

ttp:cellResolution (attribute)

Type	`ebuttdt:cellResolutionType`
Cardinality	0..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#parameter-attribute-cellResolution
Description	Expresses a virtual visual grid composed of horizontal and vertical cells. This grid divides the active video (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. If an EBU-TT document instance uses the ‘cell’ measurement unit (e.g. as part of a `tts:fontSize` attribute value) then the `ttp:cellResolution` attribute shall be specified. 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. Note: The initial value of `ttp:cellResolution` was "40 24" in EBU-TT Part 1 v1.0 and has been changed for better interoperability with

	TTML 1.0.

tts:extent (attribute)

Type	`ebuttdt:extentType`
Cardinality	0..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#style-attribute-extent
Description	Defines the width and height of the active video (see "Definition of terms") the subtitles were authored for. Only length expressions in pixels shall be used. If an EBU-TT document instance uses the 'pixel' measurement unit (e.g. as part of a `tts:fontSize` attribute value) then the `tts:extent` attribute shall be specified on the `tt:tt` element. Sample Value: "1280px 720px"

xml:lang (attribute)

Type	`xs:language	""`
Cardinality	1..1
STL mapping	Language Code (LC)
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#content-attribute-lang
Description	The language for which the EBU-TT document is prepared unless specified more locally within the document. 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" [11]. Sample Values: "en", "en-US" or "de". 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. [4] 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.[5]

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

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

3.1 tt:head

Type	Element content
Cardinality	1..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#document-structure-vocabulary-head
Description	Container element that groups styling, layout and metadata information. The head section of an EBU-TT 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 document. The content elements in the body reference this information.

3.1.1 tt:metadata

Type	Element content
Cardinality	0..1
Position	/tt/head
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-metadata
Description	Generic metadata container. The `tt:metadata` element inside the `tt:head` element is used as a generic container for metadata information that applies to the whole document. `tt:metadata` may have user defined XML vocabulary as defined in § 2.2.

3.1.2 ttm:copyright

Type	xs:string
Cardinality	0..1
Position	/tt/head
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-copyright
Description	The copyright of the document. Sample Value: "© EBU 2015". The use of the metadata element `ebuttm:documentCopyright` is deprecated and `ttm:copyright` as defined in TTML 1.0 shall be used instead.

3.1.3 tt:styling

Type	Element content
Cardinality	1..1
Position	/tt/head
TTML	http://www.w3.org/TR/ttml1/#styling-vocabulary-styling
Description	Container for styling information.

3.1.3.1 tt:metadata

Type	Element content
Cardinality	0..1
Position	/tt/head/styling
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-metadata
Description	Generic metadata container. `tt:metadata` may have user defined XML vocabulary as defined in § 2.2.

3.1.3.2 tt:style

Type	Element content
Cardinality	1..*
Position	/tt/head/styling
TTML	http://www.w3.org/TR/ttml1/#styling-vocabulary-style
Description	Set of style information. 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 uses referenced styling. EBU-TT does not use the direct specification of style attributes in the subtitle content elements (also known as inline styling).

xml:id (attribute)

Type	`xs:ID`
Cardinality	1..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#content-attribute-id
Description	*ID* of a `tt:style` element. The *ID* shall be unique in the entire document instance. It is used by `tt:body`, `tt:div`, `tt:p` and `tt:span` elements to reference the style element. 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 [11] and XML Schema Part 2: Datatypes [12]). 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 (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-style
Description	*ID*(s) of other style element(s). To "inherit" style information the `tt:style` element may itself reference one or

	more other `tt:style` elements. Style information from the referenced styles shall be inherited. If multiple styles are referenced the *ID*s shall be delimited by space characters (e.g. "styleId1 styleId2 styleId3").

Note: The style attributes used in EBU-TT are a limited subset of TTML 1.0. An EBU-TT processor is not required to support TTML 1.0 style attributes that are not used in the EBU-TT specification.

Style attributes that are not used in EBU-TT are amongst others `tts:display`, `tts:opacity`, `tts:visibility`, `tts:textOutline` and `tts:zIndex`.

In addition to the TTML 1.0 style attributes listed below, EBU-TT 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. The only exception from this rule is the `tts:padding` attribute. `tts:padding` may appear both in the `tt:style` and `tt:region element`.

Note: See Annex F for an overview which style attributes are allowed on the `tt:style` and which are allowed on the `tt:region` element.

tts:direction (attribute)

Type	`xs:string`
Enumeration	"ltr" | "rtl"
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-direction
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
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-fontFamily
Description	Font-family from which glyphs are selected.

tts:fontSize (attribute)

Type	`ebuttdt:fontSizeType`
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-fontSize
Description	The font-size of a glyph.

tts:lineHeight (attribute)

Type	`ebuttdt:lineHeightType`
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-lineHeight
Description	Inter-baseline separation between line areas. If the value is "normal" then the line height shall be the same as the largest font size that applies to any descendent element.

tts:textAlign (attribute)

Type	`xs:string`
Enumeration	"left" | "center" | "right"| "start" |"end"
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-textAlign
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`. Note: The initial value of `tts:textAlign` was "center" in EBU-TT Part 1 v1.0 and has been changed to "start" for better interoperability with TTML 1.0. 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:colorType`
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-color
Description	Foreground color of an area. Note: In TTML 1.0 the initial value for `tts:color` is implementation dependent.

tts:backgroundColor (attribute)

Type	`ebuttdt:colorType`
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-backgroundColor
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
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-fontStyle
Description	Font style that applies to glyphs.

tts:fontWeight (attribute)

Type	`xs:string`
Enumeration	"normal" | "bold"
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-fontWeight
Description	Font weight that applies to glyphs.

tts:textDecoration (attribute)

Type	`xs:string`
Enumeration	"none" | "underline"
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-textDecoration
Description	Whether a glyph is underlined.

tts:unicodeBidi (attribute)

Type	`xs:string`
Enumeration	"normal" | "embed" | "bidiOverride"
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-unicodeBidi
Description	Directional embedding or override according to the Unicode bidirectional algorithm. (see [10])

tts:wrapOption (attribute)

Type	`xs:string`
Enumeration	"wrap" | "noWrap"
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-wrapOption
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".

tts:padding (attribute)

Type	`ebuttdt:paddingType`
Cardinality	0..1
Position	/tt/head/styling/style
TTML	http://www.w3.org/TR/ttml1/#style-attribute-padding
Description	Padding (or inset) space on all sides of a block area generated by a `tt:p` element or an inline area generated by a `tt:span` element. The use of tts:padding for `tt:p` and `tt:span` is deprecated. It should not be specified on a `tt:style` element.

ebutts:multiRowAlign (attribute)

Type	`xs:string`
Enumeration	"star" | "center" | "end" | "auto"
Initial	"auto"
Applies to	`tt:p`
Inherited:	Yes
Cardinality	0..1
Position	/tt/head/styling/style
Description	Alignment of multiple 'rows' of inline areas within a containing block area. Note: `ebutts:multiRowAlign` is a new style attribute defined In addition to the style attributes from TTML. See **Annex A** for a detailed description of how the attribute can be used.

ebutts:linePadding (attribute)

Type	`ebuttdt:linePaddingType`
Cardinality	0..1
Initial	"0c"
Applies to	`tt:body`, `tt:div`, `tt:p`
Inherited	Yes
Position	/tt/head/styling/style
Description	Padding (or inset) space on the start and end edges of each rendered line-area. Background color applies to the area including the line padding. 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. Note: `ebutts:linePadding` attribute is a new style attribute defined In

	addition to the style attributes from TTML. See **Annex D** for a detailed description of how the attribute can be used.

3.1.4 tt:layout

Type	Element content
Cardinality	1..1
Position	/tt/head
TTML	http://www.w3.org/TR/ttml1/#layout-vocabulary-layout
Description	Container for region elements.

3.1.4.1 tt:metadata

Type	Element content
Cardinality	0..1
Position	/tt/head/layout
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-metadata
Description	Generic metadata container. `tt:metadata` may have user defined XML vocabulary as defined in § 2.2.

3.1.4.2 tt:region

Type	Element content
Cardinality	1..*
Position	/tt/head/layout
TTML	http://www.w3.org/TR/ttml1/#layout-vocabulary-region
Description	Defines a space or area for the display of subtitle content. 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` and `tt:p` elements may reference a region. 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 active video (see “Definition of terms”). If the region exceeds the boundary of the active video the display of the region shall be clipped accordingly. Note: The term “root container region” in TTML 1.0 defines a region that establishes a coordinate system into which content regions are placed. In EBU-TT the root container region is the active video (see “Definition of terms”).

xml:id (attribute)

Type	`xs:ID`
Cardinality	1..1
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#content-attribute-id
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 ID shall be unique in the entire document.

tts:origin (attribute)

Type	`ebuttdt:originType`
Cardinality	1..1
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#style-attribute-origin
Description	The x and y coordinates of the top left corner of a region with respect to the active video the document was authored for. The (0, 0) coordinate shall be assumed to be the top left corner of the active video. Values in percentage shall be relative to the width and height of the active video. Example: With `tts:origin`="20% 80%" the top left corner of the region is shifted 20% of the active video width to the right and 80% of the active video height to the bottom.

tts:extent (attribute)

Type	`ebuttdt:extentType`
Cardinality	1..1
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#style-attribute-extent
Description	Width and height of a region area. Values in percentage shall be relative to the width and height of the active video. Example: With `tts:extent`="100% 20%" the width of the region is 100% of the width of the active video and the height of the region is 20% of the height of the active video.

style (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#style-attribute-style
Description	*ID*(s) of one or more style element(s). The inheritable style information shall be inherited by content in that region. Note that the tts:backgroundColor is not inheritable. The value of a `tts:backgroundColor` attribute in a referenced style shall be applied to the region element. 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 with TTML style attributes.

A style attribute that is defined for the `tt:region` element shall not appear in a `tt:style` element and vice versa. The only exception from this rule is the `tts:padding` attribute. Although the use of `tts:padding` on `tt:style` is deprecated it may appear both in the `tt:style` and `tt:region` element.

Note: See Annex F for an overview which style attributes are allowed on the `tt:style` and which are allowed on the `tt:region` element.

tts:displayAlign (attribute)

Type	`xs:string`
Enumeration	"before" | "center" | "after"
Cardinality	0..1
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#style-attribute-displayAlign
Description	Alignment in the block progression direction. Note: In the writing mode "Left to Right Top to Bottom" this would result in the vertical alignment of lines of text. The value "before" would result in “top” alignment and the value "after" would result in “bottom” alignment. Note: The initial value of `tts:displayAlign` was "after" in EBU-TT Part 1 v1.0 and has been changed to "before" for better interoperability with TTML 1.0.

tts:padding (attribute)

Type	`ebuttdt:paddingType`
Cardinality	0..1
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#style-attribute-padding
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
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#style-attribute-writingMode
Description	Writing mode of subtitle content. • "lrtb": “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
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#style-attribute-showBackground
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
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#style-attribute-overflow
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.

3.1.4.2.1 tt:metadata

Type	Element content
Cardinality	0..1
Position	/tt/head/layout/region
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-metadata
Description	Generic metadata container. `tt:metadata` may have user defined XML vocabulary as defined in § 2.2.

3.2 tt:body

Type	Element content
Cardinality	0..1
Position	/tt
TTML	http://www.w3.org/TR/ttml1/#document-structure-vocabulary-body
Description	Container for subtitle and timing information. The body section of an EBU-TT 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. Note: An EBU-TT Part 1 document with no body element could be used to transport just metadata, style or layout information without subtitle content. Note: An EBU-TT Part 1 document with no body element can be considered

	as a TTML 1.0 document with no content. Note: It is expected that EBU-TT documents intended to represent subtitles for archive and exchange will always have a `tt:body` element present; where that is the case it would be good practice to verify this is the case with an additional validation rule.

style (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Position	/tt/body
TTML	http://www.w3.org/TR/ttml1/#style-attribute-style
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").

begin (attribute)

Type	`ebuttdt:smpteTimingType` | `ebuttdt:mediaTimingType` | `ebuttdt:clockTimingType`
Cardinality	0..1
Position	/tt/body
TTML	http://www.w3.org/TR/ttml1/#timing-attribute-begin
Description	Start point of a temporal interval associated with a `tt:body` element. If the timebase is "smpte" the type shall be `ebuttdt:smpteTimingType`. If the timebase is "media" the type shall be `ebuttdt:mediaTimingType`. If the timebase is "media" the time expression should be the offset from a syncbase of "00:00:00.0". If the timebase is "clock" the type shall be `ebuttdt:clockTimingType`.

end (attribute)

Type	`ebuttdt:smpteTimingType` | `ebuttdt:mediaTimingType` | `ebuttdt:clockTimingType`
Cardinality	0..1
Position	/tt/body
TTML	http://www.w3.org/TR/ttml1/#timing-attribute-end
Description	End point of a temporal interval associated with a `tt:body` element. If the timebase is "smpte" the type shall be `ebuttdt:smpteTimingType`.

	If the timebase is "media" the type shall be `ebuttdt:mediaTimingType`. If the timebase is "media" the time expression should be the offset from a syncbase of "00:00:00.0". If the timebase is "clock" the type shall be `ebuttdt:clockTimingType`.

3.2.1 tt:metadata

Type	Element content
Cardinality	0..1
Position	/tt/body
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-metadata
Description	Generic metadata container. `tt:metadata` may have user defined XML vocabulary as defined in § 2.2.

3.2.2 tt:div

Type	Element content
Cardinality	1..*
Position	/tt/body
TTML	http://www.w3.org/TR/ttml1/#content-vocabulary-div
Description	Container for textual content. Note: Nesting of `tt:div` elements are permitted (see § 3.2.2.2).

xml:id (attribute)

Type	`xs:ID`
Cardinality	0..1
Position	/tt/body//div
TTML	http://www.w3.org/TR/ttml1/#content-attribute-id
Description	*ID* of a `tt:div` element that may be used by an external application.

region (attribute)

Type	`xs:IDREF`
Cardinality	0..1
Position	/tt/body//div
TTML	http://www.w3.org/TR/ttml1/#layout-attribute-region
Description	Application of layout and style information through reference of a region. Note: If you intend to transform an EBU-TT Part 1 document to EBU-TT-D

	please note that in EBU-TT-D a `tt:p` element shall not reference a region if its parent `tt:div` element references a region and (vice versa) a region shall not be referenced by a `tt:div` element if a `tt:p` child of that `tt:div` references a region. Be also aware that strictly compliant TTML 1 parsers prune content elements if p or div elements refer to a different region to one of their ancestor div elements; this behaviour may not be intuitive to or desired by the document author.

style (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Position	/tt/body//div
TTML	http://www.w3.org/TR/ttml1/#style-attribute-style
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").

xml:lang (attribute)

Type	`xs:language	""`
Cardinality	0..1
Position	/tt/body//div
TTML	http://www.w3.org/TR/ttml1/#content-attribute-lang
Description	Language identifier for the enclosed subtitle content. The `xml:lang` attribute in the `tt:div` element may be specified to overwrite the language identification of 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) [11]. 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.

begin (attribute)

Type	`ebuttdt:smpteTimingType` | `ebuttdt:mediaTimingType` | `ebuttdt:clockTimingType`
Cardinality	0..1
Position	/tt/body//div
TTML	http://www.w3.org/TR/ttml1/#timing-attribute-begin
Description	Start point of a temporal interval associated with a `tt:div` element. If the timebase is "smpte" the type shall be `ebuttdt:smpteTimingType`. If the timebase is "media" the type shall be `ebuttdt:mediaTimingType`. If the timebase is "clock" the type shall be `ebuttdt:clockTimingType`. If the timebase is "media" or "clock" the time expression should be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If the timebase is "smpte" and "markermode" is set to "continuous" the time expression should also be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If no ancestor specifies a begin time and the timebase is "media" the time expression should be the offset from a syncbase of "00:00:00.0".

end (attribute)

Type	`ebuttdt:smpteTimingType` | `ebuttdt:mediaTimingType` | `ebuttdt:clockTimingType`
Cardinality	0..1
Position	/tt/body//div
TTML	http://www.w3.org/TR/ttml1/#timing-attribute-end
Description	End point of a temporal interval associated with a `tt:div` element. If the timebase is "smpte" the type shall be ebuttdt:smpteTimingType. If the timebase is "media" the type shall be ebuttdt:mediaTimingType. If the timebase is "clock" the type shall be ebuttdt:clockTimingType. If the timebase is "media" or "clock" the time expression should be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If the timebase is "smpte" and "markermode" is set to "continuous" the time expression should also be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If no ancestor specifies a begin time and the timebase is "media" the time expression should be the offset from a syncbase of "00:00:00.0".

3.2.2.1 tt:metadata

Type	Element content
Cardinality	0..1
Position	/tt/body//div

TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-metadata
Description	Generic metadata container. `tt:metadata` may have user defined XML vocabulary as defined in § 2.2.

3.2.2.2 tt:div

Type	Element content
Cardinality	0..*
Position	/tt/body//div
TTML	http://www.w3.org/TR/ttml1/#content-vocabulary-div
Description	Container for textual content. A `tt:div` element may be a child of another `tt:div` element. The content model shall be the same as described in § 3.2.2.

3.2.2.3 tt:p

Type	Mixed content.
Cardinality	0..*
Position	/tt/body//div
TTML	http://www.w3.org/TR/ttml1/#content-vocabulary-p
Description	Logical paragraph.

xml:id (attribute)

Type	`xs:ID`
Cardinality	1..1
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#content-attribute-id
Description	Unique *ID* of a subtitle. 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 document (e.g. sub1, sub2, sub3 or sub1, sub2, sub2a, sub2b, sub3).

xml:space (attribute)

Type	`xs:string`
Enumeration	"default" | "preserve"
Cardinality	0..1
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#content-attribute-space
Description	Indicates the author's intention of white space handling within the content of the `tt:p` element.

xml:lang (attribute)

Type	`xs:language | ""`
Cardinality	0..1
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#content-attribute-lang
Description	Language identifier for the enclosed subtitle content. To overwrite the language identification of the enclosed subtitle content the `xml:lang` attribute may be specified on the `tt:p` element. The empty string maybe 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 [11]. 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.

region (attribute)

Type	`xs:IDREF`
Cardinality	0..1
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#layout-attribute-region
Description	Application of layout information through reference of a region. Note: If you intent to transform an EBU-TT Part 1 document to EBU-TT-D please note that in EBU-TT-D a `tt:p` element must not reference a region if it's parent `tt:div` element references a region and (vice versa) a region shall not be referenced by a `tt:div` element if a `tt:p` child of that `tt:div` references a region. Be also aware that strictly compliant TTML 1 parsers prune content elements if p or div elements refer to a different region to one of

	their ancestor div elements. It is possible that this behaviour is not intuitive to or desired by the document author.

style (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#style-attribute-style
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").

begin (attribute)

Type	`ebuttdt:smpteTimingType` | `ebuttdt:mediaTimingType` | `ebuttdt:clockTimingType`
Cardinality	0..1
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#timing-attribute-begin
Description	Start point of a temporal interval associated with a `tt:p` element. If the timebase is "smpte" the type shall be ebuttdt:smpteTimingType. If the timebase is "media" the type shall be ebuttdt:mediaTimingType. If the timebase is "clock" the type shall be ebuttdt:clockTimingType. If the timebase is "media" or "clock" the time expression should be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If the timebase is "smpte" and "markermode" is set to "continuous" the time expression should also be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If no ancestor specifies a begin time and the timebase is "media" the time expression should be the offset from a syncbase of "00:00:00.0".

end (attribute)

Type	`ebuttdt:smpteTimingType` | `ebuttdt:mediaTimingType` | `ebuttdt:clockTimingType`
Cardinality	0..1
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#timing-attribute-end
Description	End point of a temporal interval associated with a `tt:p` element. If the timebase is "smpte" the type shall be ebuttdt:smpteTimingType.

	If the timebase is "media" the type shall be ebuttdt:mediaTimingType. If the timebase is "clock" the type shall be ebuttdt:clockTimingType. If the timebase is "media" or "clock" the time expression should be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If the timebase is "smpte" and "markermode" is set to "continuous" the time expression should also be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If no ancestor specifies a begin time and the timebase is "media" the time expression should be the offset from a syncbase of "00:00:00.0".

3.2.2.3.1 tt:metadata

Type	Element content
Cardinality	0..1
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-metadata
Description	Generic metadata container. `tt:metadata` may have user defined XML vocabulary as defined in § 2.2.

3.2.2.3.1.4 ttm:title

Type	`xs:string`
Cardinality	0..1
Position	/tt/body//div/p/metadata
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-title
Description	The semantics, content model and the use of the `ttm:title` element shall be as defined in TTML 1.0.

3.2.2.3.1.5 ttm:desc

Type	`xs:string`
Cardinality	0..*
Position	/tt/body//div/p/metadata
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-desc
Description	The semantics, content model and the use of the `ttm:desc` element shall be as defined in TTML 1.0.

3.2.2.3.2 tt:br

Type	Element content
Cardinality	0..*
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#content-vocabulary-br
Description	Forced line break.

3.2.2.3.2.1 tt:metadata

Type	Element content
Cardinality	0..1
Position	/tt/body//div/p/br
TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-metadata
Description	Generic metadata container. `tt:metadata` may have user defined XML vocabulary as defined in § 2.2.

3.2.2.3.3 tt:span

Type	Mixed content.
Cardinality	0..*
Position	/tt/body//div/p
TTML	http://www.w3.org/TR/ttml1/#content-vocabulary-span
Description	Inline element that encloses textual content. 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. The `tt:span` element may also be used to apply annotation or metadata.

xml:id (attribute)

Type	`xs:ID`
Cardinality	0..1
Position	/tt/body//div/p//span
TTML	http://www.w3.org/TR/ttml1/#content-attribute-id
Description	*ID* of a `tt:span` element that may be used by an external application.

xml:space (attribute)

Type	`xs:string`
Enumeration	"default" | "preserve"
Cardinality	0..1
Position	/tt/body//div/p//span
TTML	http://www.w3.org/TR/ttml1/#content-attribute-space
Description	Indicates the authors' intention for white space handling within the content of the `tt:span` element.

xml:lang (attribute)

Type	`xs:language | ""`
Cardinality	0..1
Position	/tt/body//div/p//span
TTML	http://www.w3.org/TR/ttml1/#content-attribute-lang
Description	Language identifier for the enclosed subtitle content. To overwrite the language identification of the enclosed subtitle content the `xml:lang` attribute may be specified in the `tt:span` element. The empty string maybe 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 [11]. 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.

style (attribute)

Type	`xs:IDREFS`
Cardinality	0..1
Position	/tt/body//div/p//span
TTML	http://www.w3.org/TR/ttml1/#style-attribute-style
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").

begin (attribute)

Type	`ebuttdt:smpteTimingType` | `ebuttdt:mediaTimingType` | `ebuttdt:clockTimingType`
Cardinality	0..1
Position	/tt/body//div/p//span
TTML	http://www.w3.org/TR/ttml1/#timing-attribute-begin
Description	Start point of a temporal interval associated with a `tt:span` element. If the timebase is "smpte" the type shall be ebuttdt:smpteTimingType. If the timebase is "media" the type shall be ebuttdt:mediaTimingType. If the timebase is "clock" the type shall be ebuttdt:clockTimingType. If the timebase is "media" or "clock" the time expression should be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If the timebase is "smpte" and "markermode" is set to "continuous" the time expression should also be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If no ancestor specifies a begin time and the timebase is "media" the time expression should be the offset from a syncbase of "00:00:00.0".

end (attribute)

Type	`ebuttdt:smpteTimingType` | `ebuttdt:mediaTimingType` | `ebuttdt:clockTimingType`
Cardinality	0..1
Position	/tt/body//div/p//span
TTML	http://www.w3.org/TR/ttml1/#timing-attribute-end
Description	End point of a temporal interval associated with a `tt:span` element. If the timebase is "smpte" the type shall be ebuttdt:smpteTimingType. If the timebase is "media" the type shall be ebuttdt:mediaTimingType. If the timebase is "clock" the type shall be ebuttdt:clockTimingType. If the timebase is "media" or "clock" the time expression should be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If the timebase is "smpte" and "markermode" is set to "continuous" the time expression should also be the offset from a syncbase of the begin time of the closest ancestor that specifies a begin time. If no ancestor specifies a begin time and the timebase is "media" the time expression should be the offset from a syncbase of "00:00:00.0".

3.2.2.3.3.1 tt:metadata

Type	Element content
Cardinality	0..1
Position	/tt/body//div/p//span

TTML	http://www.w3.org/TR/ttml1/#metadata-vocabulary-metadata
Description	Generic metadata container. `tt:metadata` may have user defined XML vocabulary as defined in § 2.2.

3.2.2.3.3.2 tt:br

Cardinality	0..*
Position	/tt/body//div/p//span
TTML	http://www.w3.org/TR/ttml1/#content-vocabulary-br
Description	Forced line break. Content model and usage are as defined in § 3.2.2.3.2.

3.2.2.3.3.3 tt:span

Cardinality	0..*
Position	/tt/body//div/p//span
TTML	http://www.w3.org/TR/ttml1/#content-vocabulary-span
Description	Inline element that encloses textual content. A `tt:span` element may be a child of another `tt:span` element. The content model and semantics shall be the same as described in 3.2.2.3.3.

4. Datatypes

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

Note: If a datatype is applied to an attribute or element 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 datatypes also conform to the values allowed in TTML 1.0. However it is possible that a value conforms to the TTML definitions but does not conform to the EBU-TT datatypes.

4.1 ebuttdt:cellResolutionType

The content shall be constrained to two numbers of type `xs:positiveInteger` delimited by a whitespace. The first value shall define the number of columns and the second value shall define the number of rows. For both values the positive sign ("+") shall not be used.

4.2 ebuttdt:colorType

Note: The constraints are the same as those defined by the <color> expression in TTML 1.0.

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

Although different formats may be used in an EBU-TT document the value should be expressed in RGB or RGBA.

Named colors shall be:

- "transparent"
- "black"
- "silver"
- " gray"
- "white"
- "maroon"
- "red"
- "purple"
- "fuchsia"
- "magenta"
- "green"
- "lime"
- "olive"
- "yellow"
- "navy"
- "blue"
- "teal"
- "aqua"
- "cyan"

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

- "black" (named color)
- "rgb(0, 0, 0)" (RGB color triple)
- "rgba(0, 0, 0, 255)" (RGBA color tuple)
- "#000000" (RGB color triple in hex notation)
- "#000000FF" (RGBA color tuple in hex notation)

4.3 ebuttdt:extentType

The content shall be constrained to two non-negative values of type `ebuttdt:lengthType` 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 font family- and/or generic family-names.

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

Generic family names shall be:

- "default"
- "monospace"
- "sansSerif"
- "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:fontSizeType

The content is constrained to one or two non-negative values of type `ebuttdt:lengthType`.

If a single value is specified, then this length applies equally to horizontal and vertical scaling of a glyph's square; if two values are specified, then the first expresses the horizontal scaling and the second expresses vertical scaling.

Note: Use of independent horizontal and vertical font sizes is expected to be used with cell based metrics in order to denote fonts that are two rows in height and one column in width.

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. For both values the positive sign ("+") shall not be used.

4.7 ebuttdt:lengthType

Note: The `ebuttdt:lengthType` is equal to the <length> expression defined in TTML1.0 except that the measurement parameter *em* is not allowed.

The content shall be constrained to a number of type `xs:decimal` appended either by the percentage sign "%" or the measurement units "px" (for video pixel) or "c" (for cell).

If an EBU-TT document instance uses the 'cell' measurement unit (e.g. as part of a `tts:fontSize` attribute value) then the `ttp:cellResolution` attribute shall be specified on the `tt:tt` element.

If an EBU-TT document instance uses the 'pixel' measurement unit (e.g. as part of a `tts:fontSize` attribute value) then the `tts:extent` attribute of the `tt:tt` element shall be specified.

4.8 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"

4.9 ebuttdt:lineHeightType

The value shall be the string "normal" or shall be a non-negative value of type `ebuttdt:lengthType`.

4.10 ebuttdt:originType

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

4.11 ebuttdt:paddingType

The content shall be constrained to one, two, three or four non-negative values of type `ebuttdt:lengthType` 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” edges, the second value to the “end” edges, the third value to the “after” edges and the fourth value to the “start” edges 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%"

4.12 ebuttdt:smpteTimingType

A value of type `ebuttdt:smpteTimingType` shall conform to the time coordinate defined by SMPTE 12M-1-2008 [13] and shall have the format:

hh:mm:ss:ff

Where *hh* is hours, *mm* is minutes, *ss* is seconds and *ff* is frames.

4.13 ebuttdt:mediaTimingType

The value of type `ebuttdt:mediaTimingType` shall be a **Full-Clock-value** or a **Timecount-value**.

A Full-Clock-Value shall have the format hhh*:mm:ss and may be followed by an optional decimal fraction to denote fractional seconds as in the examples below. Values of hours, minutes and seconds less than 10 shall be padded to two digits with a leading zero. Values for hours may have more than two digits.

Examples for Full-Clock-values

- 120:01:12 = 120 hours, 1 minute and 12 seconds
- 02:30:03 = 2 hours, 30 minutes and 3 seconds
- 01:00:10.25 = 1 hour, 10 seconds and 250 milliseconds
- 00:13:43.0001 = 13 minutes, 43 seconds and 100 microseconds

A **Timecount-value** shall have the format:

Non-negative number with an optional decimal *fraction* followed by a *symbol for the time metric*.

A *symbol for time metric* shall be one of the following:

- "h" for hours
- "m" for minutes
- "s" for seconds
- "ms" for milliseconds

Examples for Timecount values:

3.2h = 3.2 hours = 3 hours and 12 minutes

45m = 45 minutes

30s = 30 seconds

30.0001s = 30 seconds and 100 microseconds

5ms = 5 milliseconds

“frame” and “tick” based metrics shall not be used in a time expression of `ebuttdt:mediaTimingType`.

4.14 ebuttdt:clockTimingType

The value of ebuttdt:clockTimingType shall be a Limited-Full-Clock -value or a Timecount-value.

A Limited-Full-Clock-Value shall have the format hh:mm:ss and may be followed by an optional decimal fraction to denote fractional seconds.

hh shall be a two digit zero padded integer in the range 0-23.

mm shall be a two digit zero padded integer in the range 0-59.

ss shall be a two digit zero padded integer in the range 0-60 where the value 60 applies only to leap seconds.

A **Timecount-value** shall have the format:

Non-negative number with an optional *fraction* followed by a *symbol for the time metric*.

A *symbol for time metric* shall be one of the following:

- "h" for hours
- "m" for minutes
- "s" for seconds
- "ms" for milliseconds

Examples for Timecount values:

3.2h = 3.2 hours = 3 hours and 12 minutes

45m = 45 minutes

30s = 30 seconds

30.0001s = 30 seconds and 100 microseconds

5ms = 5 milliseconds

“frame” and “tick” based metrics shall not be used in a time expression of `ebuttdt:mediaTimingType`.

4.15 ebuttdt:noTimezoneDateType

The value of ebuttdt:noTimezoneDateType shall be of type xs:date without the specification of the timezone.

Note: The XML schema type xs:date allows the optional specification of a timezone. Therefore ebuttdt:noTimezoneDateType is a restriction of the type xs:date.

5. References

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[2]	**EBU R133**	Transport of subtitles using MXF in an IT-Based Television Production Environment. http://tech.ebu.ch/publications/r133
[3]	**EBU Tech 3360**	EBU-TT, Part 2 Mapping EBU-STL (Tech 3264) to EBU-TT subtitle files http://tech.ebu.ch/publications/tech3360
[4]	**EBU Tech 3370**	EBU-TT, Part 3 Live Subtitling applications http://tech.ebu.ch/publications/tech3370
[5]	**EBU Tech 3390**	EBU-TT, Part M Metadata definitions http://tech.ebu.ch/publications/tech3390
[6]	**SMPTE ST 2016-1:2009**	Society of Motion Picture and Television Engineers, "SMPTE Standard - Format for Active Format Description and Bar Data", SMPTE ST 2016-1:2009.
[7]	**EBU Tech 3380**	EBU-TT-D Subtitling Distribution Format https://tech.ebu.ch/publications/tech3380
[8]	**TTML 1.0**	Timed Text Markup Language (TTML) 1.0 (Second Edition), W3C Recommendation http://www.w3.org/TR/2013/REC-ttml1-20130924/
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[10]	**UAX9**	Mark Davis. Unicode Standard Annex #9. Unicode Bidirectional Algorithm. http://unicode.org/reports/tr9/
[11]	**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/
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[13]	**SMPTE-12M-1-2008**	Society of Motion Picture and Television Engineers, "SMPTE Standard for Television - Time and Control Code", SMPTE 12M-1-2008.

6. Bibliography

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UAX15	Mark Davis. Unicode Standard Annex #15. Unicode Normalization Forms. http://unicode.org/reports/tr15/
XPATH	XPath 2.0 (Second Edition). http://www.w3.org/TR/xpath20/

Annex A: 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 acts as a 'modifier' to the action defined by the `tts:textAlign` attribute value, whether that value is explicitly or implicitly defined. This attribute effectively creates additional alignment points for multiple rows of text, thus it has no effect if only a single row of text is present.

This modifier acts 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 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` is maintained unmodified (i.e. the presentation is as if `ebutts:multiRowAlign` would have the same computed value as `tts:textAlign`).

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

tts:textAlign	ebutts:multiRowAlign	Presentation
"start"	**"start"**	Start justified text. All 'rows' are aligned at start.
"start"	"center"	The longest 'row' is start aligned. Shorter 'rows' are center aligned against the center alignment point created by the longest 'row'.
"start"	"end"	The longest 'row' is start aligned. Shorter 'rows' are end aligned against the end alignment point created by the longest 'row'.
"left"	"start"	The longest 'row' is left aligned. Shorter 'rows' are start aligned against the start alignment point created by the longest 'row'.
"left"	"center"	The longest 'row' is left aligned. Shorter 'rows' are center aligned against the center alignment point created by the longest 'row'.
"left"	"end"	The longest 'row' is left aligned. Shorter 'rows' are end aligned against the end alignment point created by the longest 'row'.
"center"	"start"	The longest 'row' is center aligned. Shorter 'rows' are start aligned against the start

tts:textAlign	ebutts:multiRowAlign	Presentation
		alignment point created by the longest ‘row’.
"center"	**"center"**	Center justified text. All ‘rows’ are individually center aligned.
"center"	"end"	The longest ‘row’ is center aligned. Shorter ‘rows’ are end aligned against the end alignment point created by the longest ‘row’.
"right"	"start"	The longest ‘row’ is right aligned. Shorter ‘rows’ are start aligned against the start alignment point created by the longest ‘row’.
"right"	"center"	The longest ‘row’ is right aligned. Shorter ‘rows’ are center aligned against the center alignment point created by the longest ‘row’.
"right"	"end"	The longest ‘row’ is right aligned. Shorter ‘rows’ are end aligned against the end alignment point created by the longest ‘row’.
"end"	"start"	The longest ‘row’ is end aligned. Shorter ‘rows’ are start aligned against the start alignment point created by the longest ‘row’.
"end"	"center"	The longest ‘row’ is end aligned. Shorter ‘rows’ are center aligned against the center alignment point created by the longest ‘row’.
"end"	**"end"**	End justified text. All ‘rows’ are aligned at end.

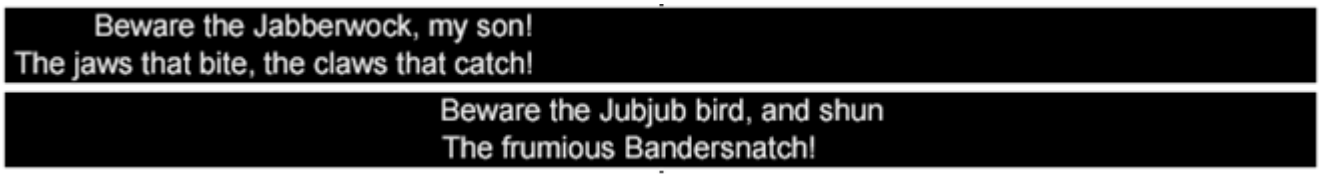
If a specified value of this attribute is not supported, then a presentation processor shall interpret the attribute as if the attribute has the value "auto" (i.e. the basic behaviour of `tts:textAlign` is maintained unmodified).

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

```
 …
<tt:styling>
   <tt:style xml:id="baseStyle" tts:backgroundColor="black" tts:color="white" />
   <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" tts:extent="355px 43px" tts:origin="0px 0px"/>
   <tt:region xml:id="regionBottom" tts:extent="355px 43px" tts:origin="0px 47px"/>
</tt:layout>
 …
<tt:div style="baseStyle">
 …
  <tt:p xml:id="subtitle1" region="regionTop" style="startEnd" begin="00:00:00:00" end="00:00:03:00">
     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="00:00:00:00"
                                                                          end="00:00:03:00">
     Beware the Jubjub bird, and shun<tt:br/>
     The frumious Bandersnatch!
  </tt:p>
 …
</tt:div>
```

Produces:



Annex B: Initial Values of TTML 1.0 and EBU-TT attributes

Attribute Name	TTML Initial Value
tts:backgroundColor	"transparent"
tts:direction	"ltr"
ttp:cellResolution	"32 15"
tts:color	Implementation dependent
tts:displayAlign	"before"
tts:fontFamily	"default"
tts:fontSize	"1c"
tts:fontStyle	"normal"
tts:fontWeight	"normal"
tts:lineHeight	"normal"
tts:overflow	"hidden"
tts:padding	"0px"
tts:showBackground	"always"
tts:textAlign	"start"
tts:textDecoration	"none"
tts:unicodeBidi	"normal"
tts:wrapOption	"wrap"
tts:writingMode	"lrtb"

Note: Version 1.0 of EBU-TT Part 1 overrides the initial values for the following TTML attributes:ttp:cellResolution ("40 24"), tts:fontSize ("1c 2c"), tts:displayAlign ("after") and tts:textAlign ("center"). To achieve better interoperability with other TTML profiles in Version 1.1 of EBU-TT Part 1 and later versions the initial values from TTML 1.0 apply for these attributes.

Note: Some attributes in EBU-TT are mandatory or have to be explicitly specified whenever they apply (e.g. ttp:dropMode is mandatory when timebase is "smpte"). As the initial value of these attributes never applies, they are not listed in this section.

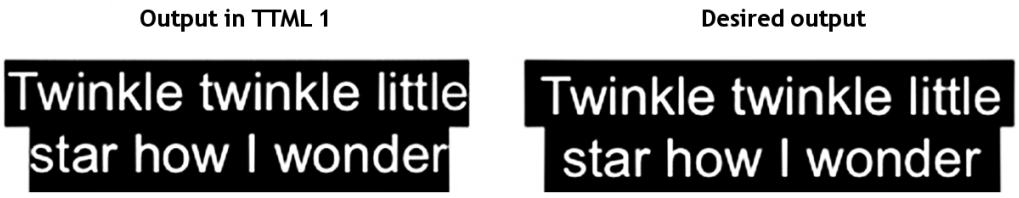
The following table lists the initial values of the attribute defined in the EBU-TT Style namespace.

Attribute Name	EBU-TT Initial Value
ebutts:multiRowAlign	"auto"
ebutts:linePadding	"0c"

Annex C: 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:

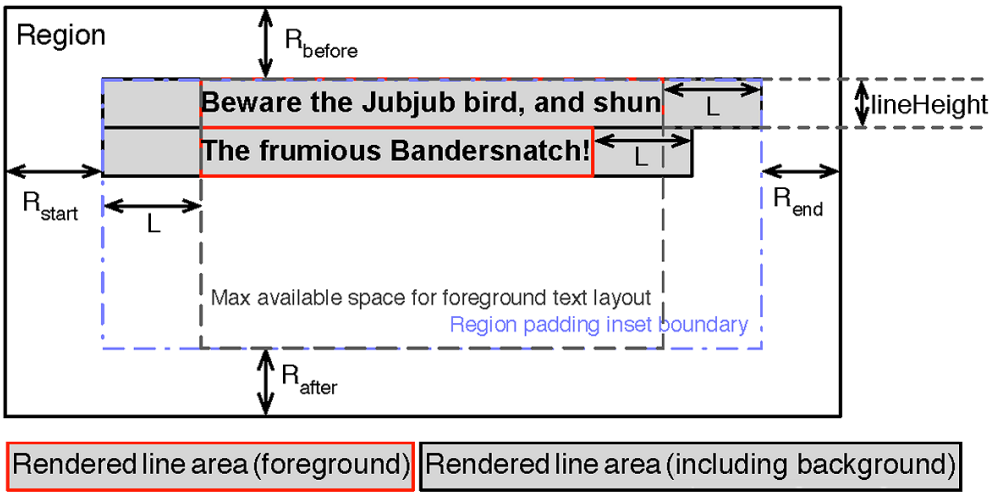


The background color shall be rendered by a presentation processor behind the foreground text content of the target, and extended to either side, in the inline progression, by the extent defined by the line padding attribute. The 'background color' used is the effective background color that applies 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[6].

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.

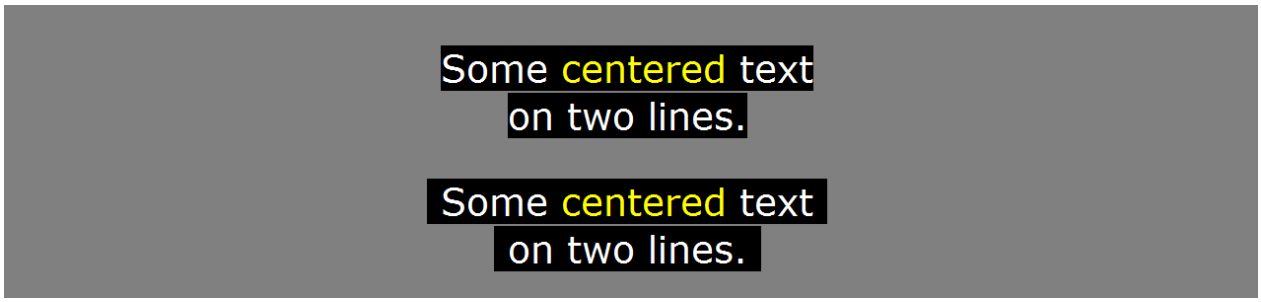
The use of `ebutts:linePadding` is illustrated by the following partial EBU-TT example.

[6] 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.

```
<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="sub2" 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 D: List of supported TTML features (Informative)

Below is a list of TTML 1.0 features a processor needs to support. Please note that this listing is for informative use only and is intended to simplify the comparison of EBU-TT Part 1 with other specifications that are derived from TTML 1.0.

```
================================================================================
TTML Profile Summary
================================================================================
Full Name of Profile:
    EBU – TECH 3350 – EBU-TT Part 1 Subtitling format definition
Short Name of Profile: EBU-TT Part 1
Version: 1.2
================================================================================
Fully supported TTML features
================================================================================
#backgroundColor-block
#backgroundColor-inline
#backgroundColor-region
#backgroundColor
#bidi
#cellResolution
#clockMode-gps
#clockMode-local
#clockMode-utc
#clockMode
#color
#content
#direction
#displayAlign
#dropMode-dropNTSC
#dropMode-dropPAL
#dropMode-nonDrop
#dropMode
#extent-region
#extent-root
#extent
#fontFamily-generic
#fontFamily-non-generic
#fontFamily
#fontSize-anamorphic
#fontSize-isomorphic
#fontSize
#fontStyle-italic
#fontWeight-bold
#fontWeight
#frameRate
#frameRateMultiplier
#layout
#length-cell
#length-integer
#length-negative
#length-percentage
#length-pixel
#length-positive
#length-real
#lineHeight
#markerMode-discontinuous
#markerMode

#metadata
#nested-div
#nested-span
```

```
#overflow-visible
#overflow
#padding-1
#padding-2
#padding-3
#padding-4
#padding
#showBackground
#structure
#styling-chained
#styling-inheritance-content
#styling-inheritance-region
#styling-nested
#styling-referential
#styling
#textAlign-absolute
#textAlign-relative
#textAlign
#time-clock
#time-offset
#timeBase-clock
#timeBase-media
#timeBase-smpte
#unicodeBidi
#wrapOption
#writingMode-horizontal-lr
#writingMode-horizontal-rl
#writingMode-horizontal
#writingMode-vertical
#writingMode

=====================================================================
Constrained TTML features
=====================================================================
#core
    Constraints:
        * 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.
#fontStyle
    Constraints:
        * The value oblique is not supported.
#origin
    Constraints:
        * The tts:origin attribute shall not be child of an element other than
region.
        * The tts:origin attribute shall not have a value of 'auto'.
#presentation
    Constraints:
        * The feature 'profile' is not supported.
        * The attribute "dur" is not supported.
#textDecoration-under
    Constraints:
        * The value 'noUnderline' is not supported.
#textDecoration
    Constraints:
        * The values 'noUnderline', 'lineThrough', 'noLineThrough', 'overline' and
'noOverline' are not supported.
#time-clock-with-frames
```

```
    Constraints:
        * The feature '#subFrameRate' is not supported.
#timing
    Constraints:
        * The feature #subFrameRate is not supported.
        * The attribute "dur" is not supported.
#transformation
    Constraints:
        * The feature #profile is not supported.

======================================================================
Extensions
======================================================================
# ebu-tt-metadata

* A transformation processor supports the #ebu-tt-metadata feature if it
recognises and is capable of transforming values in the namespace
urn:ebu:tt:metadata.

#multiRowAlign

* A transformation processor supports the #multiRowAlign feature if it recognizes
and is capable of transforming values of the ebutts:multiRowAlign attribute
specified in this specification.

* A presentation processor supports the #multiRowAlign feature if it implements
presentation semantic support for values of the ebutts:multiRowAlign attribute
specified in this specification.

#linePadding

* A transformation processor supports the #linePadding feature if it recognizes
and is capable of transforming values of the ebutts:linePadding attribute
specified in this specification.

* A presentation processor supports the #linePadding feature if it implements
presentation semantic support for values of the ebutts:linePadding attribute
specified in this specification.

Note that the #multiRowAlign and #linePadding features defined here may be used to
describe the processor capabilities for ebutts:multiRowAlign and
ebutts:linePadding as applied to EBU-TT-D processors.
```

Annex F: Overview of style attributes on tt:style and tt:region

The following TTML style attributes are allowed on the `tt:style` element:

- `tts:backgroundColor`
- `tts:color`
- `tts:direction`
- `tts:fontFamily`
- `tts:fontSize`
- `tts:fontStyle`
- `tts:fontWeight`
- `tts:lineHeight`
- `tts:padding (deprecated)`
- `tts:textAlign`
- `tts:textDecoration`
- `tts:unicodeBidi`
- `tts:wrapOption`

The following EBU-TT style attributes are allowed on the `tt:style` element:

- `ebutts:linePadding`
- `ebutts:multiRowAlign`

The following TTML style attributes are allowed on the `tt:region` element:

- `tts:displayAlign`
- `tts:extent`
- `tts:origin`
- `tts:overflow`
- `tts:padding`
- `tts:showBackground`
- `tts:writingMode`

If a region element references one or more styles that define style attributes not permitted directly on region, they shall be processed as defined in TTML1. Note that the attributes `style` and `xml:id` may be specified on the `tt:style` element and the `tt:region` element.

Annex G: Overview Document structure (Informative)

The following is a syntactic representation of the EBU-TT Part 1 document model. It is derived from the syntactic representation of TTML 1.0 and the definition of the reduced XML Infoset in TTML 1.0.

```
ELEMENT INFORMATION ITEMS
<tt:tt
    xml:space = ("default"|"preserve")>
    ttp:timeBase = ( "media" | "smpte" | "clock") #REQUIRED
    ttp:frameRate = <digit>* <digitGreaterZero> <digit>*
    ttp:frameRateMultiplier = <ebuttdt:frameRateMultiplierType>
    ttp:markerMode = ("continuous" | "discontinuous")
    ttp:dropMode = ("nonDrop" | "dropNTSC" | "dropPAL")
    ttp:clockMode = ( "local" | "gps" | "utc")
    ttp:cellResolution = <ebuttdt:cellResolutionType>
    tts:extent = <ebuttdt:extentType>  /* Restricted to length metric "px" */
    xml:lang = ("" | <xs:language>) #REQUIRED
    {any attribute in the EBU-TT Metadata namespace}
    {any attribute not in default, any TT namespace or any EBU-TT namespace}
>
    Content: tt:head, tt:body?
</tt:tt>

<tt:head
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}>
    Content:  tt:metadata?,  ttm:copyright?, tt:styling, tt:layout
</tt:head>

<ttm:copyright
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}>
    Content: <xs:string>
</ttm:copyright>

<tt:metadata
   xml:id = <xs:ID>
   xml:lang = ("" | <xs:language>)
   xml:space = ("default"|"preserve")
  {any attribute in the TT Metadata namespace}
  {any attribute in the EBU-TT Metadata namespace}
  {any attribute not in default, any TT namespace or any EBU-TT namespace}
>

 Content: ({any element in TT Metadata or EBU-TT Metadata namespace} |
           {any element not in any TT or EBU-TT namespace})*


</tt:metadata>
    Content: As defined in TTML 1.0
  </tt:metadata>

<tt:styling
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}
>
    Content: tt:metadata?, tt:style+
</tt:styling>
```

```
<tt:style
    xml:id = <xs:ID> #REQUIRED
    style = <xs:IDREFS>
    tts:direction = ( "ltr" | "rtl" )
    tts:fontFamily = <ebuttdt:fontFamilyType>
    tts:fontSize = <ebuttdt:fontSizeType>
    tts:lineHeight = ("normal" | <ebuttdt:lengthType>)
    tts:textAlign = ( "left" | "center" | "right" | "start" | "end" )
    tts:color = <ebuttdt:colorType>
    tts:backgroundColor = <ebuttdt:colorType>
    tts:fontStyle = ( "normal" | "italic" )
    tts:fontWeight = ( "normal" | "bold" )
    tts:textDecoration = ( "none" | "underline" )
    tts:unicodeBidi = ( "normal" | "embed" | "bidiOverride" )
    tts:wrapOption = ( "wrap" | "noWrap" )
    tts:padding = <ebuttdt:paddingType> /* deprecated * /
    ebutts:multiRowAlign = ("start" | "center" | "end" | "auto")
    ebutts:linePadding = <ebuttdt:linePaddingType
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace} />

<tt:layout
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}
>
    Content: tt:metadata?, tt:region+
</tt:layout>

<tt:region
    xml:id = <xs:ID> #REQUIRED
    tts:origin = <ebuttd:originType> #REQUIRED
    tts:extent = <ebuttd:extentType> #REQUIRED
    style = <xs:IDREFS>
    tts:displayAlign = ( "before" | "center" | "after" )
    tts:padding = <ebuttdt:paddingType>
    tts:writingMode = ("lrtb"| "rltb" | "tbrl" | "tblr" | "lr" | "rl" | "tb")
    tts:showBackground = ("always" | "whenActive")
    tts:overflow = ("visibile" | "hidden")
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}
>
    Content: tt:metadata?
</tt:region>

<tt:body
    style = <xs:IDREFS>
   {any attribute in the TT Metadata namespace}
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}
    begin = (<ebuttd:smpteTimingType> | <ebuttdt:mediaTimingType> |
             <ebuttdt:clockTimingType>)
    end   = (<ebuttd:smpteTimingType> | <ebuttdt:mediaTimingType> |
             <ebuttdt:clockTimingType>)
>
    Content: tt:metadata?, tt:div+
</tt:body>
```

```
<tt:div
    xml:id = <xs:ID>
    region = <xs:IDREF>
    style =  <xs:IDREFS>
    xml:lang = ("" | <xs:language>)
    begin = (<ebuttd:smpteTimingType> | <ebuttdt:mediaTimingType> |
            <ebuttdt:clockTimingType>)
    end = (<ebuttd:smpteTimingType> | <ebuttdt:mediaTimingType> |
           <ebuttdt:clockTimingType>)
   {any attribute in the TT Metadata namespace}
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}
>
    Content: tt:metadata?, tt:div*, tt:p*
</tt:div>

<tt:p
    xml:id = <xs:ID> #REQUIRED
    xml:space = ("default"|"preserve")
    xml:lang = ("" | <xs:language>)
    region = <xs:IDREF>
    style = <xs:IDREFS>
    begin = (<ebuttd:smpteTimingType> | <ebuttdt:mediaTimingType> |
             <ebuttdt:clockTimingType>)
    end = (<ebuttd:smpteTimingType> | <ebuttdt:mediaTimingType> |
           <ebuttdt:clockTimingType>)
   {any attribute in the TT Metadata namespace}
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}
>
    Content (Mixed): tt:metadata?, (tt:span|tt:br)*
</tt:p>

<tt:span
    xml:id = <xs:ID>
    xml:space = ("default"|"preserve")
    xml:lang = ("" | <xs:language>)
    style = <xs:IDREFS>
    begin = (<ebuttd:smpteTimingType> | <ebuttdt:mediaTimingType> |
             <ebuttdt:clockTimingType>)
    end = (<ebuttd:smpteTimingType> | <ebuttdt:mediaTimingType> |
           <ebuttdt:clockTimingType>)
   {any attribute in the TT Metadata namespace}
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}
>
    Content (Mixed): tt:metadata?, tt:span*, tt:br*
</tt:span>

<tt:br
   {any attribute in the TT Metadata namespace}
   {any attribute in the EBU-TT Metadata namespace}
   {any attribute not in default, any TT namespace or any EBU-TT namespace}
>
    Content: tt:metadata?
</tt:br>
```

```
EXPRESSIONS

<ebuttdt:cellResolutionType>
    : <columns> <whiteSpace> <rows>

<columns> | <rows>
    : <digit>* <digitGreaterZero> <digit>*

<ebuttdt:colorType>
    : <color> as defined in TTML 1

<ebuttdt:extentType>
    : <width> <whiteSpace> <height> /*<witdth>, <height> must not be negative. * /

<width> | <height>
    : <ebuttdt:lengthType>

<ebuttdt:fontFamilyType>
    : <familyName> | <genericFamilyName> as defined in TTML 1

<ebuttdt:fontSizeType>
    : <ebuttdt:lengthType> <whiteSpace> <ebuttdt:lengthType>?

<ebuttdt:frameRateMultiplierType>
    : <numerator> <whiteSpace> <denominator>

<numerator> | <denominator>
    : <digit>* <digitGreaterZero> <digit>*

<ebuttdt:lengthType>
    : <scalar>
    | <percentage>

<scalar>
    : <number> <units>

<percentage>
    : <number> "%"

<number>
    : <sign>? <non-negative-number>

<sign>
    : "+" | "-"

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

<non-negative-integer>
    : <digit>+

<non-negative-real>
    : <digit>* "." <digit>+

<units>
    : "px"    /* abbreviation of "pixel" */
    | "c"     /* abbreviation of "cell" */

<ebuttdt:lineHeightType>
    : "normal" | <ebuttdt:lengthType>           /* length >= 0 */

<ebuttdt:originType>
    : <x-coord> <whiteSpace> <y-coord>
```

```
<x-coord> | <y-coord>
    : <ebuttdt:lengthType>

<ebuttdt:paddingType>
    : <all-edges>
    | <beforeAndAfter> <whiteSpace> <startAndEnd>
    | <before> <whiteSpace> <startAndEnd> <whiteSpace> <after>
    | <before> <whiteSpace> <end> <whiteSpace> <after> <whiteSpace> <start>

<all-edges> | <before> | <end> | <after> | <start> | <beforeAndAfter> |
<startAndEnd>
    : <ebuttdt:lengthType> /* The value must not be negative */

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

<ebuttdt:noTimezoneDateType>
    : <xs:date> with no timezone specified

<ebuttdt:smpteTimingType>
    : <hh> ":" <mm> ":" <ss> ":" <ff>

<hh> | <mm> | <ss> | <ff>
    : <digit> <digit>
<hhh>
    : <digit> <digit>+

<ebuttdt:mediaTimingType>
    : <full-clock-value>
    | <timecount-value>

<ebuttdt:clockTimingType>
    : <limited-clock-value>
    | <timecount-value>

<full-clock-value>
    : <hhh> ":" <mm> ":" <ss> ("." <digit>+)?
<limited-clock-value>
    : <hh> ":" <mm> ":" <ss> ("." <digit>+)?
<timecount-value>
    : <digit>+ ("." <digit>+)? <metric>

<metric>
    : "h"   /* hours */
    | "m"   /* minutes */
    | "s"   /* seconds */
    | "ms"  /* milliseconds */

<digit>
    : "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

<digitGreaterZero>
    : "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

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