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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

IPTV multimedia services and applications for IPTV –
IPTV multimedia application frameworks

Scalable vector graphics for IPTV services

Recommendation ITU-T H.763.2

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Recommendation ITU-T H.763.2

Scalable vector graphics for IPTV services

Summary

Recommendation ITU-T H.763.2 describes the functionalities of SVG Tiny, which is issued by W3C organization, as one of the multimedia application frameworks for IPTV services. According to different capabilities of terminal devices on supported services and processing performance, SVG Tiny is classified into "Basic Profile" and "Advanced Profile" for different IPTV terminal device models in this Recommendation. Scalable vector graphics (SVG) basic profile is designed for the Internet protocol television (IPTV) terminal device (TD) basic model ITU-T H.721 and mobile model ITU-T H.723, and SVG advanced profile is designed for the IPTV TD full-fledged model ITU-T H.722. SVG advanced profile supports more capabilities of two-dimensional graphics' rendering than SVG basic profile, particularly in styling, animation, multimedia and interactivity.

This Recommendation describes the required aspects of SVG modules, elements, attributes and properties to be supported by those two profiles. It also gives some typical example codes or simulation results.

History

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Recommendation ITU-T H.763.2

Scalable vector graphics for IPTV services

1 Scope

This Recommendation describes the functionalities of the scalable vector graphics (SVG) for IPTV services. SVG, as one of those standard multimedia application frameworks described in [ITU-T H.760], provides interoperable use of IPTV services. IPTV terminal devices supporting SVG can provide functionalities of a variety of content and its interactivity, such as audio, video, graphics and text. Expected services include additional data such as text, animation to enrich TV programmes, and two-way portal pages.

This Recommendation describes the profiles, which is a subset of W3C SVG [W3C SVG Tiny], classified into 2 levels to be implemented by IPTV TD Basic model [ITU-T H.721], Mobile model [ITU-T H.723] and Full-fledged model [ITU-T H.722] with different service capabilities. It describes the use of IP-based protocols for transport of SVG and IPTV-related services.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- | | |
|-----------------|--|
| [ITU-T F.902] | Recommendation ITU-T F.902 (1995), <i>Interactive services design guidelines</i> . |
| [ITU-T H.720] | Recommendation ITU-T H.720 (2008), <i>Overview of IPTV terminal devices and end systems</i> . |
| [ITU-T H.721] | Recommendation ITU-T H.721 (2009), <i>IPTV terminal devices: Basic model</i> . |
| [ITU-T H.722] | Recommendation ITU-T H.722 (2014), <i>IPTV terminal device: Full-fledged model</i> . |
| [ITU-T H.723] | Recommendation ITU-T H.723(2016), <i>IPTV terminal device: Mobile model</i> . |
| [ITU-T H.760] | Recommendation ITU-T H.760 (2009), <i>Overview of multimedia application frameworks for IPTV services</i> . |
| [ITU-T H.762] | Recommendation ITU-T H.762 (2009), <i>Lightweight interactive multimedia environment (LIME) for IPTV services</i> . |
| [ITU-T H.764] | Recommendation ITU-T H.764 (2012), <i>IPTV services enhanced script language</i> . |
| [ITU-T Y.1901] | Recommendation ITU-T Y.1901 (2009), <i>Requirements for the support of IPTV services</i> . |
| [ISO/IEC 16262] | ISO/IEC 16262:2011, <i>Information technology – Programming languages, their environments and system software interfaces – ECMAScript language specification</i> . |
| [W3C SVG Tiny] | W3C Recommendation (2008), <i>Scalable Vector Graphics (SVG) Tiny 1.2 Specification</i> . |

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 Internet protocol television (IPTV) [ITU-T Y.1901]: Multimedia services such as television/video/audio/text/graphics/data delivered over IP-based networks that are managed to support the required level of QoS/QoE, security, interactivity and reliability.

3.1.2 electronic programme guide (EPG) [ITU-T Y.1901]: A structured set of data, intended to provide information on available content that may be accessed by end users.

3.1.3 linear TV [ITU-T Y.1901]: A television service in which a continuous stream flows in real time from the service provider to the terminal device and where the user cannot control the temporal order in which contents are viewed.

3.1.4 video-on-demand (VoD) [ITU-T Y.1901]: A service in which the end user can, on demand, select and view video content and where the end user can control the temporal order in which the video content is viewed (e.g., the ability to start the viewing, pause, fast forward, rewind, etc.).

3.1.5 user agent [ITU-T H.764]: One type of web agent; a piece of software acting on behalf of a person.

3.1.6 terminal device (TD) [ITU-T Y.1901]: An end-user device which typically presents and/or processes the content, such as a personal computer, a computer peripheral, a mobile device, a TV set, a monitor, a VoIP terminal or an audiovisual media player.

3.1.7 user interface (UI) [ITU-T F.902]: Software and hardware components through which a user can interact with a system.

3.1.8 ECMAScript [ISO/IEC 16262]: The programming language defined by ISO/IEC 16262:2011.

3.1.9 LIME-Script [ITU-T H.762]: The subset of ECMAScript defined in this Recommendation that composes lightweight interactive multimedia environment (LIME).

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms.

API	Application Programming Interface
CSS	Cascading Style Sheets
DOM	Document Object Model
ECMA	European Computer Manufacturers Association
HTML	Hypertext Markup Language
HTTP	Hypertext Transport Protocol
IP	Internet Protocol
IPTV SESL	IPTV Service Enhanced Scripting Language
IRI	Internationalized Resource Identifier
LIME	Lightweight Interactive Multimedia Environment for IPTV
MIME	Multipurpose Internet Mail Extensions

SMIL	Synchronized Multimedia Integration Language
SVG	Scalable Vector Graphics
SVG DOM	SVG Document Object Model
TD	Terminal Device
uDOM	SVG Micro Document Object Model
UI	User Interface
VoD	Video on Demand
XML	extensible Mark-up Language
XSL	extensible Stylesheet Language
XSLT	XSL Transformations

5 Conventions

In this Recommendation:

- The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.
- The keywords "is prohibited from" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.
- The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.
- The keywords "is not recommended" indicate a requirement which is not recommended but which is not specifically prohibited. Thus, conformance with this specification can still be claimed even if this requirement is present.
- The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 Introduction

Scalable vector graphic (SVG) [b-W3C SVG] is a language for describing two-dimensional graphics and graphical applications in extensible mark-up language (XML) [b-W3C XML 1.0]. SVG [b-W3C SVG] allows for several types of graphic objects: vector graphic shapes (e.g., paths consisting of straight lines and curves), images, video, audio and text. Graphic objects can be grouped, styled, transformed and composited into previously rendered objects. The feature set includes nested transformations, clipping paths, alpha masks, filter effects and template objects.

SVG drawings can be interactive and dynamic. Animations can be defined and triggered either declaratively or via scripting. Sophisticated applications of SVG are possible by use of a supplemental scripting language providing complete access to all elements, attributes and properties to implement multimedia services. This makes SVG one of the Internet protocol television (IPTV) multimedia application framework engines.

SVG Tiny [W3C SVG Tiny] is targeted to resource-limited devices such as mobile phones. Since IPTV terminal device (TD) is a type of resource-restrained terminal device, it may use SVG Tiny as a multimedia application framework engine to implement IPTV services.



Documents

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According to [ITU-T H.720], IPTV TDs with different capabilities are defined as basic model [ITU-T H.721], mobile model [ITU-T H.723] and full-fledged model [ITU-T H.722]. The basic model and mobile model are only capable of supporting basic IPTV services, such as linear TV, video on demand (VoD) and interactivity, and the full-fledged model may also support supplementary IPTV services such as Internet, medical, communication, etc. As a result of different IPTV services requirements and terminal capabilities, different types of IPTV TDs, which choose SVG Tiny as a multimedia application framework engine, may not support the full set.

In this Recommendation, SVG Tiny [W3C SVG Tiny] is classified into two profiles for different IPTV TDs:

- The profile hereinafter called "Basic Profile" is designed for resource restrained IPTV TD, such as the basic model defined in [ITU-T H.721] and the mobile model in [ITU-T H.723]. The attributes and properties defined in clauses 7 and 9.2 of the basic profile are mandatory for an SVG implementation for these terminal device models.
- The profile hereinafter called "Advanced Profile" is designed for enhanced IPTV TD, such as the full-fledged model [ITU-T H.722]. This profile defines the functional extensions required for supplementary IPTV services. The attributes and properties defined in clauses 7, 8 and 9.2 of the advanced profile are mandatory for an SVG implementation for the full-fledged terminal device model.

7 Basic profile

Since IPTV TD basic model [ITU-T H.721] or mobile model [ITU-T H.723] is only capable of supporting basic audio-visual IPTV services, such as linear TV and VoD, and service navigation with EPG, the basic requirement of SVG's modules, elements, attributes and properties, which is a subset of [W3C SVG Tiny], is defined to be supported in this section as "Basic Profile". The IPTV TD basic model [ITU-T H.721] and mobile model [ITU-T H.723], which chooses SVG as multimedia application framework engine, is recommended to support SVG Basic Profile.

7.1 Document structure

Document object model (DOM) is a language-independent standard object model for representing XML and related formats. Since IPTV TDs are resource-restrained equipment, a subset of DOM Level 2 Specification [b-W3C DOM2], which is called uDOM, is required to be supported.

The goal of the SVG micro document object model (uDOM) definition is to provide an application programming interface (API) that allows access to initial and computed attribute and property values, to reduce the number of interfaces compared to the traditional SVG DOM, and to reduce run-time memory footprint using the necessary features of the core XML DOM.

7.1.1 The common attributes

7.1.1.1 Attributes common to all elements

The following attributes are available on all elements. Some of these elements, such as 'id', 'xml:id', and 'xml:base' may have a direct effect on the structure and rendering of SVG, while others may only affect SVG indirectly, or may be used only for auxiliary processing of SVG content.

- id – This attribute specifies a unique identifier for the element. Because of wider use and compatibility with the legacy content and the existing user agents (including authoring tools), it is recommended that the content intended for use in a MAFR presentation engine should use 'id' instead of 'xml:id'.
- xml:id – This attribute specifies a unique identifier for the element.
- xml:base – This attribute specifies a base internationalized resource identifier (IRI) [b-IETF RFC 3987] other than the base IRI of the document or external entity.

- class – It assigns one or more class names to an element. The element belongs to these classes. A class name may be shared by several element instances.
- role – It assigns one or more role values to an element. The element has these roles. A role value may be shared by several element instances.
- rel – It assigns one or more relationship values to an element. The value of the 'rel' attribute expresses the relationships between two resources.
- rev – It assigns one or more relationship values to an element. The value of the 'rev' attribute expresses the reverse relationships between two resources.
- about – it assigns one or more relationship values to an element. The value of the 'about' attribute is intended to be used for stating the subject of the element's data.
- content – It provides a plain text value that may be suitable for humans, or may be machine-readable, or both, depending on the context. In general, this should only be used to supplement textual child content, or to be used on elements which do not normally take text as child content.
- datatype – It specifies a semantic data type for the content of the element, or the value of the 'content' attribute if one is provided for the element.
- property – it is used for expressing relationships between the element's subject (e.g., the text content of a child node or of an attribute value) and a set of known or referenced properties.
- resource – it associates a resource, typically expressed with an IRI reference, to the element, in a manner that does not normally resolve the IRI reference.
- typeof – it associates one or more data types with the element. This attribute should not be confused with the 'type' attribute, and has no direct effect on the rendering or execution of the element.

7.1.1.2 Attributes for character-content elements

Elements that might contain character data content have attributes 'xml:lang' and 'xml:space' to specify the natural language and whitespace processing of the content.

- xml:lang – This is a standard XML attribute used to specify the language (e.g., English) used in the child text content and attribute values of the element it occurs on.
- xml:space – This is a standard XML attribute used to specify whether white space is preserved in character data. The only possible values are "default" and "preserve".

7.1.2 The 'svg' element

An SVG document fragment consists of any number of SVG elements contained within a 'svg' element, including the 'svg' element.

An SVG document fragment can range from an empty fragment (i.e., no content inside of the 'svg' element), to a very simple SVG document fragment containing a single SVG graphics element such as a 'rect', to a complex, deeply nested collection.

An SVG document fragment can stand by itself as a self-contained file or resource, in which case the SVG document fragment is a SVG document or it can be embedded inline as a fragment within a parent XML document.

An SVG document fragment can only contain one single 'svg' element. This means that 'svg' elements cannot appear in the middle of SVG content. The attribute of 'svg' element for IPTV service is presented in Table 1.

Table 1 – Attributes of the 'svg' element

Attribute	Data Type	Default value	Description
version	<string>	1.2	Indicates the SVG language version to which this document fragment conforms. For IPTV TDs, only "1.2" is supported.
baseProfile	<string>	tiny	Describes the minimum SVG language profile that the author believes is necessary to correctly render the content. For IPTV TDs, only "tiny" is supported.
width	<length>	100%	The intrinsic width of the SVG document fragment. A negative value is unsupported. A value of zero disables rendering of the element.
height	<length>	100%	The intrinsic height of the SVG document fragment. A negative value is unsupported. A value of zero disables rendering of the element.
focusable	<string>	auto	Defines whether the grouped elements are focusable. The possible values are: "true" "false" "auto".
Navigation Attributes	<string>	auto	See definition of Navigation in clause 7.6.3.
contentType	<content-type>	application/ecmascript	Identifies the default scripting language for the given document.
NOTE – The high performance required attribute will be described in Advanced Profile in this Recommendation.			

The following example shows the simplest SVG content fragment with the 'svg' element.

```
<?xml version="1.0" encoding="UTF-8"?>
<svg xmlns="http://www.w3.org/2000/svg" version="1.2" baseProfile="tiny"
    width="100%" height="50%">
</svg>
```

7.1.3 The 'g' element

The 'g' element is a container element for grouping those related graphics elements. Grouping constructs, when used in conjunction with the 'desc' and 'title' elements, provide information about document structure and semantics. The attribute of 'g' element for IPTV service is presented in Table 2.

A typical example of the "g" element is shown in Figure 1.

Table 2 – Attributes of the 'g' element

Attribute	Data Type	Default value	Description
focusable	<string>	auto	Defines whether the grouped elements are focusable. The possible values are "true" "false" "auto".
Navigation Attributes	<string>	auto	See definition of Navigation in clause 7.6.3.
transform	<transform-list> / "none"	none	Specifies a coordinate system transformation to apply to the element it appears on. The possible values are "<transform-list>" "none". It supports the following values of <transform-list> in Basic Profile: translate(<tx> [<ty>]): specifies a translation by tx and ty. scale(<sx> [<sy>]): specifies a scale operation by sx and sy. For detailed information, please refer to clause 7.6 of [W3C SVG Tiny].
NOTE – The high performance required attribute will be described in Advanced Profile in this Recommendation.			

```
<?xml version="1.0" encoding="UTF-8"?>
<svg xmlns="http://www.w3.org/2000/svg" " version="1.2"
    baseProfile="tiny" width="400px" height="120px">
  <g fill="none" stroke="black" stroke-width="3">
    <!-- Draw the axes of the original coordinate system -->
    <line x1="0" y1="1.5" x2="400" y2="1.5"/>
    <line x1="1.5" y1="0" x2="1.5" y2="120"/>
  </g>
  <text x="20" y="20" font-size="18" font-family="Verdana">
    Original coord system
  </text>

  <g transform="translate(50,50)">
    <!-- Establish a new coordinate system from the initial coordinate system
        by 50 user units along x and y axis -->
    <g fill="none" stroke="red" stroke-width="3">
      <line x1="0" y1="0" x2="70" y2="0"/>
      <line x1="0" y1="0" x2="0" y2="70"/>
    </g>
    <text x="20" y="20" font-size="16" font-family="Verdana" stroke="red">
      Translated coord system
    </text>
  </g>
</svg>
```

Original coord system

Translated coord system

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Figure 1 – Example for the "g" element

7.1.4 The 'defs' element

The 'defs' element is a container element for referenced elements. The content model for 'defs' is the same as for the 'g' element; thus, any element that can be a child of a 'g' can also be a child of a 'defs', and vice versa.

There are no attributes defined for the 'defs' element.

The following example shows the simplest SVG content fragment with the 'defs' element.

```
<?xml version="1.0"?>
<svg xmlns="http://www.w3.org/2000/svg" version="1.2" baseProfile="tiny"
  width="100%" height="100%">
  <defs>
    <linearGradient xml:id="Gradient01">
      <stop offset="0.2" stop-color="#39F"/>
    </linearGradient>
  </defs>
</svg>
```

7.1.5 The 'title' and 'desc' element

Each container element or graphics element in an SVG document may contain one or more of each of the 'title' and 'desc' descriptive elements, which together comprise a sort of heading and summary of the containing element:

- The 'title' element must contain a brief plain text passage representing the title for the container or graphics element containing it.
- The 'desc' element must contain a longer, more detailed plain text description for the container or graphics element containing it.

There are no attributes defined for the 'title' and 'desc' element.

The following example shows the simplest SVG content fragment with the 'title' and 'desc' element.

```
<?xml version="1.0"?>
<svg xmlns="http://www.w3.org/2000/svg" version="1.2" baseProfile="tiny"
  width="100%" height="100%">
  <title>This is a SVG Profile for IPTV service</title>
  <desc>An example of how the contents of the 'title' and 'desc' elements may be
  presented in a user agent.</desc>
</svg>
```

7.1.6 The 'use' element

Any 'g' or graphics element is potentially a template object that can be reused in the SVG document via a 'use' element. The 'use' element references another element and indicates that the graphical content of that element is to be included and drawn at that given point in the document. The attribute of 'use' element for IPTV service is shown in Table 3.

A typical example of the "use" element is shown in Figure 2.

Table 3 – Attributes of the 'use' element

Attribute	Data Type	Default value	Description
x	<coordinate>	0	The x-axis coordinate of one corner of the rectangular region into which the referenced element is placed.
y	<coordinate>	0	The y-axis coordinate of one corner of the rectangular region into which the referenced element is placed.
xlink:href	<IRI>	empty string	An IRI reference to an element/fragment within an SVG document.
focusable	<string>	auto	Defines whether the grouped elements are focusable. The possible values are: "true" "false" "auto".
Navigation Attributes	<string>	auto	See definition of Navigation in clause 7.6.3.
transform	<transform-list> / "none"	none	See the definition of transform in clause 7.1.3.
NOTE – The high performance required attribute will be described in Advanced Profile in this Recommendation.			

```

<?xml version="1.0"?>
<svg xmlns="http://www.w3.org/2000/svg" version="1.2" baseProfile="tiny"
    width="10cm" height="3cm">

    <defs>
        <rect xml:id="IPTVRec" width="60" height="10" fill="black"
            fill-opacity="0.5"/>
    </defs>
    <rect x=".1" y=".1" width="99.8" height="29.8"
        fill="none" stroke="blue" stroke-width=".2"/>
    <use x="20" y="10" xlink:href="#IPTVRec" />
</svg>

```

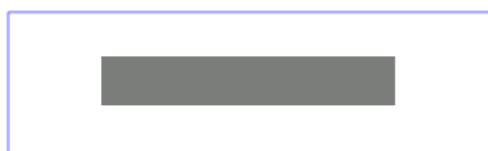


Figure 2 – Example for the "use" element

7.1.7 The 'image' element

The 'image' element indicates that the contents of an image are to be rendered into a given rectangle within the current user coordinate system. In SVG Tiny 1.2, the 'image' must reference content that is a raster image format, such as PNG or JPEG. For detailed information on image format supported by IPTV TDs, please refer to [ITU-T H.721], [ITU-T H.722] and [ITU-T H.723].

The attribute of 'image' element for IPTV service is shown in Table 4.

Table 4 – Attributes of the 'image' element

Attribute	DataType	Default value	Description
x	<coordinate>	0	The x-axis coordinate of one corner of the rectangular region into which the referenced element is placed.
y	<coordinate>	0	The y-axis coordinate of one corner of the rectangular region into which the referenced element is placed.
width	<length>	0	The width of the rectangular region. A negative value is unsupported. A value of zero disables rendering of the element.
height	<length>	0	The height of the rectangular region. A negative value is unsupported. A value of zero disables rendering of the element.
xlink:href	<IRI>	empty string	An IRI reference to an image.
focusable	<string>	auto	Defines whether the element is focusable. The possible values are: "true" "false" "auto".
Navigation Attributes	<string>	auto	See definition of Navigation in clause 7.6.3.
type	<content-type>	/	A hint about the expected Internet Media Type of the raster image.

NOTE – The high performance required attribute will be described in Advanced Profile in this Recommendation.

The following example shows the simplest SVG content fragment with the 'image' element.

```
<?xml version="1.0"?>
<svg xmlns="http://www.w3.org/2000/svg" version="1.2" baseProfile="tiny"
  width="10cm" height="10cm">
  <g xml:base="http://a.example.org/aaa/">
    <image xml:id="foo" xlink:href="foo.jpg" width="100" height="100"/>
  </g>
</svg>
```

7.2 Fonts

An SVG font is a font defined using SVG's 'font' element. The purpose of SVG fonts is to allow for delivery of glyph outlines in display-only environments. SVG fonts that accompany web pages must be supported only in browsing and viewing situations.

7.2.1 The 'font' element

The 'font' element defines a character's displaying model on the screen of IPTV TD.

The attributes of this element are presented in Table 5.

Table 5 – Attributes of the "font" element

Attribute	Data Type	Default value	Description
horiz-origin-x	<number>	0	The X-coordinate in the font coordinate system of the origin of a glyph to be used when drawing horizontally oriented text.
horiz-adv-x	<number>	0	The default horizontal advance after rendering a glyph in horizontal orientation. Glyph widths are required to be non-negative, even if the glyph is typically rendered right-to-left, as in Hebrew and Arabic scripts.
NOTE – Each 'font' element must have a 'font-face' child element which describes various characteristics of the font.			

The following is a typical example of the "font" element.

```
<font xml:id="Font1" horiz-adv-x="1000">
  <font-face font-family="Super Sans" font-weight="bold" font-style="normal">
  </font-face>
</font>
```

7.2.2 The 'glyph' element

The 'glyph' element defines the graphics for a given glyph. The coordinate system for the glyph is defined by the various attributes in the 'font' element.

The graphics that make up the 'glyph' consist of a single path data specification within the 'd' attribute.

Table 6 – Attributes of the "glyph" element

Attribute	Data Type	Default value	Description
d	string	/	The definition of the outline of a glyph, using the same syntax as for the 'd' attribute on a 'path' element.

7.2.3 The 'missing-glyph' element

The 'missing-glyph' element defines a graphic to use if there is an attempt to draw a glyph from a given font and the given glyph has not been defined. The attributes on the 'missing-glyph' element have the same meaning as the corresponding attributes on the 'glyph' element.

7.2.4 The 'font-face' element

The 'font-face' element is an XML structure which is directly corresponded to the 'font-face' facility in CSS2. It can be used to describe the characteristics of any font, SVG font or otherwise.

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Table 7 – Attributes of the "font-face" element

Attribute	DataType	Default value	Description
font-family	<string>	system's default font	A prioritized list of font family names or generic family names. Possible values of generic families are: "serif" "sans-serif" "cursive" "fantasy" "monospace".
font-style	<string>	normal	Selects the style of font within a font family. Possible values are: "normal" "italic" "oblique".
font-weight	<string>	normal	Selects the weight of the font. Possible values are: "normal" "bold" "bolder" "lighter" "100" "200" "300" "400" "500" "600" "700" "800" "900".

The following is a typical example of the "font-face" element.

```
<font-face font-family="Super Sans" font-weight="bold" font-style="normal">
</font-face>
```

7.3 Shape

Shape is a graphics element that comprises a defined combination of straight lines and curves on the screen of IPTV TD.

Shape can use the styling properties of Painting inside its elements, see clause 9.2. It can also use the common attribute 'transform', 'focusable' and Navigation. See the definition of transform in clause 7.1.3 and the definition of Navigation in clause 7.6.3.

7.3.1 The 'rect' element

The element 'rect' defines a rectangle which is axis-aligned with the current user coordinate system. For IPTV service, the "coordinate system" indicates the video output resolution of the IPTV TD.

The attributes of this element are defined in Table 8.

Table 8 – Attributes of the "rect" element

Attribute	DataType	Default value	Description
x	<coordinate>	0	The left-top point's x-axis coordinate of the rectangle, e.g., x="100".
y	<coordinate>	0	The left-top point's y-axis coordinate of the rectangle, e.g., y="100".
width	<length>	0	The width of the rectangle, e.g., width="200". The value "0" indicates that the rendering of the element is disabled.
height	<length>	0	The height of the rectangle, e.g., height="50". The value "0" indicates that the rendering of the element is disabled.
rx	<length>	0	The x-axis radius of the ellipse used to round off the corners of the rectangle, e.g., rx="10". The value "0" indicates that no rounding corner is specified.

Table 8 – Attributes of the "rect" element

Attribute	Data Type	Default value	Description
ry	<length>	0	The y-axis radius of the ellipse used to round off the corners of the rectangle, e.g., ry="10". The value "0" indicates that no rounding corner is specified.
NOTE 1 – If the "rx" and "ry" are not provided, it indicates no rounding corner is specified. NOTE 2 – If the "rx" is provided but not for "ry", the same value of "rx" should be processed by the user agent for "ry". NOTE 3 – If the "ry" is provided but not for "rx", the same value of "ry" should be processed by the user agent for "rx".			

The following is a typical example of the "rect" element.

```
<rect x="100" y="100" width="200" height="100" rx="10" ry="10" />
```

7.3.2 The 'circle' element

The 'circle' element defines a circle based on a centre point and a radius.

The attributes of the 'circle' element are given in Table 9.

Table 9 – Attributes of the "circle" element

Attribute	Data Type	Default value	Description
cx	<coordinate>	0	The x-axis coordinate of the centre of the circle, e.g., cx="100".
cy	<coordinate>	0	The y-axis coordinate of the centre of the circle, e.g., cy="100".
r	<length>	0	The radius of the circle, e.g., r="50". The value "0" indicates the rendering of the element is disabled.

The following is a typical example of the "circle" element.

```
<circle cx="100" cy="100" r="50" />
```

7.3.3 The 'line' element

The 'line' element defines a line segment that starts at one point and ends at another.

The attributes of this element are given in Table 10.

Table 10 – Attributes of the "line" element

Attribute	Data Type	Default value	Description
x1	<coordinate>	0	The x-axis coordinate of the start point, e.g., x1="100".
y1	<coordinate>	0	The y-axis coordinate of the start point, e.g., y1="100".
x2	<coordinate>	0	The x-axis coordinate of the end point, e.g., x2="200".
y2	<coordinate>	0	The y-axis coordinate of the end point, e.g., y1="200".

NOTE – If the "x2" and "y2" is the same as "x1" and "y1", it indicates that the rendering of the element is disabled.

The following is a typical example of the "line" element.

```
<line x1="100" y1="100" x2="200" y2="200" />
```

7.3.4 The 'polyline' element

The "polyline" element defines a set of connected straight line segments. Typically, "polyline" elements define the open shapes.

The attributes of this element are given in Table 11.

A typical example of the "polyline" element is shown in Figure 3.

Table 11 – Attributes of the "polyline" element

Attribute	Data Type	Default value	Description
points	<string>	empty string	The list of points that make up the polyline. Each point in the list is described in a pair of x-axis and y-axis coordinate separated by a comma ",". Different points are separated by blank " ". E.g., points="10,10 100,100 150,200 200,200". The empty string "" indicates the rendering of the element is disabled.

NOTE – If an odd number of coordinates is provided, then the element is treated as if the attribute had not been specified.

```
<polyline points="30,35 45,55 75,55 90,35 75,40 60,20 45,40 " fill="#FFCC00" stroke="#666666"/>
```

**Figure 3 – Example for the "polyline" element**

7.3.5 The "polygon" element

The "polygon" element defines a closed shape consisting of a set of connected straight line segments.

The attributes of this element are given in Table 12.

A typical example of the "polygon" element is shown in Figure 4.

Table 12 – Attributes of the "polygon" element

Attribute	Data Type	Default value	Description
points	<string>	empty string	The list of points that make up the polygon. Each point in the list is described in a coordinate-pair of x-axis and y-axis separated by a comma ",". Different points are separated by blank " ". E.g., points="10,10 100,200 150,100 100,150". The empty string "" indicates the rendering of the element is disabled.
NOTE – If an odd number of coordinates is provided, then the element is treated as if the attribute had not been specified.			

```
<polygon points="30,35 45,55 75,55 90,35 75,40 60,20 45,40 " fill="#FFCC00" stroke="#666666"/>
```



Figure 4 – Example for the "polygon" element

7.4 Text

Text that is to be rendered as part of an SVG document fragment is specified for using text content elements, inside which the characters to be drawn are expressed as XML character data. SVG's text content elements are rendered like other graphics elements. Therefore, the same coordinate system and rendering features can be applied to text elements.

Text elements can apply the styling properties of Fonts (i.e., 'font-family', 'font-style', 'font-weight', 'font-size') and properties of Text (i.e., 'text-anchor', 'display-align', 'line-increment') to text content rendering. These properties are used as attributes in Text elements. See clause 9.2.

7.4.1 The 'text' element

The 'text' element defines a graphics element consisting of text. Each 'text' element causes a single string of text to be rendered and performs no automatic line breaking or word wrapping.

The attributes of this element are given in Table 13.

Table 13 – Attributes of the "text" element

Attribute	Data Type	Default value	Description
x	<list-of-coordinates>	0	The corresponding list of absolute X coordinates for the glyphs corresponding to the characters within this element. For IPTV TD basic model [ITU-T H.721], the recommended minimum value range is 0-720. For full-fledged model [ITU-T H.722], the recommended rang is 0-1920.

Table 13 – Attributes of the "text" element

Attribute	DataType	Default value	Description
y	<list-of-coordinates>	0	The corresponding list of absolute Y coordinates for the glyphs corresponding to the characters within this element. For IPTV TD basic model [ITU-T H.721], the recommended minimum value range is 0-576. For full-fledged model [ITU-T H.722], the recommended rang is 0-1080.
focusable	<string>	auto	Defines whether the element is focusable. The possible values are: "true" "false" "auto".
Navigation Attributes	<string>	auto	See definition of Navigation in clause 7.6.3.
editable	<string>	none	Indicates whether the text can be edited. Possible values are: none: editing facilities are not provided for the content. simple: user agent must provide a way to edit the content which is not hidden or removed from the rendering tree.
NOTE – If a single <coordinate> is provided, then the value represents for the current text position for rendering the glyphs that correspond to the first character within this element or any of its descendants.			

The following is a typical example of 'text' element.

```
<text x="100" y="100" font-family="sans-serif" font-weight="bold" font-
  style="normal" font-size="55">
  Text using embedded font
</text>
```

7.4.2 The 'tbreak' element

The 'tbreak' element is an empty element that forcibly breaks the current line of text, even if the current line of text is empty (i.e., multiple consecutive 'tbreak' elements each cause a line break). It has no attributes aside from the standard core and conditional attributes.

7.5 Painting

Painting is applied in successive operations to graphics elements including shapes, text, raster image and video. SVG Tiny supports two built-in types of fill and stroke rendering operations, i.e., solid colour and gradients.

7.5.1 The 'solidColor' element

The 'solidColor' element is a paint server that provides a single colour with opacity. It can only be referenced using the 'fill' and 'stroke' properties.

This element applies 'solid-color' property and 'solid-opacity' property to define the colour and opacity of painting. See clause 9.2.