

SMIL: Synchronized Multimedia Integration Language

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Presentation Outline:

- Introduction
 - Problems with Multimedia on the WWW
 - Goals for a multimedia format
- Example Presentation
- SMIL basics
 - media elements, spatial layout, temporal layout, linking, alternate content, semantic annotations
- Relationship with other W3C recommendations such as XML
- SMIL Support

The Problem: Multimedia

Lots of Bits

- Images, audio and video are beyond Internet design specs
- Results in space/time constraints at:
 - the server
 - the network(s)
 - the client

Not All Bits are Equally Important

- Time between samples often more important than bits in sample, for example lip synchronization (but not always...)

Content may be Distributed Across Network

- Need to synchronize presentation

Declarative: the key to Web integration

Choices:

- *Programmed*: encode events that display and remove objects
 - Lingo (Director) (using Shockwave)
 - Java (Dynamic HTML)
- *Declarative*: specify a set of objects and their synchronization
 - VRML
 - CWI's CMIF
 - INRIA's Madeus
- Declarative for basic aspects, extra complexity using programmed.

Objectives for Web-based Multimedia

Add synchronization capabilities to the Web

Provide a declarative language for the Web

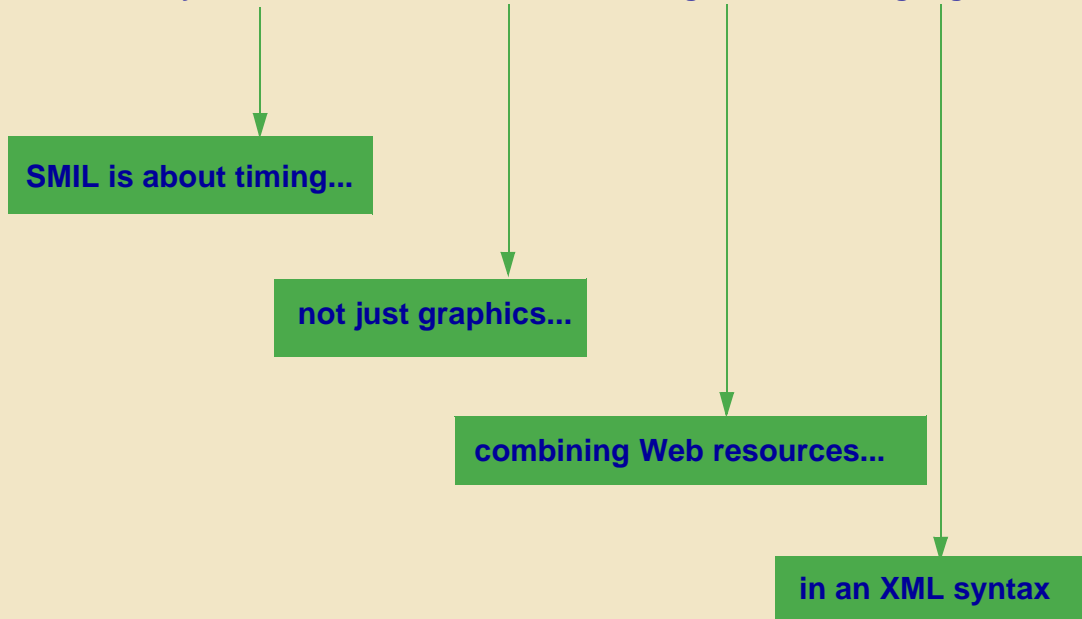
- interoperability

Format should be text based

- so can be edited by hand
- preferably XML based

SMIL

Synchronized Multimedia Integration Language



SMIL

Synchronized Multimedia Integration Language

- pronounced *smile*
- SMIL 1.0 became W3C recommendation on 15th June 1998
- SMIL Boston is public draft for next version, last released February 25 2000

SYMM group includes

- CWI, Oratrix - GRiNS authoring environment and player
- RealNetworks
 - RealPlayer 7 (G2), time-focussed media type, 3rd party creation tools
- Microsoft - Internet Explorer 5.5 supports HTML+SMIL

Focus

- SMIL 1.0 - Multimedia “basics”, adaptive
- SMIL Boston - “prettier” (animation, transitions), integration with other W3C languages

SMIL as XML Markup

Integration language

- Media elements referred to, not included

SMIL is XML

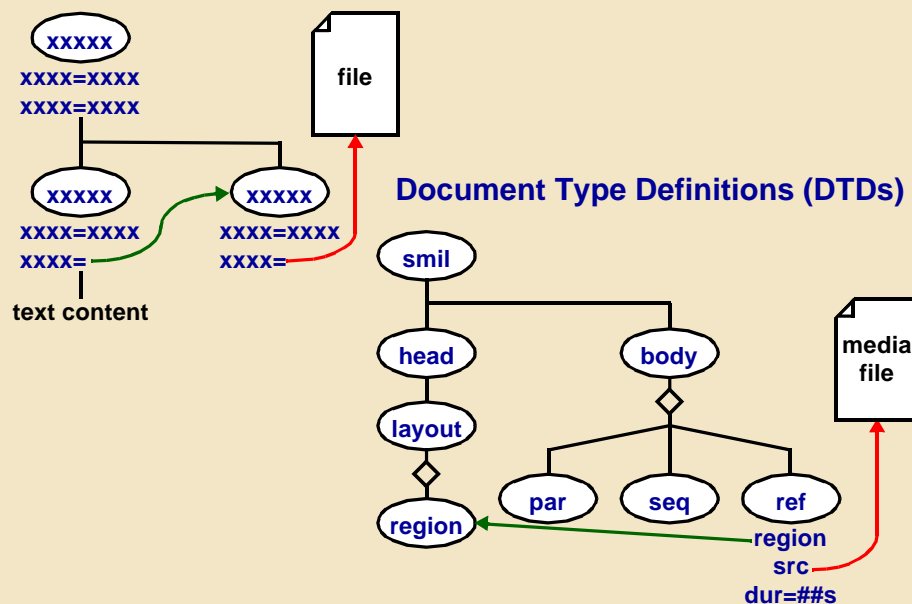
- Defined with XML DTD
- Can be hand-authored
- Declarative language
 - attribute/value pairs
- Integrable with XML environments

Relationship with Other W3C Recommendations

- Again, SMIL is XML
- Basic layout isomorphic and replacable with CSS
- Shares constructs with (X)HTML
- SMIL Boston “Family” languages enable new SMIL-based XML formats

XML (eXtensible Markup Language)

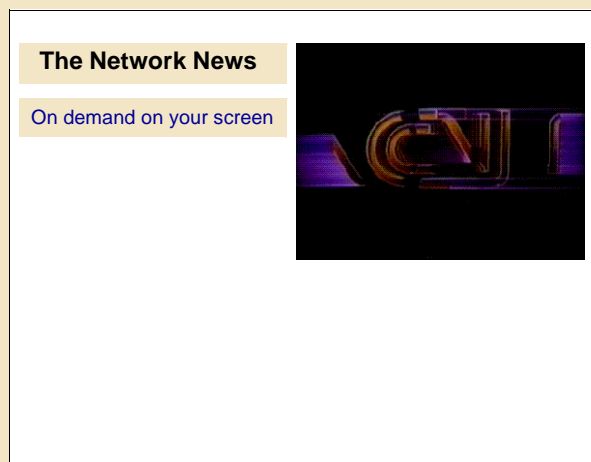
Foundation Syntax for all Documents



An XML (SMIL) Document

```
?xml version="1.0" encoding="ISO-8859-1"?>
!DOCTYPE smil PUBLIC "-//W3C//DTD SMIL 1.0//EN"
    "http://www.w3.org/AudioVideo/Group/SMIL10.dtd">
smil>
<head>
  <meta name="sync" content="soft"/>
  <layout>
    <root-layout id="SMIL-" width="492" height="810"/>
    <region id="address-region" width="50%" height="8%"/>
    <region id="image-region" top="8%" height="91%"/>
  </layout>
</head>
<body>
  <seq>
    <par>
      <text type="text/plain" region="address-region"
        src="Herengracht284.txt" dur="2s"/>
      
    </par>
    <par>
      <text type="text/plain" region="address-region" src="Herengracht539.txt"/>
      
    </par>
  </seq>
</body>
</smil>
```

A Sample Presentation



**Formatted text,
video and audio**

Local anchor setup

Top Story:
Growth of the World-Wide Web

Amsterdam

Los Angeles

Proportion of Audience

The graph shows a line starting at approximately 10% on the y-axis and rising to about 80% at the end of the x-axis. The area under the line is divided into three colored regions: blue at the bottom, orange in the middle, and green at the top. The labels 'Los Angeles' and 'Proportion of Audience' are positioned near the graph.

Graph appears during spoken commentary

Remote Correspondent

Top Story:
Growth of the World-Wide Web

Amsterdam

Los Angeles

First video finishes, second video plays

Following a Link

Top Story:
Growth of the World-Wide Web

Los Angeles

Amsterdam

Dick Bulterman

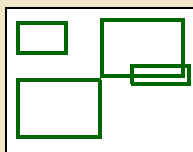
CWI

HOME SWEET HOME

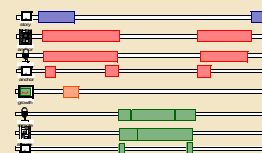
At any point during the video the viewer can request extra information.

So what do we need to specify?

II Spatial layout

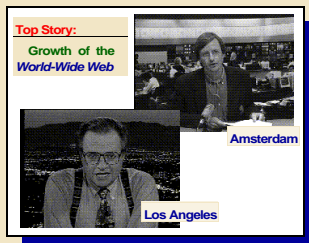


III Temporal layout



I Content

(part of) media item



IV Links

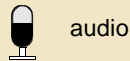
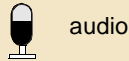
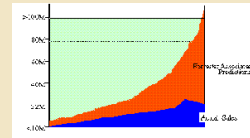
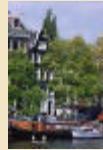
source and destination

VI Semantic annotations

V Alternative content

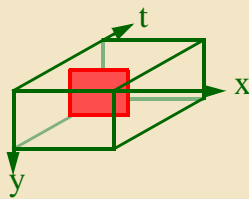
bandwidth
task
user characteristics

I Content

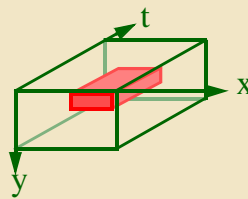


The top story tonight looks at the development of the World Wide Web. The growth of the Web has been exponential for the last few years and it is still unclear...

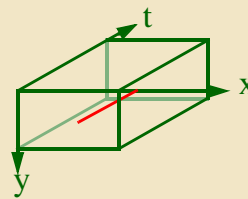
Spatial and Temporal Dimensions of Media Items



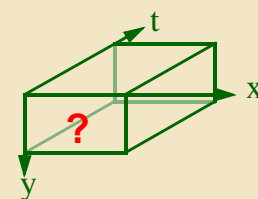
text:
2D objects in
linear sequence,
aspect ratio not
important



video:
2D layout plus
time, aspect
ratio probably
important



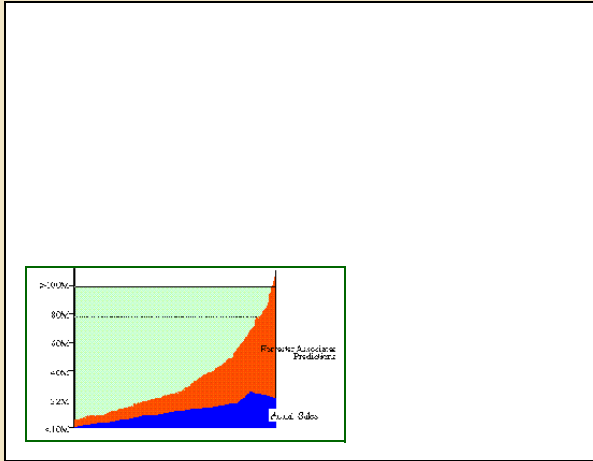
audio:
time only



?:
0 or 2D layout,
with or without
time

graphics:
2D layout,
aspect ratio
probably
important

Instance of Media Item



- I Media item, or part
- II Extent, position and Z-order
- III Duration
- IV Alternate Content
- V Link end-points
- VI Associated semantics

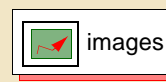
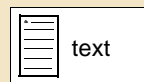
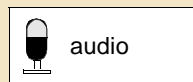
We will return to all these points at the end.

SMIL — Media Object Elements

SMIL 4.2.3. `ref`, `text`, `textstream`, `img`, `audio`, `video` and `animation`

```
<ref src="anything.???" ... />
<text src="caption.html" ... />
<textstream src="stockticker.rtx" ... />

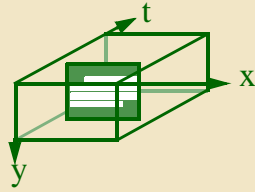
<audio src="http://www.w3c.org/SYMM/joe-audio.wav" ... />
<video src="rtsp://www.cwi.nl/SMIL/video.rm" ... />
<animation src="cute.anim" ... />
```



The `src` attribute is a URI, locating the data.

The player does not derive the exact type of the media object from the name of the media object element. It uses, e.g., the "type" attribute, or the type information communicated by the server or the operating system. Names are for readability.

Specification of part of media item



text — string

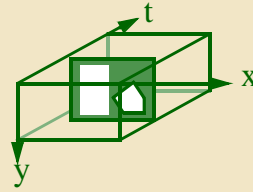
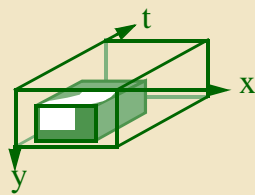
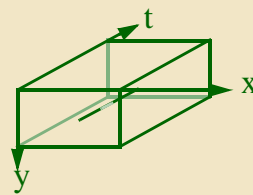


image — area



video — (moving) area

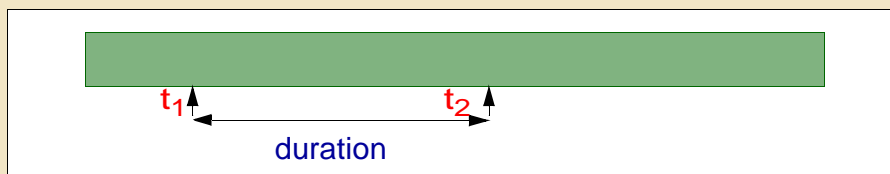


audio — phrase

SMIL — clips in time

Time and space treated independently.

- Spatial clipping done via region mechanism, discussed later
- Time restricted to a single extent
 - a contiguous section of a continuous media object can be specified



SMIL 4.2.3. clip-begin and clip-end attributes

```
<video src="the.news/mpeg/zoomin.mpv"  
  clip-begin="smpte=00:01:19:20"  
  clip-end="smpte=00:01:38:40" ... />
```

— syntax of values is ...

SMIL — clip begin/end syntax

```
Clip-time-value ::= Metric "=" ( Clock-val | Smpte-val )
Metric          ::= Smpte-type | "npt"
Smpte-type     ::= "smpte" | "smpte-30-drop" | "smpte-25"
Smpte-val     ::= Hours ":" Minutes ":" Seconds
               [ ":" Frames [ "." Subframes ] ]
Hours          ::= 2DIGIT
Minutes       ::= 2DIGIT
Seconds       ::= 2DIGIT
Frames        ::= 2DIGIT
Subframes     ::= 2DIGIT
```

Metric has three SMPTE options: **smpte**, **smpte-30-drop**, **smpte-25**, otherwise it is **NPT** (Normal Play Time), which uses a clock value.

Examples of clip-begin value:

SMPTE timestamp: **smpte=10:12:33:20**

NPT: **npt=12:05:35.3**

— syntax of a clock value is ...

SMIL 4.2.1. — Clock value syntax

```
Clock-val      ::= Full-clock-val | Partial-clock-val
               | Timecount-val
Full-clock-val ::= Hours ":" Minutes ":" Seconds ( "." Fraction )?
Partial-clock-val ::= Minutes ":" Seconds ( "." Fraction )?
Timecount-val  ::= Timecount ( "." Fraction )?
               ( "h" | "min" | "s" | "ms" )? ; default is "s"
Hours          ::= 2DIGIT; any positive number
Minutes       ::= 2DIGIT; range from 00 to 59
Seconds       ::= 2DIGIT; range from 00 to 59
Fraction      ::= DIGIT+
Timecount     ::= DIGIT+
2DIGIT        ::= DIGIT DIGIT
DIGIT         ::= [0-9]
```

Examples of legal clock values:

Full clock value: **02:30:03 = 2 hours, 30 minutes and 3 seconds**

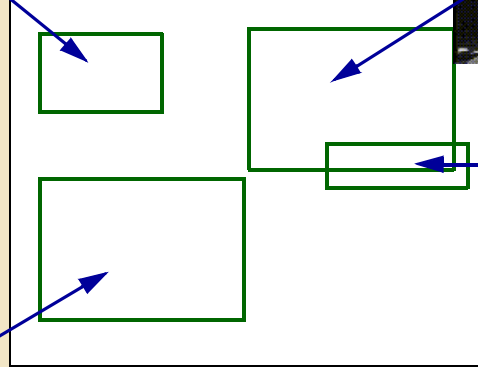
Partial clock value: **02:33 = 2 minutes and 33 seconds**

Timecount values: **3h , 45min , 30s, 5ms**

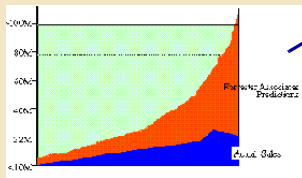
II Spatial layout

Top Story:

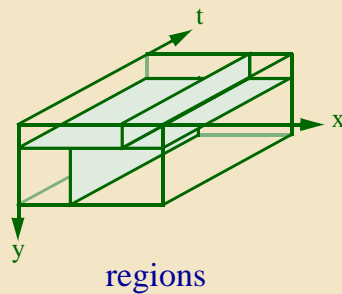
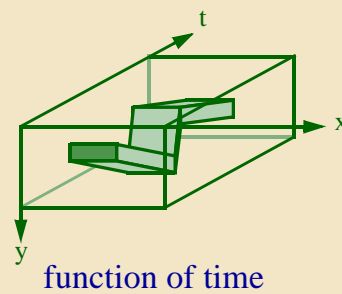
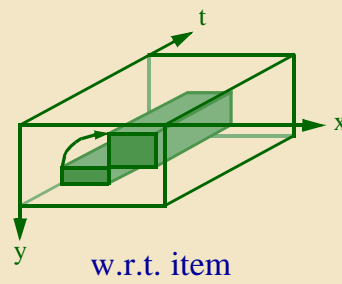
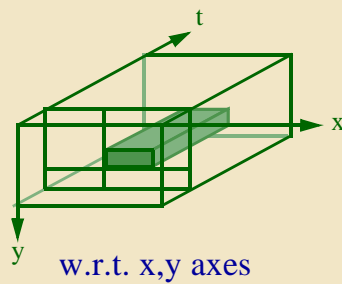
Growth of the
World-Wide Web



Amsterdam



Possible ways to specify layout

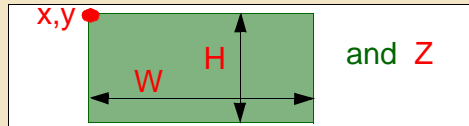


SMIL — Region

Each media object instance contains a region reference:

- allows author to know where object will be played
`<video src="anchor.mpg" region="V-main" />`

SMIL 3.3.1. **region** is defined by:



```
<region id="V-main" top="5%" left="50%" height="100%"  
width="100%" z-index="3" />  
<region id="V-remote" top="10" left="100" height="200"  
width="200" z-index="3" />
```

- An “id” for each region is required. Its value is an XML identifier.
- Length values are percentage values or in pixels. The unit “px” may be omitted.

Z-index

The Z-index gives the stacking order (highest integer stacks on top).
If elements A and B have the same value Z-index then:

- if B starts after A
then B is stacked on top of A.
- if B and A start simultaneously
and B is lexically after A
then B is stacked on top of A.

The WebNews Layout



```
<layout>
  <root-layout width="721" height="587" id="matise" />
  <region id="T_title" left="2%" top="5%" width="40%"
    height="24%" z-index=2 />
  <region id="V-remote" left="3%" top="44%" width="54%"
    height="40%" z-index=3 />
  ...
</layout>
```

SMIL — Basic Layout

SMIL 3.3.2. `root-layout` defines a rectangular area. All other regions are defined with respect to it — there is no nested, or relative, layout.

The `root-layout` is the viewport, or window, to which the presentation is rendered visually.

A SMIL document can have at most one `root-layout`.

If a media object element has no explicit `region` attribute then a default layout is given by the player.

To obtain the default layout for *all* media object elements, an empty SMIL basic layout can be declared:

```
<layout type="text/smil-basic-layout"></layout>
```

If no `root-layout` is specified then the size of the window is calculated by the player to be as large as the largest media object element.

SMIL— clips in space

SMIL 3.3.1 `fit` attribute



`hidden` (default)

media item
not scaled



`hidden` (default)

media item
not scaled



`scroll`

media item
not scaled



`meet`

aspect ratio
preserved



`slice`

aspect ratio
preserved



`fill`

aspect ratio
not preserved

Relationship between SMIL layout and CSS2

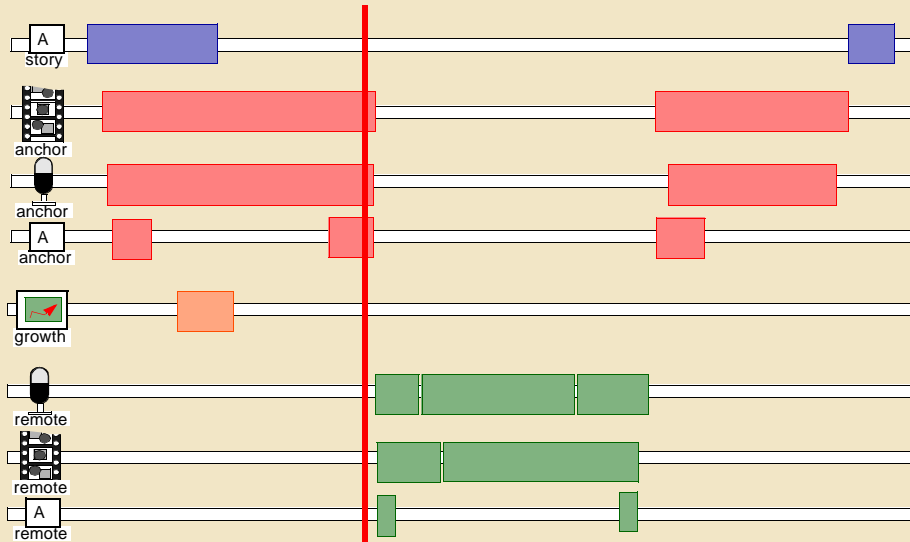
SMIL basic layout is consistent with the visual rendering module in CSS2. It introduces the “fit” attribute. It is otherwise a subset.

SMIL basic layout applies only to media object elements.

SMIL media object elements refer to a region.

CSS2 “region” elements refer to the media object elements.

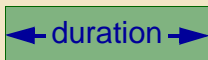
III Temporal Layout



Which time?

Types of time:

- **media item time axis**
 - video divided in frames, audio sampled at 44kHz



- **document time**
 - image starts at certain time and ends at a later time




- **run-time presentation**
 - video data bits get caught up in network, so end time is delayed



Duration of a media object element

Intrinsic

- derived from content of media item

 audio (or video) lasts 5.3 seconds


- intrinsic duration of discrete media, such as text or image, is zero.

Explicit


- an explicit duration can be given

SMIL 4.2.1. **dur** attribute, value is a clock-value or “indefinite”

```
<video src="zoomin.mpv" region="V-main" dur="4s" />
```

 media object stops after 4 seconds

```
<video src="zoomin.mpv" region="V-main" dur="6.5s" />
```

 media object stops after 6.5 seconds

— in this case, the audio track just stops and the last frame of the video remains

Duration of a Media Object Element ctd.


An object can have its duration extended by repeating the content.

SMIL 4.2.1. **repeat** attribute

```
<video src="zoomin.mpv" region="V-main" repeat="3" />
```

 media object stops after 15.9 seconds

```
<video src="zoomin.mpv" region="V-main" repeat="3" dur="11s" />
```

 media object stops after 11 seconds

```
<video src="zoomin.mpv" region="V-main" repeat="indefinite" />
```

 media object stops when parent stops

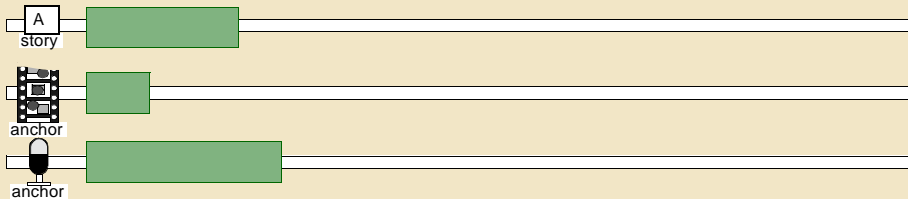
Attribute value of **repeat** is an integer or “indefinite”.

Start time of elements—par

SMIL 4.2.1 **par** element groups elements which are played in parallel

- Children of a par element are started at the same time

```
<par>
  <text src="leader_title.html" region="m_title" dur="5s" />
  <video src="cnn.mpv" region="V-Main" />
  <audio src="cnn.aiff" region="music" />
</par>
```



- The start time of a child of a **par** element is equal to the start time of the **par** element itself.

Start time of elements—seq

SMIL 4.2.2 **seq** element groups elements which are played sequentially

- Children are played one after the other, based on the textual order

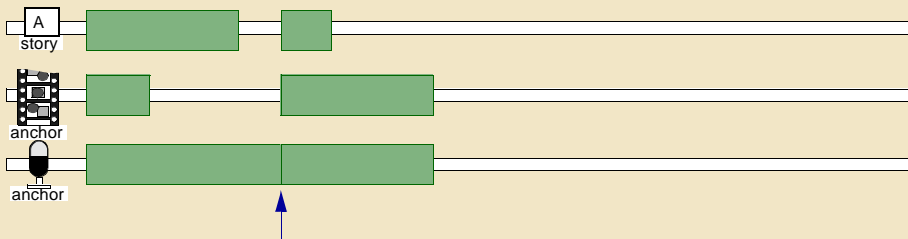
```
<seq>
  <video src="logo.mpv" region="V-main" />
  <video src="anchor.mpv" region="V-main" />
</seq>
```



- The start time of the first child of a seq element is the start time of the seq element itself.
- The start time of the next child is the end time of the previous child.

Par's and seq's can be nested

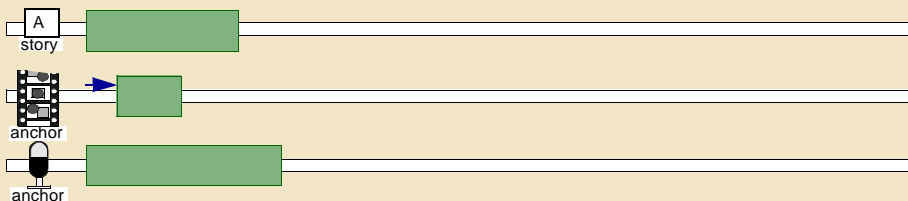
```
<seq>
  <par>
    <text src="leader_title.html" region="m_title" dur="5s" />
    <video src="cnn.mpv" region="V-Main" />
    <audio src="cnn.aiff" region="music" />
  </par>
  <par>
    <text src="story_title.html" region="m_title" dur="2s" />
    <video src="anchor.mpv" region="V-Main" />
    <audio src="anchor.aiff" region="music" />
  </par>
</seq>
```



Explicit start time in a par element

SMIL 4.2.1. **begin** attribute, **delay-value**

```
<par>
  <text src="leader_title.html" region="m_title" dur="5s" />
  <video src="cnn.mpv" region="V-Main" begin="1.4s" />
  <audio src="cnn.aiff" region="music" />
</par>
```

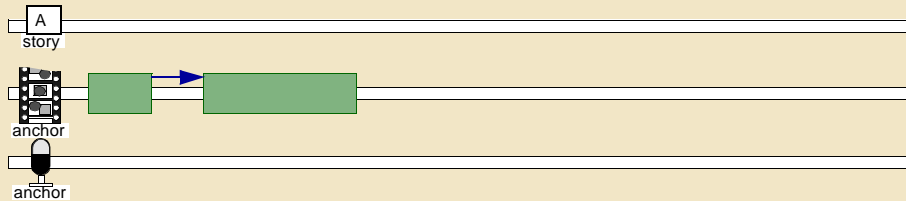


- Video is delayed until 1.4s after the start of the **par** element.
- The syntax of the delay-value is a clock-value (page 18).

Explicit start time in a seq element

SMIL 4.2.1. **begin** attribute, delay-value

```
<seq>
  <video src="logo.mpv" region="V-main" />
  <video src="anchor.mpv" region="V-main" begin="1.4s"/>
</seq>
```

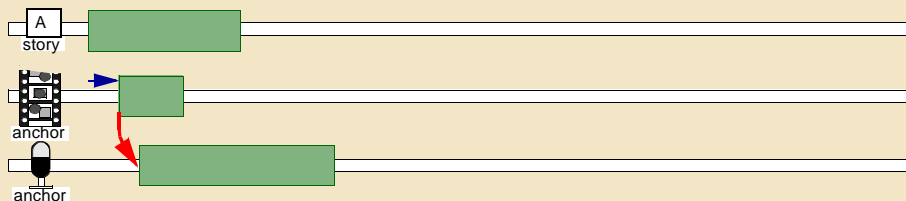


- Video is delayed until 1.4s after the end of the previous element.

Start time relative to another element

SMIL 4.2.1. **begin** attribute, event-value

```
<par>
  <text src="leader_title.html" region="m_title" dur="5s" />
  <video id="v1" src="cnn.mpv" region="V-Main" begin="1.4s" />
  <audio src="cnn.aiff" region="music" begin="id(v1)(0.5s)" />
</par>
```



- Audio is delayed until 0.5s after the start of video element "v1".
- Syntax of event-value is `"id(Id-value)(begin|end|clock-value)"`.

End time of media object element

SMIL 4.2.4.2. A media object element with an implicit or explicit duration and a start time has an end = begin + duration.

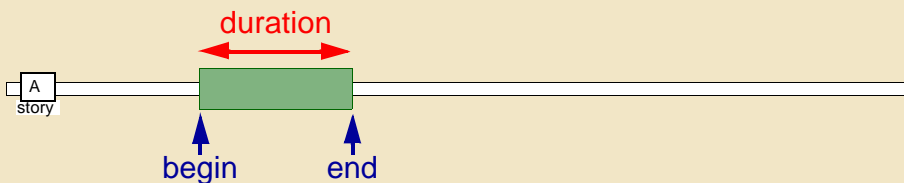
```
<video src="cnn.mpv" region="V-Main" begin="4s" />
```



SMIL 4.2.1. **end** attribute. Syntax same as **begin** attribute.

SMIL 4.2.4.2. A media object element with an explicit start time and an explicit end has a duration = end - begin.

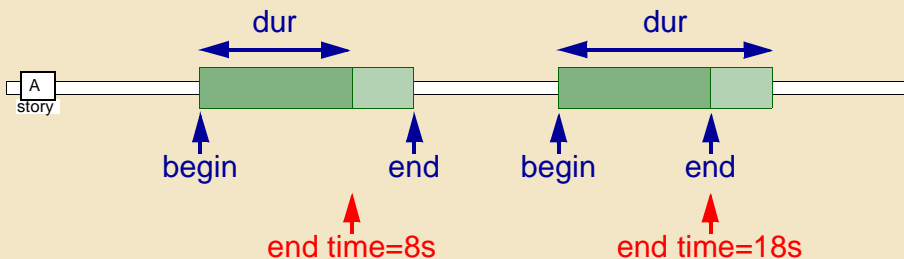
```
<text src="title.html" region="m_title" begin="4s" end="8s" />
```



End time of media object element ctd.

A media object element with an explicit start time, a duration and an explicit end, has as end time the minimum of the end time and (begin+duration).

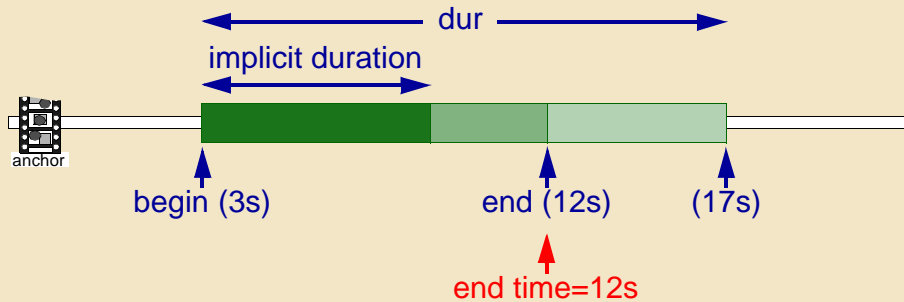
```
<seq>
  <text src="title.html" region="m_title" begin="4s" dur="4s"
    end="10s" />
  <text src="title.html" region="m_title" begin="14s" dur="6s"
    end="18s" />
</seq>
```



End time of media object element ctd.

A media object element may also have an intrinsic duration.

```
<video src="cnn.mpv" region="V-Main" begin="3s" dur="14s"  
end="12s" />
```



End time of media object element ctd.

If the end time is before the begin time then the element is not played.

The end time of a media object element with indefinite duration is determined by the end time of its parent.

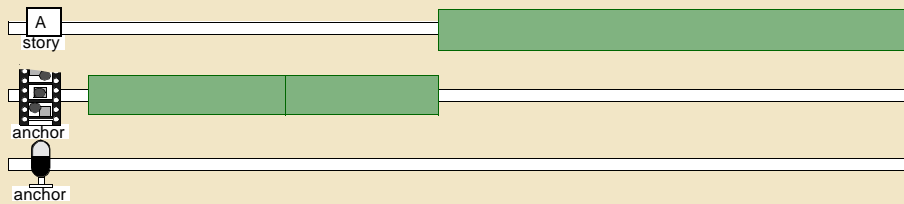
If the parent has no definite end time then the media object element will play indefinitely.

End time of seq element

A seq element ends when its last child ends or according to its end attribute.

If its last child has an indefinite end then the seq has an indefinite end.

```
<seq>
  <video src="logo.mpv" region="V-main" />
  <video src="anchor.mpv" region="V-main" />
  <text src="title.html" region="m_title" dur="indefinite" />
</seq>
```

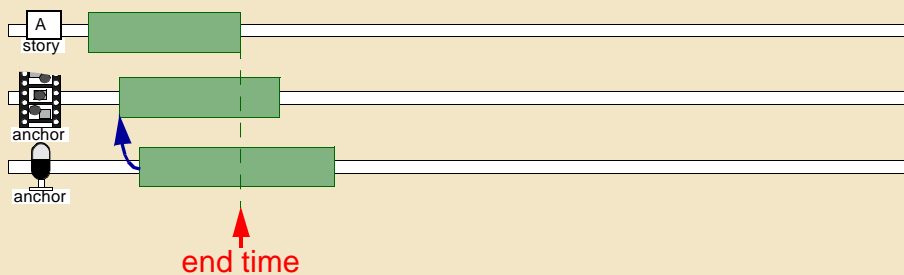


End time of par element—first

SMIL 4.2.1 endsync

- par can end when the **first** element to finish ends

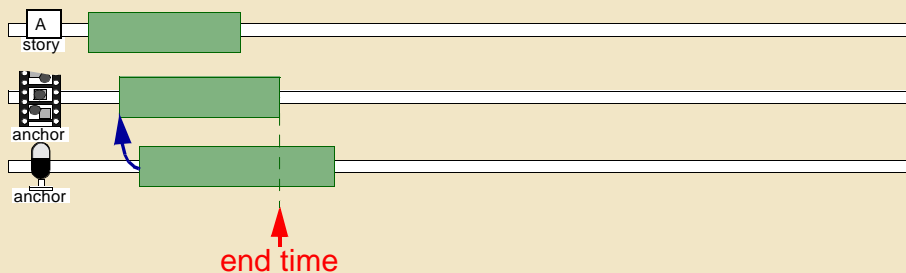
```
<par endsync="first">
  <text src="leader_title.html" region="m_title" dur="5s" />
  <video id="v1" src="cnn.mpv" region="V-Main" begin="1.4s" />
  <audio src="cnn.aiff" region="music" begin="id(v1)(0.5s)" />
</par>
```



End time of par element—id-ref

- `par` can end when the referenced element ends: `id(Id-value)`

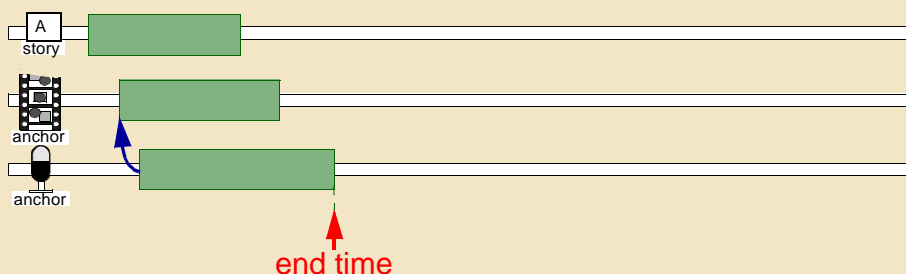
```
<par endsync="id(v1)">  
  <text src="leader_title.html" region="m_title" />  
  <video id="v1" src="cnn.mpv" region="V-Main" begin="1.4s" />  
  <audio src="cnn.aiff" region="music" begin="id(v1)(0.5s)" />  
</par>
```



End time of par element—last

- `par` can end when the `last` element to finish ends (default)

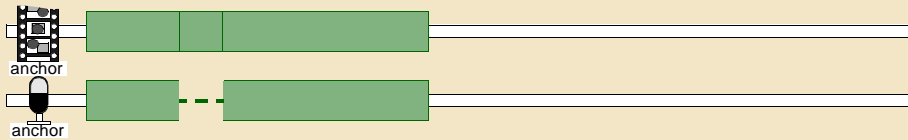
```
<par endsync="last">  
  <text src="leader_title.html" region="m_title" dur="5s" />  
  <video id="v1" src="cnn.mpv" region="V-Main" begin="1.4s" />  
  <audio src="cnn.aiff" region="music" begin="id(v1)(0.5s)" />  
</par>
```



Types of synchronization

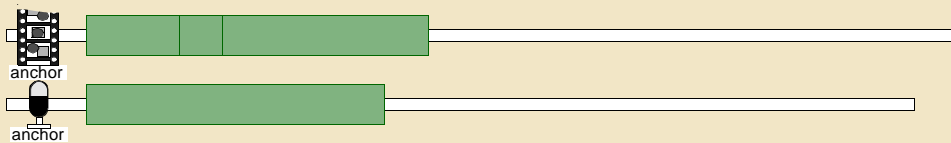
Hard synchronization

- Video delayed by network, audio stops and waits — useful for separate lip-synchronized audio and video streams.



Soft synchronization

- Video delayed, audio continues — useful for background music.

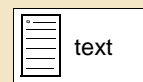
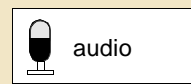


- Note: this behaviour is not specified in the standard.

IV Alternate content



... explosive growth of the WWW ...



... explosive growth of the WWW ...
... explosieve groei van het WWW ...
... eksplozivni rast WWW ...
... crescita esplosiva della WWW ...

Adaptation issues

Adaptation for User

- Task/environment/disabilities
- Language
- Previous knowledge

Adaptation for Environment

- Delays: bandwidth, available CPU time
- Available processing: media peripherals, additional browser features

W3C Web Accessibility Initiative (WAI)

- Guidelines for accessible (text-based) Web documents
- Meaningful values for attributes like `alt`, `title`, `abstract` and `longdesc`
- Meaningful content of link triggers (`a` element)
- How to apply these to a fixed timeline?

Switch

SMIL 4.3. `switch`

- At most one of the children of a switch element is played.
- The first acceptable element is chosen, so ordering should be best first.

```
<switch>
  <audio system-bitrate="44000" src="hi-res.aiff" />
  <audio system-bitrate="16000" src="low-res.aiff" />
</switch>
```
- If no element is suitable then no child of the switch is played. A catch-all choice at the end of the switch (with no test attribute) could be used.

Test Attributes

Selecting Content Alternatives

- **system-bitrate** — bandwidth of Web connection
 - can switch media: video -> image -> text
- **type** — mime type of media object
- **system-required** — select if certain processing available

Selecting for User

- **system-language** — what language the user understands best
- **system-captions** — show content if user want closed captioning (subtitles)
 - usually single content of switch (on or off)
- **system-overdub-or-caption** — choice between audio or text

Adaptive Visual Complexity

- **system-screen-size**, **system-screen-depth**

Extension Attributes for Particular Domain

- Won't be recognized by all browsers
 - Potential examples — knowledge level, audience profile, length of time

Multiple test attributes

Switch on bitrate and language

```
<switch>
  <audio system-bitrate="44000" system-language="nl"
    src=nl-hi-res.aiff />
  <audio system-bitrate="44000" system-language="en"
    src=uk-hi-res.aiff />

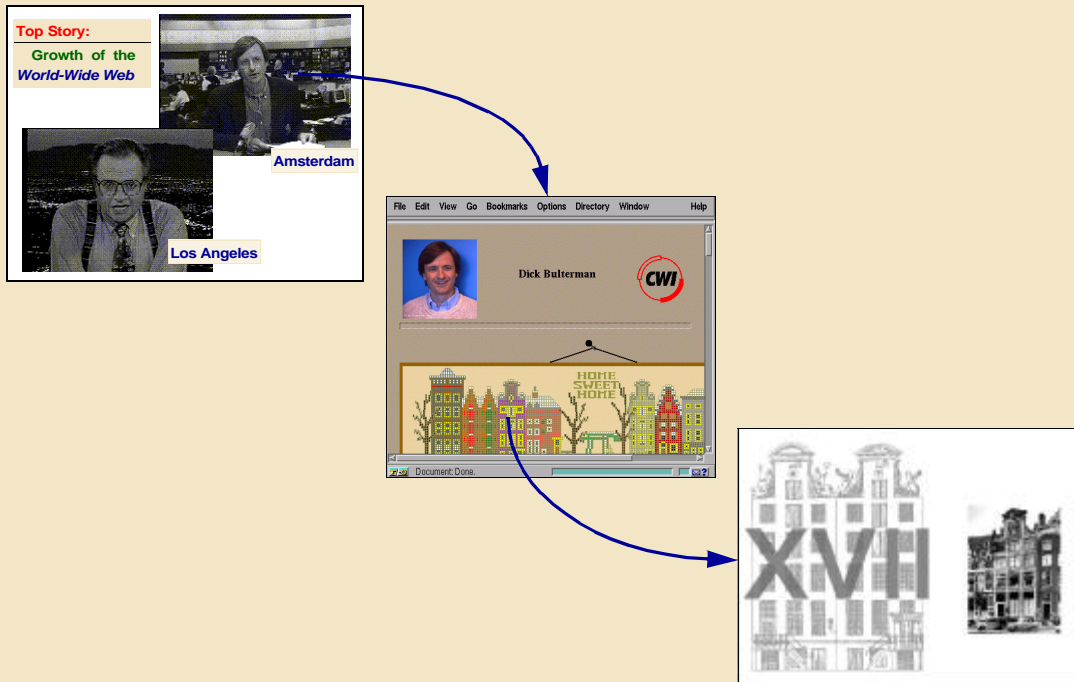
  <audio system-bitrate="16000" system-language="nl"
    src=nl-low-res.aiff />
  <audio system-bitrate="16000" system-language="en"
    src=uk-low-res.aiff />
</switch>
```

SMIL 4.2.1. `par`, `seq` and media object elements can also have test attributes

```
<textstream system-captions="on" src="txstream.rtx" />
```

- Element is played, or not, independently of any other element.

V Linking

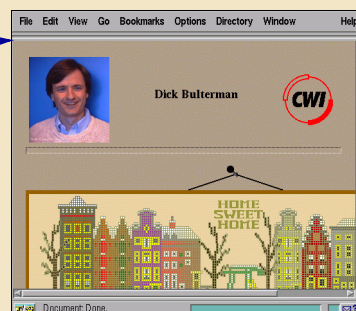


Link from element to presentation

SMIL 4.5.1. <a> element — similar to HTML <a> element.

- Source is unaffected and destination, **href**, is shown in **new** window.

```
<a show="new" href="archives-dcab.smi">  
  <video src="zoomin.mpv" region="V-Main" />  
</a>
```



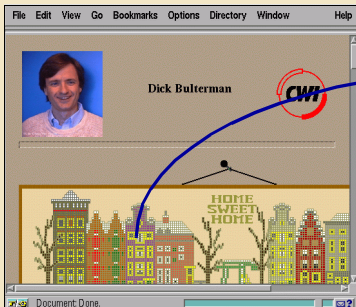
- Source may also **pause** while destination is shown,
- or destination may **replace** the source (default).

Link from element to element

SMIL 4.5. Linking to SMIL fragments

- Destination element within another SMIL document uses # connector.

```
<a show="new" href="time-time.smil#XVII">
  <text src="archives-dcab.html" region="I-Main"
    dur="indefinite" />
</a>
```



- Destination presentation starts as if the presentation had been fast-forwarded to the beginning of the element designated by the fragment.

Link from element to subpart of media object

SMIL 4.5.2. anchor element

The **anchor** element allows the specification of temporal and spatial subparts of a media object element.

- Spatial subparts use the **coords** attribute (similar to HTML image maps).

```
<video src="zoomin.mpv" region="V-Main" >
  <anchor id="mic" coords="40%, 70%, 55%, 100%" />
</video>
```



fit="slice"

Defined w.r.t. media object,
not w.r.t. region

- Order of **coords** is left-x, top-y, right-x, bottom-y.
- Temporal subparts use the **begin** and **end** attributes.

```
<video src="zoomin.mpv" region="V-Main" >
  <anchor id="graph-ref" begin="4.3s" end="6.8s" />
</video>
```

Links in embedded documents

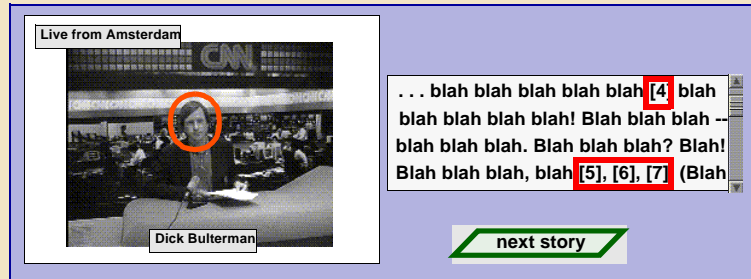
SMIL 4.5. Handling of links in embedded documents


- SMIL players may involve other (non-SMIL) applications or plug-ins, for example an HTML renderer.

```
<text src="comment.html" region="C-right" />
```

- An HTML browser may display SMIL documents embedded in an HTML page.
- A SMIL document may contain a media object element of data type SMIL.

```
<ref src="webnews.smi" region="S-left" />
```



-  anchor in containing SMIL document  anchor in embedded SMIL document
 anchor in embedded HTML fragment

Anchors as source and destination of a link

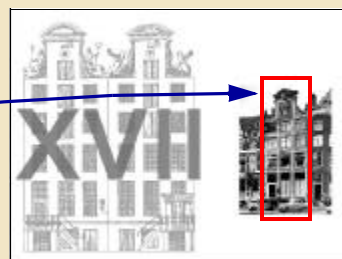
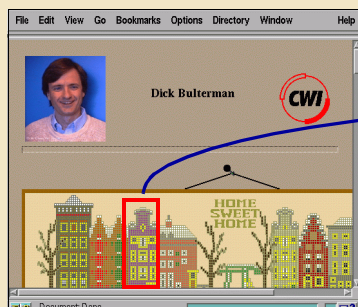
- **href** needed if used as source, **id** needed if used as destination

Source document (image in SMIL, anchor and link defined in SMIL):

```
  
  <anchor href="time-time.smil#gable-3" show="new"  
    coords="35%, 5%, 40%, 95%" />  
</img>
```

Destination document "time-time.smil" (image in SMIL):

```
  
  <anchor id="gable-3" coords="30%, 0%, 70%, 100%" />  
</img>
```



VI Semantic annotations

SMIL 3.4. **meta** element defines properties of a document

- The **name** attribute is the property and the **content** attribute gives the value.
`<meta name="title" content="Web News, 15th June 1998" />`
`<meta name="base" content="http://www.cwi.nl/SMIL/webnews/" />`
- The list of properties (values of **name** attribute) are open-ended.

Attributes on **par**, **seq** and **media object** elements

SMIL 4.2.1. **abstract**, **author**, **copyright**, **title** (recommended)

Attributes on **media object** elements

SMIL 4.2.3. **alt** (contains alternative text, recommended), **longdesc** (supplement to **alt**, but longer and should include descriptions of anchors)

Attributes on **region** elements

SMIL 3.3.1 **title** (recommended)

High-Level Structure of Document

Partitioning in Sections

```
<smil>
  <head>
    <meta>
      ... information about the document ...
    </meta>
    <layout>
      ... layout definition ...
    </layout>
  </head>
  <body>
    ... objects and temporal relations ...
    ... links and anchor objects ...
  </body>
</smil>
```


Backwards Compatibility

SMIL 3.3.1. `skip-content` attribute allows documents in higher SMIL versions to be played by players of lower SMIL versions.

If the `skip-content` attribute is true (default value) then the content of the element is ignored in the SMIL 1.0 player.

SMIL's Relationship with Other W3C Recommendations

SMIL Documents are XML Documents

- SMIL syntax is defined by an XML DTD

Private Extensions must use Namespaces

- `skip-content` attribute allows content of non-SMIL elements to be played
- `system-required` attribute states the subtree requires the named implementation

SMIL Layout and CSS-2

- SMIL basic layout is consistent with the visual rendering module in CSS-2
 - it introduces the "fit" attribute
 - it is otherwise a subset.
- SMIL basic layout applies only to media object elements.
- SMIL media object elements refer to a region
 - CSS-2 "region" elements refer to the media object elements.

SMIL Boston

Much Much More

- SMIL 1.0 spec is 30 pages, SMIL Boston spec is 300 pages

Animation

- Values of SMIL constructs change over time
- Enables more vibrant presentation
- Incorporation with SVG

Timing Integration

- Use of SMIL constructs in other document sets
- Enables, for example, HTML+SMIL in Internet Explorer
- Raises issues of semantic significance of hierarchy

Broadcasting/streaming

- No preload or full download
- Use of non-predictive events in timing
- Need to maintain hard synchronization
- Large potential use of SMIL

SMIL Boston Modules

SMIL is broken up into separate modules

- Thus not all of SMIL Boston needs to be used in one instance

The SMIL Boston Modules are:

- Animation
- Content Control — *selection, adaptation and optimization*
- Layout
- Linking — *navigation*
- Media Object — *media content that is integrated into presentation*
- Metadata — *machine-processible data about the presentation*
- Structure — *base elements for high-level SMIL structure*
- Timing and Synchronization — *98 pages!!*
- Transition Effects — *fades and wipes*
- Document Object Model (DOM) — *XML data transfer and exchange*

SMIL Boston Language Profiles

Multiple SMIL Profiles

- Made by combining SMIL Boston modules

SMIL Boston Profile

- “Maximum” SMIL
- Describes how all SMIL Boston modules are combined into one format

HTML+SMIL

- In Internet Explorer 5.5 — originally HTML+Time
- Encodes “PowerPoint-like” presentations
- Textflow-based display that changes with time and interaction

SMIL Basic Profile

- “Minimum” SMIL
- For low-end devices like mobile phones and palmtops
- Ensures a class of SMIL presentations that can be seen on these devices

Baseline Media Formats

- Non-normative selected media formats for each media type

Existing Tools

RealPlayer 7 (G2)

- Primary driving force
 - millions downloaded
- Real-Media specific player made broader with SMIL incorporation
- 3rd party template-focussed authoring tools

GRiNS

- Commercial spinoff from CMIFed research tool
- High-end authoring tool for complex presentations
- Authors presentations using RealPlayer 7 formats
- GRiNS player

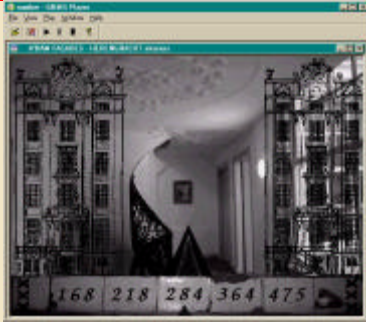
Internet Explorer

- HTML+SMIL profile

QuickTime 4.1

- Recently announced SMIL support

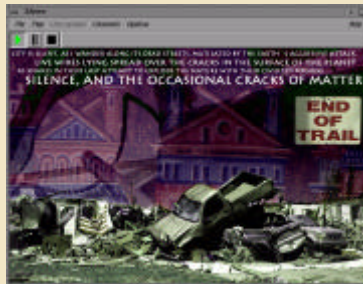
SMIL Applications



Infotainment



Accessibility



Conceptual Art

Summary

SMIL — media object element revisited

```
<video id="vid1" region="R_video"
  src="rtsp://www.w3.org/CoolStuff.rm"
  clip-begin="smpte=00:01:19:20"
  clip-end="smpte=00:01:38:40"
  begin="3s"
  dur="22s"
  end="21s"
  alt="Video of Joe chatting to Tim"
  longdesc="Joe and Tim are in a meeting room. Joe is on the
    left and Tim is on the right"
  title="Joe greets Tim"
  system-bitrate="28800">
  <anchor id="joe" begin="0s" end="5s" coords="0%,0%,50%,50%"
    href="http://www.w3.org/" />
  <anchor id="tim" begin="5s" end="10s" coords="50%,50%,50%,50%"
    href="http://www.w3.org/Tim" />
</video>
```

More information

- <http://www.cwi.nl/SMIL>
- <http://www.w3.org/TR/REC-SMIL>
- <http://www.w3.org/TR/SMIL-Boston>
- <http://www.w3.org/AudioVideo/>
- <http://www.w3c.org/Press/1998/SMIL-REC>
- <http://www.justsmil.com/>
- <http://www.oratrix.com/>
- <http://www.real.com/player>