Do you have the time?
Composition and Linking in Time-based Hypermedia

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- The problem
- Presentation time
- Where is the time?
  — media element time, document time, rendered time, runtime
- Runtime
  — linking within/among multimedia presentations

What is the problem?

How can we combine timing and linking in multimedia?

Author:

- chronological development of the narrative
- temporal arrangement of media elements

Hypertext system designer:

- add concurrent media streams to document
- include temporal aspects in model

Multimedia system designer:

- add links to linear multimedia presentation

Three cases

- timeline of single linear multimedia presentation
- navigation among linear multimedia presentations
- navigation within and among non-linear multimedia presentations

Document vs. presentation time

document—underlying storage representation perceived by an author

presentation—perceived by a reader

Document needs to contain information for directing playback
- which elements
- when displayed
- for how long
- when removed

Presentation time

duration

Media element time

start time   **end time**
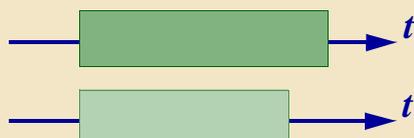
Document time

Rendered time

Runtime

Media element time

clip-begin   **clip-end**

Source video

Media element content
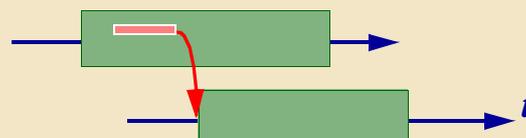
← **duration** →

Media element time
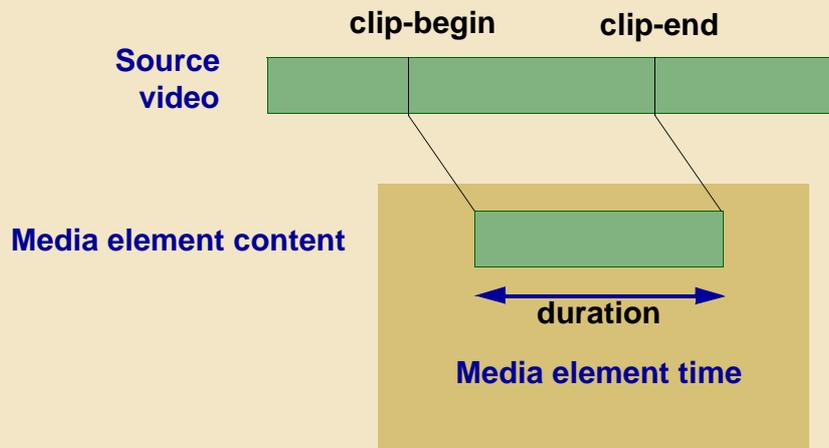
SMIL clip-begin and clip-end

Document time

clip-begin   **clip-end**

Source video

Media element content

Author assigned duration (or scale factor)

t

← **duration** →

Document time
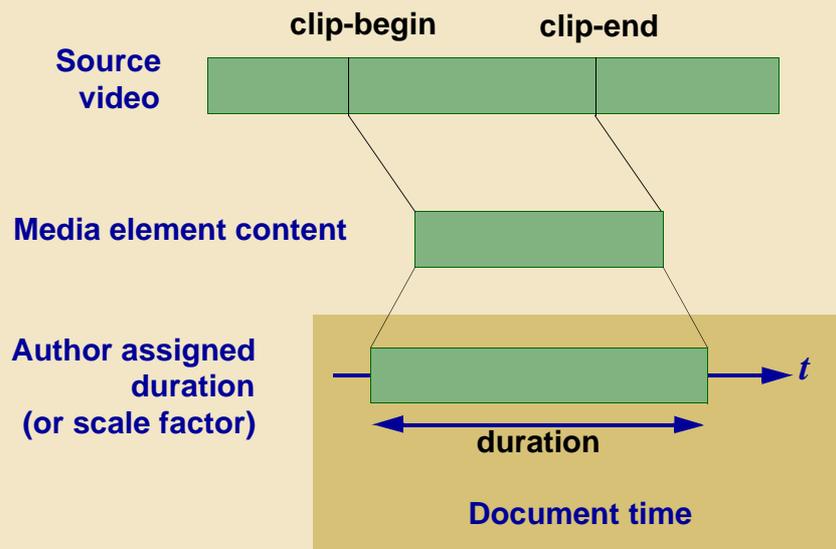
SMIL repeat and duration

Transition time and anchor time

Author assigned duration (or scale factor)

transition times

duration

Document time
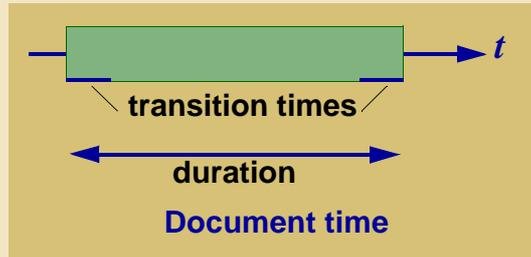
Anchors defined in content

Anchor durations

Media element time

Document time

Temporal composition

Document time
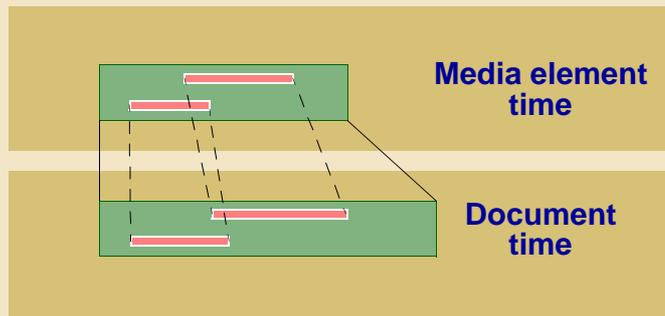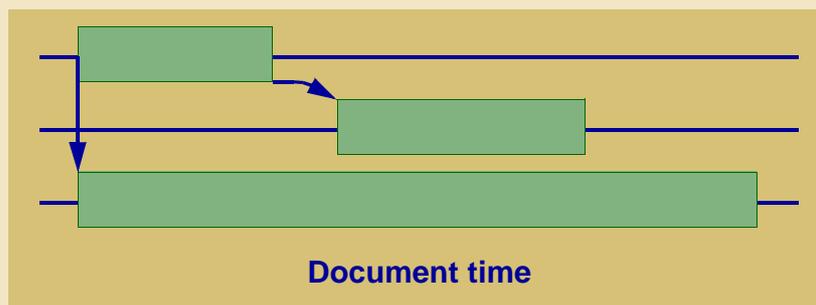
SMIL par, seq, begin, and end

Par and seq have implicitly defined synchronization constraints

Par and seq can also have duration and repeat attributes

Soft vs. hard synchronization

Multiple synchronization arcs

Document time
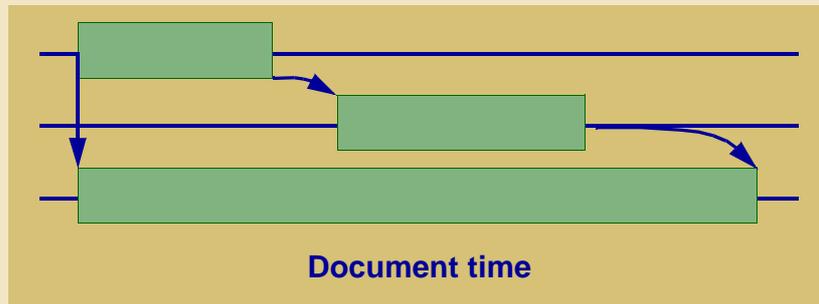
Second arc constrains indefinite duration of lowest component or scales intrinsic duration.

Further sync arcs are invalid.

More complex model could allow different tempos within component.

Implicit synchronization arcs

par   **Document time**

seq   **Document time**

Rendered time

text

image

video

Document time (atemporal composite)

image
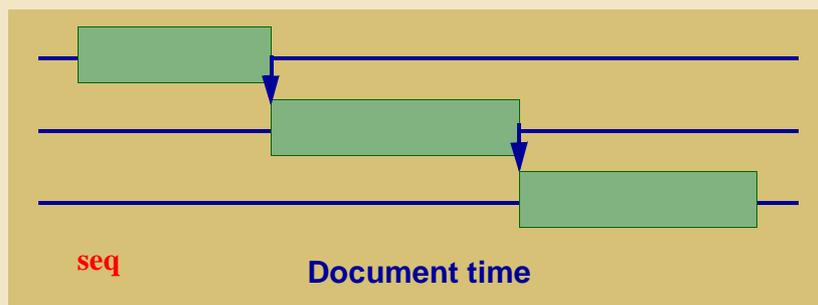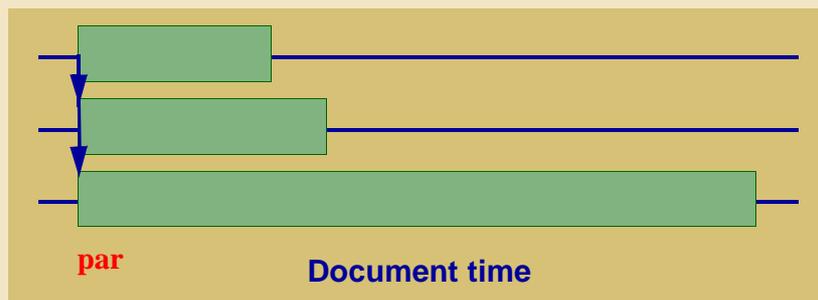
Rendered time
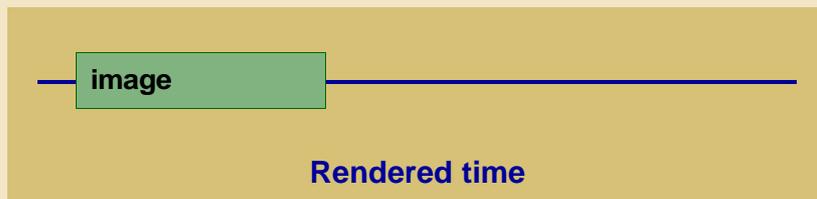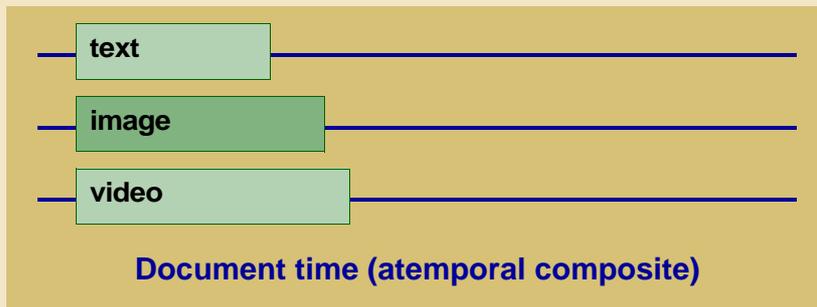
SMIL **switch**

Atemporal Composition

text (links to music)

image

music1

music2

Atemporal composite

Document or Rendered time
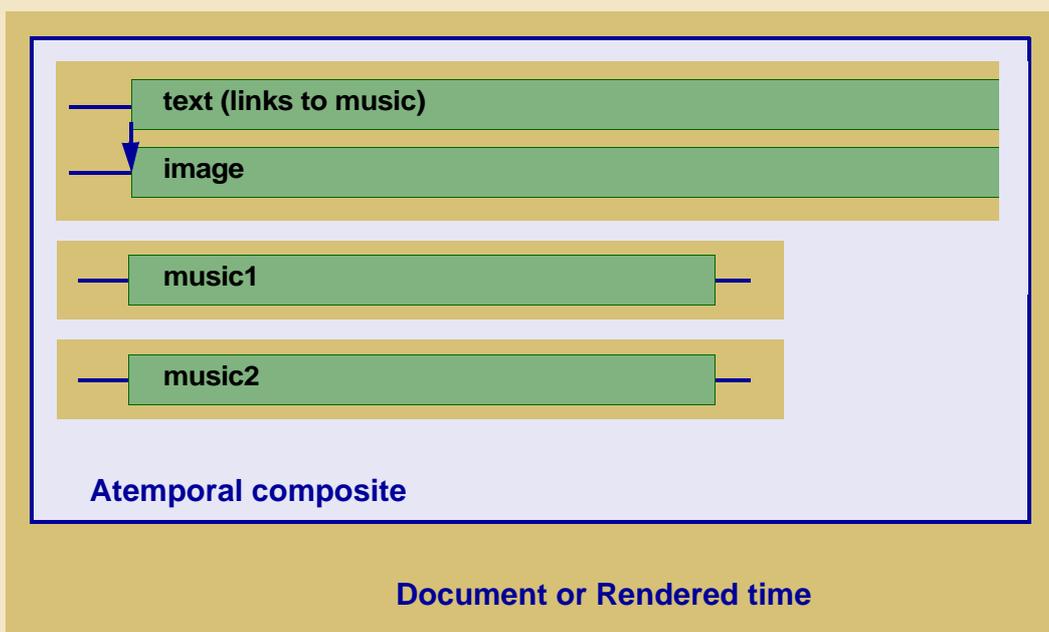
Interaction within a linear multimedia presentation

Rendered time

anchor   synchronization arc   link

Runtime

Runtime

anchor   synchronization arc   link
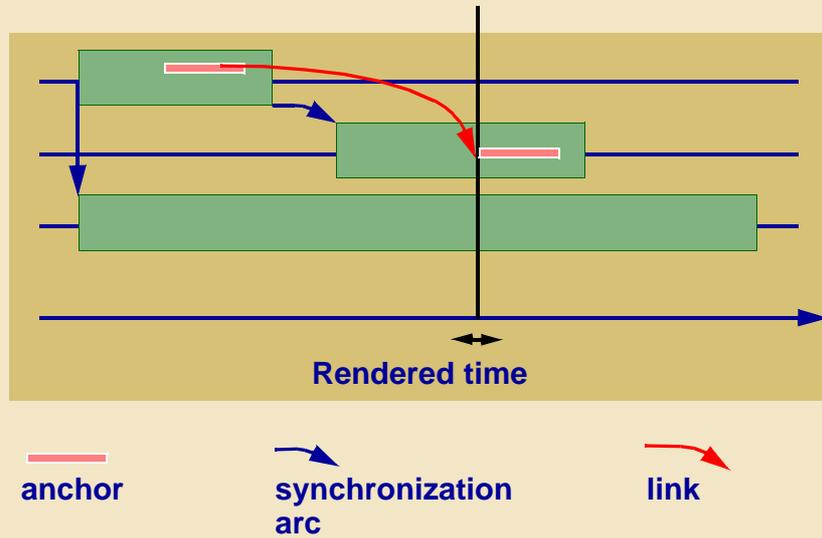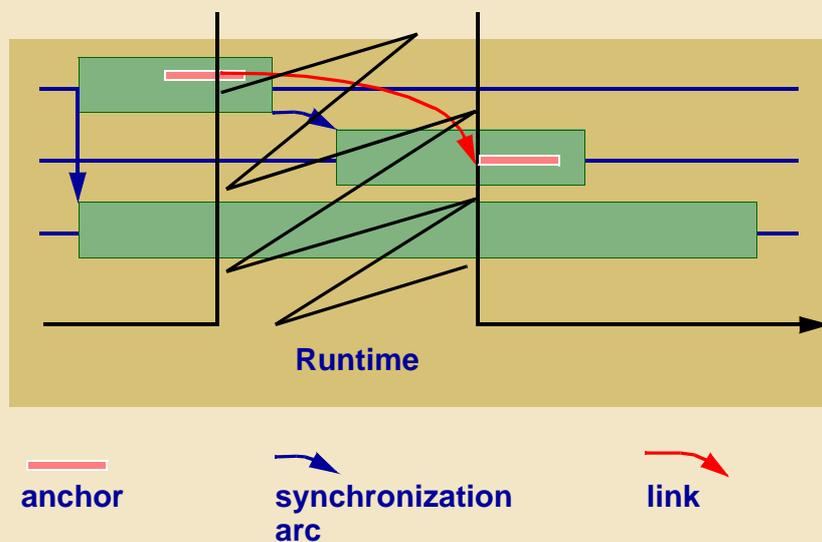
Linking among linear multimedia presentations

Replace

Rendered time
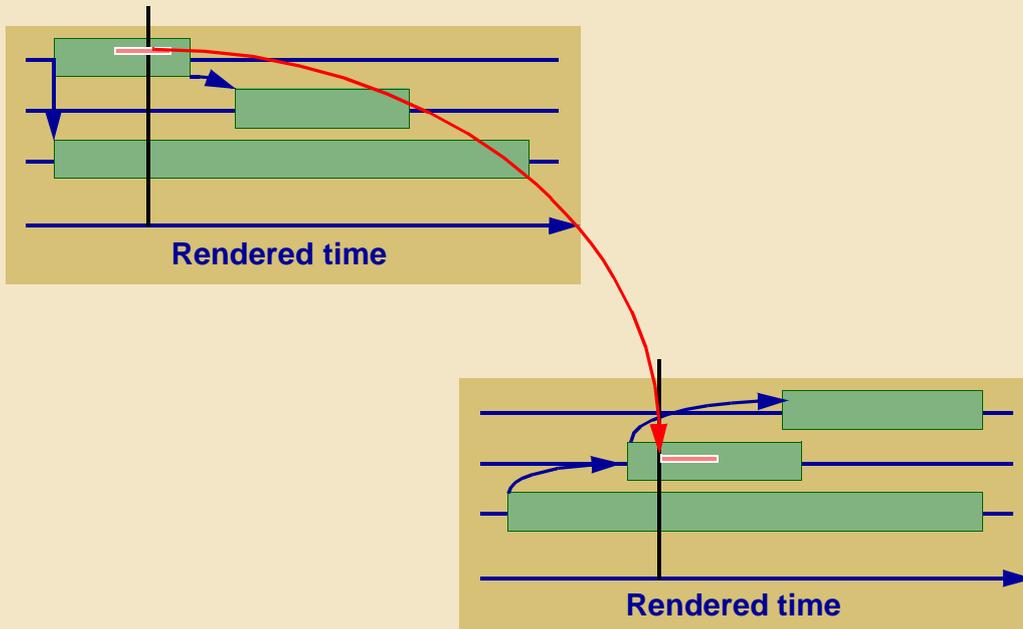
Rendered time

Linking among linear multimedia presentations

Continue

image

music1

Rendered time

music2

Rendered time

Runtime

Linking within and among non-linear multimedia presentations

music

video

text

text

text

Atemporal composite
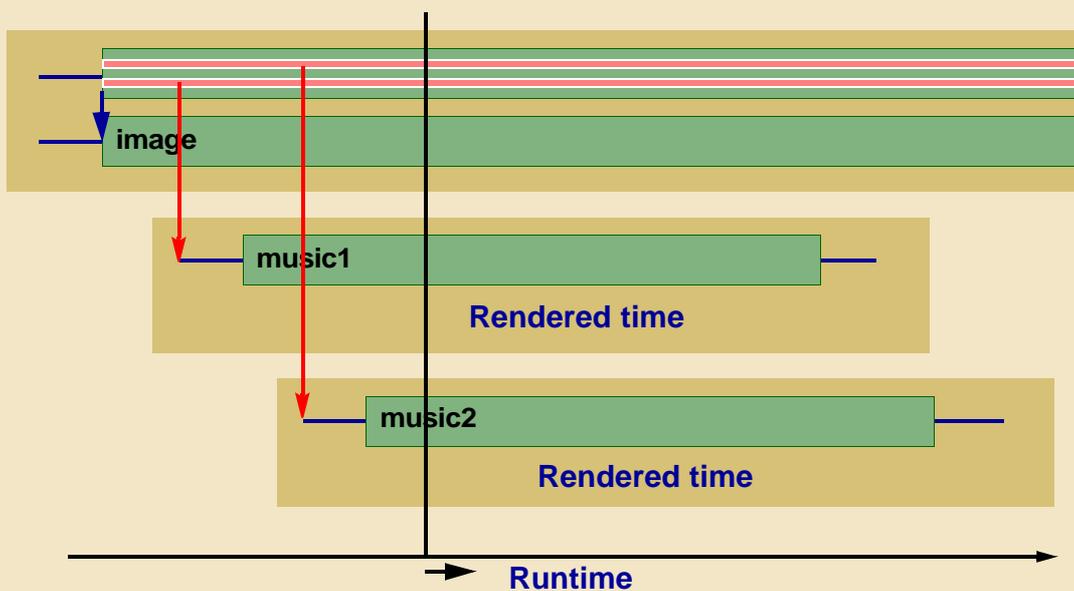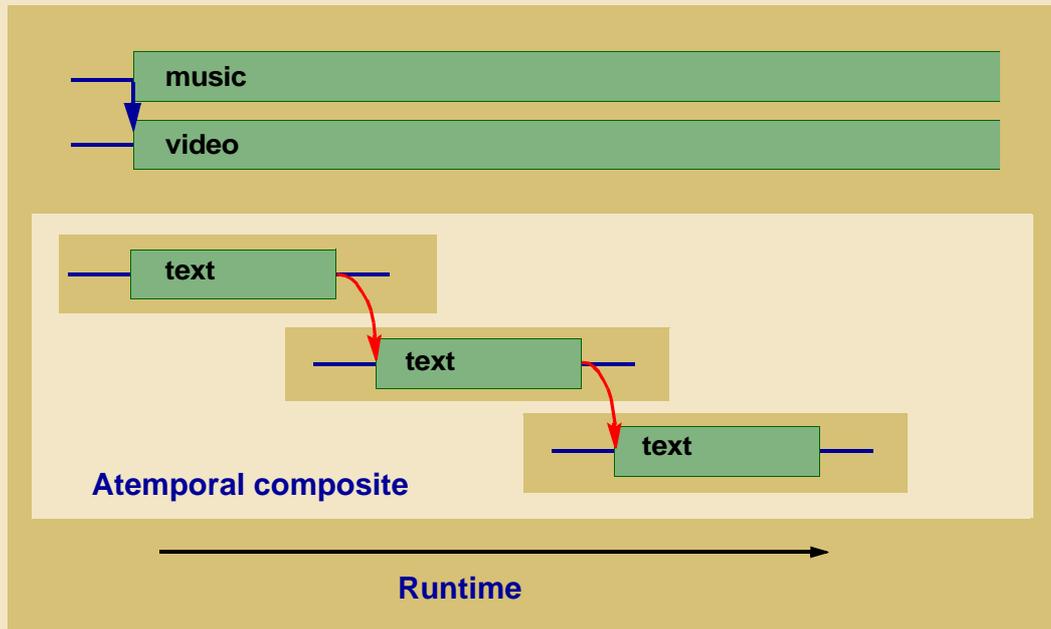
Runtime

Conclusion

Four types of presentation time
- media element time, document time, rendered time, runtime

Document time needs to be incorporated in document model

Runtime most important from reader's point of view
- traversing time axis
- linking among multimedia presentations
- linking within and among non-linear multimedia presentations

Behaviour has consequences for document model
- temporal and atemporal composition
- link definition