Implementing the Media Fragments URI Specification: Media Fragments Firefox Extension

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Media Fragments

- Interesting scene from a movie
- Region of an image containing a specified person
- Portion of music (e.g. fancy guitar solo)
- Audio track from a video file

Media Fragments use cases

- Bookmarking parts of audio/video file
- Mash-ups
- Annotating media fragments
- Conserving bandwidth

Fragments Dimensions

- **Temporal: begin, end time**
- **Spatial: region of the video in terms of pixels/percents**
- **Track: track name**
- **Named: unique fragment id**

Media Fragments URIs

- **Using URI query part:**

```
http://www.example.org/video.ogv?t=60,100
```

- **Using URI fragment part:**

```
http://www.example.org/video.ogv#t=60,100
```

- **Mixing both:**

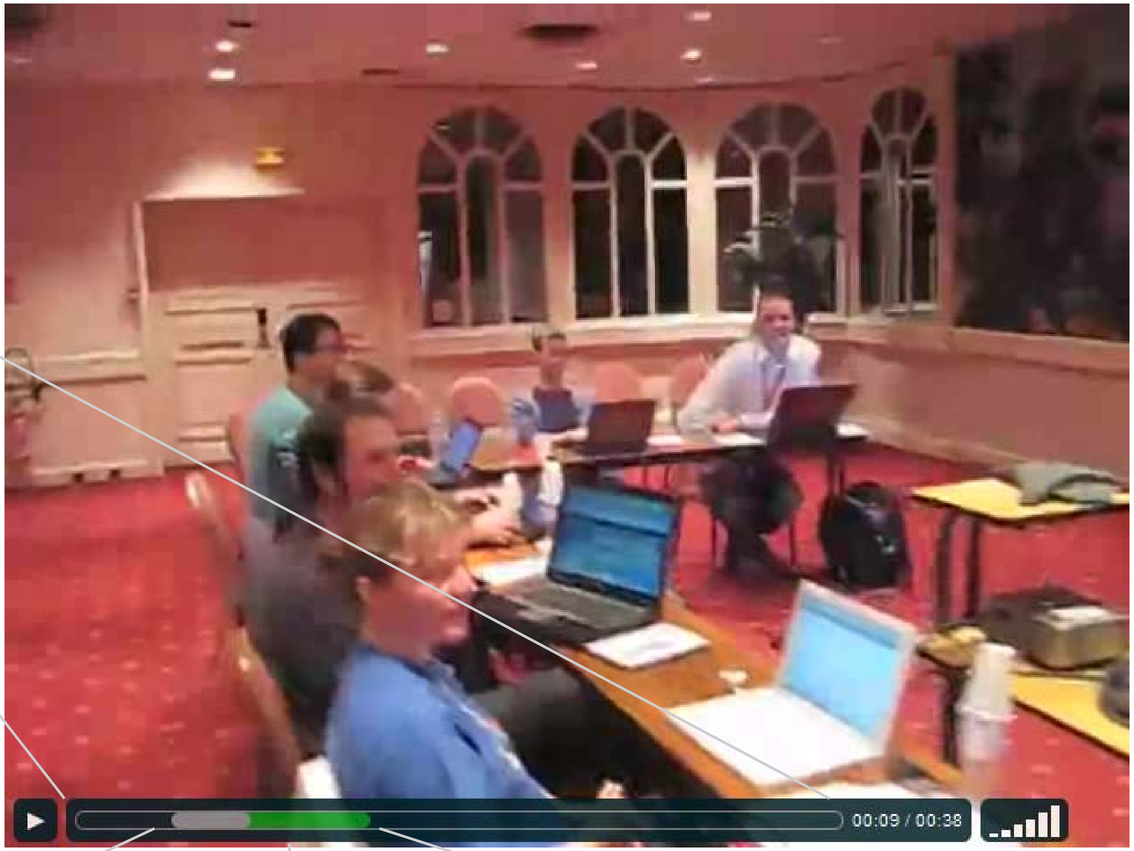
```
http://www.example.org/video.ogv?t=60,100#t=10,15
```

Media Fragments Resolution

- **For the URI query part:**
  - media file processed only on server side
  - client receives a new video file
- **For the URI fragment part:**
  - client analyzes URI fragment
  - request to the server is enhanced with proper Range header value
  - server sends corresponding byte ranges to the client

Media Fragments Extension (temporal)

Original resource length



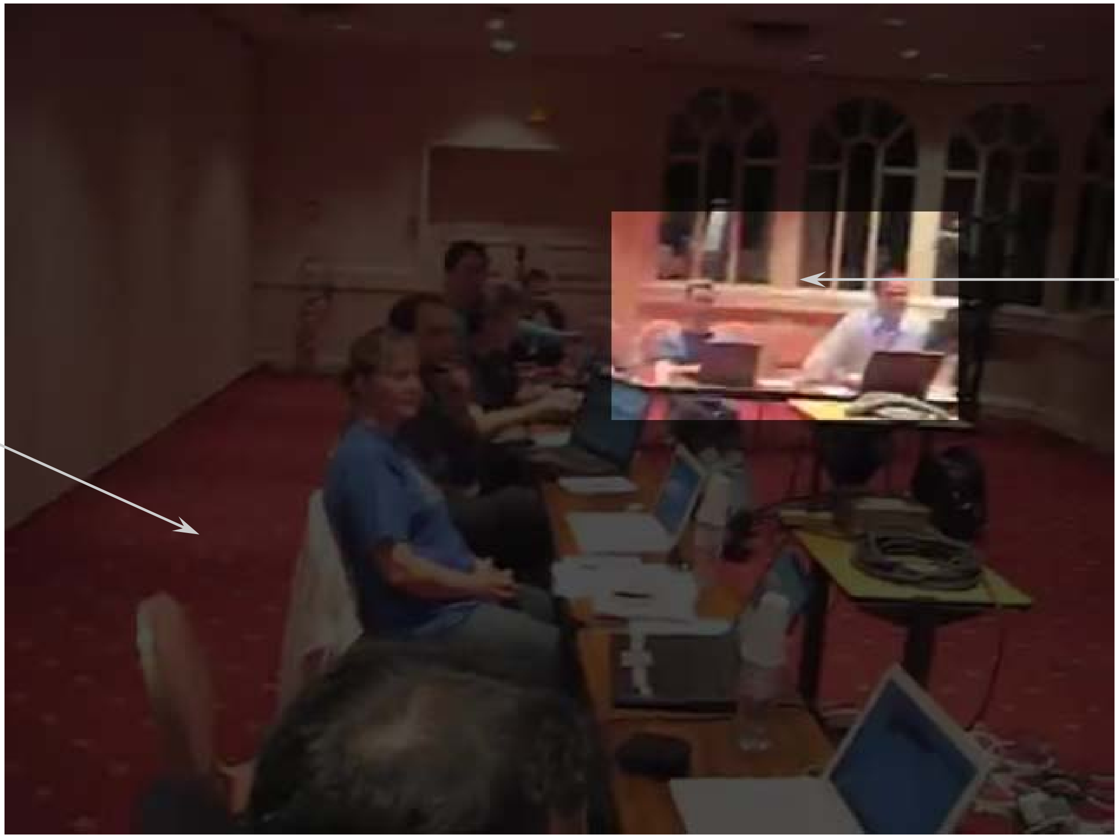
Fragment beginning

Playback progress

Fragment end

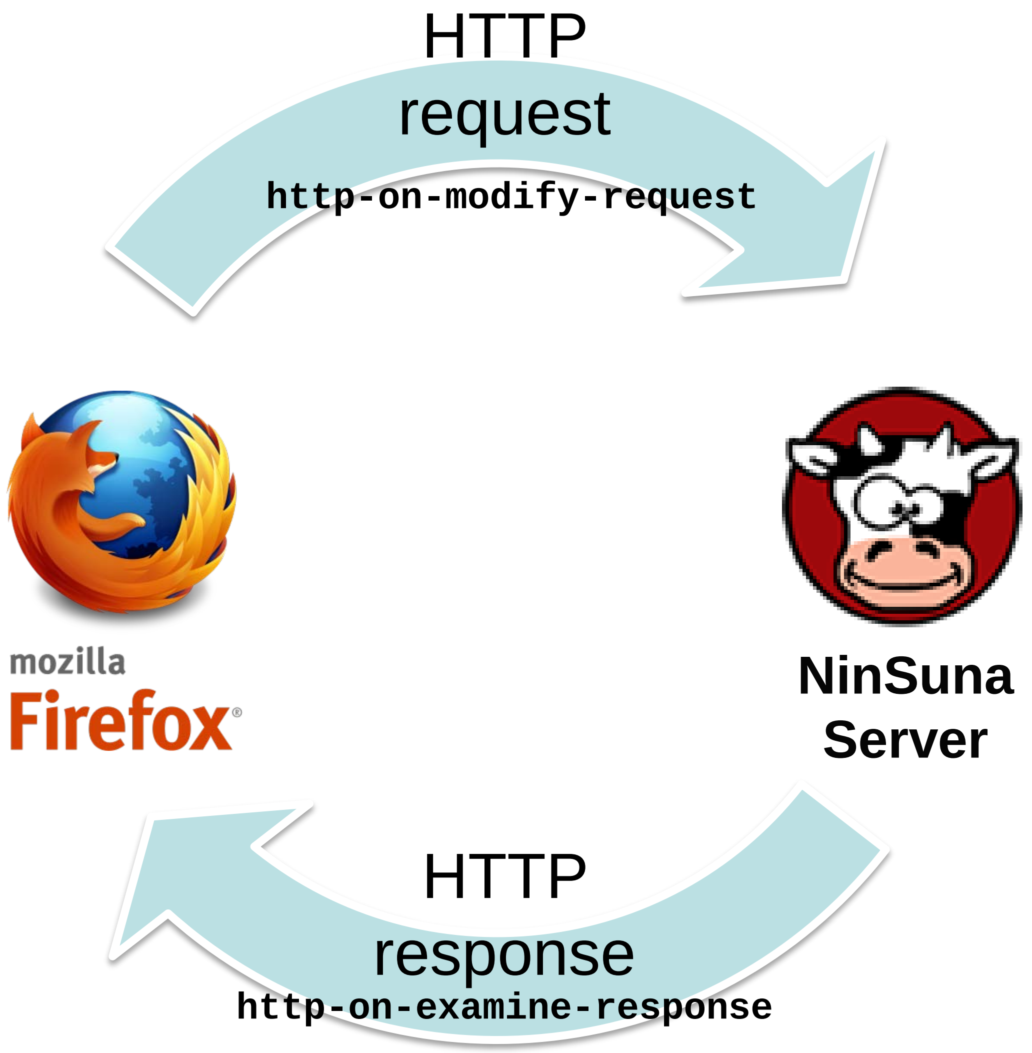
Media Fragments Extension (spatial)

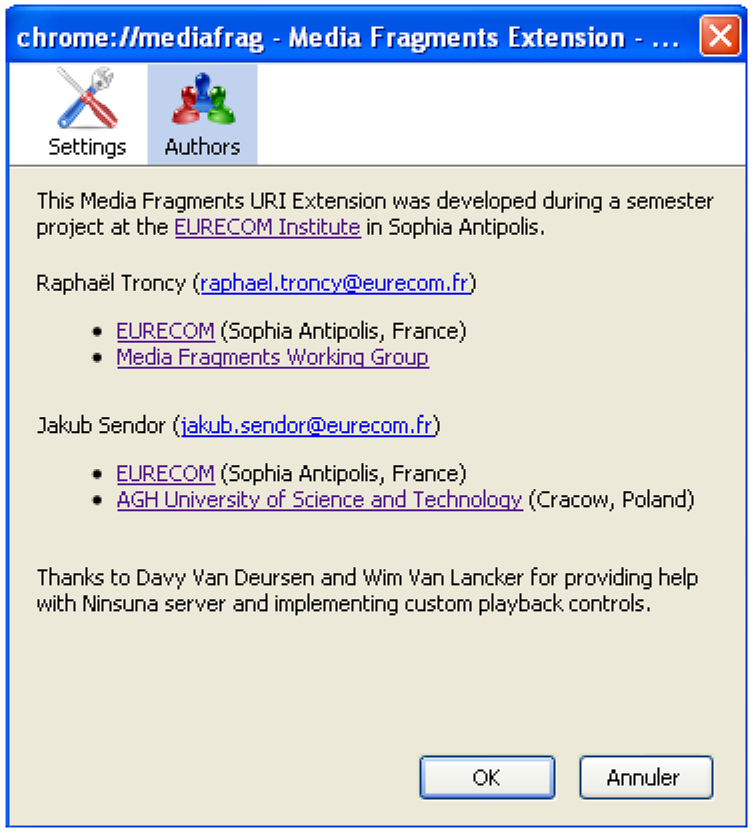
semi-opaque overlay



highlighted fragment

Observing HTTP Traffic





This Media Fragments URI Extension was developed during a semester project at the EURECOM Institute in Sophia Antipolis.

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Examining HTTP Traffic

- **HTTP request:**
  - retrieving URI
  - parsing key=values pairs from fragment part
  - setting Range header
- **HTTP response:**
  - checking Content-Type
    and Content-Range-Mapping headers values
  - attaching custom playback controls to page
  - creating spatial dimension overlay (if specified)

Example: requesting time fragment

- **A web developer specifies a video source with a temporal fragment URI:**

```
http://ninsuna.elis.ugent.be/DownloadServlet/mfwg/fragf2f.ogv#t=5,15
```

- **key=value pair is analyzed, fragment begin and end time are matched**

```
t=5,15
```

- **Media Fragments Extension analyses the fragment part, retrieves beginning and end time and sets proper Range header value:**

```
Range: t:npt=5-15
```

Example: requesting time fragment

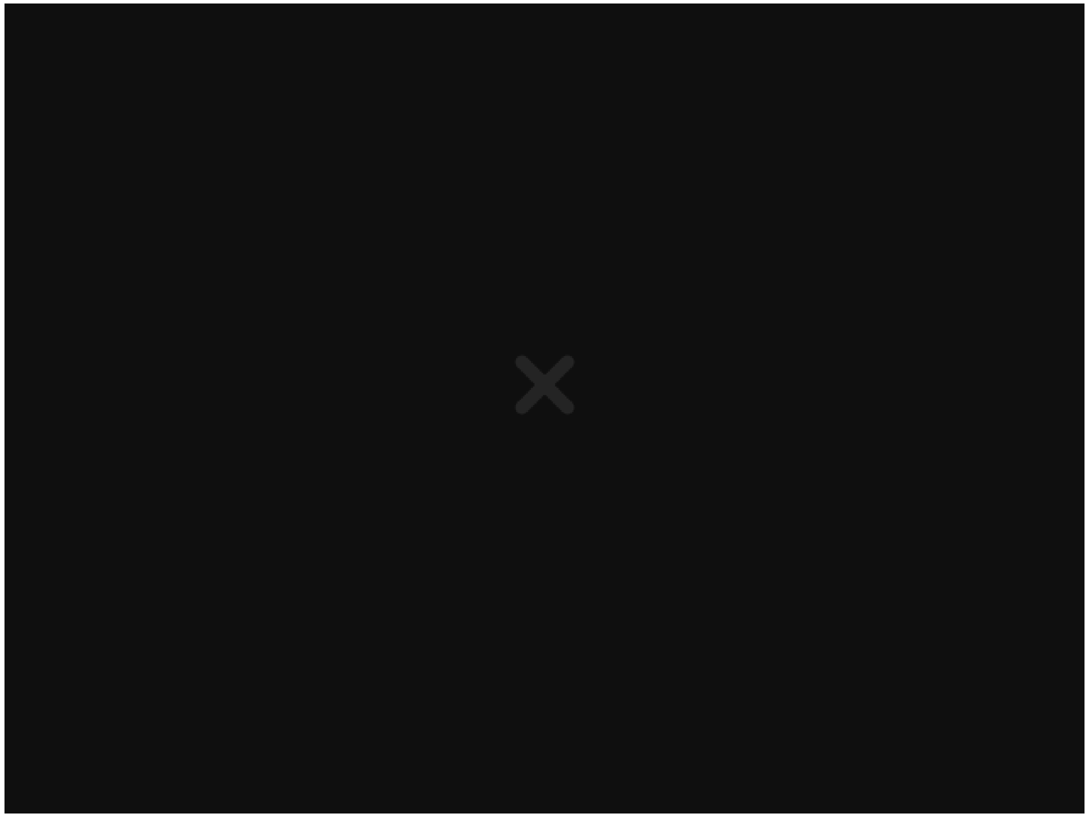
- **The NinSuna server responds with the 206 Partial Content response and Content-Range-Mapping header showing the mapped time ranges and media fragment in the message payload:**

```
HTTP/1.1 206 Partial Content

Content-Type: video/ogg
Accept-Ranges: bytes, t, track, id
Content-Range: bytes 629578-1690588/4055466
Content-Range-Mapping:
{t:npt 4.8-14.8/0-38.33}={bytes 629578-690588/4055466}
```

Example: requesting time fragment

- ... and it won’t work!
- Because the player does not have the media file header



Example: requesting time fragment

- **Player needs to be initialized, thus bare fragment is not playable**
- **To fix this, we add *;include-setup* to the Range header value:**

```
Range: t:npt=5-15;include-setup
```

Example: requesting time fragment

- The response from the server is slightly different:

```
HTTP/1.1 206 Partial Content

Content-Type: multipart/byteranges;boundary=End
Content-Range-Mapping:
 {t:npt 4.8-14.8/0-38.33;include-setup}
={bytes 0-5998,629578-1690588/4055466}
...

--End
Content-Type: video/ogg
Content-Range: bytes 0-5997/4055466

{binary data}
--End
Content-Type: video/ogg
Content-Range: bytes 629578-1690588/4055466

{binary data}
--End
--End--
```

Example: requesting time fragment

- **This is why we need to attach a Stream Listener to the HTTP channel:**

```
HTTP/1.1 206 Partial Content

Content-Type:
multipart/byteranges;boundary=End
...

--End
Content-Type: video/ogg
Content-Range: bytes 0-5997/4055466

{binary data}
--End
Content-Type: video/ogg
Content-Range: bytes 629578-
1690588/4055466

{binary data}
--End
--End--
```

```
HTTP/1.1 206 Partial Content

Content-Type: video/ogg
...

{binary data}
{binary data}
```

Spatial fragments

- Without additional information send to server
- Overlay is created by appending four additional DIVs to the webpage
- They are styled to create the impression of semi-opaque layer over the video element

Current Issues

- **Modifying a video element that is not embedded into a webpage is not possible**
  - Fragment will be requested and retrieved properly
  - Attaching custom playback controls is not possible
- **Track dimension:**
  - Fragments are not consecutive bytes ranges
  - Firefox is not digesting this
- **Media Fragments Non-Aware servers:**
  - Some servers that do not understand the Range header send sometimes error
  - To be implemented: resending request without Range header and adjusting playback controls on client side

Future Work

- **Aim to cover 100% of specification:**
  - error behaviors and graceful degradation
- **Adding more functionality to the custom playback controls:**
  - seeking outside fragment
  - “on the fly” update of spatial dimension overlay
- **Media Fragments proxy support:**
  - all videos will be available as fragments!
- **Publishing first stable version:**
  - Mozilla Add-ons, automatic updates