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Title **On DASH Low Latency CE**
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1 Introduction

As part of the Core Experiment work on low latency streaming with DASH, we have made several investigations on HTTP chunk transfer mode. This contribution reports some results.

2 Discussion

As reported during previous discussions, when using chunked-transfer encoding (HTTP 1.1 servers and proxy only), it is possible to start transferring segment data before the segment is completely produced.

Let D_S be the duration of the segment, D_C be the duration of the chunk, and T_C the time at which the first chunk is available.

Ignoring the use of *availabilityStartTime*, the following cases may occur:

- an HTTP 1.0 client asks for the resource. The server cannot use chunked-transfer encoding and has to make sure the segment is completely produced and its length known before being able to answer to the request. If the request is received between time T_C and $T_C + D_S - D_C$, the server will hold the request for at most $D_S - D_C$ before answering, or reply with a 503 (temporary unavailable) or other means. In any case, the client will not process the content before $T_C + D_S - D_C$.

- an HTTP 1.1 client asks for the resource. The client may start receiving content if the request is made at or after T_C.

Now considering the processing associated with *availabilityStartTime* , we have the following possibilities for assigning the segment *availabilityStartTime*:

- the segment AST corresponds to the availability time of the complete segment (HTTP 1.0 compatible), i.e. $T_C + D_S - D_C$. An HTTP 1.1 client will therefore not benefit from the low latency aspect of the transfer.
- the segment AST corresponds to the availability time of the first chunk (HTTP 1.1 compatible), i.e. T_C. The server will have to make HTTP 1.0 clients wait for $D_S - D_C$ to start playback.

In our experiments, we have been using both possibilities without any issue, assuming that the client is able to process incomplete segment data as soon as it is received. However, an HTTP 1.1 client may not be able to do that, for various reasons, and therefore unable to process a media segment until completely downloaded. If such client makes the request at T_C, it will still wait, keeping its connection underused for the whole segment duration, i.e. the download time will be almost equal to segment duration. In such case, the client will waste some precious time waiting for the transfer to complete, while it could have used some of this time to download additional resources.

As a consequence of this discussion, we therefore suggest allowing signaling of the time difference between the production time of the first chunk of a segment and the production time of the complete segment.

Add to MPD and RepresentationBaseType the following:

Element or Attribute Name	Use	Description
availabilityStartTimeOffset	OD	Specifies the time difference between the availability time of the first chunk of a segment and the availability time of the complete segment. The default value is 0.

3 Conclusion

In this contribution we have reviewed the relationship between chunked transfer encoding in HTTP 1.1, the *availabilityStartTime* attribute and HTTP 1.1 and 1.0 behaviors. We believe existing signal signaling on DASH availabilityStartTime should be enough for low latency streaming, but that further signaling of the time difference between the first chunk is available and the whole segment is available could be useful to some implementations.

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