Agenda for today

1. Brief overview of linked specifications
2. Discuss PRs
   a. #27 - Adding LOC packaging
   b. #26 - Timeline tracks
3. Core features that need development
Where does WARP fit in to the architecture?

WARP
Streaming Format

LOC
Streaming Format

Chat Format

MoQ Transport
A pub/sub protocol for moving binary messages

WebTransport

Raw QUIC

APP

CDN
WARP components

Done and available at

Done and available at
https://datatracker.ietf.org/doc/draft-wilaw-moq-cmafpackaging/

Done and available at
https://datatracker.ietf.org/doc/draft-mzanaty-moq-loc-03

7 issues: https://github.com/moq-wg/warp-streaming-format/issues
PR #27 - Adding LOC packaging

• Provides the ability for WARP tracks to carry either CMAF-packaged or LOC-packaged bitstreams.
• The packaging field of the catalog must use one of the following values

<table>
<thead>
<tr>
<th>Packaging field value</th>
<th>Condition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmaf-frag-per-group</td>
<td>CMAFpackaging 4.1 is active</td>
<td>Each CMAF Fragment is placed in a single MOQT Object and there is one MOQT Object per MOQT Group</td>
</tr>
<tr>
<td>cmaf-chunk-per-object</td>
<td>CMAFpackaging 4.2 is active</td>
<td>Each CMAF chunk is placed in a MOQT Object and there is one MOQT Group per CMAF Fragment</td>
</tr>
<tr>
<td>loc</td>
<td>LOC packaging is active</td>
<td>Each EncodedAudioChunk or EncodedVideoChunk sample is placed in a separate MOQT Object</td>
</tr>
</tbody>
</table>
Example catalog with LOC and CMAF packaging

```json
{
  "version": 1, "streamingFormat": 1, "streamingFormatVersion": "0.2",
  "commonTrackFields": {
    "namespace": "output.example.com/event/12345",
    "renderGroup": 1
  },
  "tracks": [
    {
      "name": "video",
      "selectionParams": {
        "codec": "avc1.64001f",
        "mimeType": "video/mp4",
        "width": 1280,
        "height": 720,
        "framerate": 30,
        "bitrate": 4952892
      },
      "initTrack": "init_video_720",
      "packaging": "cmaf-frag-per-group"
    },
    {
      "name": "audio",
      "selectionParams": {
        "codec": "opus",
        "samplerate": 48000,
        "channelConfig": "2",
        "bitrate": 32000
      },
      "packaging": "loc"
    }
  ]
}
```
PR #26 - Timeline proposal

• The timeline track provides data about the previously published groups and object and their relationship to
  • wall-clock time
  • media time
  • associated timed-metadata.
• Timeline tracks allow players to seek to precise points behind the live head in a live broadcast, or for random access in a VOD asset.
• A timeline track may also be used to insert events at media times which do not correlate with Object boundaries.
• Timeline tracks are optional. Multiple timeline tracks MAY exist inside a catalog.
Timeline track proposal

Timeline tracks are csv files. Why?

- Low overhead, easy to read & parse
- Simply concatenation using media time as the ordering key

```
MEDIA_PTS,GROUP_ID,OBJECT_ID,WALLCLOCK,METADATA
0,0,0,1698351160,
2002,1,0,1698353162,
4004,2,0,1698355164,
6006,3,0,1698357166,
8008,4,0,1698359168,
10010,5,0,1698361170,
12012,6,0,1698363172,
14014,7,0,1698365174,
16016,8,0,1698367176,
18018,9,0,1698369178,
20020,10,0,1698371180,
22022,11,0,1698373182,
24024,12,0,1698375184,
...
```

A player wanting to seek to 1698363173 would subscribe to Group 6.
Example with object-aligned JSON metadata

MEDIA_PTS,GROUP_ID,OBJECT_ID,WALLCLOCK,METADATA
0,0,0,1698351160, {
"score": {
"England": 0, "Spain": 0
}
}
2002,1,0,1698353162, 4004,2,0,1698355164, 6006,3,0,1698357166, 8008,4,0,1698359168, 10010,5,0,1698361170, 12012,6,0,1698363172, 14014,7,0,1698365174, 15020,7,2,1698366180, {
"score": {
"England": 1, "Spain": 0
}
}
16016,8,0,1698367176, 18018,9,0,1698369178, 20020,10,0,1698371180, 22022,11,0,1698373182, 24024,12,0,1698375184,
Example with object-aligned XML metadata

MEDIA_PTS,GROUP_ID,OBJECT_ID,WALLCLOCK,METADATA
0,0,0,1698351160,{""score":{""England"":0,""Spain"":0}}
2002,1,0,1698353162,
4004,2,0,1698355164,
6006,3,0,1698357166,
8008,4,0,1698359168,
80163,,,,"<Event id='6'
presentationTime='80163'><scte35:signal><scte35:binary>/DBhAAAAAAA///wBQb+qM1E7QBLAhdDVUJVJSAAnX+fCAgAAAAALLLXnTUCAAlXQ1VFSUgAACZ/nwglAAAAACyy150RAAACF0NVRUllAAAnf58ICAAAAAAAsstezEAAAihiGnw==</scte35:binary></scte35:signal></Event>"}
10010,5,0,1698361170,
12012,6,0,1698363172,
14014,7,0,1698365174,
15020,7,2,1698366180,{""score":{""England"":0,""Spain"":1}}}
Timeline reference in a catalog

```json
{
  "version": 1, "streamingFormat": 1, "streamingFormatVersion": "0.2",
  "commonTrackFields": {
    "namespace": "conference.example.com/conference123/alice","packaging": "loc","renderGroup": 1
  },
  "tracks": [
    {
      "name": "live-timeline",
      "type": "timeline",
      "depends": ["video","audio"]
    },
    {
      "name": "video",
      "selectionParams": {"codec": "av01.0.08M.10.0.110.09","width": 1920,"height": 1080,"framerate": 30,"bitrate": 1500000}
    },
    {
      "name": "audio",
      "selectionParams": {"codec": "opus","samplerate": 48000,"channelConfig": "2","bitrate": 32000}
    }
  ]
}
```
Timeline updates

Group ID, Object ID)

0,0  0,1  0,2  0,3  1,0  1,1  1,2  1,3

MEDIA_PTS,GROUP_ID,OBJECT_ID,WALLCLOCK,METADATA
0,0,0,1698351160, 2002,1,0,1698353162, 4004,2,0,1698355164, 6006,3,0,1698357166, 8008,4,0,1698359168, 10010,5,0,1698361170,

MEDIA_PTS,GROUP_ID,OBJECT_ID,WALLCLOCK,METADATA
12012,6,0,1698363172,

MEDIA_PTS,GROUP_ID,OBJECT_ID,WALLCLOCK,METADATA
14014,7,0,1698365174,

MEDIA_PTS,GROUP_ID,OBJECT_ID,WALLCLOCK,METADATA
20020,10,0,1698371180,

MEDIA_PTS,GROUP_ID,OBJECT_ID,WALLCLOCK,METADATA
22022,11,0,1698373182,

MEDIA_PTS,GROUP_ID,OBJECT_ID,WALLCLOCK,METADATA
24024,12,0,1698375184,

No longer than 30s between full updates
Core issues remaining

- **Finalize CMAF/LOC stream mapping** based on Object Model to Transport Mapping #333
- Communicating what groups are available over time for clipping and DVR.
- Finalize simulcast
- **Object prioritization** (MOQT dependency)
- **Bitrate adaptation** (client side and/or server side) (MOQT dependency - Sender-side ABR #259)
- **Advertising insertion** (MOQT dependency) - should also work with real-time latency
- **DRM** – define and add Schema and pssh data to catalog as track properties. (catalog dependency)