

RTP Payload Format for VC-1

draft-klemets-rtp-avt-vc1-00.txt

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VC-1 overview

- Codec spec: SMPTE 421M
 - Currently being standardized by SMPTE technical committee C24
 - Should be publicly available *really soon now*
 - I would be surprised if it isn't available before Vancouver IETF
 - I-D is supposed to contain enough detail to be able to conduct a meaningful review
- Three profiles:
 - Simple (SP), Main (MP), Advanced (AP)
 - AP is geared towards digital cinema and broadcast applications (HD and SD)
 - Typical bit rates: 768-10000 kbps but theoretically supports up to 150 Mbps
 - SP and MP are for lower bit rate streaming
 - E.g., wireless (SP max bit rate is 384 kbps)

VC-1 bit stream

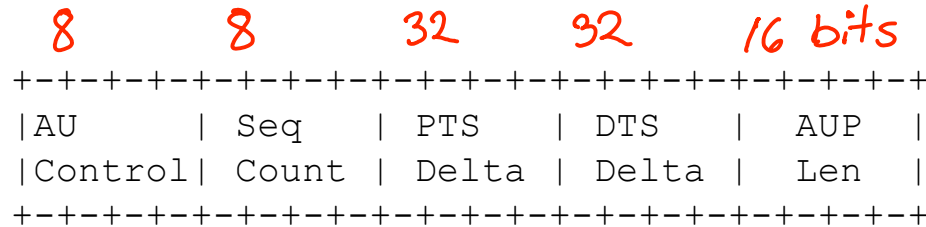
- Layered structure similar to MPEG
 - Sequence Layer
 - In-band header in AP only
 - SP and MP requires out-of-band mechanism for sequence layer info (e.g, SDP)
 - Entry Point Layer (AP only)
 - Picture Layer
 - Slice Layer (AP only and optional)
 - Macroblock layer
 - Block Layer

Payload Format

```
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+ .. +--+--+--+--+
| RTP      | AU(1) | AU(2) |      | AU(n) |
| Header  |      |      |      |      |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+ .. +--+--+--+--+
```

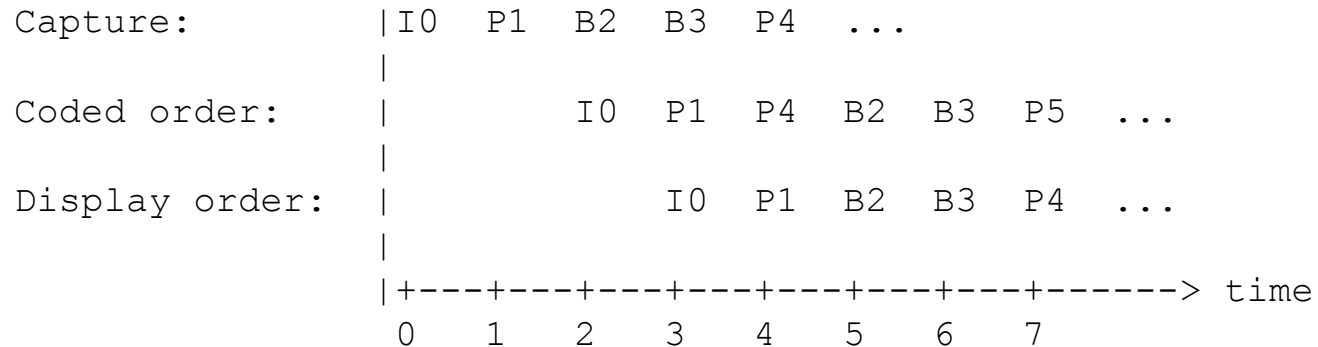
- Each AU is a single picture (frame)
- Sequence Layer and Entry Point headers also included, if applicable
- Fragmentation occurs at Slice Layer boundary, if possible
- Each AU starts with variable length header (shown on next slide)

AU header



- Seq Count must change each time the Seq Layer header changes
 - Seq header may be too big to include in each RTP packet
 - ~14 bytes + (0-130 bytes for HRD leaky buckets)
 - Idea: Omit leaky buckets, or include only 1 leaky bucket param = ~20 bytes
 - Value of 0 reserved for Seq header included in a=fmtp SDP parameter
 - Feedback: Add new SDP parameter to allow Seq header in SDP to be bound to non-zero Seq Count value
- Feedback: Include Picture header (as is done in RFC 2250)
 - Should be possible if Slice Layer is used, but otherwise the Picture header may be too big
- Feedback: Fields not word-aligned
 - Could be solved by placing Length field after Seq Count field
 - But is this really important?

Ordering of frames



- When B-frames are present, P-frames are sent before the B-frames that depend on them
- Receiver buffers one extra frame
 - B-frames are displayed immediately, I- and P-frames are delayed
 - In example above: P4 is not displayed until first non-B frame (P5) is received.
 - P4 buffering delay determined by number of B-frames (2 in example)

RTP timestamp field

- RTP TS set to Decode Time
 - Always monotonically non-decreasing
 - Equivalent to sample time + offset, except in the case when P-frames are reordered
- Most natural fit for implementation:
 - Decoder only needs RTP stack to deliver frames in time for decoding (i.e., based on decode time)
 - PTS produced by decoder
 - Synch with audio happens after decoding
 - Only Decode Time stored in ASF file
- Computing PTS from DTS requires more work than other way around
 - Cf. example on previous slide
 - PTS of P4 is only known after B2, B3 & P5 have been seen
 - Number of B-frames is not constant for Advanced Profile
- If this is a big deal, can change I-D to say RTP TS is PTS

Next steps

- Other comments / discussion?
- Accept as AVT work item?
 - Post updated I-D (~ 8/30)
 - Update I-D again before Vancouver IETF

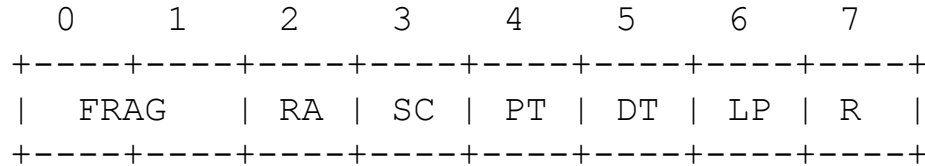
Backup slides

Sample SDP

- Simple Profile, Main Level

```
m=video 49170 RTP/AVP 98
a=rtpmap:98 VC1/90000
a=fmtp:98 profile=0;level=2;width=352;height=288;framerate=15000;
    bitrate=384000;buffer=2000;config=4e291800
```

AU Control field



- **FRAG: 2 bits**
 - 0: The AU payload contains a fragment of a frame other than the first or last fragment.
 - 1: The AU payload contains the first fragment of a frame.
 - 2: The AU payload contains the last fragment of a frame.
 - 3: The AU payload contains a complete frame (not fragmented.)
- **SC: 1 bit**
 - Sequence Layer Counter present. This bit MUST be set to 1 if the AU header includes the Seq Count field. The bit MUST be 0 for Simple and Main profile bit streams.
- **RA: 1 bit**
 - Random Access Point indicator. This bit MUST be set to 1 if the AU contains a frame that is a random access point. In the case of Simple and Main profiles, any I-picture is a random access point. In the case of Advanced profile, the first frame after an entry-point segment header is a random access point. Note that if entry-point segment headers are not transmitted at every random access point, this MUST be indicated using the MIME parameter "mode=2" or "mode=3", as appropriate.
- **PT: 1 bit**
 - PTS Delta Present. This bit MUST be set to 1 if the AU header includes the PTS Delta field.
- **DT: 1 bit**
 - DTS Delta Present. This bit MUST be set to 1 if the AU header includes the DTS Delta field.
- **LP: 1 bit**
 - Length Present. This bit MUST be set to 1 if the AU header includes the AUP Len field.
- **R: 1 bit**
 - Reserved. This bit MUST be set to 0 and MUST be ignored by receivers.