RTP Payload Format for Interleaved Packets

draft-huang-payload-rtp-interleave-00

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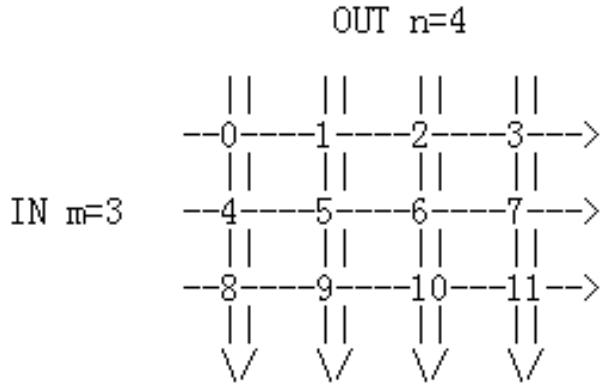
Why is An Interleaved Payload Needed

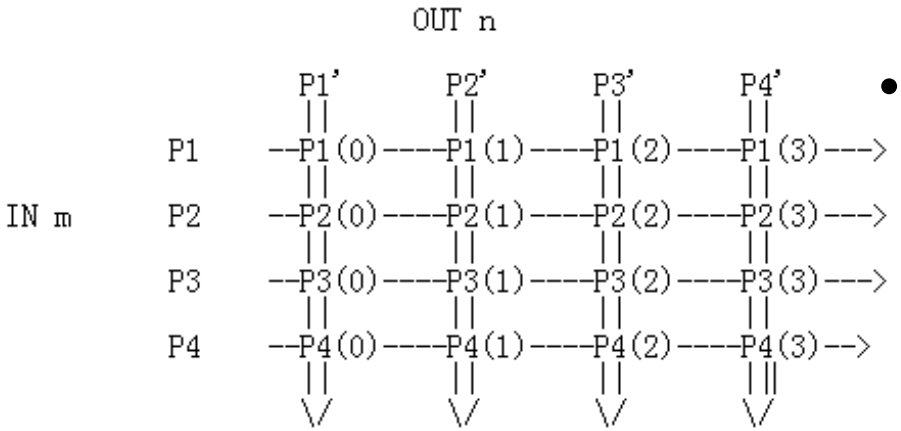
- Interleaving is quite useful for network environment where interference is an issue, e.g., DSL and wireless network.
- Although interleaving does not suit interactive applications, it’s quite helpful for streaming applications where certain delay is allowable, like IPTV.
- Interleaving is supported in some RTP Payload formats, e.g., H.265, H.264. However, not all of them.
- Thus, a common RTP payload format for interleaved media is introduced.

Interleaving Schemes



Interleaving based on RTP packets

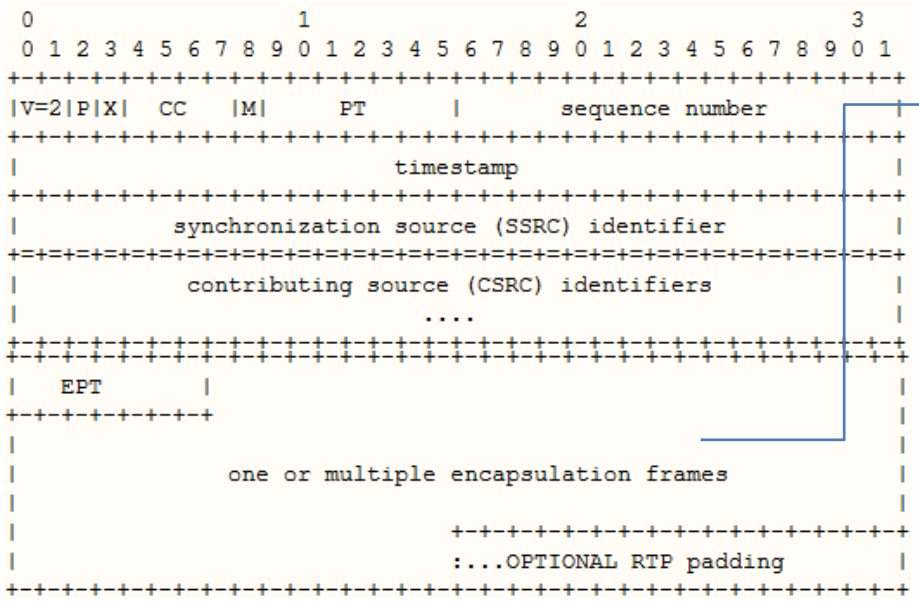
- Usually useful for small packets applications which can aggregate the packets together.
- Not quite suitable for video applications.

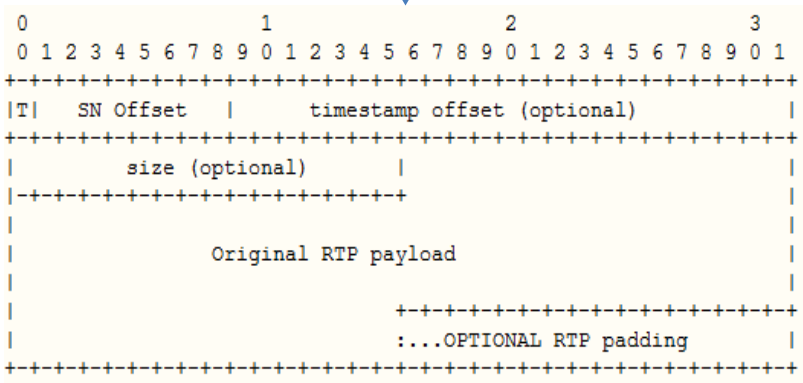


Scattered RTP packets Interleaving

- Each RTP packet is divided into n parts and the interleaver combines some parts of one packet with some of other packets to form a new RTP packet

Interleaving RTP Payload Format

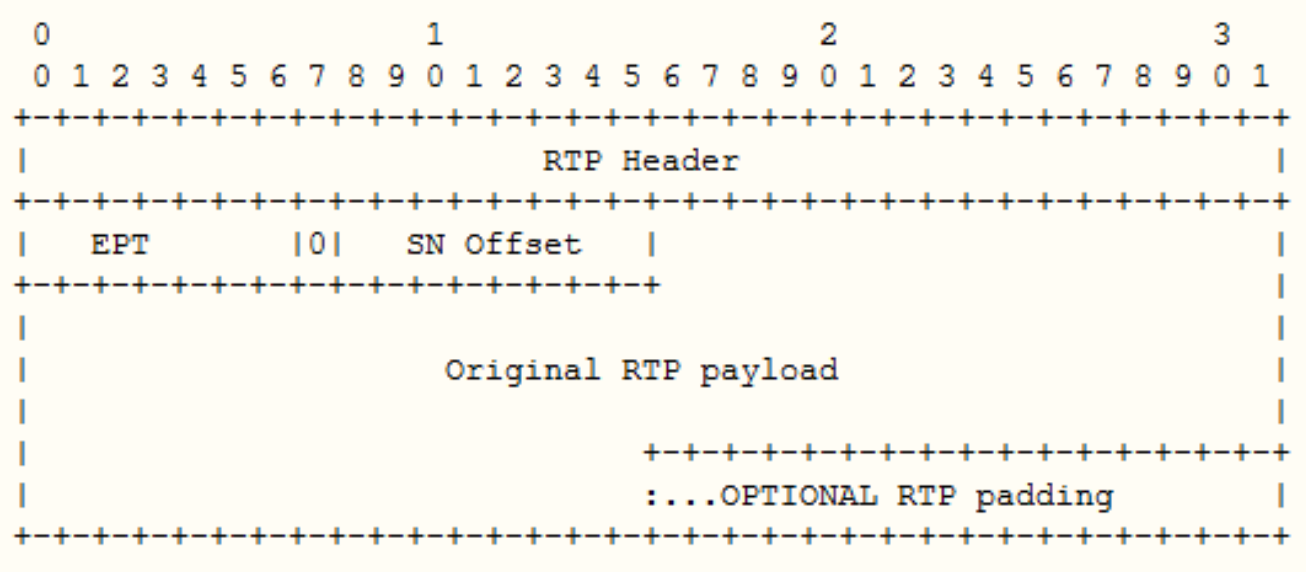




- encapsulation payload type (EPT): Original RTP payload type.
- encapsulation frame type (T):
  - T=0: Last encapsulation frame (MUST be the last encapsulation frame)
  - T=1: Aggregated encapsulation frame
- SN Offset: Used to calculate the original sequence number.
  - original sequence number = sequence number + SN offset
- Timestamp offset: Used to calculate the original timestamp. Only applicable for T=1.
  - original timestamp = timestamp + timestamp offset
- Size: the length of the original RTP payload body. Only applicable for T=1.

Example:

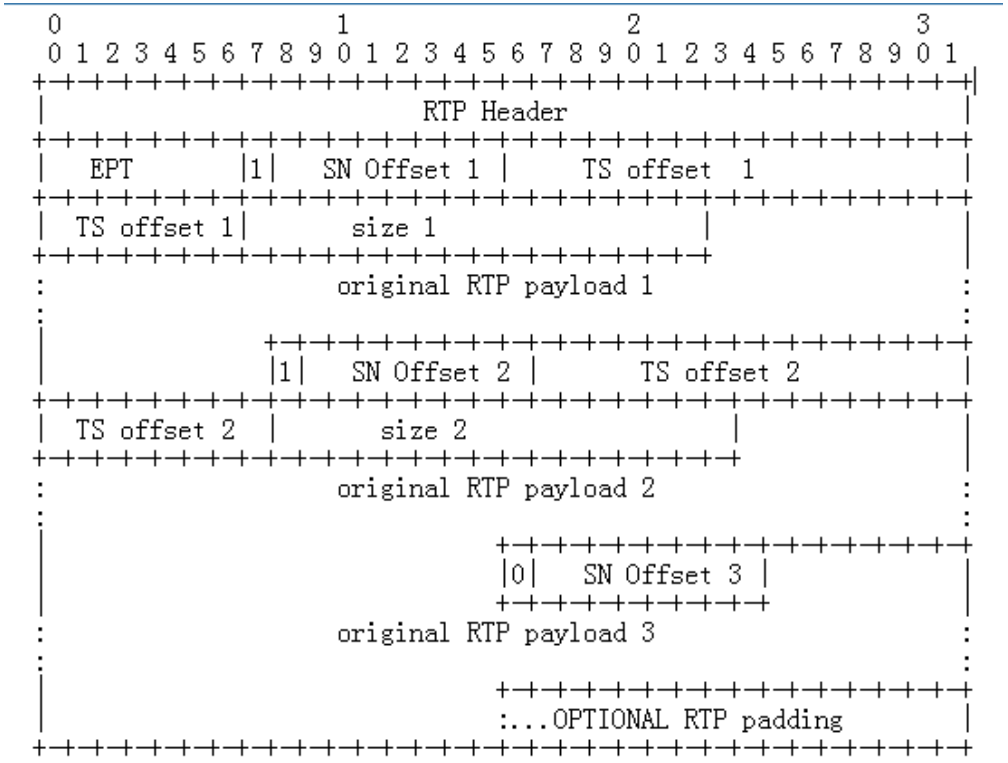
An interleaving RTP packet including only one encapsulation frame



- T=0
- The timestamp in the RTP header is the original timestamp.
- Can be used for per-RTP packet interleaving or scattered RTP packets Interleaving
  - When used for scattered RTP packets Interleaving, the original RTP header should be participated in the interleaving so that the de-interleaver can recover the whole RTP packet correctly. In that a case, SN offset should be set to 0.

Example:

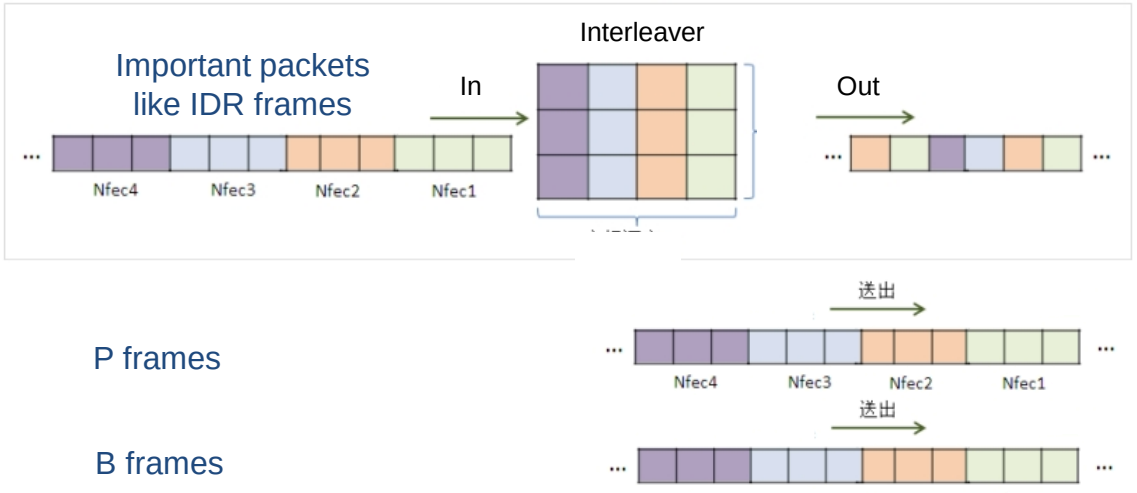
An interleaving RTP packet including multiple encapsulation frames



- The timestamp in the RTP header is the original timestamp of the last encapsulation frame.
- Can be used for aggregation RTP packets interleaving

Selective Interleaving

- Interleaving increases delay.
- Choosing packets carrying important frames e.g, I-frames, to interleave can somehow reduce the delay.
- To do that, It is allowed that interleaving RTP payload format is transmitted together with the uninterleaved payload format so that the de-interleaver can identify the interleaved packets to recover.



Next Step

- SDP signaling issues.
- Welcome reviews and suggestions.

THANK YOU

Interleaving is still used in some ISP's network

- DSL technology has been widely implemented in access network.
- To anti-interference, FEC and interleaving are used to alleviate the effect of impulsive noise.
- However, it increases the delay, which is about 25ms.
- Removing the interleaving will reduce the delay to 3ms, but greatly increase the error packet rate.
- FTTH could solve the problem, but it requires operators to update their network, which may not be considered by all of them.
  - E.g., some European operators are still using DSL because the cost of updating network is quite high. They are still considering to dig out the potentiality of their legacy network.

Experiment of Selective Interleaving

- Environment: system – win7; cpu – Intel(R) Xeon(R) CPU E5-2680 0 @2.70GHz 270GHZ; RAM – 6.0GB
- Protocol & Payload: RTP, TS stream
- Interleaving: m=5; n=5; RTP packet length= 1316(7*TS packets);

	Maximum Delay(us)	Minimum Delay(us)	Average Delay(us)	Total time for interleaving(ms)	total time of video(ms)
Interleaving	44798	55	1241	59205	59205
Selective Interleaving (Only I frame)	18171	54	159	6092	65276

Selective interleaving reduces the processing delay by 90%.