Some Considerations on Frame Forwarding at the AVB

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Rules and procedures for frame forwarding

- Based on reservation mapping rules and admission decision
- Rules for packet queuing and forwarding
  - Allocated bandwidth guarantee
  - Bounded delay and jitter guarantee

- Required qualities
  - Bandwidth : average bandwidth, burst
  - Delay, jitter : 2ms(285us/hop)

- New traffic type
  - Time sensitive stream characterized less than 2ms delay and jitter
  - New user priority and an exclusive queue for the traffic

- Complexity of rules and procedures for frame forwarding
  - Not only depends on guaranteeing the required qualities
  - Depends on the link utilization target and the property of reservation mapping rules and admission decision

Deterministic end-to-end performance

- Prefer to have deterministic delay when forwarding frames
  - Delay within jitter bound
  - No needs to allocate delays on an end-to-end path

- Without considering translation of the required quality in view of resources and resource reserving methods on forwarding mechanism,
- on any given traffic situation, how to achieve the deterministic end-to-end performance with the frame forwarding rules ?

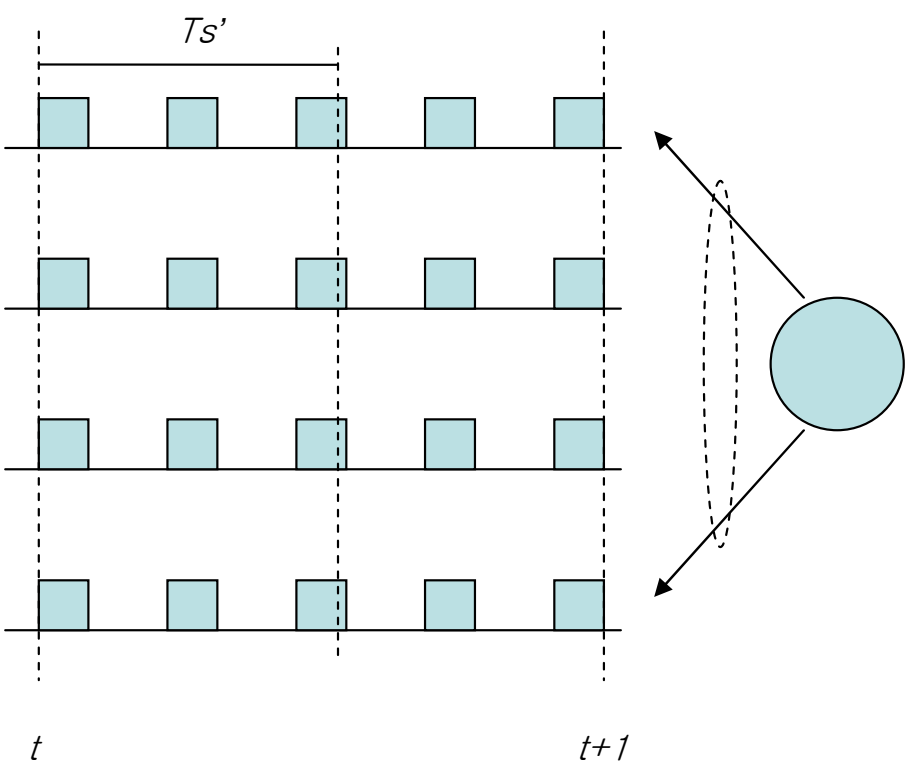
- It is possible only if
  - given traffic specification for every streams
  - and the property of aggregated traffics can be described in time sense

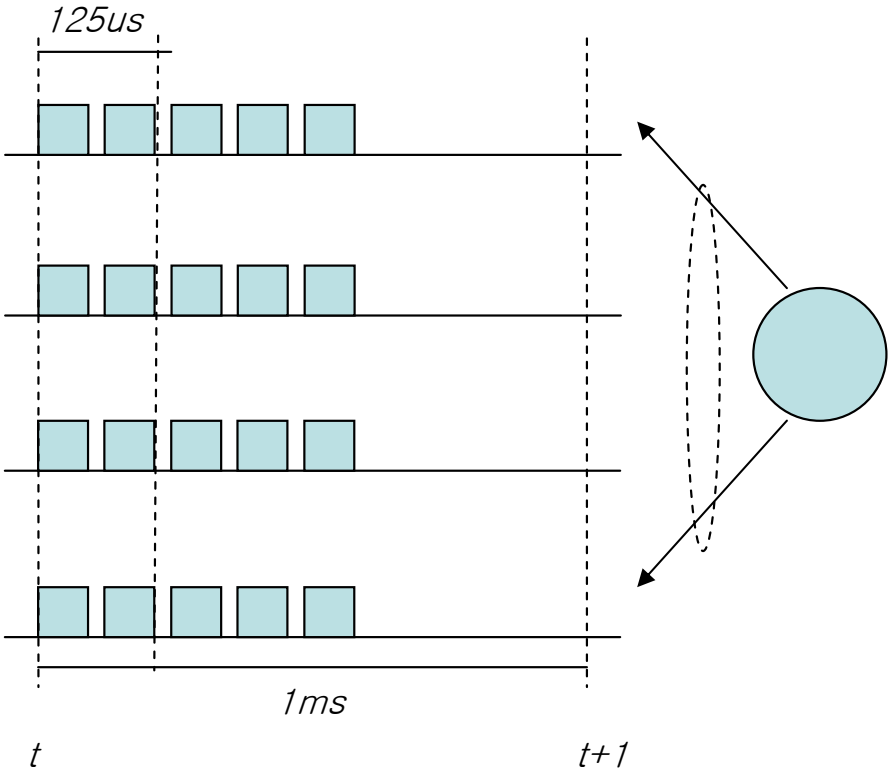
- Deterministic end-to-end performance
  - TDM like bit-level switching is the only solution by this time
  - Unsolved historical engineering problem ? In economic sense
  - How about frame based Constant Bit Rate traffic ?

Deterministic delay & CBR Traffics

- Deterministic delay possible when switching TDM like traffic
  - Globally synchronized
  - Bit-level switching
- Frame based CBR traffics
  - average bite rate on certain monitoring time will be constant.
  - If shorten the monitoring time below certain level, average rate will be varied.
  - According to application, required monitoring time differs
- According to monitoring time, forwarding rules have to vary
  - Having large window, less fluctuation on rate, but large burst
  - Having small window, large fluctuation on rate
  - Even though forwarding CBR traffic, it is not easy to get deterministic forwarding delay at the AVB, if not control the monitoring windows for every flows.

CBR, monitoring duration and Delay





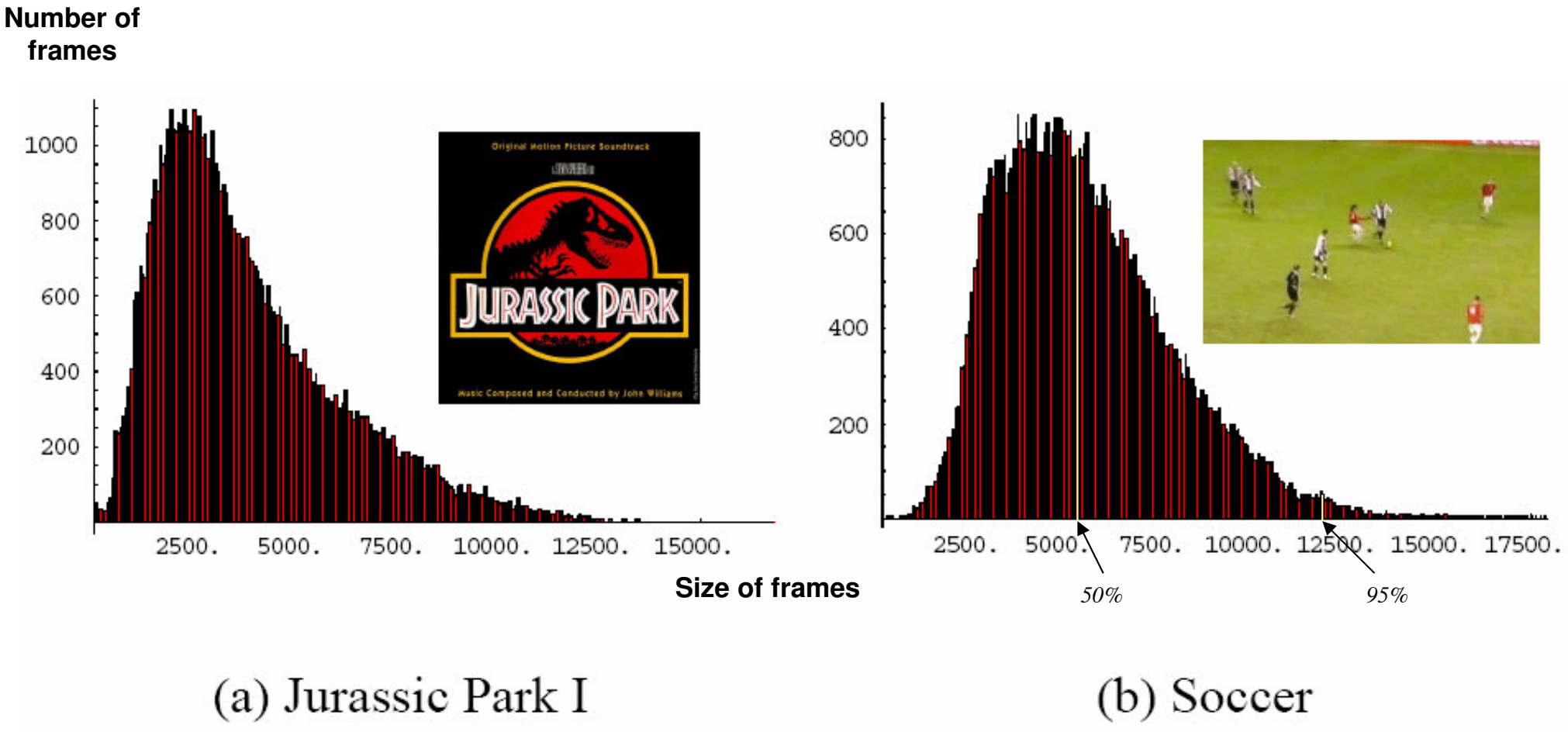
Engineering solutions for deterministic performance (I)

- **Possible solutions**
  - Explicit procedure for providing traffic specifications or imbedded estimation on traffic specifications
  - Time synchronized resource allocation and synchronized forwarding along the path
  - Regulate transmission in time base at an out link with the ingress traffic shaping
  - Engineered admission (over provisioning)
  - And so on

Engineering solutions for deterministic performance (II)

- Engineering solutions
  - Compromise between link utilization target and costs by architecture complexity
  - Needs a method to provide traffic specifications
  - How to describe the traffic specifications will constrain to define the rules of frame forwarding to achieve deterministic end-to-end performance
  - Frame forwarding rules have to maximize the effect of two additional functions
  - Frame forwarding rules have to minimize needs on additional resources.
  - No modifications on legacy forwarder
  - Minor modifications on legacy forwarder

Traffics of stream services

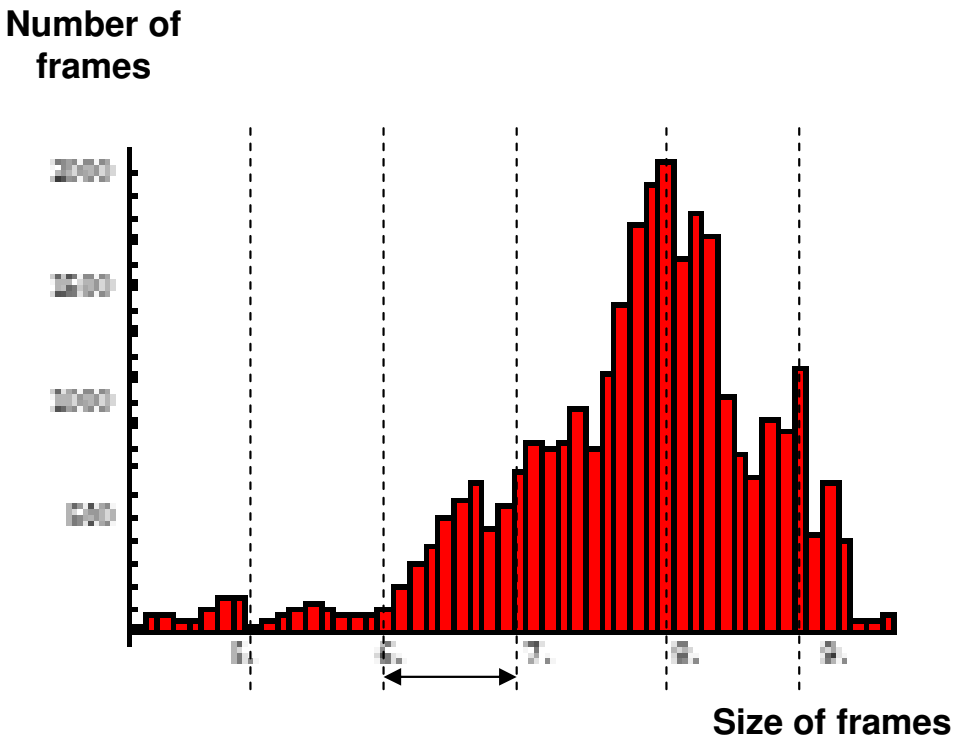


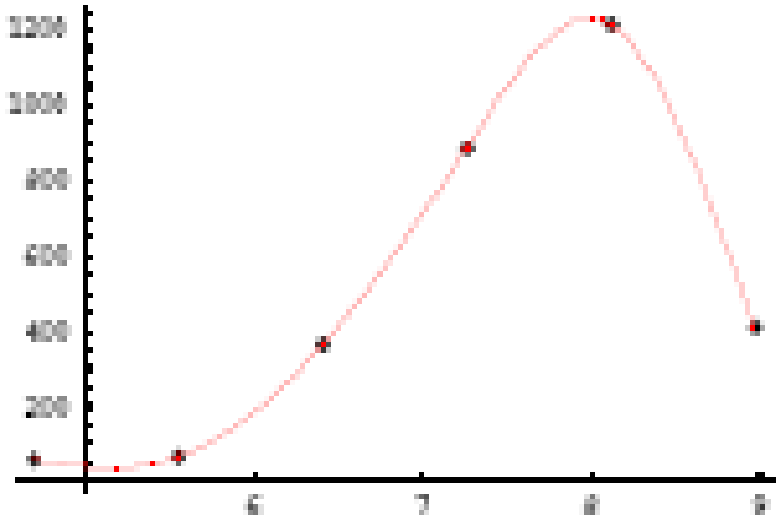
(a) Jurassic Park I

(b) Soccer

Histograms for MPEG-4 Trace for Files (bytes)

Estimation of traffic specifications





Summary

- AVB
  - Already spent resources for adding functions : memory, processing capability, bandwidth
  - Need effective use of additional functions : layer 2 timing synch and reservation protocol
- Design Requirements on AVB frame forwarding
  - Provide deterministic end-to-end performance
  - Minimize additional cost memory & processing for the frame forwarding
- Deterministic delay for CBR & VBR
  - for frame based CBR traffic, still needs to reserve peak bandwidth or room for a burst to obtain deterministic delay
  - Additional resources are required for performing identifier, counter, and shapers for each flows
  - Even though having a source model, still challenge to control the aggregated VBR traffics
- Cost effective solutions
  - Between no modifications on legacy forwarder and minor modifications on legacy forwarder
  - Needs a method to provide traffic specifications

Thanks for your attention !!

Questions ?

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