

Bandwidth Reservation for Guaranteeing Deterministic End-to-End Delay

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Beijing, IEEE 802.1 AVB TG

Seong-Soon Joo, ETRI

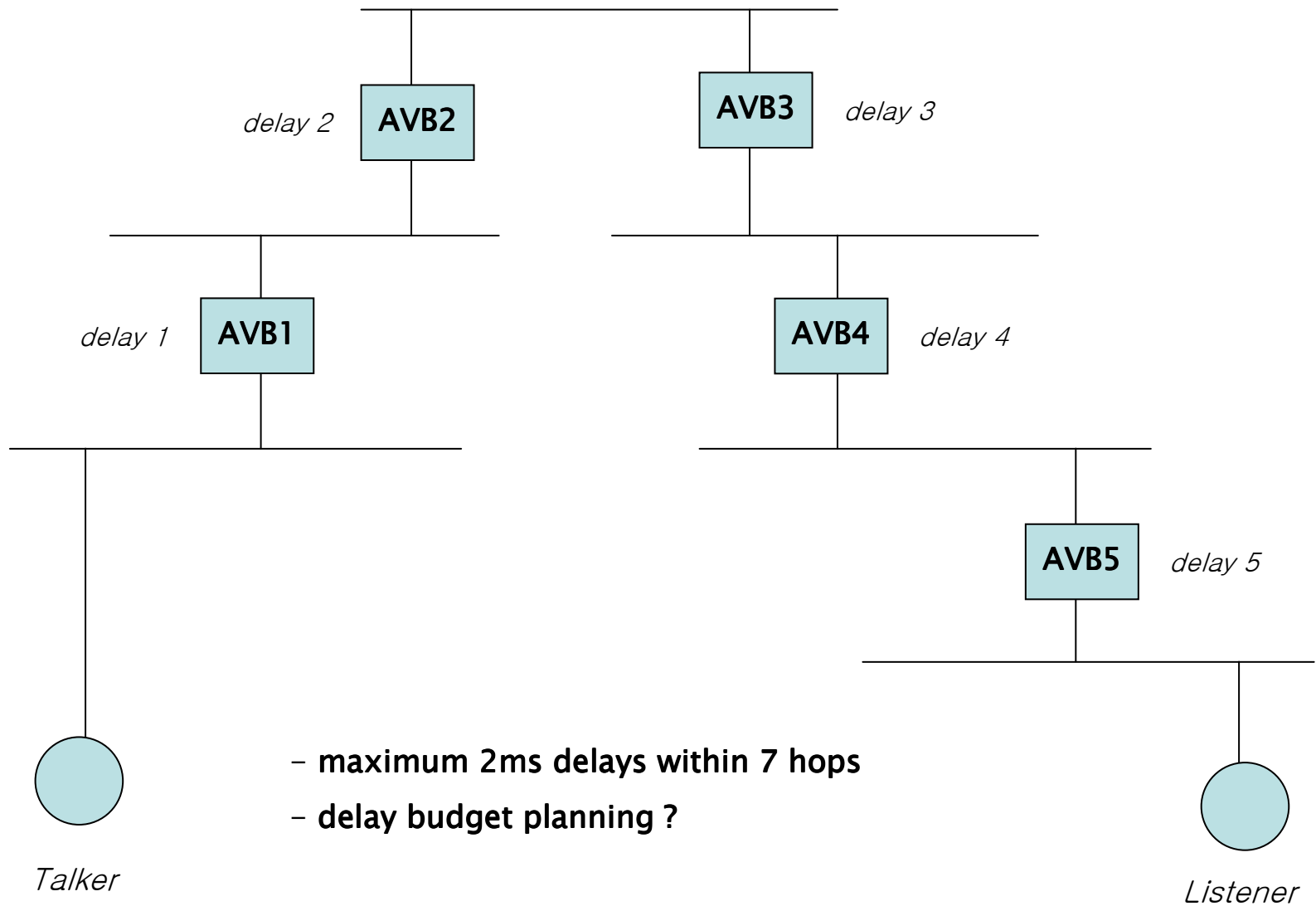
Bandwidth Reservation at AVB

- **Major discrepancy of AVB to legacy Ethernet**
 - Low jitter on end-to-end latency
 - Reserve bandwidth on the path from talker to listener
 - Admission procedure for reserving bandwidth

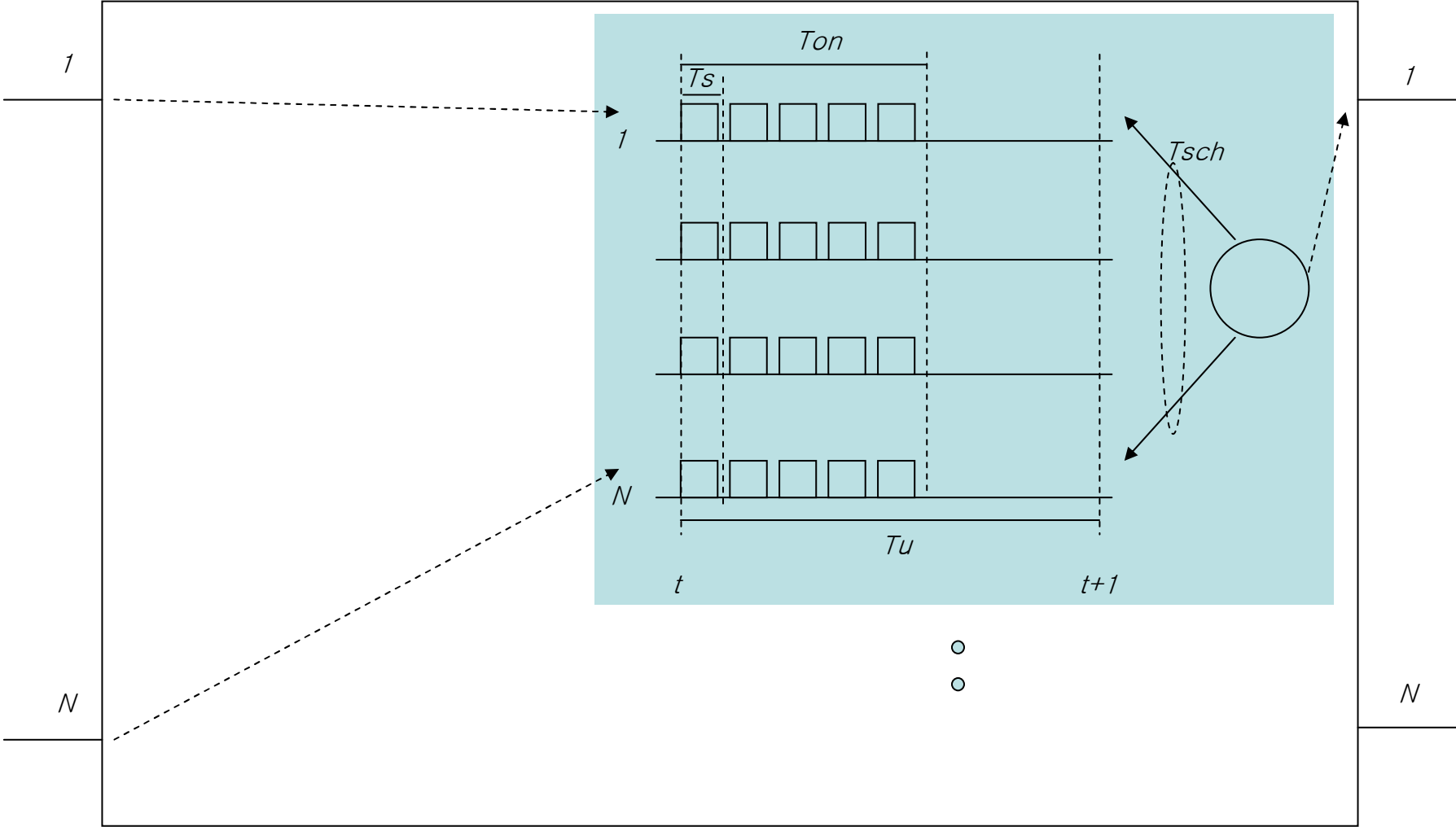
- **Bandwidth at AVB**
 - Number of bits per sec transmitted on an output link
 - or granted number of packets to be pull out from tx queue for the unit time
 - or assigned service time of preemptive scheduler (bytes per class interval)
 - and so on ...

- **Why we define the bandwidth for AVB project ?**
 - Goal to achieve in AVB is guaranteeing deterministic end-to-end latency
 - Functions for providing the bandwidth reserved for a session is closely related to the forwarding architecture
 - Traffic monitoring, shaping, scheduling, ...
 - To be free from the detailed implementation issues as possible as we can

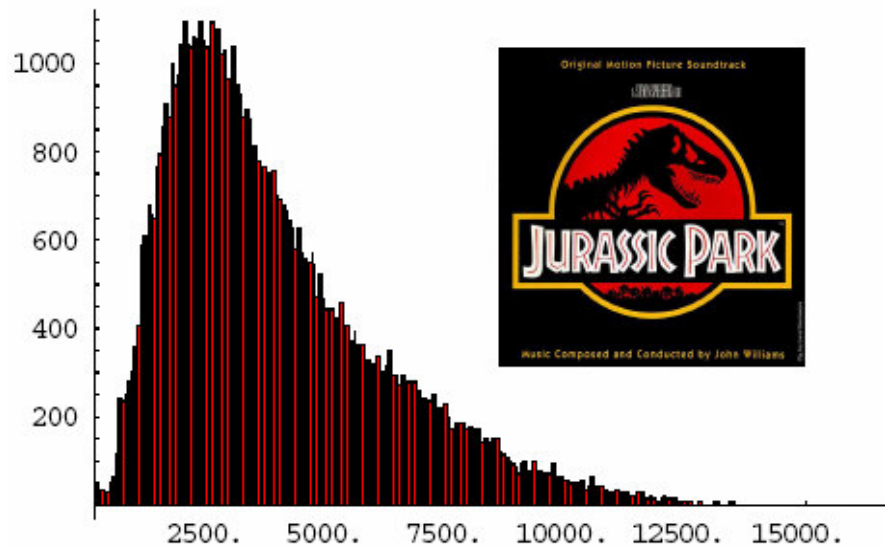
Delay Distribution on End-to-End path



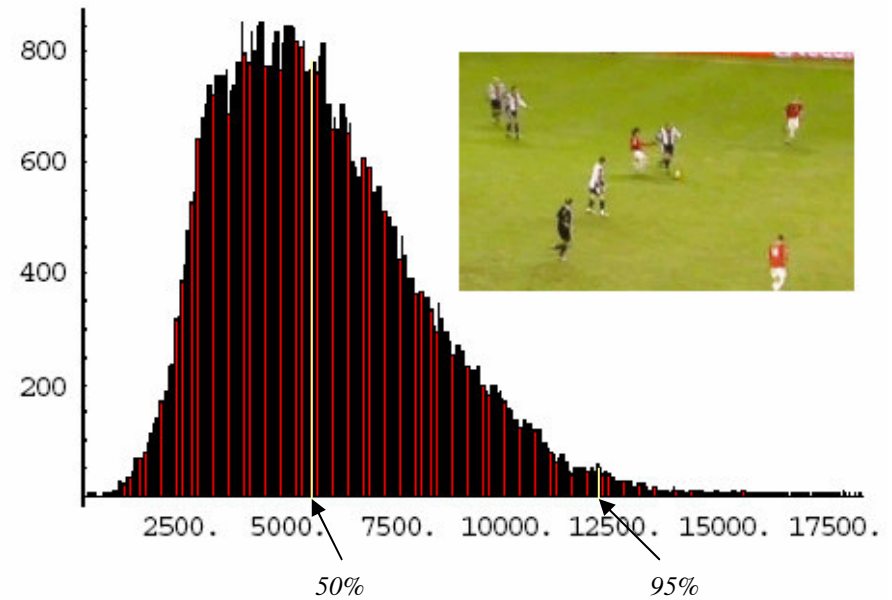
Flows and Forwarder



Traffics of Stream Services



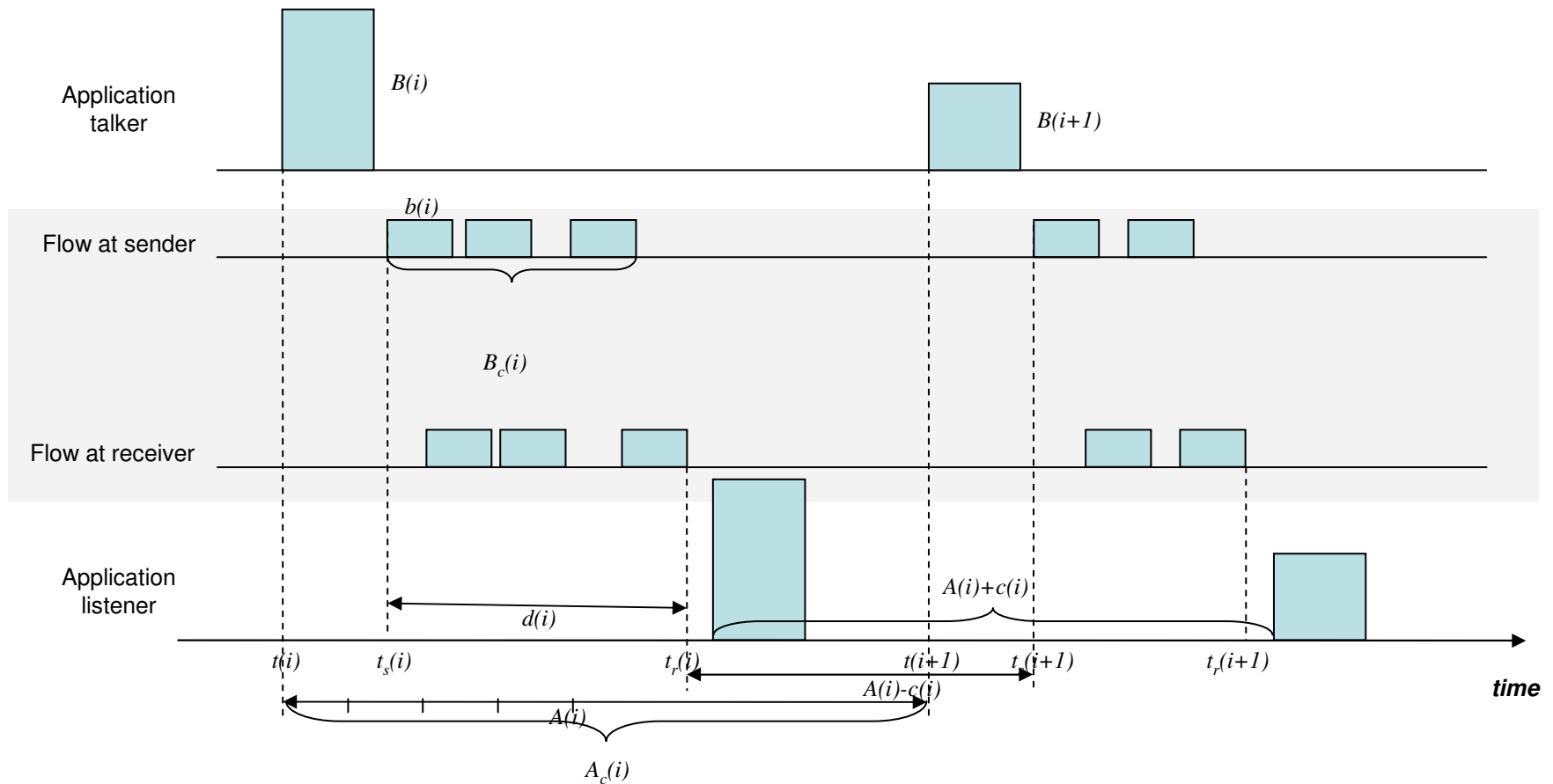
(a) Jurassic Park I



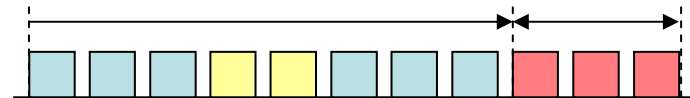
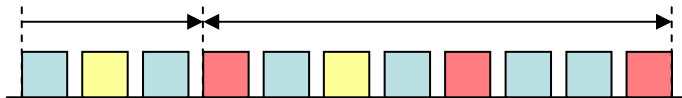
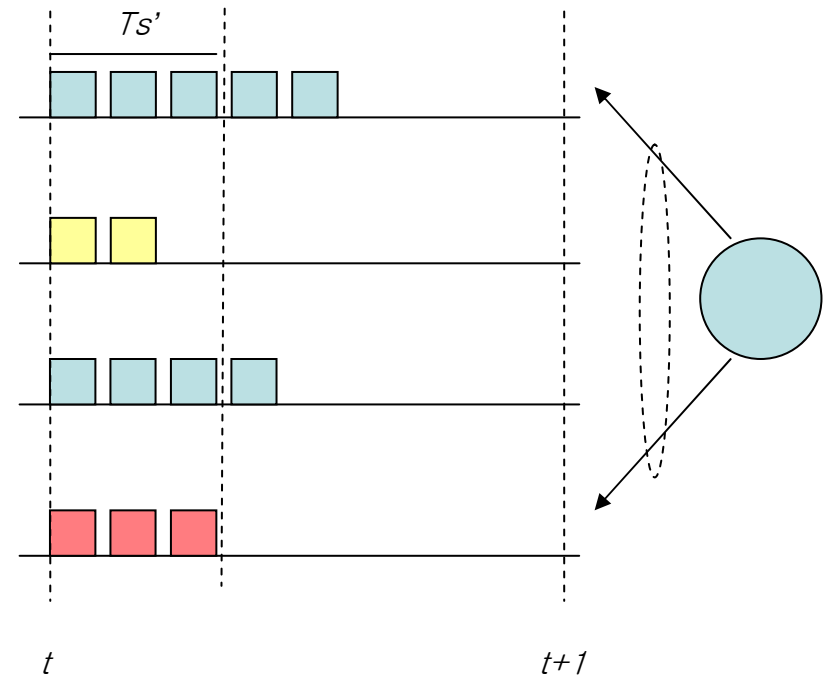
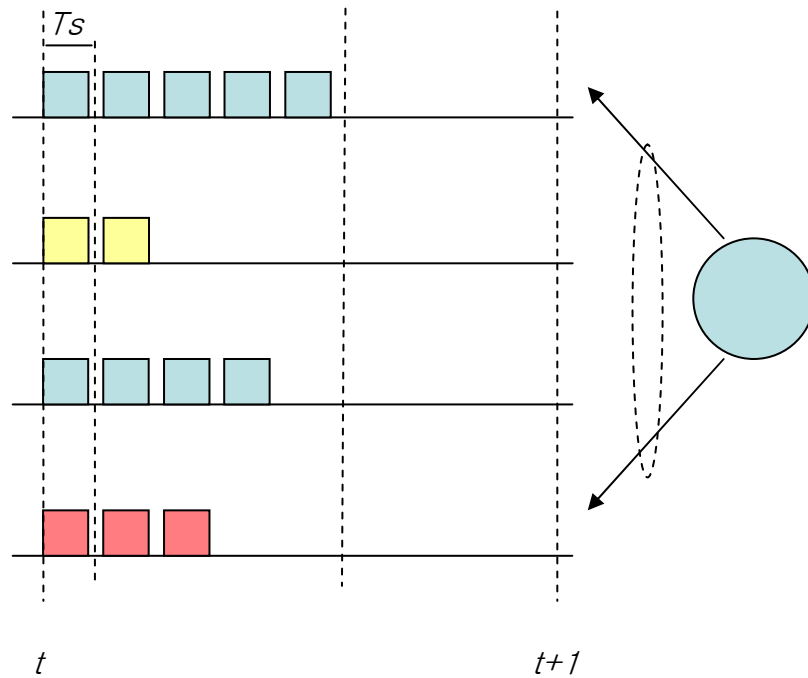
(b) Soccer

Histograms for MPEG-4 Trace for Files (bytes)

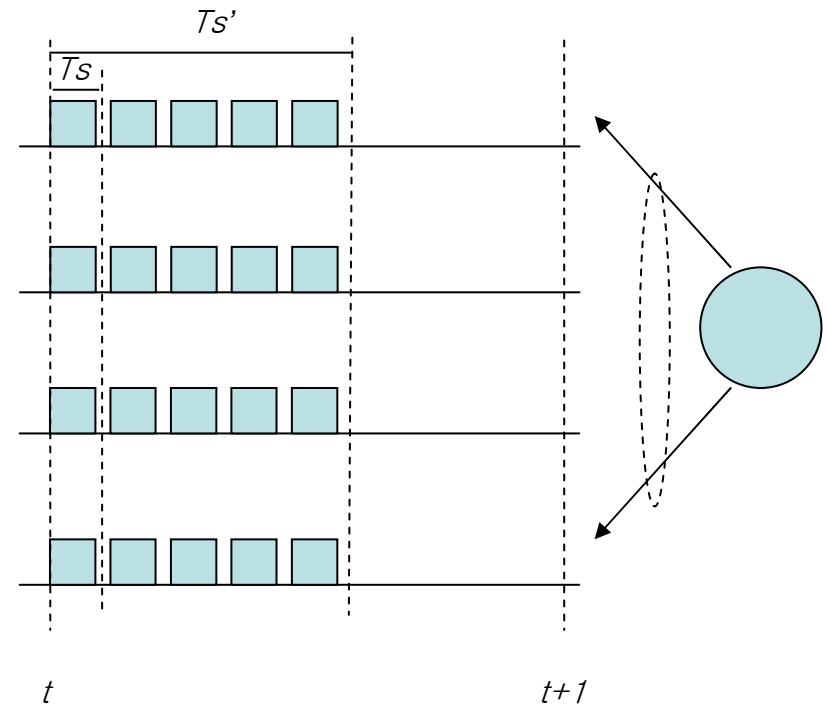
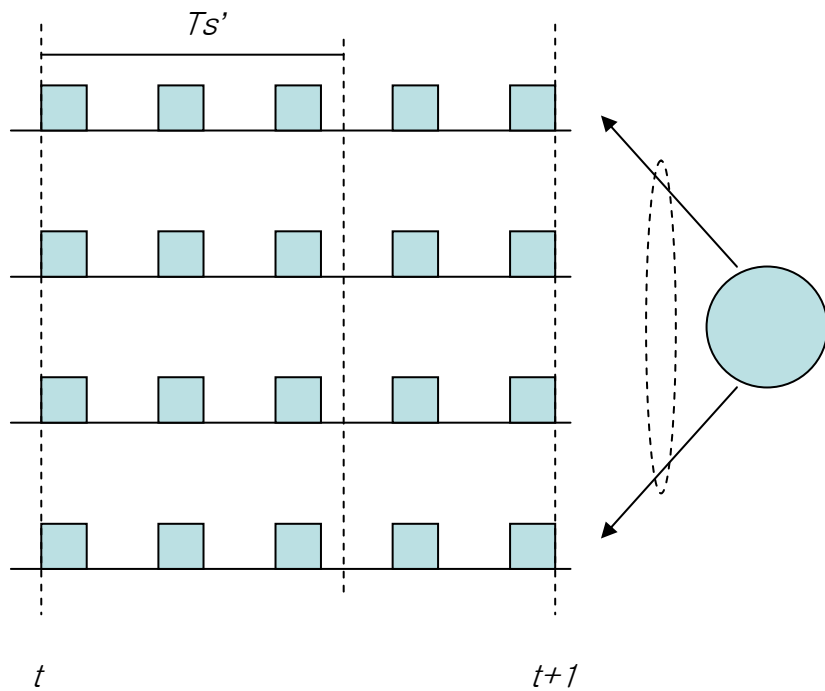
Packetized flow and Delay variation



Delay Variation with the Scheduler

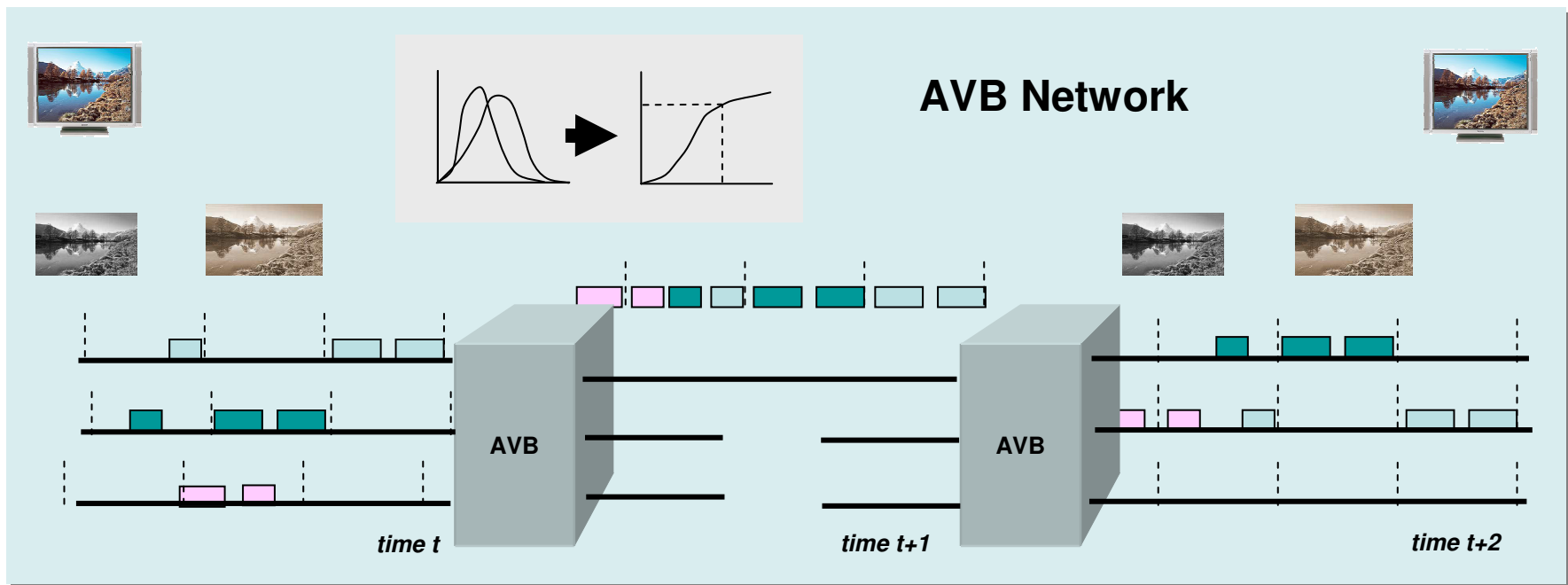


Shaping and Delay



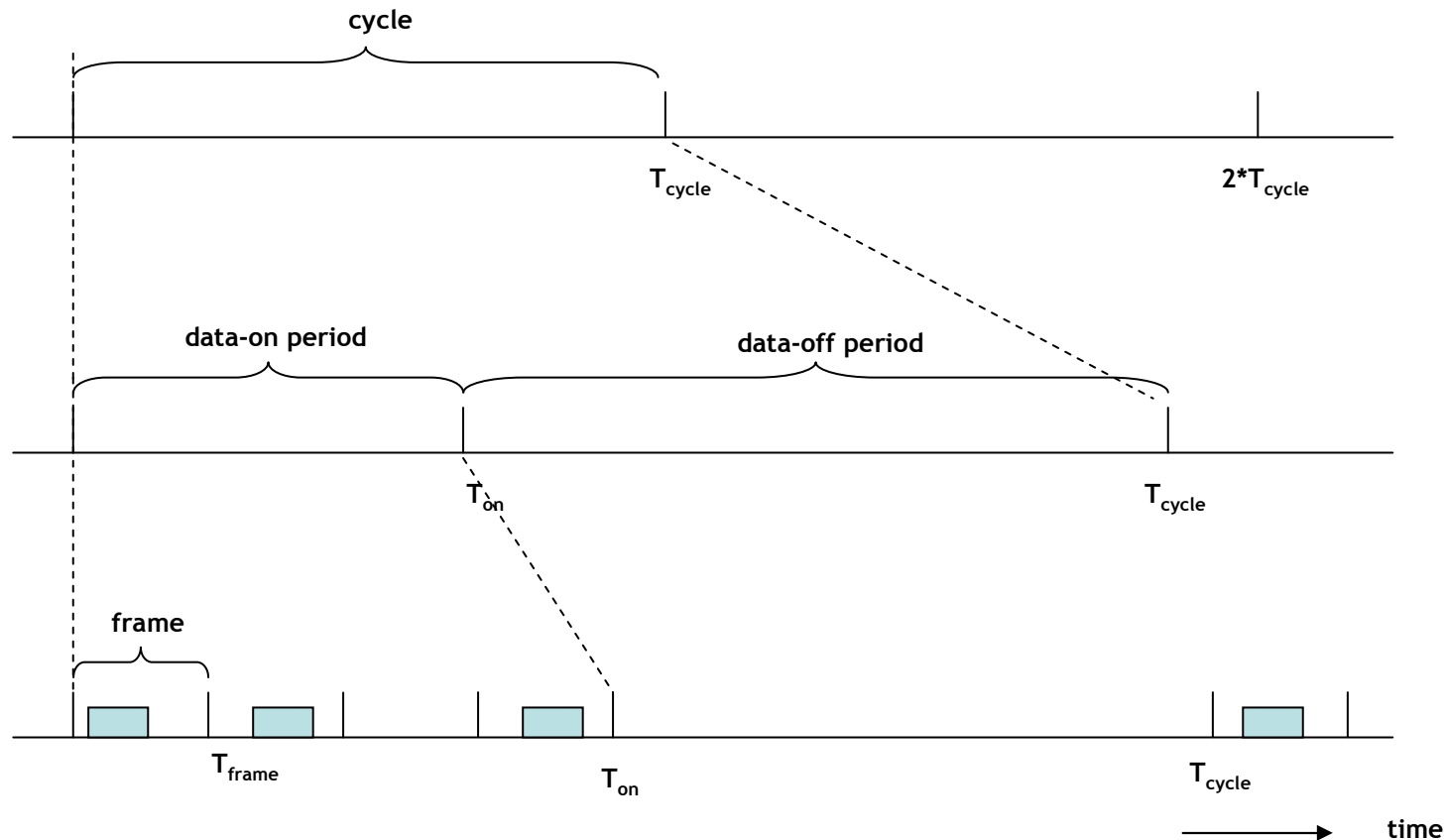
A Bandwidth Reservation for VBR services

- scheduling every T_{sch} for the classified input ports
- reserve $t_s(P)$ to transmit the frames packetized for the application data which is less than the size with probability P of pdf
- every T_{on} cycle, n_{app} frames are arrived
- at AVB, flows of N input ports are forwarded to one output port
- queued-in probability at one AVB
 - $T_{sch} < T_{on}$: $(1-P)*N$ (non-shared resource), $(1-P)^N$ (shared resource)
 - $T_{sch} > T_{on}$: $(T_{sch}/T_{on})*(1-P)*N$



A Model of the Required Bandwidth

- pdf of the number of consecutive frames
 - reserve resources for forwarding frames with the number of probability P
- pdf of the cycle & pdf of the data-on period
 - reserve resources for the data-on period with the length of probability P_{data} every cycle with the length of probability P_{cycle}



Guaranteeing deterministic E2E latency

- **Deterministic forwarding**
 - Reserve peak bandwidth
 - Serve the consecutive frames for $t_s(1)$
 - Constant bit rate services (audio, uncompressed video, ...)
 - No shaping, cut-through forwarding

- **Statistical reservation with the probability of deterministic latency**
 - Admit the session based on the probability of deterministic latency
 - Reserve tx scheduling time, (resources) ...
 - Shaping or/and flow control, or do not anything

- **Proposal**
 - describe the required bandwidth for a service with the cycle time and the ratio of the data-on period

Thanks for your attention !!

ssjoo@etri.re.kr