MISCELLANEOUS

RFC 5681 → Congestion Control

RFC 6298 → timer

→ IN SLOW START ($cwnd < ss\_thresh$)

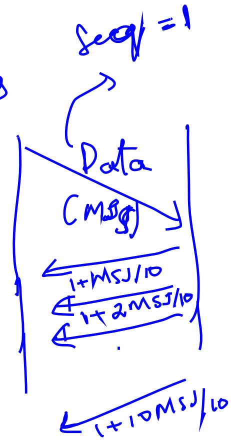
SUPPOSE WE receive an ACK which acknowledges 'N' bytes of <u>new</u> data

then $cwnd \mathrel{+}= \min(N, MSS)$

IN <u>Congestion Avoidance</u> ($cwnd \geq ss\_thresh$)

For every ACK which acknowledges <u>NEW</u> data

$$cwnd \mathrel{+}= \frac{(MSS)^2}{cwnd}$$

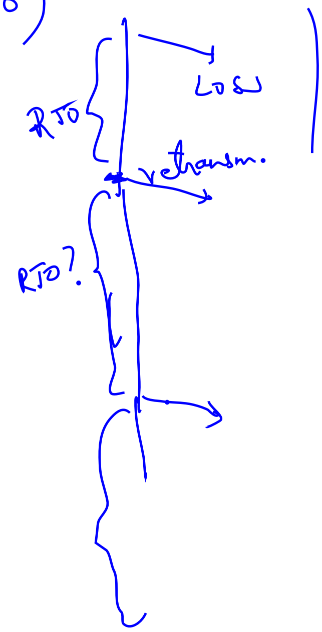


<u>RFC 6298</u>: Initial RTO = 1 sec or higher

<u>Loss</u> by <u>T.O.</u>: $ssthresh = \max\left(\text{Window}/2,\ 2 * MSS\right)$

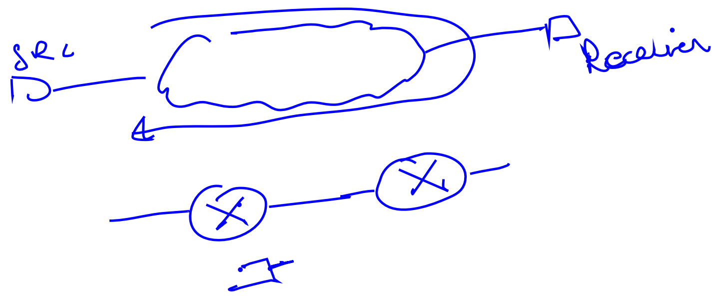
Window = max (cwnd, Adv. window)

<u>Loss By T.O.</u>: $RTO = \min(2 * RTO,\ max\_RTO)$



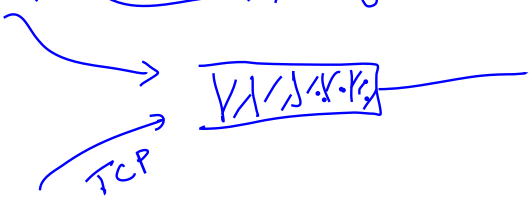
<u>TCP VEGAS</u> → 1994-5

RTT detect congestion



Does RTT for congestion help?

VoIP (over UDP) → latency sensitive

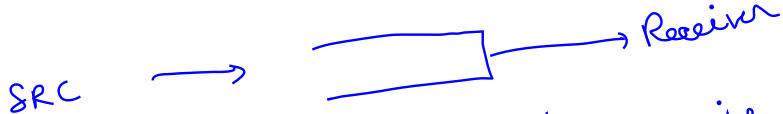


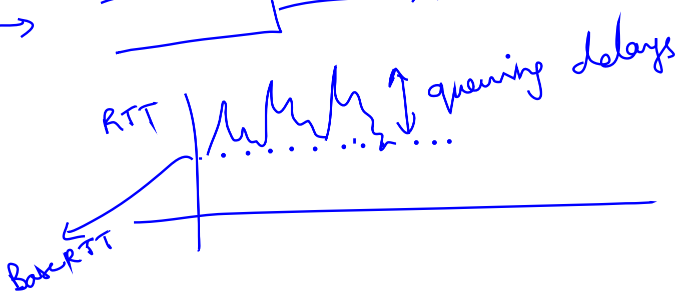
TCP VEGAS

Detect Loss by T.O. and 3 Dup Acks and modify cwnd and ssthresh as in TCP Reno

SLOW START RULES ARE SAME AS RENO

Model path as a single queue





If queue empty (no congestion)

then (RTT = BaseRTT)

$$\text{ExptRate} = \frac{\text{cwnd}}{\text{BaseRTT}}$$

BaseRTT → measure

$$\text{ActualRate} = \frac{\text{cwnd}}{\text{RTT}} \leq \text{ExptRate} \quad (\text{since } RTT \geq \text{BaseRTT})$$

RTT → smooth out the measured RTTs in the recent past

$$\text{Diff} = \text{ExptRate} - \text{ActualRate}$$

In Congestion Avoidance ($cwnd \geq ssthresh$)

$$Diff < \alpha \Rightarrow$$ Cwnd is increased by 1MSS per RTT

parameter

like Reno (additive increase)

(eg: $cwnd \mathrel{+}= \frac{(MSS)^2}{cwnd}$ at every ACK for new data)

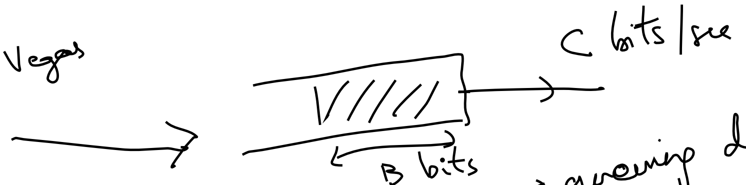
$$\beta < Diff \Rightarrow$$ cwnd decreased by 1MSS per RTT

$$\alpha < Diff < \beta \Rightarrow$$ cwnd is not modified

$$Diff = \frac{cwnd}{BaseRTT} - \frac{cwnd}{RTT} = Cwnd\left(\frac{\boxed{RTT - BaseRTT}}{BaseRTT \times RTT}\right)$$

queuing delay

TCP Vegas



$$Diff = \frac{\cancel{cwnd}\,(B/C)}{\cancel{RTT} \times BaseRTT} \approx \frac{B}{BaseRTT}$$

queuing delay

$$\frac{cwnd}{RTT} \approx C$$

Actual Rate

Suppose. $\alpha = 30\,KBps$; $\beta = 60\,KBps$

$BaseRTT = 100ms$

$$\alpha < Diff < \beta$$

targeting

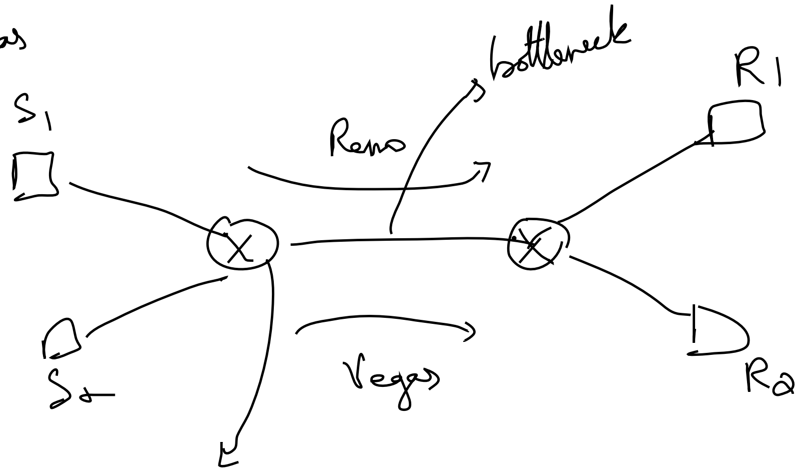
$$\alpha < \frac{B}{BaseRTT} < \beta$$

$$3KB = \alpha \cdot BaseRTT < B < \beta \cdot BaseRTT = 6KB$$

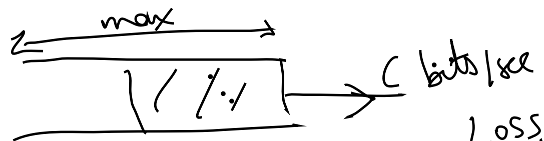
1) What if TCP Vegas flows compete with Reno flows?

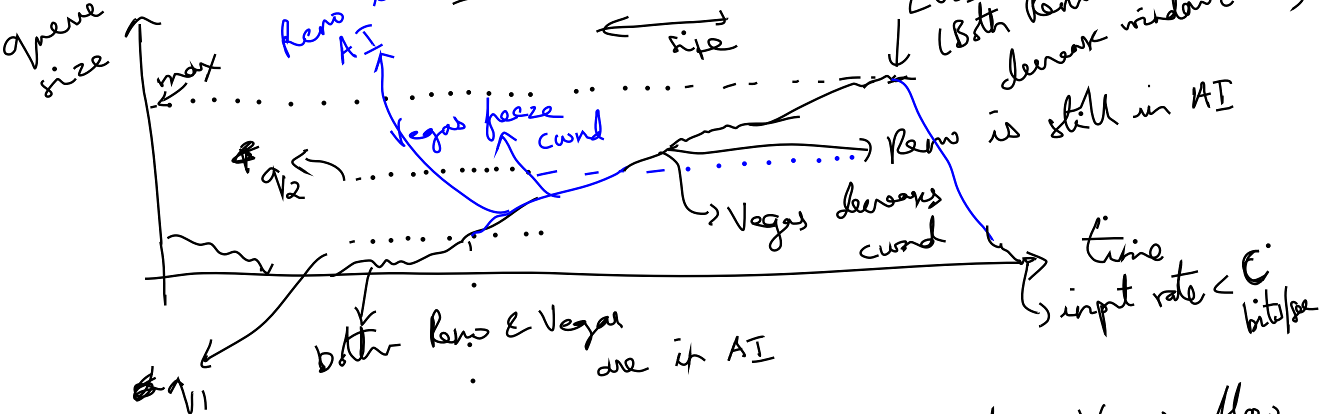
2) What if we replace all Reno flows in Internet with Vegas?

1) Reno vs. Vegas



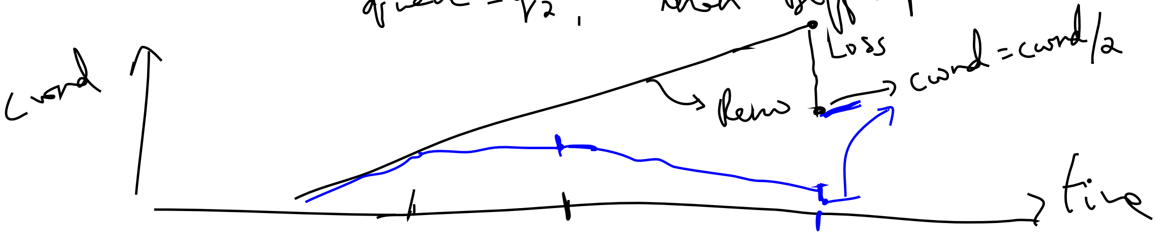
Ignore slow start





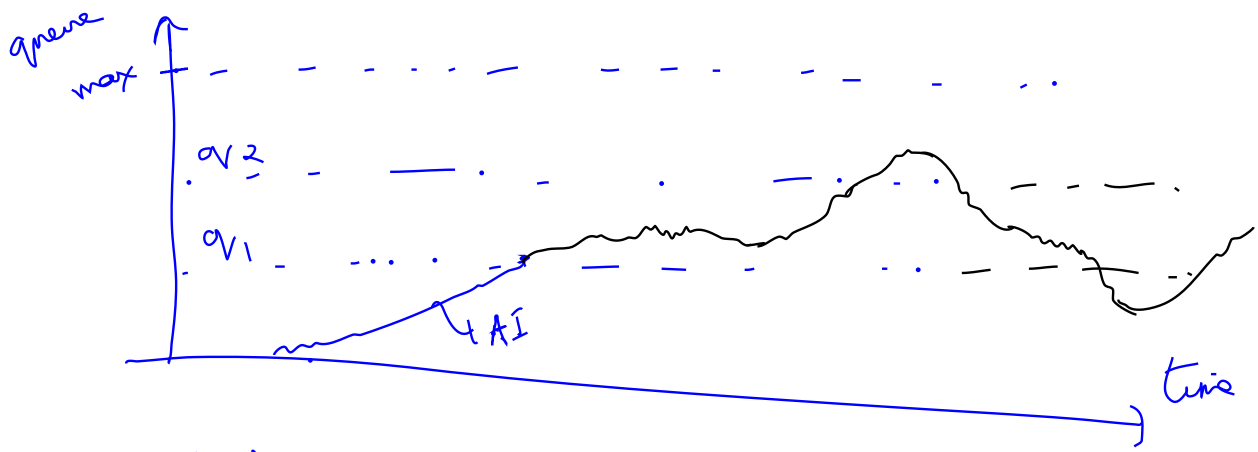
Assume if queue $= q_1$, then Diff $= \alpha$ for Vegas flow

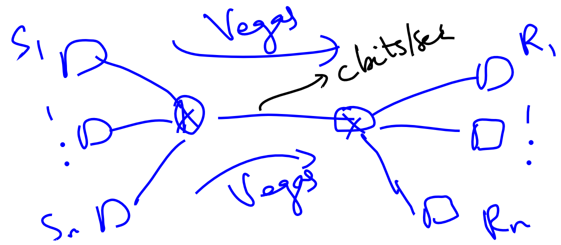
queue $= q_2$, then Diff $= \beta$ — " —



Reno is aggressive compared to Vegas

2) Only Vegas flows





Assume all have same RTT

$S_i \to R_i$ is an Vegas flow

TCP: 5-tuples
SRC & DST IP & Port Nos,
Protocol field (IP Hdr)
(says TCP is transport)

good any VoIP-type application

a) No pkt Loss
b) queuing delays between $\frac{q_1}{c}$ & $\frac{q_2}{c}$
where c is output rate of the queue

c) Throughput can be higher than for the all Reno case, because here the queues never empty unlike the all Reno case

Claim: all Vegas case gave 50% higher throughput than all Reno case

P2P