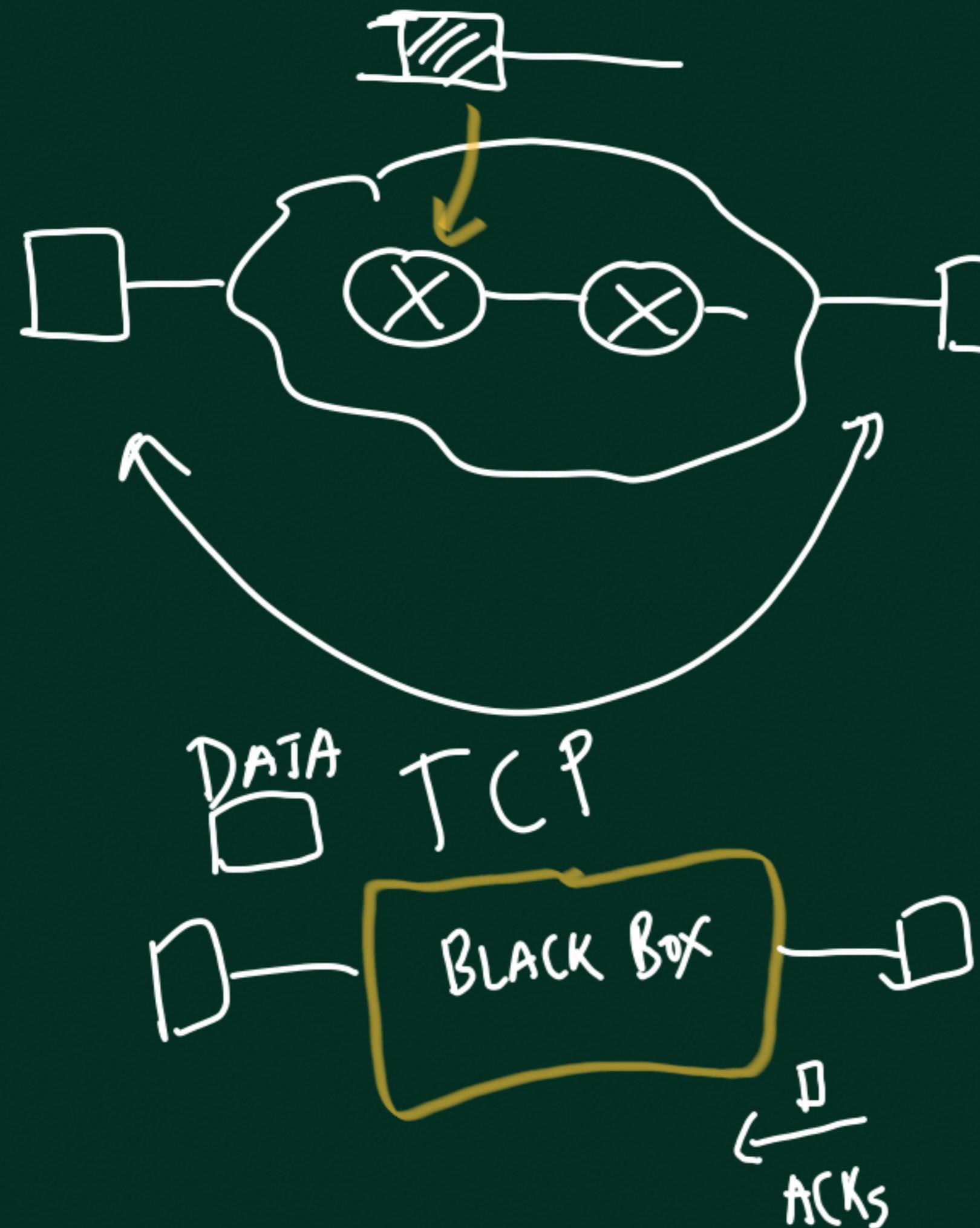
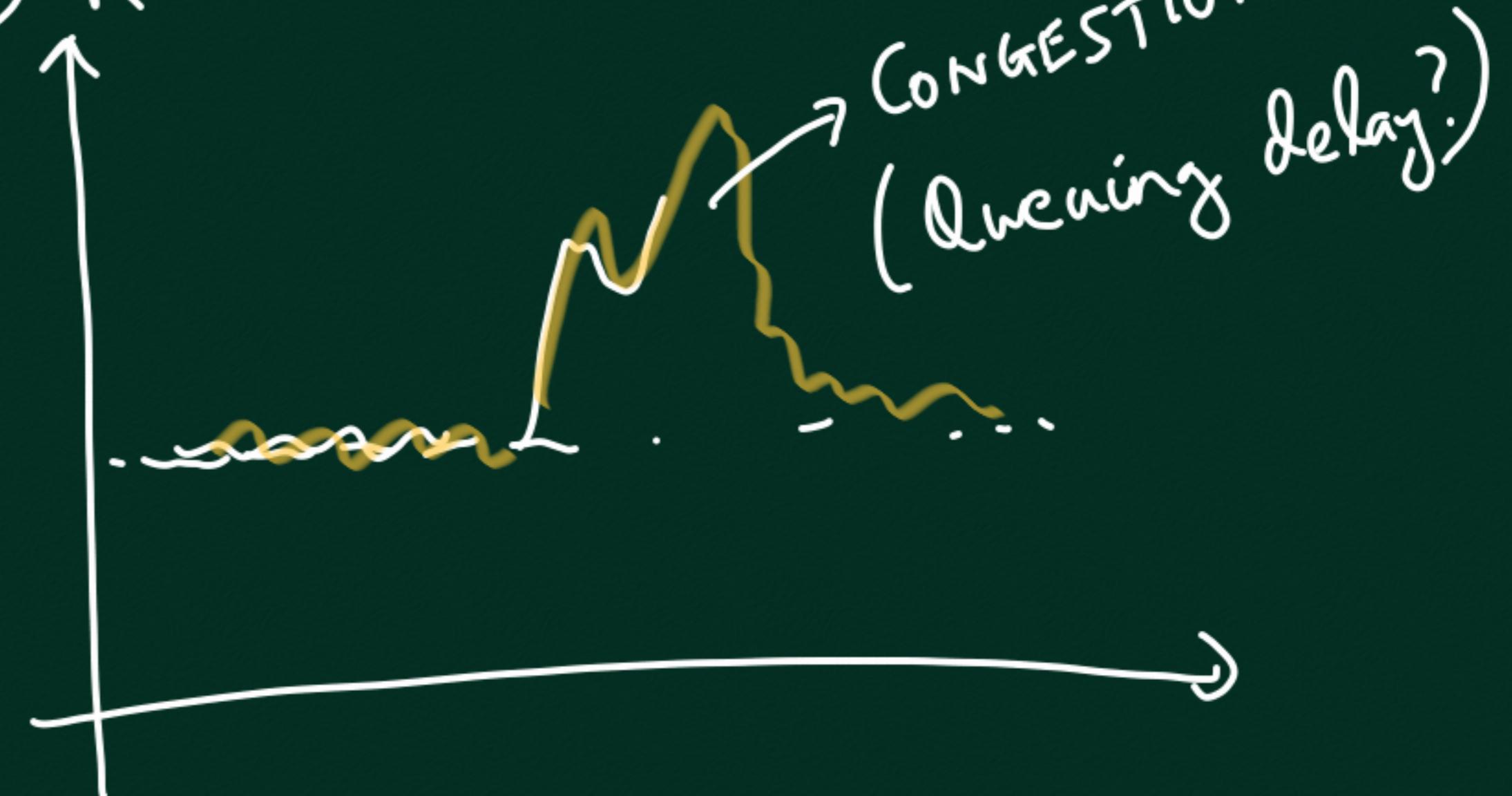


TCP CONGESTION CONTROL

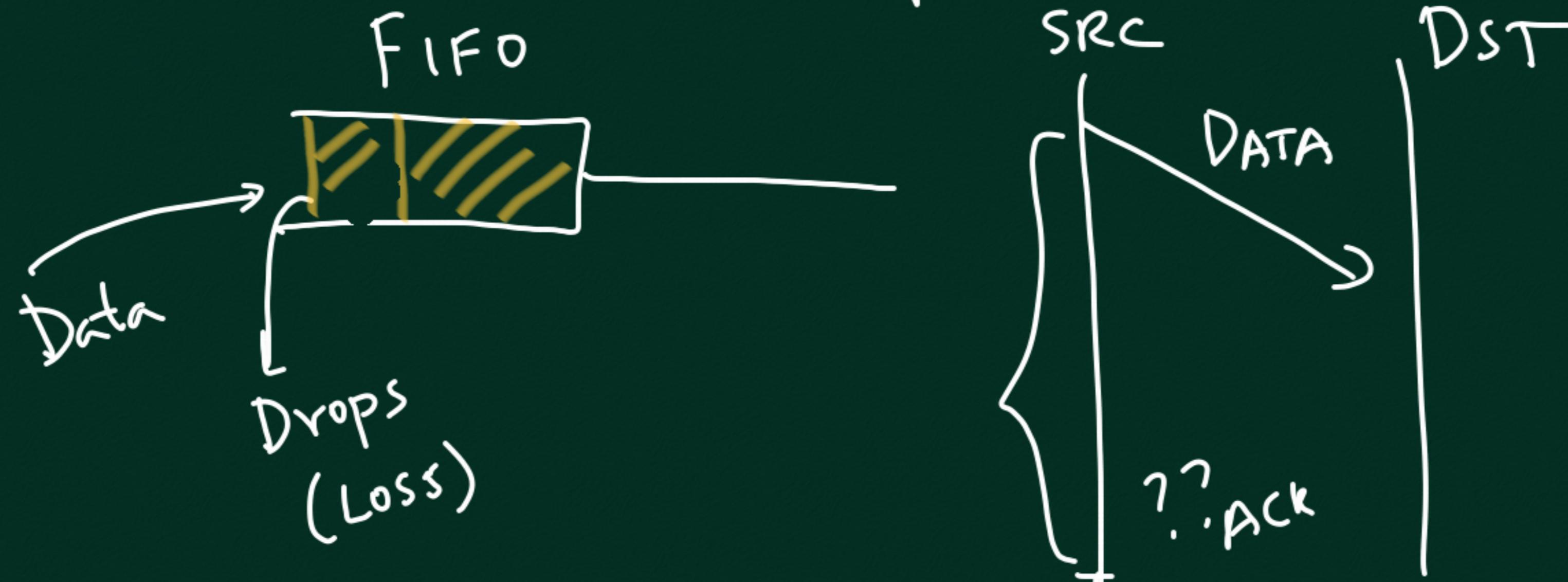


SIGNALS OF CONGESTION?

① RTT



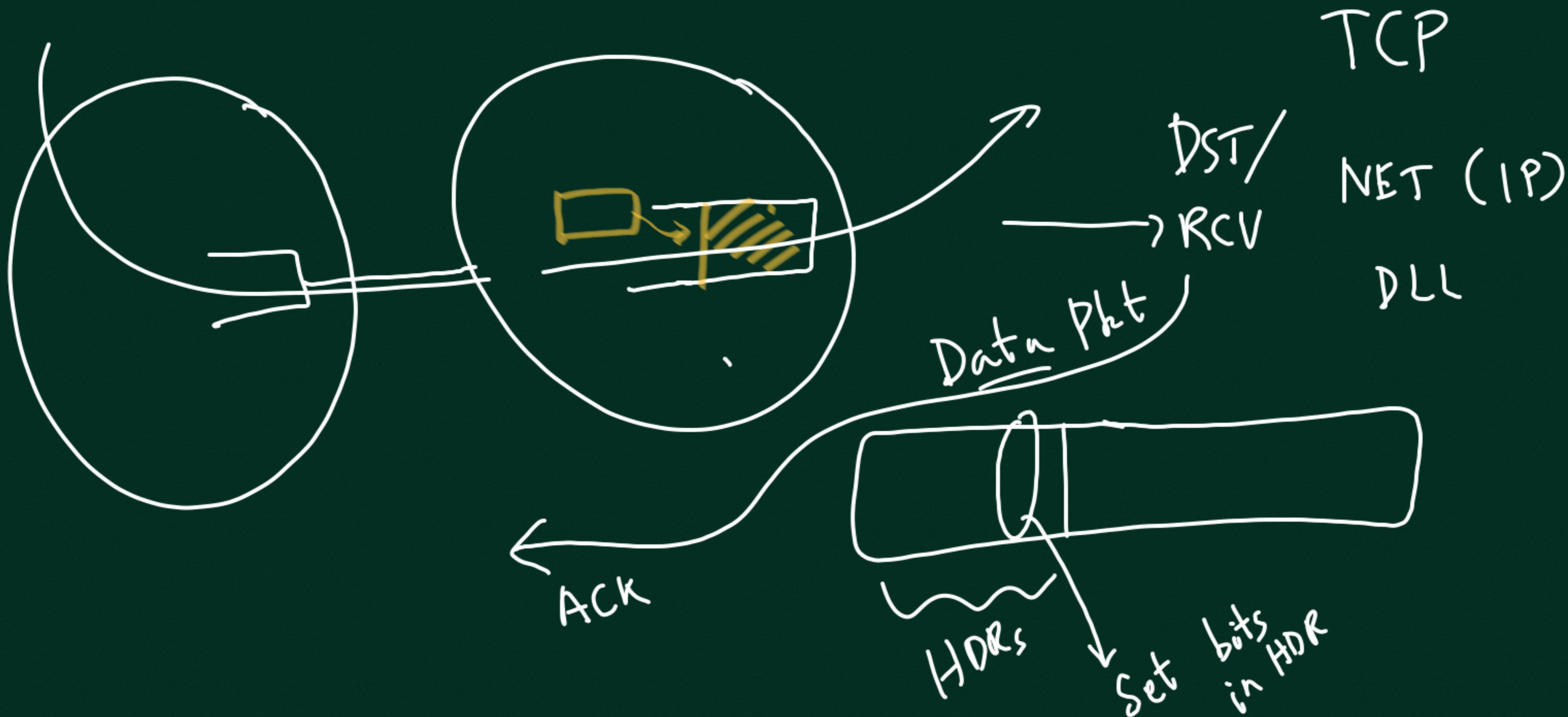
② PACKET LOSS



Q. How do we know
loss has occurred?

Q. Early detection of
congestion?

③ ECN : Explicit Congestion Notification



ISSUE: RANGE OF AVAILABLE B/W VERY HIGH

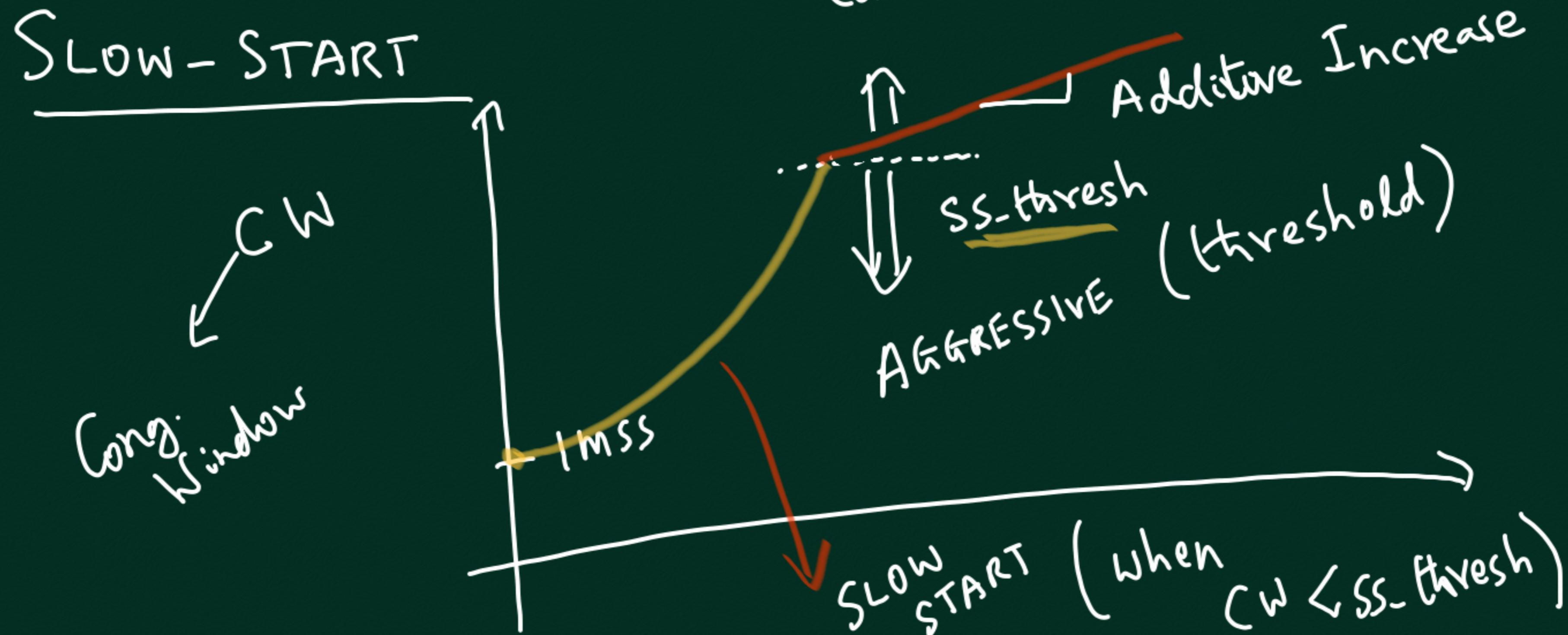
10 kbps — 10 Gbps

CONSERVATIVE

(CONGESTION

AVOIDANCE

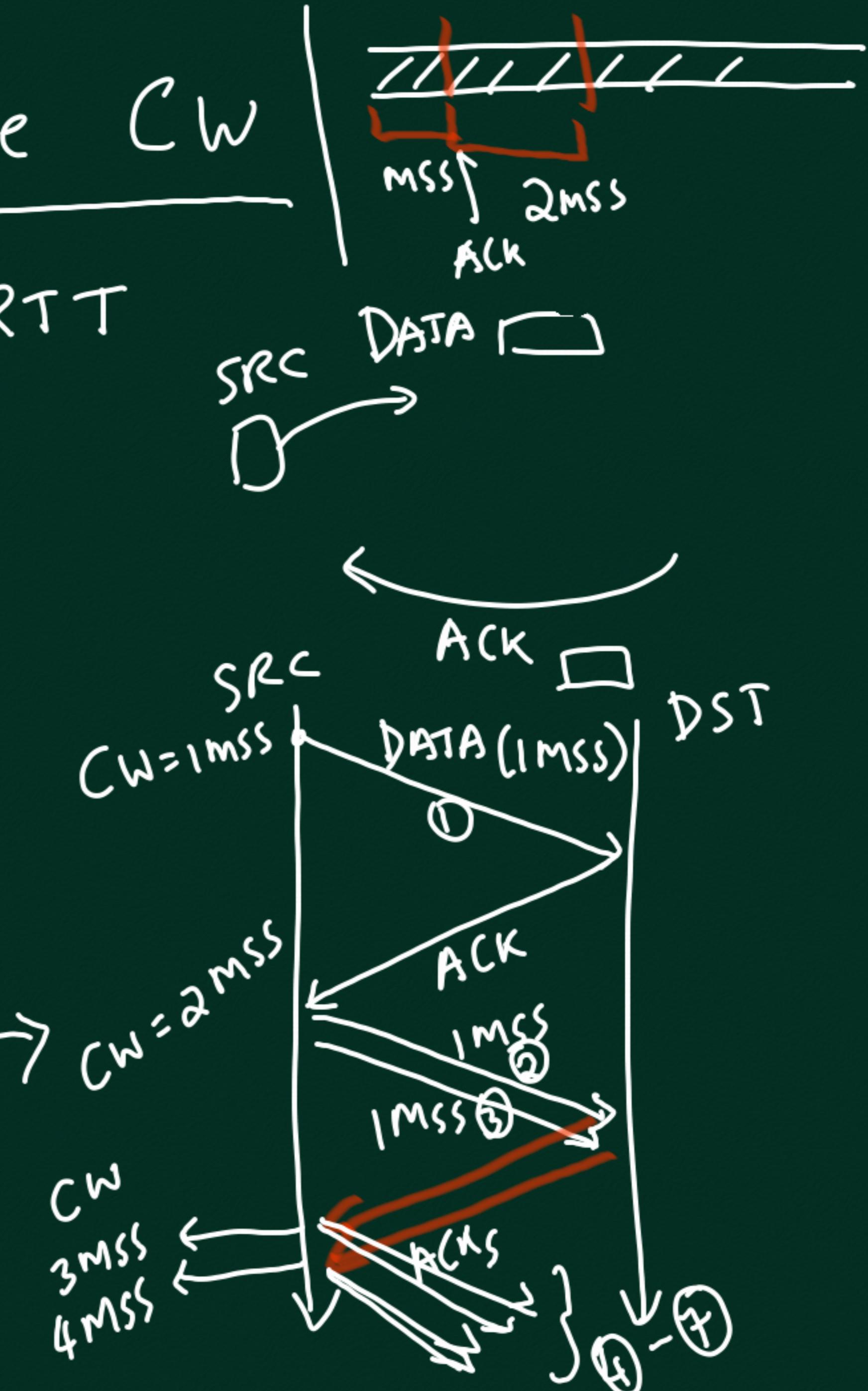
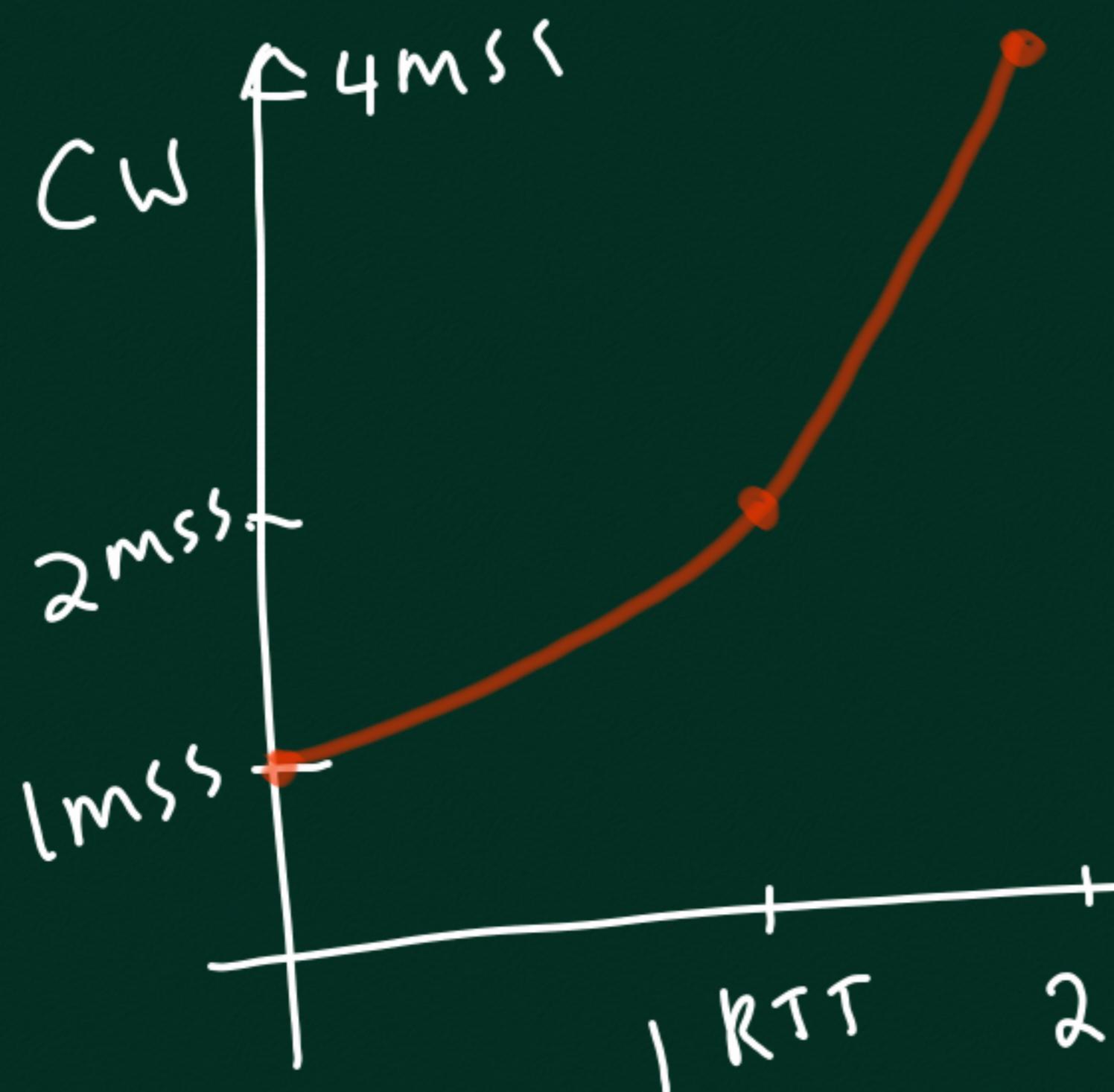
$CW \geq ss\text{-thresh}$

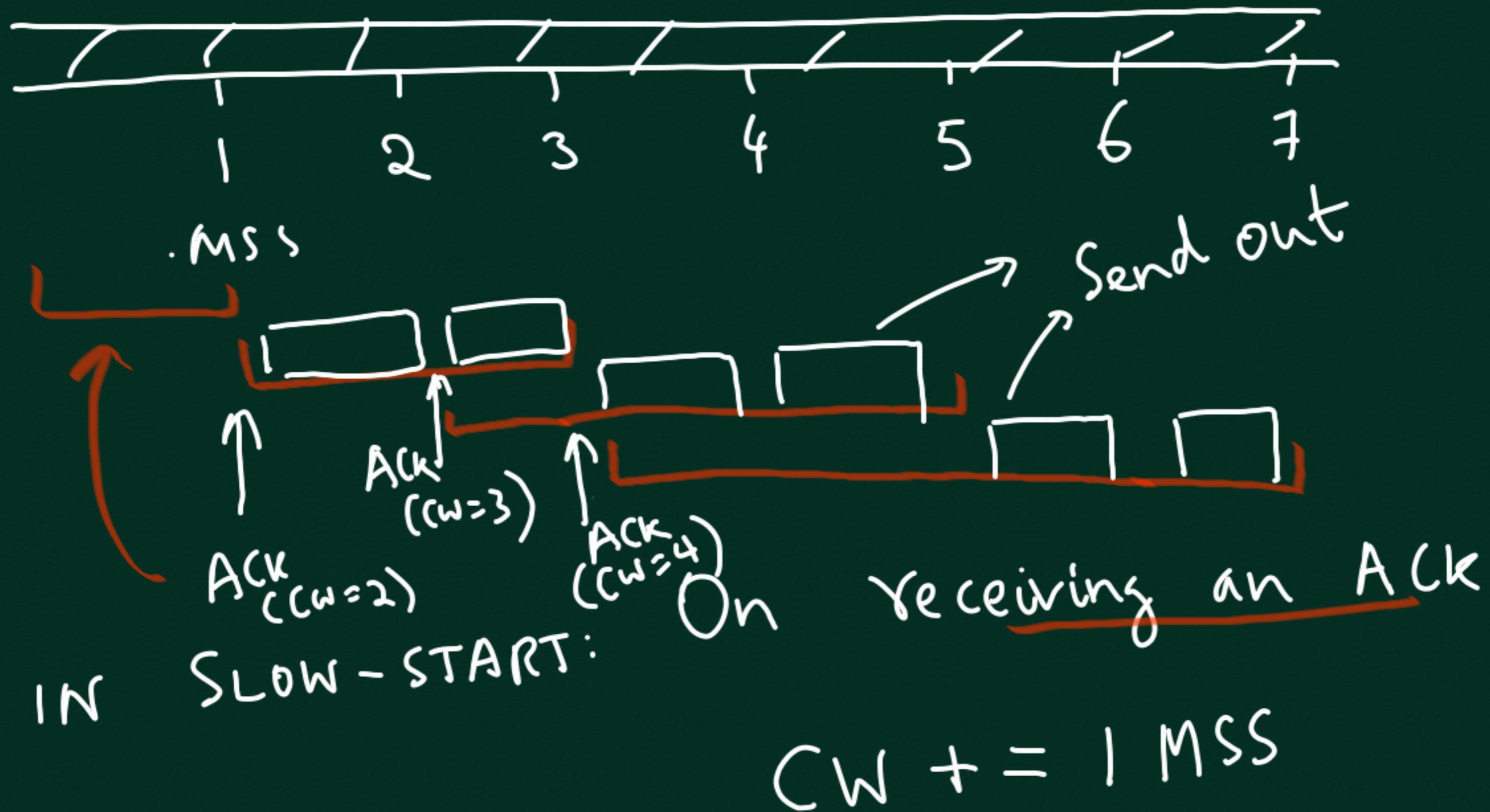


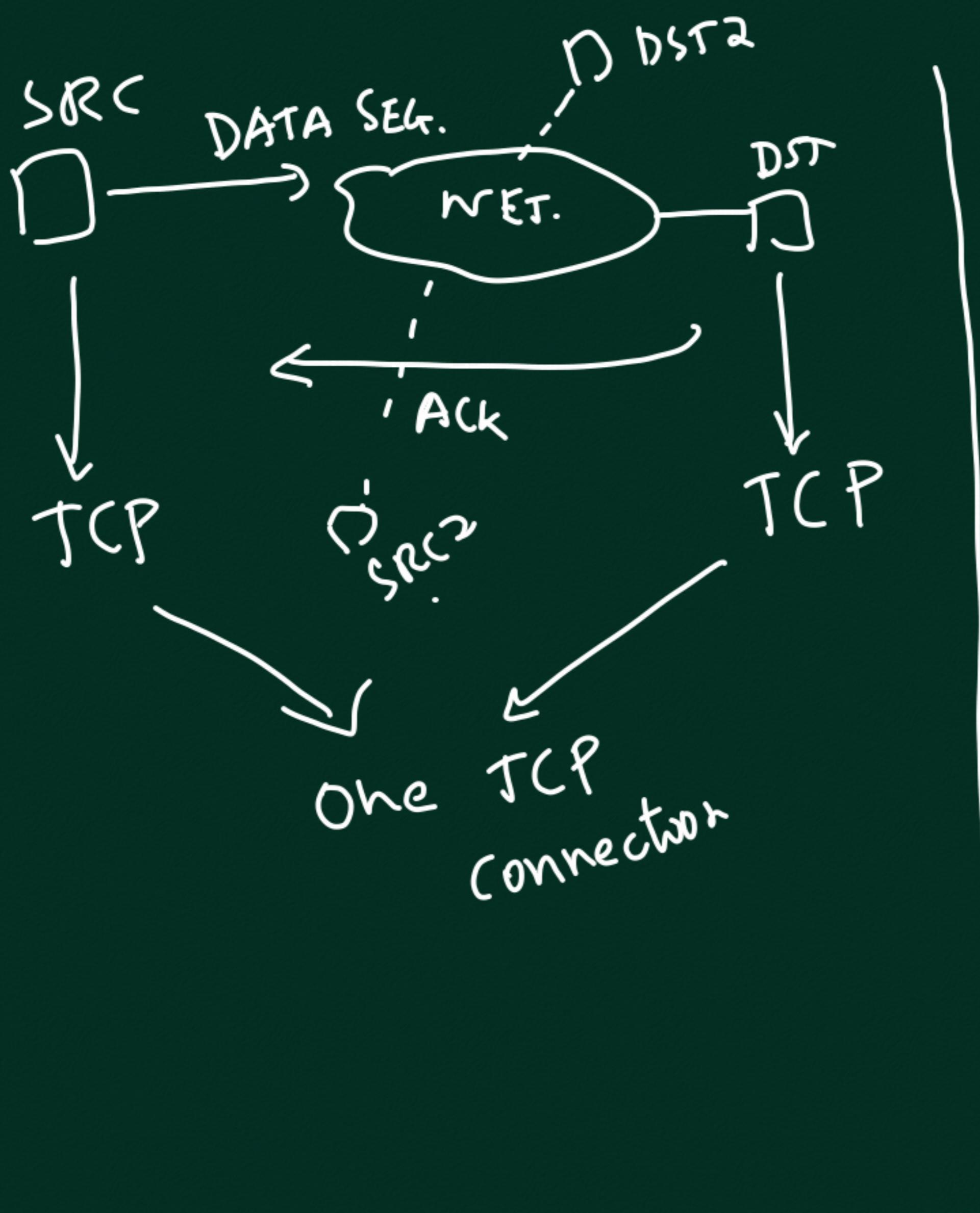
How To Practically Increase CW

SLOW START

DOUBLE CW every RTT





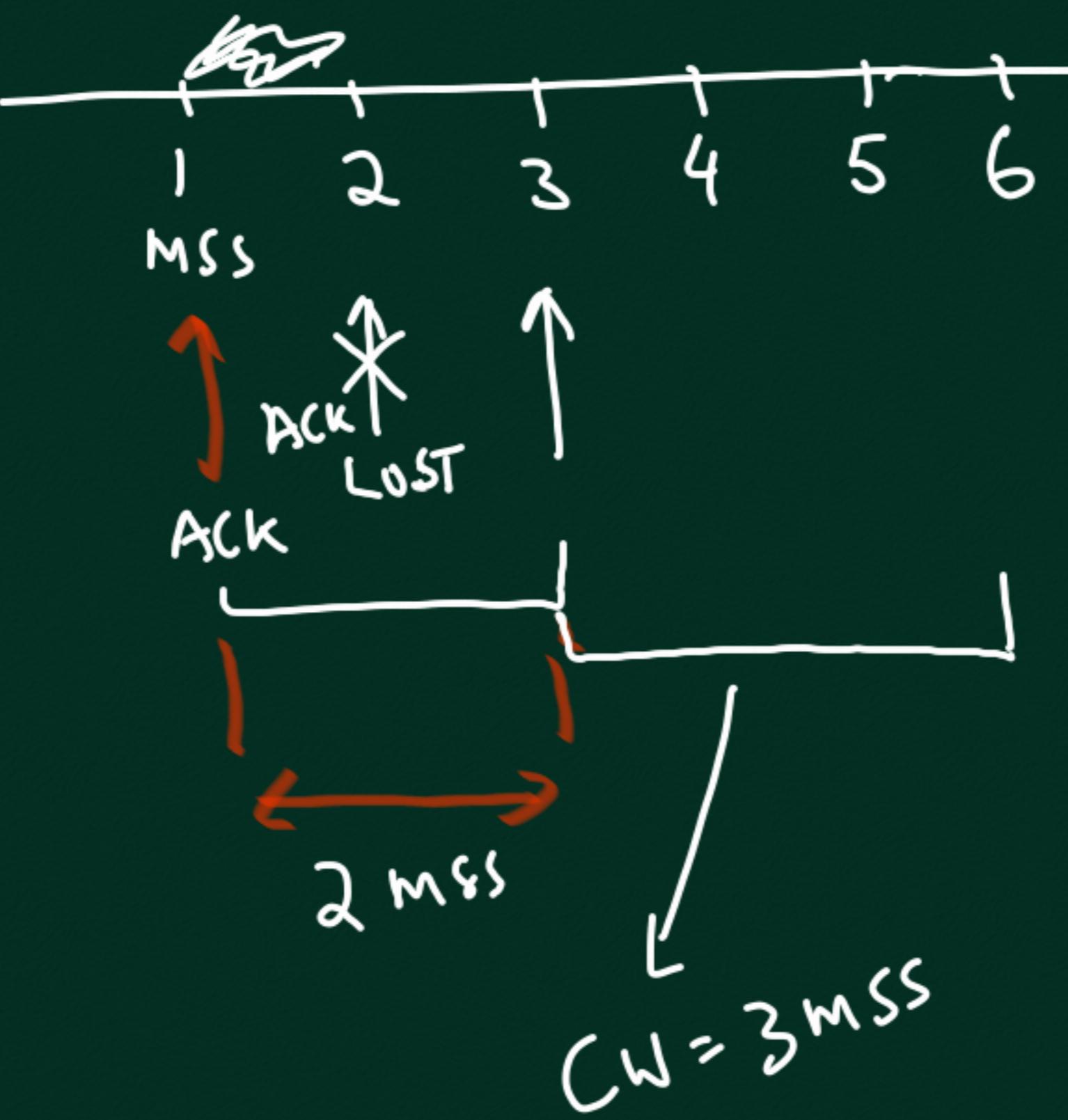
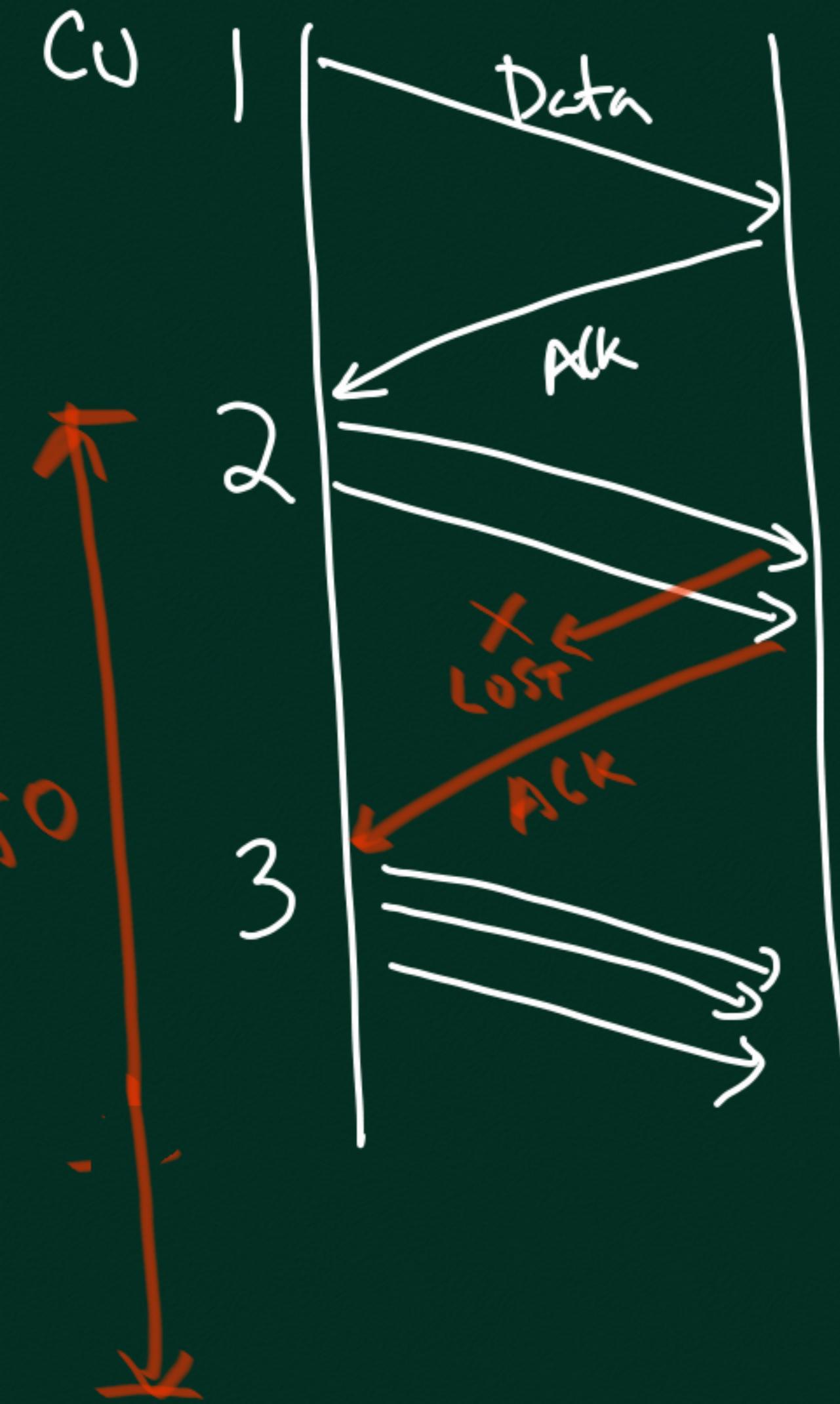


RFC 5681

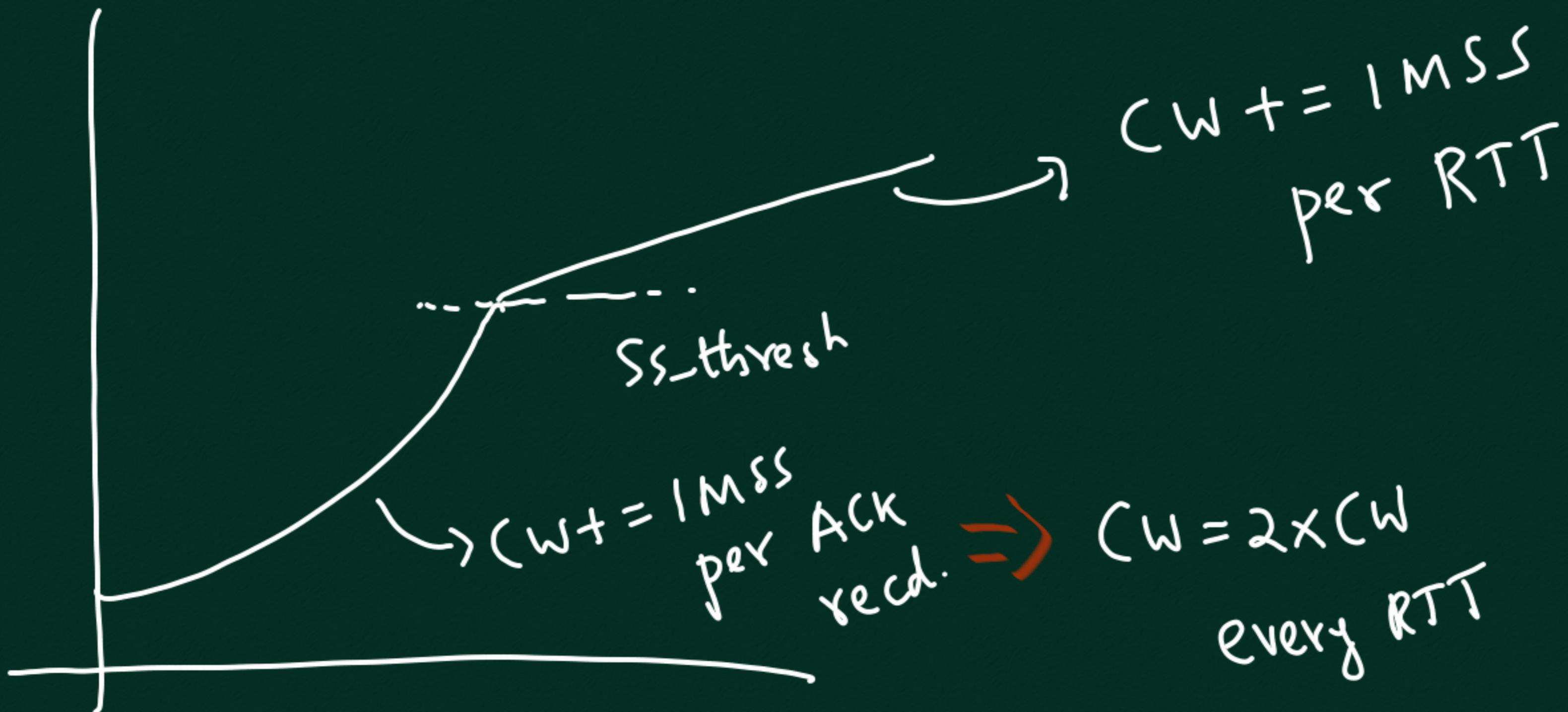
In SLOW START
(i.e. $CW < SS\text{-thresh}$)

then if an ACK
acknowledges 'N' bytes
then new bytes

$$CW += \min(N, MSS)$$



How To Do ADDITIVE INCREASE?



$CW + = x$ per ACK \longrightarrow $CW + = 1 \text{ MSS}$ per RTT

$$CW \xrightarrow{?} \begin{array}{l} \cdot \# \text{ segments per} \\ (n) \qquad \qquad \qquad \text{RTT?} \\ \frac{CW}{MSS} \end{array}$$

Want

$$n x = 1 \text{ MSS}$$

$$x = \frac{MSS}{n} = \frac{MSS}{\frac{CW}{MSS}} = \frac{(MSS)^2}{CW}$$

CONGESTION AVOIDANCE (ADD. INC.)

→ If $CW \geq ss_thresh$

then on receiving an ACK

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



may have repeated ACK

RFC 5681 : If $CW \geq ss_thresh$

on getting ACK for new data (non-zero number
of new bytes ACKed)

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

In
C.A.
phase

