CMSC417 Spring 2016 Lecture #13 3/23/2016

Agenda

⇒ project 3 assigned, due 4/6 @ 11:59pm

⇒ review sliding window

⇒ reciever-based flow control

- □ when to ack
- □ how to ack

⇒ how many seq #s do you need?

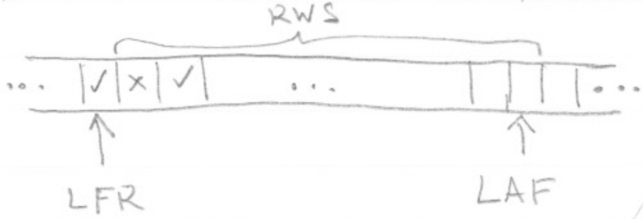
⇒ TCP

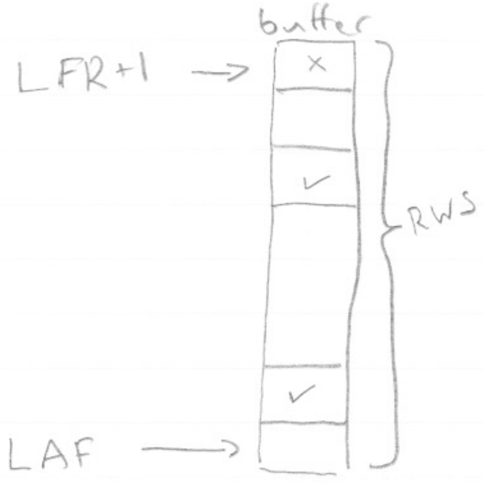
CMSC417 Spring 2016 Lecture #13 3/23/2016

Sliding Window Receiver

⇒ Keeps 3 variables
- ⇒ RWS = receiver window size
- ⇒ LAF = last acceptable frame
- ⇒ LFR = last frame recieved

⇒ invariant $LAF - LFR \leq RWS$





SWS ~= buffer size
even if frames arrive out-of-order,
I have this many slots to store frames
and still deliver them to the application
in order

on recving frame w/seq # s

```
if (s ≤ LFR)
    discard (may ack)   // we already got it
else if (LFR < s ≤ LAF)
    accept
    must ack
else
    discard        // no space
```

CMSC417 Spring2016 Lecture #13 3/23/2016

What to ack?

⇒ the frame you just received?

⇒ all recvd frames?

⇒ the last frame you've recvd everthing up to?

⇒ the "holes" you have? (nack == negative ack)

This is called a cummulative ack

⇒ what TCP does

⇒ in acks, set seq# to LFR

⇒ locally keep LAF = LFR + RWS

Example

LFR = 5 RWS = 4 ⇒ LAF = 9

we get 7, 8 → buffer
ack 5

we get 6 → relase 6, 7, 8 to app
ack 8

LFR = 8 RWS = 4 ⇒ LAF = 12

⇒ Do you need to tell the sender the RWS?
could it help?

⇒ How big should RWS be? How big does it need to be?

□ RWS = 1 is called go-back-N

□ why is it called that? when is it efficient?

CMSC417 Spring 2016 Lecture #13 3/23/2016

Fimite seq #s

How many seq #s do we need?

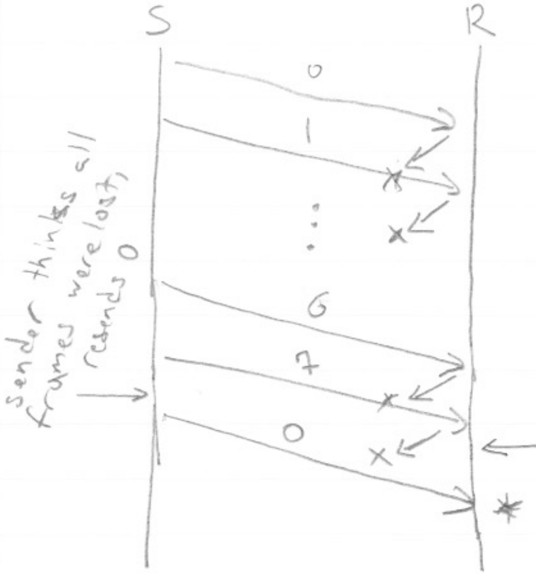
clearly $|\text{seq \#s}| \geq SWS$

and

$|\text{seq \#s}| \geq RWS$

assume SWS = RWS = 7

seq #s in 0..7, so 8 total



receiver is now expecting 0-6

* oops!

receiver thinks it's the new 0, but it's actually the old 0

⇒ sender will only send frames from LAR+1 to LAR+SWS

⇒ receiver is expecting frames from LFR+1 to LFR+RWS

⇒ how far apart can these two windows get?

- sender sends everything
- receiver gets everything, but all acks lost

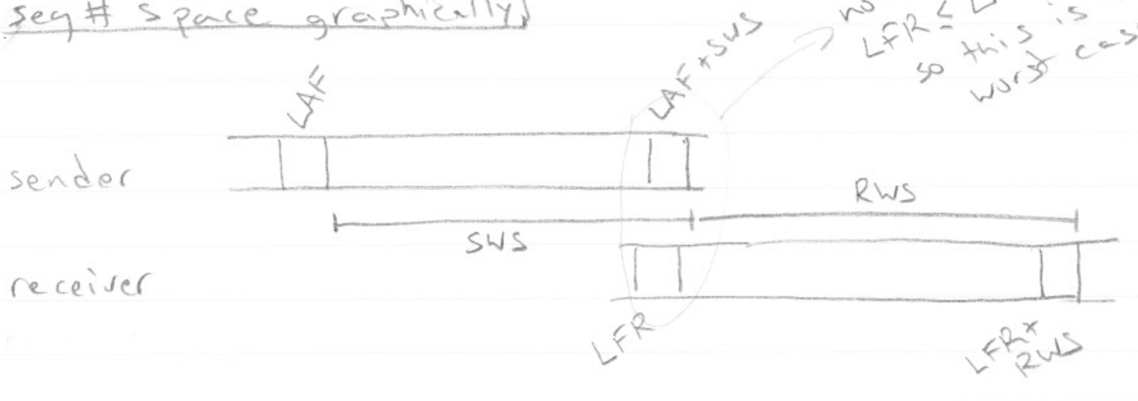
⇒ LFR = LAR + SWS

⇒ receiver expecting through LFR+RWS = LAR+SWS+RWS

$|\text{seq \#s}| \geq SWS + RWS$

CMSC417 Spring 2016 Lecture #13 3/23/2016

seq # space graphically|



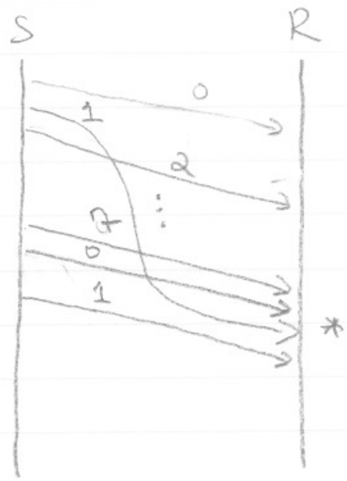
note that LFR ≤ LAF + SWS, so this is the worst case

don't care about frames befor LAF b/c sender won't send them
don't care about frames after LFR + RWS b/c receiver will ignore them

thus we need SWS + RWS unique sequence #s to be safe

if SWS ≠ RWS, then $2\,SWS \leq |seq\#s|$
$SWS \leq |seq\#s| / 2$
in the book → $SWS < (|seq\#s| + 1) / 2$

out of order frames|



SWS = RWS = 4
seq #s = 0..7

* oops, receiver takes delayed 1 as the real one

when is out-of-order safe?