CPSC 317 COMPUTER NETWORKING

2023W2: Transport – Day 5 – Selective Repeat

READING

- Reading: 3.4.4

LEARNING GOALS (FROM LAST CLASS)

Sliding Window Protocols

- Given a range of sequence numbers determine if a set of sender and receiver window sizes is legal

LEARNING GOALS

Selective-Repeat

- Trace the execution of Selective-Repeat (SR)
- Analyze SR under segment loss
- Trace the execution of SR when the range of sequence numbers is restricted

SEQUENCE NUMBER RANGE

- The range of possible sequence numbers is limited by n, the number of bits used to represent them
  - Example: 3 bits gets numbers 0-7, 8 bits gets numbers 0-255
  - Sequence number arithmetic is modulo 2^n (e.g., with n = 3 bits, the range is 0-7, so after 7 comes 0)
- What is the maximum sender window size for the range 0-255?
  - Maybe easier to compute: what about range 0-3?
  - Can the receiver distinguish a new 0 from a resent old 0?

SEQUENCE NUMBER RANGE

- Assume that segments can't be re-ordered in the network
- Rule: sender's window size + receiver's window size <= sequence number range
- For a range with n numbers (0 to $n-1$):
  - Go-Back-N:
    - receiver's window size is 1
    - sender's maximum window size is $n-1$
- Why?

WHAT IF SWS + RWS == N? (SCENARIO 1)

N == 4, SWS == 3, RWS == 1

- Sender sends 0, 1, 2
- What is the sender window? [0, 1, 2]

- Receiver receives 0, 1, 2 sends ACKs for all of them
- What is the receiver window? [3]

- All the ACKS are received
- What is the sender window? [3, 0, 1]
- The sender sends 3, 4, 5 which have seq no. 3, 0, 1

- What does the receiver do?

WHAT IF SWS + RWS == N? (SCENARIO 2)

N == 4, SWS == 3, RWS == 1

- Sender sends 0, 1, 2
- What is the sender window? [0, 1, 2]

- Receiver receives 0, 1, 2 sends ACKs for all of them
- What is the receiver window? [3]

- All the ACKS are lost
- What is the sender window? [0,1, 2]
- The sender times out and resends 0, 1, 2

- What does the receiver do?

WHAT IF SWS + RWS > N? (SCENARIO 1)

N == 4, SWS == 4, RWS == 1

- Sender sends 0, 1, 2, 3
- What is the sender window? [0, 1, 2, 3]

- Receiver receives 0, 1, 2, 3 sends ACKs for all of them
- What is the receiver window? [0]

- All the ACKS are received
- What is the sender window? [0, 1, 2, 3]
- The sender sends 4, 5, 6, 7 which have seq no. 0, 1, 2, 3

- What does the receiver do?

WHAT IF SWS + RWS > N? (SCENARIO 2)

N == 4, SWS == 4, RWS == 1

- Sender sends 0, 1, 2, 3
- What is the sender window? [0, 1, 2, 3]
- All the ACKS are lost
- What is the sender window? [0, 1, 2, 3]
- The sender times out and resends 0, 1, 2, 3

- Receiver receives 0, 1, 2, 3 sends ACKs for all of them
- What is the receiver window? [0]
- What does the receiver do?

GBN SUMMARY

- Pros

- Cons

SELECTIVE-REPEAT STRATEGY

Receiver:

- Each segment is ack'ed individually
- Out of order segments are stored for later: ***receiver's window***

Sender:

- Can have a specific number of outstanding (unacknowledged) segments in memory: ***sender's window***
- Each segment has its own timer
- Each segment is individually resent if timeout is reached
- ACKs received in order move the sender's window

SELECTIVE-REPEAT DEMO

https://computerscience.unicam.it/marcantoni/reti/applet/SelectiveRepeatProtocol/selRepProt.html

SEQUENCE NUMBERS FOR SR

- Assume that segments can't be re-ordered in the network
- Rule: sender's window size + receiver's window size <= sequence number range
- For a range with n numbers (0 to $n-1$):
  - Selective-Repeat:
    - any values for window sizes that add up to n is fine
    - for same size on both sides, use $\lfloor {}^{n}/_{2} \rfloor$
- Why?

CLICKER QUESTION

A sender is sending a lot of data to a receiver, and occasionally an ACK from the receiver is lost. Which strategy will suffer the LEAST from this lost ACK?

A. Go-Back-N

B. Selective-Repeat

C. They will suffer the same

CLICKER QUESTION

A sender is sending a lot of data to a receiver, and occasionally a data segment from the sender is lost. Which strategy will suffer the LEAST from this lost data segment?

A. Go-Back-N
B. Selective-Repeat
C. They will suffer the same

SEQUENCE NUMBER RANGE

- What if segments can be re-ordered in the network?

WINDOW SIZES

- What is the impact of larger sender window size?
- What is the impact of larger receiver window size?

IN-CLASS ACTIVITY

- ICA45
- Selective Repeat