HW2: UDP Reliable File Transfer

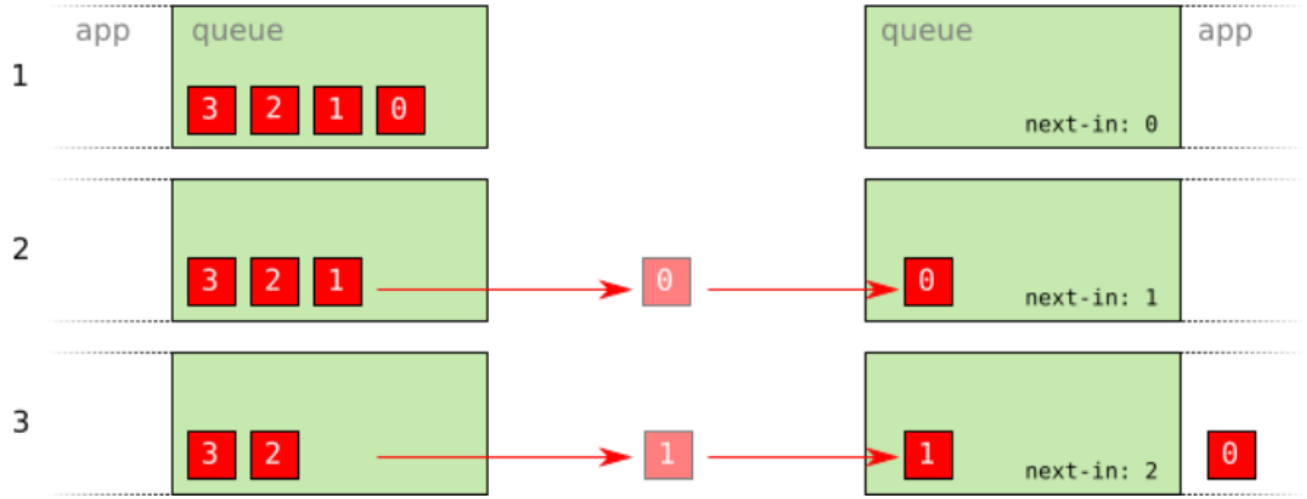
11/25

Reliable File Transfer

- You need to use UDP to transfer a file from a sender to a receiver.
- Since the packet may be lost on the network, sender and receiver should use the timeout method to detect the event and deal with it.
- You need to implement the reliable file transfer with 3 different timeout methods.

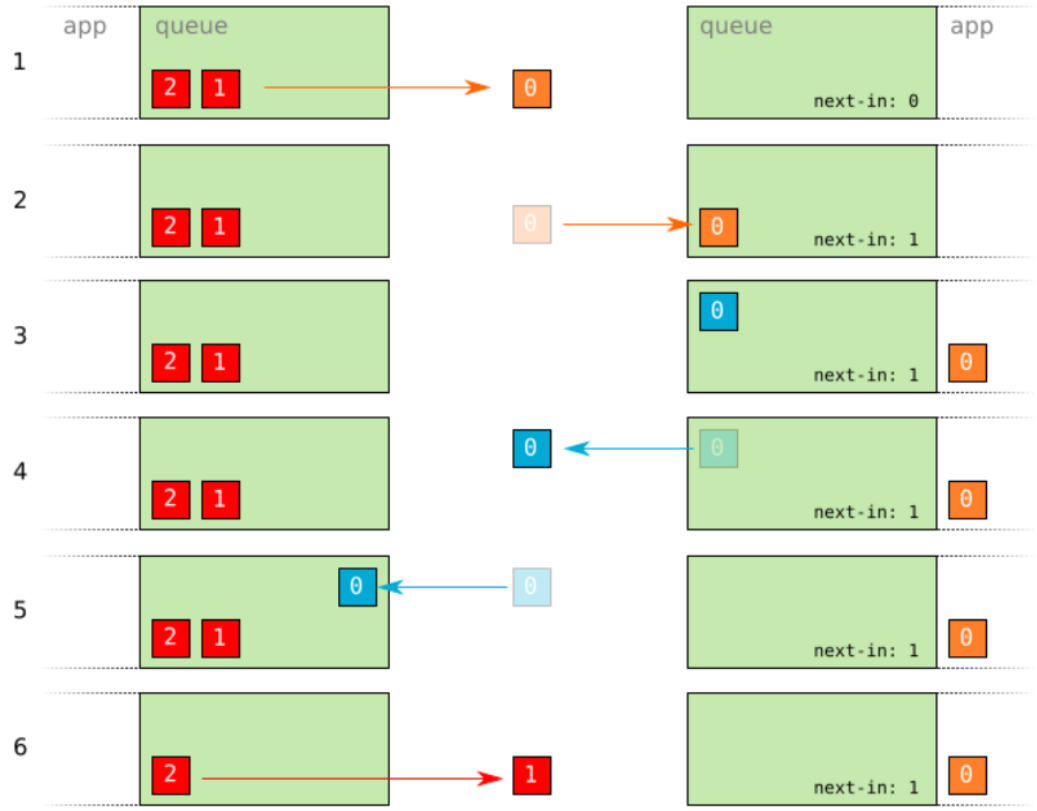
Sequence Number

- Consider problems of packet loss



ACK

- Sender has to resend packets if it doesn't receive ACK.



3 Different Timeout Methods

- Timeout using SIGALRM
- Timeout using select
- Timeout using setsockopt

SIGALRM

- For some linux distribution, you may need to use siginterrupt to allow SIGALRM signal to interrupt syscalls when using SIGALRM timeout method.

```
signal(SIGALRM, sig_alarm);
siginterrupt(SIGALRM, 1);
```

- Use *ualarm()* to schedule signal after given number of microseconds.

Makefile

- From this homework, you must use Makefile to compile your codes. And you need to upload your Makefile with your codes. If you don't use Makefile, we will not let you demo your homework.
- You need to learn how to use Makefile by yourself.

Makefile

- Reference
  - https://www.youtube.com/watch?v=aw9wHbFTnAQ
  - http://maxubuntu.blogspot.tw/2010/02/makefile.html

Requirement

- The usage of the executable files should be like below.
  - ./sender_sigalrm [send filename] [target address] [connect port]
  - ./receiver_sigalrm [save filename] [bind port]
- After finishing the transmission, both sender and receiver should terminate automatically.
- Makefile should have "make" function to compile all files and "make clean" function to remove all compiled files.

Network Environment

- To test your programs, you need to simulate packet loss events by using tool ‘tc’ (traffic control).

Network Environment

- You can use the following command to set the packet loss rate and packet delay.
- sudo tc qdisc add dev <Device> root netem loss <Packet Loss Rate> delay <Delay Time> <Variation> distribution normal
- For example, the command below set the packet loss rate to 5%, delay time to 7ms~13ms on device lo.

```
wanda@wanda-lab215:~$ sudo tc qdisc add dev lo root netem loss 5% delay 10ms 3ms
distribution normal
wanda@wanda-lab215:~$ sudo tc qdisc ls dev lo
qdisc netem 8003: root refcnt 2 limit 1000 delay 10.0ms  3.0ms loss 5%
```

Network Environment

- To delete the network setting, you should use the following command.
- sudo tc qdisc del dev <Device> root
- For example, you can use the command below to delete the rule.

```
wanda@wanda-lab215:~$ sudo tc qdisc del dev lo root
wanda@wanda-lab215:~$ sudo tc qdisc ls dev lo
qdisc noqueue 0: root refcnt 2
```

Network Environment

- If the following error occurs when adding a rule, try to delete rules first.

```
wanda@wanda-lab215:~$ sudo tc qdisc add dev lo root netem loss 5% delay 10ms 3ms
distribution normal
wanda@wanda-lab215:~$ sudo tc qdisc add dev lo root netem loss 5% delay 10ms 3ms
distribution normal
Error: Exclusivity flag on, cannot modify.
wanda@wanda-lab215:~$ sudo tc qdisc del dev lo root
wanda@wanda-lab215:~$ sudo tc qdisc add dev lo root netem loss 5% delay 10ms 3ms
distribution normal
```

Network Environment

- You should not run your programs on the workstation (i.e. npbsd, nplinux, bsd, and linux). Instead, you do that on your own PC.

Check Correctness

- Use tool ‘diff’ to check if the file transfer is correct.
- Usage: diff <File 1> <File 2>
- If two files are the same, it shows nothing, or it shows the difference.

Grading Policy

- Timeout using SIGALRM (30%)
- Timeout using select (30%)
- Timeout using setsockopt (30%)
- Makefile (10%)
- Performance (+20%)

Grading Policy

- We will test your programs with packet loss rate less than 10% and th e transferred file size will be less than 1MB.
- Your programs should finish file transferring in 1 minute.

Performance (BONUS +20)

- (Optional)
- For the performance test, we will test your program with different packet loss, limited link bandwidth, non-zero RTT, and variable queuing delay.
- You can only choose **one retransmission mechanism that you implement (SIGALRM, select, or setsockopt)** to participate in the competition.
- Please upload the bonus to assignment *homework2_bonus*.
- Check the grading policy for this bonus in the spec.

Due Date

- 2021/12/13 23:55
- Submit your code to e3 and put all code under same folder named **<Student ID>** (DO NOT ZIP FILES).
- Example hand-in format:

```
301234567
├── Makefile
├── sender_sigalrm.c/cpp
├── receiver_sigalrm.c/cpp
└── ……
```

- If you have any questions, please contact TAs.