

COMS 4119 Computer Networks (Spring 2021)

Problem Set #4

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2. Programming:

The code is submitted on Canvas.

I test the codes together with NEWUDPL. I read a text file with a lengthy story, and break them into segments in sender.py and send to receiver.py to recover to see if I can still get the same story in the receiver side.

Case 1: Reordering

First, I test the reordering packet issue in the sender side:

```
connect to outbound of receiver
'''shell script
./newudpl -vv -p 5001 -i "localhost/*" -o localhost:5003
'''

connect to outbound of sender
'''shell script
./newudpl -vv -p 5002 -i "localhost/*" -o localhost:5000 -O 80
'''

Now the sender argument is
'''shell script
python3 sender.py --host localhost --port 5003 --dest_host localhost --
                                dest_port 5002 --timeout 2 < sample.
                                txt
'''

Now the receiver argument is
'''shell script
python3 receiver.py --host localhost --port 5000 --dest_host localhost --
                                dest_port 5001
'''
```

and the server and receiver gives the following output

As is shown by Figure 1, all the packets arrive in order at receiver side in order with index debug info.

```

Run: receiver sender
[INFO]: Transmitting No.26 packet...
sender received ACK!
[INFO]: Transmitting No.27 packet...
sender received ACK!
[INFO]: Transmitting No.28 packet...
sender received ACK!
[INFO]: Transmitting No.29 packet...
sender received ACK!
[INFO]: Transmitting No.30 packet...
sender received ACK!
[INFO]: Transmitting No.31 packet...
sender received ACK!
[INFO]: Transmitting No.32 packet...
sender received ACK!
[INFO]: Transmitting No.33 packet...
sender received ACK!
[INFO]: Transmitting No.34 packet...
sender received ACK!
[INFO]: Transmitting No.35 packet...
sender received ACK!
[INFO]: Transmitting No.36 packet...
sender received ACK!
[INFO]: Transmitting No.37 packet...
sender received ACK!
Process finished with exit code 0

[INFO]: Packet index at 35
will be with Shere Khan's hide on my head. For the rest, Akela goes free to live as he pleases. Ye will not kill him, because that is not my will. Nor do I think that ye will si
here any longer, lolling out your tongues as though ye were somebodies, instead of dogs whom I drive out-thus! Go!" The fire was burning furiously at the end of the branch,
and Mowgli struck right and left round the circle, and the wolves ran howling with the sparks burning their fur. At last there were only Akela, Bagheera, and perhaps ten
wolves that had taken Mowgli's part. Then something began to hurt Mowgli inside him, as he had never been hurt in his life before, and he caught his breath and sobbed, and
the tears ran down his face.
"Wha is it? What is it?" he said. "I do not wish to leave the jungle, and I do not know what this is. Am I dying, Bagheera?"
"No, Little Brother. That is only tears such as men use," said Bagheera. "Now I know thou art a man, and a man's cub no longer. The jungle is shut indeed to thee henceforward
-----Received packets from sender-----
[INFO]: Packet index at 36
. Let then fall, Mowgli. They are only tears." So Mowgli sat and cried as though his heart would break; and he had never cried in all his life before.
"Now," he said, "I will go to men. But first I must say farewell to my mother." And he went to the cave where she lived with Father Wolf, and he cried on her coat, while the four
cubs howled miserably.
"Ye will not forget me?" said Mowgli.
"Never while we can follow a trail," said the cubs. "Come to the foot of the hill when thou art a man, and we will talk to thee; and we will come into the croplands to play with
thee by night."
"Come soon!" said Father Wolf. "Oh, wise little frog, come again soon; for we be old, thy mother and I."
"Come soon," said Mother Wolf, "little naked son of mine. For, listen, child of man, I loved thee more than ever I loved my cubs."
"I will surely come," said Mowgli. "And when I come it will be to lay out Shere Khan's hide upon the Council Rock. Do not forget me! Tell them in the jungle never to forget me!"
The dawn was beginning to
-----Received packets from sender-----
[INFO]: Packet index at 37
break when Mowgli went down the hillside alone, to meet those mysterious things that are called men.
*** FIN received, closing the server.....
Process finished with exit code 0

```

Figure 1: Case 1: reordering packet

Case 2: Bit Error

In this case, I assume that both sender and receiver may have 40% of bit error and see what happens

```

connect to outbound of receiver
'''shell script
./newudpl -vv -p 5001 -i "localhost/*" -o localhost:5003 -B 40
'''

connect to outbound of sender
'''shell script
./newudpl -vv -p 5002 -i "localhost/*" -o localhost:5000 -B 40
'''

```

```

Now the sender argument is
'''shell script
python3 sender.py --host localhost --port 5003 --dest_host localhost --
                                dest_port 5002 --timeout 2 < sample.
                                txt
'''

Now the receiver argument is
'''shell script
python3 receiver.py --host localhost --port 5000 --dest_host localhost --
                                dest_port 5001
'''

```

As we can see in Figure 2: due to bit errors, some packets will be retransmitted, but finally all the packets will be delivered and a FIN message will be sent.

Case 3: Packet Loss

In this case, I assume that both sender and receiver may have 40% of packet loss and see what happens

```

connect to outbound of receiver
'''shell script
./newudpl -vv -p 5001 -i "localhost/*" -o localhost:5003 -L 40
'''

connect to outbound of sender
'''shell script
./newudpl -vv -p 5002 -i "localhost/*" -o localhost:5000 -L 40
'''

Now the sender argument is
'''shell script
python3 sender.py --host localhost --port 5003 --dest_host localhost --
                                dest_port 5002 --timeout 2 < sample.
                                txt
'''

Now the receiver argument is
'''shell script
python3 receiver.py --host localhost --port 5000 --dest_host localhost --
                                dest_port 5001
'''

```

As we can see in Figure 3: due to packet loss, some packets will be dropped and retransmitted, but finally all the packets will be delivered as the delivery proceeds

```

receiver x sender x
sender received ACK!
*** ack not equal to seq! ***
Timeout occurs! retransmit.....
[INFO]: Transmitting No.35 packet...
sender received ACK!
**[WARNING]**: keyError occurs and json is corrupted: 'acknowledgement_number'
*** data corrupted! ***
Timeout occurs! retransmit.....
[INFO]: Transmitting No.35 packet...
sender received ACK!
[INFO]: Transmitting No.36 packet...
sender received ACK!
*** ack not equal to seq! ***
Timeout occurs! retransmit.....
[INFO]: Transmitting No.36 packet...
sender received ACK!
*** ack not equal to seq! ***
Timeout occurs! retransmit.....
[INFO]: Transmitting No.36 packet...
sender received ACK!
*** ack not equal to seq! ***
Timeout occurs! retransmit.....
[INFO]: Transmitting No.36 packet...
sender received ACK!
[INFO]: Transmitting No.37 packet...
sender received ACK!
Process finished with exit code 0

receiver x sender x
*** seq not equal to ack in server! ***
-----Received packets from sender-----
**[WARNING]**: keyError occurs and json is corrupted: 'FIN'
*** data corrupted! ***
-----Received packets from sender-----
**[WARNING]**: keyError occurs and json is corrupted: 'FIN'
*** data corrupted! ***
-----Received packets from sender-----
**[WARNING]**: payload itself is corrupted...
*** data corrupted! ***
-----Received packets from sender-----
[INFO]: Packet index at 36
. Let them fall, Mowgli. They are only tears." So Mowgli sat and cried as though his heart would break; and h
"Now," he said, "I will go to men. But first I must say farewell to my mother." And he went to the cave where
cubs howled miserably.
"Ye will not forget me?" said Mowgli.
"Never while we can follow a trail," said the cubs. "Come to the foot of the hill when thou art a man, and we
thee by night."
"Come soon!" said Father Wolf. "Oh, wise little frog, come again soon; for we be old, thy mother and I."
"Come soon," said Mother Wolf, "little naked son of mine. For, listen, child of man, I loved thee more than e
"I will surely come," said Mowgli. "And when I come it will be to lay out Shere Khan's hide upon the Council
The dawn was beginning to
-----Received packets from sender-----
[INFO]: Packet index at 37
break when Mowgli went down the hillside alone, to meet those mysterious things that are called men.
*** FIN received, closing the server.....
Process finished with exit code 0

```

Figure 2: Case 2: Packet Loss



The figure consists of two terminal screenshots. The top screenshot shows a 'sender' window with a log of packet transmissions. It shows packets 10, 11, 12, and 13 being transmitted, each followed by a timeout and a retransmission, until they are finally acknowledged (ACK). Packet 14 is also shown being transmitted and retransmitted multiple times. The bottom screenshot shows a 'receiver' window with a log of received packets. It shows packets 13 and 14 being received, followed by a message indicating that the sequence number does not match the acknowledgment in the server, suggesting a packet loss or out-of-order delivery.

```

receiver x sender x
[INFO]: Transmitting No.10 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.10 packet...
sender received ACK!
[INFO]: Transmitting No.11 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.11 packet...
sender received ACK!
[INFO]: Transmitting No.12 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.12 packet...
sender received ACK!
[INFO]: Transmitting No.13 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.13 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.13 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.13 packet...
sender received ACK!
[INFO]: Transmitting No.14 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.14 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.14 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.14 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.14 packet...
Timeout occurs! retransmit.....
[INFO]: Transmitting No.14 packet...

receiver x sender x
-----Received packets from sender-----
[INFO]: Packet index at 13
aloo, the sleepy brown bear who teaches the wolf cubs the Law of the Jungle: old Baloo, who can come and go where he
upon his hind quarters and grunted.
"The man's cub-the man's cub?" he said. "I speak for the man's cub. There is no harm in a man's cub. I have no gift
be entered with the others. I myself will teach him."
"We need yet another," said Akela. "Baloo has spoken, and he is our teacher for the young cubs. Who speaks besides B
A black shadow dropped down into the circle. It was Bagheera the Black Panther, inky black all over, but with the pe
watered silk. Everybody knew Bagheera, and nobody cared to cross his path; for he was as cunning as Tabaqui, as
elephant. But he had a voice as soft as wild honey dripping from a tree, and a skin softer than down.
"O A
-----Received packets from sender-----
[INFO]: Packet index at 13
*** seq not equal to ack in server! ***
-----Received packets from sender-----
[INFO]: Packet index at 13
*** seq not equal to ack in server! ***
-----Received packets from sender-----
[INFO]: Packet index at 14
kela, and ye the Free People," he purred, "I have no right in your assembly, but the Law of the Jungle says that if
new cub, the life of that cub may be bought at a price. And the Law does not say who may or may not pay that pri
"Good! Good!" said the young wolves, who are always hungry. "Listen to Bagheera. The cub can be bought for a price.
"Knowing that I have no right to speak here, I ask your leave."
"Speak then," cried twenty voices.
"To kill a naked cub is shame. Besides, he may make better sport for you when he is grown. Baloo has spoken in his t
newly killed, not half a mile from here, if ye will accept the man's cub according to the Law. Is it difficult?"
There was a clamor of scores of voices, saying: "What matter? He will die in the winter rains. He will scorch in the
Pack. Where is th
-----Received packets from sender-----

```

Figure 3: Case 3: Packet Loss