Computer Networks Lab Report – Assignment 3

TITLE

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Class – BCSE 3rd year

Group – A3

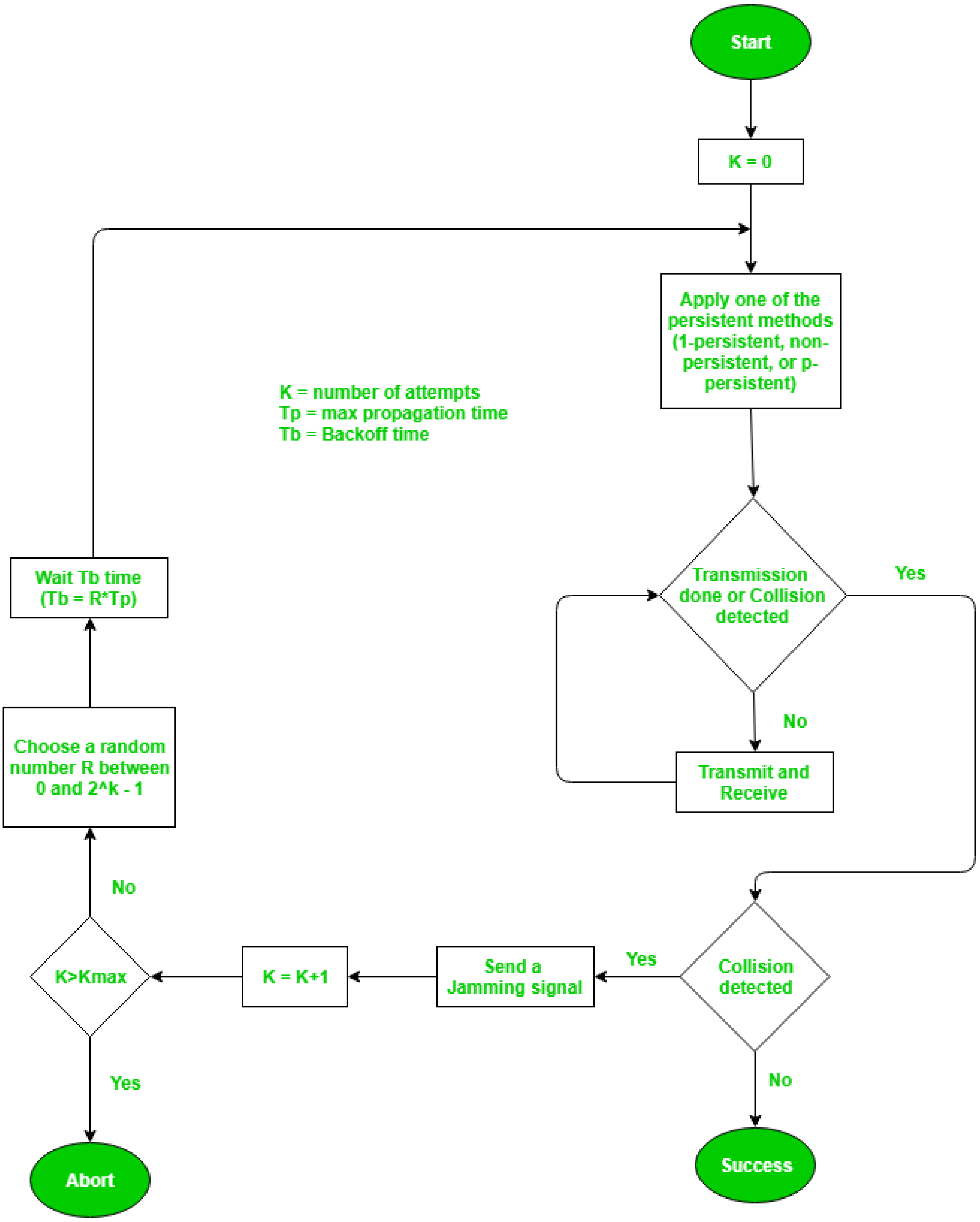
Assignment Number – 3

Problem Statement – Implement p-persistent CSMA and CSMA/CD.

In this assignment, you have to implement p-persistent CSMA with exponential backoff and additive backoff. Measure the performance parameters like throughput (i.e., average amount of data bits successfully transmitted per unit time) and forwarding delay (i.e., average end-to--end delay, including the queuing delay and the transmission delay) experienced by the CSMA frames (IEEE 802.3). Plot the comparison graphs for throughput and forwarding delay by varying p. State your observations on the impact of different data rates for exponential/additive backoff along with p-persistent CSMA.

Evaluation date – 18/03/2019
Submission date – 25/03/2019

DESIGN


Start
K = 0
Apply one of the persistent methods (1-persistent, non-persistent, or p-persistent)
K = number of attempts
Tp = max propagation time
Tb = Backoff time
Transmission done or Collision detected
Yes
No
Transmit and Receive
Wait Tb time (Tb = R*Tp)
Choose a random number R between 0 and 2^k - 1
No
K>Kmax
K = K+1
Send a Jamming signal
Yes
Collision detected
No
Yes
Abort
Success

I have implemented the error detection module in three program files.

- **sender.py** (Sender program)
- **receiver.py** (Receiver program)
- **channel.py** (Channel program)

The individual files fulfils different assignment purposes, following which have been explained in details :

1. **sender.py** – The following are the tasks performed in this Sender program :
    a. The data is entered by the user.
    b. It follows the above design to transmit the data.

2. **receiver.py** – The following are the tasks performed in this Receiver program :
    a. The data is received from one of the sender processes.

3. **channel.py** – The following are the tasks performed in this Channel program :
    a. Asks for number of sender processes and receiver processes.
    b. Initiates all sender and receiver processes.
    c. Receives data from one sender at a time.
    d. When the channel receives data from a sender, it changes its state to Busy. (The duration is set by the sender process).
    e. Sends the received data to one of the receiver (chosen randomly).

IMPLEMENTATION

Code Snippet of channel.py:

```
import socket
import time
import subprocess
import random
import os

class Channel():

        def __init__(self, totalsender, totalreceiver):
                self.totalsender = totalsender
                self.senderhost = '127.0.0.1'
                self.senderport = 8080
                self.senderconn = []

                self.totalreceiver = totalreceiver
                self.receiverhost = '127.0.0.2'
                self.receiverport = 9090
                self.receiverconn = []

        def initSenders(self):
                senderSocket = socket.socket()
                senderSocket.bind((self.senderhost, self.senderport))
                senderSocket.listen(self.totalsender)
                for i in range(1, self.totalsender+1):
                        conn = senderSocket.accept()
                        self.senderconn.append(conn)
                print('Initiated all sender connections')
```

```
    def closeSenders(self):
        for conn in self.senderconn:
            conn[0].close()
        print('Closed all sender connections')

    def initReceivers(self):
        receiverSocket = socket.socket()
        receiverSocket.bind((self.receiverhost, self.receiverport))
        receiverSocket.listen(self.totalreceiver)
        for i in range(1, self.totalreceiver+1):
            conn = receiverSocket.accept()
            self.receiverconn.append(conn)
        print('Initiated all receiver connections')

    def closeReceivers(self):
        for conn in self.receiverconn:
            conn[0].close()
        print('Closed all receiver connections')

    def processData(self):
        fileout = open('status.txt',"w")
        fileout.write(str(0))
        fileout.close()
        while True:
            for i in range(len(self.senderconn)):
                print()
                conn = self.senderconn[i]
                fileout = open('status.txt',"w")
                fileout.write(str(0))
                fileout.close()
                data = conn[0].recv(1024).decode()
                fileout = open('status.txt',"w")
                fileout.write(str(1))
                fileout.close()

                if not data:
                    break
                if data == 'q0':
                    break

                print('Received from Sender',i+1,':',str(data))

                recvno = random.randint(0,len(self.receiverconn)-1)
                print('Sending to Receiver',recvno+1)
                rconn = self.receiverconn[recvno]
                rconn[0].sendto(data.encode(), rconn[1])

            if data == 'q0':
                break
        return

if __name__ == '__main__':
    totalsen = int(input('Enter number of senders: '))
    totalrecv = int(input('Enter number of receivers: '))

    ch = Channel(totalsen, totalrecv)
    ch.initSenders()
    ch.initReceivers()
    ch.processData()
    ch.closeSenders()
    ch.closeReceivers()
```

Code Snippet of sender.py:

```
import socket
import sys
import time
import random

def Main(senderno):
    print('Initiating Receiver #',senderno)
    host = '127.0.0.2'
    port = 9090

    mySocket = socket.socket()
    mySocket.connect((host, port))

    while True:
        print()
        data = mySocket.recv(1024).decode()
        if not data:
            break
        if data == 'q':
            break

        print('Received from channel :', str(data))

    mySocket.close()

if __name__ == '__main__':
    if len(sys.argv) > 1:
        senderno = int(sys.argv[1])
    else:
        senderno = 1
    Main(senderno)
```

Code Snippet of receiver.py:

```
import socket
import sys
import time
import random

def Main(senderno):
    print('Initiating Sender #',senderno)
    host = '127.0.0.1'
    port = 8080

    mySocket = socket.socket()
    mySocket.connect((host, port))
    prevtime = time.time()
    success = 0
    while True:
        print()
        data = input("Enter $ ")
        #prevtime = time.time()
        k = 0
        kmax = 15
        while True:
            print('ATTEMPT NUMBER',str(k))
            print('Checking channel status ...')
            filein = open('status.txt',"r")
            status = int(filein.read())
            if status == 0:
                print("Channel is IDLE!")

                prob = random.uniform(0,1)
                print('probability value is :',str(prob))
                print()
                if prob <= 0.5:
                    fileout = open('status.txt',"w")
                    fileout.write(str(1))
                    fileout.close()
                    waittime = random.randint(3,7)
                    print('Channel has been captured. It will take '+str(waittime)+'
seconds to send!')

                    print('Sending to channel :',str(data))
                    time.sleep(waittime)
                    mySocket.send(data.encode())
                    success += 1
                    break
                else:

                    print('Waiting for time-slot 2 seconds')
                    time.sleep(2)
                    filein = open('status.txt',"r")
                    status = int(filein.read())
                    print('After waiting for 2 second, the channel is',end=' ')
                    if status == 0:
                        print('IDLE')
                    else:
                        print('BUSY')
                    k += 1
                    if k > kmax:
                        print("Transmission aborted!")
                        break
                    if status == 0:
                        continue

                    else:
                        r = random.randint(0,pow(2,k)-1)
                        print("waiting for back off period")

            elif status == 1:
                time.sleep(0.1)
                print("Channel is BUSY!")

            print()

        if not data:
            break
        if data == 'q':
            break

    print("------------------------------")
    curtime = time.time()
    totaltime = curtime - prevtime
    throughput = success/totaltime
    print("Throughput :",str(throughput))

    mySocket.close()

if __name__ == '__main__':
    if len(sys.argv) > 1:
        senderno = int(sys.argv[1])
    else:
        senderno = 1
    Main(senderno)
```

TEST CASES

Sender.py (1st sender):

```
C:\Users\SOURAV\Desktop\comp-networks-lab\ass3\csma>python sender.py 1
Initiating Sender # 1

Enter $ 1001
ATTEMPT NUMBER 0
Checking channel status ...
Channel is IDLE!
probability value is : 0.14882951956621937

Channel has been captured. It will take 3 seconds to send!
Sending to channel : 1001
```

Sender.py (2nd sender):

```
C:\Users\SOURAV\Desktop\comp-networks-lab\ass3\csma>python sender.py 2
Initiating Sender # 2

Enter $ 0001
ATTEMPT NUMBER 0
Checking channel status ...
```

```
Channel is BUSY!

ATTEMPT NUMBER 0
Checking channel status ...
Channel is BUSY!

ATTEMPT NUMBER 0
Checking channel status ...
Channel is BUSY!

ATTEMPT NUMBER 0
Checking channel status ...
Channel is BUSY!

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Channel is BUSY!

ATTEMPT NUMBER 0
Checking channel status ...
Channel is BUSY!

ATTEMPT NUMBER 0
Checking channel status ...
Channel is IDLE!
probability value is : 0.736050029321153
```

```
Waiting for time-slot 2 seconds
After waiting for 2 second, the channel is IDLE
ATTEMPT NUMBER 1
Checking channel status ...
Channel is IDLE!
probability value is : 0.19798104388936366

Channel has been captured. It will take 3 seconds to send!
Sending to channel : 0001
```

Receiver.py (1st receiver):

```
C:\Users\SOURAV\Desktop\comp-networks-lab\ass3\csma>python receiver.py 1
Initiating Receiver # 1

Received from channel : 1001
```

Receiver.py (2nd receiver):

```
C:\Users\SOURAV\Desktop\comp-networks-lab\ass3\csma>python receiver.py 2
Initiating Receiver # 2

Received from channel : 0001
```

Channel.py:

```
C:\Users\SOURAV\Desktop\comp-networks-lab\ass3\csma>python channel.py
Enter number of senders: 2
Enter number of receivers: 2
Initiated all sender connections
Initiated all receiver connections

Received from Sender 1 : 1001
Sending to Receiver 1

Received from Sender 2 : 0001
Sending to Receiver 2
```

RESULTS & ANALYSIS

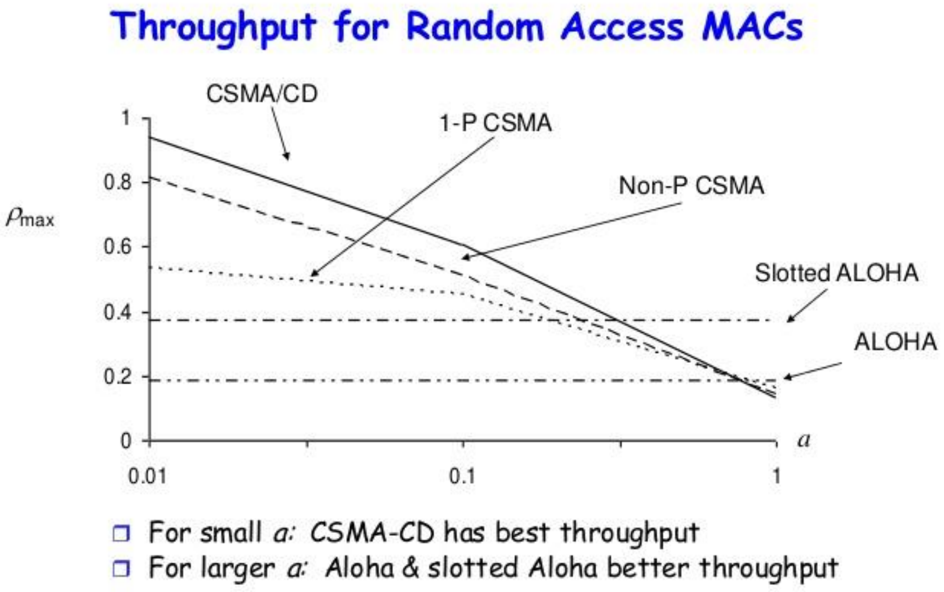
p-persistent CSMA :

- This method is used when channel has time slots such that the time slot duration is equal to or greater than the maximum propagation delay time.
- Whenever a station becomes ready to send, it senses the channel.
- If channel is busy, station waits until next slot.
- If channel is idle, it transmits with a probability p.
- With the probability q=l-p, the station then waits for the beginning of the next time slot.
- If the next slot is also idle, it either transmits or waits again with probabilities p and q.
- This process is repeated till either frame has been transmitted or another station has begun transmitting.
- In case of the transmission by another station, the station acts as though a collision has occurred and it waits a random amount of time and starts again.

Advantage of p-persistent CSMA:

- It reduces the chance of collision and improves the efficiency of the network.

CSMA/CD :



Throughput for Random Access MACs

- □ For small *a:* CSMA-CD has best throughput
- □ For larger *a:* Aloha & slotted Aloha better throughput

• The station that has a ready frame sets the back off parameter to zero.
• Then it senses the line using one of the persistent strategies.
• If then sends the frame. If there is no collision for a period corresponding to one complete frame, then the transmission is successful.
• Otherwise the station sends the jam signal to inform the other stations about the collision.
• The station then increments the back off time and waits for a random back off time and sends the frame again.
• If the back off has reached its limit then the station aborts the transmission.

COMMENTS

This assignment has helped me in understanding the CSMA and CSMA/CD, on implementing them.