VOICE CONFERENCEING APPLICATION

CO324 NETWORK AND WEB APPLICATION DESIGN

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1 Introduction

1.1 VOIP

Peer-to-peer (P2P) network is a decentralized communications model in which each party has the same capabilities and either party can initiate a communication session. Unlike the client/server model, in which the client makes a service request and the server fulfills the request, the P2P network model allows each node to function as both a client and a server. One of the main features of a P2P system is that each node contributes resources such as bandwidth, storage space, and CPU power. As a result, the system gains more capacity as more nodes become involved. This is opposite to a client-server architecture, where the addition of clients always degrades the overall performance.

1.2 Features

One of the most popular applications in p2p is VOICE communication. Skype and Whatsapp are some of the most common applications in daytoday life. In our applications there are two modes of operations,

- 1. Peer to peer voice communication between two parties.
- 2. Peer to peer voice communication among multiple parties.

2 Design

3 Quick Guide

To Run the Unicast Application, The client who initiate the call,

```
javac Peer.java
java Peer peer1
The client who joins the call,
javac Peer.java
java Peer peer2 [ip address of the initiated client]
```

To run the Multicast Application, Who ever can join to the conference using a multicast ip address

```
javac Multicast.java
java Multicast [Multicast ip address]
```

4 Implementation

4.1 Underlying Protocol

The application is built based on UDP protocol. Unlike TCP, UDP is connectionless, which means that data packets can be sent without warning, preparation, or negotiation. UDP also lacks any kind of error control. Not only can packets be delivered in the incorrect order, but they can also get completely left out. UDP is meant for applications where you are more concerned with keeping the stream of information going than making sure you receive every single packet.

For a real-time voice conferencing application, the speed/efficiency of the communication is mandatory. In a VOIP application if a packet is received out of order or few packet missings the user probably won't even notice. One of the most important factor is UDP supports broadcasting and we could able to use multicast feature on that.

4.2 Unicast Implementation

There are 3 threads used by the program for

- Sound capturing serialization sending.
- Receiving packets and deserialization.
- Play buffer to enable duplex communication.

The first iteration follows up mainly 5 steps to do the task of unicast communication

- 1. Initialize communication parameters by giving ip address as an argument.
- 2. Audio sufficient is recorded to fill the buffer.
- 3. Serial number is added to packets in the buffer and send packets.
- 4. New thread is started and packets are received in receiving party side and deserialize them.
- 5. New thread is started and received describilized packets are played in buffer.

4.3 Multicast Implementation

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- 5. New thread is started and received descrialized packets are played in buffer.

4.4 Packet Format

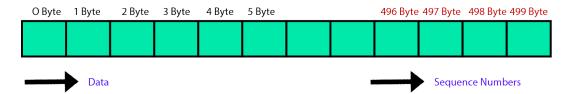


Figure 1: Packet Format

The UDP packet of the voice conferencing application consists of 500bytes by default such that 496 bytes allotted to audio signal and closing 4 bytes are allotted for sequence number. This begins from one and go up to 231. Which is more than sufficient for a single call, that is this application makes use of audio quality such that for 1 second it needs only 128 packets of data so with 231 user is able to call for a long period.

4.5 Packet lost handling and Reordering

In voice conferencing applications, packets loss can be happened. Therefore In case of packet loss, application isn't request to resend that packet in the buffer. (This implementation has a buffer of 1024 packets). In order to solve the small reordering issues automatically, our applications waits for some time to fill the buffer for weak connections. In other words the application won't play the packets as it receives unless the connection is perfect. So initially, our application stores the receiving packets in the buffer and thereafter, plays back from the buffer. There is a common variable which indicates what packet is being played currently when the voice conferencing is going on. The packet will be neglected if the receiving packets serial number is lower than the current playing because of that packet is having unallowable reordering. These severe reordered packets are discarded automatically by the application.

5 Testing & Performance

5.1 Unicast P2P with Packet loss

The application is tested under packet losses of 0\%, 5\%, 50\%

```
mint@mint:~/Desktop/peer/VoCe$ javamint@mint:~/Desktop/peer/VoCe$ java Pee
Cmint@mint:~/Desktop/peer/VoCe$
Available mixers:
                                                                          0 Port HDMI [hw:0]
Available mixers:
                                                                          1 Port PCH [hw:1]
                                  1 Port PCH [hw:1]
 Port HDMI [hw:0]
                                                                          2 default [default]
 Port PCH [hw:1]
default [default]
                                  2 default [default]
                                                                          2 Mic is supported!
                                  2 Mic is supported!
                                                                          Available mixers:
 Mic is supported!
                                  Available mixers:
                                                                          0 Port HDMI [hw:0]
wailable mixers:
                                                                          1 Port PCH [hw:1]
 Port HDMI [hw:0]
                                  0 Port HDMI [hw:0]
                                                                          2 default [default]
 Port PCH [hw:1]
                                  1 Port PCH [hw:1]
 default [default]
                                                                          2 Mic is supported!
                                  2 default [default]
2 Mic is supported!
Waiting for the peer to answer...
                                                                          Waiting for the peer to answer...
                                  2 Mic is supported!
                                                                          Client has Answered your call...
Client has Answered your call...
                                  Waiting for the peer to answer...
                                                                           Losses 5143 Not in order packets
Losses 848 Not in order packets 0
                                  Client has Answered your call...
                                                                           Losses 5447 Not in order packets 0
Losses 42 Not in order packets 0
                                   Losses 915 Not in order packets 0 Losses 5372 Not in order packets 0
Losses 25 Not in order packets 0
                                   Losses 125 Not in order packets 0 Losses 5480 Not in order packets 0
Losses 16 Not in order packets 0
                                   Losses 107 Not in order packets 0 Losses 5353 Not in order packets 0
Losses 137 Not in order packets 0
Losses 36 Not in order packets 0
                                   Losses 41 Not in order packets 0
Losses -1276 Not in order packets 0
Losses 1452 Not in order packets 0
Losses 38 Not in order packets 0
Losses 92 Not in order packets 0
Losses 0 Not in order packets 0
Losses 22 Not in order packets 0
Losses 111 Not in order packets 0
Losses 63 Not in order packets 0
Losses -4 Not in order packets 0
Losses 71 Not in order packets
Losses 34 Not in order packets 0
                                                                         50% Packet
                                                 5% Packet
         Normal
                                                                             Lost
        Condition
                                                    Lost
```

Figure 2: Packet loss

5.2 Unicast P2P with Delay

The application is tested on delays 200ms, 700ms, 1500ms

```
int:~/Desktop/peer/VoCe$ java PeerToPee^<sub>Cmint@mint:~/Desktop/peer/VoCe$ java mint@mint:~/Desktop/peer/VoCe$ java Pee</sub>
Available mixers:
                                                                  Available mixers:
                                                                                                                          Available mixers:
0 Port HDMI [hw:0]
1 Port PCH [hw:1]
2 default [default]
2 Mic is supported!
Available mixers:
                                                                  0 Port HDMI [hw:0]
                                                                                                                          0 Port HDMI [hw:0]
                                                                  1 Port PCH [hw:1]
2 default [default]
                                                                                                                          1 Port PCH [hw:1]
2 default [default]
                                                                  2 Mic is supported!
Available mixers:
                                                                                                                          2 Mic is supported!
                                                                 Available mixers:

0 Port HDMI [hw:0]

1 Port PCH [hw:1]

2 default [default]

2 Mic is supported!

Waiting for the peer to answer...

Client has Answered your call...

Losses 1737 Not in order packets 0

Losses 48 Not in order packets 0

Losses 44 Not in order packets 0

Losses -48 Not in order packets 0

Losses -48 Not in order packets 0
  Port HDMI [hw:0]
Port PCH [hw:1]
default [default]
                                                                                                                          Available mixers:
                                                                                                                          0 Port HDMI [hw:0]
                                                                                                                          1 Port PCH [hw:1]
  Mic is supported!
                                                                                                                          2 default [default]
Waiting for the peer to answer...
                                                                                                                          2 Mic is supported!
Waiting for the peer to answer...
Client has Answered your call...
 Losses 1510 Not in order packets 1
 Losses 98 Not in order packets 0
                                                                                                                          Client has Answered your call...
 Losses -67 Not in order packets 0
                                                                                                                            Losses 6128 Not in order packets 0
 Losses 172 Not in order packets 0
                                                                                                                            Losses 3919 Not in order
                                                                   Losses 69 Not in order packets 0
Losses -155 Not in order packets 0
Losses 285 Not in order packets 0
 Losses 78 Not in order packets 0
                                                                                                                            Losses 4316 Not in order packets 0
 Losses -39 Not in order packets 0
                                                                                                                            Losses 4276 Not in order packets 0
 Losses 166 Not in order packets 0
                                                                                                                            Losses 4989 Not in order packets 0
Losses -135 Not in order packets 0
                                                                    Losses 45 Not in order packets 0
                                                                    Losses -171 Not in order packets 0
Losses 195 Not in order packets 0
Losses 162 Not in order packets 0
                                                                    Losses 0 Not in order packets 0
Losses -80 Not in order packets 0
```

Delay of 200ms Delay of 700ms Delay of 1500ms

Figure 3: Delay

5.3 Multicast P2P with Packet loss

The application is tested under packet losses of 10%, 50%

```
oubudu@pubudu-Vostro-3559:~/Desktop/tet$ japubudu@pubudu-Vostro-3559:~/Desktop/tet$ java Multicast 224.0.0.20
                                             Available mixers:
Available mixers:
 Port PCH [hw:0]
default [default]
                                             0 Port PCH [hw:0]
                                             1 default [default]
 Mic is supported!
                                             1 Mic is supported!
Available mixers:
                                             Available mixers:
 Port PCH [hw:0]
default [default]
                                             0 Port PCH [hw:0]
                                             1 default [default]
                                             1 Mic is supported!
 Mic is supported!
                                             Losses -1904 Not in order packets 1905
Losses -5275 Not in order packets 10492
Losses -5372 Not in order packets 10623
                                              Losses -3918 Not in order packets 3921
Losses -5488 Not in order packets 10739
                                              Losses -3507 Not in order packets 3496
 Losses -5307 Not in order packets 10720
                                              Losses -3708 Not in order packets 3708
```

Packet Lost1 10%

Packet Lost1 50%

Figure 4: Packet Lost

5.4 Multicast P2P with Delay

The application is tested on delays 200ms, 1500ms

```
pubudu@pubudu-Vostro-3559:~/Desktop/tet$ pubudu@pubudu-Vostro-3559:~/Desktop/tet$ java Multicas
Available mixers:
                                           Available mixers:
0 Port PCH [hw:0]
1 default [default]
                                           0 Port PCH [hw:0]
                                           1 default [default]
1 Mic is supported!
                                           1 Mic is supported!
Available mixers:
                                           Available mixers:
 Port PCH [hw:0]
default [default]
                                           0 Port PCH [hw:0]
                                           1 default [default]
 Mic is supported!
                                           1 Mic is supported!
 Losses 6 Not in order packets 1
                                            Losses -2079 Not in order packets 10043
 Losses -2343 Not in order packets 2201
 Losses -4470 Not in order packets 4470
                                            Losses -2459 Not in order packets 10719
                                            Losses -2441 Not in order packets 10693
 Losses -2781 Not in order packets 2781
Losses -3576 Not in order packets 3576
                                            Losses -2856 Not in order packets 10702
```

Delay of 200ms

Delay of 1500ms

Figure 5: Delay

6 Reference

- $1.\ https://docs.oracle.com/javase/tutorial/sound/sampled-overview.html$
- $2.\ https://docs.oracle.com/javase/tutorial/networking/datagrams/broadcasting.html$
- $3. \ https://netbeez.net/blog/how-to-use-the-linux-traffic-control/$

END