Comm Audio

Design Documentation

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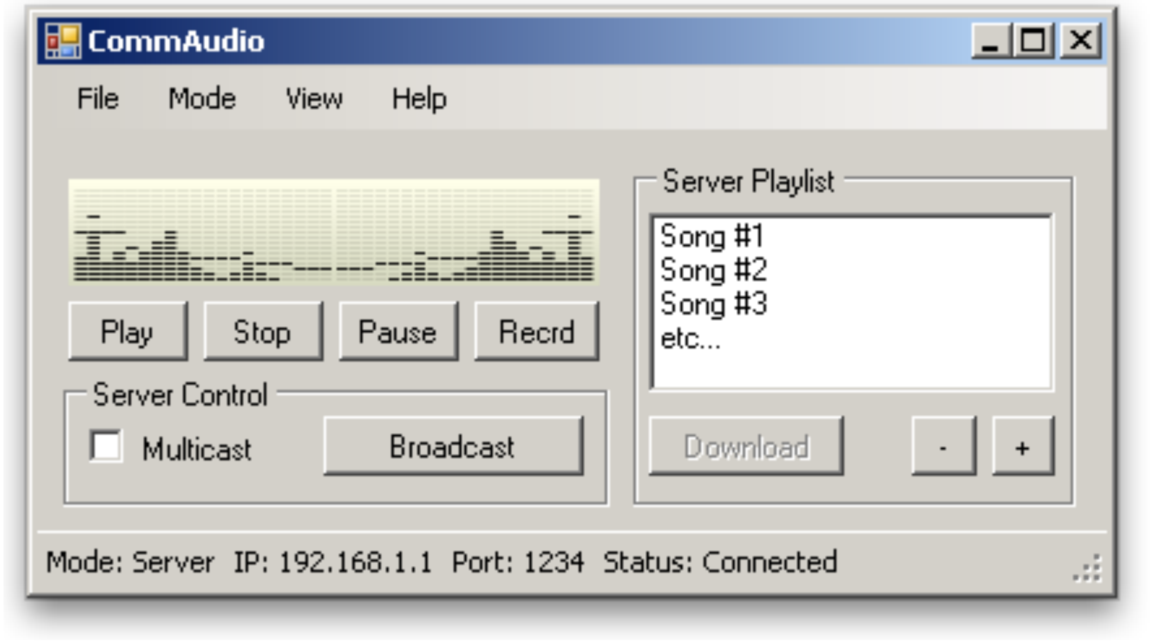
APPLICATION DESIGN & DIAGRAMS

GUI Mockup



Mode: Server IP: 192.168.1.1 Port: 1234 Status: Connected

figure 1: Server Mode

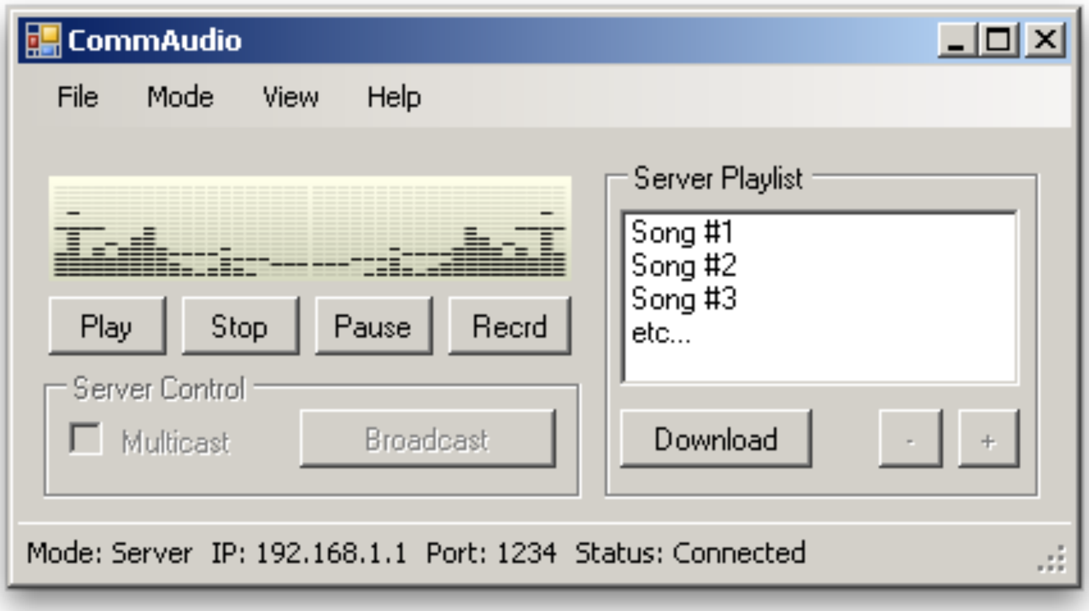
We have decided to incorporate the client and server side of this project into a single application. As such, various aspects of the application will be enabled or disabled based on the mode in which the application is currently operating.

The main abilities of the client/server application is the ability to control what is currently streaming through the play/stop/pause functions. Additionally, the record function will cause all currently streaming/multicast sessions to cease and bring the application into recording mode.

All functions are available to the GUI while in server mode except for the download function, as it will always be the client that downloads from the server. Specific functions available to the server are as follows:

- Multicast – Set the server into multicast mode, allowing new client connections until the server begins to broadcast.
- Broadcast – Block all future client connections and begin broadcasting the playlist to currently connected clients.

- Add to Playlist (+) – Opens up the file dialogue box, allowing the user to select files to add to the playlist queue.
- Remove from Playlist (-) – Removes selected files from the playlist.



Song #1
Song #2
Song #3
etc...

Mode: Server IP: 192.168.1.1 Port: 1234 Status: Connected

figure 2: Client Mode

While the application is in client mode, all server related functions are disabled, however, the previously disabled "Download" function, is enabled for the client. The download option, however, is only enabled if the client is in streaming mode with the server, not multicast mode. This function allows the client to download any of the selected songs in the playlist.

Additionally, if the client is in streaming mode with the server, the client will have control over which songs in the playlist to play. This is done by selecting the songs in the playlist that the client wants to stream. When the client presses play, it will notify the server which songs to stream to the client.

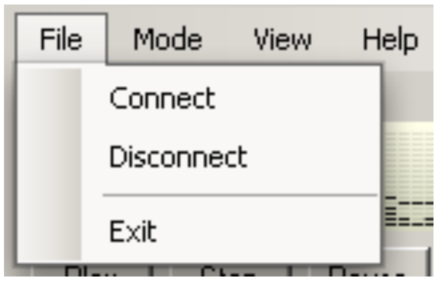


figure 3: File Menu

The file menu allows both the client and server to exit the application. However, the behaviour of the “Connect” and “Disconnect” menu items differ based on the mode for which the application is currently set.

While in server mode, the “Connect” menu item will cause the server to start listening for clients. Meanwhile, the “Disconnect” menu item will cause the server to stop listening for new clients and terminate any open connections.

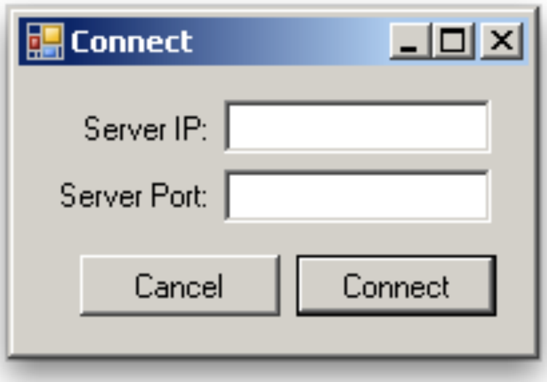


figure 4: Connection Options

If the application is in client mode, the “Connect” menu item will cause a connection options dialog open, prompting the client to enter the server’s IP address as well as the server’s port. By pressing “Connect” the application will first verify the correctness of the IP address and port and then test to see if a server exists at the specified port and IP address. If any of the settings are in error, or the server does not exist, an error message will be presented to the client, allowing the client to re-enter the connection settings and try again.

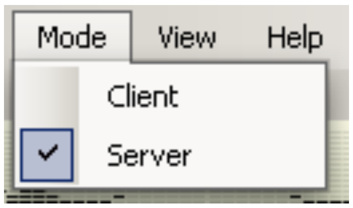


figure 5: Mode Menu

The mode menu allows the user to set whether the application is operating in client or server mode. Changing the application's mode will enable and disable any functions which are not relevant to that mode's operation. Additionally, the user will be unable to change the application's mode while the client or server is connected.

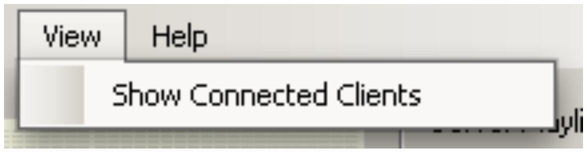


figure 6: View Menu

The view menu allows the user, while in server mode, to view a list of connected clients. This list will appear as a separate window that shows each client's IP address. This list will be updated dynamically, adding and removing clients from the list as they connect and disconnect.

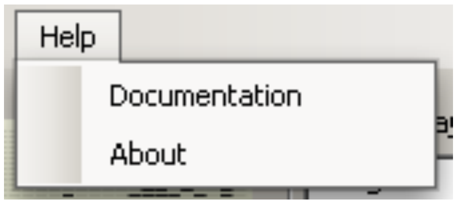


figure 7: Help Menu

The help menu allows the user to view the application's user documentation as well as an about box, which displays the applications version and the developers involved with the application.

The user documentation window will either be a rich text document that is opened through an external program (WordPad) or a built-in dialogue box.

Overview

This is the main overview of how our design documents are organized.

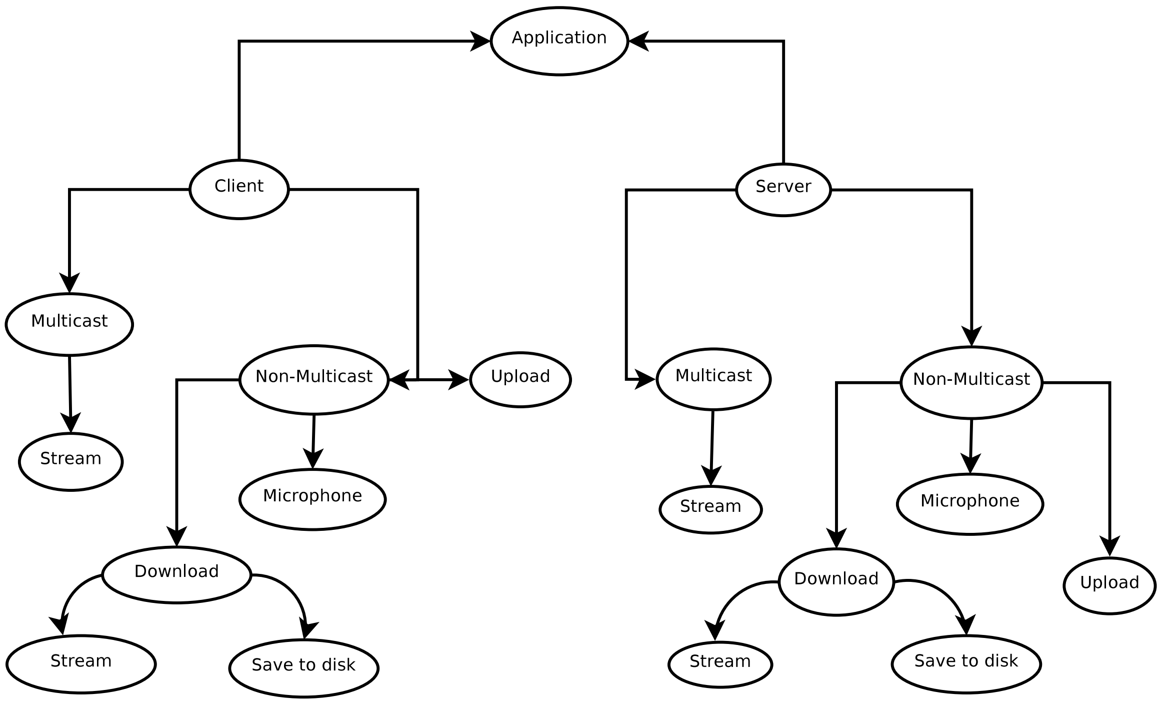


figure 8: Application Overview

When the application starts up you have the option of being a client or server.

If you are the client you can either be a multicast or non-multicast client. Multicast clients can only stream the music being played by the server whereas non-multicast clients can upload, have a microphone conversation or download which consists of streaming or saving the file.

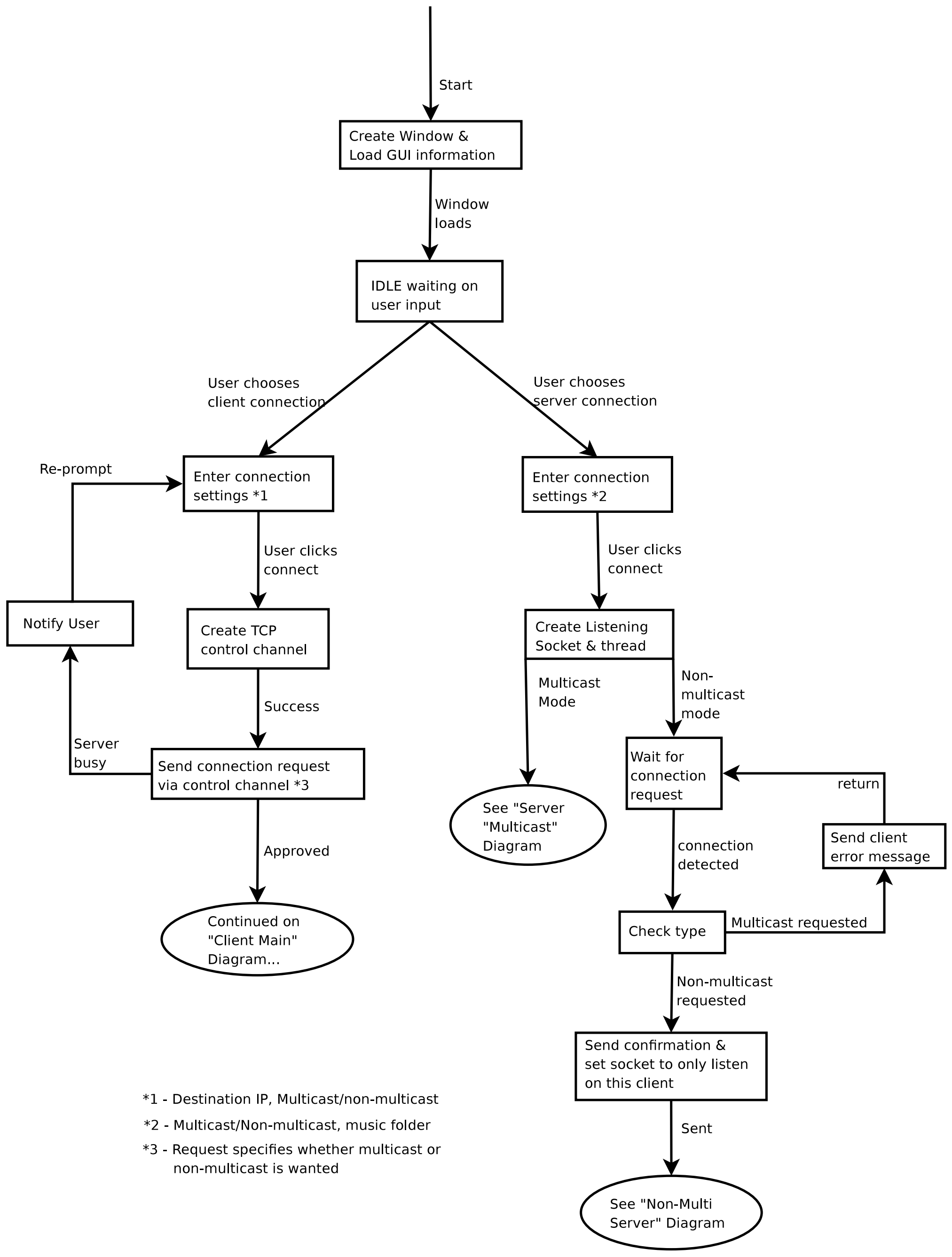
If you decide to be the server you can also be multicast or non-multicast. If the server is multicast all it does is play the songs to the IP's in the multicast IP group. Non-multicast servers can stream a song to a client, have a microphone conversation or download songs from the client. The server-side download portion of the overview symbolizes the server handling how the clients download.

Note: *Wherever a UDP socket is created a long with a new service thread, the thread that initialized them goes to the wndProc listening for messages.*

****Note:*** *The rectangles are states and the ellipses are connection points to another diagram.*

Application

This is the main entry point for the program. The program waits for the user to enter the settings which calls the corresponding functions. The server is started first and waits for client connections. If it's the correct type of connection, it will accept, otherwise it will send a busy message.

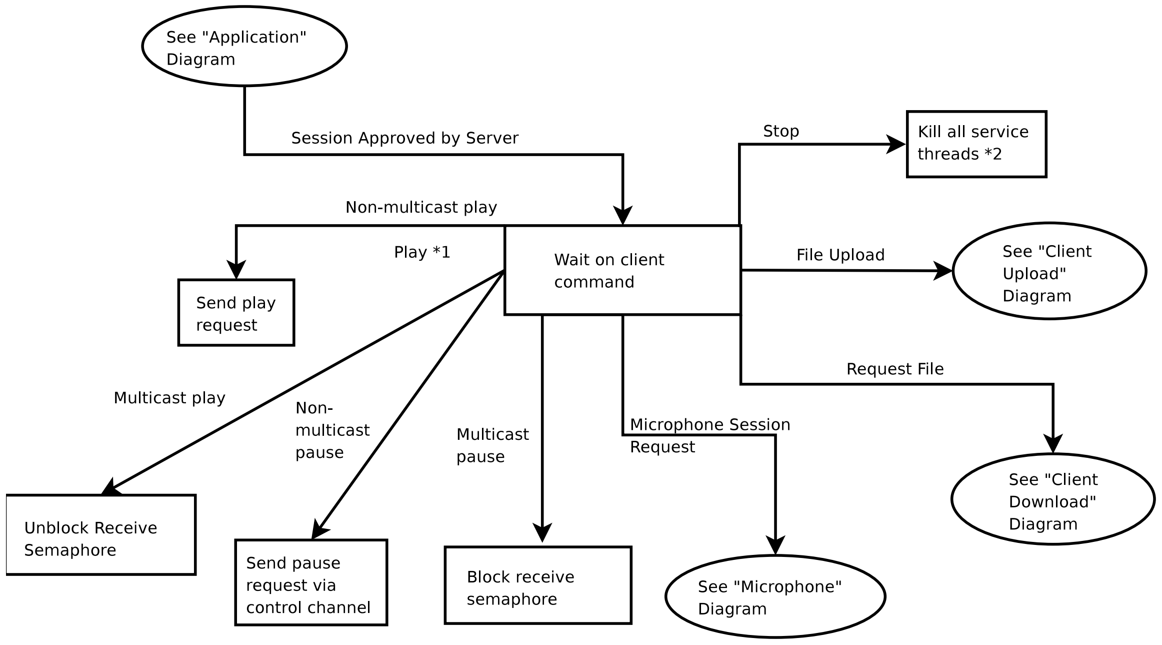


Start
Create Window & Load GUI information
Window loads
IDLE waiting on user input
User chooses client connection
User chooses server connection
Re-prompt
Enter connection settings *1
Enter connection settings *2
User clicks connect
User clicks connect
Notify User
Create TCP control channel
Create Listening Socket & thread
Success
Multicast Mode
Non-multicast mode
Server busy
Send connection request via control channel *3
Wait for connection request
return
See "Server "Multicast" Diagram
Send client error message
Approved
connection detected
Continued on "Client Main" Diagram...
Check type
Multicast requested
Non-multicast requested
Send confirmation & set socket to only listen on this client
*1 - Destination IP, Multicast/non-multicast
*2 - Multicast/Non-multicast, music folder
*3 - Request specifies whether multicast or non-multicast is wanted
Sent
See "Non-Multi Server" Diagram

figure 9: Application

Client Main

The following diagram is how the client deals with the server while in non-multicast mode. The client's input is from what the user selects and is sent to the server via a server control channel.


See "Application" Diagram
Session Approved by Server
Wait on client command
Stop
Kill all service threads *2
File Upload
See "Client Upload" Diagram
Request File
See "Client Download" Diagram
Microphone Session Request
See "Microphone" Diagram
Non-multicast play
Play *1
Send play request
Multicast play
Unblock Receive Semaphore
Non-multicast pause
Send pause request via control channel
Multicast pause
Block receive semaphore

*1 - Options only available during a non-multicast audio stream

*2 - Server will automatically assume that client has pressed stop since it can no longer read from the control channel

figure 12: Client Main

Client Download

Handles the download for both multicast and non-multicast as well as streaming or save to disk. If it's streaming we use UDP otherwise we use the control channel. The client chooses to download a song, depending if it's multicast or non-multicast determines the outcome. The server will send an EOF message when it is done sending the file(s). If there are multiple files, the server will take out the EOF message between songs until the last one.

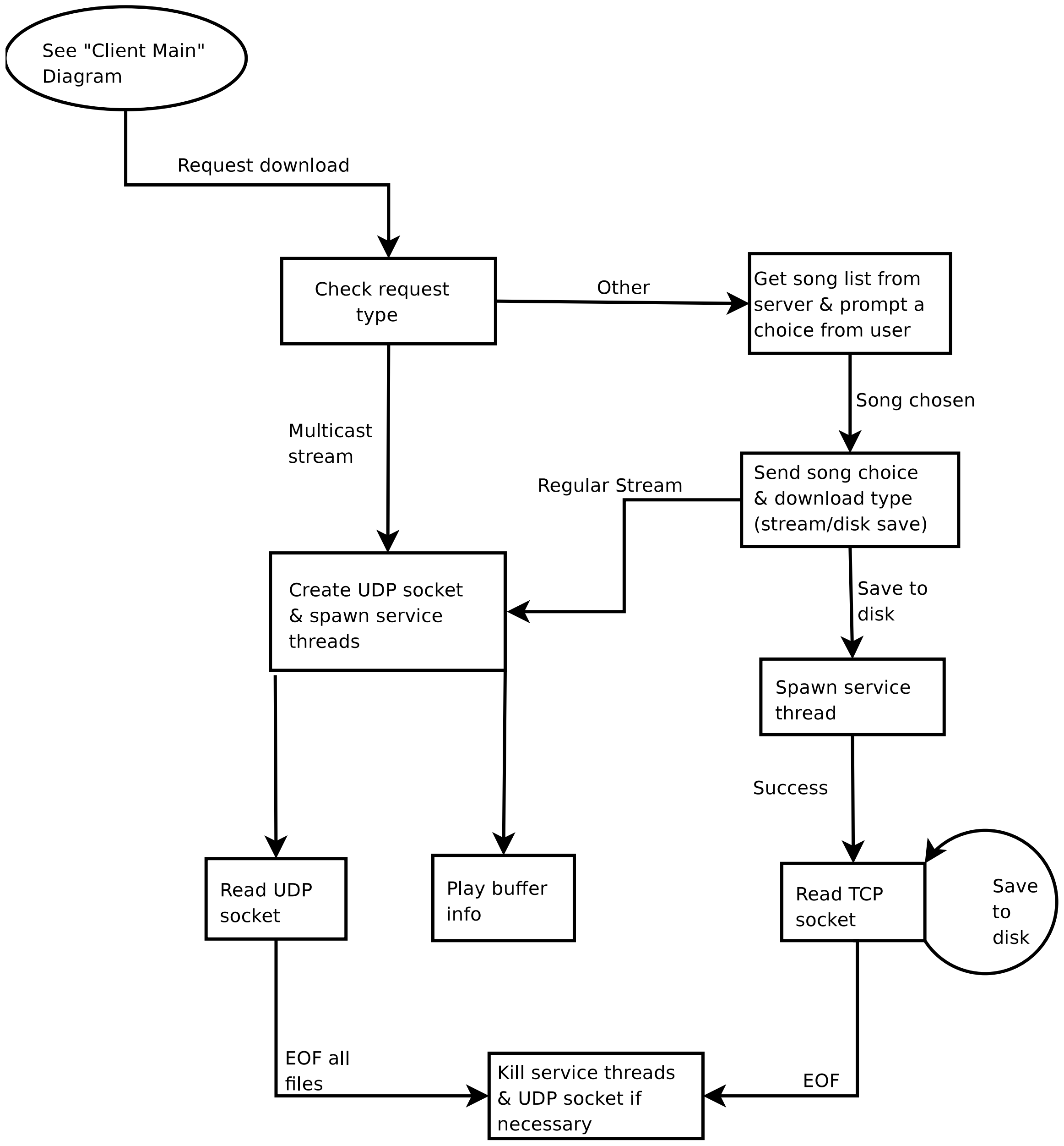
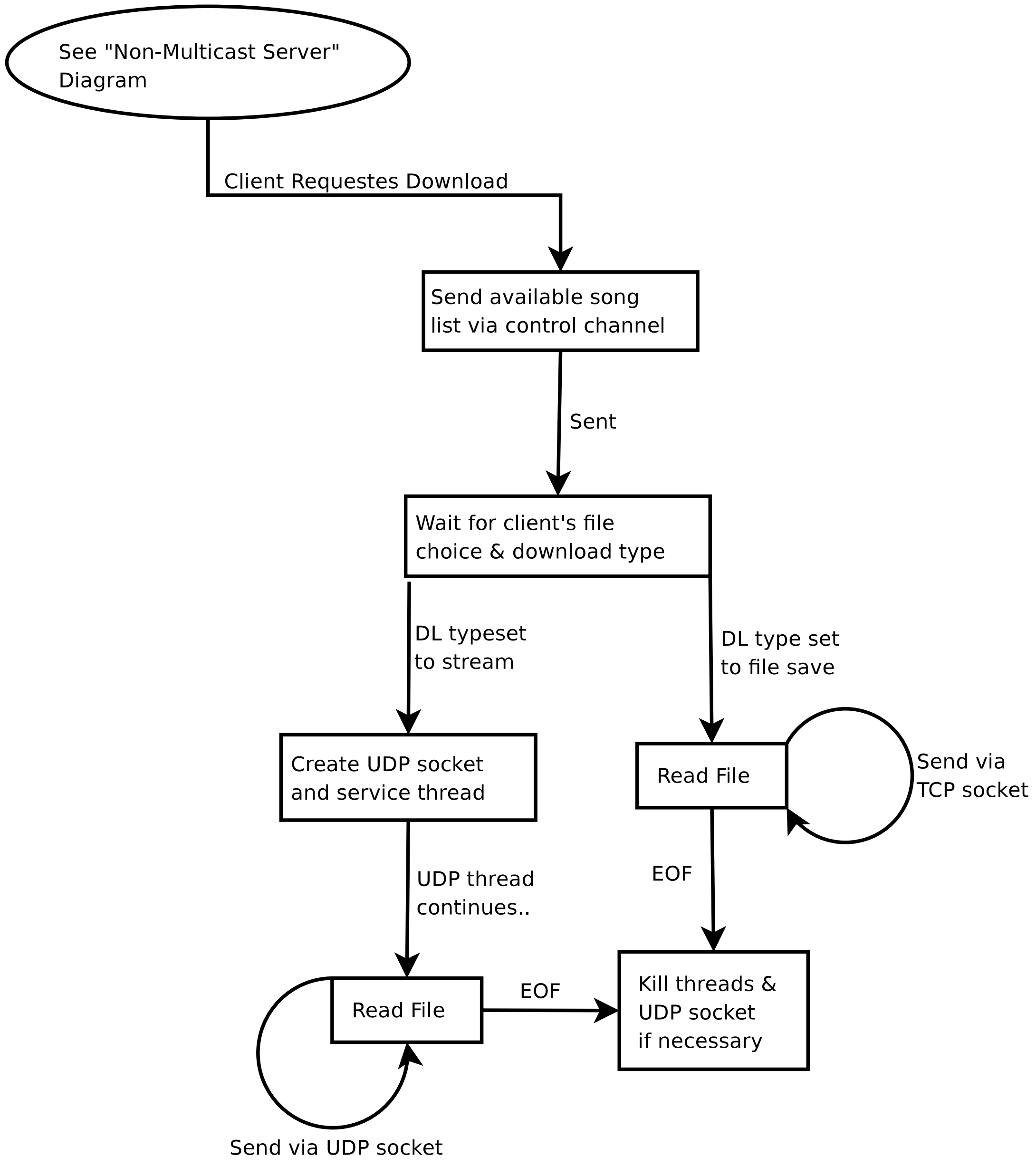

See "Client Main" Diagram
Request download
Check request type
Other
Get song list from server & prompt a choice from user
Song chosen
Multicast stream
Regular Stream
Send song choice & download type (stream/disk save)
Create UDP socket & spawn service threads
Save to disk
Spawn service thread
Success
Read UDP socket
Play buffer info
Read TCP socket
Save to disk
EOF all files
Kill service threads & UDP socket if necessary
EOF

figure 10: Client Download

Server Download

This diagram shows how the server handles a download request from the client. By the time we get here, the server has already accepted the client connection so there is no need to send a confirmation to the client, acknowledging the request. Instead we just send the song list and wait for the user's song choice and whether they choose to stream or save the file. If stream was chosen then the server will use UDP whereas if save is chosen then it will use the control channel.



See "Non-Multicast Server" Diagram
Client Requestes Download
Send available song list via control channel
Sent
Wait for client's file choice & download type
DL typeset to stream
DL type set to file save
Create UDP socket and service thread
Read File
Send via TCP socket
UDP thread continues..
EOF
Read File
EOF
Kill threads & UDP socket if necessary
Send via UDP socket

figure 11: Server Download

Non-multicast Server

This diagram shows how the server responds to client input via the control channel while the server is in streaming mode (non-multicast mode).

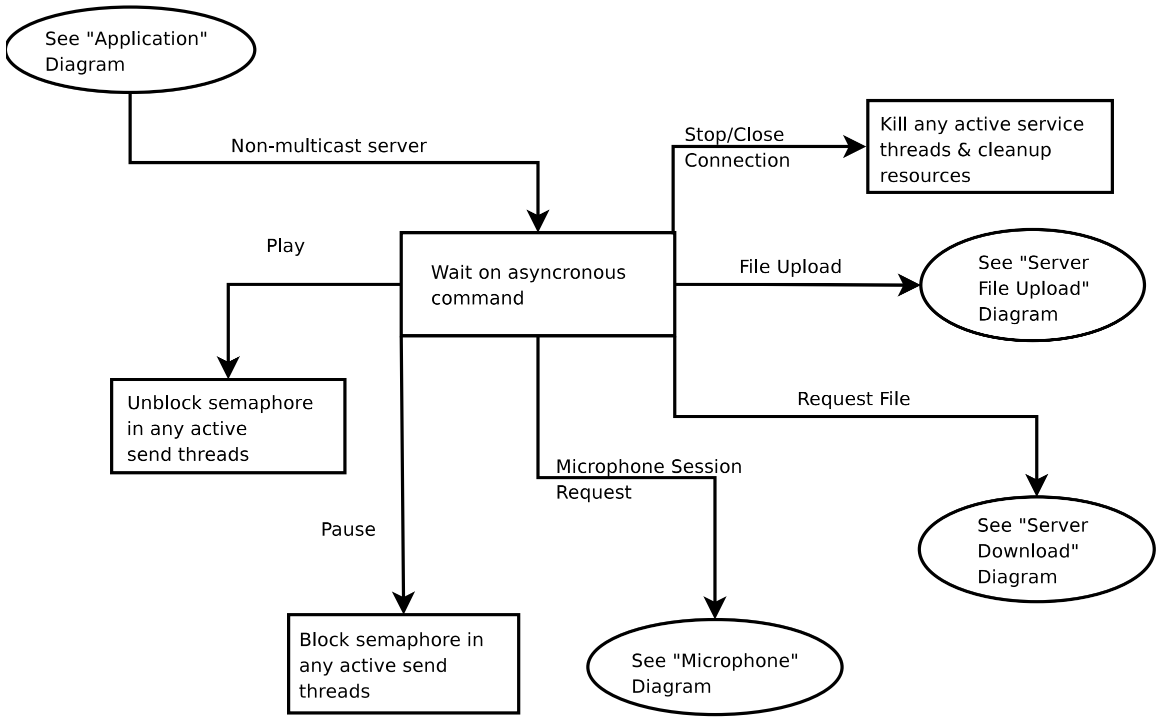

See "Application" Diagram
Non-multicast server
Stop/Close Connection
Kill any active service threads & cleanup resources
Play
Wait on asyncronous command
File Upload
See "Server File Upload" Diagram
Unblock semaphore in any active send threads
Request File
Microphone Session Request
Pause
See "Server Download" Diagram
Block semaphore in any active send threads
See "Microphone" Diagram

figure 13: Non-multicast Server

Multicast Server

The server continues to wait for incoming connections in which the client includes its own IP address and connection settings. If the client connection is multicast then the server will add its IP to the multicast group. It will continue to wait for connections until a client clicks the broadcast button which will start the stream. If a client connects while this is happening, it will send a busy message.

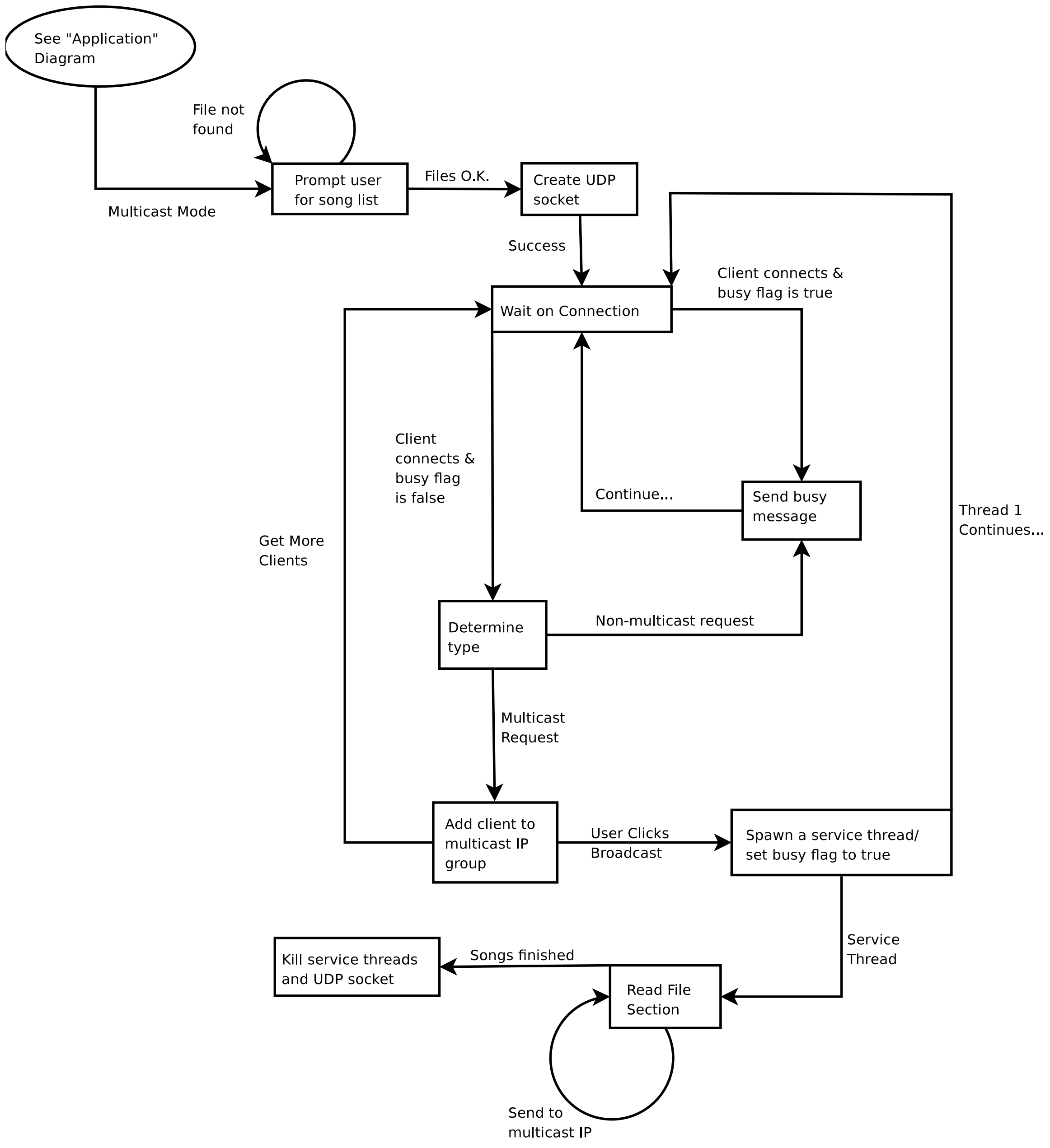


figure 14: Multicast Server

Microphone

This diagram shows how the client/server works when there is a microphone connection. Since it's a two way connection in which both can send and receive, it will be the same on the client and server.

Note: since the main thread is still getting user input, the send thread will act similar to a multicast server in that when we press pause it will block the receive semaphore on the client. This way the client can prevent feedback caused by sending the data that he/she is receiving through the speakers (noise).

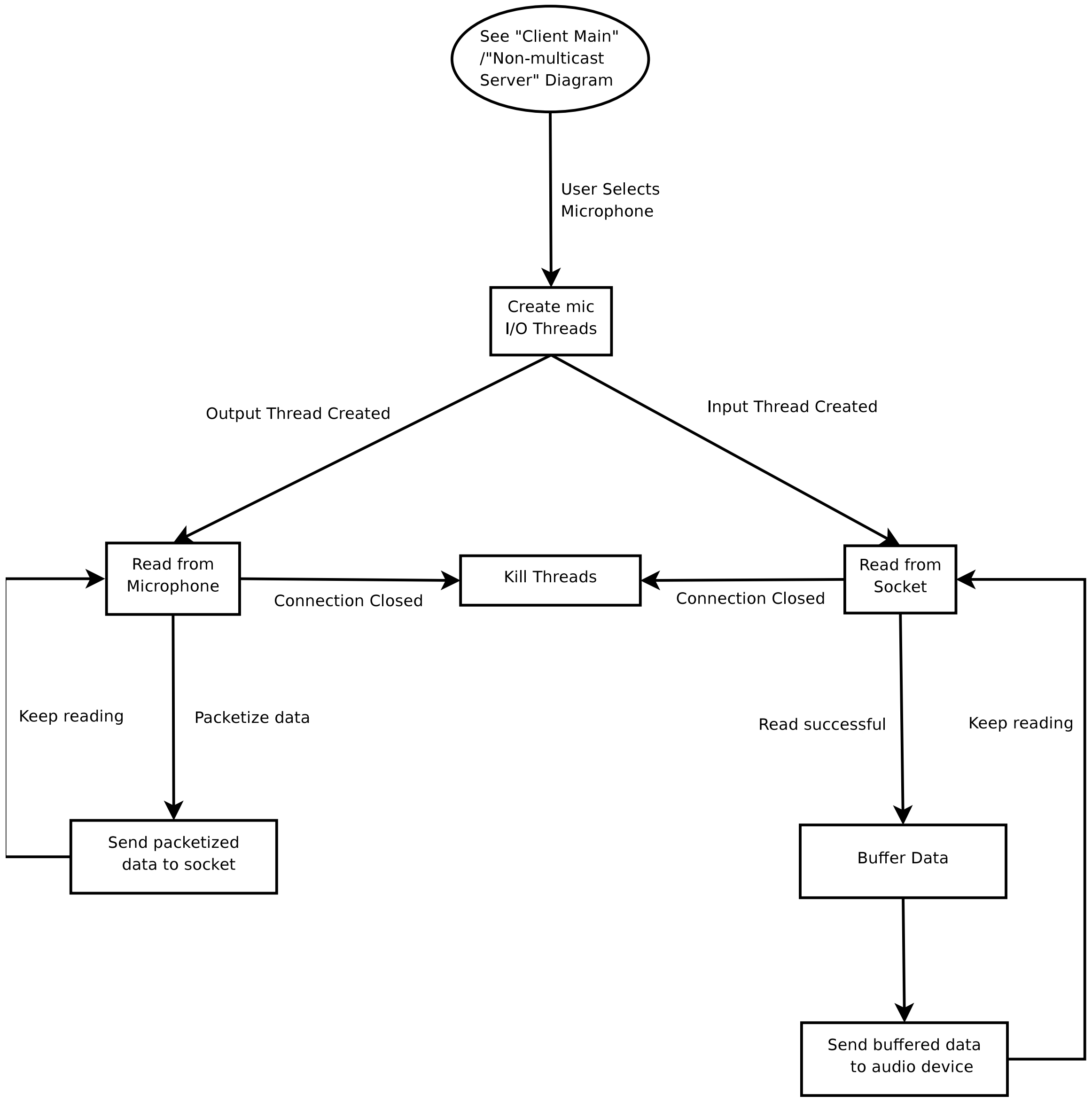


figure 15: Microphone

Client Upload & Server Download (from Client)

The diagram on the left is how the client handles an upload and the one on the right is how the server handles the client upload.

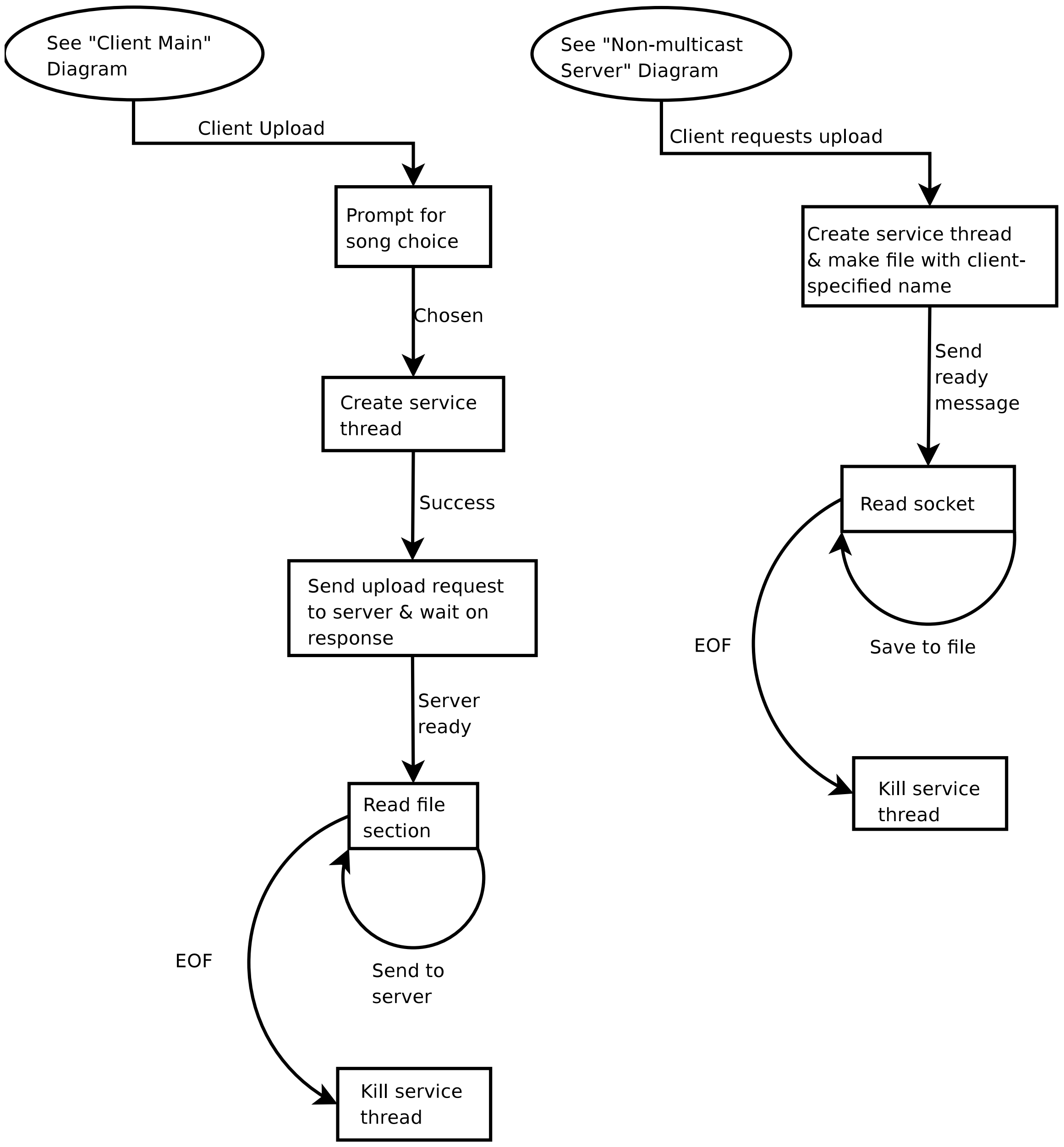


figure 16: Client Upload & Server Download (from Client)

PSEUDO-CODE

Application

```
Main start

     set and register the window properties

     create the window

     enter wndProc message loop

Main end


wndProc start

     allowable messages:

          WM_CREATE:

               initialize any data structures necessary
               for tracking state information

               enable/disable GUI items as necessary

          WM_SIZE

               move main window

               move all child windows

          WM_PAINT

               redraw the window items & text fields

          WM_COMMAND

               call handle_inputs function

wndProc end
```

```
handle_inputs start

    input messages:

        connection choice:

            if server, set type to server

            if client, set type to client

        connect button:

            get connection settings from the text fields

            if settings are set to multicast server:

                call serverMulticast function

            if settings are set to non-multicast server:

                listen for client connection request

                on connection, check the request type:

                    if muticast requested:

                        send error message & continue listening

                    if non-multicast requested:

                        send confirmation & set socket
                        to listen to only this client

                        call nm_server function

            if settings are set to client:

                create a TCP control channel

                send a connection request to the server
                via the control channel

                if server is busy or connection type doe
                not match:

                    notify the user and re-prompt
                    connection settings

                if server approves the session:

                    call client_main function

handle_inputs end
```

Client Main

```
client_main start

     user inputs/requests:

          Non-Multicast Play (only available during a stream)

               send play request to server via control channel

          Non-multicast Pause

               send pause request to server via control channel

          Multicast Play

               unlbock receive semaphore

          Multicast Pause

               block receive semaphore

          File Upload

               call client_upload function

          Microphone Session

               send microphone request to server via control channel

               if accepted

                    call microphone function

          Request File

               call client_download function

          Stop

               kill all service threads & UDP socket (if exists)

client_main end
```

Client Download

```
client_download start

     if request is multicast:

          call udp_services function

     if request is non-multicast:

          get song list from the server

          prompt the user to choose a song from the list

          send the server our song choice & download type (TCP/UDP)

          if we want to stream (UDP):

               call udp_services function

          if we want to save to disk (TCP):

               create a service thread

               service thread:

                    read the TCP socket, storing it to a buffer

                         save buffer data to file

                         if EOF is found:

                              kill service thread

client_download end
```

```
udp_services start

     create UDP socket

          create service threads

               thread 1:

                    play information stored in buffer

               thread 2:

                    read UDP socket & store in buffer

                    if we have read to EOF on all files

                         kill service threads

                         kill UDP socket

udp_services end
```

Server Download

```
server_download start
     Send song list via control channel
     wait for response
     if response is ‘stream’
          create stream thread
     if response is ‘download’
          create save thread
server_download end


Stream thread start
     create & bind UDP socket
     loop reading contents from file
          store in buffer
          send buffer to UDP socket
          if EOF
               close socket
Stream thread end


Save thread start
     create & bind TCP socket
          loop reading contents from file
          store in buffer
          send buffer to TCP socket
                    if EOF
               close socket
Save thread end
```

Non-multicast Server

```
nm_server start

     client requests:

          Play

               unblock send semaphore

          Pause

               block send semaphore

          Stop/Close connectoin

               kill all send threads

               cleanup resources (such as sockets)

          Request File

               call server_download function

          File Upload

               call server_upload function

          Microphone

               call microphone function

nm_server end
```

Multicast Server

```
serverMulticast start
    prompt user for song list
        if the file isn't found:
            re-prompt
    create UDP socket
    wait for a client to connect until the user clicks broadcast
        client connects and busy flag is set to true:
            send a busy message to that client
        client connects and busy flag is set to false:
            if client's request is for a non-multicast session
                send a busy message to that client
            if client's request is for a multicast session
                add the client's IP to the multicast IP group
                continue getting more clients

    set the busy flag to true
    spawn a service thread
    loop copying sections of file to the buffer
        send buffer information to the multicast IP group
        when all songs are finished:
            kill service thread
            close UDP socket & resources
serverMulticast end
```

Microphone

```
microphone start
     Create input thread
     Create output thread
microphone end


input thread start
     Open socket
     if open successful
          read while connection active
               add data to buffer
                         play buffer
input thread end


output thread start
     Open socket
     If open successful
          Read while play button active
               Packetize buffer
               Send packetized buffer to socket
output thread end
```

Client Upload & Server Download (from Client)

```
server_upload start
    create file with specified name
    create service thread
    send ready message
    while not EOF
        read socket data and save to the file
    kill service thread
server_upload end


client_upload start
    create service thread
    prompt for file choice
    create service thread
    send upload request //wait for response


    while not EOF
        read file & send data over control channel //TCP
    kill service thread
client_upload end
```