A PROPOSED CHAT OVER IP ADDRESS SYSTEM

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ABSTRACT

Network system is the system that provides communication among multiple people; it is now a necessity of life in order to build a good society. Internet chat communications have seen enormous growth over the last several years. The suggested system is the private network communication between two users, whereas a chat session is the network communication between two or more users.

The suggested system is modern technique that provides communication via voice chat or written text as well as both. This communication is take place via IP address, forming a local area network for communication via IP address as voice chat or messages.

The suggested system providing low cost communication via IP address that could be available for most computers or end devices of an organization or a special building for people in there.

1. GENERAL INTRODUCTION

1.1. Introduction

Network system is the system that provides communication among multiple people; it is now a necessity of life in order to build a good society. Internet chat communications have seen enormous growth over the last several years. The suggested system is the private network communication between two users, whereas a chat session is the network communication between two or more users.

Chat sessions can either be private, where each user is invited to join the session, or public, where anyone can join the session.

Communication provides many useful capabilities such as resource sharing, reliability, saving money and social communication. With such system people can exchange information via wide area of connection.

For any communication system there exist many components such that: end devices, the transmission media, and the message

The suggested system is modern technique that provides communication via voice chat or written text as well as both. This communication is take place via IP address.

The system provides that any number of people can be communicated via IP address forming a local area network for communication via IP address as voice chat or messages.

The suggested system providing low cost communication via IP address that could be available for most computers or end devices of an organization or a special building for people in there.

The system was applied using Visual Studio 2012, under the windows7 operating system, using the facilities of both the suggested system gives the final results.

1.2. Goals of the suggested system:

1. Low cost such that the dependant of the system upon the software connection rather than hardware, including minimize the cost of hardware maintenance.
2. The region of the system depends on the region of the router, such that including the levels of a building, an organization of any building.
3. The system providing and expanding capability as adding any number of users for the chat by adding their IP address.

1.3. The Beneficiaries of the System

The system provides free communication between a limited range of beneficiaries through the formation of an internal network, which can be one of the following categories:

1. A group of employees within the building of a company or institution, in order to achieve continuity for the benefit of the business.

2. A group of people inside a building of several floors, in order to achieve social communication.

3. Establish a network between a president and a group of supervisors to communicate the appropriate orders and directives.

4. The formation of a local network within a classroom or laboratory to secure communication between the teacher and the students.

2. THEORETICAL STUDY

2.1. Introduction

Computer Network is a collection of computers and/or devices (often referred to as nodes) connected to each other. The network allows computers to communicate with each other and share resources and information. A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network [1].

Data Communication: is a process of exchanging data or information. In case of computer networks this exchange is done between two devices over a transmission medium. This process involves a communication system which is made up of hardware and software [2].

The hardware part involves: the sender and receiver devices and the intermediate devices through which the data passes. **The software part involves**: certain rules which specify what is to be communicated, how it is to be communicated and when. It is also called as a **Protocol**.

A **Protocol** is defined as a set of rules that governs data communications. A protocol defines what is to be communicated, how it is to be communicated and when it is to be communicated [1].

Most networks use distributed processing, in which a task is divided among multiple computers. Instead of one single large machine being responsible for all aspects of a process, separate computers (usually a personal computer or workstation) handle a subset.

2.2. Network Advantages

1. **Resource Sharing:** it means the goal is to make all programs, data and equipment available to anyone on the network without regard to the physical location of the resource and the user[1].

   Example: Suppose a user happens to be 1000 km away from his data should not prevent him from using the data as though they were local. Also load sharing is another aspect of resource sharing.

2. High Reliability: Network provides high reliability by having alternative sources of supply.

Example: Suppose all files could be replicated on two or three machines, so if one of them is unavailable (due to a hardware failure), the other copies could be used. For military, banking, air traffic control, and many other applications, the ability to continue operating the face of hardware problems is of great importance.

3. Low Cost/Saving Money: Small computers have a much better price/performance ratio than large one. Mainframes are roughly a factor of forty faster than the fastest single chip microprocessors, but they cost a thousand times more. This imbalance has caused many system designers to build systems consisting of powerful personal computers, as per user, with data kept on one or more shared file server machines.

4. Communications: A computer network can provide a powerful communication medium among widely separated people. Using a network, it is easy for two or more people who live far apart to write a report together.

Example: when one author makes a change to the document, which is kept online, the others can see the change immediately, instead of waiting several days for a letter.

2.3. Network Criteria

A network must be able to meet a certain number of criteria. The most important of these are performance, reliability, and security.

1. **Performance:** Performance can be measured in many ways, including transit time and response time. **Transit time** is the amount of time required for a message to travel from one device to another. **Response time** is the elapsed time between an inquiry and a response.

   *The performance of a network depends on a number of **factors**:*

   - ✓ The number of users
   - ✓ The type of transmission medium
   - ✓ The capabilities of the connected hardware
   - ✓ The efficiency of the software.

   *Performance is often evaluated by two networking **metrics**:*

   Throughput and **delay**. (There is always needing for more throughput and less delay). However, these two criteria are often **contradictory**. If there exists a try to send more data to the network, that may increase throughput but also increase the delay because of traffic congestion in the network.

2. **Reliability:** It is usually measured by(depends on):

   - ✓ Accuracy of delivery

- ✓ The frequency of failure
- ✓ The time it takes a link to recover from a failure
- ✓ The network's robustness in a catastrophe.

3. **Security:** Network security issues include protecting data from unauthorized access, protecting data from damage and development, and implementing policies and procedures for recovery from breaches and data losses.

2.4. Data Representation

Data is collection of raw facts which is processed to deduce information. There may be different forms in which data may be represented. Some of the forms of data used in communications are as follows:

1. **Text:** Text includes combination of alphabets in small case as well as upper case. It is stored as a pattern of bits. Widely used encoding system: ASCII, Unicode.

2. **Numbers:** Numbers include combination of digits from 0 to 9. It is stored as a pattern of bits.

3. **Images**: (An image is worth a thousand words) is a very famous saying. In computers images are digitally stored. A Pixel is the smallest element of an image. To put it in simple terms, a picture or image is a matrix of pixel elements.

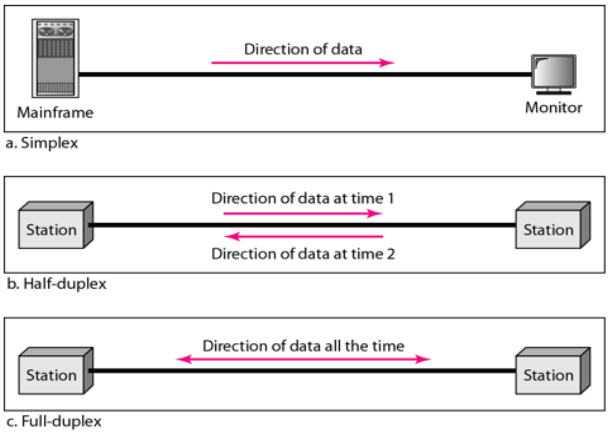
4. **Audio:** Data can also be in the form of sound which can be recorded and broadcasted. Example: What we hear on the radio is a source of data or information. Audio data is continuous, not discrete.

5. **Video:** Video refers to the recording or broadcasting of a picture or movie. Video can either be produced as a continuous entity (e.g., by a TV camera), or it can be a combination of images, each a discrete entity, arranged to convey the idea of motion.

2.5. DATA FLOW

Two devices communicate with each other by sending and receiving data. The data can flow between the two devices in the following ways. Figure (1) describes the three ways.

Figure 1. *Data flow (simplex, half-duplex, and full-duplex)*



1. Simplex

In Simplex, communication is unidirectional. Only one of the devices sends the data and the other one only receives the data. Example: a CPU sends data while a monitor only receives data.

2. Half Duplex

In half duplex both the stations can transmit as well as receive but not at the same time. When one device is sending, the other can only receive and vice-versa. Example: A walkie-talkie.

3. Full Duplex

In Full duplex mode, both stations can transmit and receive at the same time. Example: mobile phones.

2.6. Types of Connection

A network is two or more devices connected through links. A link is a communications pathway that transfers data from one device to another. For visualization purposes, it is simplest to imagine any link as a line drawn between two points. For communication to occur, two devices must be connected in some way to the *same link* at *the same time*. There are two possible types of connections: point-to-point and multipoint.

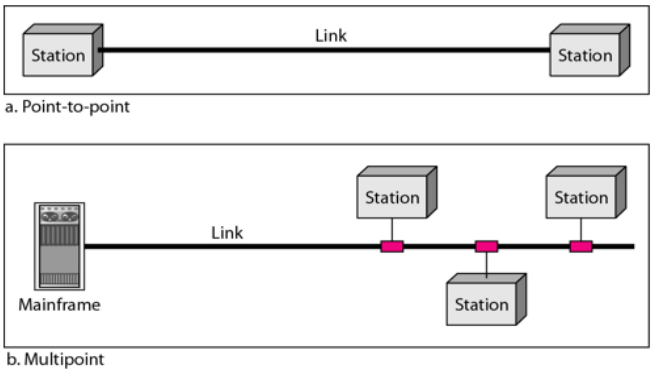
1. Point-to-Point connection:

A point-to-point connection provides a dedicated link between two devices. The entire capacity of the link is reserved for transmission between those two devices. Most point-to-point connections use an actual length of wire or cable to connect the two ends, but other options, such as microwave or satellite links, are also possible (see Figure 2a). When you change television channels by infrared remote control, you are establishing a point-to-point connection between the remote control and the television's control system.

2. Multipoint connection:

A multipoint (also called multidrop) connection is one in which more than two specific devices share a single link (see Figure 2b). In a multipoint environment, the capacity of the channel is shared, either spatially or temporally. If several devices can use the link simultaneously, it is a spatially shared connection. If users must take turns, it is a timeshared connection.

Figure 2. ***Types of connections: point-to-point and multipoint***



2.7. Network Hardware

Several hardware devices used in networks.

1- Hub

An unintelligent network device that sends one signal to all of the stations connected to it. All computers/devices are competing for attention because it takes the data that comes into a port and sends it out all the other ports in the hub. Traditionally, hubs are used for star topology

networks, but they are often used with other configurations to make it easy to add and remove computers without bringing down the network. Resides on Physical Layer of the OSI model

2- Switch

Split large networks into small segments, decreasing the number of users sharing the same network resources and bandwidth. Understands when two devices want to talk to each other, and gives them a switched connection. Help prevent data collisions and reduce network congestion, increasing network performance. Most home users get very little, if any, advantage from switches, even when sharing a broadband connection. Resides on Data Link Layer of the OSI model.

3- Bridge

Connects two LANs and forwards or filters data packets between them. Creates an extended network in which any two workstations on the linked LANs can share data. Transparent to protocols and higher level devices like routers. Forward data depending on the Hardware (MAC) address, not the Network address (IP). Resides on Data Link Layer of the OSI model.

4- Repeater

Used to boost the signal between two cable segments or wireless access points. Cannot connect different network architecture. Does not simply amplify the signal, it regenerates the packets and re-times them. Resides on Physical Layer of the OSI model.

5- Router

A device that connects any number of LANs. Uses standardized protocols to move packets efficiently to their destination. More sophisticated than bridges, connecting networks of different types (for example, star and token ring). Forwards data depending on the Network address (IP), not the Hardware (MAC) address. Routers are the only one of these four devices that will allow you to share a single IP address among multiple network clients. Resides on Network layer of the OSI model.

6- Network Interface Cards (NICs)

Puts the data into packets and transmits packet onto the network.

2.8. Network Model: TCP/IP Protocol Suite

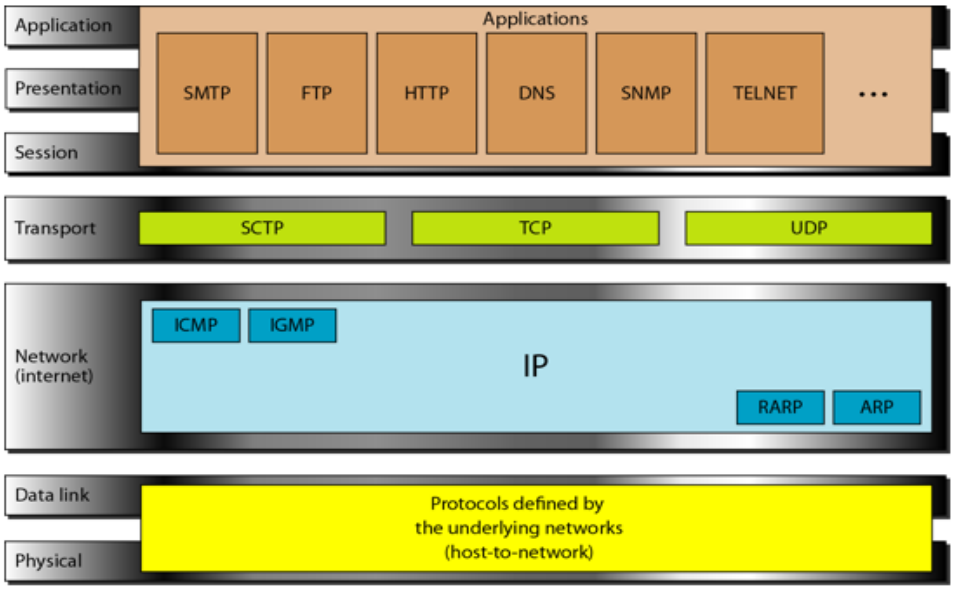
The TCP/IP protocol suite is a layered hierarchal model. The term hierarchical means that each upper-level protocol is supported by one or more lower-level protocols.

Therefore, the layers in this model is serves each other. The original TCP/IP protocol suite was defined as having four layers: host-to-network, internet, transport, and application Figure 3.

TCP/IP is a hierarchical protocol made up of interactive modules, each of which provides a specific functionality; however, the modules are not necessarily interdependent.

The layers of the TCP/IP protocol suite contain relatively independent protocols that can be mixed and matched depending on the needs of the system.

Figure 3. *TCP/IP and OSI model*



At the transport layer, TCP/IP defines three protocols: Transmission Control Protocol (TCP), User Datagram Protocol (UDP), and Stream Control Transmission Protocol (SCTP).

At the network layer, the main protocol defined by TCP/IP is the Internetworking Protocol (IP); there are also some other protocols that support data movement in this layer.

2.9. Internetworking Protocol (IP)

The Internetworking Protocol (IP) is the transmission mechanism used by the TCP/IP protocols. It is an unreliable and connectionless protocol-a best-effort delivery service. The term best effort means that IP provides no error checking or tracking. IP assumes the unreliability of the underlying layers and does its best to get a transmission through to its destination, but with no guarantees.

IP transports data in packets called datagrams, each of which is transported separately. Datagrams can travel along different routes and can arrive outof sequence or be duplicated. IP does not keep track ofthe routes and has no facility for reordering datagrams once they arrive at their destination.

The limited functionality of IP should not be considered a weakness, however. IP provides bare-bones transmission functions that free the user to add only those facilities necessary for a given application and thereby allows for maximum efficiency.

2.10. IP address : Logical Address

Network address: This is the designation used in routing to send packets to a remote network—for example, 10.0.0.0, 172.16.0.0, and 192.168.10.0.

In the 1970's, the Transmission Control Protocol (TCP) is developed, to provide both Network and Transport functions. When this proved to be an inflexible solution, those functions were separated - with the Internet Protocol (IP) providing Network layer services , and TCP providing Transport layer services.

Together, TCP and IP provide the core functionality for the TCP/IP or Internet protocol suite.

IP provides two fundamental Network layer services:

Logical addressing – provides a unique address that identifies both the host, and the network that host exists on.

Routing – determines the best path to a particular destination network, and then routes data accordingly.

IP was originally defined, and has been revised several times. IP Version 4 (IPv4) was the first version to experience widespread deployment'

IPv4 employs a 32-bit address, which limits the number of possible addresses to 4,294,967,296.

IPv4 will eventually be replaced by IP Version 6 (IPv6), due to a shortage of available IPv4 addresses.

A core function of IP is to provide logical addressing for hosts. An IP address provides a hierarchical structure to both uniquely identify a host, and what network that host exists on.

An IP address is most often represented in decimal, in the following format:

158.80.164.3.

An IP address is comprised of four octets, separated by periods:

First Octet	Second Octet	Third Octet	Fourth Octet
158	**80**	**164**	**3**

Each octet is an 8-bit number, resulting in a 32-bit IP address.

The smallest possible value of an octet is 0, or 00000000 in binary. The largest possible value of an octet is 255, or 11111111 in binary.

The above IP address represented in binary would look as follows:

First Octet	Second Octet	Third Octet	Fourth Octet
10011110	01010000	10100100	00000011

3. SYSTEM DESIGN AND IMPLEMENTATION

3.1. Introduction

In this chapter, a general overview of the system will be given. An algorithm will be explained, and the work of the system in details, and finally, the forms of the system will be explained.

3.2. General System Overview

The proposed system is a chat system that serves some users those need to communicate with each other. The system is based on the principle of securing internal communication between a group of beneficiaries based on the following:
The system exploits the router's transmission using the IP addresses provided by the device. The connection is free where there is no need for a connection to the Internet.

The system provides secure connection because communication is specifically determined by the IP addresses provided by the router. The users have contact by: Text messages, Voice dialing and import text files in full and send them via the system.

The system can create a collective chat rooms where participants (more than two participants) can communicate together. The proposed system met all the network advantages and criteria that are discussed in chapter two.

The system workspace is windows8 and using Visual Studio.

3.3. Proposed System in Details

The system consists of two main parts:
- Sending voice over IP address and receiving voice data over TCP.
- Sending messages via IP address and receiving text messages over TCP.
For voice system, it relies on voice data streams through RTP Routing Transfer Protocol (network protocol for the delivery of voice and video over TCP networks, used in media messages, telephone communications and internet TV services).

The sound system consists of two parts (CLIENT, SERVER) where SERVER can be run on the computer and IP address is set to the user's device. So that customers covered by the network can know this IP address. For the CLIENT part, IP address is assigned to the parties to be contacted.

3.3.1. Proposed System Algorithm

The algorithm of the proposed system is shown in the Figure 4.

Algorithm chat over IP address

Step 1: find out the IP address for the devices that connected to the router

Step 2: set out the jitter buffer to an appropriate amount (the same for all of the participants).

Step 3: for the server part do the following substeps:

a. **set IP address in the appropriate filed**

b. **set port number, a dedicated one**

Step 4: for the client part do the following substeps:

a. **set IP address in the appropriate filed**

b. **set port number, a dedicated one**

Step 5: choose from the following:

a. **start a conversation according the users that their IP addresses were set in step 3.**

b. **Start sending written messages according the users that their IP addresses.**

Step 6: add new participants if any for the chat conversation

Figure 4. Proposed System Algorithm

3.3.2. System Details

1. Voice Chat Part

This is a proprietary part of the project to send and receive audio data by TCP. This application streams the audio data not by multicast but by TCP. So there is assurance that there is no data lost and it can be transferred over subnets and routers away.

The server can be run on the local PC. The current IP4-Address may be obtained by with help of running cmd.exe (command prompt) and typing "ipconfig". A static IP-Address should be used, so that possible clients do not have to change their settings after reconnecting some days later. The clients must connect to the IP4-Address and port configured on the running server. The server can be run in silent mode (no input, no output) just transferring audio data between all connected clients.

Choose a free port that is not used by another application. The connection within LAN will be established.

Figure 5 shows the form of the system for the server part at voice chat system.

The same strategy reused for the client part, as Figure 6 shows.

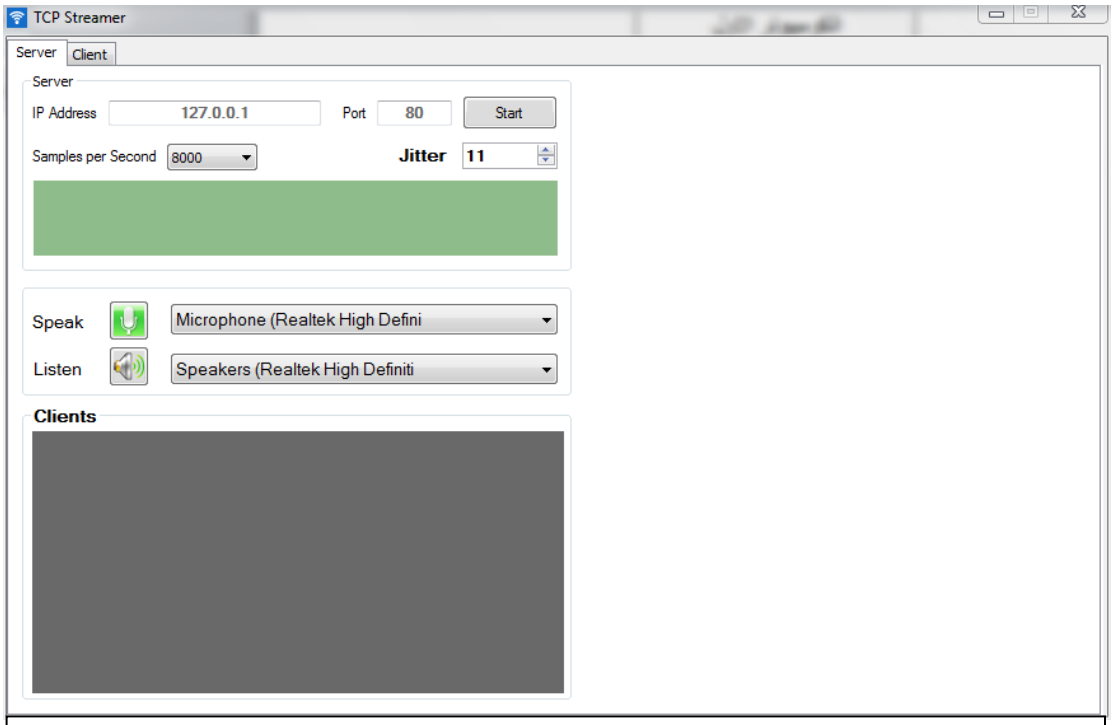


Figure 5. Server Part of the Voice Chat

For the client part there must be different information about the IP address and the port number.

For both the client and server there exist two buttons, one for the microphone and another for the speaker. Via these two buttons the user can mute his microphone and can mute the speaker for the other participant.

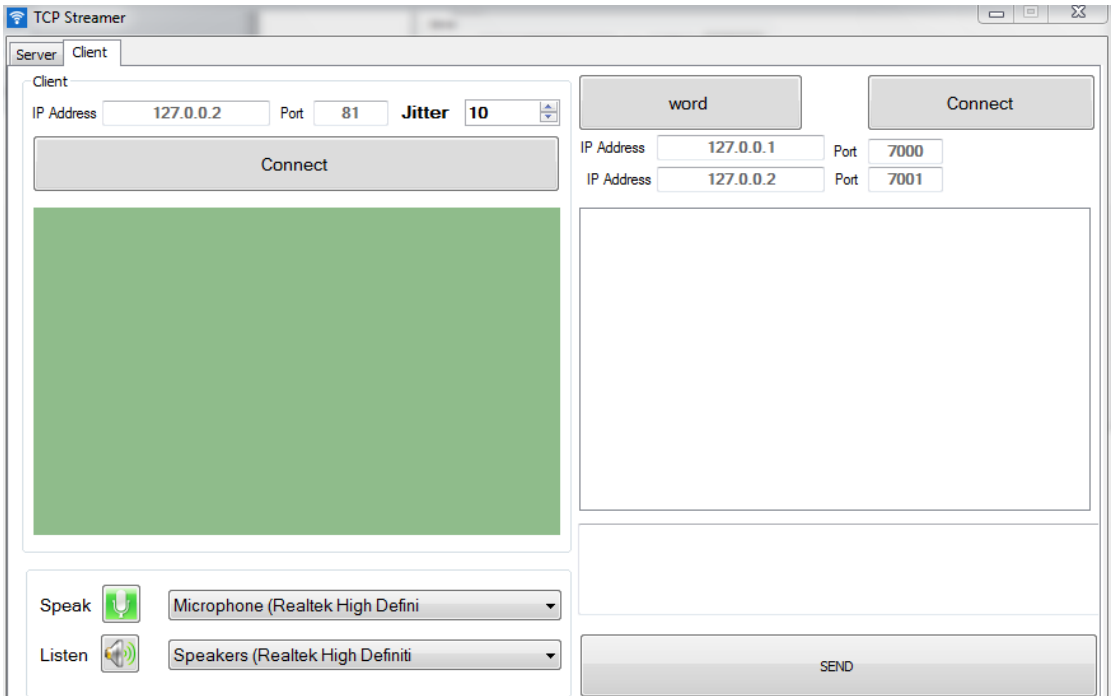


Figure 6. Client Part of the Voice Chat

Setting Jitter field

Because of network traffic and time clock differences, there is an importance to use Jitter-Buffers to compensate data transfer. The Jitter-Buffer can be set for each server, so all clients will use the same amount. One Jitter-Buffer represents one data-packet, included in a TCP-Stream. The server starts playing, when the Jitter-Buffer reaches the half of maximum. This can be watched in the progress bar which is shown for each client Figure 7. The more Jitter-Buffers set, than more delay will occur. The TCP Streamer can be run as client or as server. One server can handle one or more clients.

The Jitter Buffer is designed to handle the data, when half of the maximum is reached. After an overflow or underflow, the buffer tries to get back to this value.

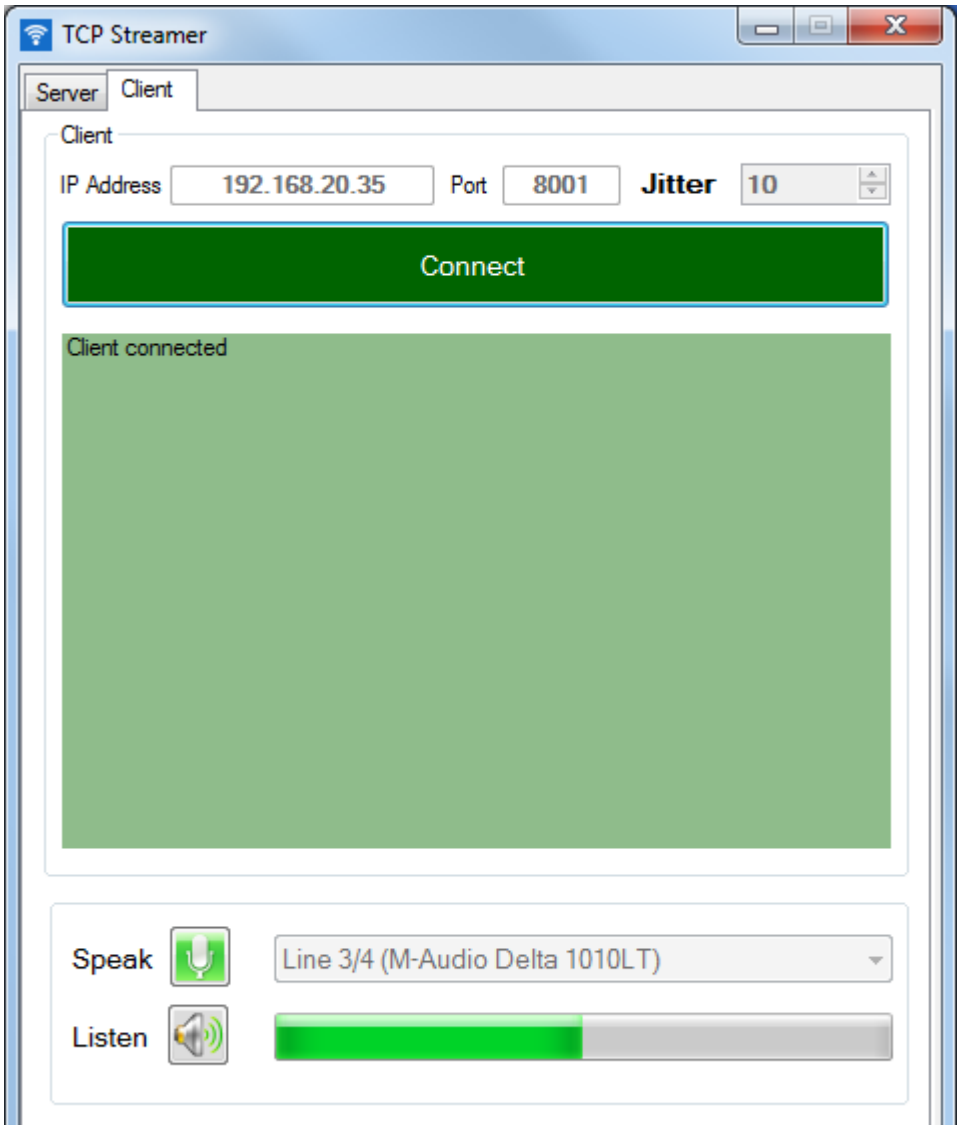


Figure 7. Voice Chat during connection

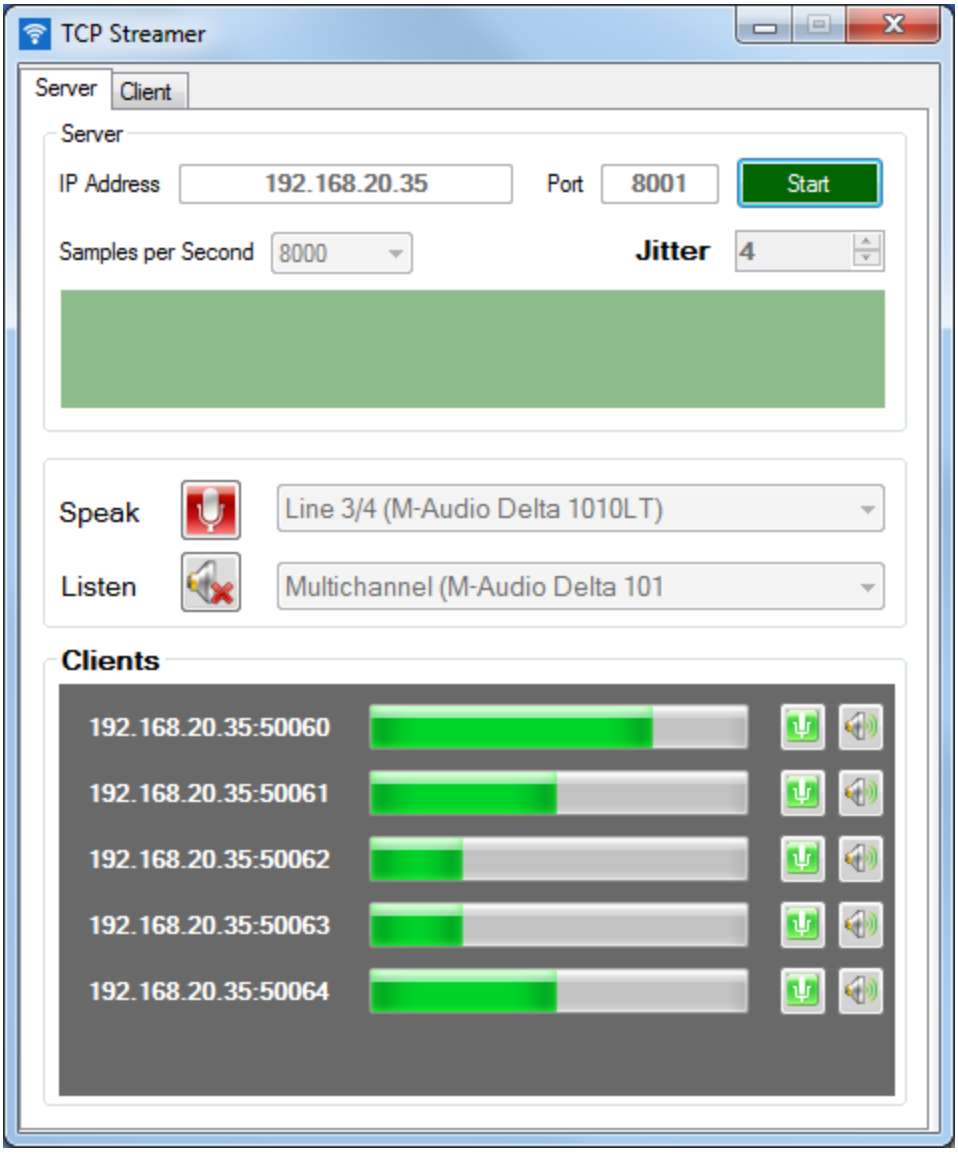
After the client is connected, the speaker combo box changes to a progress bar showing the value of incoming data. The Quality depends on Server-Configuration. The Jitter-Buffer client sides is only important for the delay of incoming data.

Running as a server, can be waited for one or more clients. Choosing the microphone and listen device if wanted, but the server could be run without hearing or speaking server sides, so that only the clients speak to each other. Each client can be muted exclusive (Speaker and Micro).

The IP-Address must be the address of the computer. The port number should not be used by other applications. The Jitter-Buffer value server sides is important for the delay of all connected clients. Use the lowest value as possible. The server has to mix all data from all clients, so it should choose a performance workstation on which to run the server.

2. Text Message Part

This connection is performed by adding IP address and port number for all users of the system, by pressing on the button (connect) in order to establish a connection.



This part of the system contains two facilities:

a. Connecting the users during text messages, for any number of the message or how long of it. Sending and receiving the messages via the system by clicking the send button.
b. Sharing text files, during the connection among users, the system provides good service of sharing an entire text file document by sending it from one user to all others.

3.4. System Environment

The system is designed and implemented on PC with Windows operating system with Visual Studio 2012. By using all the facilities of this powerful programming language, the system has been built.

4. CONCLUSIONS AND FUTURE WORK

4.1. Conclusions

The proposed system is providing connection according to an IP address. Simple things can be recorded as conclusion.

1. The proposed system provides low cost communications over the IP address rather than using complex and more expensive hardware devices.
2. The proposed system provides the creating of the multiple user chat room, that is more than two users can connect for each other.
3. The system provides free communication between a limited range of beneficiaries through the formation of an internal network, which can be employees and team leader, teacher and students or any small group need to share information.
4. The system provides secure, reliable, and less expensive communication.
5. The system provides text files sharing among users.

4.2. **Future Work**

1. As the system using message chat, the language is used is the English language only. Developing this limitation by adding facilities for translating for other languages such as Arabic.
2. According to resource sharing, the system can be developed in order to share image files among multiple users.
3. Connecting the small LAN that is served by the system to the outer WAN such as Internet in order to strong and expand the connection.

REFERENCES

[1] Behrouz A. Forouzan, "*Data Communications and Networking*", McGraw-Hill, 4th edition, 2007.

[2] Larry L. Peterson & Bruce S. Davie, "*Computer Networks*", a system approach, Elsevier Science (USA), 2003.

[3] Gilbert Held, "*Ethernet Networks: Design, Implementation, Operation, Management*", John Wiley & Sons Ltd, 2003.

[4] Raymond B. Jennings and others, "*A Study of Internet Instant Messaging and*

Chat Protocols", IBM T.J. Watson Research Center, 2010

[5] J. Rosenberg et al., "*SIP: Session Initiation Protocol*", IETF RFC 3261, June 2002.

[6] B. Campbell, R. Mahy, and C. Jennings, "*The Message Session Relay Protocol*", draft-ietf-simple-message-sessions-11.txt, July 2005.

[7] R. Mahy, "*Benefits and Motivation for Session Mode Instant Messaging*", draft-mahy-simple-why-session-mode-01.txt, Feb. 2005.