# Using IP Multicast Distribute Encryption Message

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## Abstract

There are many aspects have been discussed in this study for IP multicasting. It can be used in many applications such as chatting in local area network, marketing and also can be used in educational services. This paper shows such IP multicasting of how create and use it in many application. This paper also discussed many issues for IP multicast such as adding and leaving the join group, advantages and disadvantages of IP multicasting. The prototype has been applied in WLAN by sending secure messages from one client to many recipients. Furthermore, it shows the time between many recipients for sending and receiving such messages based one simple security algorithms for more security.

**Keyword:** *Encryption Message, Client Server , Distributed System, Information Technology.*

## 1. Introduction

Distributing, as a word it used with a different term such as distributed system, distributed programming and distributed algorithm, in fact it referred to computer networks. Where computers are physically distributed individually within some geographical area and make a connection between them. Nowadays these terms are used in a much wider sense, even referring to independent processes that run on the same computer and interact with each other by sending messages [2]. Generally, the communication between two computers (client and server) needs to be reliable. Therefore, every device connected to a distributed systems network is assigned a unique number known as an Internet Protocol (IPv4 or IPv6) address. The IP is part of the communication protocols that allow communicating between the devices on the networks [1].

There are three main types of IPv4 addresses: Unicast, broadcast, and multicast . Unicast id designed to transfer a packet between two hosts (node) in the network. A broadcast is used to send packets to sub network domain. A multicast address is designed to enable delivery of packets to the set of hosts that have been configured as a group address from 244.0.0.0 to 239.255.255.255 in various sub networks. The main disadvantages of multicast are not connection oriented [12]. A multicast is delivered to destination group member with the same “best-effort” reliability as a slandered unicast IP. The main difference between a multicast IP packet and a unicast IP packet is the presence of a “group address” in the Destination Address field of the IP header [2].

Each host is free to join or leave using a datagram socket as a join group at any time. That’s mean no restriction on the physical location or how many numbers of members in a multicast group. The main device on the internet is router that uses the group membership protocol to learn about the existing of hosts in the network that attached in its sub network [15].

As an example in most traditional Internet applications, such as web browsers and email, operate between one sender and one receiver. In other cases, we need emerging applications; one sender will transmit to a group of receivers simultaneously. These features will help to increase your organization's ability to communicate and collaborate, leveraging more value from your network investment. Examples are the packets that need to be transmitted to employees, video and audio conferencing for remote meetings and telecommuting, replicating databases and web site information, live transmission of multimedia training and university courses, communication of stock quotes to brokers, updates on the latest election results, collaborative computing, transmission over networks of live TV or radio news and entertainment programs, and many others.

These applications should need in advance for traffic handling to overcome to overcome bottlenecks. We can say in simple here that IP Multicast is an efficient, standards-based and less time solution with broad industry support for group communication. IP Multicast is an extension of IP under the class multicasting name, the internetworking protocol that is used on the Internet. With IP Multicast, applications send one copy of the information to a group address, reaching all recipients who want to receive it. Without multicasting, the same information must be either carried over the network multiple times, one time for each recipient, or broadcast to everyone on the network, consuming unnecessary bandwidth and processing, and/ or limiting the number of participants. Group of recipients will be involved in this participate during the sessions; only those receivers that join the group multicasting actually receive the traffic for that group's session.

IP Multicast technologies address the needed mechanisms at different levels in the network and internetworking infrastructure to efficiently handle group communications. Under development since the early 1990's by leading researchers and the industry, IP Multicast is an important advance in IP networking. All of these application that involve with the IP multicasting can be applied in easy work and we have added here a simple security for encryption the packet that send to many recipients to make it more secure for exchange data or for future development.

One of the main challenges that face the time needing to send messages from one sender to group those receive this message, this way by using unicast takes more time for sending to the group because it needs to send one message at each time to each one of the group. So when sends message to group contain five clients, it will need to send this message five times. On the other hand, with IP Multicast it would be easy to support many of the recipients. By multicast will reduce time so it can pervious message send only one, and another challenge to ensure securing multicast communication is confidential information that is transferred or receive enable data multicasting to verify, that the data contained originated should be sent to the user without another ,problem becomes more complex in common, in other word encryption of a document in a secret key constitutes a signature strong authentication of document and weak against repudiation , in particular send to a group of recipients.

The objective of this paper proposes distribute encryption message based on IP multicast .with IP multicast it would be easy to support many of recipients as it achieved the speed and secrecy in the transfer of information. The main research objectives of this study are :To measure the performance for the group hosts based on response time between the sender and the many receivers, To implement the secure packet for sending the encryption messages between many hosts using some encryption algorithm and to understand the

difference between broadcast, multicast, and unicast and how the Protocol Independent Multicast Protocols (IMP) to join the new client with a group.

This study provides an executive introduction to IP Multicast to be used among many groups. It presents the basic concept for IP multicast; highlights its advantages and disadvantages, and provides implemented to secure sending packet based on encryption algorithms. It also shows network performance by joining and adding new users simultaneously and the algorithm can show the efficient response time among many hosts even in a second or milli-seconds. Whether one is a user of TCP/IP-based technologies or an organization interested for implementing or taking advantages of IP Multicast within product or service, this study will be beneficial and lucrative for all of them. This study shows "administratively scope of IPv4 multicast space" to be in the range of IPv4 from 239.0.0.0 to 239.255.255.255. The application has been applied practically using local area network connected with the internet. The application put into use the safe type language “Java programming” to operate the whole program.

## 2. Literature Review

### 2.1 Multicast Protocols

The most common transport layer protocol to use multicast addressing is User Datagram Protocol (UDP). By its nature, UDP is not reliable—messages may be lost or delivered out of order. Reliable multicast protocols such as Pragmatic General Multicast (PGM) have been developed to add loss detection and retransmission on top of IP multicast.

IP multicast is widely deployed in enterprises, commercial stock exchanges, and multimedia content delivery networks. A common enterprise use of IP multicast is for IPTV applications such as distance learning and televised company meetings [30].

Liao et.al. and Wu et. Al .have proposed to facilitate the loss recovery through intermediate nodes in order to avoid latency and messaging overhead [1,2]. Xu et. al. have been used an approach to provide quality of service to video applications [3].

Pagani et. al. have adopted an approach that adaptively chooses flooding and recovery along routing tree based on the mobility [4]. Many researcher such as Almeroth et. al. develop an approach that uses flow control to ensure reliability [5].

### 2.2 Privacy in Multicast

One of the most important security concerns in multicast is maintaining privacy of communication. How do multiple network users who are in the same multicast "group" exchange data such that no one outside the group can decipher what is being sent? A natural way to guarantee this would be to have users share a common key, called the group key, and to require that all multicast transmissions from any user within the group be encrypted using that key. If they are guaranteed that the group key is known only to group members, then such an encryption protocol would trivially solve the privacy problem [28, 30].In Figure 1 this would mean transmitting to all nodes in network. In Figure 2 illustrates transmitting to all nodes but privacy in multicast.

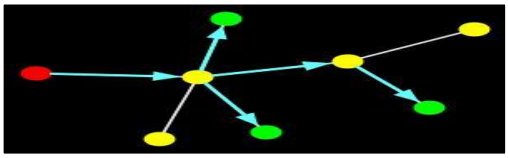

**Figure 1.Transmitting to multiple recipients using Multicast**

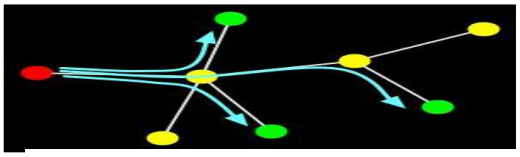

**Figure 2. Transmitting to multiple recipients using privacy in multicast**

Example researches, Brooks's et.al (2009) applied Multicast Encryption Infrastructure for Security in Sensor Networks. Designing secure sensor networks is difficult. They propose an approach that uses multicast communications and requires fewer encryptions than pair wise communications. The network is partitioned into multicast regions; each region is managed by a sensor node chosen to act as a key server. The key servers solicit nodes in their neighborhood to join the local multicast tree. The key server generates a binary tree of keys to maintain communication within the multicast region using a shared key .This approach supports a distributed key agreement protocol that identifies the compromised keys and supports membership changes with minimum system over head. They evaluate the overhead of this approach by using the number of messages and encryptions to estimate power consumption. Using data from field tests of a military surveillance application, they show that this multicast approach needs fewer encryptions than pair-wise keying approaches. They also show that this scheme is capable of thwarting many common attacks [29].

Duan and Canny (2006) presented a general framework for constructing effective multicast cryptosystems with provable security and show that a line of previous work on multicast encryption are all special cases of this general approach. They provided new methods for building such cryptosystems with various levels of security (e.g., IND-CPA, IND-CCA2).The results they obtained enable the construction of a whole class of new multicast schemes with guaranteed security using a broader range of common primitives such as OAEP. Moreover, they were show that multicast cryptosystems with high level of security (e.g. IND-CCA2) can be based upon public key cryptosystems with weaker (e.g. CPA) security as long as the decryption can be securely and effectively "shared". This constructions feature truly constant-size decryption keys whereas the lengths of both the encryption key and cipher text are independent of group size [24].

## 3. Methodology

The methodology for this work contains four phases including State problem, Sending Message, Pre-processing message and Evaluation of Model. We follow this methodology because each phase in this methodology is related to the research and scope .it is a very flexible in implementation and it will be suitable for our work. The steps of the data process are illustrated in Figure 3.

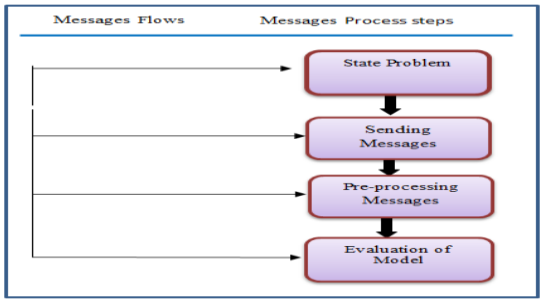


**Figure 3.Messages Process Representation**

### 3.1 State problem

The first step in general methodology is awareness of the problem. The information about problem come from many sources: new developments in industry or in a reference discipline. For this study the awareness of the challenges that face the time needing to send message from one sender to group those receive this message, this way by using unicast takes more time for sending to group because it needs to send one message at each time to each one of group . So when send message for group contain five clients, it will need five once send message .On the other hand, with IP Multicast it would be easy to support many of recipients. By multicast will reduce time so it can pervious message send only one. Also we have suggested her to send messages in more securely.

### 3.2 Sending Messages

The second phase of the methodology suggested adding security to message that sending to many hosts to protect sending message from intercept by using encryption algorithm, the encryption key can be extracted from the mathematical formula in Figure 4 shows that, the Java code of the encryption algorithm is given as Figure 5.

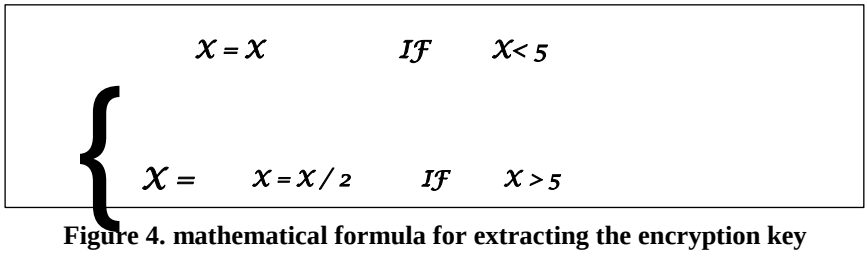


**Figure 4. mathematical formula for extracting the encryption key**

```
396          public String kaserEn(String str){
397              // Effect:  returen encryption str
398              // Require: str
399              // Modify:  str
400                          int i, intc; char c=' '; char cc;
401                          i = 0;
402                          // to create encryption key
403                          int x = str.length();
404                          while (x>5){
405                              x = x/2;
406                          }
407                          String ss="";
408                          // to ncryption
409                          while (i < str.length()){
410                          c = str.charAt(i);
411                          intc = (int) c;
412                          cc = (char) (intc + x);
413                      ss=ss+cc;
414                          i++; }
415                          return ss;
416                  }
```

**Figure 5. Java code for encryption algorithm**

This formula will receive the total length of the string (text message) from the method, and if the total number more than Five it will start divide it by Two until be less than Five. Finally the result from the formula will consider as the encryption key, and this technique ensures the changeable key, so that only receiving who has authentication can see the original message by using decryption key to break the encryption message. An application developed and designed by using the Java language, because it's suitable to build this project type and Using Java tools help to achieve flexibility for the application.

### 3.3 Pre-processing message

We develop this project by using the Java language, to show an advantage and dis-advantage for IP multicast with a simple encryption algorithm.

### 3.4 Evaluation of Model

We evaluate this work by using LAN, so we makes test for our work on LAN network that connected with router to the internet. The first step, we send message that no need to be secure (without encryption) ,all clients see the content message directly ,and repeat sending without secure (with encryption) that one client want only one client read his message and no one from the other will read the content of the message .It was successful test ,after send message with encryption that was seen for all client but no one can read the content because the encryption ,the target client was enabled to read content message after make decryption to the message.

### 3.5 Simulation model

In this methodology we will propose our work mechanism model to show message sending process from sender to group of receivers, moreover the process of sending and receiving encryption message between many hosts .Sending and receiving blind text: Sending unencrypted message to group of receivers, as well as every host receiving the message at the same time .The java code of this part of the application is presented in Figure 6.

```
331
332         public void SendRequest(){
333            // Effect: send the blind text
334            // Require: the connction is enable
335         try{
336              add = InetAddress.getByName("224.0.0.0");
337              MulticastSocket socket = new MulticastSocket();
              byte[] buffer = new byte[65535];
339              String mess = jTextField2.getText()+":"+ area.getText();
340              buffer = mess.getBytes();
341              DatagramPacket packet = new DatagramPacket(buffer,buffer.length, add, 6789);
342              packet.setData(buffer);
343              socket.send(packet);
344              area.setText("");
345              socket.close();
346                 }
347               catch(IOException io){}
348                }
```

**Figure 6. Java code for sending blind text**

Sending and receiving encrypted text: Sending encryption message to a group of receivers as Figure 7 shows, as well as every host receiving the encryption message at the same time as Figure 8 shows. The java code of this part of the application is presented in Figure 9.

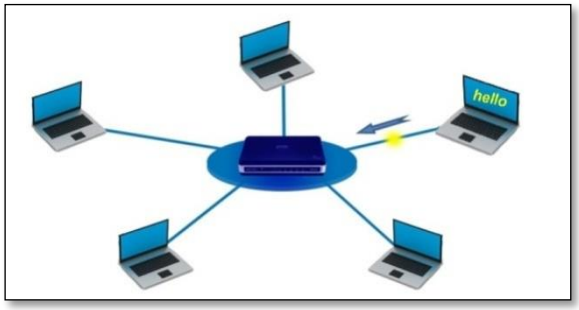


**Figure 7.explains encryption sending the message**

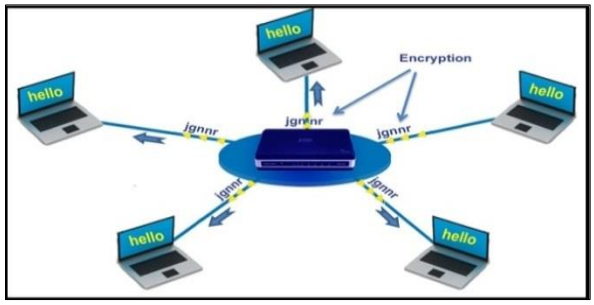


**Figure 8.explains receiving the encryption message**

```
375         public void    SendEnRequest(){
376         // Effect:  send the encryption message
377         // Require: the connection is enabled
378         try{
379              add = InetAddress.getByName("224.0.0.0");
380              MulticastSocket socket = new MulticastSocket();
381              socket.joinGroup(add);
382              byte[] buffer = new byte[65535];
383              String mess1 =  area.getText();
384              String mess=kaserEn(mess1);
385              String mess2 = jTextField2.getText()+":"+ mess;
386              buffer = mess2.getBytes();
387              DatagramPacket packet = new DatagramPacket(buffer,
388              buffer.length, add, 6789);
389              socket.send(packet);
390              area.setText("");
391              socket.close();
392              }
393               catch(IOException io){}
394                         }
```

**Figure 9. Java code for sending encryption message**

The user can send and receive the blind text as well as the encryption text as Figure10 process of sending and receiving the message between any two hosts.

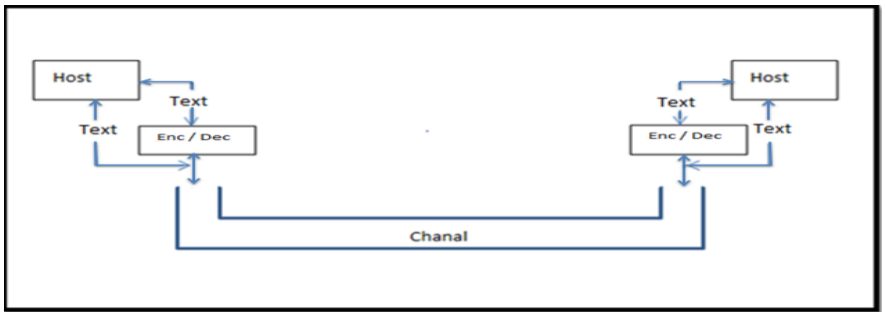


**Figure 10. sending encryption message**

## 3.6 Experimental Steps

In this part we are going to illustrate application mechanism that consists of two steps (login window and chat window) that shows as below:

### *3.6.1 Login window*

Main login interface as in the Figure 11. This application requires the user to perform an authentication procedure whereby they are required to insert a user name and password in order to use this chat application. The application will be launched when the user entered the correct username and password. However, if the user entered the wrong combination of username and password, the program will immediately show error box that contain a message to inform the user to correct the inserted username and password.

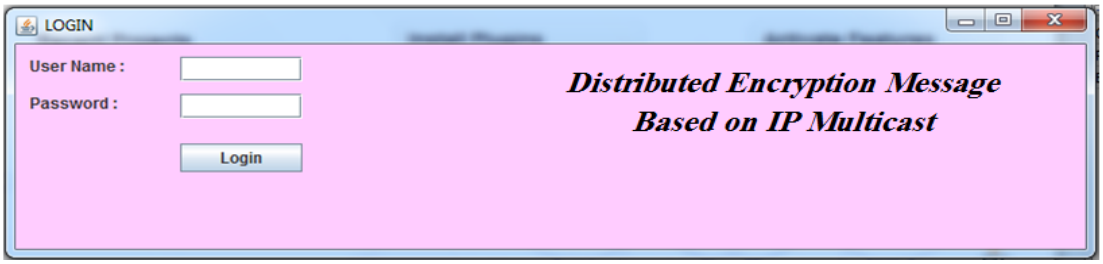


**Figure 11. login**

### 3.6.2 Chat Window

Figure 12 presents the main user interface for our chat application. The interface includes labels and buttons that increase the application's usability and ease of use.

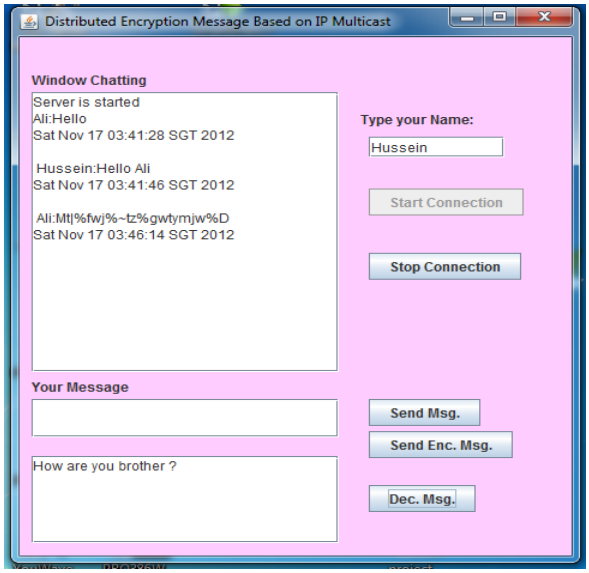


**Figure 12. application windows**

But, if the user didn't type any name to join the chat group and try to start a connection, the application will show error box that contains message to ask him to type his/her name . Users may connect to the server simply by clicking on the 'Start Connect' button provided on the main interface. When the connection successfully done, the window chatting will display "Server is started". Once a connection with the server is established, a user may have the option to continue on using text chatting by writing their message in the 'Your Message' textbox area show that in Figure 13.

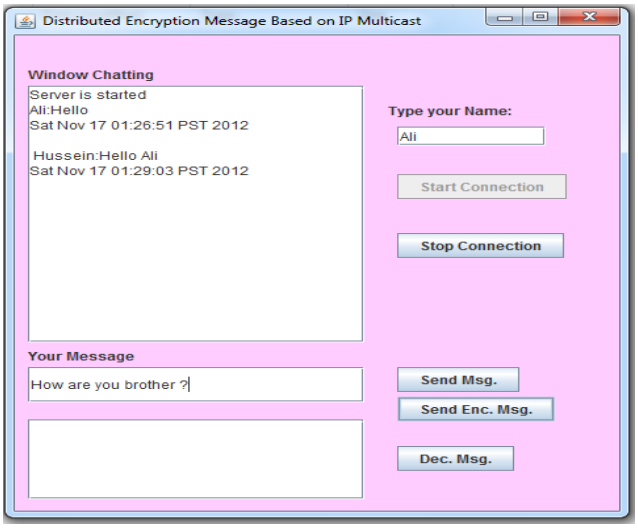


**Figure 13. Appear Message and Time**

Also, once connection with the server is established, a user may have the option to continue on using text chatting by writing their message in the 'Your Message' textbox area. After that, the user is able to use "Send Enc. Msg." to send encryption message. Every encryption message will display in window chatting. The message will not appear same once that write on the text area "Your Message" because it will encrypt in our Algorithm. Also, the encrypted message will display on the all hosts in the same samples as a Figure 14 showing that approach.

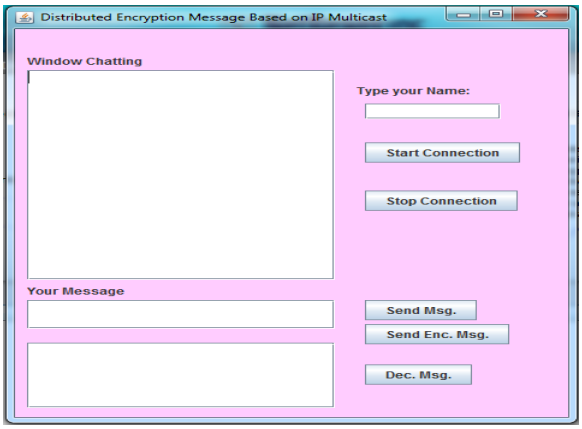


**Figure 14. Appear Encryption Message on X Host**

### 3.7 Program setup

Setup (or Installation) of a computer program (including device drivers and plugging), is the act of making the program ready for execution. Some computer programs can be executed by simply copying them into a folder stored on a computer and executing them. Other programs are supplied in a form unsuitable for immediate execution and therefore need an installation procedure. Once installed, the program can be executed again and again, without the need to reinstall before each execution.

The chat application requests two main things to work correctly. First of all, this application build under Java programming language, therefore, the user should install Java Runtime Environment (JRE) and the Java Development Kit (JDK). After that, the application can run without any error. However, the program still needs a connection to the network for connecting with a group of IP.

### 3.8 Tools

Traditionally, most communication between computers is based on the Network Protocol; therefore most network sockets are Network sockets. A network socket is an endpoint of an inter-process communication flow across a computer network. A socket API is an application programming interface (API), usually provided by the operating system, that allows application programs to control and use network sockets.

Network socket APIs are usually based on the Berkeley sockets standard. A socket address is the combination of an IP address and a port number, much like one end of a telephone connection is the combination of a phone number and a particular extension. Based on this address, network sockets deliver incoming data packets to the appropriate application process or thread.

Java is an object-oriented programming language with a built-in application programming interface (API) that can handle graphics and user interfaces and that can be used to create applications or applets. Because of its rich set of API's, similar to Macintosh and Windows, and its platform independence, Java can also be thought of as a platform in itself. Java also has standard libraries for doing mathematics as well as Java including many libraries. The java.net package provides two classes--Socket and Server Socket--that implement the client side of the connection and the server side of the connection, respectively.

### 3.9 Platform

Most developers recognize the NetBeans IDE as the original free Java IDE. It is that, and much more! The NetBeans IDE provides support for several languages (PHP, JavaFX, C/C++, JavaScript, etc.) and frameworks.

NetBeans is an open-source project dedicated to providing rock solid software development products (the NetBeans IDE and the NetBeans Platform) that address the needs of developers, users and the businesses who rely on NetBeans as a basis for their products.

## 4. Finding Results and Conclusion

The objective of this project was to design and implement a chat application based on the multicast technology, which allows sending and receiving instant messaging and sending the encryption messages between many hosts using some encryption algorithm. All these operations were under wireless local area network (WLAN). The application client side was implemented on the windows platform using the Java language and the Socket library file, while the chat application was implemented on Netbeans IDE 7.1 using a Java language. [17]

The main results that we obtained in this project; it is success to send and receive the message based on IP multicasting technique. The message can be send from one client to group of receivers, as well as anyone can join the multicast group by getting the application.

Moreover, the security issue is a second object that we have achieved in this project. Where, the clients can receive cipher text, but who can send that text and decrypting it just that who has the application that we have suggested as clearly shown in Figure 15. This application contain encryption algorithm to provide high secure level for top secrete text.

There are many aspects have been discussed in this study for IP multicasting. It can be used in many applications such as chatting in local area network, marketing and also can be used in educational services. This paper shows such IP multicasting of how create and use it in many application. This paper also discussed many issues for IP multicast such as adding and leaving the join group, advantages and disadvantages of IP multicasting. The prototype has been applied in WLAN by sending secure messages from one client to many recipients. Furthermore, it shows the time between many recipients for sending and receiving such messages based one simple security algorithms for more security.

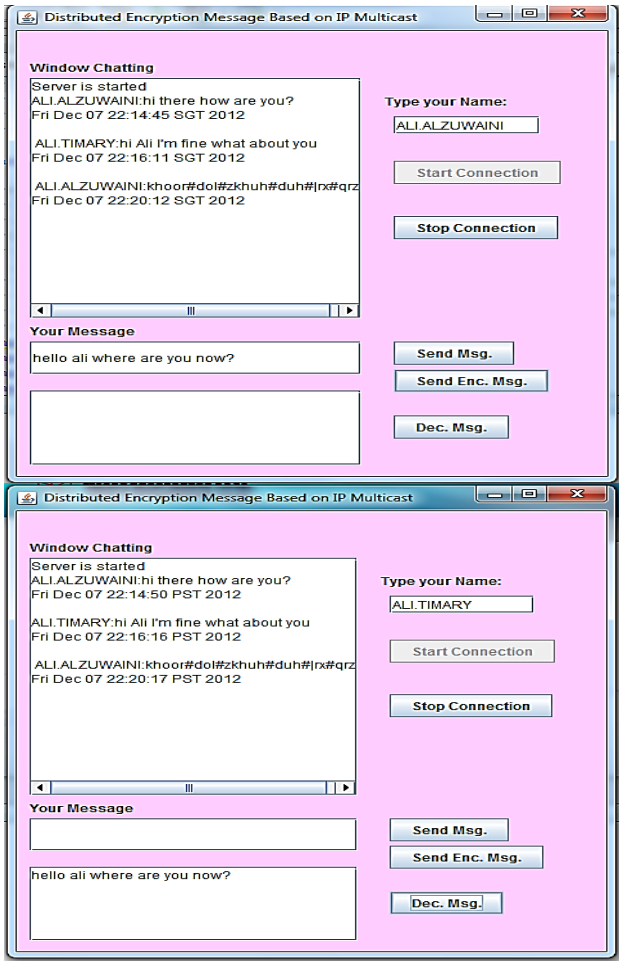


**Figure 15. Send and Receive Encrypted Message**

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