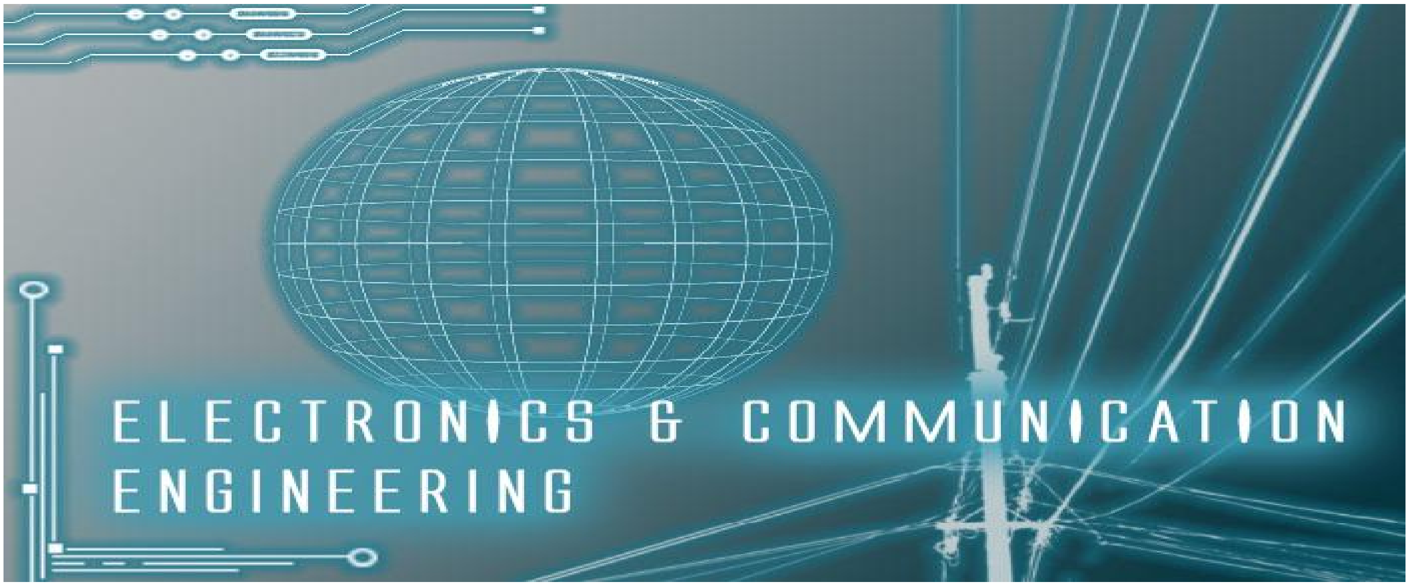
# Varuvan Vadivelan Institute of Technology

Dharmapuri – 636 703

## LAB MANUAL

| | |
|---|---|
| **Regulation** | **: 2013** |
| **Branch** | **: B.E. – ECE** |
| **Year & Semester** | **: III Year / VI Semester** |

# EC6611- COMPUTER NETWORKS LABORATORY



# ANNA UNIVERSITY CHENNAI

# REGULATION - 2013

## EC6611- COMPUTER NETWORKS LABORATORY

1. Implementation of Error Detection / Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Go back-N and selective repeat protocols
4. Implementation of High Level Data Link Control
5. Study of Socket Programming and Client – Server model
6. Write a socket Program for Echo/Ping/Talk commands.
7. To create scenario and study the performance of network with CSMA / CA Protocol and compare with CSMA/CD protocols.
8. Network Topology - Star, Bus, Ring
9. Implementation of distance vector routing algorithm
10. Implementation of Link state routing algorithm
11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms Using NS
12. Encryption and decryption.

**TOTAL : 45 PERIODS**

# INDEX

## INTRODUCTION

## COMPUTER NETWORKS LABORATORY

A computer network is an interconnection of various computers to share software, hardware, resources and data through a communication medium between them. A Computer Networking is a set of autonomous computers that permits distributed processing of the information and data and increased Communication of resources .Any Computer Networking communication need a sender, a receiver and a communication medium to transfer signal or Data from sender to the receiver. We need sender, receiver, communication channel, protocols and operating system to establish a computer networking. A networks model describes the organization of various computers in a network for using resources.

A computer networks communication can be based on centralized, distributed or collaborative computing. Centralized computing involves many workstations or terminals, connected to one central mainframe or other powerful computer. Distributed computing interconnects one or more personal computers and allows various services like Data sharing, hardware sharing resources sharing or network sharing. The collaborative computing is the combination of centralized and distributed computing.

### 1. Centralized computing.

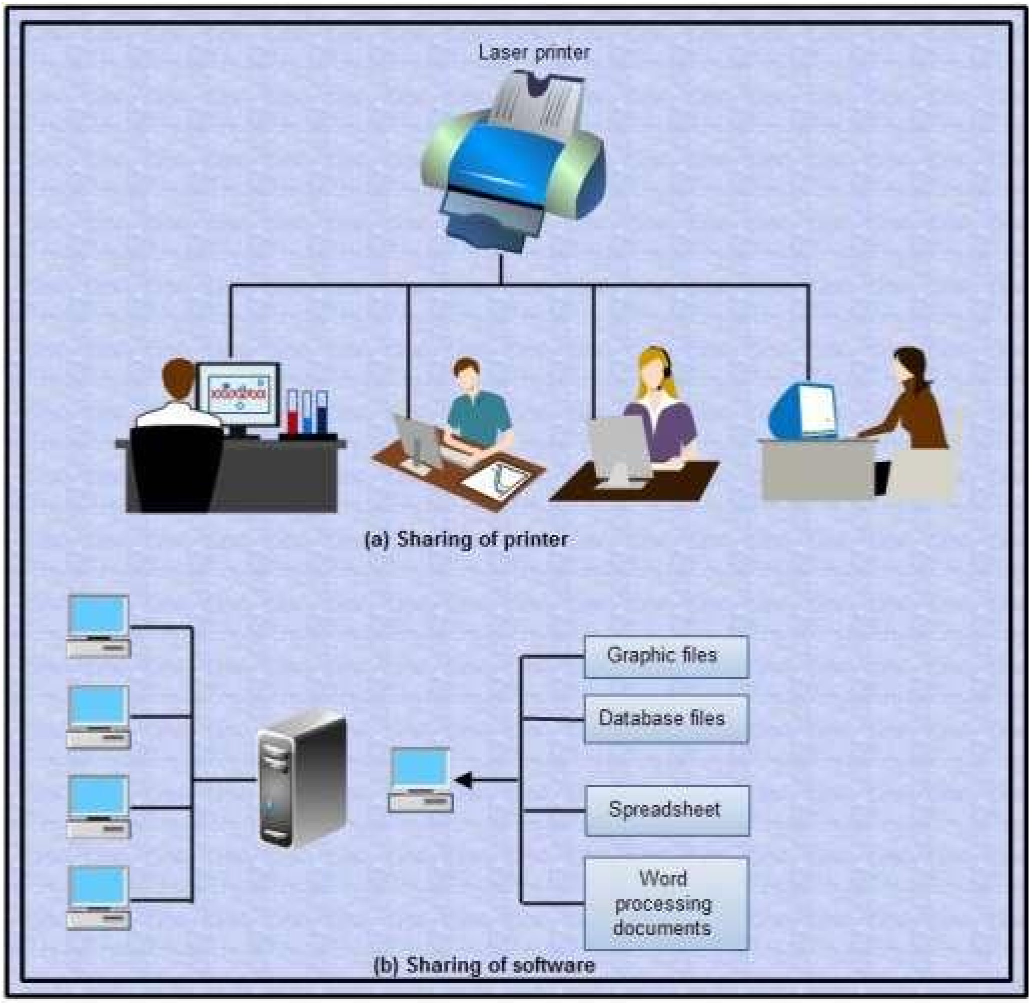
- It is also known as client-server computing.
- In this type of system, multiple computers are joined to one powerful mainframe computer.
- The server or mainframe computer has huge storage and processing capabilities.
- The computers that are connected to the mainframe or server are called Clients or Nodes.
- These nodes are not connected to each other; they are only connected to server.

### 2. Distributed computing

- If one computer can forcibly start, stop or control another computers are not autonomous. A system with one control unit and many slaves, or a large computer with remote printers and a terminal is not called a computer network; it is called a Distributed System.
- Distributed computing means that the task is divided among multiple computers.
- Distributed computing interconnects one or more personal computers or Workstations.
- In distributed computing, the nodes are capable of processing their own data and rely on network for services other than data processing.
- It allows various services like network sharing, hardware sharing and file sharing.

### 3. Collaborative computing / Hybrid computing

- It is the combination of centralized and distributed computing



*Hybrid computing*

In collaborative computing, the nodes are able to serve the basic needs of their users but they are dependent on some other computers for processing some specific request.

**Computer Network Classification**:

The local area network communication can be constructed by using server based model or peer to peer model. In peer to peer networks, the individual clients share data and resources but no one computer is treated as server. Networks can be classified into local area Networks, metropolitan area Networks and wide area networks. Local area network is the small network that covers a small area of Network. Metropolitan area networks are created by combining various local area networks. Wide area networks are the biggest networks that provide connectivity across the globe. Networks provide the benefits of exchanging information or Data, sharing resources, reducing system costs, increased reliability and flexible working environment.

## Computer Network topology:

The physical arrangement of computers in a communication network is called as topology. In star topology, every system on the network is connected to a central controller called Hub and all the data is transmitted through this. Star topology is very easy to install and configure. In bus topology, a single cable acts as a backbone of the communication network and all the nodes or computers are attached to it by using T connectors.

## Uses of Computer Networks:

The computer networks are playing an important role in providing services to large organizations as well as to the individual common man.

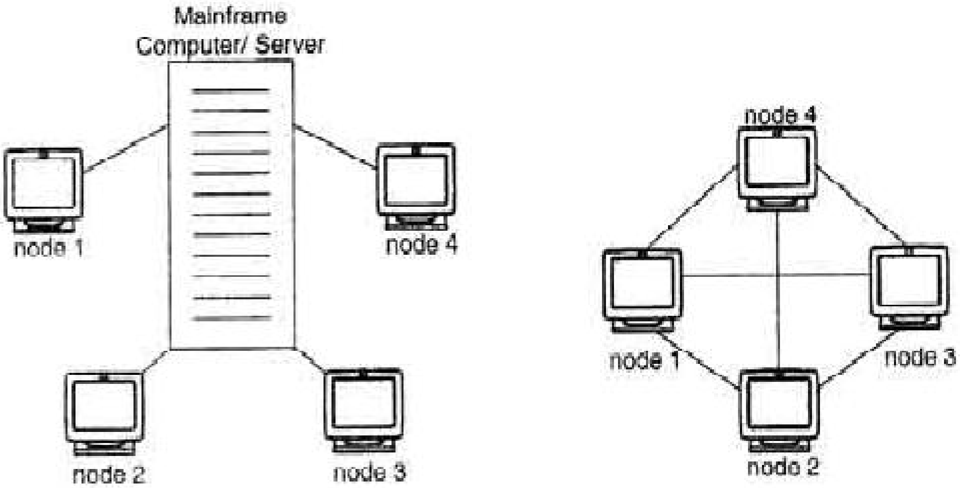
## Service Provided by the Network for Companies:

- Many organizations have a large number of computers in operation. These computers may be within the same building, campus, city or different cities.
- Even though the computers are located in different locations, the organizations want to keep track of inventories, monitor productivity, do the ordering and billing etc.
- The computer networks are useful to the organizations in the following ways:

1. Resource sharing.
2. For providing high reliability.
3. To save money.
4. It can provide a powerful communication medium.

**1. Resource sharing**

- It allows all programs, equipments and data available to anyone on the network irrespective of the physical location of the resource and the user.



*Resource sharing*

**2. High reliability due to alternative sources of data:**

- It provides high reliability by having alternative sources of data. For e.g. all files could be replicated on more than one machines, so if one of them is unavailable due to hardware failure or any other reason, the other copies can be used.

- The aspect of high reliability is very important for military, banking, air traffic control, nuclear reactor safety and many other applications where continuous operations is a must even if there are hardware or software failures.

**3. Money saving:**

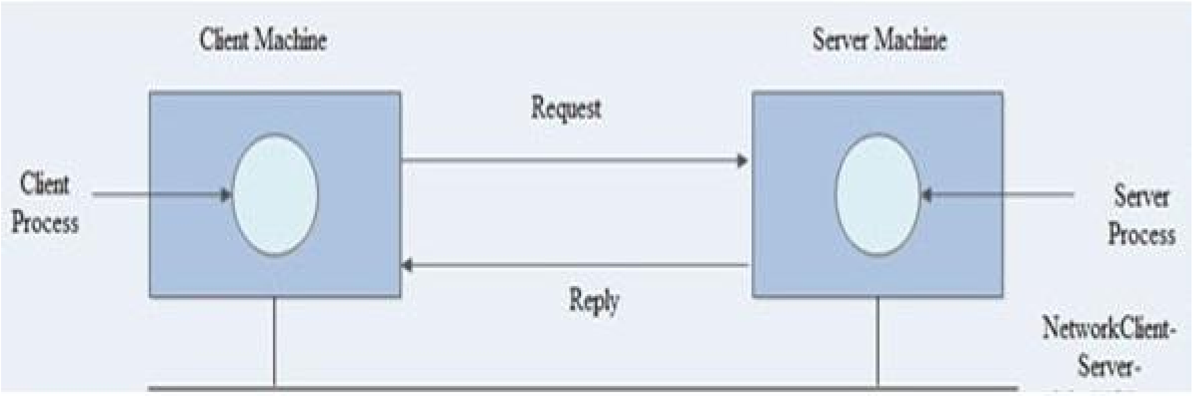
- Computer networking is an important financial aspect for organizations because it saves money.

- Organizations can use separate personal computer one per user instead of using mainframe computer which are expensive.

- The organizations can use the workgroup model (peer to peer) in which all the PCs are networked together and each one can have the access to the other for communicating or sharing purpose.

- The organization, if it wants security for its operation it can go in for the domain model in which there is a server and clients. All the clients can communicate and access data through the server.

## CLIENT - SERVER BLOCK MODEL:



*Client -Server*

**Client**: The individual workstations in the network are called as clients.

**Server**: The central computer which is more powerful than the clients and which allows the clients to access its software and database is called as the server.

- Server computers typically are more powerful than client computers or are optimized to function as servers.
- The whole arrangement is called as client -server model.

**EX.NO:1**

**DATE:**

## IMPLEMENTATION OF ERROR DETECTION / ERROR CORRECTION TECHNIQUES

**AIM:**

Write a program for error detection and error correction techniques by Hamming Method using C language.

**APPARATUS REQUIERD:**

- C -editor
- Standalone desktop.

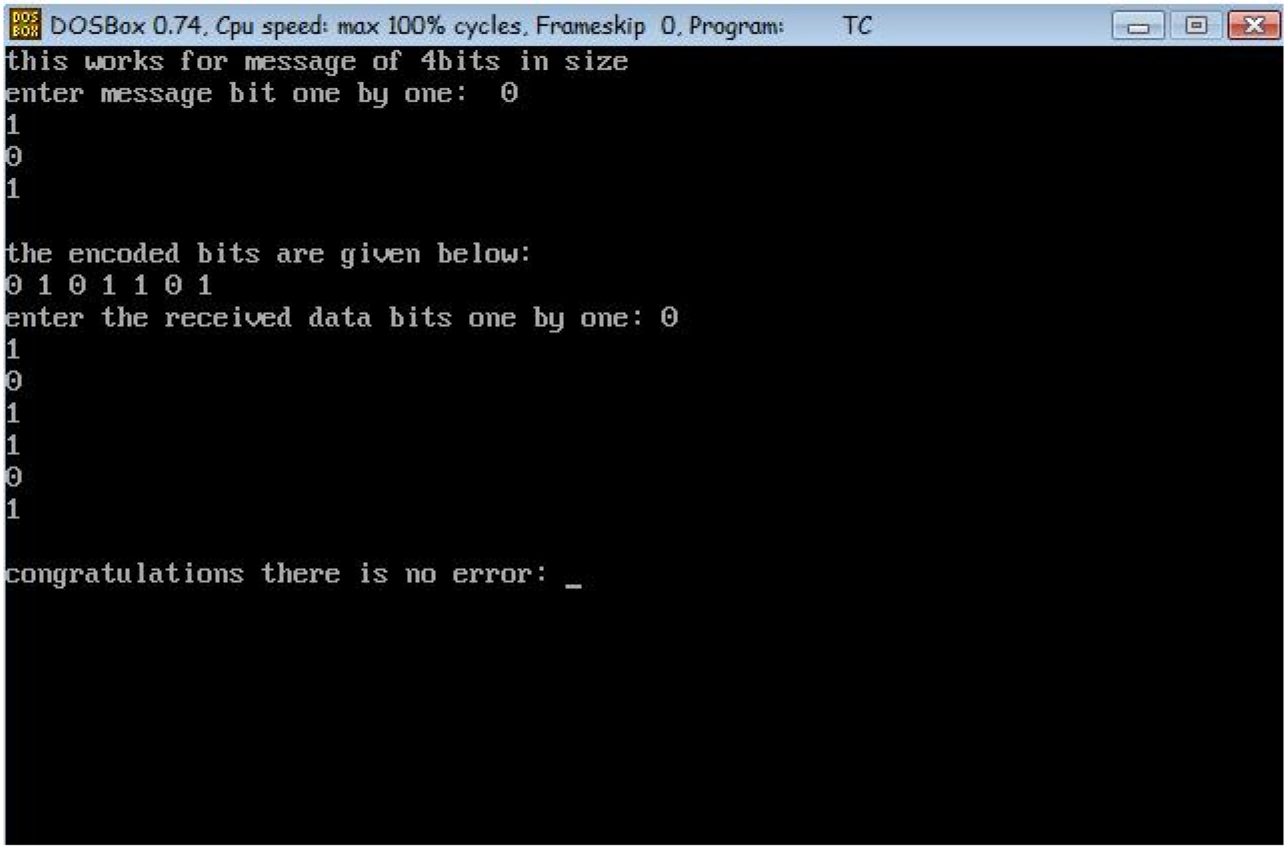
**PROCEDURE:**

1. Start the program.
2. Open C-editor.
3. Type the C program.
4. Save the program with file name ext .c
5. Run the program.
6. If any error occurs in the program correct the error and run it again.
7. Enter the data of 4 bit size message bit.
8. Check the entered data.
9. Stop the program.

**PROGRAM FOR HAMMING METHOD :**

```
          #include<stdio.h>
.         #include<conio.h>
          Void main() {
          int data[7],rec[7],i,c1,c2,c3,c;
          printf ("this works for message of 4bits in size \n enter
          message bit one by one:  ");
          scanf ("%d %d %d %d",& data[0],&data[1],&data[2],&data[4]);
          data[6]=data[0]^data[2]^data[4];
          data[5]=data[0]^data[1]^data[4];
          data[3]=data[0]^data[1]^data[2];
          printf("\n the encoded bits are given below: \n");
          for (i=0;i<7;i++) {
          printf("%d ",data[i]);
          }
          printf("\n enter the received data bits one by one: ");
          for (i=0;i<7;i++) {
               scanf("%d",& rec[i]);
          }
          c1=rec[6]^rec[4]^rec[2]^rec[0];
          c2=rec[5]^rec[4]^rec[1]^rec[0];
          c3=rec[3]^rec[2]^rec[1]^rec[0];
          c=c3*4+c2*2+c1 ;
          if(c==0) {
               printf ("\n congratulations there is no error: ");
          } else {
               printf("\n error on the position: %d\n the correct
           message is \n",c);
               if(rec[7-c]==0)
                              rec[7-c]=1; else
                              rec[7-c]=0;
               for (i=0;i<7;i++) {
                    printf("%d ",rec[i]);
               }
               }
          getch();
                    }
                    }
```

**MODEL OUTPUT:**



DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC

```
this works for message of 4bits in size
enter message bit one by one:  0
1
0
1

the encoded bits are given below:
0 1 0 1 1 0 1
enter the received data bits one by one: 0
1
0
1
1
0
1

congratulations there is no error: _
```

**RESULT:**

Thus the Error detection and correction methods were executed and verified successfully by using c – editor.

**EX.NO:2**

**DATE:**

## IMPLEMENTATION OF STOP AND WAIT PROTOCOL

## AIM:

To implement a Stop & Wait protocol by parallel port & LAN port interface using LAN-T software to Provide reliable data transfer between two nodes over an unreliable networks.

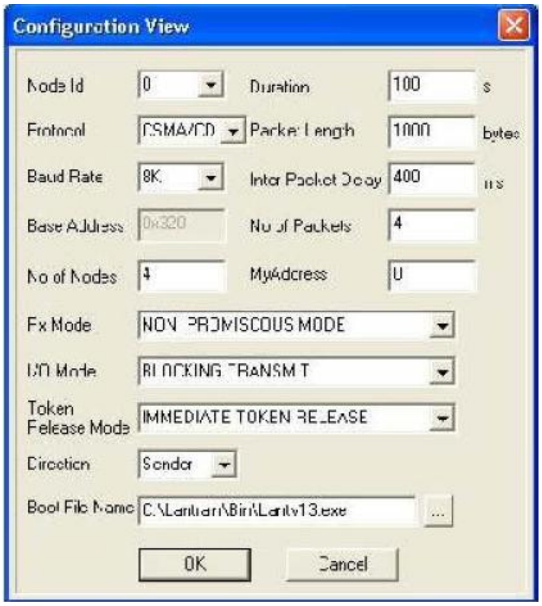
## APPARATUS REQUIERD:

- LTS-01 trainer kit and LAN-T Software
- 2 Computers with Windows XP and Ethernet port available on them
- RJ-45 to RJ-45 LAN connecting cables.

## PROCEDURE:

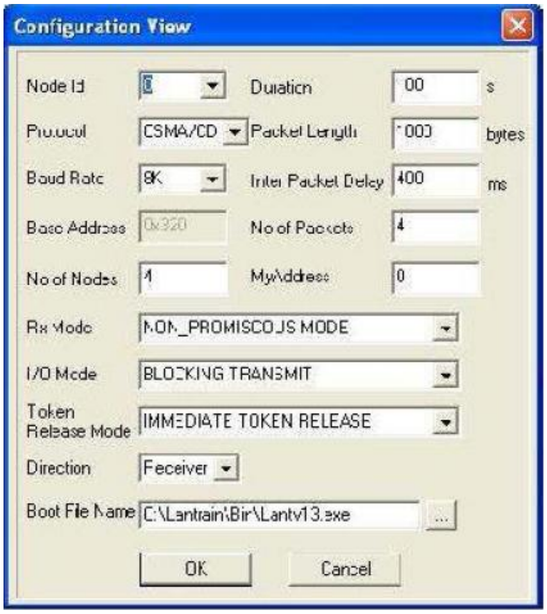
1. Click on the Stop & Wait icon from the desktop on both PCs.
2. Click the Configuration button in the window in both the Pc's.

**PC 1 SENDER**



| | | | |
|---|---|---|---|
| Node Id | 0 | Duration | 100 s |
| Protocol | CSMA/CD | Packet Length | 1000 bytes |
| Baud Rate | 8K | Inter Packet Delay | 400 ms |
| Base Address | 0x320 | No of Packets | 4 |
| No of Nodes | 4 | MyAddress | 0 |
| Rx Mode | NON_PROMISCOUS MODE | | |
| I/O Mode | BLOCKING TRANSMIT | | |
| Token Release Mode | IMMEDIATE TOKEN RELEASE | | |
| Direction | Sender | | |
| Boot File Name | C:\Lantrain\Bin\Lantv13.exe | | |

**PC 2 RECEIVER**



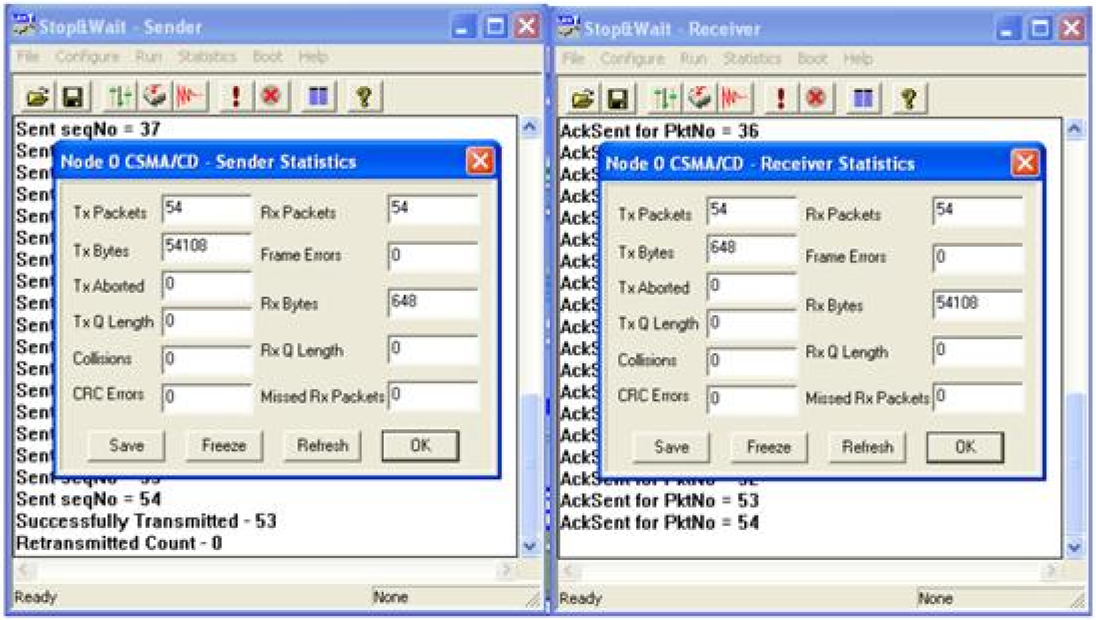
| | | | |
|---|---|---|---|
| Node Id | 0 | Duration | 100 s |
| Protocol | CSMA/CD | Packet Length | 1000 bytes |
| Baud Rate | 8K | Inter Packet Delay | 400 ms |
| Base Address | 0x320 | No of Packets | 4 |
| No of Nodes | 4 | MyAddress | 0 |
| Rx Mode | NON_PROMISCOUS MODE | | |
| I/O Mode | BLOCKING TRANSMIT | | |
| Token Release Mode | IMMEDIATE TOKEN RELEASE | | |
| Direction | Receiver | | |
| Boot File Name | C:\Lantrain\Bin\Lantv13.exe | | |

3. Click OK button and Download the driver to the NIU using the BOOT button Command.

4. Run the experiment by clicking run button or by choosing RUN start from each application.

5. Set the Timeout Value to 1500 ms.

**PC1 SENDER** **PC2 RECEIVER**



Sent seqNo = 37
Sent
Sent
Sent
Sent
Sent
Sent
Sent
Sent
Sent
Sent
Sent
Sent
Sent
Sent
Sent
Sent seqNo = 53
Sent seqNo = 54
Successfully Transmitted - 53
Retransmitted Count - 0

Node 0 CSMA/CD - Sender Statistics

| | | | |
|---|---|---|---|
| Tx Packets | 54 | Rx Packets | 54 |
| Tx Bytes | 54108 | Frame Errors | 0 |
| Tx Aborted | 0 | Rx Bytes | 648 |
| Tx Q Length | 0 | Rx Q Length | 0 |
| Collisions | 0 | Missed Rx Packets | 0 |
| CRC Errors | 0 | | |

AckSent for PktNo = 36
AckS
AckS
AckS
AckS
AckS
AckS
AckS
AckS
AckS
AckS
AckS
AckS
AckS
AckS
AckS
AckSent for PktNo = 52
AckSent for PktNo = 53
AckSent for PktNo = 54

Node 0 CSMA/CD - Receiver Statistics

| | | | |
|---|---|---|---|
| Tx Packets | 54 | Rx Packets | 54 |
| Tx Bytes | 648 | Frame Errors | 0 |
| Tx Aborted | 0 | Rx Bytes | 54108 |
| Tx Q Length | 0 | Rx Q Length | 0 |
| Collisions | 0 | Missed Rx Packets | 0 |
| CRC Errors | 0 | | |

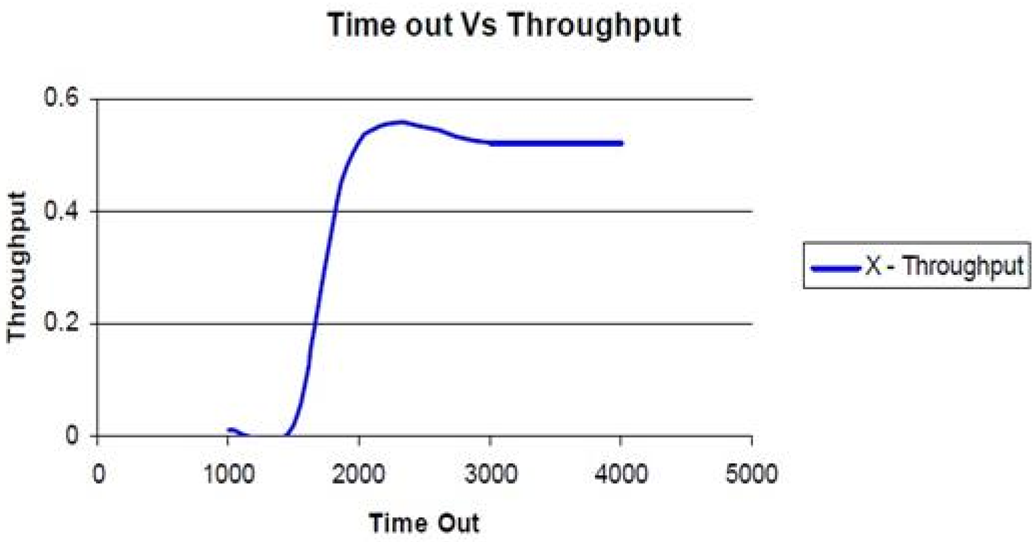
6. Note down the no of successfully Transmitted Packets.

7. Repeat the above steps for various time out values and plot the graph between timeout Value & Throughput. Find the optimum timeout value from the plot.

**Calculation of Throughput (X):**

$$X = \frac{(\text{Successfully Tx packets count} * \text{Packet Length} * 8)}{(\text{Duration of Experiment} * \text{Data rate})}$$

## MODEL GRAPH :



## MODEL TABULATION:

| Time out value in ms | Successfully Tx packets | X - Throughput |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

## RESULT:

Thus the Stop & Wait protocol using parallel port & LAN port interface was implemented and the parameters measured by using LAN-T simulation software.

**EX.NO:3**

**DATE:**

## IMPLEMENTATION OF SLIDING WINDOW GO BACK N

### AIM:

To implement a Sliding Window Go Back N & LAN port interface to Provide reliable data transfer between two nodes over an unreliable network using LAN-T software.

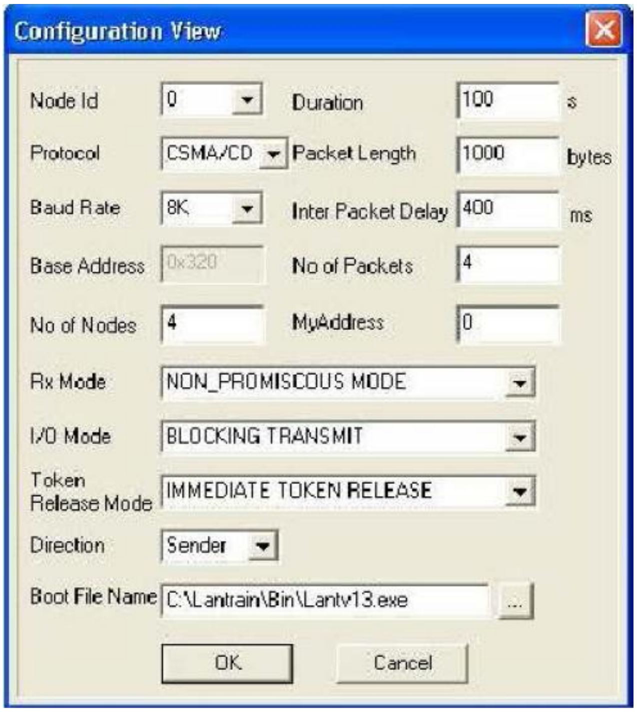
### APPARATUS REQUIERD:

- LTS-01 trainer kit and LAN-T Software
- 2 Computers with Windows XP and Ethernet port available on them
- RJ-45 to RJ-45 LAN connecting cables

### PROCEDURE:

1. Click on the Sliding Window GBN icon from the desktop on both PCs.
2. Click the Configuration button in the window in both the Pc's.

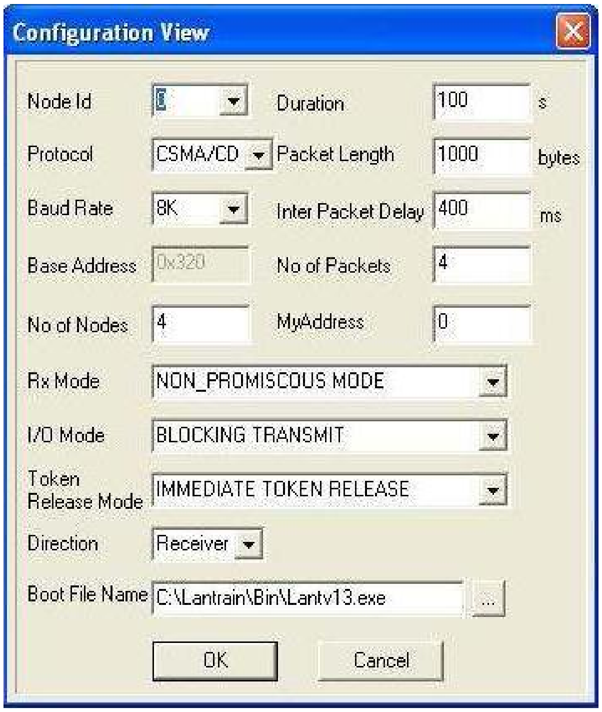
**PC 1 SENDER**



Configuration View

| | | | |
|---|---|---|---|
| Node Id | 0 | Duration | 100 s |
| Protocol | CSMA/CD | Packet Length | 1000 bytes |
| Baud Rate | 8K | Inter Packet Delay | 400 ms |
| Base Address | 0x320 | No of Packets | 4 |
| No of Nodes | 4 | MyAddress | 0 |
| Rx Mode | NON_PROMISCOUS MODE | | |
| I/O Mode | BLOCKING TRANSMIT | | |
| Token Release Mode | IMMEDIATE TOKEN RELEASE | | |
| Direction | Sender | | |
| Boot File Name | C:\Lantrain\Bin\Lantv13.exe | | |

**PC 2 RECEIVER**



Configuration View

| | | | |
|---|---|---|---|
| Node Id | 0 | Duration | 100 s |
| Protocol | CSMA/CD | Packet Length | 1000 bytes |
| Baud Rate | 8K | Inter Packet Delay | 400 ms |
| Base Address | 0x320 | No of Packets | 4 |
| No of Nodes | 4 | MyAddress | 0 |
| Rx Mode | NON_PROMISCOUS MODE | | |
| I/O Mode | BLOCKING TRANSMIT | | |
| Token Release Mode | IMMEDIATE TOKEN RELEASE | | |
| Direction | Receiver | | |
| Boot File Name | C:\Lantrain\Bin\Lantv13.exe | | |

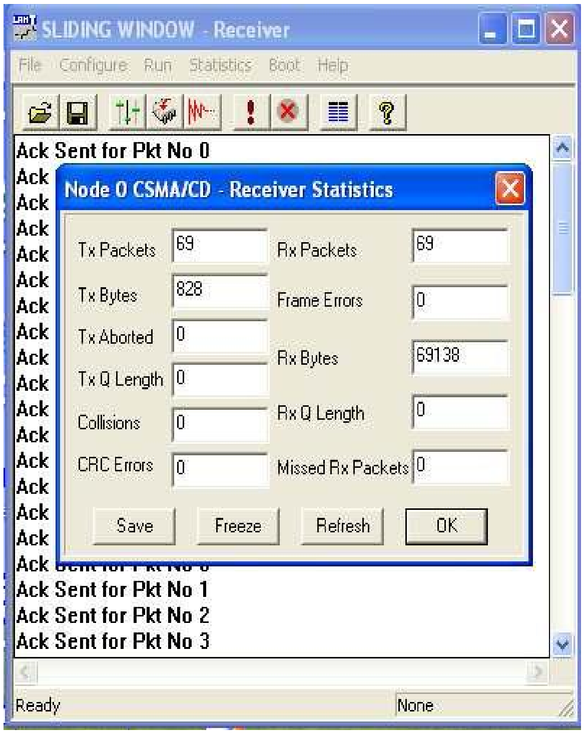
. Click OK button and Download the driver to the NIU using the BOOT button command.

Booting from any one of the applications is enough.

4. Run the experiment by clicking button or by choosing RUN _ start from each application.

5. Set the Timeout Value to 1500 ms.

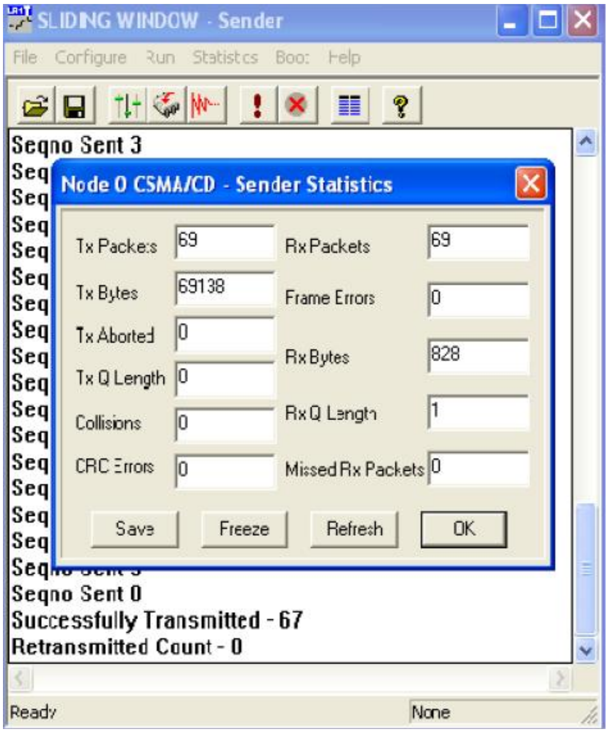
**PC 1 SENDER** **PC 2 RECEIVER**


SLIDING WINDOW - Receiver
File Configure Run Statistics Boot Help
Save
Freeze
Refresh
OK
Ready
None

```
Ack Sent for Pkt No 0
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack Sent for Pkt No 0
Ack Sent for Pkt No 1
Ack Sent for Pkt No 2
Ack Sent for Pkt No 3
```

Node 0 CSMA/CD - Receiver Statistics

Tx Packets 69
Tx Bytes 828
Tx Aborted 0
Tx Q Length 0
Collisions 0
CRC Errors 0
Rx Packets 69
Frame Errors 0
Rx Bytes 69138
Rx Q Length 0
Missed Rx Packets 0



```
Seqno Sent 3
Seq
Seq
Seq
Seq
Seq
Seq
Seq
Seq
Seq
Seq
Seq
Seq
Seq
Seq
Seq
Seqno Sent 3
Seqno Sent 0
Successfully Transmitted - 67
Retransmitted Count - 0
```

Node 0 CSMA/CD - Sender Statistics

Tx Packets 69
Tx Bytes 69138
Tx Aborted 0
Tx Q Length 0
Collisions 0
CRC Errors 0
Rx Packets 69
Frame Errors 0
Rx Bytes 828
Rx Q Length 1
Missed Rx Packets 0

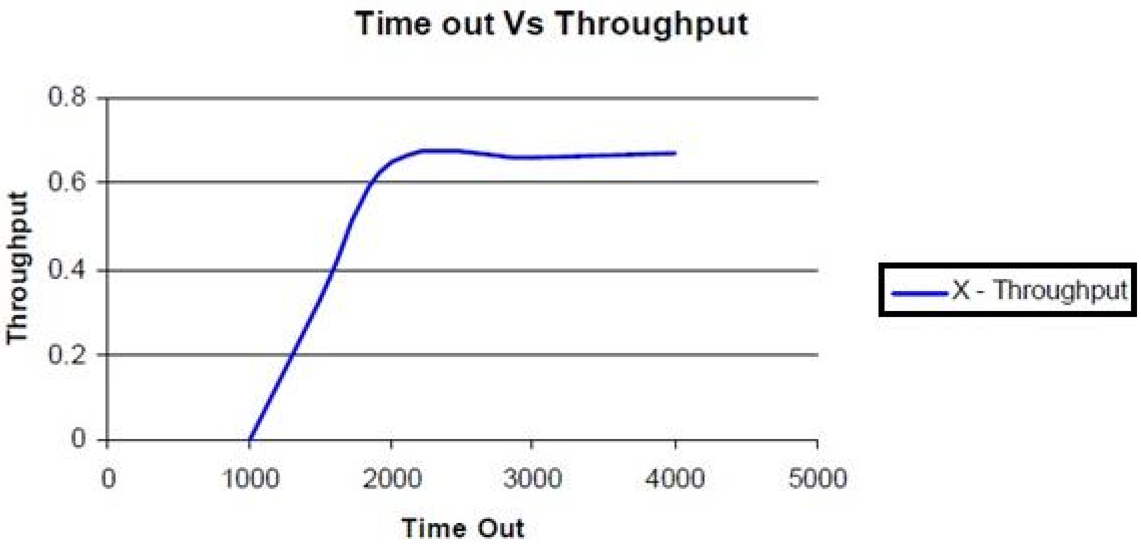
6. Note down the no. of successfully Transmitted Packets.

7. Repeat the above steps for various time out values and plot the graph between timeout Value & throughput and find the optimum time out value from the plot.

## Calculation of Throughput (X):

$$X = \frac{\text{(Successfully Tx packets count * Packet Length * 8)}}{\text{(Duration of Experiment * Data rate)}}$$

## MODEL GRAPH:



## MODEL TABULATION:

| Time out<br>value in ms | Successfully<br>Tx packets | Practical<br>Throughput |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

**RESULT:**

Thus the Sliding Window Go Back N & LAN port interface was implemented and the parameters measured by using LAN-T simulation software.

**EX.NO:4**

**DATE:**

# IMPLEMENTATION AND STUDY OF SLIDING WINDOW SELECTIVE REPEAT PROTOCOL.

## AIM:

To study and implement the sliding window selective repeat protocol to Provide a reliable data transfer between two nodes over an unreliable network using LAN-T Software.

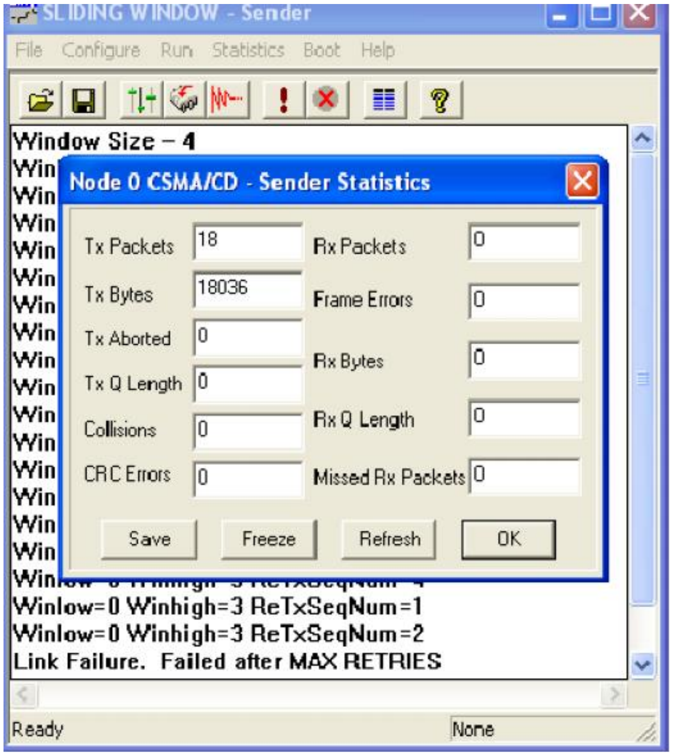
## APPARATUS REQUIERD:

- LTS-01 trainer kit and LAN-T Software
- 2 Computers with Windows XP and Ethernet port available on them
- RJ-45 to RJ-45 LAN connecting cables

## PROCEDURE:

1. Click on the Selective Repeat icon from the desktop on both PCs.
2. Click the Configuration button in the window in both the Pc's

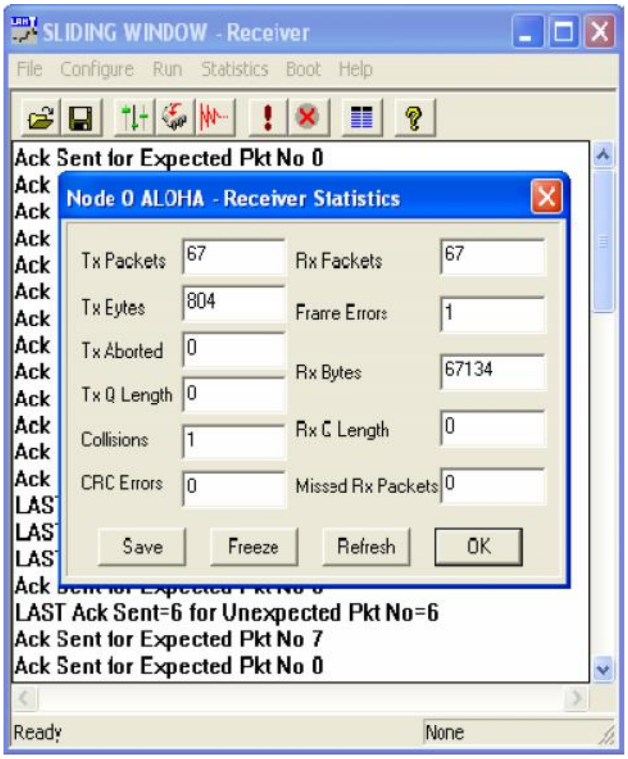
**PC SENDER 1**


SLIDING WINDOW - Sender
File Configure Run Statistics Boot Help
Node 0 CSMA/CD - Sender Statistics
Save
Freeze
Refresh
OK
Ready
None

```
Window Size – 4
Win
Win
Win
Win
Win
Win
Win
Win
Win
Win
Win
Win
Win
Win
Win
Win
Winlow=0 Winhigh=3 ReTxSeqNum=1
Winlow=0 Winhigh=3 ReTxSeqNum=2
Link Failure.  Failed after MAX RETRIES
```

| | | | |
|---|---|---|---|
| Tx Packets | 18 | Rx Packets | 0 |
| Tx Bytes | 18036 | Frame Errors | 0 |
| Tx Aborted | 0 | Rx Bytes | 0 |
| Tx Q Length | 0 | | |
| Collisions | 0 | Rx Q Length | 0 |
| CRC Errors | 0 | Missed Rx Packets | 0 |

**PC SENDER 2**


SLIDING WINDOW - Receiver
File Configure Run Statistics Boot Help
Node 0 ALOHA - Receiver Statistics
Save
Freeze
Refresh
OK
Ready
None

```
Ack Sent for Expected Pkt No 0
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
Ack
LAS
LAS
LAS
Ack
LAST Ack Sent=6 for Unexpected Pkt No=6
Ack Sent for Expected Pkt No 7
Ack Sent for Expected Pkt No 0
```

| | | | |
|---|---|---|---|
| Tx Packets | 67 | Rx Fackets | 67 |
| Tx Eytes | 804 | Frame Errors | 1 |
| Tx Aborted | 0 | Rx Bytes | 67134 |
| Tx Q Length | 0 | | |
| Collisions | 1 | Rx C Length | 0 |
| CRC Errors | 0 | Missed Rx Packets | 0 |

## SETTING THE CONFIGURATION MENU:

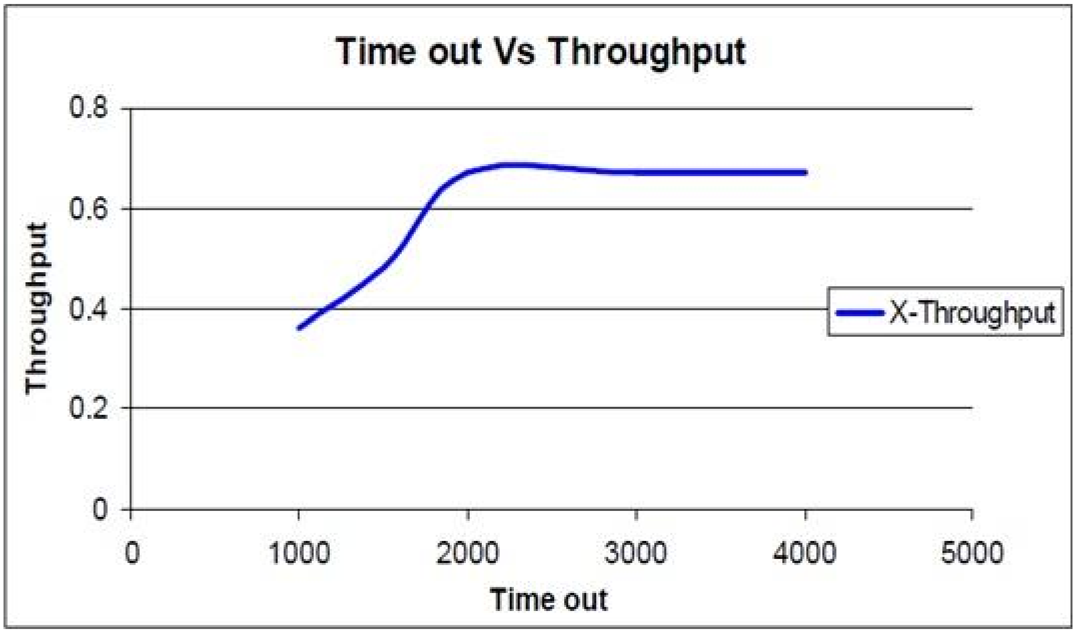
| PC 1 | | PC 2 | |
|---|---|---|---|
| **Node ID** | 0 | **Node ID** | 0 |
| **Protocol** | CSMA/CD | **Protocol** | CSMA/CD |
| **Baud Rate** | 8Kbps (At both the configure menu and NEU) | **Baud Rate** | 8Kbps (At both the config menu and NEU) |
| **Duration** | 100s | **Duration** | 100s |
| **Packet Length** | 100 bytes | **Packet Length** | 100 bytes |
| **Bit Delay** | 0(at NEU) | **Bit Delay** | 0(at NEU) |
| **Direction** | Sender | **Direction** | Receiver |
| **No of packets** | 4 | **No of packets** | 4 |
| **IPD** | 400 | **IPD** | 0 |

3. Click OK button and Download the driver to the NIU using the BOOT button command. Booting from any one of the applications is enough.
4. Run the experiment by clicking run button or by choosing RUN start from each application.
5. Set the Timeout Value to 1000 ms.
6. Note down the no. of successfully Transmitted Packets.
7. Repeat the above steps for various time out values and plot a graph between timeout Value & Throughput and find the optimum timeout value from the plot.

## Calculation of Practical Throughput:

$$X = \frac{(\text{Successfully Tx packets count} * \text{Packet Length} * 8)}{(\text{Duration of Experiment} * \text{Data rate})}$$

**MODEL GRAPH :**



**MODEL TABULATION:**

| Time out<br>value in ms | Successfully<br>Tx packets | Practical<br>Throughput |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

**RESULT:**

Thus the sliding window selective repeat protocol for data transfer between two nodes over an unreliable network through parallel port & LAN port interface was implemented and studied by using LAN-T simulation software.

**EX.NO:5**

**DATE:**

## STUDY OF SOCKET PROGRAMMING AND CLIENT – SERVER MODEL

**AIM:**

To write a program and study of socket programming and client – server based model by using JDK tool kit software.

**APPARATUS REQUIERD:**

- Personal computer
- JDK Tool kit 5.0

**PROCEDURE:**

**Server:**

- Create a server socket and bind it to port.
- Listen for new connection and when a connection arrives, accept it.
- Send server‟s date and time to the client.
- Read client‟s IP address sent by the client.
- Display the client details.
- Repeat steps 2-5 until the server is terminated.
- Close all streams.
- Close the server socket.
- Stop.

**Client:**

- Create a client socket and connect it to the server‟s port number.
- Retrieve its own IP address using built-in function.
- Send its address to the server.
- Display the date & time sent by the server.
- Close the input and output streams.
- Close the client socket.
- Stop.

**PROGRAM FOR CLIENT – SERVER MODEL:**

```
//SERVER
import java.net.*;
import java.io.*;
import java.util.*;
class tcp date server
{
Public static void main (String arg [])
{
Server Socket ss = null;
Socket cs;
 Print Stream ps;
Buffered Reader dis;
String inet;
try
{
ss = new Server Socket(4444);
System.  Out. Print ln ("Press Ctrl+C to quit");
While (true)
{
cs = ss.accept();
ps = new Print Stream (cs. get Output Stream());
Date d = new Date () ;
ps. println(d);
dis = new Buffered Reader(new Input Stream Reader
(cs .get Input Stream ()));
inet = dis.read Line();
System.out.println ("Client System/IP address is :"+ inet);
ps.close ();
dis.close ();
}
}
catch (IO Exception e)
{System.out .println ("The exception is:" + e);
}
}
}
// CLIENT
import java.net.*;
import java.io.*;
class tcpdateclient
{
public static void main (String args[])
{Socket soc; Buffered Reader dis;
String sdate; Print Stream ps;
try { Inet Address is = Inet Address. get Local Host();
if (args.length == 0)
soc = new Socket(InetAddress.getLocalHost(),4444);
else soc = new Socket (Inet Address.
 Get By Name (args[0]),4444);
dis = new Buffered Reader
(new Input Stream Reader(soc. Get Input Stream()));
Sdate=dis. read Line ();
System.out.println ("The date/time on server is : " +sdate);
ps = new Print Stream(soc. get Output Stream());
ps.println (is);
ps. close();
catch (IO Exception e)
{
System.out.println ("THE EXCEPTION is :" + e);
}
}
}
```

**OUTPUT:**

```
//SERVER
C:\Documents and Settings\ADMIN>cd C:\Java\jdk1.6.0_02\bin
C:\Java\jdk1.6.0_02\bin>javac tcpdateserver.java
C:\Java\jdk1.6.0_02\bin>java tcp date server
Press Ctrl+C to quit
Client System/IP address is: SYSTEM-35/192.168.1.45
//CLIENT
C:\Documents and Settings\ADMIN>cd C:\Java\jdk1.6.0_02\bin
C:\Java\jdk1.6.0_02\bin>javac tcpdateclient.java
C:\Java\jdk1.6.0_02\bin>java tcpdateclient
The date/time on server is: Thu Mar 12 10:54:41 IST 2015
C:\Java\jdk1.6.0_02\bin>
```

**RESULT:**

Thus the socket programming and client – server based model was studied and verified by using JDK tool kit software.

**EX.NO:6**

**DATE:**

## WRITE A SOCKET PROGRAM FOR ECHO COMMANDS

### AIM:

To write a java program for echo commands using socket programming

### APPARATUS REQUIERD:

- JDK TOOLKIT 5.0
- Standalone desktop.

### Echo server:

1. Start the program.
2. Import java.net and other necessary packages.
3. Create objects for Data Input Stream, Socket and Print Writer to receive client message and send it back.
4. Store the message in a string and print the message using print () method.
5. Send the same received message to the client using Print Writer and Socket.
6. When the received character is ‘.’, then stop sending the data back.
7. Stop the program.

### Echo Client:

1. Start the program.
2. Import java.net and other necessary packages.
3. Create objects for Server Socket and Socket to send the message.
4. Create objects for Print Stream to write message from client to server.
5. Get the user input and store it in a string.
6. Print the string in the Socket using Print Stream to be received by the server.
7. Using the Print () method, receive the client echo message and print it.
8. If the user input is ‘.’, then stop sending the data.
9. Stop the program.

## PROGRAM FOR ECHO CLIENT

### Echo Serve:

```
import java.io.*;
import java.net.*;
class echoserver
{
public static void main(String args[])
{
try
{
Socket s=null;
ServerSocket ss=new ServerSocket(8000);
s=ss.accept();
System.out.println(s);
BufferedReader br=new BufferedReader(new
InputStreamReader(s.getInputStream()));
PrintWriter print=new PrintWriter(s.getOutputStream());
int i=1;
while(i>0)
{
String str=br.readLine();
if(str.equals("."))
break;
System.out.println("msg received by client:"+str);
print.println(str);
print.flush();
}}
catch(IOException e)
{
System.out.println("\n error:"+e);
}
}
}
```

**PROGRAM FOR ECHO CLIENT:**

```
import java.io.*;

import java.net.*;

class echoclient

{

public static void main(String a[])

{

try

{

Socket s=new Socket("LocalHost",8000);

DataInputStream in=new DataInputStream(System.in);

BufferedReader br1=new BufferedReader(new
InputStreamReader(System.in));

BufferedReader br2=new BufferedReader(new
InputStreamReader(s.getInputStream()));

PrintWriter print=new PrintWriter(s.getOutputStream());

System.out.println("\n msg to be echo:");

String str=br1.readLine();

print.println(str);

print.flush();

System.out.println(br2.readLine());

}

catch(UnknownHostException e)

{}

catch(IOException e)

{

System.out.println("\n error:"+e);

}}}
```

**OUTPUT:**

**Echo client:**

```
C:\Documents and Settings\Vvit staff>cd\

C:\>cd D:\Sasi\Java

D:\Sasi\Java> set path=c:\program files\java\jdk1.6.0_02\bin

D:\Sasi\Java>javac echoclient.java

D:\Sasi\Java>java echo client


Msg to be echo:
GOD IS GREAT
GOD IS GREAT
D:\Sasi\Java>
```

**ECHOSERVER:**

```
C:\Documents and Settings\Vvit staff>cd\

C:\>cd D:\Sasi\Java

D:\Sasi\Java> set path=c: \b program files\java\jdk1.6.0_02\bin

D:\Sasi\Java>javac echoserver.java

D:\Sasi\Java>java echo server

Socket[addr=/127.0.0.1, port=1623,local port=8000]
msg received by client: GOD IS GREAT
D:\Sasi\Java>
```

**RESULT:**

Thus the java Socket Program for Echo Commands is executed and output is verified successfully.

**EX.NO:7**

**DATE:**

## WRITE A SOCKET PROGRAM FOR PING COMMANDS.

**AIM:**

To write a java program for Ping commands of socket programming.

**APPARATUS REQUIERD:**

- JDK TOOLKIT 5.0
- Standalone desktop.

**PROCEDURE:**

**PING Server:**

1. Start the program.
2. Import java.net and other necessary packages.
3. Initialize the ping server with both sockets as null value.
4. Start the server socket.
5. At the client give the IP address of the server.
6. The client program is then started by starting socket.
7. At the receiver end, the client is pinged.
8. Stop the program.

**PING Client:**

1. Start the program.
2. Import java.net and other necessary packages.
3. Initialize the ping client with both sockets as null value.
4. Start the socket.
5. Get the IP address of the server.
6. Ping the server.
7. At the receiver end, the server is pinged.
8. Stop the program.

**PROGRAM FOR PING SERVER:**

```
import java.io.*;
import java.net.*;
public class pingserver
{
public static void main(String a[])
{
String line1,line2;
int i;
ServerSocket es;
DataInputStream di;
PrintStream ps;
Socket csoc;
es=null;
csoc=null;
try
{
es=new ServerSocket(9999);
}
catch(Exception e)
{
System.out.println(e);
}
System.out.println("ping server");
try
{
csoc=es.accept();
di=new DataInputStream(csoc.getInputStream());
ps=new PrintStream(csoc.getOutputStream());
for(i=0;i<4;i++)
{
line1=di.readLine();
System.out.println("pinged by client");
ps.println(line1+"reply from host:bytes=3<time<1ms TT<=128");
}
di.close();
ps.close();    }
catch(Exception e)
{
System.out.println(e);
 } } }
```

**PROGRAM FOR PING CLIENT:**

```
import java.io.*;
import java.net.*;
public class pingclient
{
public static void main(String args[])
{
PrintWriter out=null;
int i,j,k;
BufferedReader networkIn=null;
try
{
System.out.println("enter the IP address:");
DataInputStream in = new DataInputStream(System.in);
String ip = in.readLine();
Socket thesocket = new Socket(ip, 9999);
networkIn = new BufferedReader(new
InputStreamReader(System.in));
out = new PrintWriter(thesocket.getOutputStream());
System.out.println("\npinging" + ip + "with 32 bytes of
data\n");
for (i = 0; i < 4; i++)
{
out.println(ip);
out.flush();
String inp = networkIn.readLine();
if (inp != null)
{
for (j = 0; j < 10000; j++)
{
for (k = 0; k < 50000; k++)
{
}
}
System.out.println("reply from" + inp);
}
else
{
for (i = 0; i < 4; i++)
{
for (j = 0; j < 10000; j++)
{
for (k = 0; k < 50000; k++)
{
}
System.out.println("\nrequest time out");
}
}
}}
}
catch (IOException e)
{
for (i = 0; i < 4; i++)
{
for (j = 0; j < 1000; j++)
{
for (k = 0; k < 5000; k++)
{
}
}
System.out.println("\nrequest timed out");
}
}
try
{
if(networkIn!=null)
networkIn.close();
if(out!=null)
out.close();
}
catch(Exception e){
System.out.println("\nrequested time out");
}
}
}
```

## OUT PUT:

```
PING Client
    C:\Documents and Settings\Vvit staff>cd\
    C:\>cd D:\Sasi\Java
    D:\Sasi\Java> set path=c:\program files\java\jdk1.6.0_02\bin
    D:\Sasi\Java>javac pingclient.java
    D:\Sasi\Java>java ping client

enter the IP address:
192.168.1.10
pinging192.168.1.10with 32 bytes of data
5
reply from5
8
reply from8
9
reply from9
4
reply from4
D:\Sasi\Java>
PING Server
    C:\Documents and Settings\Vvit staff>cd\
    C:\>cd D:\Sasi\Java
    D:\Sasi\Java> set path=c:\program files\java\jdk1.6.0_02\bin
    D:\Sasi\Java>javac pingserver.java
    D:\Sasi\Java>java ping server

ping server
pinged by client
pinged by client
pinged by client
pinged by client
D:\Sasi\Java>
```

## RESULT:

Thus the java Socket Program for ping Commands is executed and output is verified successfully.

**EX.NO:8**

**DATE:**

## WRITE A SOCKET PROGRAM FOR TALK COMMANDS.

### AIM:

To write a program for talk commands using socket programming to send and receive message from client and server using connection oriented service.

### APPARATUS REQUIERD:

- JDK TOOLKIT 5.0
- Standalone desktop

### PROCEDURE:

### Server:

1. Start the program.
2. Create server and client sockets.
3. Use input streams to get the message from user.
4. Use output stream to send message to the client.
5. Wait for client to display this message and write a new one to be displayed by the server.
6. Display message given at client using input streams read from socket.
7. If in the message given by server or client, the word “end” is encountered, exit both the programs.
8. Stop the program.

### Client:

1. Start the program.
2. Create a client socket that connects to the required host and port.
3. Using input streams read message given by server and print it.
4. Using input streams, get message from user to be given to the server.
5. Use output streams to write message to the server.
6. Stop the program

**PROGRAM FOR TALK SERVER:**

```
import java.io.*;
import java.net.*;
Public class talk server
{
Public static void main (String args []) throws Exception
{
Server Socket ecsvr=null;
String line1, line 2;
Data Input Stream dis =null;
Print Stream pts=null;
Socket cls ckt=null;
Buffered Reader in1=null;
Server =new Server Socket(9999);
System. out. Println ("TALK SERVER");
System. Out.  println ("---------------------");
clsckt= ecsvr. accept ();
dis =new Data Input Stream (cls ckt. Get Input Stream ());
pts =new Print Stream(cls ckt. get Output Stream());
System. Out. Println ("Node successfully connected..");
While (true)
{
line1=dis. readLine ();
System. Out .println("Message Received");
System. out. println("The Message ="+line1);
in1=new Buffered Reader (new Input Stream Reader (System. in));
line2=in1.readLine ();
if(line2.equals("end"))
{
break;
}
pts. println (line2);
pts. Flush ();
System .out. println ("Message sent successfully");
}
dis. close();
pts. close();
}
}
```

**PROGRAM FOR TALK CLIENT:**

```
import java.io.*;
import java.net.*;
public class talk client
{
public static void main(String args[])
{
Print Writer out=null;
String line1;
Buffered Reader networkln=null;
try{
Socket the Socket=new Socket("LocalHost",9999);
networkln=new Buffered Reader(new Input Stream Reader(the
Socket. Get Input Stream ()));
Buffered Reader userln=new Buffered Reader (new Input Stream
Reader (System .in));
out=new Print Writer(the Socket .get Output Stream());
System .out. Println ("TALK CLIENT");
System. out .println("--------------------");
while(true){
System.out.println ("send message to server: ");
String the Line=userln. Read Line ();
if(the Line. equals("end"))
break;
out. Println (the Line);
out .flash();
System. Out. Println ("message sent successfully");
System. Out. Println (" ");
System. out .println("message received from talk server:
"+networkln. ReadLine ());
}  }
Catch (IO Exception (e)
{
System.err. println (e);
}   try
{
if(networkln!=null)
network ln. close ();
if(out!=null)
Out. Close ();
}    catch (Exception e){
System.err. println (e);
}  }
```

**OUTPUT:**

***TALK server***

```
 C:\Documents and Settings\Vvit staff>cd\
 C:\>cd D:\Sasi\Java
 D:\Sasi\Java> set path=c:\program files\java\jdk1.6.0_02\bin
 D:\Sasi\Java>javac talkerver.java
 D:\Sasi\Java>java talk server
TALK SERVER
----------------------
Node successfully connected.
Message Received
The Message =HAI
HI..
Message sent successfully
Message Received
The Message =HOW ARE YOU
I AM FINE
Message sent successfully
Message Received
The Message =K BYE
end
D:\Sasi\Java>
```

***TALK Client***

```
 C:\Documents and Settings\Vvit staff>cd\
 C:\>cd D:\Sasi\Java
 D:\Sasi\Java> set path=c:\program files\java\jdk1.6.0_02\bin
 D:\Sasi\Java>javac talkclient.java
 D:\Sasi\Java>java talk client
TALK CLIENT
--------------------
send message to server: HAI
message sent successfully
message received from talk server: HI..
send message to server: HOW ARE YOU
message sent success full
message received from talk server: I AM FINE
send message to server: K BYE
message sent successfully
send message to server:
end
D:\Sasi\Java>
```

**RESULT:**

Thus the java Socket Program for Talk Commands is executed and output is verified successfully.

**EX.NO:9**

**DATE:**

## IMPLEMENTATION OF DISTANCE VECTOR ROUTING ALGORITHM

**AIM:**

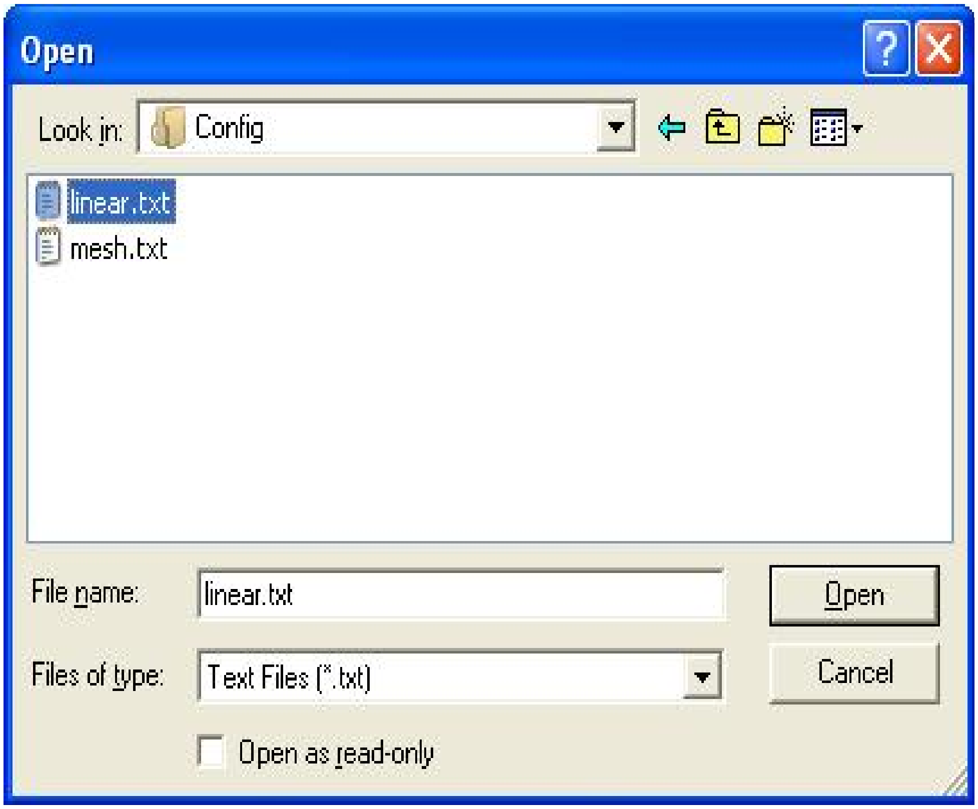
To simulate the distance vector routing protocol to maintain routing tables as the traffic and topology of the network changes using LAN-T software.

**APPARATUS REQUIERD:**

- LTS-01 trainer kit  and LAN-T Software.
- 2 Computers with Windows XP and Ethernet port available on them.
- RJ-45 to RJ-45 LAN connecting cables

**PROCEDURE:**

1. Double click on LAN-T Routing Simulator icon from the desktop.
2. Click load button and browse open **C:\Lantrain\Config\ linear.txt.**



Look in: Config

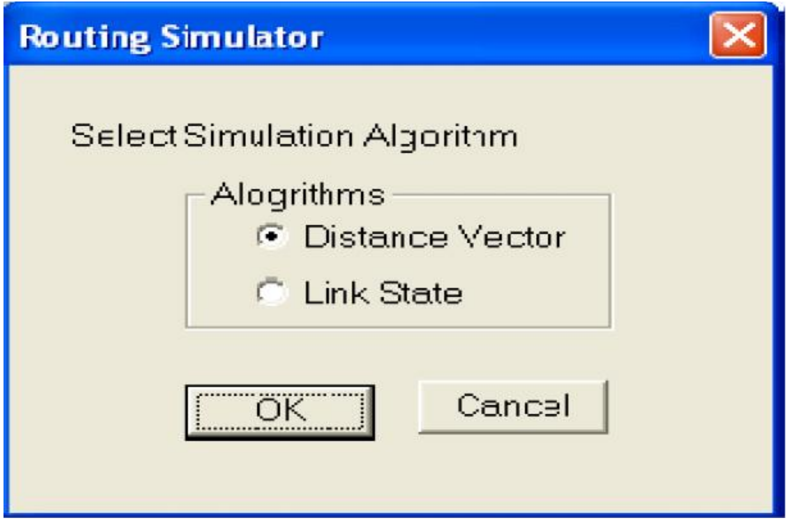
linear.txt

mesh.txt

File name: linear.txt

Files of type: Text Files (*.txt)

3. Click configure  button and select Distance vector algorithm.



Routing Simulator

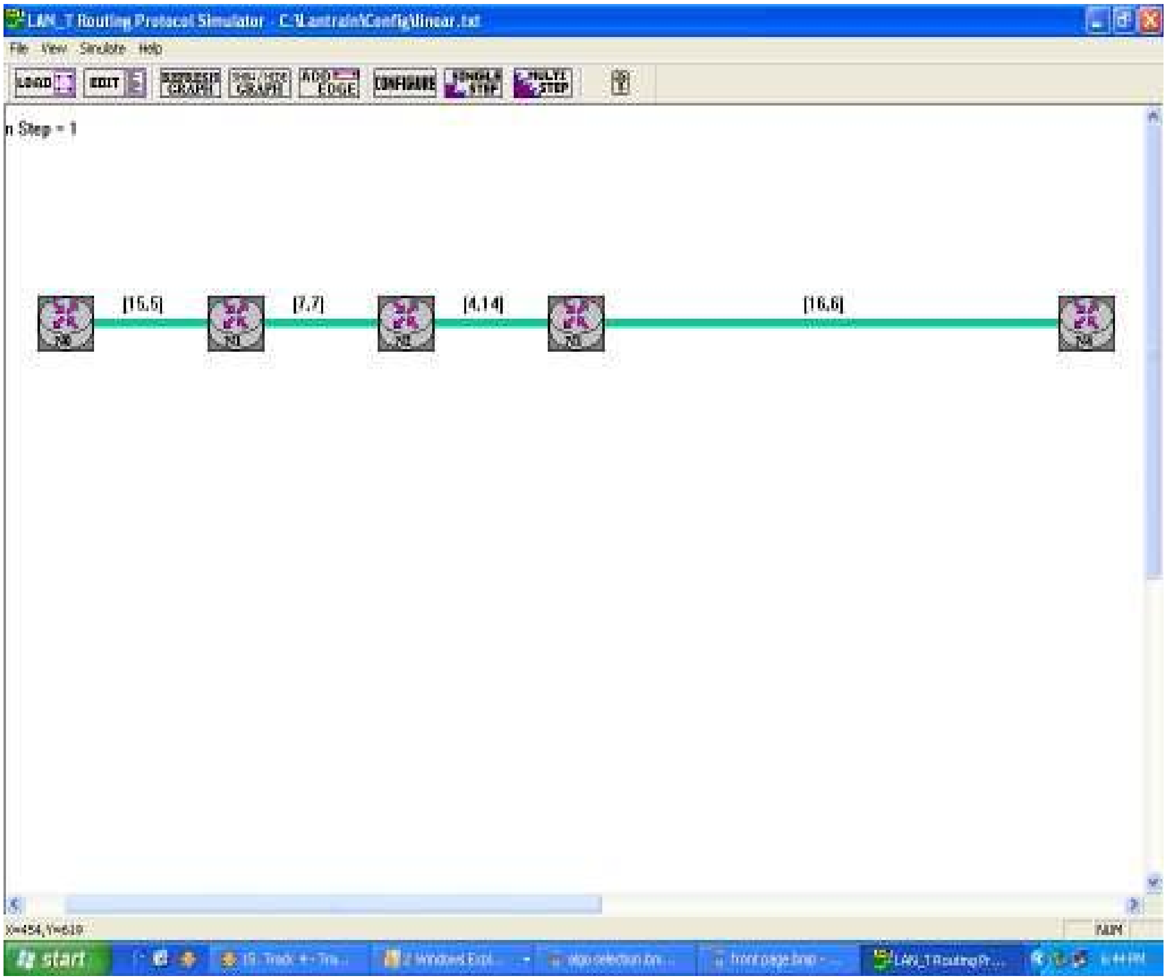
Select Simulation Algoritım

Alogrithms

● Distance Vector

○ Link State

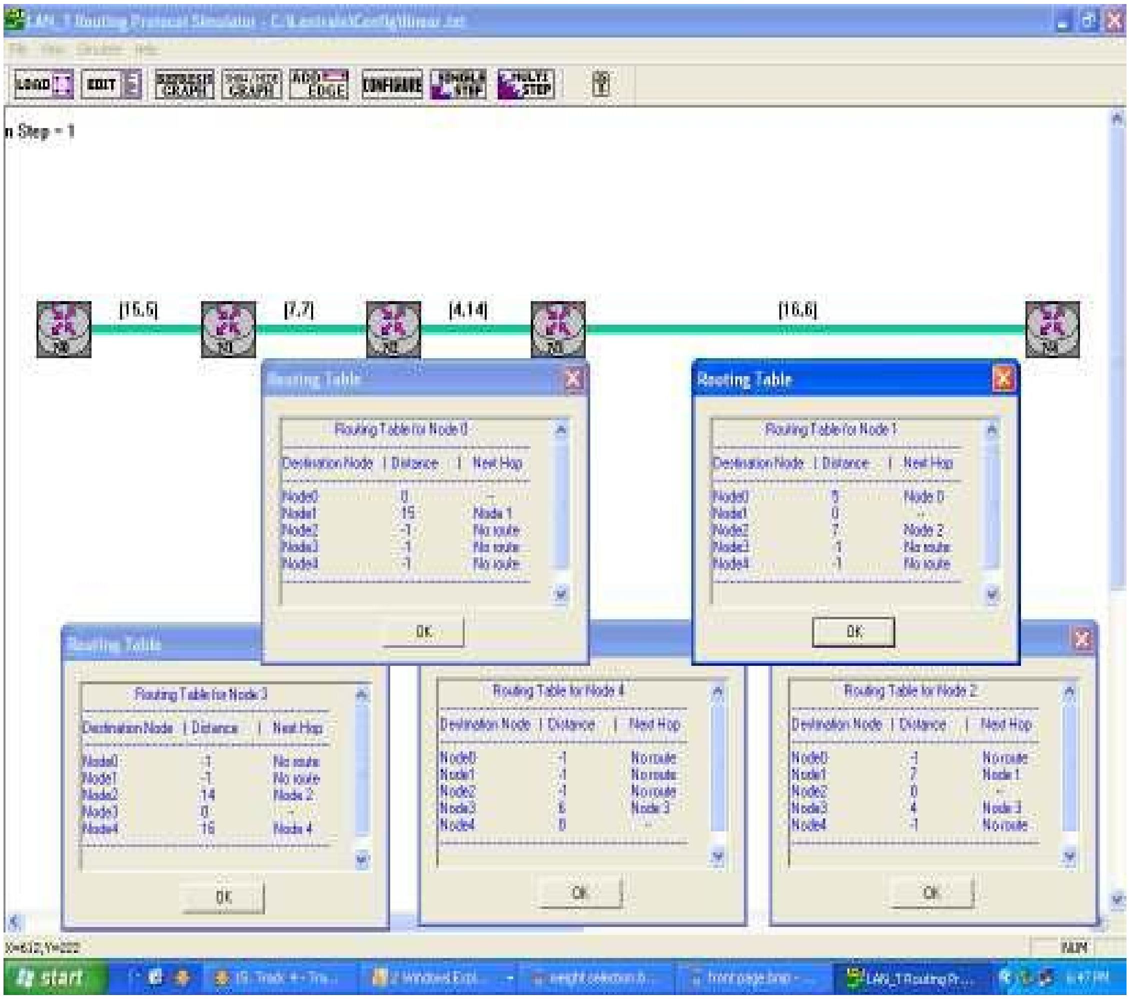
4. The icon in the screen represents the nodes and the green colour line represents the path and the values inside the braces represents the ‘Forward and Reverse’ weights.



LAN_T Routing Protocol Simulator - C:\Lantrain\Config\linear.txt

n Step = 1

5. Click on the node icon to obtain the message window.



```
Routing Table for Node 0
Destination Node  | Distance  | Next Hop
Node0               0           --
Node1               15          Node 1
Node2               -1          No route
Node3               -1          No route
Node4               -1          No route
```

```
Routing Table for Node 1
Destination Node  | Distance  | Next Hop
Node0               5           Node 0
Node1               0           --
Node2               7           Node 2
Node3               -1          No route
Node4               -1          No route
```

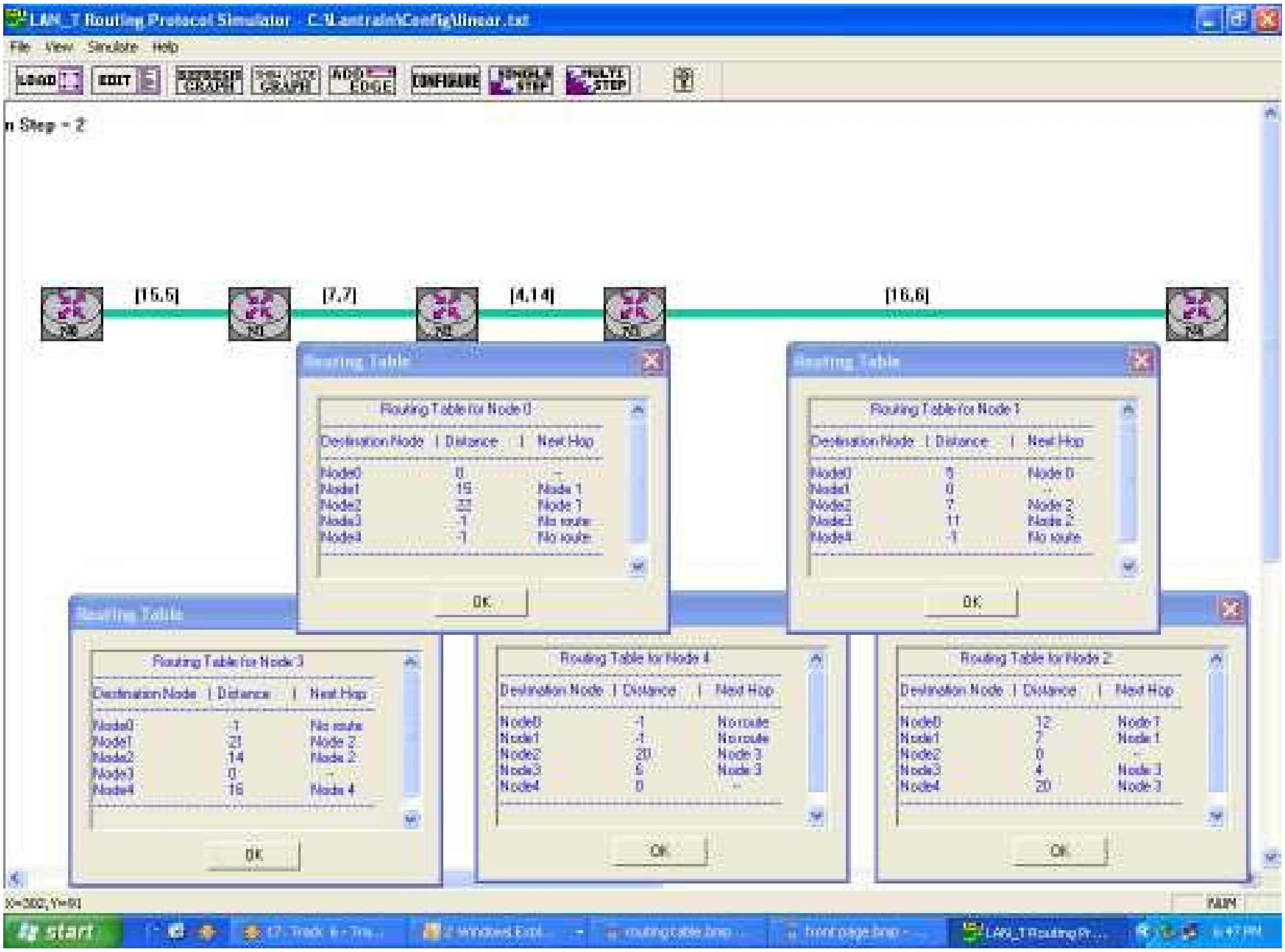
```
Routing Table for Node 3
Destination Node  | Distance  | Next Hop
Node0               -1          No route
Node1               -1          No route
Node2               14          Node 2
Node3               0           --
Node4               16          Node 4
```

```
Routing Table for Node 4
Destination Node  | Distance  | Next Hop
Node0               -1          No route
Node1               -1          No route
Node2               -1          No route
Node3               6           Node 3
Node4               0           --
```

```
Routing Table for Node 2
Destination Node  | Distance  | Next Hop
Node0               -1          No route
Node1               7           Node 1
Node2               0           --
Node3               4           Node 3
Node4               -1          No route
```

6. The above picture shows the nodes and its routing table.

7. Observe the routing table showing no route to some of the destinations even though there is a physical connection. This is because the routing table of the corresponding nodes are not been updated since there is no hopping. To update the routing table click button.



Routing Table for Node 0

| Destination Node | Distance | Next Hop |
|---|---|---|
| Node0 | 0 | -- |
| Node1 | 15 | Node 1 |
| Node2 | 22 | Node 1 |
| Node3 | -1 | No route |
| Node4 | -1 | No route |

Routing Table for Node 1

| Destination Node | Distance | Next Hop |
|---|---|---|
| Node0 | 5 | Node 0 |
| Node1 | 0 | -- |
| Node2 | 7 | Node 2 |
| Node3 | 11 | Node 2 |
| Node4 | -1 | No route |

Routing Table for Node 3

| Destination Node | Distance | Next Hop |
|---|---|---|
| Node0 | -1 | No route |
| Node1 | 21 | Node 2 |
| Node2 | 14 | Node 2 |
| Node3 | 0 | -- |
| Node4 | 16 | Node 4 |

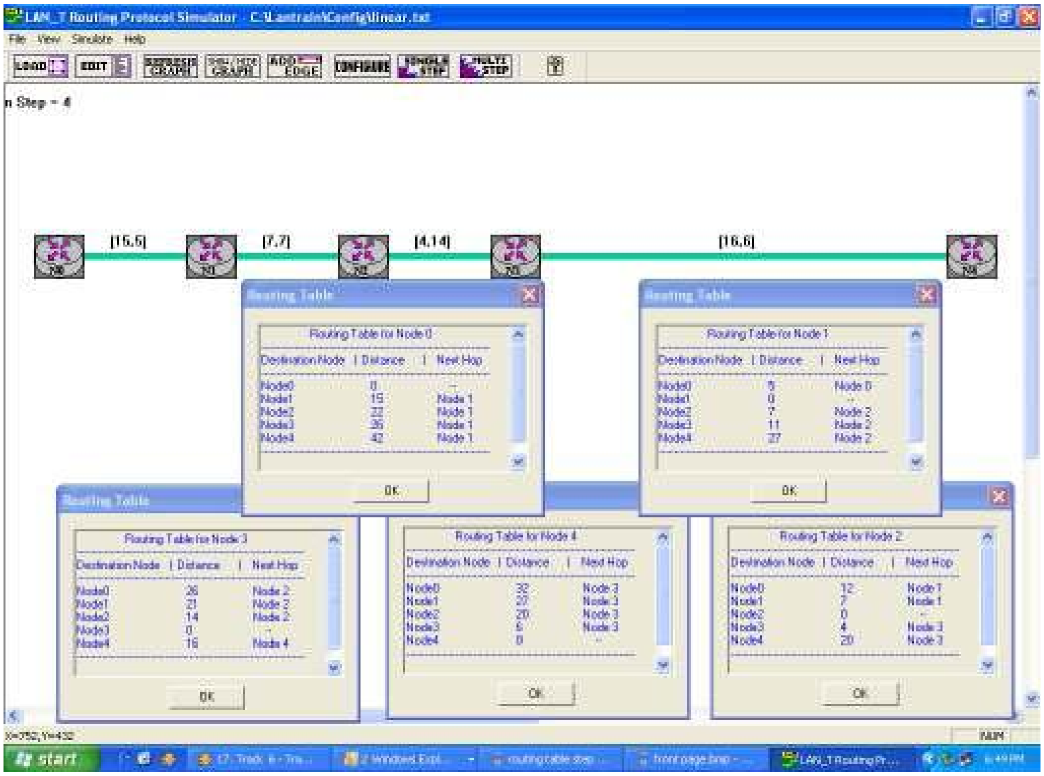
Routing Table for Node 4

| Destination Node | Distance | Next Hop |
|---|---|---|
| Node0 | -1 | No route |
| Node1 | -1 | No route |
| Node2 | 20 | Node 3 |
| Node3 | 6 | Node 3 |
| Node4 | 0 | -- |

Routing Table for Node 2

| Destination Node | Distance | Next Hop |
|---|---|---|
| Node0 | 12 | Node 1 |
| Node1 | 7 | Node 1 |
| Node2 | 0 | -- |
| Node3 | 4 | Node 3 |
| Node4 | 20 | Node 3 |

8. Hopping is done by clicking run button.



```
Routing Table for Node 0
------------------------------------------
Destination Node  | Distance   |  Next Hop
------------------------------------------
Node0               0             --
Node1               15            Node 1
Node2               22            Node 1
Node3               36            Node 1
Node4               42            Node 1
------------------------------------------
```

```
Routing Table for Node 1
------------------------------------------
Destination Node  | Distance   |  Next Hop
------------------------------------------
Node0               5             Node 0
Node1               0             --
Node2               7             Node 2
Node3               11            Node 2
Node4               27            Node 2
------------------------------------------
```

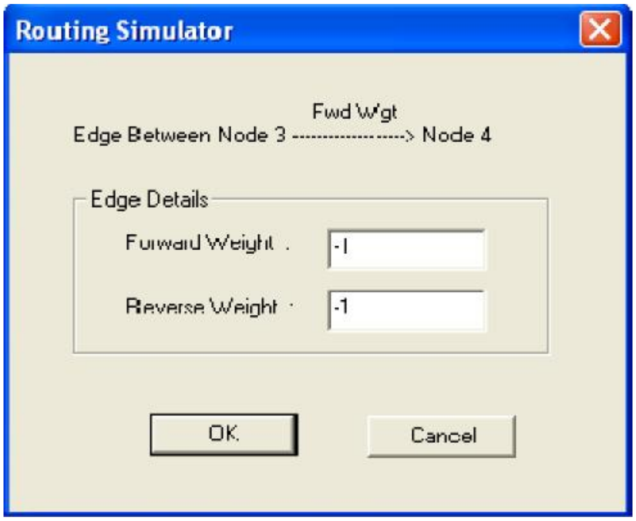
```
Routing Table for Node 3
------------------------------------------
Destination Node  | Distance   |  Next Hop
------------------------------------------
Node0               26            Node 2
Node1               21            Node 2
Node2               14            Node 2
Node3               0             --
Node4               16            Node 4
------------------------------------------
```

```
Routing Table for Node 4
------------------------------------------
Destination Node  | Distance   |  Next Hop
------------------------------------------
Node0               32            Node 3
Node1               27            Node 3
Node2               20            Node 3
Node3               6             Node 3
Node4               0             --
------------------------------------------
```

```
Routing Table for Node 2
------------------------------------------
Destination Node  | Distance   |  Next Hop
------------------------------------------
Node0               12            Node 1
Node1               7             Node 1
Node2               0             --
Node3               4             Node 3
Node4               20            Node 3
------------------------------------------
```

9. Now, after several hopping the routing table gets updated. The number of hopping increases as the number of nodes increases.

10. Click the green color line lying between N3 and N4.



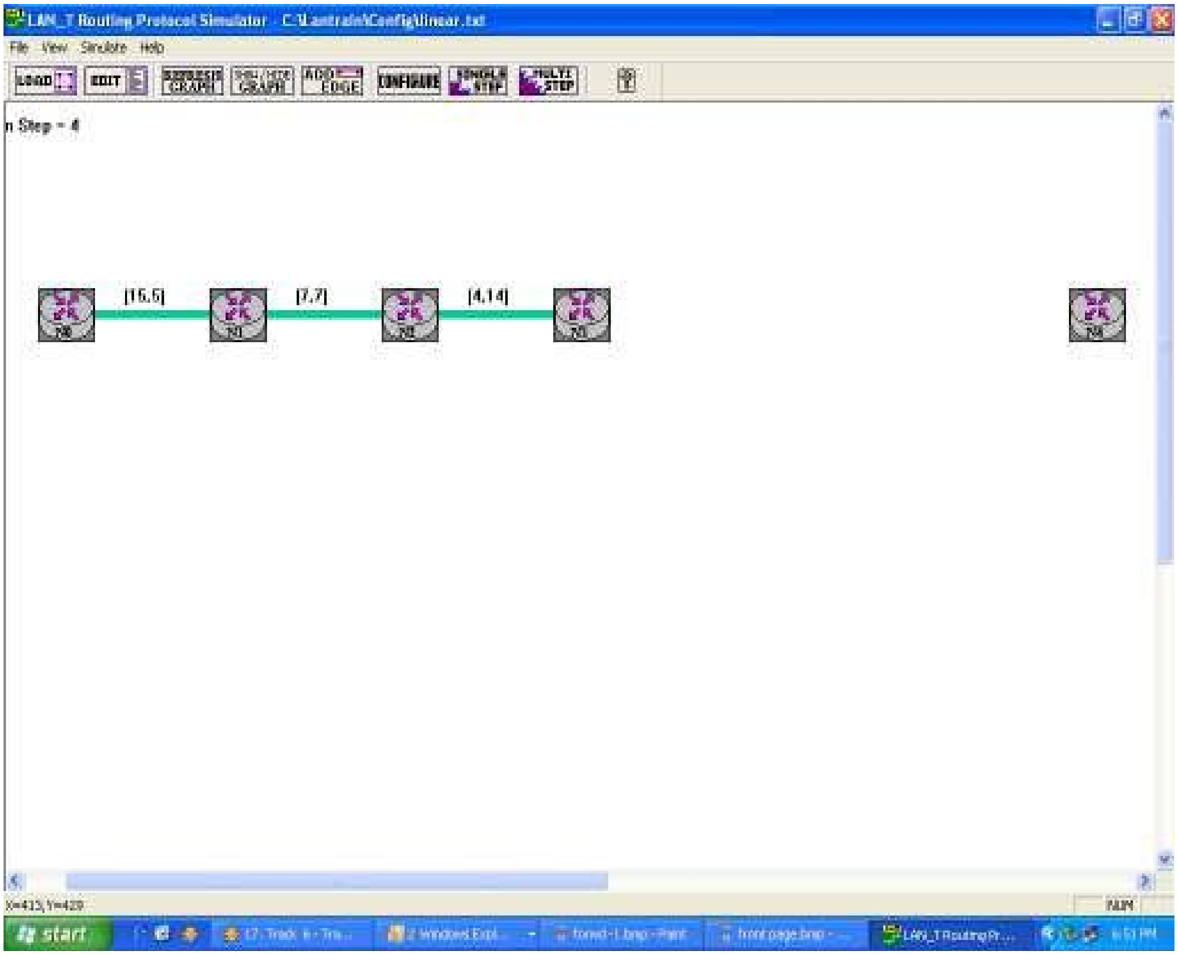
Fwd Wgt
Edge Between Node 3 -----------------> Node 4

Edge Details

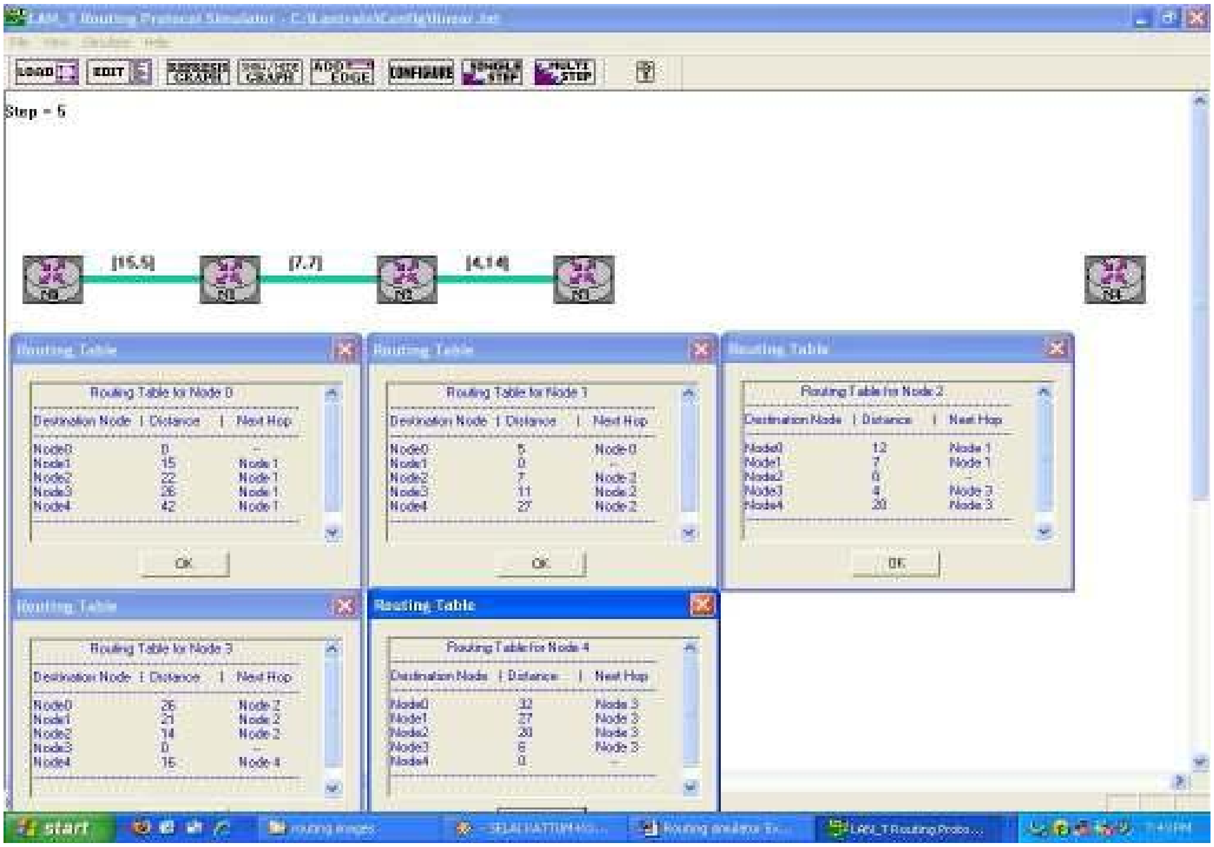
Forward Weight : -1

Reverse Weight : -1

11. Enter the forward and reverse weight as ‘-1’ in order to disconnect N4 from the other nodes.



12. Now observe the routing table.



Step = 5

Routing Table

```
            Routing Table for Node 0
-------------------------------------------
Destination Node  | Distance   |  Next Hop
-------------------------------------------
Node0               0             --
Node1               15            Node 1
Node2               22            Node 1
Node3               26            Node 1
Node4               42            Node 1
-------------------------------------------
```

OK

Routing Table

```
            Routing Table for Node 1
-------------------------------------------
Destination Node  | Distance   |  Next Hop
-------------------------------------------
Node0               5             Node 0
Node1               0             --
Node2               7             Node 2
Node3               11            Node 2
Node4               27            Node 2
-------------------------------------------
```

OK

Routing Table

```
            Routing Table for Node 2
-------------------------------------------
Destination Node  | Distance   |  Next Hop
-------------------------------------------
Node0               12            Node 1
Node1               7             Node 1
Node2               0             --
Node3               4             Node 3
Node4               20            Node 3
-------------------------------------------
```

OK

Routing Table

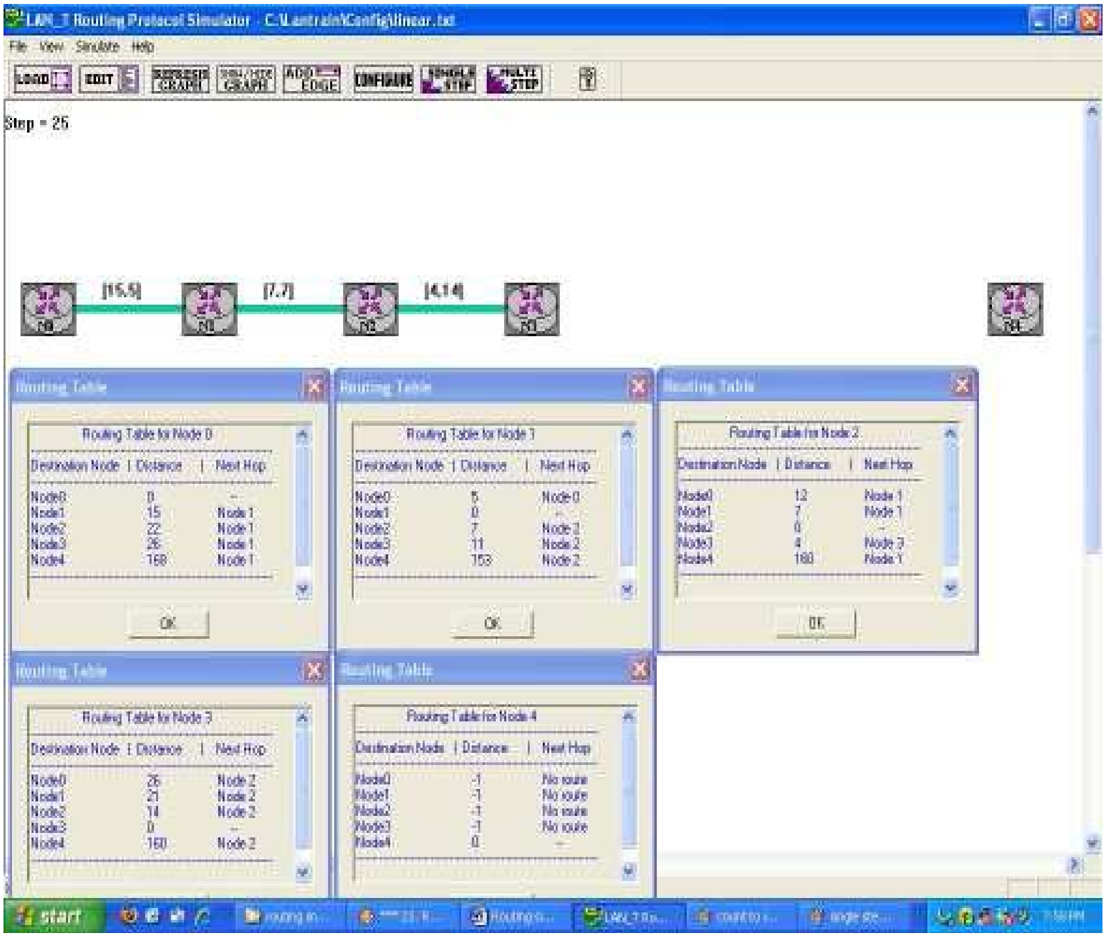
```
            Routing Table for Node 3
-------------------------------------------
Destination Node  | Distance   |  Next Hop
-------------------------------------------
Node0               26            Node 2
Node1               21            Node 2
Node2               14            Node 2
Node3               0             --
Node4               16            Node 4
-------------------------------------------
```

Routing Table

```
            Routing Table for Node 4
-------------------------------------------
Destination Node  | Distance   |  Next Hop
-------------------------------------------
Node0               32            Node 3
Node1               27            Node 3
Node2               20            Node 3
Node3               6             Node 3
Node4               0             --
-------------------------------------------
```

.

13. Now, observe the no changes in the routing table, as they are not Updated Click button to update the routing table.



```
Routing Table for Node 0
----------------------------------------
Destination Node  | Distance   |  Next Hop
----------------------------------------
Node0              0              --
Node1              15             Node 1
Node2              22             Node 1
Node3              26             Node 1
Node4              168            Node 1
----------------------------------------
```

```
Routing Table for Node 1
----------------------------------------
Destination Node  | Distance   |  Next Hop
----------------------------------------
Node0              5              Node 0
Node1              0              --
Node2              7              Node 2
Node3              11             Node 2
Node4              153            Node 2
----------------------------------------
```

```
Routing Table for Node 2
----------------------------------------
Destination Node  | Distance   |  Next Hop
----------------------------------------
Node0              12             Node 1
Node1              7              Node 1
Node2              0              --
Node3              4              Node 3
Node4              160            Node 1
----------------------------------------
```

```
Routing Table for Node 3
----------------------------------------
Destination Node  | Distance   |  Next Hop
----------------------------------------
Node0              26             Node 2
Node1              21             Node 2
Node2              14             Node 2
Node3              0              --
Node4              160            Node 2
----------------------------------------
```

```
Routing Table for Node 4
----------------------------------------
Destination Node  | Distance   |  Next Hop
----------------------------------------
Node0              -1             No route
Node1              -1             No route
Node2              -1             No route
Node3              -1             No route
Node4              0              --
----------------------------------------
```

14. Even after several hopping the routing tables of N0, N1, N2, N3 shows the path and weight to N4.

## RESULT:

Thus the simulation of the distance vector routing protocol to maintain routing tables as the traffic and topology of the network changes has been verified.

**EX.NO:10**

**DATE**:

## IMPLEMENTATION OF LINK STATE ROUTING ALGORITHM

**AIM:**

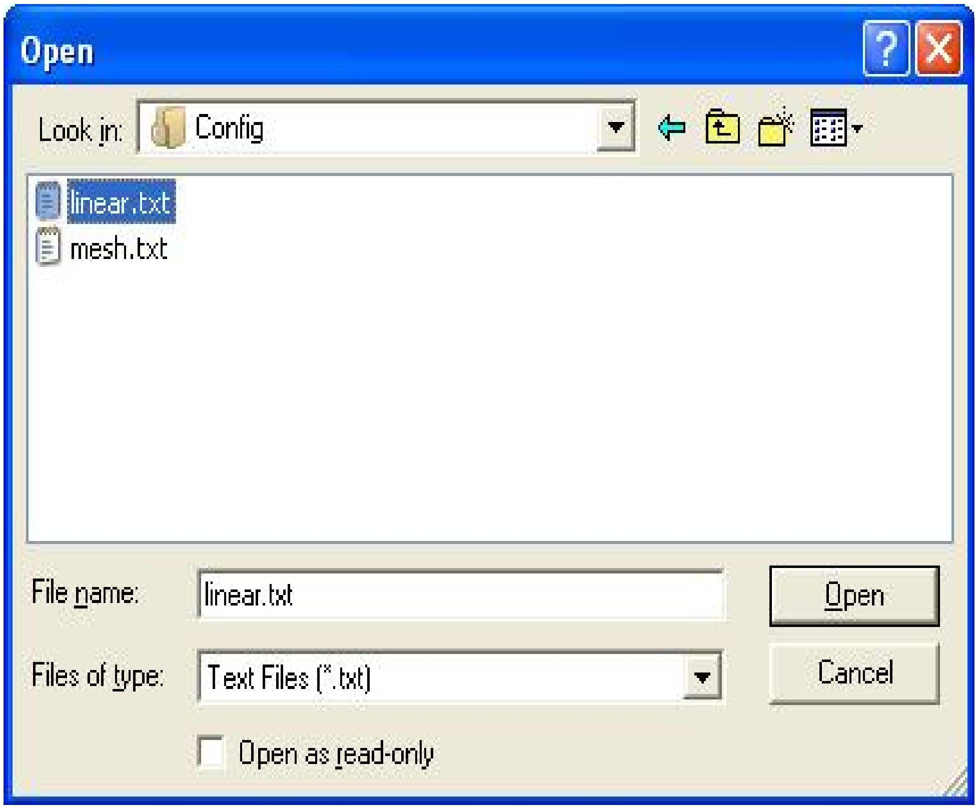
To simulate the link state routing protocol to maintain routing tables as the traffic and topology of the network change by using LAN-T Software.

**APPARATUS REQUIERD:**

- LTS-01 trainer kit and LAN-T Software.
- 2 Computers with Windows XP and Ethernet port available on them.
- RJ-45 to RJ-45 LAN connecting cables.

**PROCEDURE:**

1. Double click on LAN-T Routing Simulator icon from the desktop.
2. Click button and browse open **C:\Lantrain\Config\ linear.txt**.



Look in: Config

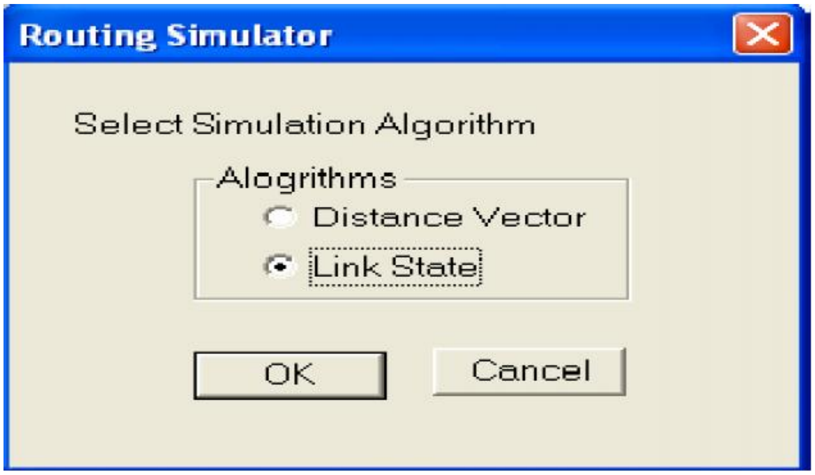
linear.txt
mesh.txt

File name: linear.txt

Files of type: Text Files (*.txt)

□ Open as read-only

3. Click configure button and select link state algorithm.



Routing Simulator

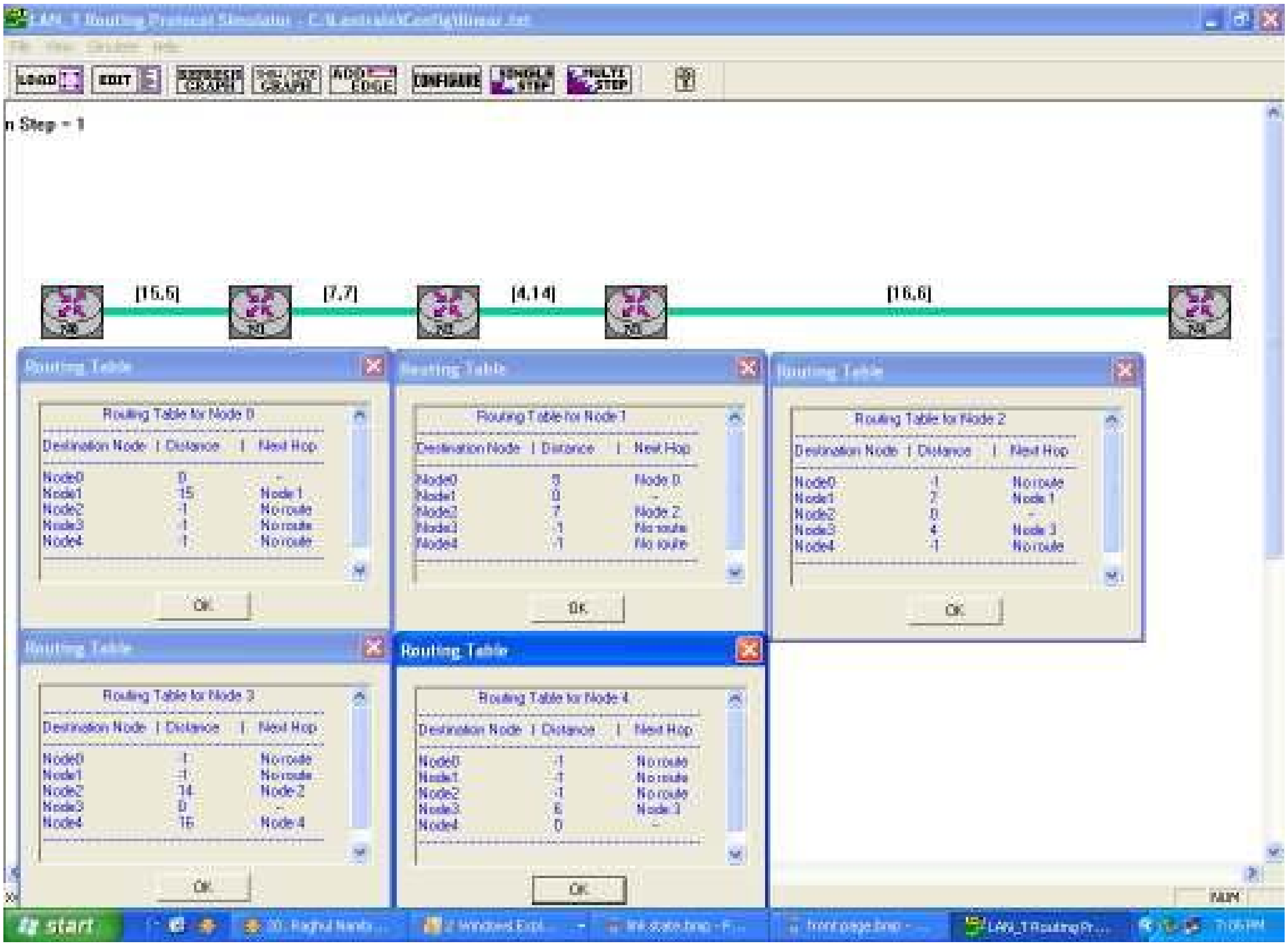
Select Simulation Algorithm

Alogrithms

○ Distance Vector

● Link State

4. Click on the nodes to obtain the routing table.



Routing Table

```
Routing Table for Node 0
--------------------------------------------
Destination Node  | Distance    |  Next Hop
--------------------------------------------
Node0                 0             -
Node1                 15            Node 1
Node2                 -1            No route
Node3                 -1            No route
Node4                 -1            No route
--------------------------------------------
```

Routing Table

```
Routing Table for Node 1
--------------------------------------------
Destination Node  | Distance    |  Next Hop
--------------------------------------------
Node0                 5             Node 0
Node1                 0             -
Node2                 7             Node 2
Node3                 -1            No route
Node4                 -1            No route
--------------------------------------------
```

Routing Table

```
Routing Table for Node 2
--------------------------------------------
Destination Node  | Distance    |  Next Hop
--------------------------------------------
Node0                 -1            No route
Node1                 7             Node 1
Node2                 0             -
Node3                 4             Node 3
Node4                 -1            No route
--------------------------------------------
```

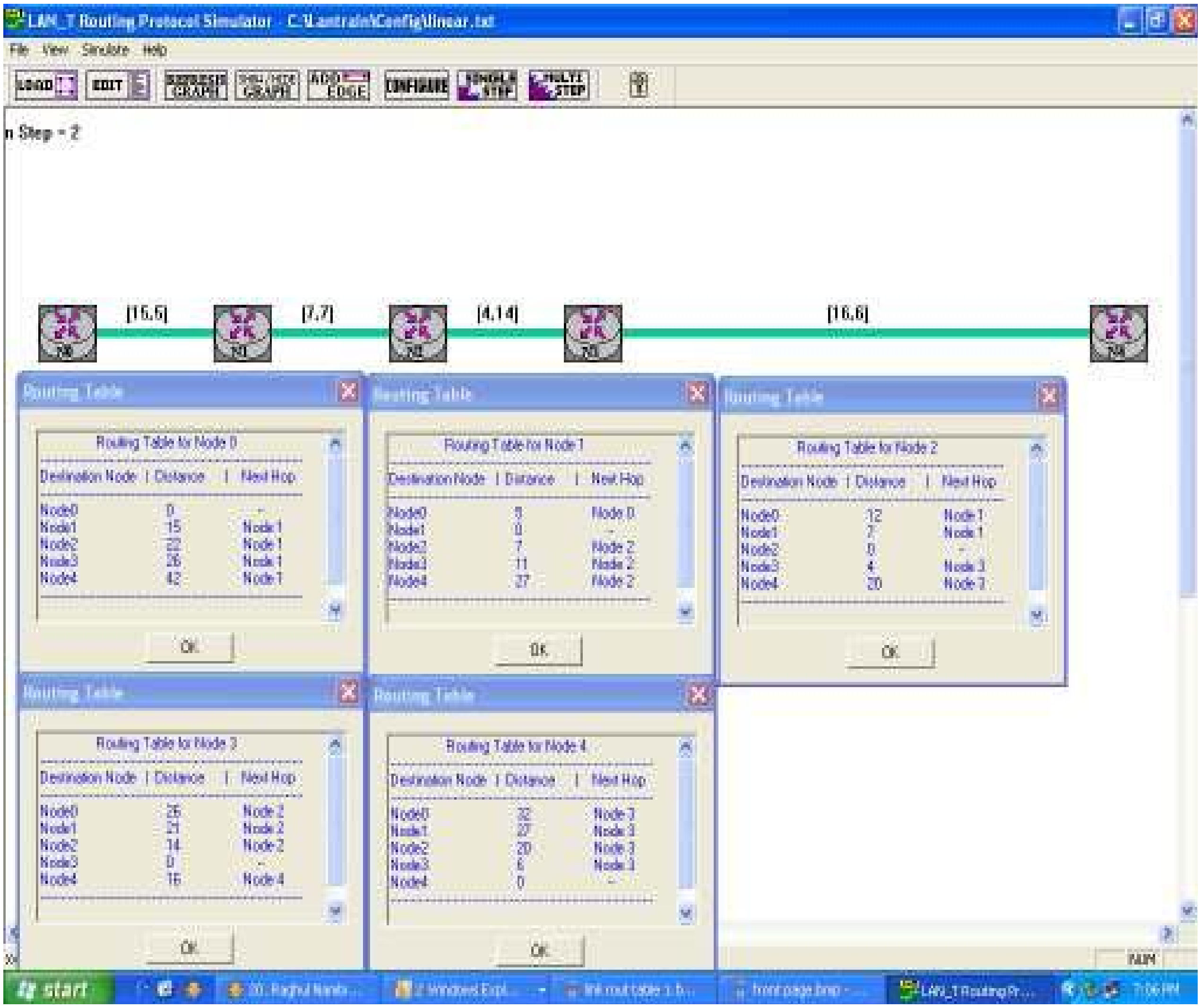
Routing Table

```
Routing Table for Node 3
--------------------------------------------
Destination Node  | Distance    |  Next Hop
--------------------------------------------
Node0                 -1            No route
Node1                 -1            No route
Node2                 14            Node 2
Node3                 0             -
Node4                 16            Node 4
--------------------------------------------
```

Routing Table

```
Routing Table for Node 4
--------------------------------------------
Destination Node  | Distance    |  Next Hop
--------------------------------------------
Node0                 -1            No route
Node1                 -1            No route
Node2                 -1            No route
Node3                 6             Node 3
Node4                 0             -
--------------------------------------------
```

5. Click the single step button to update the routing table and routing table  of entire nodes gets updated after a single hopping.



```
        Routing Table for Node 0
------------------------------------------
Destination Node  | Distance    |  Next Hop
------------------------------------------
Node0               0              -
Node1               15             Node 1
Node2               22             Node 1
Node3               26             Node 1
Node4               42             Node 1
------------------------------------------
```

```
        Routing Table for Node 1
------------------------------------------
Destination Node  | Distance    |  Next Hop
------------------------------------------
Node0               5              Node 0
Node1               0              -
Node2               7              Node 2
Node3               11             Node 2
Node4               27             Node 2
------------------------------------------
```

```
        Routing Table for Node 2
------------------------------------------
Destination Node  | Distance    |  Next Hop
------------------------------------------
Node0               12             Node 1
Node1               7              Node 1
Node2               0              -
Node3               4              Node 3
Node4               20             Node 3
------------------------------------------
```

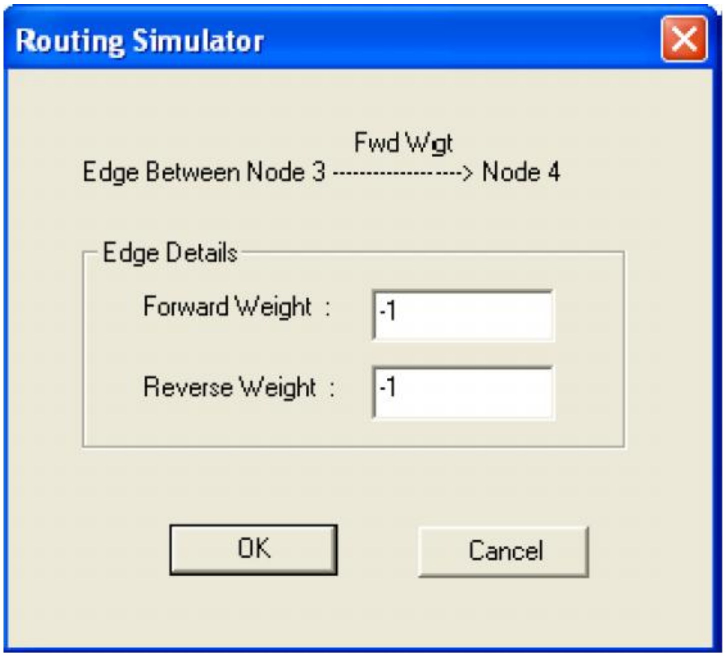
```
        Routing Table for Node 3
------------------------------------------
Destination Node  | Distance    |  Next Hop
------------------------------------------
Node0               26             Node 2
Node1               21             Node 2
Node2               14             Node 2
Node3               0              -
Node4               16             Node 4
------------------------------------------
```

```
        Routing Table for Node 4
------------------------------------------
Destination Node  | Distance    |  Next Hop
------------------------------------------
Node0               32             Node 3
Node1               27             Node 3
Node2               20             Node 3
Node3               6              Node 3
Node4               0              -
------------------------------------------
```

**Count to Infinity problem:**

6. Click on the green colour line lying between N3 and N4.

7. Enter forward and reverse weights as **-1** to disconnect N4 from the other nodes.



Fwd Wgt
Edge Between Node 3 -----------------> Node 4

Edge Details

Forward Weight : -1

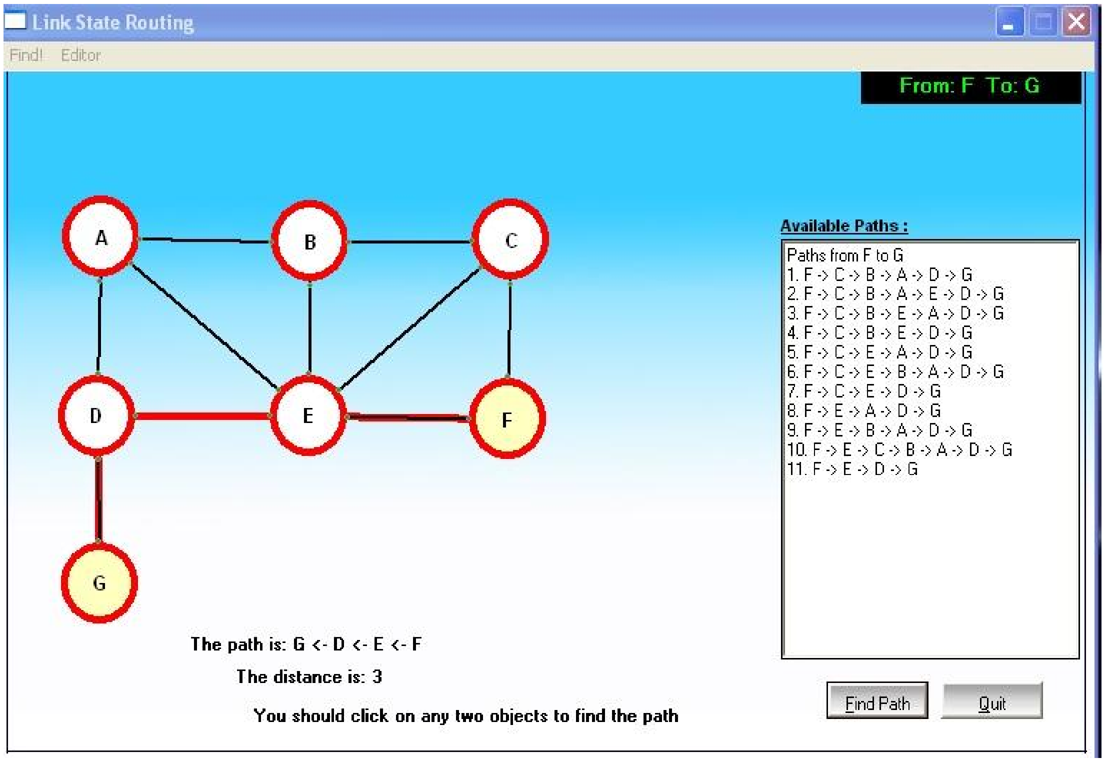
Reverse Weight : -1

8. Observe the routing table. The values are not changed as it’s not updated.

9. Click the single step button.

10. Now you could see the routing table for each nodes been updated.

## MODEL OUTPUT:



From: F To: G

Available Paths :

```
Paths from F to G
1. F -> C -> B -> A -> D -> G
2. F -> C -> B -> A -> E -> D -> G
3. F -> C -> B -> E -> A -> D -> G
4. F -> C -> B -> E -> D -> G
5. F -> C -> E -> A -> D -> G
6. F -> C -> E -> B -> A -> D -> G
7. F -> C -> E -> D -> G
8. F -> E -> A -> D -> G
9. F -> E -> B -> A -> D -> G
10. F -> E -> C -> B -> A -> D -> G
11. F -> E -> D -> G
```

The path is: G <- D <- E <- F

The distance is: 3

You should click on any two objects to find the path

## RESULT:

Thus the simulate the link state routing protocol to maintain routing tables as the traffic and topology of the network changes has been verified.

**EX.NO:11**

**DATE**:

## IMPLEMENTATION AND STUDY THE PERFORMANCE OF NETWORK WITH CSMA / CA PROTOCOL

**AIM:**

To Implement the CSMA/CA protocol for packet communication between a number of nodes connected to a common bus using LAN-T Software.

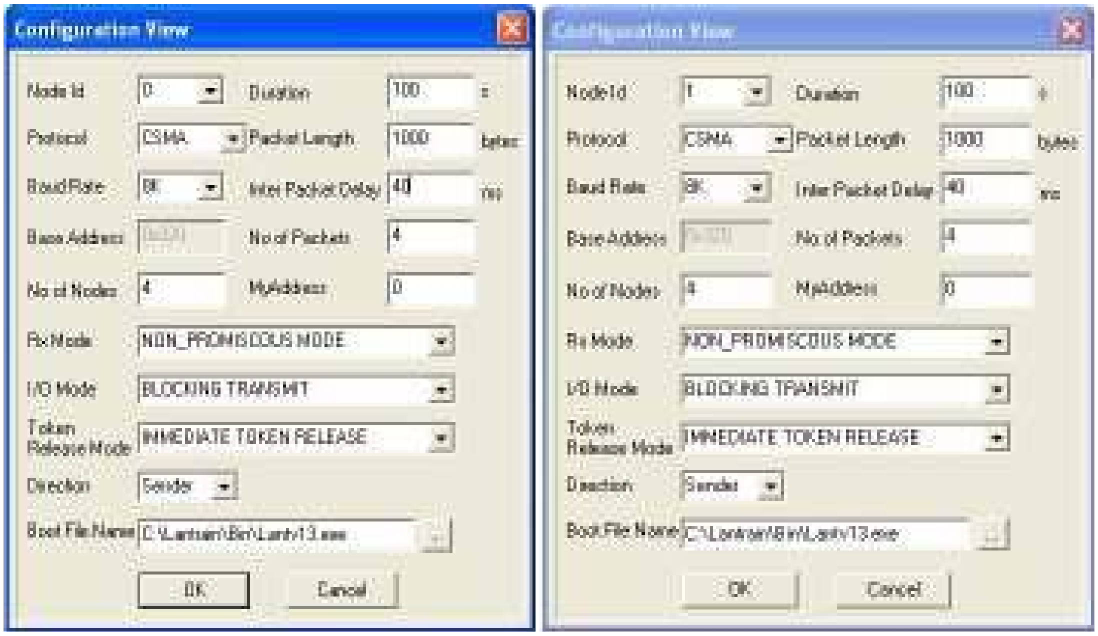
**APPARATUS REQUIERD:**

- LTS-01 trainer kit and LAN-T Software.
- 2 Computers with Windows XP and Ethernet port available on them.
- RJ-45 to RJ-45 LAN connecting cables.

**PROCEDURE:**

1. Click on the MAC Experiment icon twice from the desktop on both PC's.
2. Click the Configuration button in the window in both the PC's.

**PC SERVER 1**



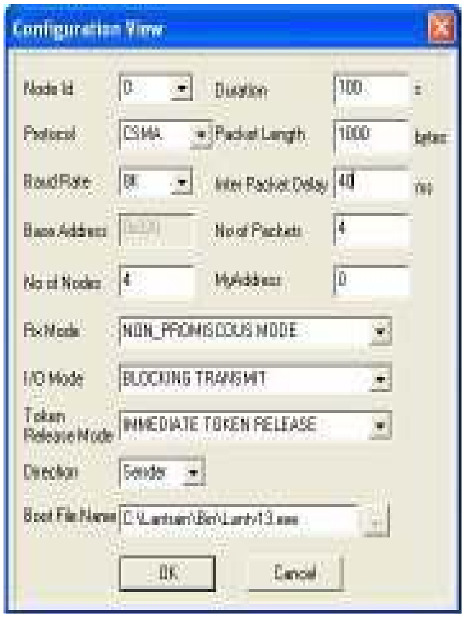
Configuration View

Node Id: 0 | Duration: 100 s
Protocol: CSMA | Packet Length: 1000 bytes
Baud Rate: 8K | Inter Packet Delay: 40 ms
Base Address: [illegible] | No of Packets: 4
No of Nodes: 4 | MyAddress: 0
Rx Mode: NON_PROMISCOUS MODE
I/O Mode: BLOCKING TRANSMIT
Token Release Mode: IMMEDIATE TOKEN RELEASE
Direction: Sender
Boot File Name: C:\Lantrain\Bin\Lantv13.exe

Configuration View

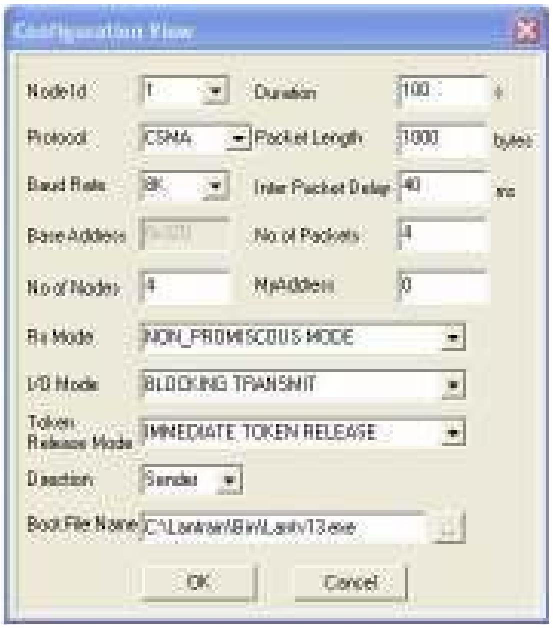
Node Id: 1 | Duration: 100 s
Protocol: CSMA | Packet Length: 1000 bytes
Baud Rate: 8K | Inter Packet Delay: 40 ms
Base Address: [illegible] | No of Packets: 4
No of Nodes: 4 | MyAddress: 0
Rx Mode: NON_PROMISCOUS MODE
I/O Mode: BLOCKING TRANSMIT
Token Release Mode: IMMEDIATE TOKEN RELEASE
Direction: Sender
Boot File Name: C:\Lantrain\Bin\Lantv13.exe

## PC SERVER2



Configuration View

Node Id: 0
Duration: 100 s
Protocol: CSMA
Packet Length: 1000 bytes
Baud Rate: 8K
Inter Packet Delay: 40 ms
Base Address: [illegible]
No of Packets: 4
No of Nodes: 4
MyAddress: 0
Rx Mode: NON_PROMISCOUS MODE
I/O Mode: BLOCKING TRANSMIT
Token Release Mode: IMMEDIATE TOKEN RELEASE
Direction: Sender
Boot File Name: C:\Lantrain\Bin\Lantv13.exe



Configuration View

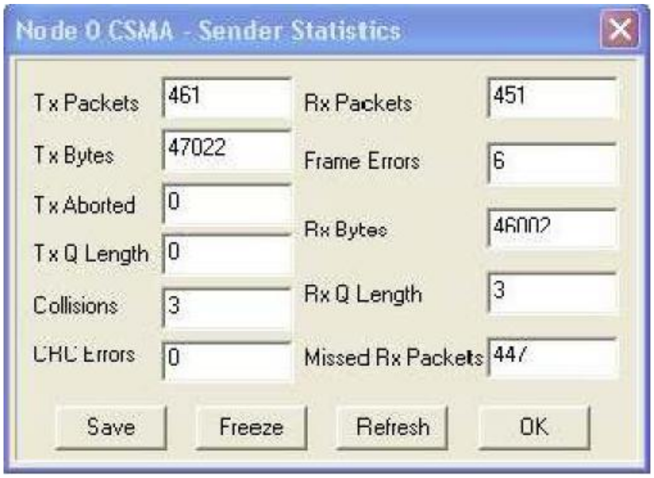
Node Id: 1
Duration: 100 s
Protocol: CSMA
Packet Length: 1000 bytes
Baud Rate: 8K
Inter Packet Delay: 40 ms
Base Address: [illegible]
No of Packets: 4
No of Nodes: 4
MyAddress: 0
Rx Mode: NON_PROMISCOUS MODE
I/O Mode: BLOCKING TRANSMIT
Token Release Mode: IMMEDIATE TOKEN RELEASE
Direction: Sender
Boot File Name: C:\Lantrain\Bin\Lantv13.exe

## SETTING THE CONFIGURATION MENU:

| PC 1 | | PC 2 | |
|---|---|---|---|
| **Node ID** | 0 on config menu 1 and<br>1 on config menu 2 | **Node ID** | 0 on config menu 1 and<br>1 on config menu 2 |
| **Protocol** | ALOHA | **Protocol** | CSMA/CD |
| **Baud Rate** | 8Kbps (At both the config menu and NEU) | **Baud Rate** | 8Kbps (At both the config menu and NEU) |
| **Duration** | 100s | **Duration** | 100s |
| **Packet Length** | 100 bytes | **Packet Length** | 100 bytes |
| **Bit Delay** | 0(at NEU) | **Bit Delay** | 0(at NEU) |
| **Direction** | Sender | **Direction** | Receiver |
| **My address** | 1 | **My address** | 2 on config menu 1 and 3 on config menu 2 |

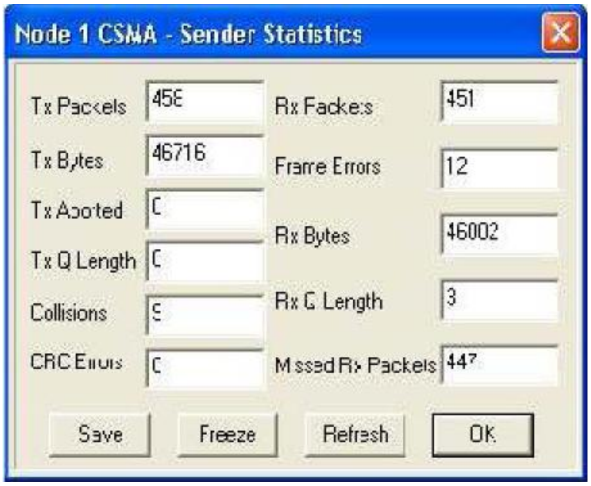
3. Click OK button and Download the driver to the NIU using the BOOT button command. Booting from any one of the applications is enough.
4. Run the experiment by clicking button or by choosing RUN Start from each application.
5. View the statistics window for results. To view the statistics window click on button. Only Tx packets and collision count are taken into account for MAC calculation

## PC SERVER 1



Node 0 CSMA - Sender Statistics

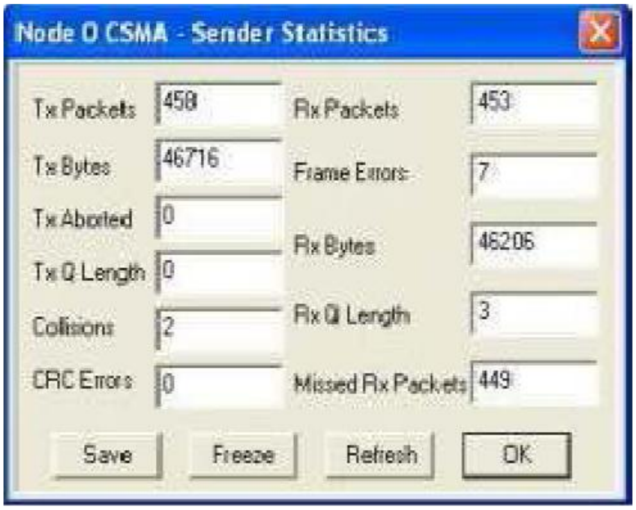
Tx Packets 461
Tx Bytes 47022
Tx Aborted 0
Tx Q Length 0
Collisions 3
CRC Errors 0
Rx Packets 451
Frame Errors 6
Rx Bytes 46002
Rx Q Length 3
Missed Rx Packets 447



Node 1 CSMA - Sender Statistics

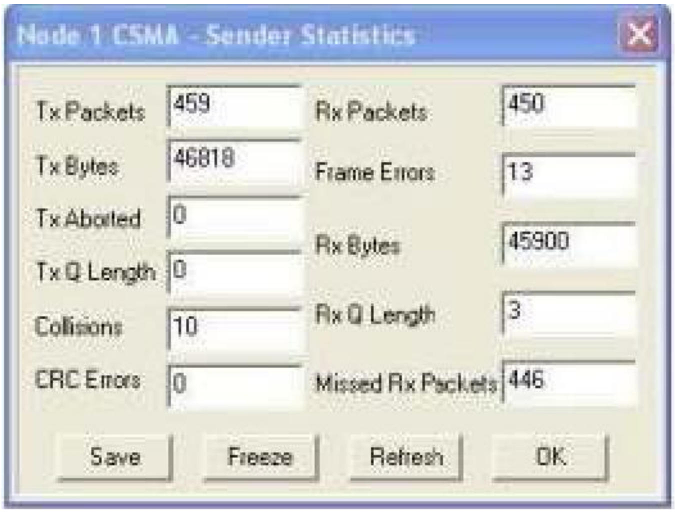
Tx Packets 458
Tx Bytes 46716
Tx Aborted 0
Tx Q Length 0
Collisions 9
CRC Errors 0
Rx Packets 451
Frame Errors 12
Rx Bytes 46002
Rx Q Length 3
Missed Rx Packets 447

## PC SERVER 2



Node 0 CSMA - Sender Statistics

Tx Packets 458
Tx Bytes 46716
Tx Aborted 0
Tx Q Length 0
Collisions 2
CRC Errors 0
Rx Packets 453
Frame Errors 7
Rx Bytes 46206
Rx Q Length 3
Missed Rx Packets 449



Node 1 CSMA - Sender Statistics

Tx Packets 459
Tx Bytes 46818
Tx Aborted 0
Tx Q Length 0
Collisions 10
CRC Errors 0
Rx Packets 450
Frame Errors 13
Rx Bytes 45900
Rx Q Length 3
Missed Rx Packets 446

6. Note down the readings once the experiment is completed.
7. Repeat the above steps for various values of ta.
8. Calculate the Practical offered load from the below given formula and plot the graph between the practical Offered load and Throughput.
9. Repeat the experiments for various values of Packet length, Node, Data rate and Bit delay.

### Calculation of generated load :

**Equation:**

$$G = \frac{N * P}{C * ta}$$

**G** is the generated load in the network.
**N** is the number of transmitting nodes. For example, 4 nodes (using 2 computers)
**P** is the packet length expressed in bits; say 100 bytes (800 bits).
**C** is the data rate normally set as 8kbs, which is selected in the NEU.
**ta** is the inter packet delay expressed in seconds; the time interval between two consecutive packets generated.

### Calculation of Throughput (X) from the obtained readings:

Successfully transmitted packet by a node = Tx Packets - Collision Count

$$X = \frac{(\text{Sum of Successfully Tx packet in all the nodes * Packet Length * 8})}{(\text{Duration of Experiment * Data ra}}$$

### Calculation of Theoretical Throughput:

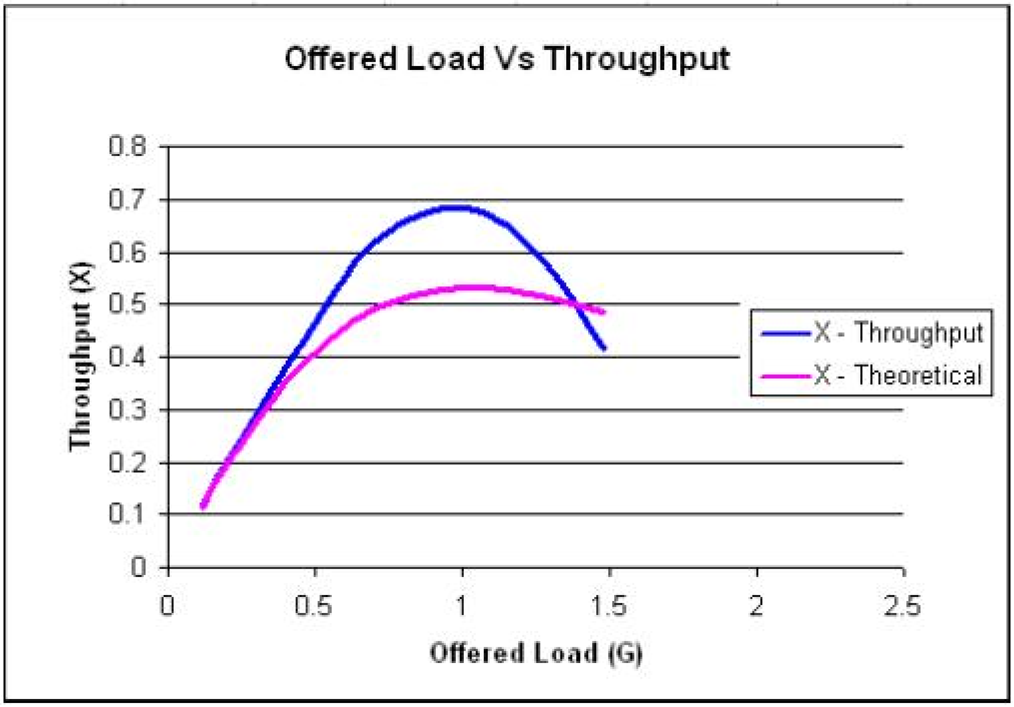
$$X = \frac{G(1+G+aG(1+G+aG/2))e-G(1+2a)}{G (1+2a)-(1-e-aG)+(1+aG)e-G(1+a)}$$

a = (end to end bit delay in bits) / (Packet length in bits) = (bit delay*N) / (P)

### Calculation of Offered load:

$$G = \frac{(\text{Sum of Tx packets in all the nodes * Packet Length * 8})}{(\text{Duration of Experiment * Data rate})}$$

## MODEL GRAPH:



## MODEL TABULATION:

**For bit delay = 1**

| IPD | Tx1 | Tx 2 | Tx 3 | Tx 4 | G – Practical Offered Load | X –Throughput | Theoretical Throughput |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**RES ULT** :

Thus the Implementation of the CSMA/CA protocol for packet communication between a numbers of nodes connected to a common bus data has been verified.

**EX.NO:12**

**DATE**:

## IMPLEMENTATION AND STUDY THE PERFORMANCE OF NETWORK WITH CSMA/CD PROTOCOLS

### AIM:

To Implement the CSMA/CD protocol for packet communication between a number of nodes

Connected to a common bus using LANT-T software.

### APPARATUS REQUIERD:

- LTS-01 trainer kit and LAN-T Software.
- 2 Computers with Windows XP and Ethernet port available on them.
- RJ-45 to RJ-45 LAN connecting cables.

### PROCEDURE:

1. Click on the **MAC** Experiment icon twice from the desktop on both PC's.
2. Click the Configuration button in the window in both the PC's.
3. Click OK button and Download the driver to the NIU using the BOOT button command. Booting from any one of the applications is enough.
4. Run the experiment by clicking button or by choosing RUN _ start from each application.
5. View the statistics window for results. To view the statistics window click on button. only Tx packets and successfully transmitted packets are taken into account for CSMA/CD calculation.
6. Note down the readings once the experiment is completed.
7. Repeat the above steps for various values of ta.
8. Calculate the Practical offered load from the below given formula and plot the graph between the practical Offered load and Throughput.
9. Repeat the experiment for various values of Packet length, Node and Data rate.

## SETTING THE CONFIGURATION MENU:

| PC 1 | | PC 2 | |
|---|---|---|---|
| **Node ID** | 0 on config menu 1 and<br>1 on config menu 2 | **Node ID** | 0 on config menu 1 and<br>1 on config menu 2 |
| **Protocol** | CSMA/CD | **Protocol** | CSMA/CD |
| **Baud Rate** | 8Kbps (At both the config menu and NEU) | **Baud Rate** | 8Kbps (At both the config menu and NEU) |
| **Duration** | 100s | **Duration** | 100s |
| **Packet Length** | 100 bytes | **Packet Length** | 100 bytes |
| **Bit Delay** | 0(at NEU) | **Bit Delay** | 0(at NEU) |
| **Direction** | Sender | **Direction** | Receiver |
| **No of packets** | 4 | **No of packets** | 4 |

## Calculation of Throughput for CSMA/CD protocol:

### Equation:

$$\boxed{G = \frac{N * P}{C * ta}}$$

**G** is the generated load in the network.
**N** is the number of transmitting nodes. For example, 4 nodes (using 2 computers)
**P** is the packet length expressed in bits; say 100 bytes (800 bits
**C** is the data rate normally set as 8kbs, which is selected in the NEU.
**ta** is the inter packet delay expressed in seconds; the time interval between two consecutive Packets generated

## Calculation of Throughput (X) from the obtained readings:

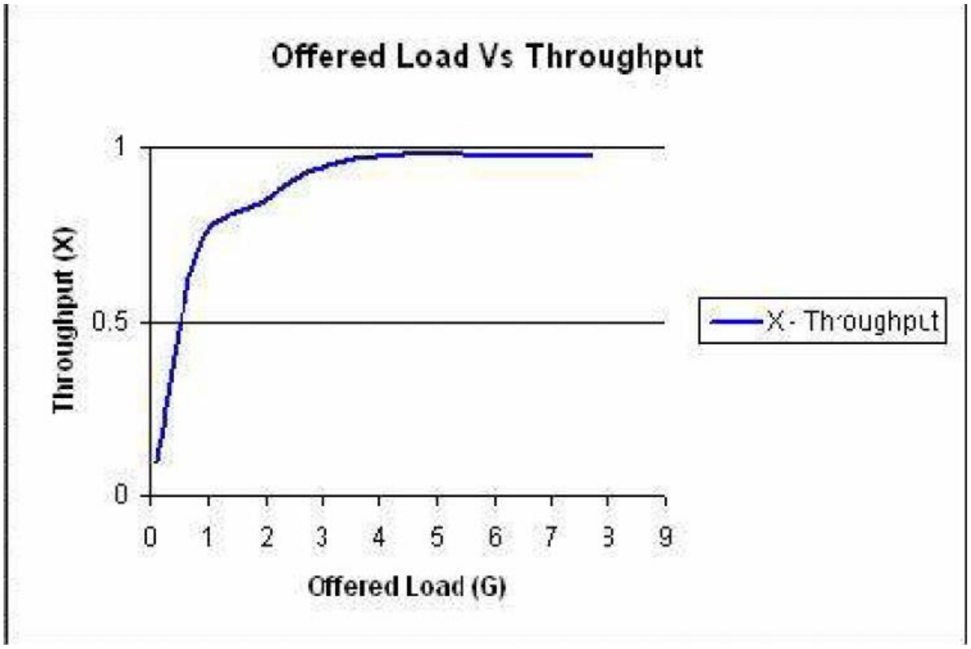
Successfully transmitted packet by a node = Tx Packets - Collision Count

$$\boxed{X = \frac{\textit{(Sum of Successfully Tx packet in all the nodes * Packet Length * 8)}}{\textit{(Duration of Experiment * Data rate)}}}$$

## Calculation of Offered load:

$$\boxed{G = \frac{\textit{(Sum of Offered load count in all the nodes * Packet Length * 8)}}{\textit{(Duration of Experiment * Data rate)}}}$$

## MODEL GRAPH :



## MODEL TABULATION:

| IPD | Tx1 | Tx 2 | Tx 3 | Tx 4 | G – Practical Offered Load | X -Throughput | Theoretical Throughput |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## RESULT:

Thus the Implementation of the CSMA/CD protocol for packet communication between a numbers of Nodes connected to a common bus has been verified.

**EX.NO:13**

**DATE**:

## IMPLEMENTATION OF DATA ENCRYPTION AND DECRYPTION

**AIM:**

To implement the Encryption and Decryption of a file using RC4 algorithm.

**APPARATUS REQUIERD:**

- Java JDK 5.0.
- Personal computer.

**PROCEDURE:**

**Initial Setup:**

1. Install Java JDK 5.0.
2. Browse C:\Lantrain\DataSecurity.
3. Copy the RC4 folder and three class files (Connect, RC4Client, and Server) and paste it into the Java\jdk1.5\bin folder in both the server and client PC's.

**Setting up the Server:**

1. Open the command prompt window (Start _Run _ type cmd).
2. Browse the java bin folder.
3. Type java Server to run the server.

**Encrypting a file:**

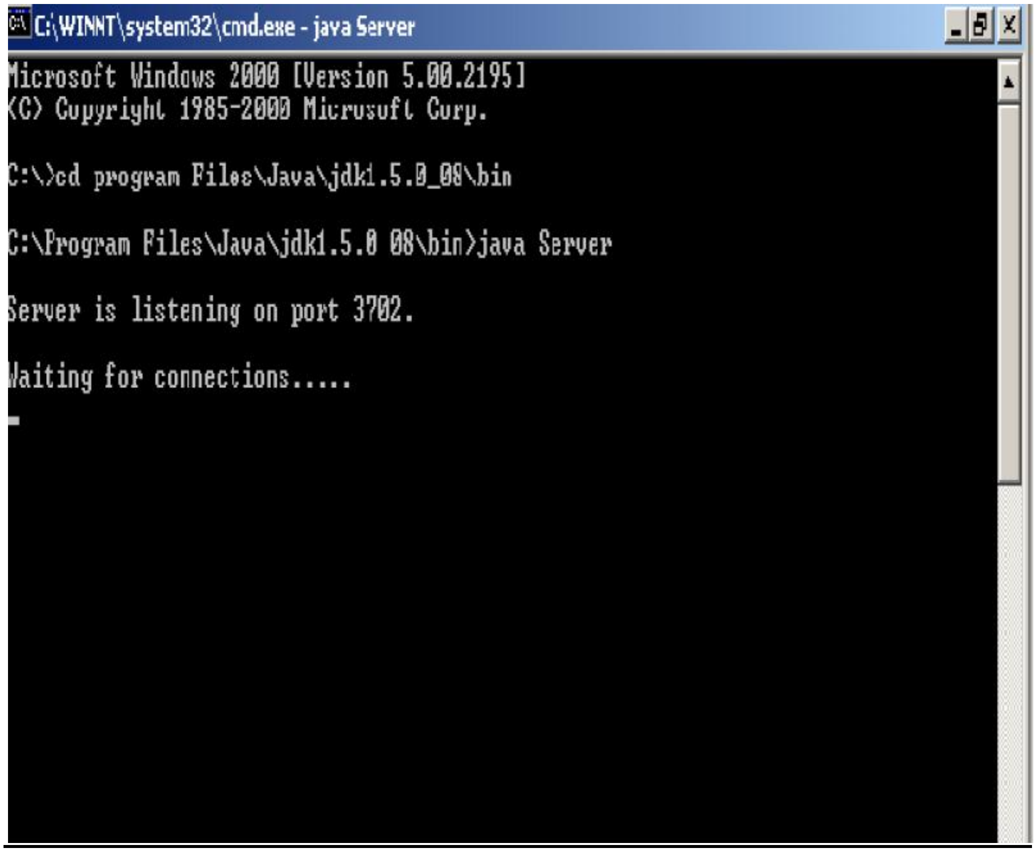
1. Open command prompt in the client side.
2. Browse the java bin folder.
3. Type java RC4Client.
4. Enter the IP address of the server.
5. Enter the mode of operation.
6. Enter the Encryption key not more than 5 characters.
7. Enter the path name of the file to be encrypted. (For e.g.: c:\\abc.txt)
8. Type YES if you like to close the session or type NO if you like to continue decrypting the Cipher text.

9. The encrypted text is available in c:\output.tx .Try to re-arrange the cipher text using any crypt-analysis tool

**Decrypting the Cipher text file:**

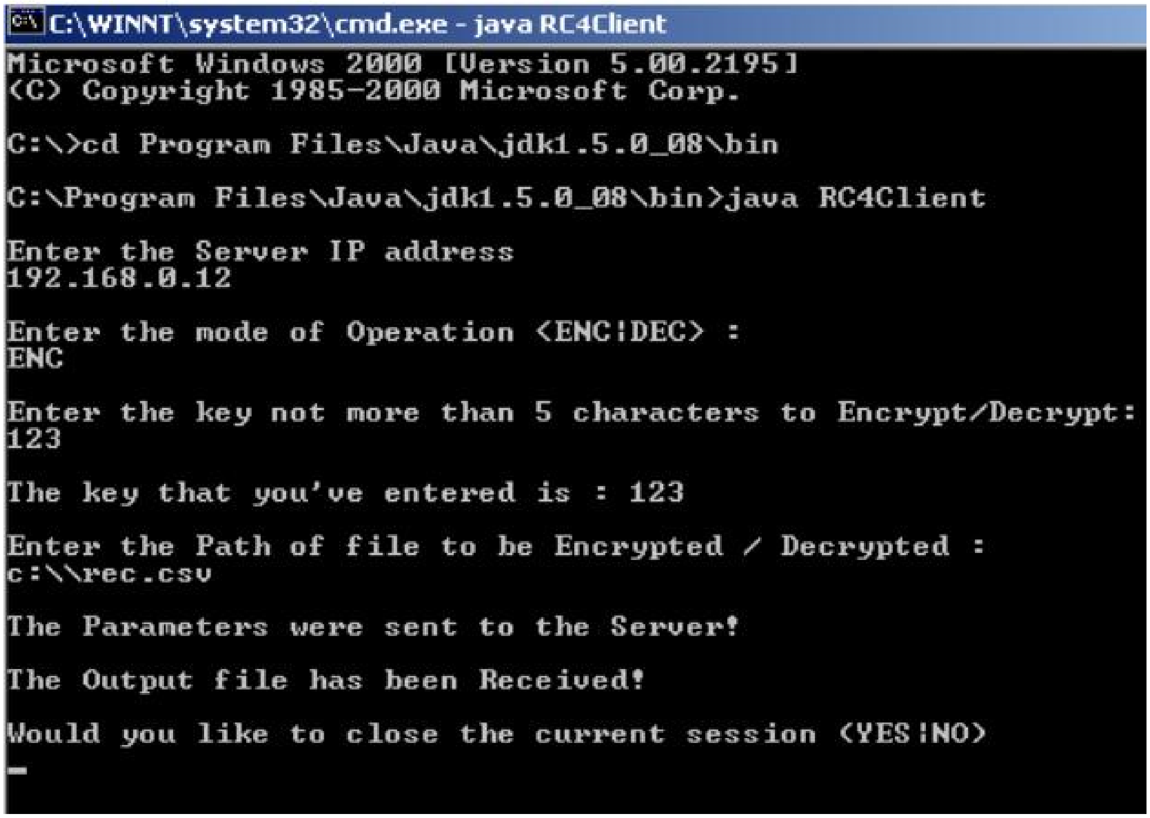
1. Enter the mode of operation as DEC for decrypting the cipher text.
2. Enter the Decryption keys same as used for Encryption.
3. Enter the full path name of the file to be decrypted. (i.e., c:\\output.txt)
4. Find out the decrypted file in c:\\output.txt.

**SETTING UP THE SERVER:**



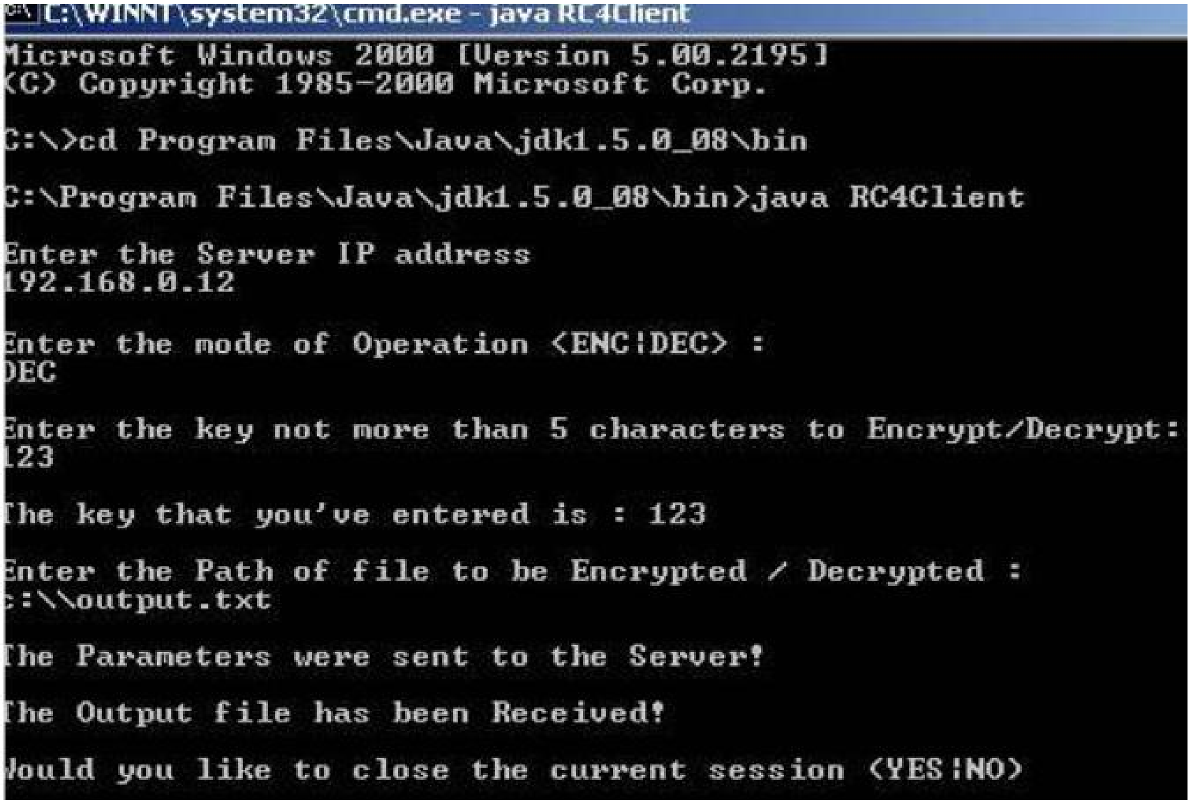
```
Microsoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-2000 Microsoft Corp.

C:\>cd program Files\Java\jdk1.5.0_08\bin

C:\Program Files\Java\jdk1.5.0 08\bin>java Server

Server is listening on port 3702.

Waiting for connections.....
```

## MODEL OUT PUTS OF ENCRYPTION:



```
Microsoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-2000 Microsoft Corp.

C:\>cd Program Files\Java\jdk1.5.0_08\bin

C:\Program Files\Java\jdk1.5.0_08\bin>java RC4Client

Enter the Server IP address
192.168.0.12

Enter the mode of Operation (ENC|DEC) :
ENC

Enter the key not more than 5 characters to Encrypt/Decrypt:
123

The key that you've entered is : 123

Enter the Path of file to be Encrypted / Decrypted :
c:\\rec.csv

The Parameters were sent to the Server!

The Output file has been Received!

Would you like to close the current session (YES|NO)
_
```

## MODEL OUTPUT OF DECRYPTION:



```
C:\WINNT\system32\cmd.exe - java RC4Client
Microsoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-2000 Microsoft Corp.

C:\>cd Program Files\Java\jdk1.5.0_08\bin

C:\Program Files\Java\jdk1.5.0_08\bin>java RC4Client

Enter the Server IP address
192.168.0.12

Enter the mode of Operation <ENC|DEC> :
DEC

Enter the key not more than 5 characters to Encrypt/Decrypt:
123

The key that you've entered is : 123

Enter the Path of file to be Encrypted / Decrypted :
c:\\output.txt

The Parameters were sent to the Server!

The Output file has been Received!

Would you like to close the current session <YES|NO>
```

## RESULT:

Thus the data encryption and decryption file using RC4 algorithm was studied and verified.

**EX.NO:14**

**DATE:**

## STUDY OF NETWORK SIMULATOR (NS).AND SIMULATION OF CONGESTION CONTROL ALGORITHMS USING NS

### AIM:

To Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS Tool.

### NET WORK SIMULATOR (NS2)

**Ns overview**

- Ns programming: A Quick start
- Case study I: A simple Wireless network
- Case study II: Create a new agent in Ns

**Ns overview**

- Ns Status
- Periodical release (ns-2.26, Feb 2003)
- Platform support
- FreeBSD, Linux, Solaris, Windows and Mac

**Ns functionalities**

Routing, Transportation, Traffic sources, queuing disciplines, QoS

**Wireless**

Ad hoc routing, mobile IP, sensor-MAC
Tracing, visualization and various utilities
NS (Network Simulators)

Most of the commercial simulators are GUI driven, while some network simulators are CLI driven. The network model / configuration describe the state of the network (nodes, routers, switches, and links) and the events (data transmissions, packet error etc.). An important output of simulations is the trace files. Trace files log every packet, every event that occurred in the simulation and are used for analysis. Network simulators can also provide other tools to facilitate visual analysis of trends and potential trouble spots.

Most network simulators use discrete event simulation, in which a list of pending "events" is stored, and those events are processed in order, with some events triggering future events such as the event of the arrival of a packet at one node triggering the event of the arrival of that packet at a downstream node.

Simulation of networks is a very complex task. For example, if congestion is high, then estimation of the average occupancy is challenging because of high variance. To estimate the likelihood of a buffer overflow in a network, the time required for an accurate answer can be extremely large. Specialized techniques such as "control varieties" and "importance sampling" have been developed to speed simulation.

**Examples of network simulators**

There are many both free/open-source and proprietary network simulators. Examples of notable network simulation software are, ordered after how often they are mentioned in research papers:

1. ns (open source)
2. OPNET (proprietary software)
3. NetSim (proprietary software)

**Uses of network simulators**

Network simulators serve a variety of needs. Compared to the cost and time involved in setting up an entire test bed containing multiple networked computers, routers and data links, network simulators are relatively fast and inexpensive. They allow engineers, researchers to test scenarios that might be particularly difficult or expensive to emulate using real hardware - for instance, simulating a scenario with several nodes or experimenting with a new protocol in the network. Network simulators are particularly useful in allowing researchers to test new networking protocols or changes to existing protocols in a controlled and reproducible environment. A typical network simulator encompasses a wide range of networking technologies and can help the users to build complex networks from basic building blocks such as a variety of nodes and links. With the help of simulators, one can design hierarchical networks using various types of nodes like computers, hubs, bridges, routers, switches, links, mobile units etc.

Various types of Wide Area Network (WAN) technologies like TCP, ATM, IP etc. and Local Area Network (LAN) technologies like Ethernet, token rings etc., can all be simulated with a typical simulator and the user can test, analyze various standard results apart from devising some novel protocol or strategy for routing etc. Network simulators are also widely used to simulate battlefield networks in Network-centric warfare

There are a wide variety of network simulators, ranging from the very simple to the very complex. Minimally, a network simulator must enable a user to represent a network topology, specifying the nodes on the network, the links between those nodes and the traffic between the nodes. More complicated systems may allow the user to specify everything about the protocols used to handle traffic in a network. Graphical applications allow users to easily visualize the workings of their simulated environment. Text-based applications may provide a less intuitive interface, but may permit more advanced forms of customization.

**Packet loss**

Occurs when one or more packets of data travelling across a computer network fail to reach their destination. Packet loss is distinguished as one of the three main error types encountered in digital communications; the other two being bit error and spurious packets caused due to noise.

Packets can be lost in a network because they may be dropped when a queue in the network node overflows. The amount of packet loss during the steady state is another important property of a congestion control scheme. The larger the value of packet loss, the more difficult it is for transport layer protocols to maintain high bandwidths, the sensitivity to loss of individual packets, as well as to frequency and patterns of loss among longer packet sequences is strongly dependent on the application itself.

**Throughput**

This is the main performance measure characteristic, and most widely used. In communication networks, such as Ethernet or packet radio, throughput or network throughput is the average rate of successful message delivery over a communication channel. The throughput is usually measured in bits per second (bit/s mbps), and sometimes in data packets per second or data packets per time slot This measure how soon the receiver is able to get a certain amount of data send by the sender. It is determined as the ratio of the total data received to the end to end delay. Throughput is an important factor which directly impacts the network performance

**Delay**

Delay is the time elapsed while a packet travels from one point e.g., source premise or network ingress to destination premise or network degrees. The larger the value of delay, the more difficult it is for transport layer protocols to maintain high band widths. We will calculate end to end delay

**Queue Length**

A queuing system in networks can be described as packets arriving for service, waiting for service if it is not immediate, and if having waited for service, leaving the system after being served. Thus queue length is very important characteristic to determine that how well the active queue management of the congestion control algorithm has been working.

**RESULT:**

Thus the study of Network simulator (NS2) has discussed and studied.

**EX. NO: 15**

**DATE:**

## NETWORK TOPOLOGY - TOKEN BUS

## AIM:

To implement the network topology by token passing access in token bus LAN using LAN-T Software.

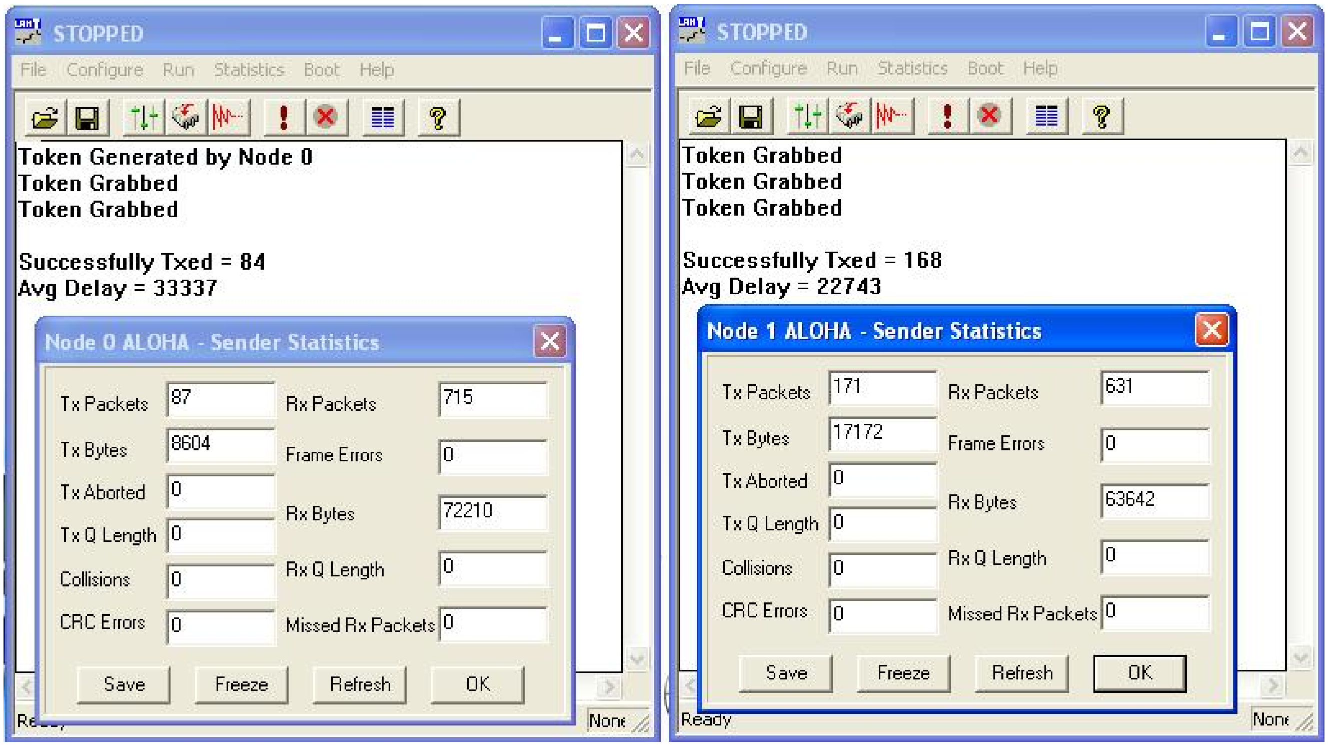
## APPARATUS REQUIERD:

- LTS-01 trainer kit and LAN-T software.
- 2 Computers with Windows XP and Ethernet port available on them.
- RJ-45 to RJ-45 LAN connecting cables.

## PROCEDURE:

1. Click on the Token Bus icon twice from the desktop.
2. Click the Configuration button in the window in both the PC's.

**PC 1**



Token Generated by Node 0
Token Grabbed
Token Grabbed

Successfully Txed = 84
Avg Delay = 33337

Node 0 ALOHA - Sender Statistics

| | | | |
|---|---|---|---|
| Tx Packets | 87 | Rx Packets | 715 |
| Tx Bytes | 8604 | Frame Errors | 0 |
| Tx Aborted | 0 | Rx Bytes | 72210 |
| Tx Q Length | 0 | | |
| Collisions | 0 | Rx Q Length | 0 |
| CRC Errors | 0 | Missed Rx Packets | 0 |

Token Grabbed
Token Grabbed
Token Grabbed

Successfully Txed = 168
Avg Delay = 22743

Node 1 ALOHA - Sender Statistics

| | | | |
|---|---|---|---|
| Tx Packets | 171 | Rx Packets | 631 |
| Tx Bytes | 17172 | Frame Errors | 0 |
| Tx Aborted | 0 | Rx Bytes | 63642 |
| Tx Q Length | 0 | | |
| Collisions | 0 | Rx Q Length | 0 |
| CRC Errors | 0 | Missed Rx Packets | 0 |

## SETTING THE CONFIGURATION MENU:

| PC 1 | | PC 2 | |
|---|---|---|---|
| **Node ID** | 0 on config menu 1 and<br>1 on config menu 2 | **Node ID** | 0 on config menu 1 and<br>1 on config menu 2 |
| **Protocol** | ALOHA | **Protocol** | ALOHA |
| **Baud Rate** | 8Kbps (At both the config menu and NEU) | **Baud Rate** | 8Kbps (At both the config menu and NEU) |
| **Duration** | 100s | **Duration** | 100s |
| **Packet Length** | 100 bytes | **Packet Length** | 100 bytes |
| **Bit Delay** | 0(at NEU) | **Bit Delay** | 0(at NEU) |
| **Direction** | Sender | **Direction** | Sender |

Note: All the nodes have to be configured as ‘Senders’. Set the topology as ‘Bus’.

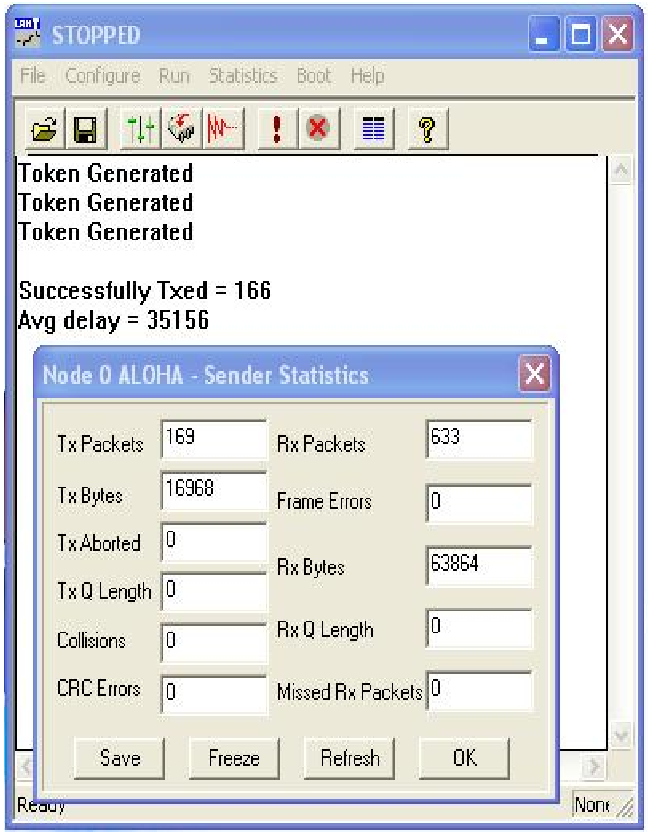
*CSMA/CA application is built on Aloha shell script and hence we select protocol as Aloha.

3. Click OK button and Download the driver to the NIU using the BOOT button command. Booting from any one of the applications is enough.

4. Run the experiment by clicking button or by choosing RUN start from each application. Run the all the experiments at the same time.

5. Enter the THT time in all nodes and press the OK button first in the node, which has the lowest Priority of my Address.

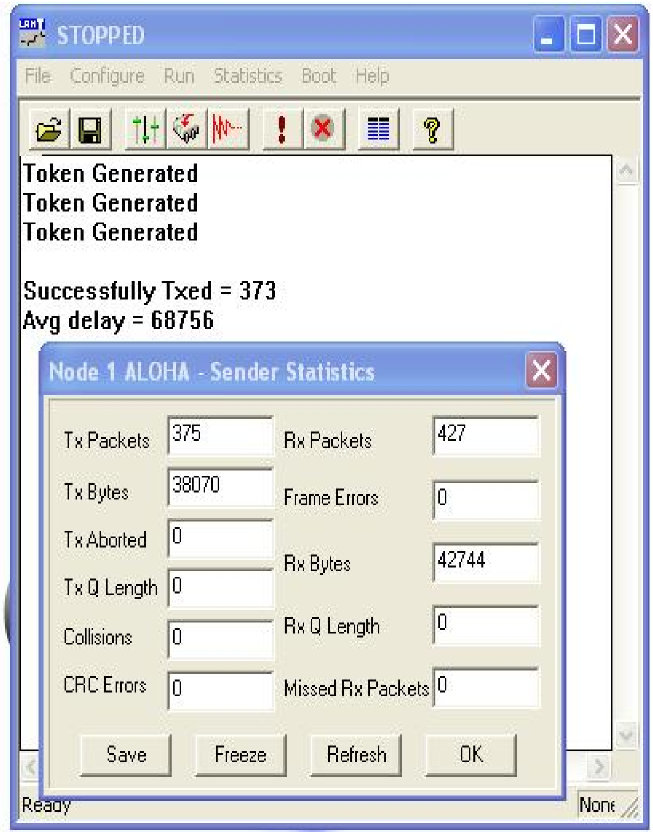
## PC SERVER 2



```
Token Generated
Token Generated
Token Generated

Successfully Txed = 166
Avg delay = 35156
```

Node 0 ALOHA - Sender Statistics

|  |  |  |  |
|---|---|---|---|
| Tx Packets | 169 | Rx Packets | 633 |
| Tx Bytes | 16968 | Frame Errors | 0 |
| Tx Aborted | 0 | Rx Bytes | 63864 |
| Tx Q Length | 0 | Rx Q Length | 0 |
| Collisions | 0 |  |  |
| CRC Errors | 0 | Missed Rx Packets | 0 |



```
Token Generated
Token Generated
Token Generated

Successfully Txed = 373
Avg delay = 68756
```

Node 1 ALOHA - Sender Statistics

|  |  |  |  |
|---|---|---|---|
| Tx Packets | 375 | Rx Packets | 427 |
| Tx Bytes | 38070 | Frame Errors | 0 |
| Tx Aborted | 0 | Rx Bytes | 42744 |
| Tx Q Length | 0 | Rx Q Length | 0 |
| Collisions | 0 |  |  |
| CRC Errors | 0 | Missed Rx Packets | 0 |

6. Set the Token Holding Time (THT) (say 2000 ms).

7. View the statistics window for results. To view the statistics window, click run button.

8. Note down the readings once the experiment is completed.

9. Repeat the above steps for various values of ta.

10. Calculate the Practical offered load from the below given formula and plot the graph between the Practical Offered load and Throughput.

11. Repeat the experiment for various values of Packet length, Node, Data rate.

12. Repeat the above steps, while running the experiment set the BER to $10^{-2}$ or try to stop one of the nodes and observe the behavior and explain the same.

## Calculation of the generated load:

$$\boxed{\mathbf{G = \frac{N * P}{C * t_a}}}$$

**G** is the generated load in the network.

**N** is the number of transmitting nodes. For example, 4 nodes (using 2 computers)

**P** is the packet length expressed in bits; say 100 bytes (800 bits).

**C** is the data rate normally set as 8kbs, which is selected in the NEU**.**

**$t_a$** is the inter packet delay expressed in seconds;.

## Calculation of Throughput (X) from the obtained readings:

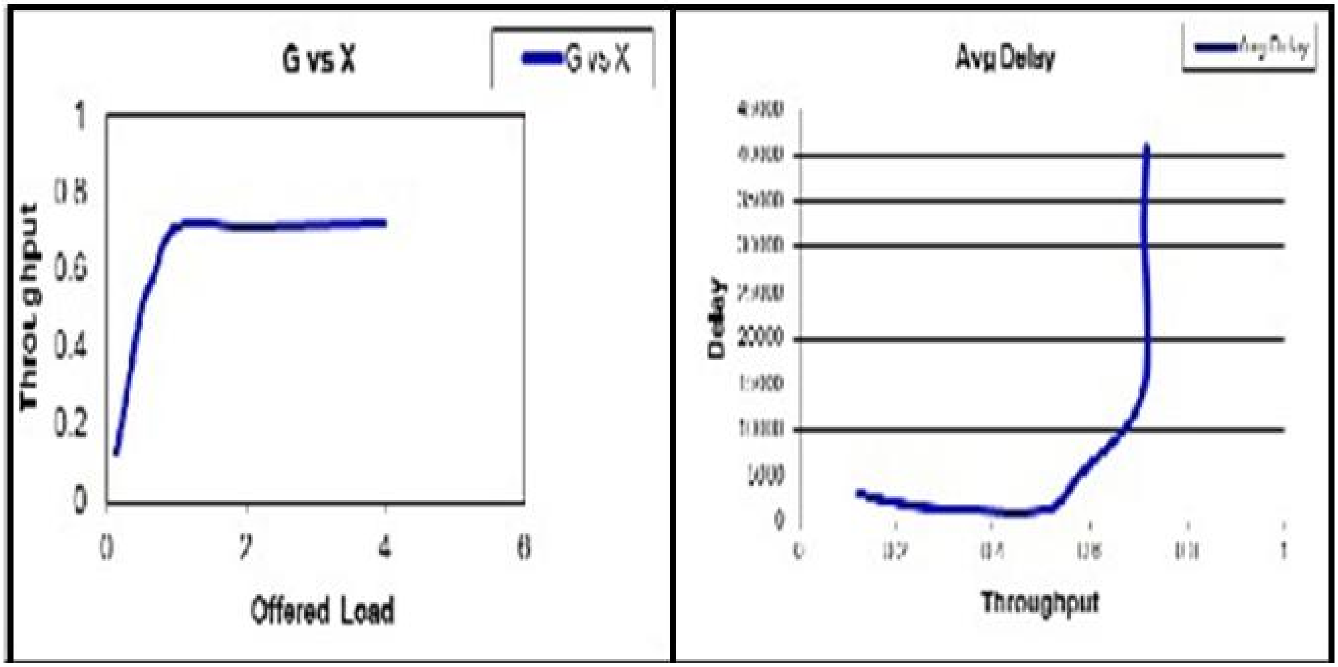
$$\boxed{X = \frac{\text{(Sum of Tx packet in all the nodes * Packet Length * 8)}}{\text{(Duration of Experiment * Data rate)}}}$$

## Calculation of the Offered load:

$$\boxed{\mathbf{G = \frac{N * P}{C * t_a}}}$$

G – Offered load
N – Number of nodes
P – Packet length in bits
C – Data rate in bits/sec
$t_a$ – Inter packet delay in millisecs.

## MODEL GRAPH:



## MODEL TABULATION:

| IPD | Tx 1 | Tx 2 | Tx 3 | Tx 4 | G – Offered Load | X – Throughput | Avg Delay |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## RESULT:

Thus the implementation of the token passing access in token bus-lan has been calculated and verified.

**EX. NO: 16**

**DATE:**

## NETWORK TOPOLOGY - TOKEN RING

**AIM:**

To implement the token passing access in Token Ring by using LAN-T software.

**APPARATUS REQUIERD:**

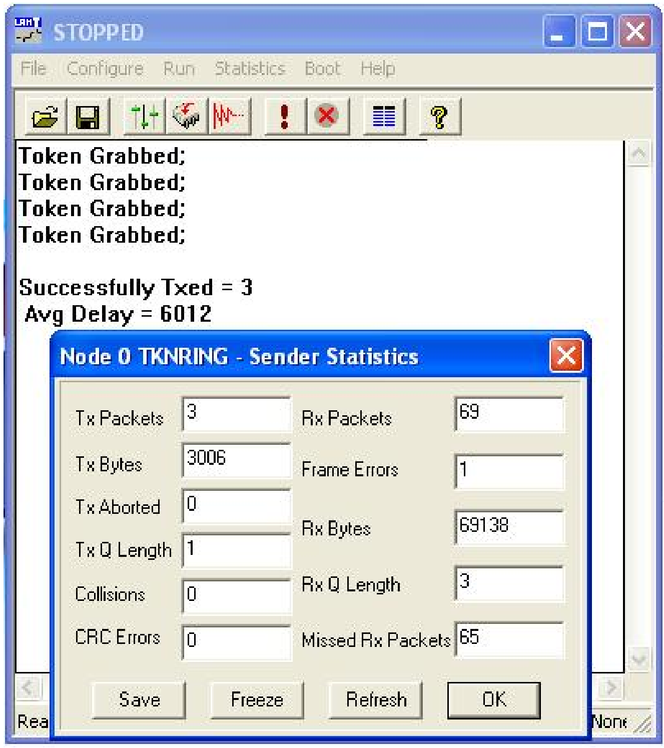
- LTS-01 trainer kit and LAN-T software.
- 2 Computers with Windows XP and Ethernet port available on them
- RJ-45 to RJ-45 LAN connecting cables

**PROCEDURE:**

1. Click on the Token Ring icon twice from the desktop.

2. Click the Configuration button in the window in both the PC's.

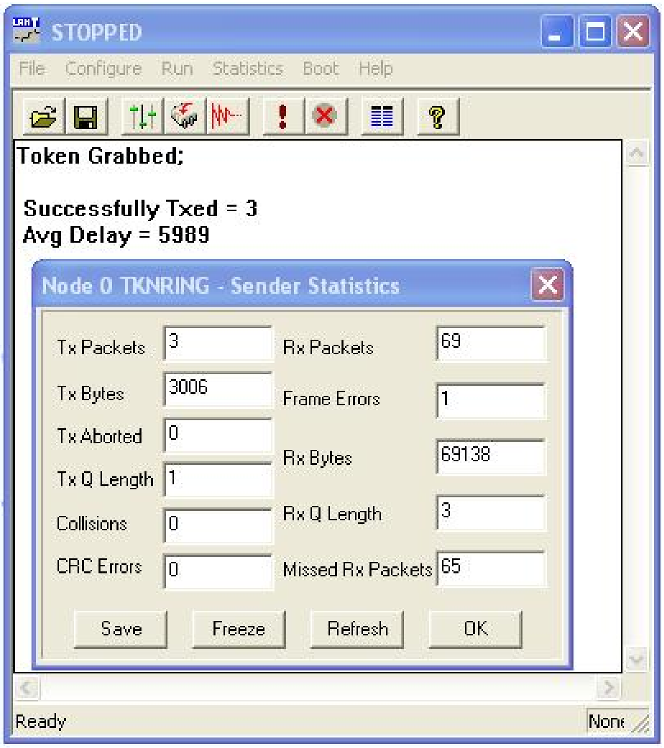
**PC SERVER 1**


STOPPED
File Configure Run Statistics Boot Help
Node 0 TKNRING - Sender Statistics
Save
Freeze
Refresh
OK
Rea
None

```
Token Grabbed;
Token Grabbed;
Token Grabbed;
Token Grabbed;

Successfully Txed = 3
 Avg Delay = 6012
```

Tx Packets: 3  
Tx Bytes: 3006  
Tx Aborted: 0  
Tx Q Length: 1  
Collisions: 0  
CRC Errors: 0  
Rx Packets: 69  
Frame Errors: 1  
Rx Bytes: 69138  
Rx Q Length: 3  
Missed Rx Packets: 65

**PC SERVER 2**


STOPPED
File Configure Run Statistics Boot Help
Node 0 TKNRING - Sender Statistics
Save
Freeze
Refresh
OK
Ready
None

```
Token Grabbed;

 Successfully Txed = 3
 Avg Delay = 5989
```

Tx Packets: 3  
Tx Bytes: 3006  
Tx Aborted: 0  
Tx Q Length: 1  
Collisions: 0  
CRC Errors: 0  
Rx Packets: 69  
Frame Errors: 1  
Rx Bytes: 69138  
Rx Q Length: 3  
Missed Rx Packets: 65

## SETTING THE CONFIGURATION MENU:

| PC 1 | | PC 2 | |
|---|---|---|---|
| **Node ID** | 0 on config menu 1 and<br>1 on config menu 2 | **Node ID** | 0 on config menu 1 and<br>1 on config menu 2 |
| **Protocol** | RING | **Protocol** | RING |
| **Baud Rate** | 8Kbps (At both the config menu and NEU) | **Baud Rate** | 8Kbps (At both the config menu and NEU) |
| **Duration** | 100s | **Duration** | 100s |
| **Packet Length** | 100 bytes | **Packet Length** | 100 bytes |
| **Bit Delay** | 0(at NEU) | **Bit Delay** | 0(at NEU) |
| **Direction** | Sender | **Direction** | Sender |

Note: All the nodes have to be configured as ‘Senders’. Set the topology as ‘Ring’

3. Click OK button and Download the driver to the NIU using the BOOT button command. Booting from anyone of the applications is enough.

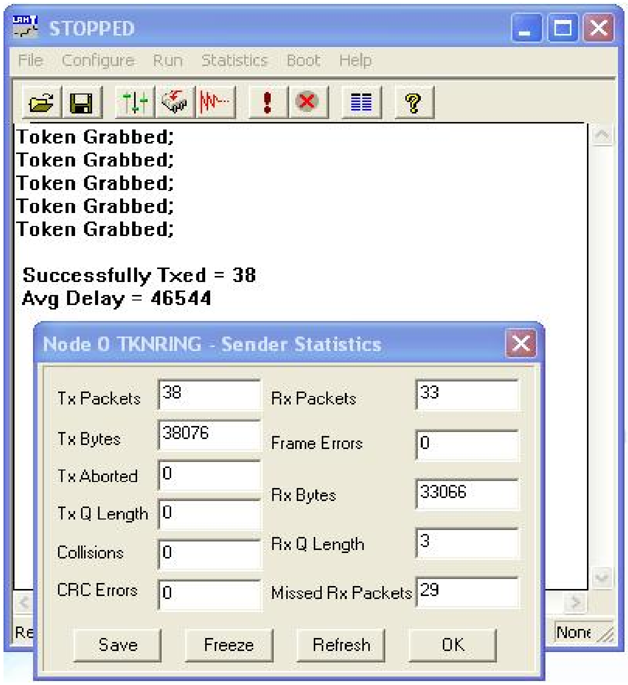
4. Run the experiment by clicking button or by choosing RUN Start from each application. Run the all the experiments at the same time.

5. View the statistics window for results. To view the statistics window, click run button.

6. Set the Token Holding Time (THT) (say 2000 ms).

7. Note down the readings once the experiment is completed.

**PCSERVER 1** **PC SERVER 2**

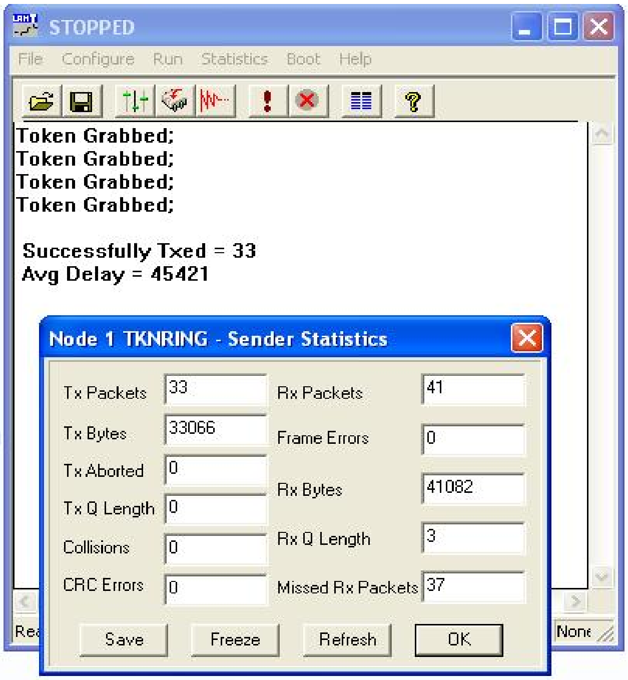


Token Grabbed;
Token Grabbed;
Token Grabbed;
Token Grabbed;
Token Grabbed;

Successfully Txed = 38
Avg Delay = 46544

Node 0 TKNRING - Sender Statistics

Tx Packets 38
Tx Bytes 38076
Tx Aborted 0
Tx Q Length 0
Collisions 0
CRC Errors 0
Rx Packets 33
Frame Errors 0
Rx Bytes 33066
Rx Q Length 3
Missed Rx Packets 29



Token Grabbed;
Token Grabbed;
Token Grabbed;
Token Grabbed;

Successfully Txed = 33
Avg Delay = 45421

Node 1 TKNRING - Sender Statistics

Tx Packets 33
Tx Bytes 33066
Tx Aborted 0
Tx Q Length 0
Collisions 0
CRC Errors 0
Rx Packets 41
Frame Errors 0
Rx Bytes 41082
Rx Q Length 3
Missed Rx Packets 37

8. Repeat the above steps for various values of ta.

9. Calculate the Practical offered load from the below given formula and plot the graph between the practical Offered load and Throughput.

10. Repeat the experiment for various values of Packet length, Node, Data rate.

11. Repeat the above steps, while running the experiment set the BER to $10^{-2}$ or try to stop one of the nodes and observe the behavior and explain the same.

**Calculation of the generated load:**

$$\boxed{G = \frac{N * P}{C * t_a}}$$

**G** is the generated load in the network.

N is the number of transmitting nodes. For example, 4 nodes (using 2 computers)

**P** is the packet length expressed in bits; say 100 bytes (800 bits).

**C** is the data rate normally set as 8kbs, which is selected in the NEU.

$t_a$ is the inter packet delay expressed in seconds; the time interval between two consecutive packets generated.

**Calculation of Throughput (X) from the obtained readings:**

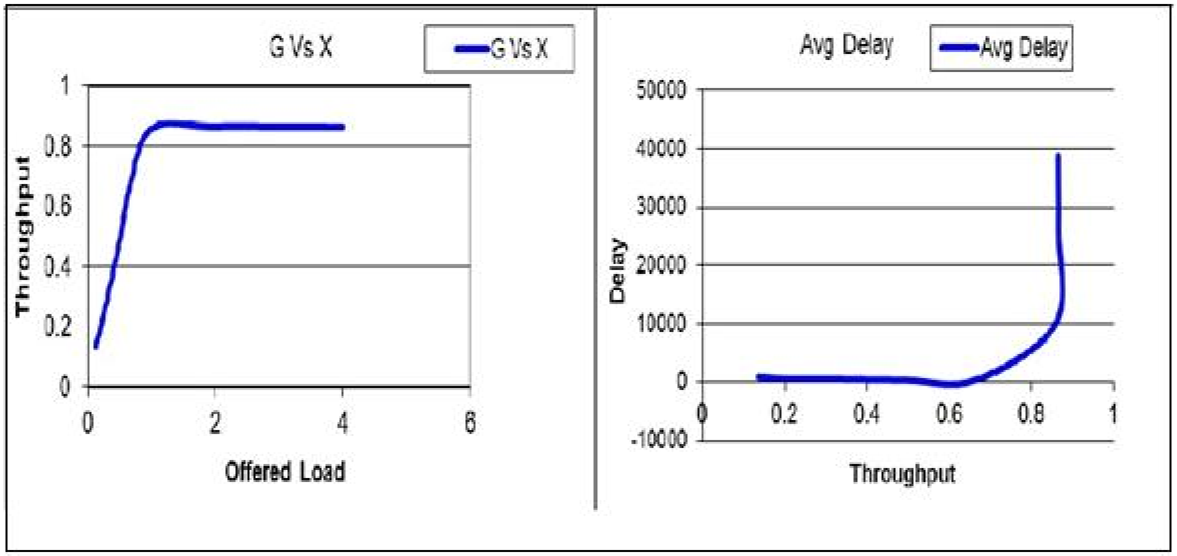
$$\boxed{X = \frac{\text{(Sum of Tx packet in all the nodes * Packet Length * 8)}}{\text{(Duration of Experiment * Data rate)}}}$$

**Calculation of the Offered load:**

$$\boxed{G = \frac{N * P}{C * t_a}}$$

G – Offered load
N – Number of nodes
P – Packet length in bits
C – Data rate in bits/sec
$t_a$ – Inter packet delay in millisecs.

## MODEL GRAPH:



## MODEL TABULATION:

| IPD | Tx 1 | Tx 2 | Tx 3 | Tx 4 | G – Offered Load | X – Throughput | Avg Delay |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## RESULT:

Thus the implementation of the token passing access in Token ring has been calculated and verified.

**EX. NO: 17**

**DATE:**

## IMPLEMENTATION OF HIGH LEVEL DATA LINK CONTROL

### AIM:

To write a c program to implement a data link control for bit stuffing method by using C-editor.

### APPARATUS REQUIERD:

- C -editor
- Standalone desktop.

### PROCEDURE:

1. Start the program.
2. Open C-editor.
3. Type the C program.
4. Save the program with file name ext .c.
5. Run the program.
6. If any error occurs in the program correct the error and again run the program.
7. Enter the data of message bit.
8. Check the entered data.
9. Stop the program.

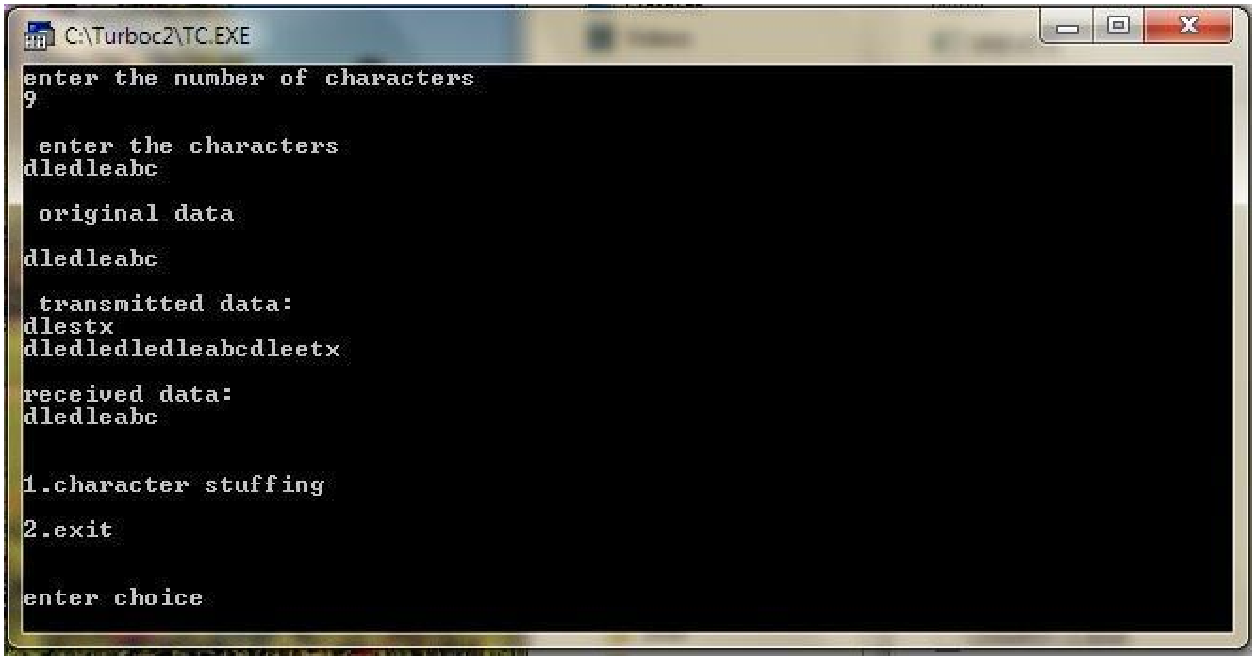
**PROGRAM FOR DATA LINK CONTROL:**

```
#include<stdio.h>
#include<conio.h>
void charc(void);
void main()
{
int choice;
while(1)
{
printf("\n\n\n1.character stuffing");
printf("\n\n2.exit");
printf("\n\n\n enter choice");
scanf("%d",& choice);
printf("%d", choice);
if(choice>2)
printf("\n\n invalid option....please renter");
switch(choice)
{
case 1:
charc ();
break;
case 2:
exit(0);
}
}
}
void charc(void)
{
char c[50],d[50],t[50];
int i,m,j;
clrscr();
printf("enter the number of characters\n");
scanf("%d",&m);
printf("\n enter the characters\n");
for(i=0;i<m+1;i++)
scanf("%c",&c[i]);
}
printf("\n original data\n");
for(i=0;i<m+1;i++)
 printf("%c",c[i]);
d[0]='d';
d[1]='l';
```

```
d[2]='e';
 d[3]='s';
d[4]='t';
d[5]='x';
for(i=0,j=6;i<m+1;i++,j++)
 {
if((c[i]=='d'&&c[i+1]=='l'&& c[i+2]=='e'))
{
d[j]='d';
j++;
d[j]='l';
j++;
d[j]='e';
j++;
m=m+3;
}
d[j]=c[i];
}
m=m+6;
m++;
d[m]='d';
m++;
d[m]='l';
m++;
d[m]='e';
m++;
d[m]='e';
m++;
d[m]='t';
m++;
d[m]='x';
m++;
printf("\n\n transmitted data: \n");
for(i=0;i<m; i ++)
 {
printf ("%c",d[i]);
}
for(i=6,j=0;i<m-6;i++,j++)
 {
if(d[i]=='d'&&d[i+1]=='l'&&d[i+2]=='e'&&d[i+3]=='d'&&d[i+4]=='l'
&&d[i+5]=='e')
i=i+3;
t[j]=d[i];
}
printf("\n\n received data:");
```

```
for(i=0;i<j; i++)
 {printf("%c", t[i]);
}
}
```

**MODEL OUTPUT:**



```
enter the number of characters
9

 enter the characters
dledleabc

 original data

dledleabc

 transmitted data:
dlestx
dledledledleabcdleetx

received data:
dledleabc


1.character stuffing

2.exit


enter choice
```

**RESULT:**

Thus the program for implementation of a data link control for bit stuffing method is executed and output is verified successfully.