``

LONDON METROPOLITAN UNIVERSITY

islington college
(इस्लिङ्टन कलेज)

Module Code & Module Title

CS5001NI Networking And Operating System

Assessment Weightage & Type

25% Individual Coursework

Year and Semester

2020-21 Autumn / 2020-21 Spring

Student Name: Anshul Agarwal

London Met ID: 19031269

College ID: Np01nt4a190006

Assignment Due Date: 25th December 2020

Assignment Submission Date:25th December 2020

Title Where Required):

Word Count (Where Required):

I confirm that I understand my coursework needs to be submitted online via Google Classroom under the relevant module page before the deadline in order for my assignment to be accepted and marked. I am fully aware that late submissions will be treated as non-submission and a marks of zero will be awarded.

ACKNOWLEDGEMENT

I would like to express my gratitude to London Metropolitan University and Islington College for giving me an opportunity for providing us this course in our syllabus. I would also like to thank Mr. Puranjan Acharya our tutor teacher and Mr. Dpeshor Silwal out module leader teacher for providing us this project report which has enabled us to widen our scope of knowledge.

I would also like to express my gratitude to all my colleagues and people who have helped me by providing their valuable assistance and time for completion of project work.

ABSTRACT

This coursework has been divvied into parts task A and task B. Task A is all about the WAN model which is about the mythical company name Asia Bank whose headquarter is in Edinburgh along with two ATM in Nepal Named Itahari LAN and Butwal LAN. The task A was all about creating the WAN model with the help of the COMNET III software.

Task B was all about the research part the topic of the research was wireless network. I found many difficulties while doing this coursework but after some research I found some ways of completing this coursework with enhanced my skills and knowledge. I found this coursework quiet amazing to complete.

Table of Contents

Task A

1.1 Introduction

In this module “Networking and Operating System” we have studied about the how the network works and their simulation with the help of the Comnet III software. After the completion of the course we were told to do coursework of this module to check our creativity and how much we have understood. Coursework contains two tasks that are Task A and Task B. Task A is about the comnet and Task B is about the report and the topic of the report is “Wireless network”.

Let’s us start the Task A where we were told to develop a topology about the network simulation model. The scenario is all about the mythical multinational Asia bank whose headquarters is in Edinburgh. Asia bank is willing to open two new branches in two different places in Nepal that is Itahari and Butwal. This consists of 30 ATM nodes plus one single teller giving a total 31 ATM’s in each LAN. Itahari LAN, Butwal LAN, Edinburgh LAN is connected to frame relay cloud. Edinburgh LAN subnet is connected to WAN clouds through Access point. Edinburgh LAN access point is connected to the router and router is connected to the token passing ring after that the token passing is connected to the processing node and again the processing node is connected to the response source. Itahari LAN subnet is connected to WAN Cloud through access point. Itahari LAN is connected to the router and router is connected to the CSMA/CD link and again the CSMA/CD is connected to the processing node and the computer group. Computer group is connected to the message source. Processing node is connected to the message source. Butwal LAN subnet is connected to WAN Cloud through access point. Butwal LAN is connected to the router and router is connected to the CSMA/CD link and again the CSMA/CD is connected to the processing node and the computer group. Computer group is connected to the message source. Processing node is connected to the message source. In WAN Cloud three Aps are directly connected to Itahari access, Edinburgh access, Butwal access with the help of point to point link. Itahari access is connected with two virtual circuit Edinburgh-Itahari virtual circuits and Itahari-Edinburgh virtual circuit and both of the virtual circuit is connected to Edinburgh access point to point link. Similarly Butwal access is connected with

two virtual circuits Edinburgh- Butwal virtual circuits and Butwal -Edinburgh virtual circuit and both of the virtual circuit is connected to Edinburgh access point to point link.

Comnet III is a device or instrument that helps us analyze the communication network and is used to construct model networks, control algorithms and workloads for them.. After creating the network model, control algorithm and workload then we can simulate the operation of network and provide control measures of network performance. Network simulation brings a realistic exploration to the course and helps students to see and get the idea of an internet operation consisting of various networks and protocols.The important usage of the application includes:

- Peak loading Studies
- Network sizing at the design stage
- Resilience and contingency planning
- Introduction of new users/applications
- Evaluating performance improvement options
- Evaluating grade of service contracts.

Comnet III application was developed within the programming language MODSIM III using an object-oriented plan, in such a way that objects is made inside the application to represent different parts of equipment which help us to present the network. In developing the program using object-oriented system, it was difficult to represent real world equipment. The program was written with different object or essential building pieces which can be match or edited the characteristics according to the real world network need. The tools used in comnet are listed below:

- Processing node
- Computer group
- Network device
- Access point
- Subnet
- Cloud
- WAN link or VC
- Point to point link

- CSMA/CD Link
- Token-passing link
- Message Source
- Response Source
- Background Text
- Diagonal arc
- Horizontal/vertical arc

All the tools can be used to define the characteristics of the piece networking device.

(compuare, 2000).

1.2 WAN Models

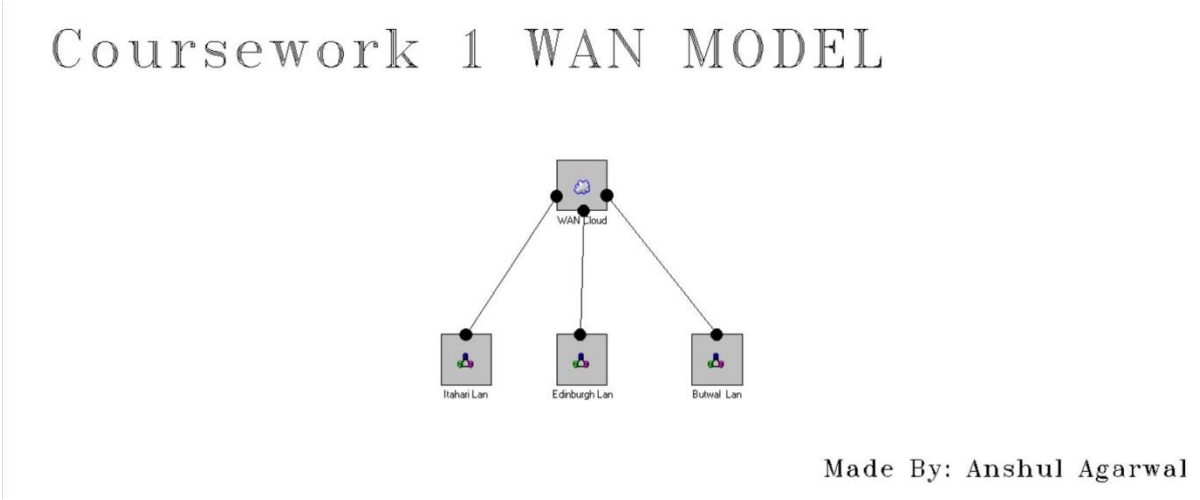


Figure 1: WAN MODEL

Description: WAN model, there is one WAN cloud connected with three subnet named Itahari LAN, Butwal LAN, Edinburgh LAN. Each subnet is connected with the help of the access point.

1.2.1 EDINBURGH LAN

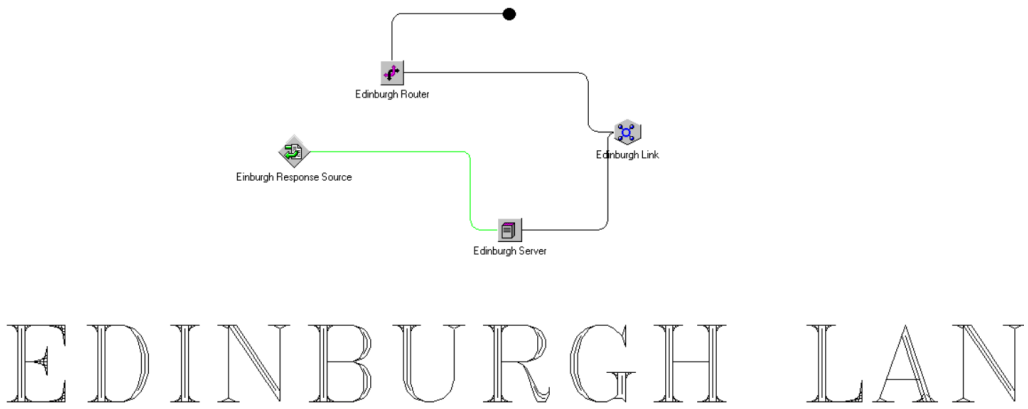


Figure 2: EDINBURGH LAN Model

Description: Edinburgh LAN there is one access point which is connected router (Edinburgh router) and then Edinburgh router is connected to token passing ring (Edinburgh token passing ring). From the token passing ring the wire is connected to processing node (Edinburgh Server) and then at last the wire is connected to the response server (Edinburgh Response Server).

1.2.1.1 NETWORKING DEVICE: ROUTER

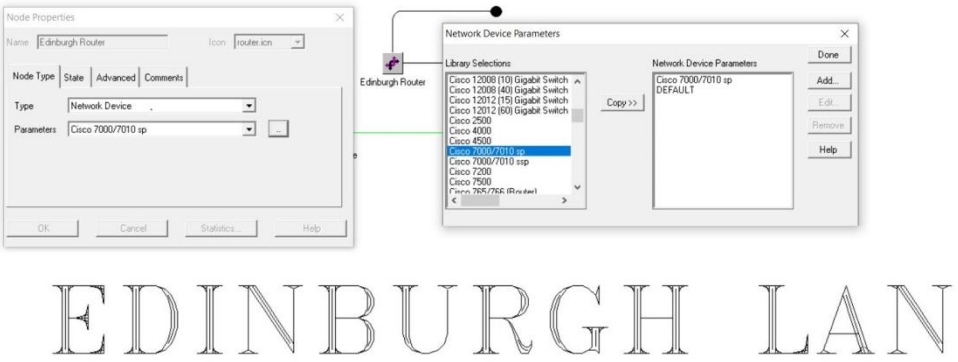


Figure 3: EDINBURGH LAN Router Configuration

Description: In router the configuration we have made is router's name is changed to Edinburgh Router similarly we have the routers type to Cisco 7000/7010sp by clicking two dot button and selecting cisco7000/7010sp clicking on done.

1.2.1.2 TOKEN PASSING LINK

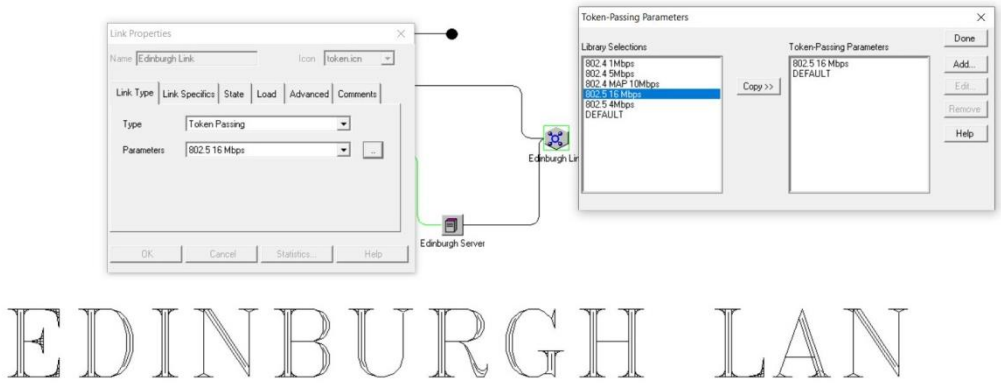


Figure 4: EDINBURGH LAN Token Passing Link Configuration

Description: In token passing ring the configuration we have made is token passing ring name is changed to Edinburgh LAN Token passing ring similarly we have the token passing ring parameter to 802.5 16 Mbps by clicking two dot button and selecting 802.5 16 Mbps clicking on done.

1.2.1.3 PROCESSING SERVER

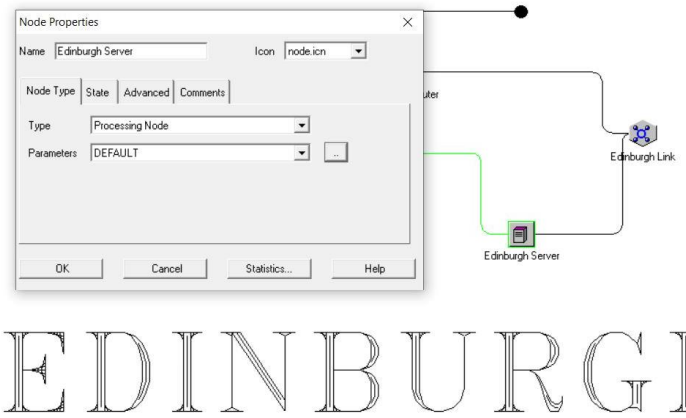


Figure 5: EDINBURGH LAN Processing Server Configuration

Description: In processing node the configuration we have made is processing node name is changed to Edinburgh Server similarly we have the parameters type to default.

1.2.1.4 RESPONSE SERVER

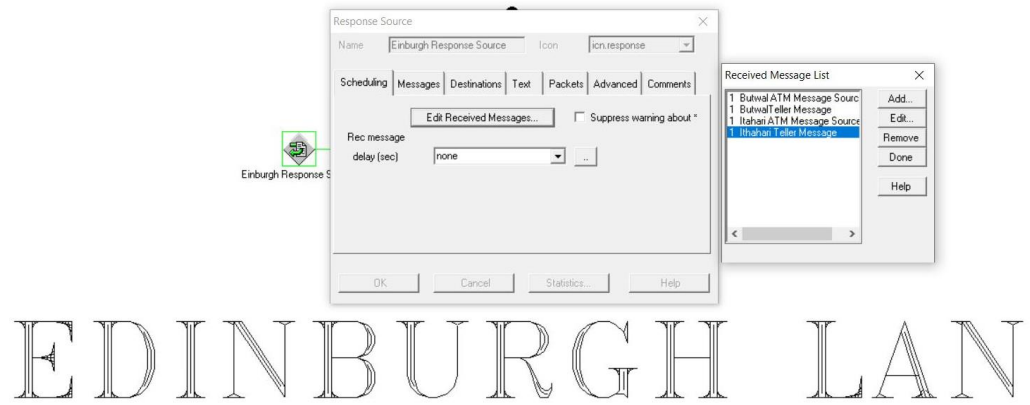


Figure 6: EDINBURGH LAN Response Server Scheduling Configuration

Description: In response server configuration we have made is response server name is changed to Edinburgh Response sever similarly we have scheduling types by selecting the entire message server.

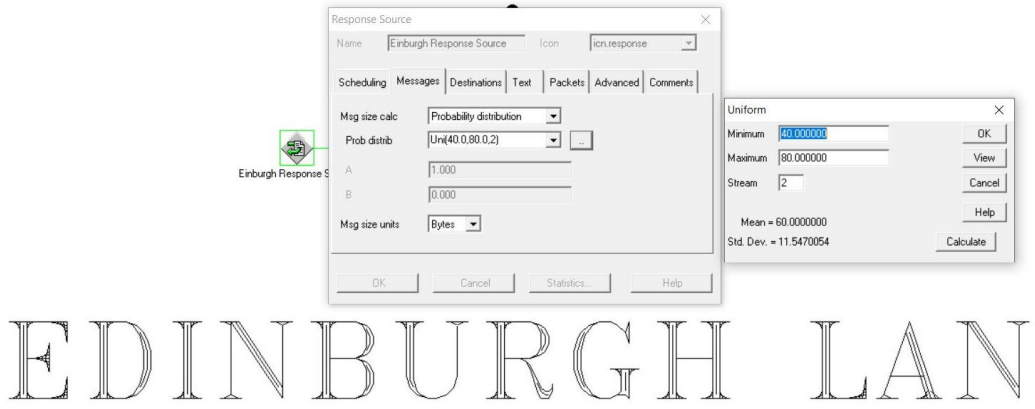


Figure 7: EDINBURGH LAN Response Server Message Configuration

Description: In response server the configuration we have made is Msg size calc to probability distribution similarly we have to message type prob distriub Uni (40.0, 80.0, 0.2) we can edit the parameter by clicking two dot beside the prob distrib and we can enter the maximum, minimum, and stream value.

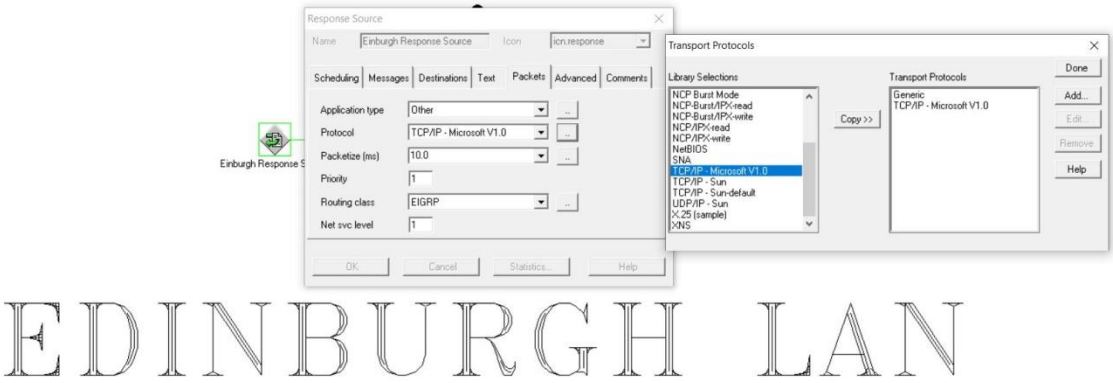


Figure 8: EDINBURGH LAN Response Server Packets Configuration

Description: In response server the configuration we to click on packets click on protocol select TCP/IP-MicrosoftV1.0 to select this click on the two and select the TCP/IP-MicrosoftV1.0 and click on done.

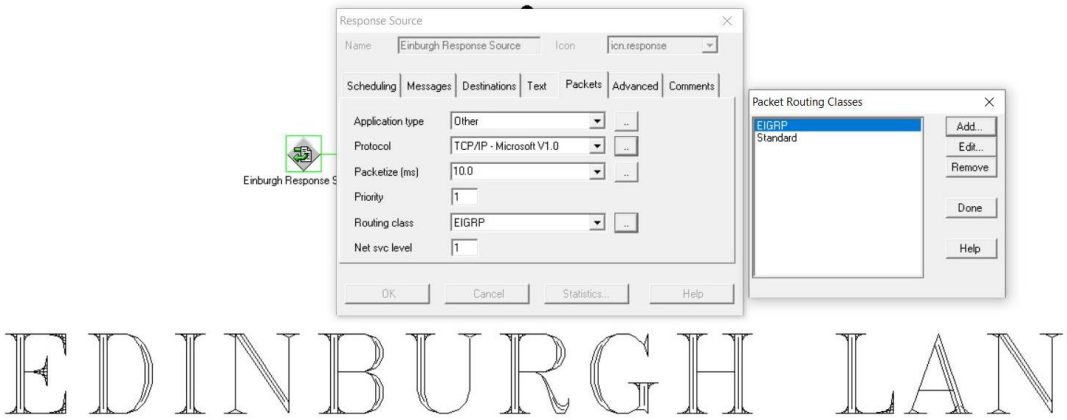


Figure 9: EDINBURGH LAN Response Server Packets Configuration

Description: In response server the configuration we to click on packets click on Routing class select EIGRIP to select this click on the two and select the EIGRIPand click on done.

1.2.2 WAN CLOUD

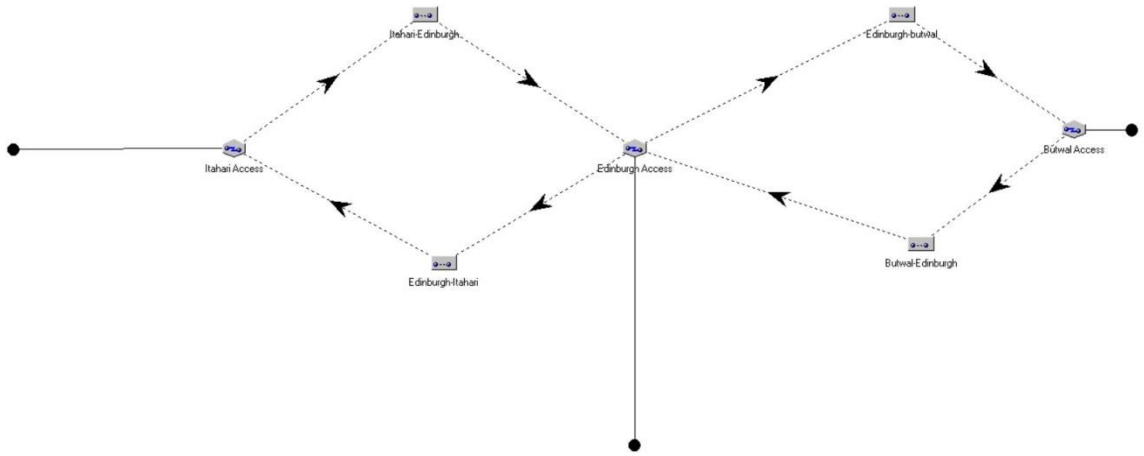


Figure 10: WAN CLOUD

Description: In WAN Cloud there are three accesses point connected to point to point link (Itahari Access, Butwal Access, Edinburgh Access) and point to point link is connected to virtual circuit (Edinburgh-Itahari, Itahari-Edinburgh, Butwal-Edinburgh, Edinburgh-Butwal).

1.2.2.1 ACCESS LINK

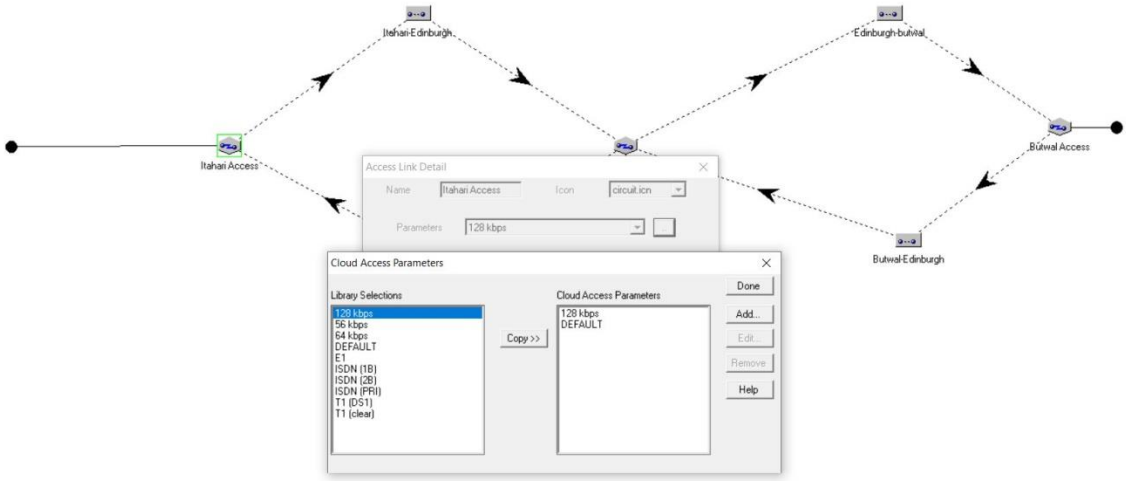


Figure 11: *Itahari Access Point*

Description: In point to point link the configuration was we have made is point to point link name is Itahari Access similarly we have hanged the parameter to 128 kbps by selecting in two dots 128 kbps and select on done.

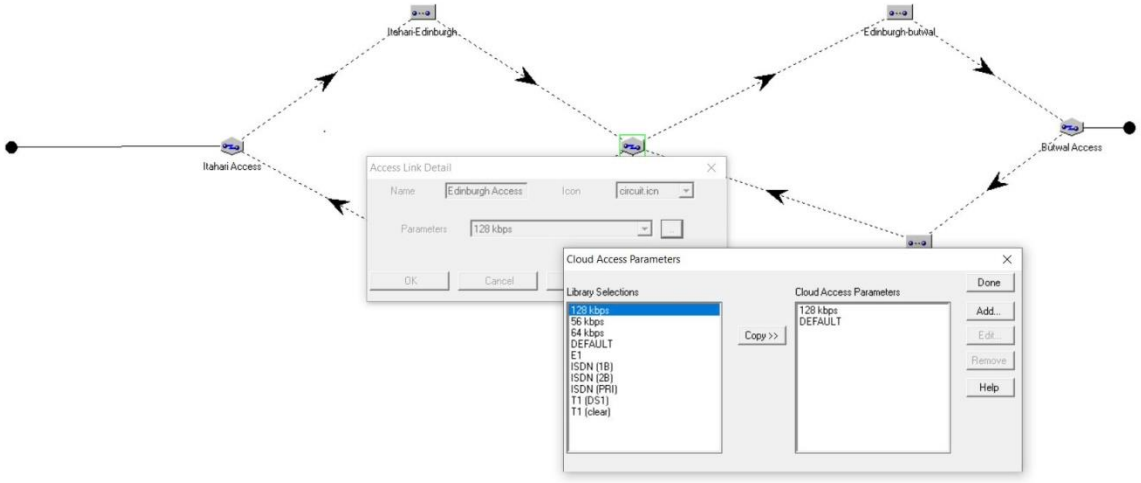


Figure 12: Edinburgh Access Point

Description: In point to point link the configuration was we have made is point to point link name is Edinburgh Access similarly we have hanged the parameter to 128 kbps by selecting in two dots 128 kbps and select on done.

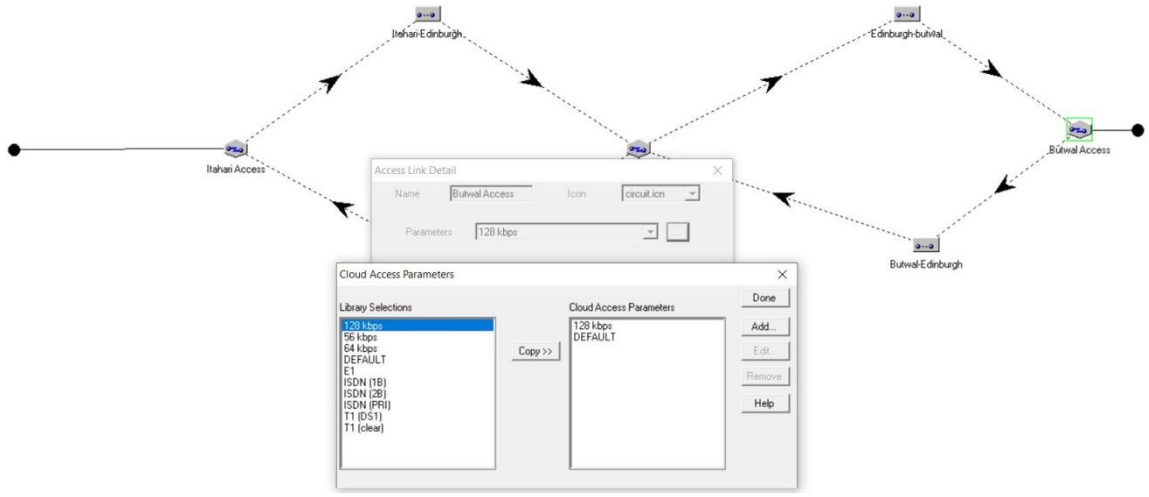


Figure 13: Butwal Access Point

Description: In point to point link the configuration was we have made is point to point link name is Butwal Access similarly we have hanged the parameter to 128 kbps by selecting in two dots 128 kbps and select on done.

1.2.2.2 VIRTUAL CIRCUIT

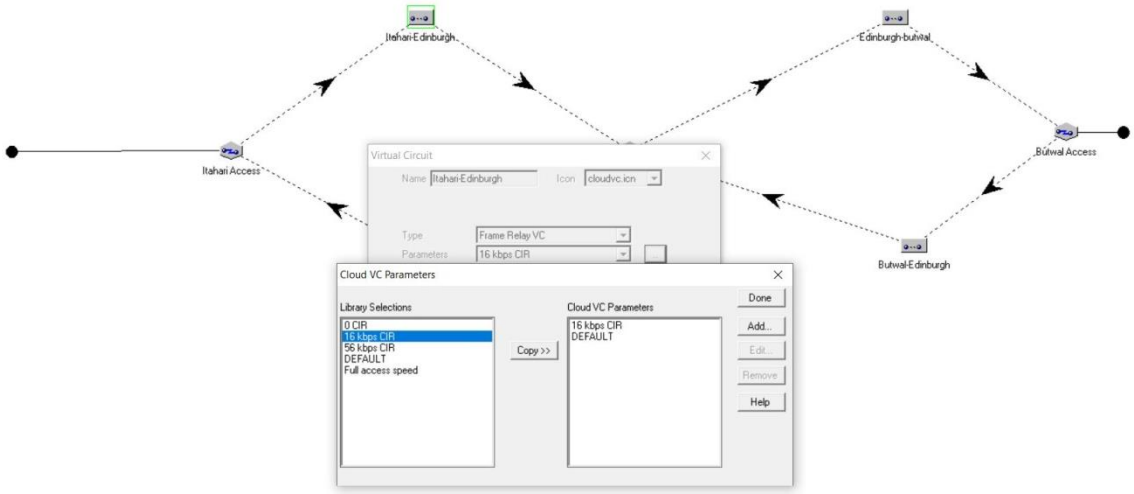


Figure 14: Itahari-Edinburgh Virtual Circuit

Description: In virtual circuit the configuration was we have made is virtual circuit name is Itahari-Ediburgh Access similarly we have hanged the parameter to 16 kbps CR by selecting in two dots 16kbps CR and select on done.

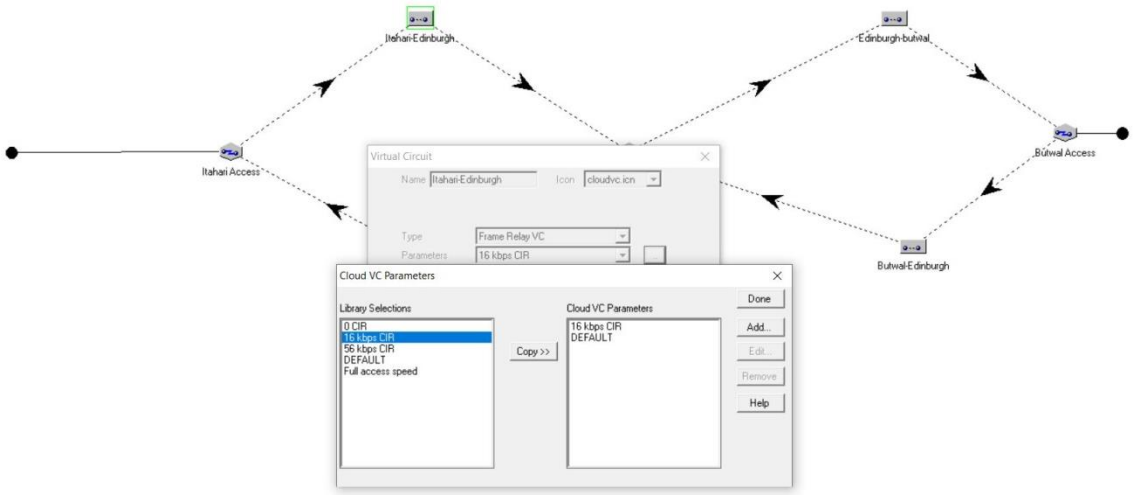


Figure 15: Edinburgh-Itahari Virtual Circuit

Description: In virtual circuit the configuration was we have made is virtual circuit name is Ediburgh-Itahari Access similarly we have hanged the parameter to 16 kbps CR by selecting in two dots 16kbps CR and select on done.

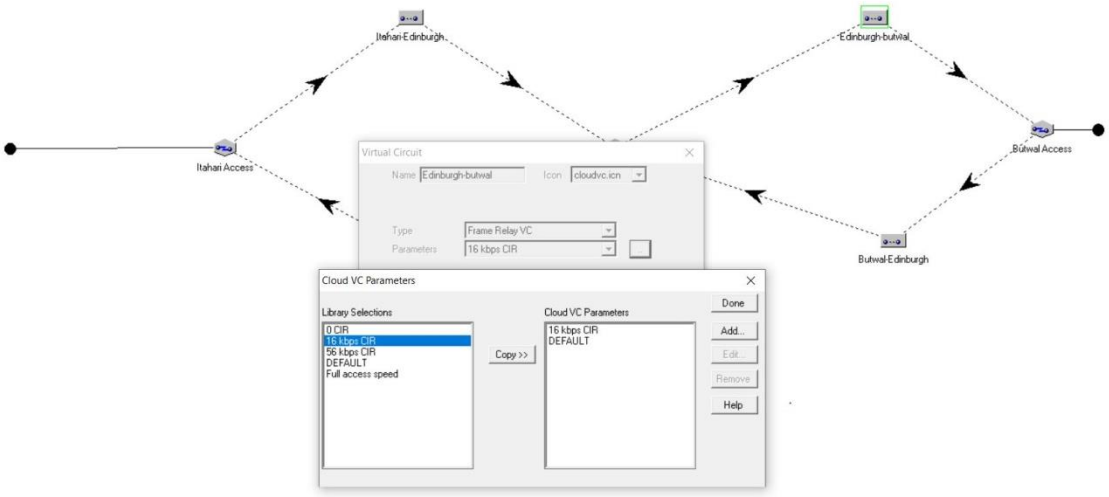


Figure 16: Edinburgh-Butwal Virtual Circuit

Description: In virtual circuit the configuration was we have made is virtual circuit name is Ediburgh-Butwal Access similarly we have hanged the parameter to 16 kbps CR by selecting in two dots 16kbps CR and select on done.

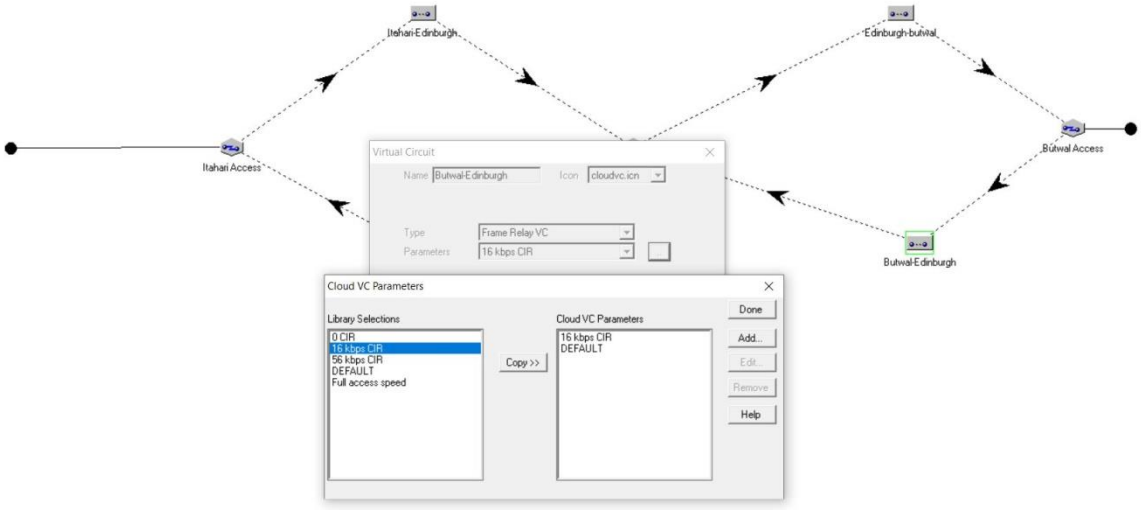


Figure 17: Butwal-Edinburgh Virtual Circuit

Description: In virtual circuit the configuration was we have made is virtual circuit name is Butwal-Ediburgh Access similarly we have hanged the parameter to 16 kbps CR by selecting in two dots 16kbps CR and select on done.

1.2.3 ITHARAI AND BUTWAL LINK

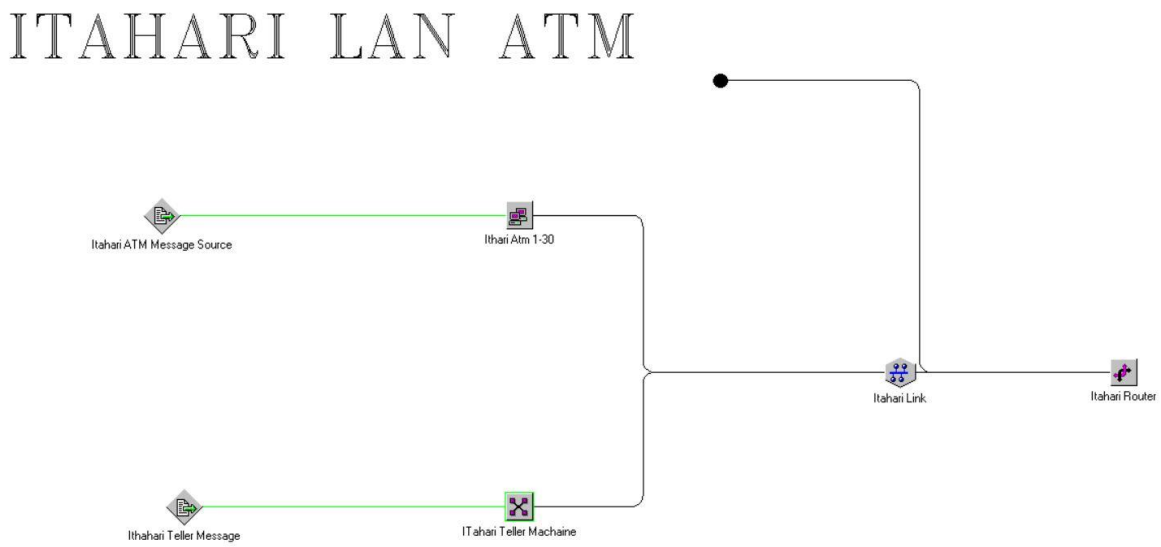


Figure 18: ITAHARI LAN MODEL

Description: In Itahari LAN ATM model there is one access point which one side is connected to WAN Cloud and one side is connected to router (Itahari Router) and other point of the router is connected CSMA/CD Link (Itahari link) and CSDMA /CD is connected with computer group (Itahari ATM 1-30) and processing node (Itahari Teller Machine). Computer Group is again connected with message source (Itahari message Source). Processing node is again connected with the message source (Itahari Teller Message).

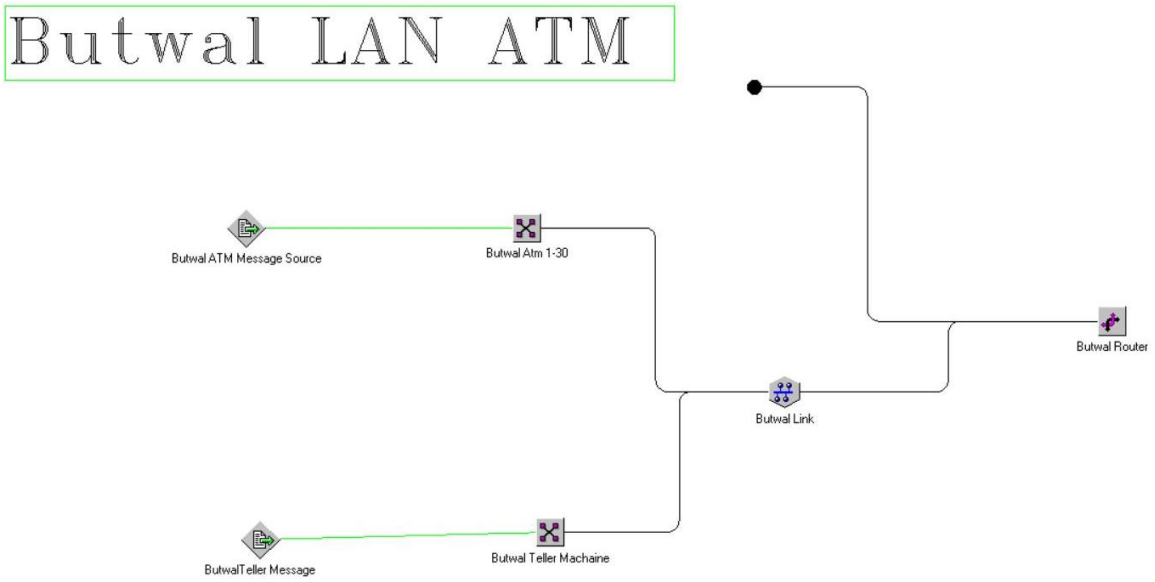


Figure 19: BUTWAL LAN MODEL

Description: In Butwal LAN ATM model there is one access point which one side is connected to WAN Cloud and one side is connected to router (Butwal Router) and other point of the router is connected CSMA/CD Link (Butwal link) and CSDMA /CD is connected with computer group (Butwal ATM 1-30) and processing node (Butwal Teller Machine). Computer Group is again connected with message source (Butwal message Source). Processing node is again connected with the message source (Butwal Teller Message).

1.2.3.1 NETWORK DEVICE: ROUTER

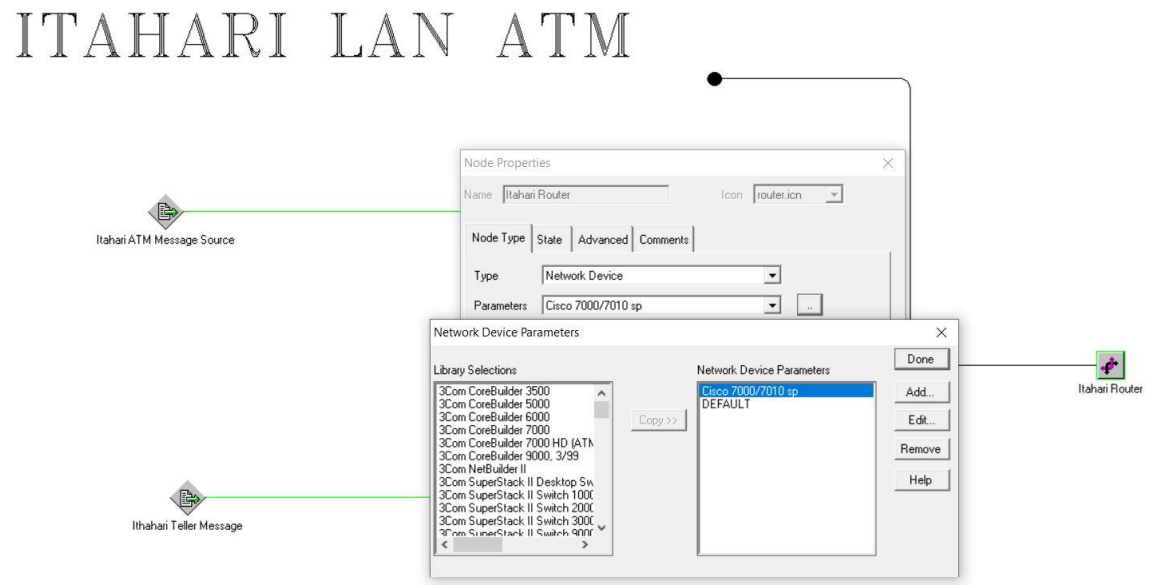


Figure 20: ITAHARI LAN ROUTER

Description: In router the configuration we have made is router's name is changed to Itahari Router similarly we have the routers type to Cisco 7000/7010sp by clicking two dot button and selecting cisco7000/7010sp clicking on done

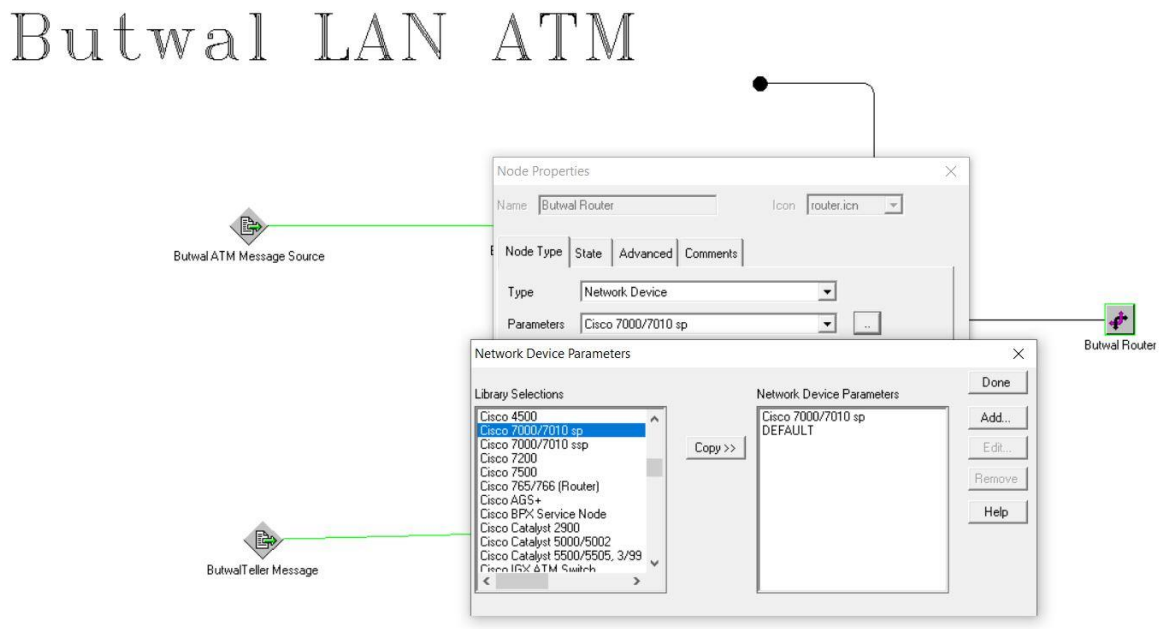


Figure 21: BUTWAL LAN ROUTER

Description: In router the configuration we have made is router's name is changed to Butwal Router similarly we have the routers type to Cisco 7000/7010sp by clicking two dot button and selecting cisco7000/7010sp clicking on done.

1.2.3.2 CSDMA/CD LINK

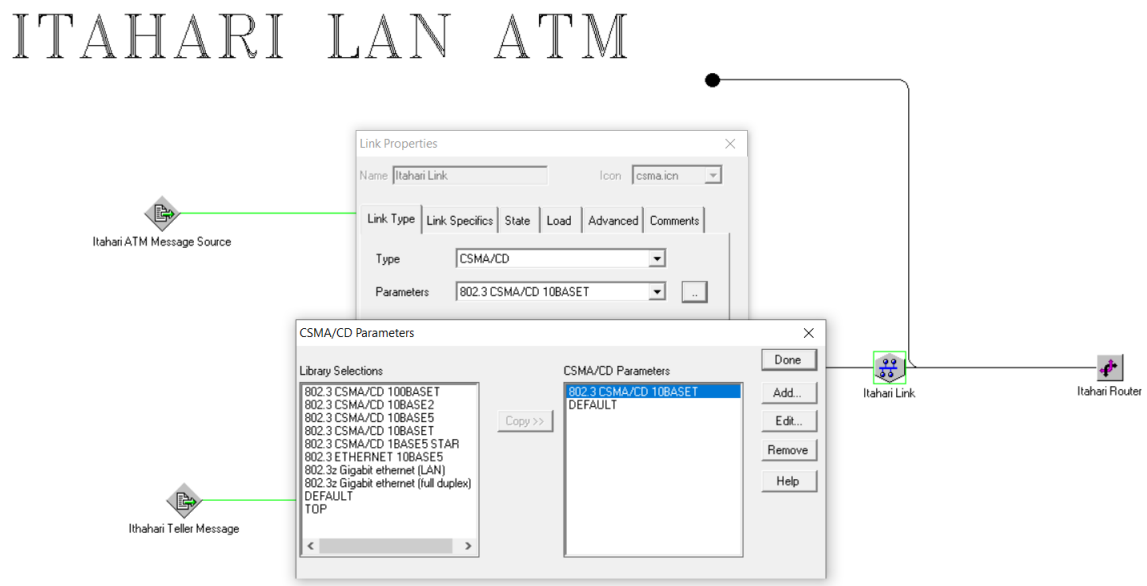


Figure 22: Itahari LAN CSMA/CD

Description: In CSMA/CD Link the configuration we have made is CSMA/CD Link name is changed to Itatahri LAN CSDMA/CD Link similarly we have the CSMA/CD LINK parameter to 802.3 CSMA/CD 10BASET clicking two dot button and selecting 802.3 CSMA/CD 10BASET clicking on done.

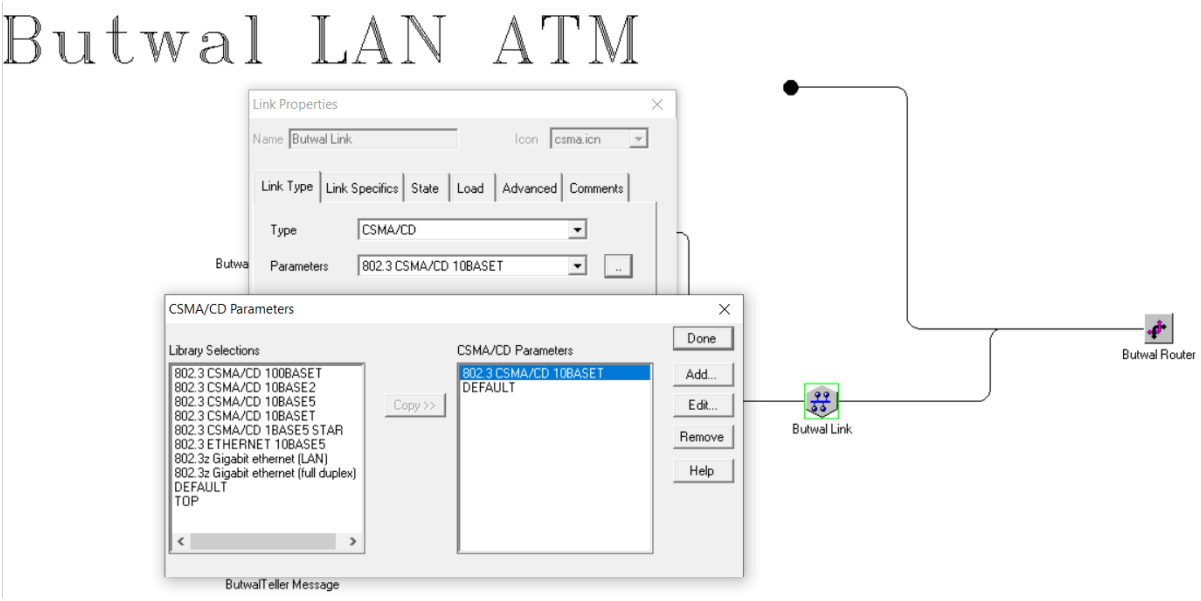


Figure 23: Butwal LAN CSDMA/CD |LINK

Description: In CSMA/CD Link the configuration we have made is CSMA/CD Link name is changed to Butwal LAN CSDMA/CD Link similarly we have the CSDMA/CD link parameter to 802.3 CSMA/CD 10BASET clicking two dot button and selecting 802.3 CSMA/CD 10BASET clicking on done.

1.2.3.3 PROCESSING NODE

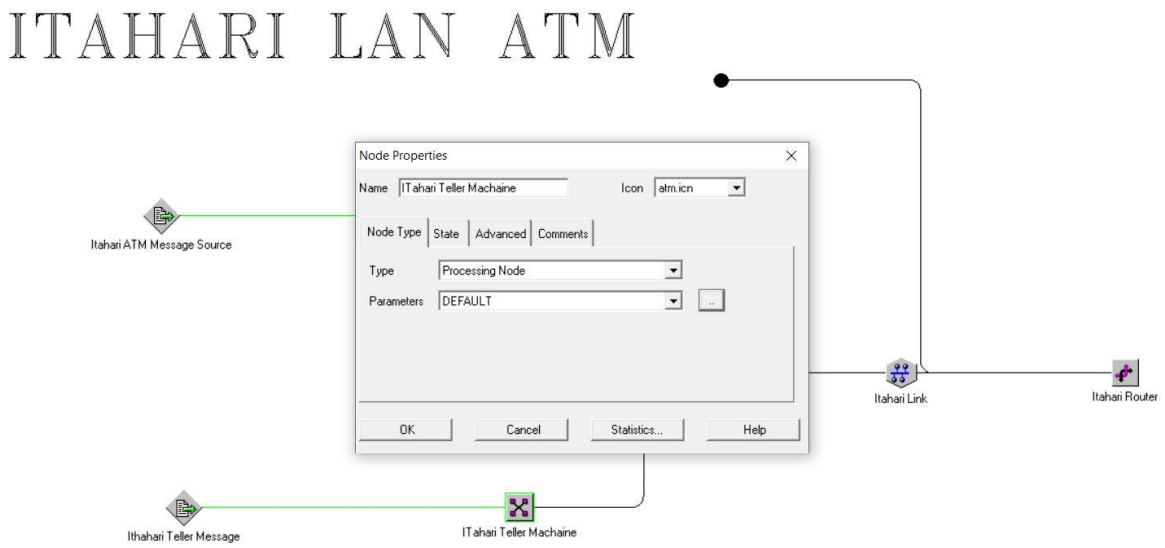


Figure 24: Itahari LAN Processing Node

Description: In processing node the configuration we have made is proessing node name is changed to Itatahri teller machine processing node similarly we have the processing node parameter toDefault.

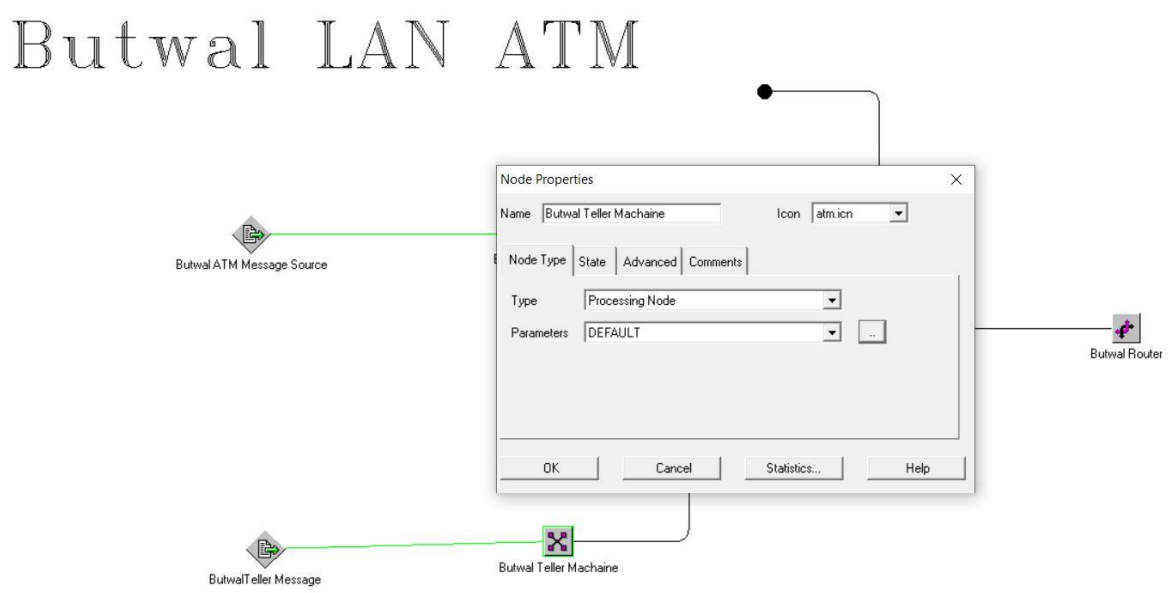


Figure 25: Butwal LAN Processing Node

Description: In processing node the configuration we have made is proessing node name is changed to IButwal teller machine processing node similarly we have the processing node parameter toDefault.

1.2.3.4 MESSAGE SOURCE

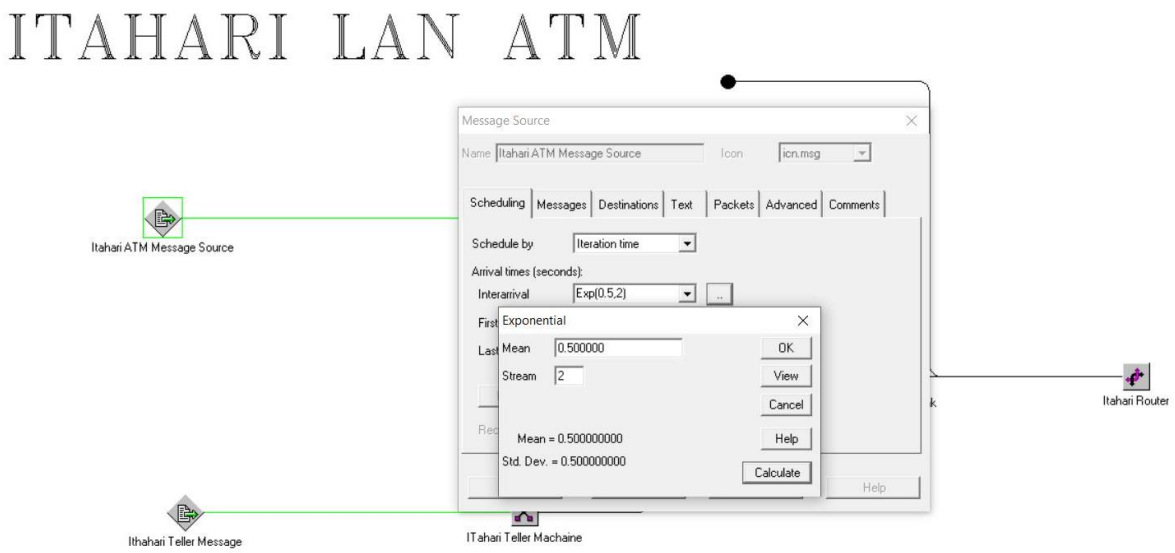


Figure 26: Itahari LAN Message Source Scheduling Configuration

Description: In response source the configuration we have made is response server name is changed to Itatahri ATM Message source response source similarly we have the scheduling is changed to iteration time, similarly we have to change the inter arrival time to (0.5,2) we can change the inter arrival by clicking on the two dot set the mean and stream value and click on ok

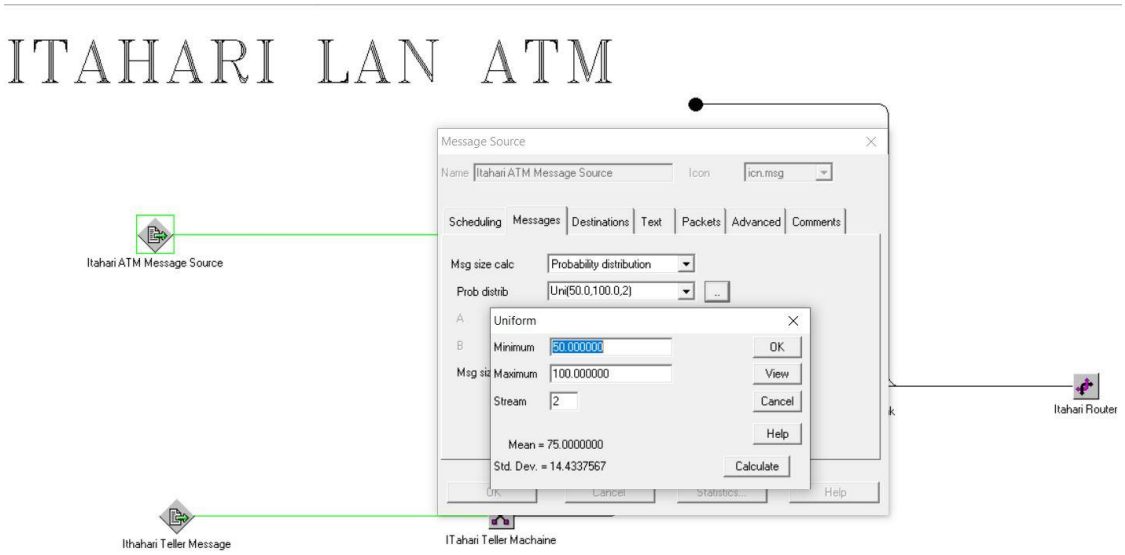


Figure 27: Itahari LAN Message Source message configuration

Description: In response source the configuration we have made is response server we have Message size calc is changed to probability distribution, similarly we have to change the prob distrib to (50.0,100.0,2) we can change the prob distrib by clicking on the two dot set the minimum, maximum and stream value and click on ok.

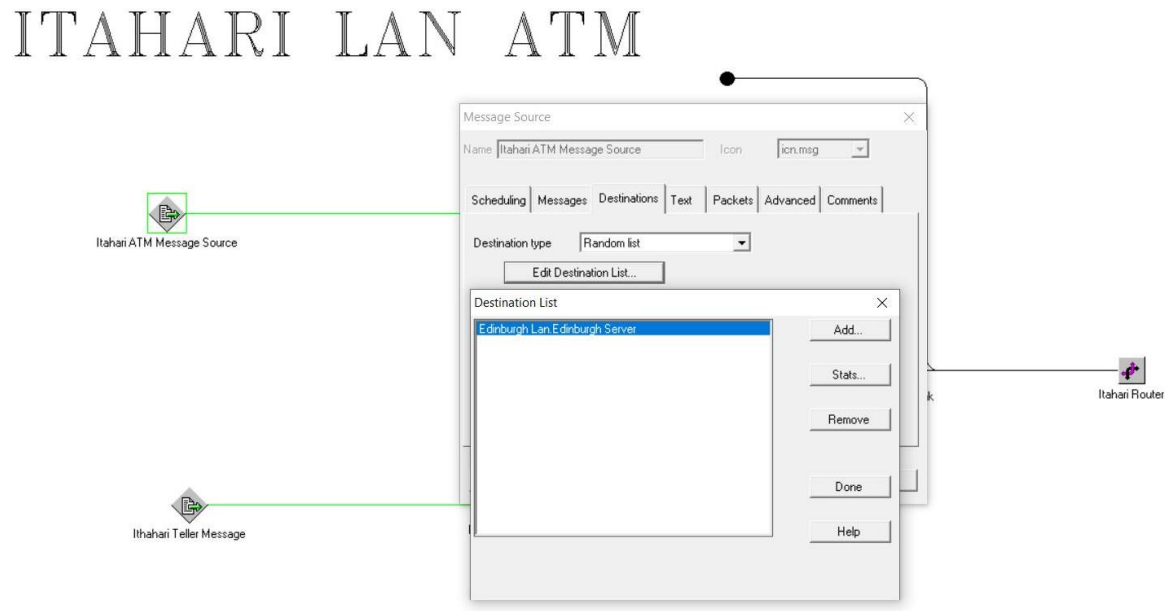


Figure 28: Itahari LAN Message Source Destination configuration

Description: In response source the configuration we have made is response server we have Destination is changed to Random list, similarly we have to edit Destination List to Edinburgh LAN, Edinburgh Server and click on ok.

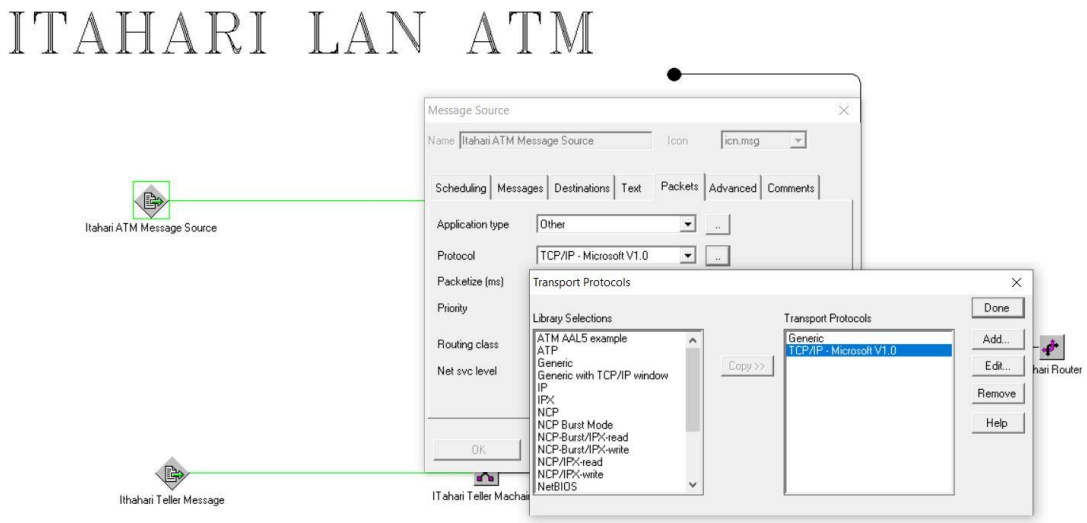


Figure 29: Itahari LAN Message Source Packet Protocol Configuration

Description: In response source the configuration we have made is response server we have packet and click on the protocol and select on TCP/IP -Microsoft V1.0 to select this click on two dots beside the protocol and select TCP/IP- MicrosoftV1.0 and click on ok.

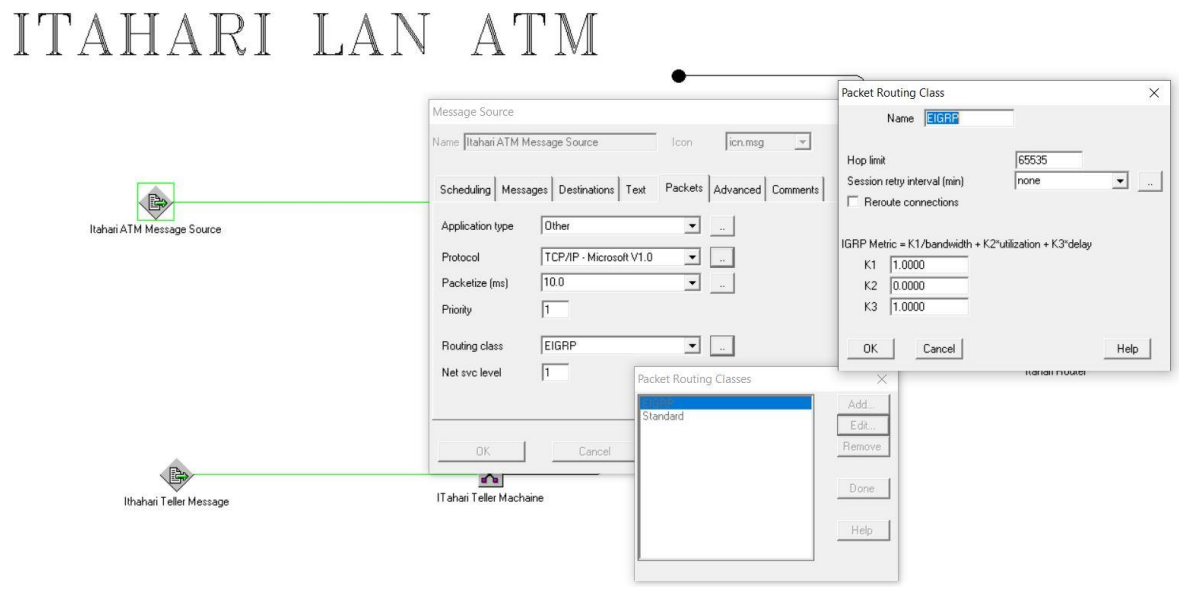


Figure 30: Itahari LAN Message Source Packet Routing Class Configuration

Description: In response source the configuration we have made is response server we have packet and click on the Routing Class and click on two dots beside the Routing class and then click on add and then dialog box open and the n keep the name EIGRIP in that opened dialog box name and then click on ok.

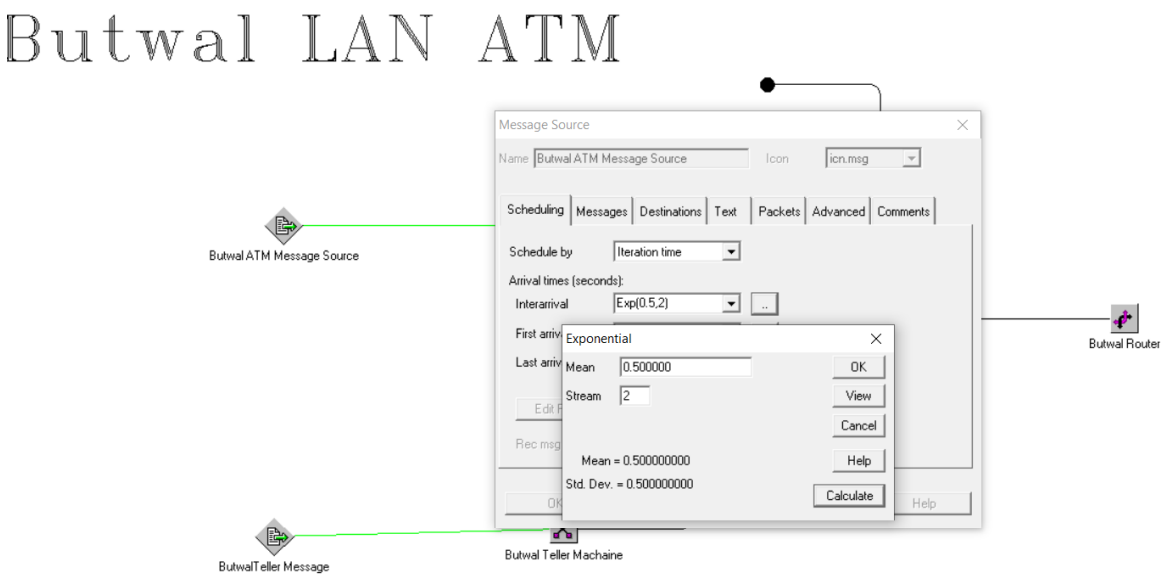


Figure 31: Butwal LAN Message Source Scheduling Configuration

Description: In response source the configuration we have made is response server name is changed to Butwal ATM Message source response source similarly we have the scheduling is changed to iteration time, similarly we have to change the inter arrival time to (0.5, 2) we can change the inter arrival by clicking on the two dot set the mean and stream value and click on ok

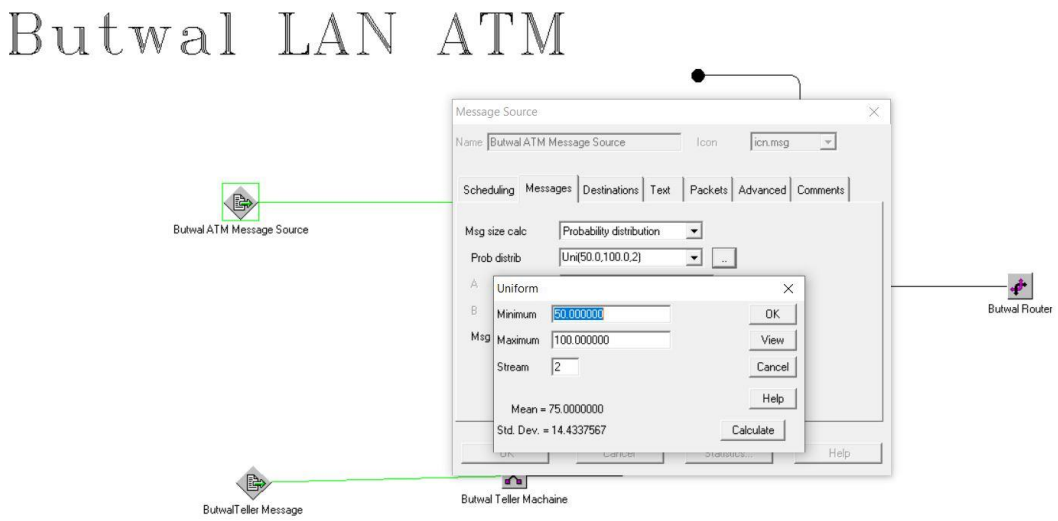


Figure 32: Butwal LAN Message Source Message configuration

Description: In response source the configuration we have made is response server we have Message size calc is changed to probability distribution, similarly we have to change the prob distrib to (50.0,100.0,2) we can change the prob distrib by clicking on the two dot set the minimum, maximum and stream value and click on ok.

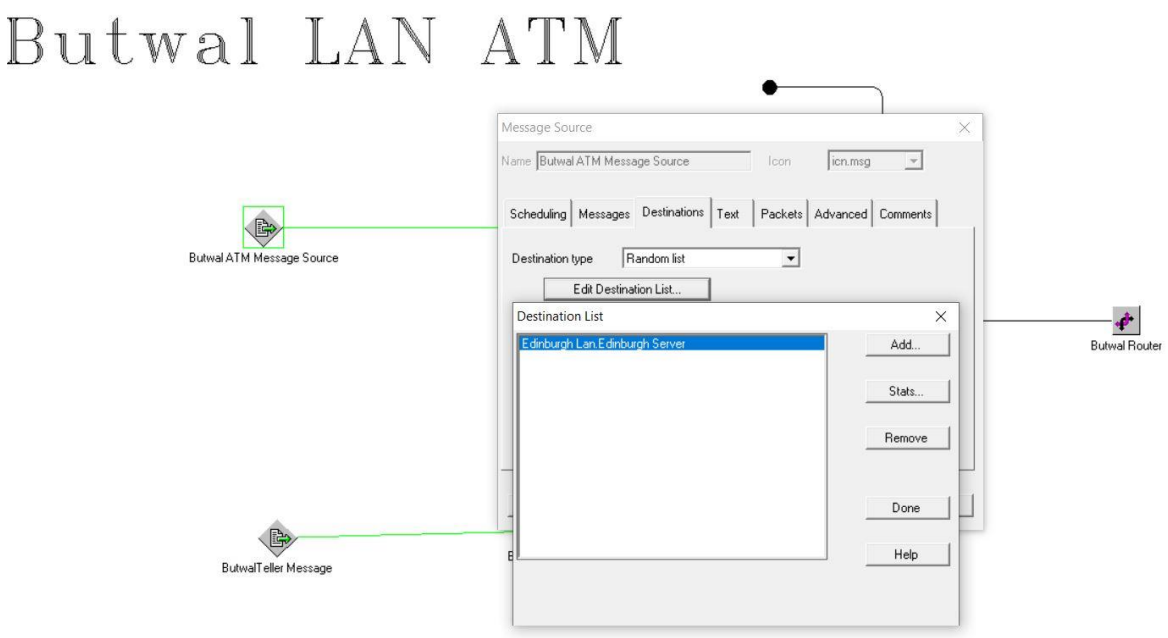


Figure 33: Butwal Message Source Destination Configuration

Description: In response source the configuration we have made is response server we have Destination is changed to Random list, similarly we have to edit Destination List to Edinburgh LAN, Edinburgh Server and click on ok.

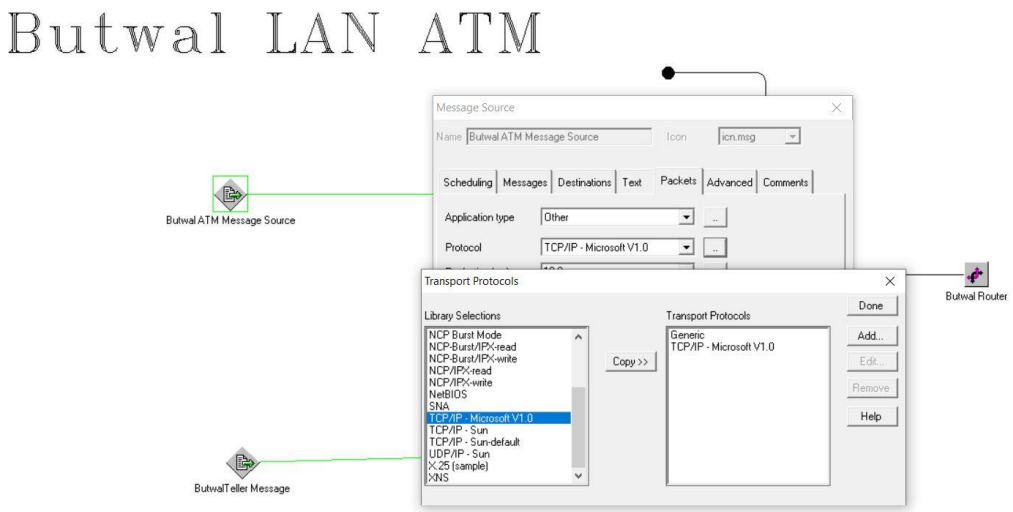


Figure 34: Butwal LAN Message Source Packet Protocol Configuration

Description: In response source the configuration we have made is response server we have packet and click on the protocol and select on TCP/IP -Microsoft V1.0 to select this click on two dots beside the protocol and select TCP/IP- MicrosoftV1.0 and click on ok

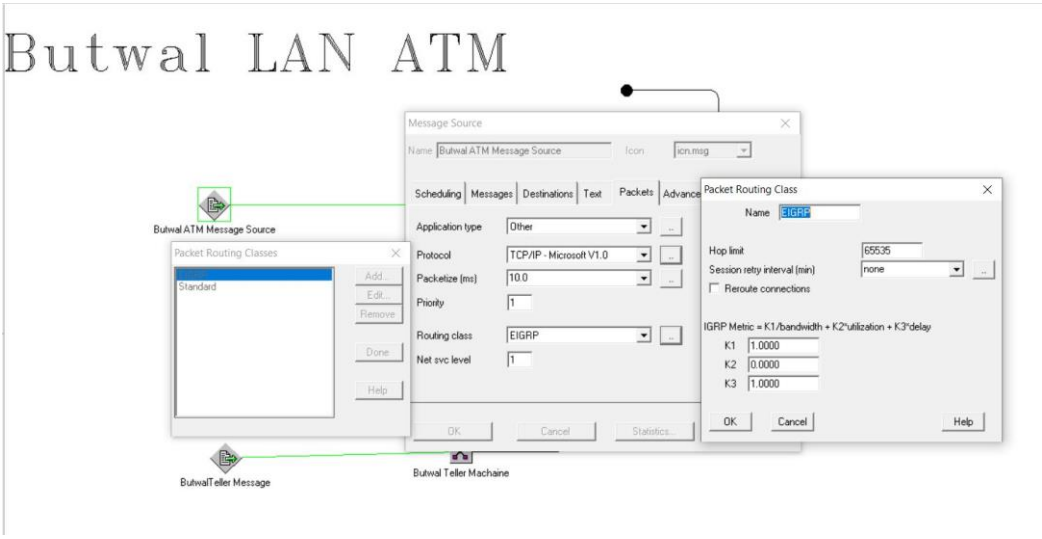


Figure 35: Butwal LAN Message Source Packet Routing Class Configuration

Description: In response source the configuration we have made is response server we have packet and click on the Routing Class and click on two dots beside the Routing class and then click on add and then dialog box open and the n keep the name EIGRIP in that opened dialog box name and then click on ok.

1.2.3.4 COMPUTER GROUP

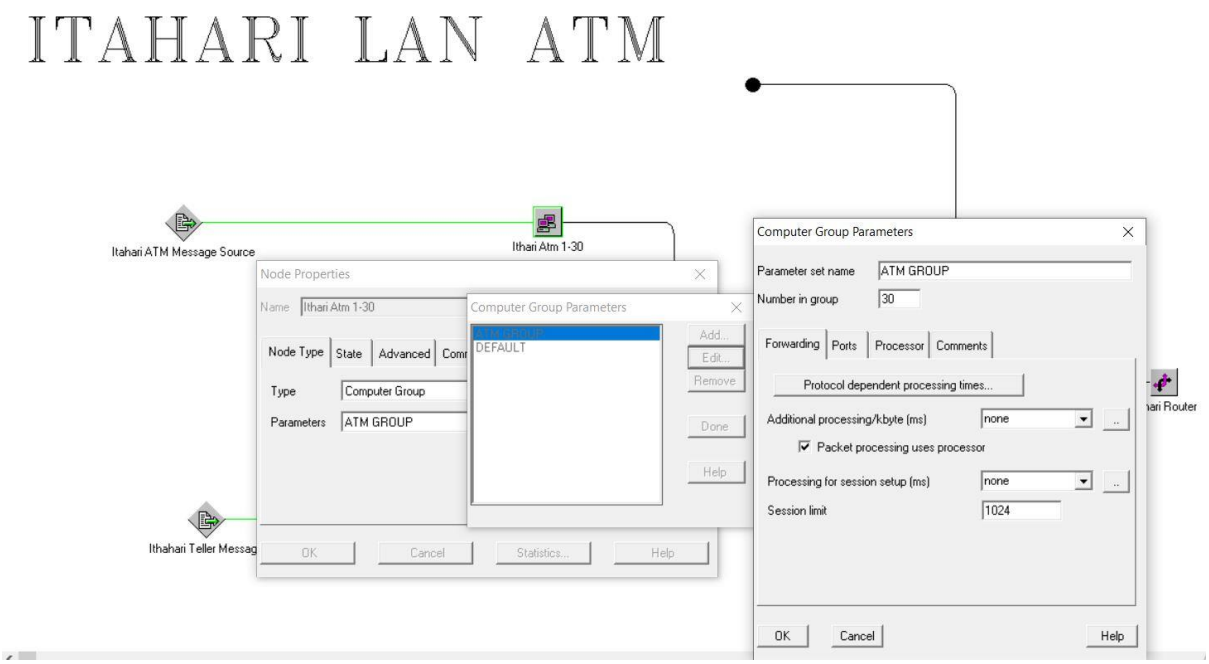


Figure 36: Itahari Computer Group

Description: In computer group the configuration was made in computer name to Itahari ATM 1-30, similarly we have to change the parameter and click on two dot button and keep the parameter name to ATM GROUP and keep the number in group of 30, and click on ok.

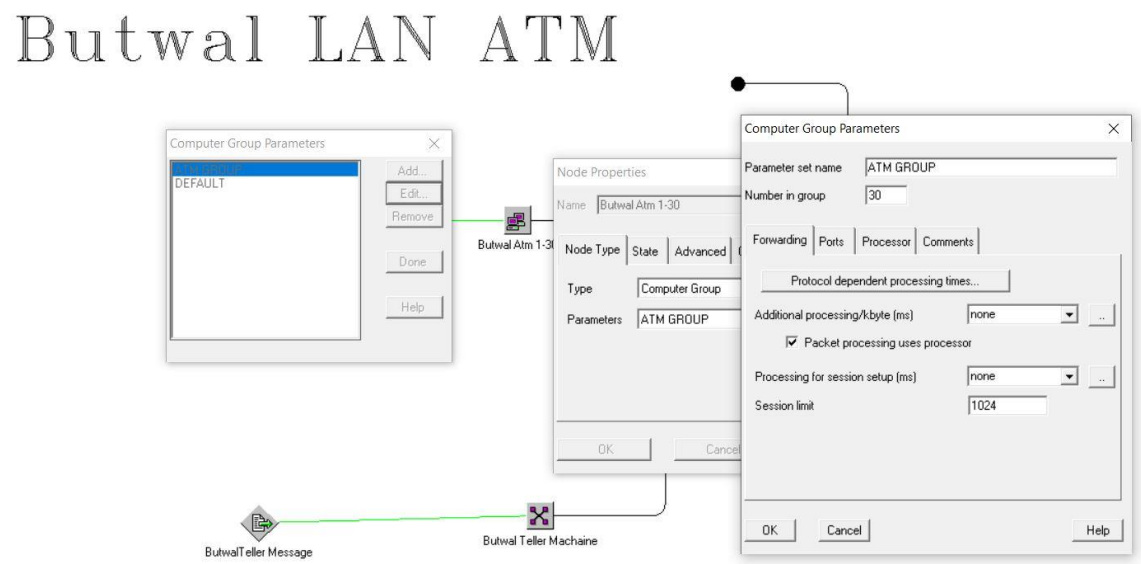


Figure 37: Butwal Computer Group

Description: In computer group the configuration was made in computer name to Butwal ATM 1-30, similarly we have to change the parameter and click on two dot button and keep the parameter name to ATM GROUP and keep the number in group of 30, and click on ok.

1.2.3.5 MESSAGE SOURCE

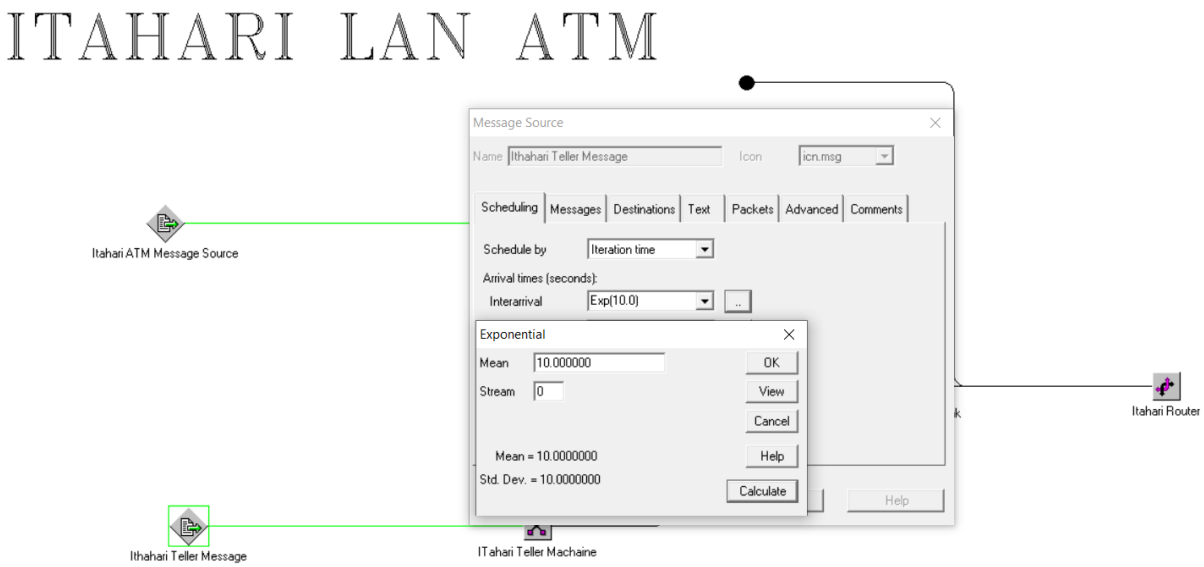


Figure 38: ITAHARI LAN TELLER MACHINE MESSAGE SOURCE SCHEDULING CONFIGURATION

Description: In message source the configuration was made to the message source name Itahari Teller Message similarly we have to change the scheduling in scheduling by schedule by iteration time similarly change the inter arrival Exp (10.0) and click on ok.

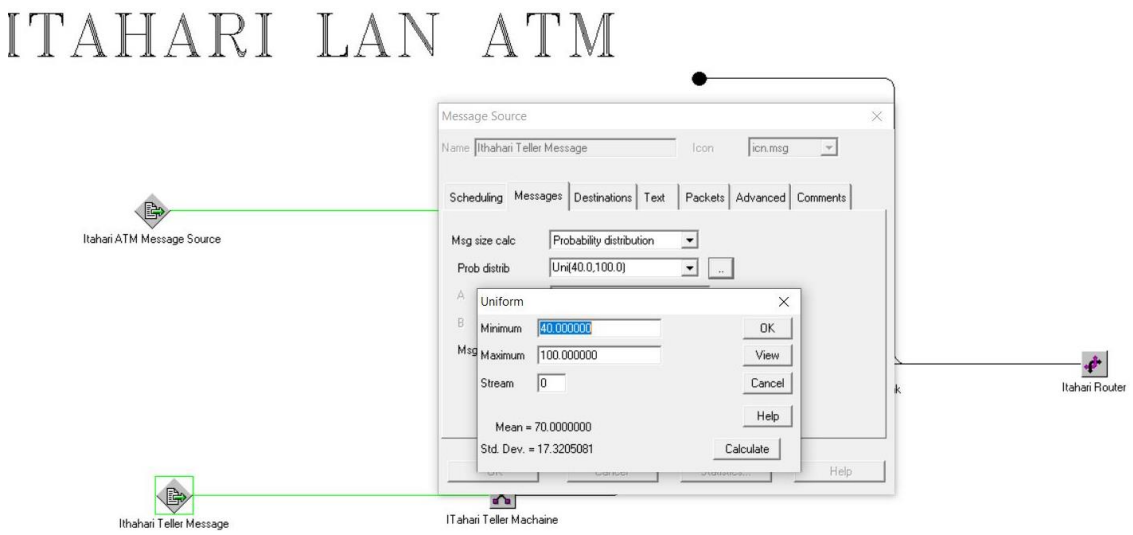


Figure 39: ITAHARI LAN TELLER MACHINE MESSAGE SOURCE MESSAGE CONFIGURATION

Description: In message source the configuration was made to the message by clicking on msg size calc to probability distribution similarly we have to change the probability distrib UNI (40,100.0, 0) and two edit the UNI value click on two dot button insert the value in the form of (Max, Min, stream)click on ok.

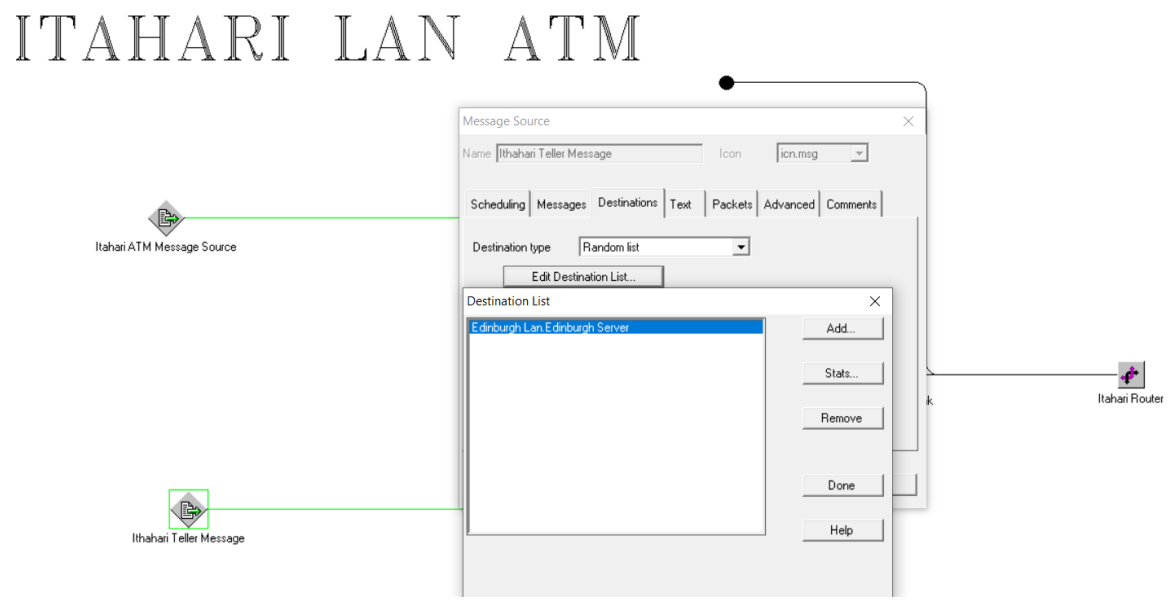


Figure 40: ITAHARI LAN TELLER MACHINE MESSAGE SOURCE DESTINATION CONFIGURATION

Description: In message source the configuration was made to the Destination by clicking on Edit destination List and select Edinburgh LAN, Edinburgh Server and click on ok.

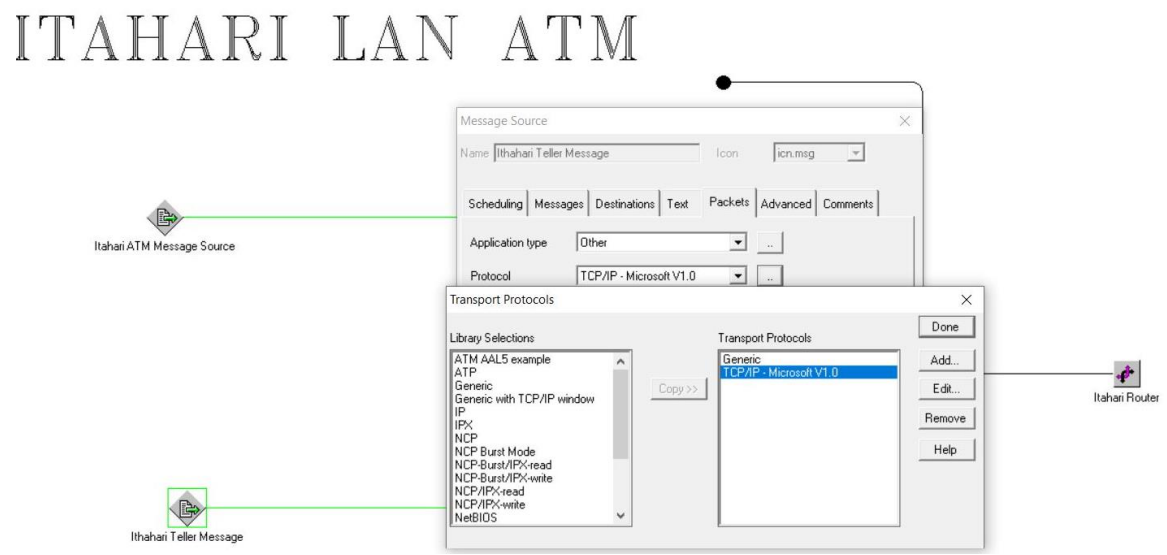


Figure 41: ITAHARI LAN TELLER MACHINE MESSAGE SOURCE PACKET PROTOCOL CONFIGURATION

Description: In message source the configuration was made to the packets by clicking on protocol select the TCP/IP-MicrosoftV1.0 to select this click on two dot button clicks on TCP/IP-Microsoft v1.0 and then click on ok.

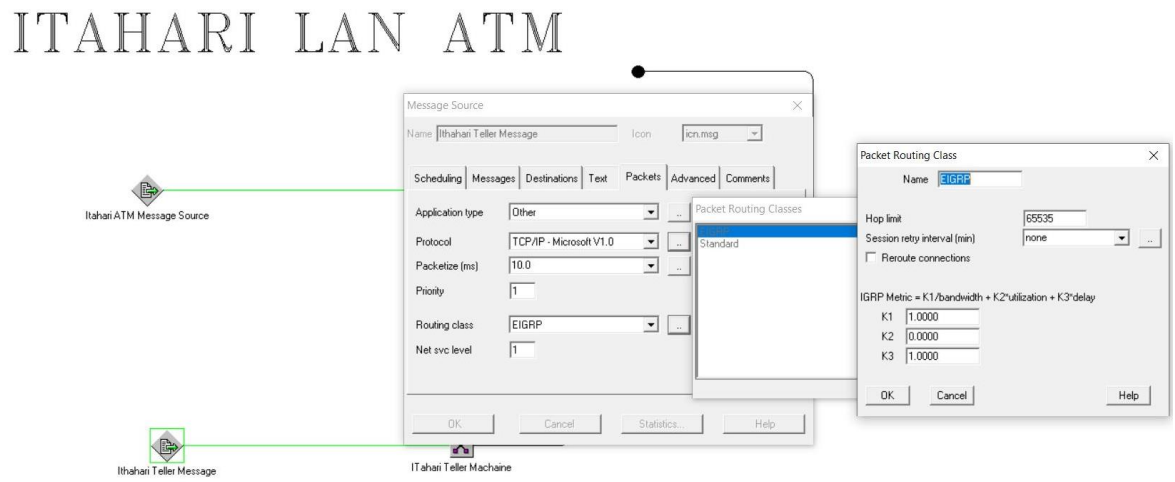


Figure 42: ITAHARI LAN TELLER MACHINE MESSAGE SOURCE PACKET ROUTING CLASS CONFIGURATION

Description: In message source the configuration was made to the packets by clicking on routing class the select EIGRIP to select this click on two dot button and click on add and write the name EIGRIP and click on ok.

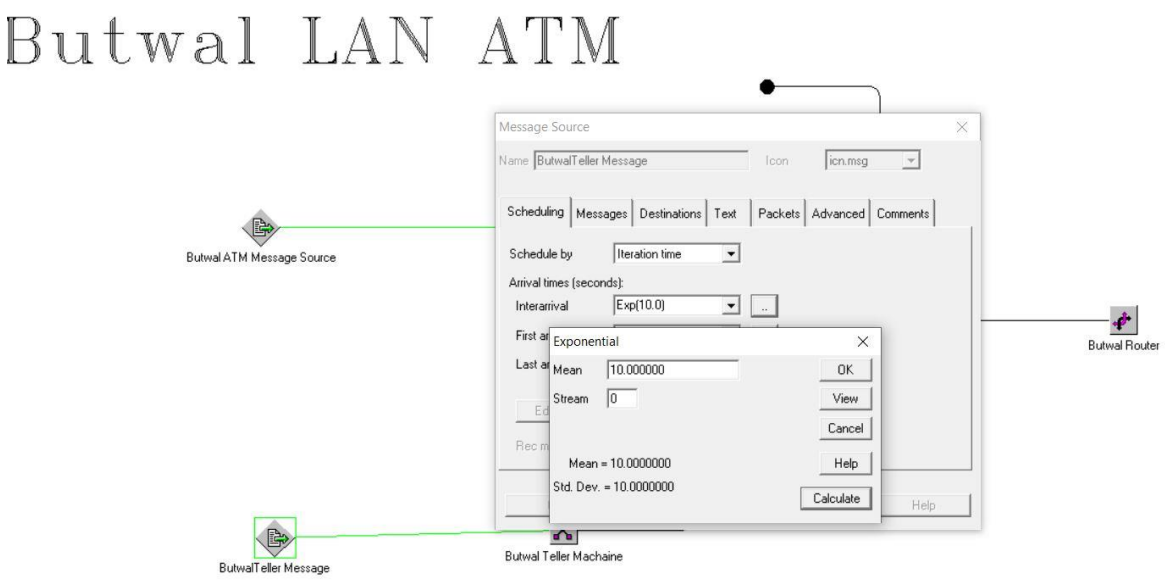


Figure 43: BUTWAL LAN MESSAGE SOURCE SCHEDULING CONFIGURATION

Description: In message source the configuration was made to the message source name Butwal Teller Message similarly we have to change the scheduling in scheduling by schedule by iteration time similarly change the inter arrival Exp (10.0) and click on ok.

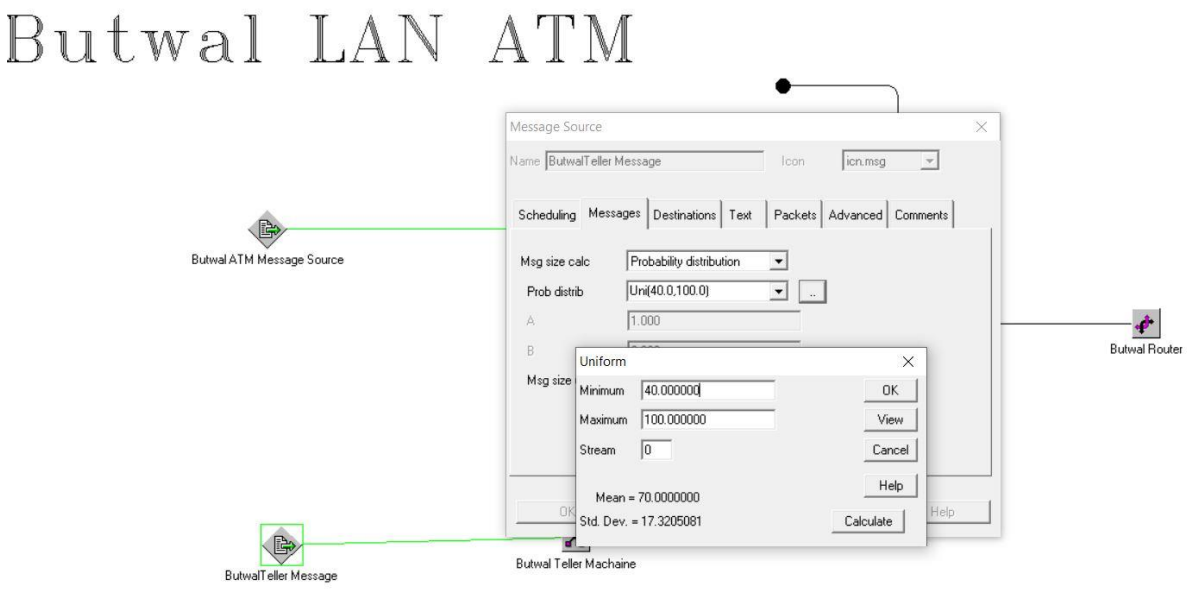


Figure 44: BUTWAL LAN MESSAGE SOURCE MESSAGE CONFIGURATION

Description: In message source the configuration was made to the message by clicking on msg size calc to probability distribution similarly we have to change the probability distrib UNI (40,100.0, 0) and two edit the UNI value click on two dot button insert the value in the form of (Max, Min, stream)click on ok.

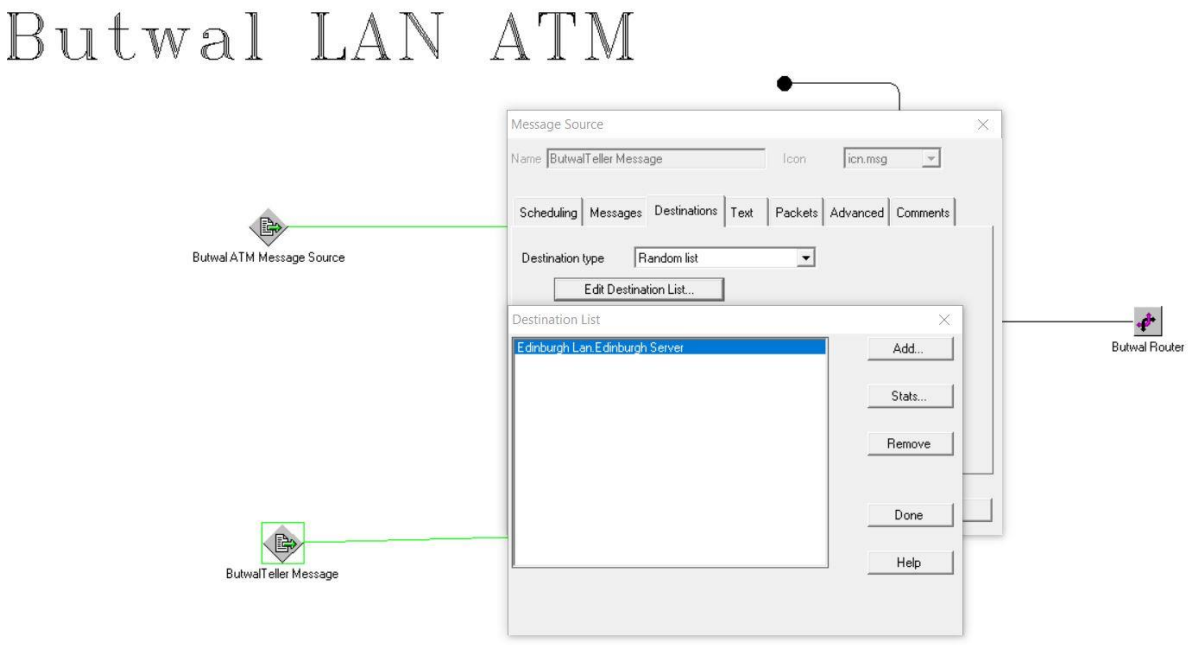


Figure 45: BUTWAL LAN MESSAGE SOURCE DESTINATION CONFIGURATION

Description: In message source the configuration was made to the Destination by clicking on Edit destination List and select Edinburgh LAN, Edinburgh Server and click on ok.

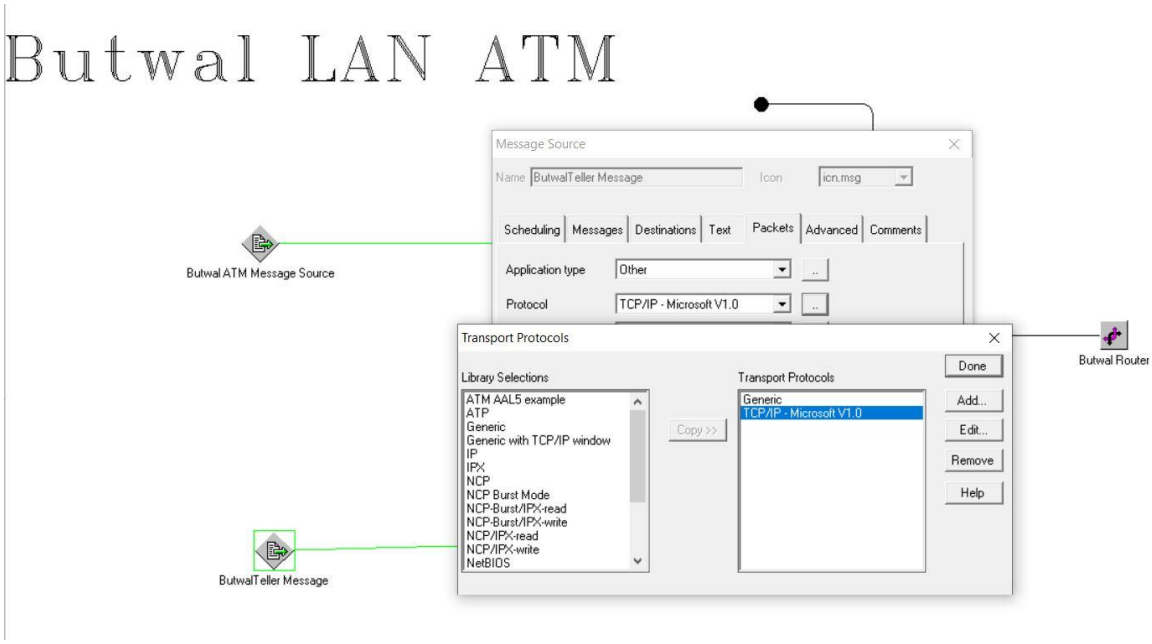


Figure 46: BUTWAL LAN MESSAGE SOURCE PACKETS PROTOCOL CONFIGURATION

Description: In message source the configuration was made to the packets by clicking on protocol select the TCP/IP-MicrosoftV1.0 to select this click on two dot button clicks on TCP/IP-Microsoft v1.0 and then click on ok.

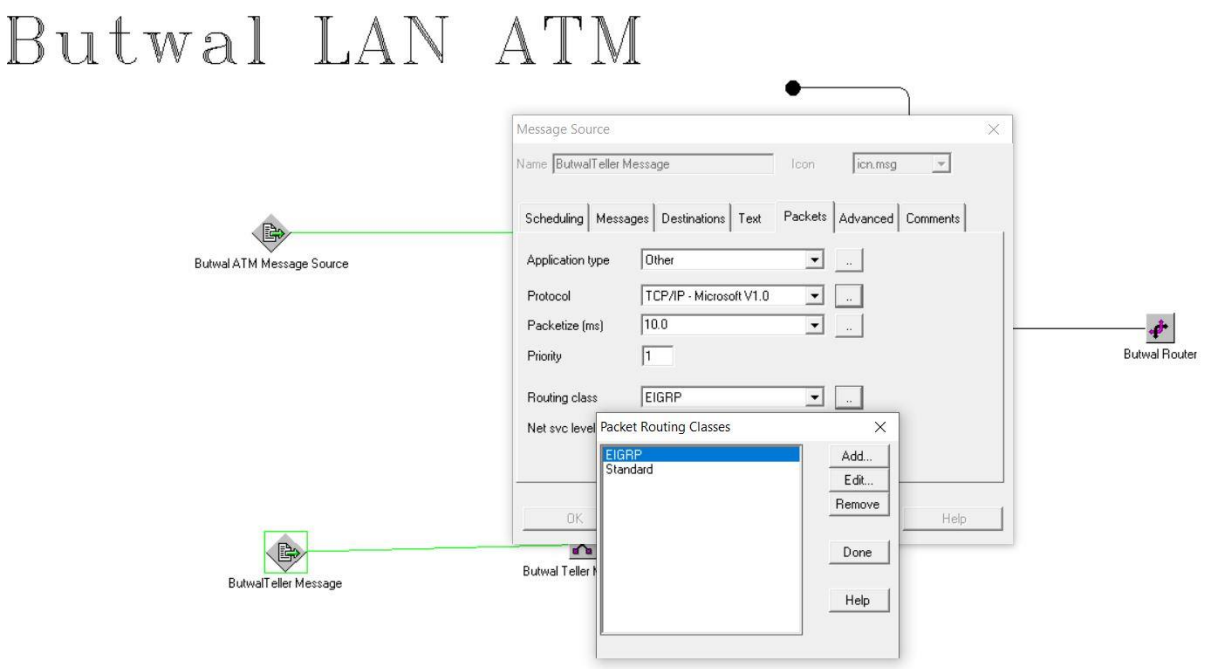


Figure 47: BUTWAL LAN MESSAGE SOURCE PACKETS ROUTING CLASS CONFIGURATION

Description: In message source the configuration was made to the packets by clicking on routing class the select EIGRIP to select this click on two dot button and click on add and write the name EIGRIP and click on ok.

1.3 Description of Report

1.3.1 NODES: RECEIVED MESSAGE COUNTS Receiver (Message Name) vs Count

Receiver	COUNT	MESSAGE NAME
Edinburgh Lan.Edinburg	980	Itahari ATM Message Source
Edinburgh Lan.Edinburg	997	Butwal ATM Message Source
Edinburgh Lan.Edinburg	1	Ithahari Teller Message
Edinburgh Lan.Edinburg	2	Butwal Teller Message

Table 1: Recived Message Count

From the above table is all about the received message count of all the nodes. This report was made generated after the completion of the simulation model. We can see that there a 4 nodes named Itahari ATM Message which has message count of 980, Butwal ATM Message Source which has message count of 997, Ithahari Teller Message which has the message count of 1, and last Butwal teller message which has the message count of the 2.

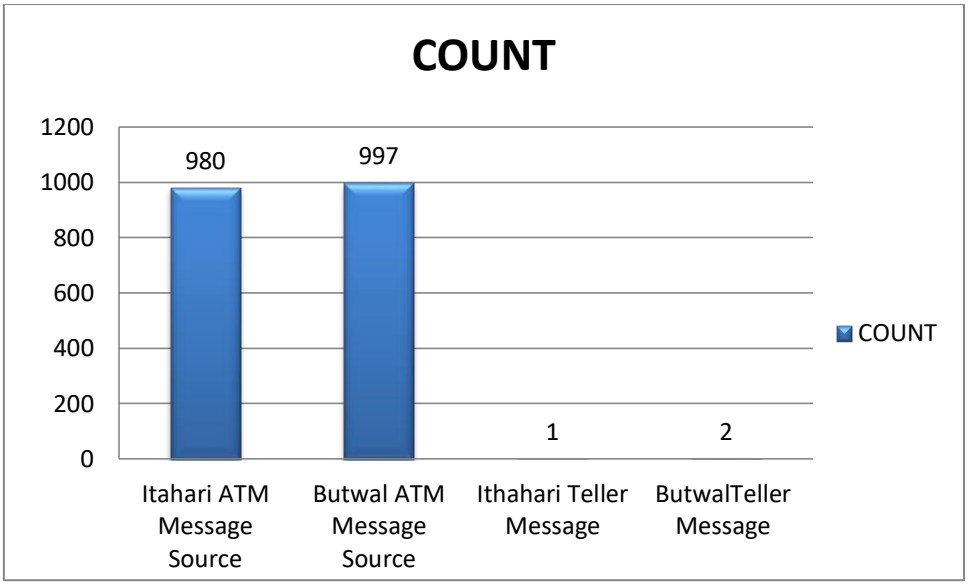


Figure 48: RECEIVER VS COUNT

From the above graph we can see that the highest peak of the bar graph is of the Butwal ATM message Source with the value of 997 and the second highest is of the Itahari AM message Source with the value of 997, third highest message source is of Butwal Teller Message with the value of 2 and last message source is of Itahari Teller Message with the value of 1.

1.3.2. Link: Channel Utilization Link vs. % Utilization

LINK / APP TYPES	PACKETS DELIVERED	PKTS/ SEC	BYTES DELIVERED	KBPS DELIVERED	% Bytes	UTIL(%)
Itahari Lan.Itahari LAN Other	19022	317.033	1091107	145.481	100.000	2.25
Edinburgh LAN .Edinburg Other	12737	212.283	658076	87.743	100.000	0.80
Butwal Lan.Butwal LAN Other	19064	317.733	1090638	145.418	100.000	2.26

Table 2: Channel Utilization

From the above table is all about channel utilization we can see.This report was generated after the completion of the simulation model. We can see that there are three link channel named Itahari LAN.Itahari LAN other, Edinburgh LAN.Edinburgh LAN other, Butwal LAN.BUTWAL LAN others. Itahari LAN has the utilization of the 2.25%, Edinburgh LAN has the utilization of the 0.80%, Butwal LAN has the utilization of the 2.26%.

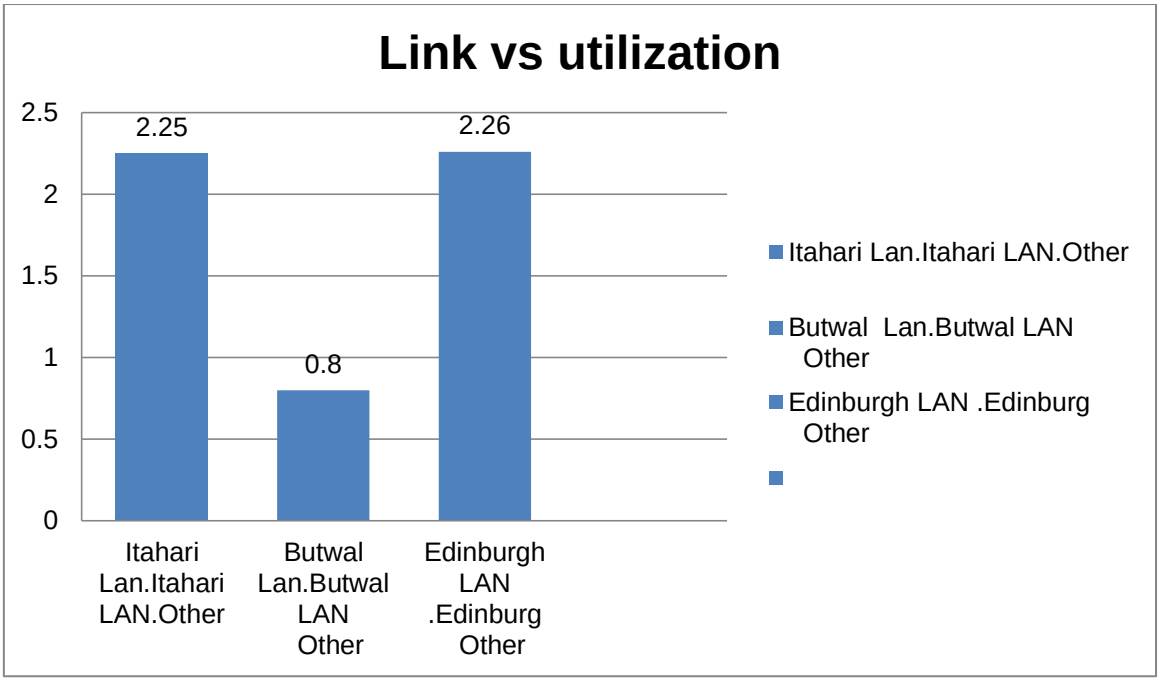


Figure 49: LINK VS UTILIZATION

From the above graph we can see that the highest link utilized is used by the Edinburgh LAN by 2.26% and the second highest link utilization is used by the Itahari LAN by 2.25% and the last the least link utilized is used by Butwal LAN by 0.8%.

1.3.3. WAN Cloud: Frame Count by VC Cloud: VC vs Frame Accepted vs Kilobit accepted

1.3.3.1 Cloud: VC vs Frame delay average

WAN CLOUDS: FRAME DELAY BY VC

REPLICATION 1 FROM 0.0 TO 60.0 SECONDS

CLOUD: VC WAN Cloud	FRAME DELAY (MS)			BURST SIZE (kb)	
	AVG	STD	MAX	AVG	MAX
Itahari-Edinburgh	1164	697	2518	158	320
Edinburgh-Itahari	17	0	17	111	243
Edinburgh-butwal	17	0	22	111	251
Butwal-Edinburgh	1168	`701	2522	159	320

Table 3: Frame Delay

From the above table is all about the virtual circuit delay vs frame delay average. This report was generated after the completion of the simulation report. There are for virtual circuit named Itahari Edinburgh, Edinburgh Itahari, Edinburgh Butwal, Butwal Edinburgh. Frame delay average used by the respective virtual circuit is Itahari Edinburgh 1164, Edinburgh Itahari 17, Edinburgh Butwal 17, Butwal Edinburgh 1168.

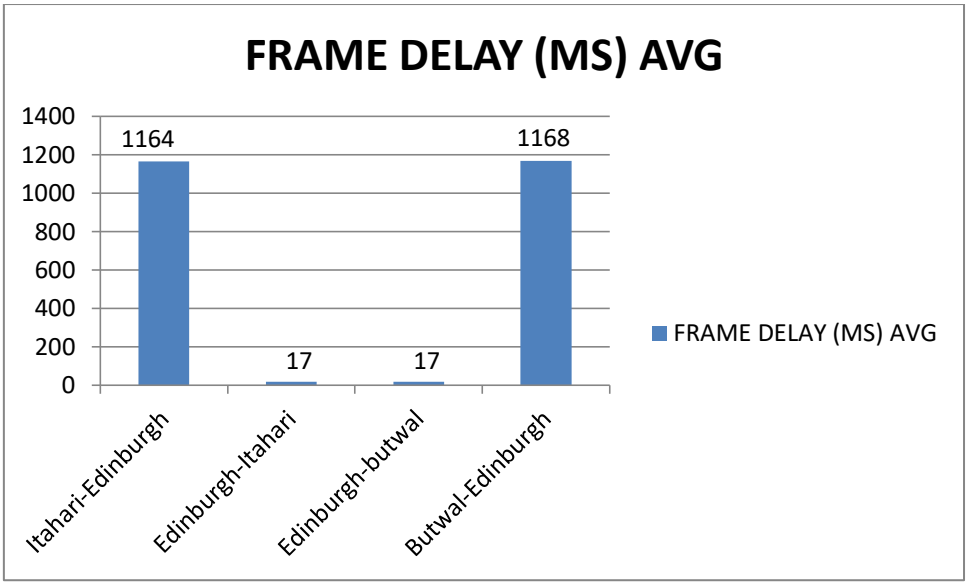


Figure 50: VC vs. Frame Delay Average

From the above bar graph we can see that the highest peak point is of the frame delay average is of Butwal-Edinburgh with the value of 116 8, second highest peak value of the frame delay average is 1164, at last the Edinburgh Itahari and Edinburgh Butwal has the same value of the frame delay average is 17.

1.3.3.2 Cloud: VC vs. Burst size average

CLOUD: VC WAN Cloud	BURST SIZE (kb)
	AVG
Itahari-Edinburgh	158
Edinburgh-Itahari	111
Edinburgh-butwal	111
Butwal-Edinburgh	159

Table 4: Frame Delay Burst Size

From the above table is all about the virtual circuit delay vs burst size. This report was generated after the simulation. There are four virtual circuits and their burst sizes (kb) are: Itahari-Edinburgh 158, Edinburgh-Itahari 111, Edinburgh-Butwal 111 and last one is Butwal-Edinburgh 159.

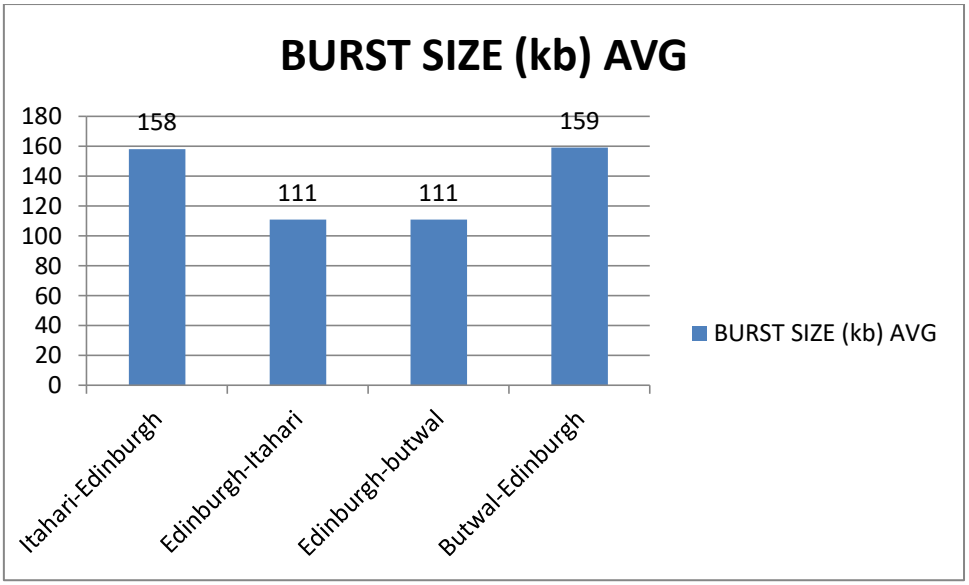


Figure 51: VC VS BURST SIZE AVERAGE

From the above graph we can see that the highest burst size (Kb) is of Butwal-Edinburgh 159 kb, second highest burst size (kb) is of Itahari-Edinburgh 158 kb. But the Edinburgh-Itahari and Edinburgh –Butwal has same burst size (kb) 111.

1.3.3 WAN Cloud: Frame Count By VC

Cloud: VC vs Frame Accepted vs Kilobit accepted

WAN CLOUDS: FRAME COUNTS BY VC

REPLICATION 1 FROM 0.0 TO 60.0 SECONDS

CLOUD: VC: FRAMES	FRAMES / ACCEPTED		KILOBITS DROPPED	
KILOBITS	NORMAL	DE	NORMAL	DE
WAN Cloud	(TOTAL KILOBITS TRANSMITTED = 5265)			
Itahari-Edinburg Frm	1616	1570	0	9459
kb	803	810	0	4656
Edinburgh-Itahar Frm	2304	882	0	0
kb	737	282	0	0
Edinburgh-butwal Frm	2303	880	0	0
kb	737	282	0	0
Butwal-Edinburgh Frm	1600	1582	0	9569
kb	804	808	0	4692

Table 5: Frame Count and kilobits

From the above table is all about the cloud virtual circuit vs frames accepted. This reported was generated after simulation was done. The frame accepted by wan cloud in frames and kilobits are Itahari-Edinburgh frm 1616 kb 803, Edinburgh-Itahari frm 2304 frm 2304, Edinburgh-butwal frm 2303 frm 737 and butwal –Edinburgh Frm 1600 kb 804.

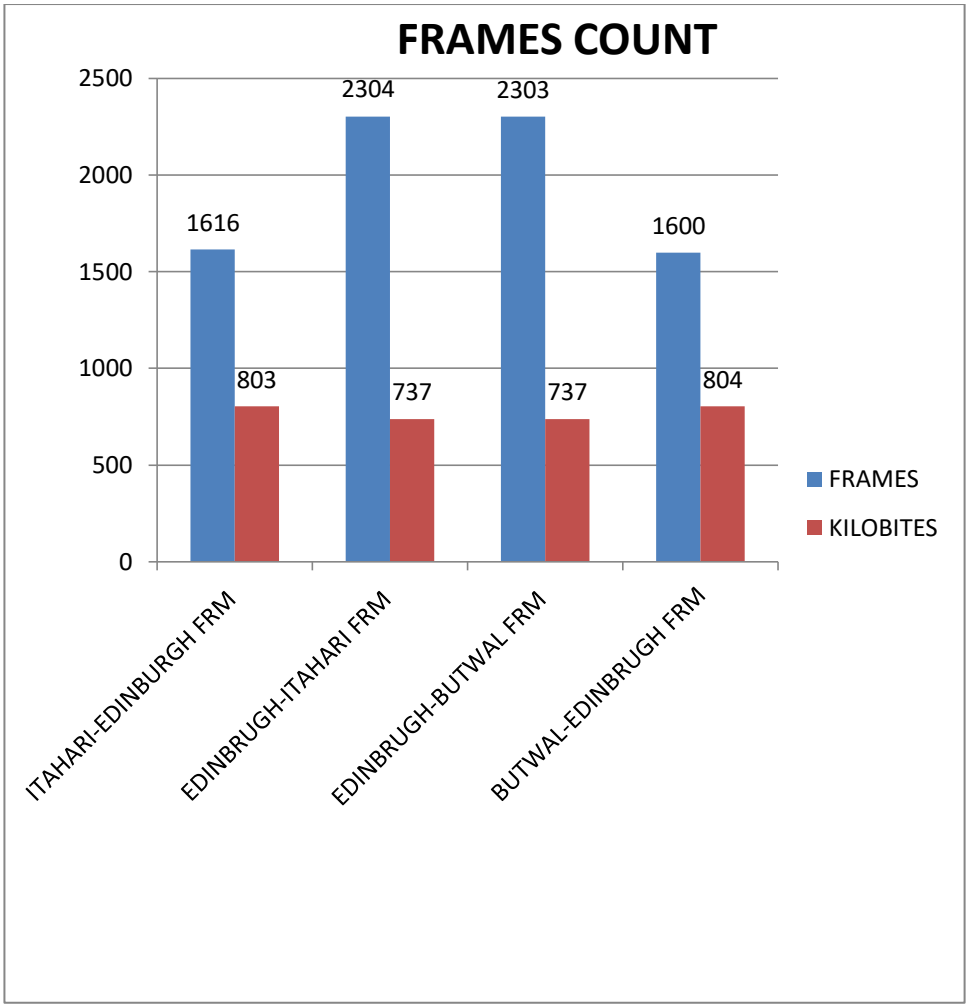


Figure 52: VC VS FRAME ACCEPTED VS KILOBIT ACCEPED

From the above graph we can see the highest frames count frame is of Edinburgh-Itahari 2304 and the second highest frame count is of Edinburgh-Butwal 2303 and third highest frame count frame is of Itahari-Edinburgh 1616 at last but not the least the least highest frame count is of Butwal-Edinburgh frm 1600. The above table the highest kb is of Butwal-Edinburgh with 804, the second highest kilobits of Itahari-Edinburgh 737 and the last both Edinburgh-Itahari and Edinburgh-Butwal has the same kb which is 737.

1.3.3.1 WAN CLOUDS: ACCESS LINK STATS

Cloud Access link vs frame accepted entry vs frame accepted exit

CLOUD:	FRAMES		BUFFER (BYTES)			% UTIL
ACCESS LINK (ENTRY) (EXIT)	ACCEPTED	DROPPED	MAX	AVG	STD	
Itahari Access Entry	3186	9459	N/A	N/A	N/A	97.44
Exit	3186	0	80	7	15	17.26
Edinburgh Access Entry	6369	0	N/A	N/A	N/A	34.50
Exit	6368	0	33930	7808	10305	49.97
Butwal Access Entry	3182	9569	N/A	N/A	N/A	98.03
Exit	3183	0	123	7	15	17.25

Table 6: Message+ Response Source: Message Delay

From the above table is all about the cloud access link vs frame entry and exit. This report was generated after the simulation was done. The entry and exit point of the respective link are: Itahari-Access Entry 3186, Exit 3186, and Edinburgh Access entry 6369, Exit 6368, and Butwal Access Entry 3182, exit 3183.

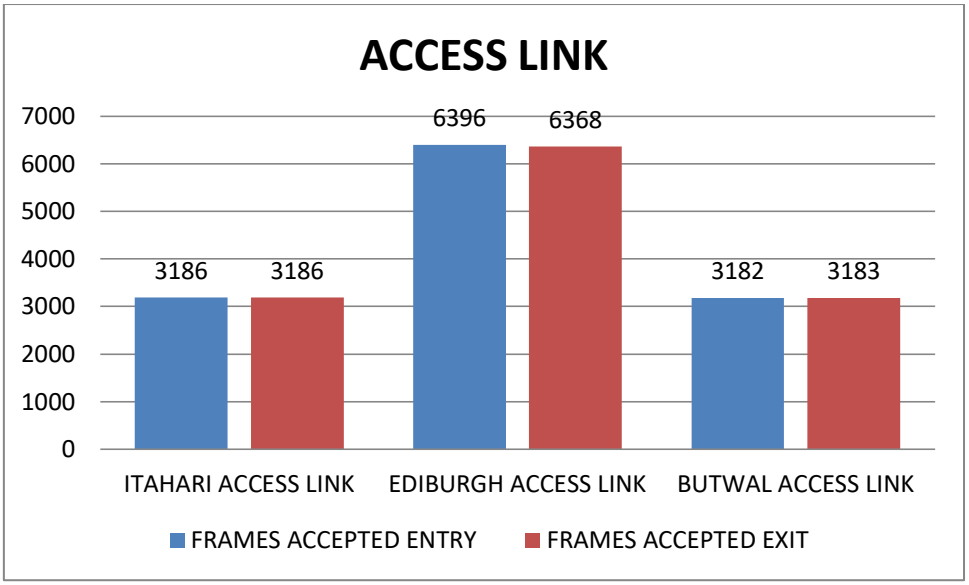


Figure 53: Cloud Access link vs frame accepted entry vs frame accepted exit

From the above graph tell us about the highest and lowest of the entry and exit. The highest entry access link is of Edinburgh Access link 6396, second highest entry link is of Itahri Access link 3182 and least accepted entry link is of Butwal Access link 3182. The highest exit point is of Edinburgh Access link 6368, the second highest exit point is of Itahari Access Link 3186 and last the least exit point is of Butwal Access point 3183.

1.3.3.6. Message + response Source: Message Delay

Origin /Message Source Name/ Destination List vs average

ORIGIN / MSG SRC NAME: MESSAGES	MESSAGE DELAY			
DESTINATION LIST	ASSEMBLED	AVERAGE	STD DEV	MAXIMUM
Itahari Lan.Ithari Atm 1-30 / src Itahari ATM Message Source: Edinburgh Lan.Edinbu				
	518	21512.131 MS	13604.146 MS	51179.183 MS
Itahari Lan.ITahari Teller Machaine / src Ithahari Teller Message: Edinburgh Lan.Edinbu				
	1	1008.668 MS	0.000 MS	1008.668 MS
Edinburgh Lan.Edinburgh Server / src Einburgh Response Source: ECHO				
	0	0.000 MS	0.000 MS	0.000 MS
Butwal Lan.Butwal Atm 1-30 / src Butwal ATM Message Source: Edinburgh Lan.Edinbu				
	511	21797.681 MS	14133.598 MS	51890.134 MS
Butwal Lan.Butwal Teller Machaine / src ButwalTeller Message: Edinburgh Lan.Edinbu				
	1	33995.972 MS	0.000 MS	33995.972 MS

Table 7: Message+Response Source: message Delay

From the above table is all about the message name origin and the destination vs the average message delay. This report was created after the simulation model. There are four origin and destination Itahari Lan.Ithari Atm 1-30 / src Itahari ATM Message Source: Edinburgh Lan.Edinburgh 21512.131 averag message delay, Itahari Lan.ITahari Teller Machaine / src Ithahari Teller Message: Edinburgh Lan.Edinburgh 1008.668 average message delay, Edinburgh Lan.Edinburgh Server / src Einburgh Response Source: ECHO 0.0 average message delay, Butwal Lan.Butwal Atm 1-30 / src Butwal ATM Message Source: Edinburgh Lan.Edinburgh

31797.681 message average delay, Butwal Lan.Butwal Teller Machaine / src ButwalTeller Message: Edinburgh Lan.Edinburgh 33995.972

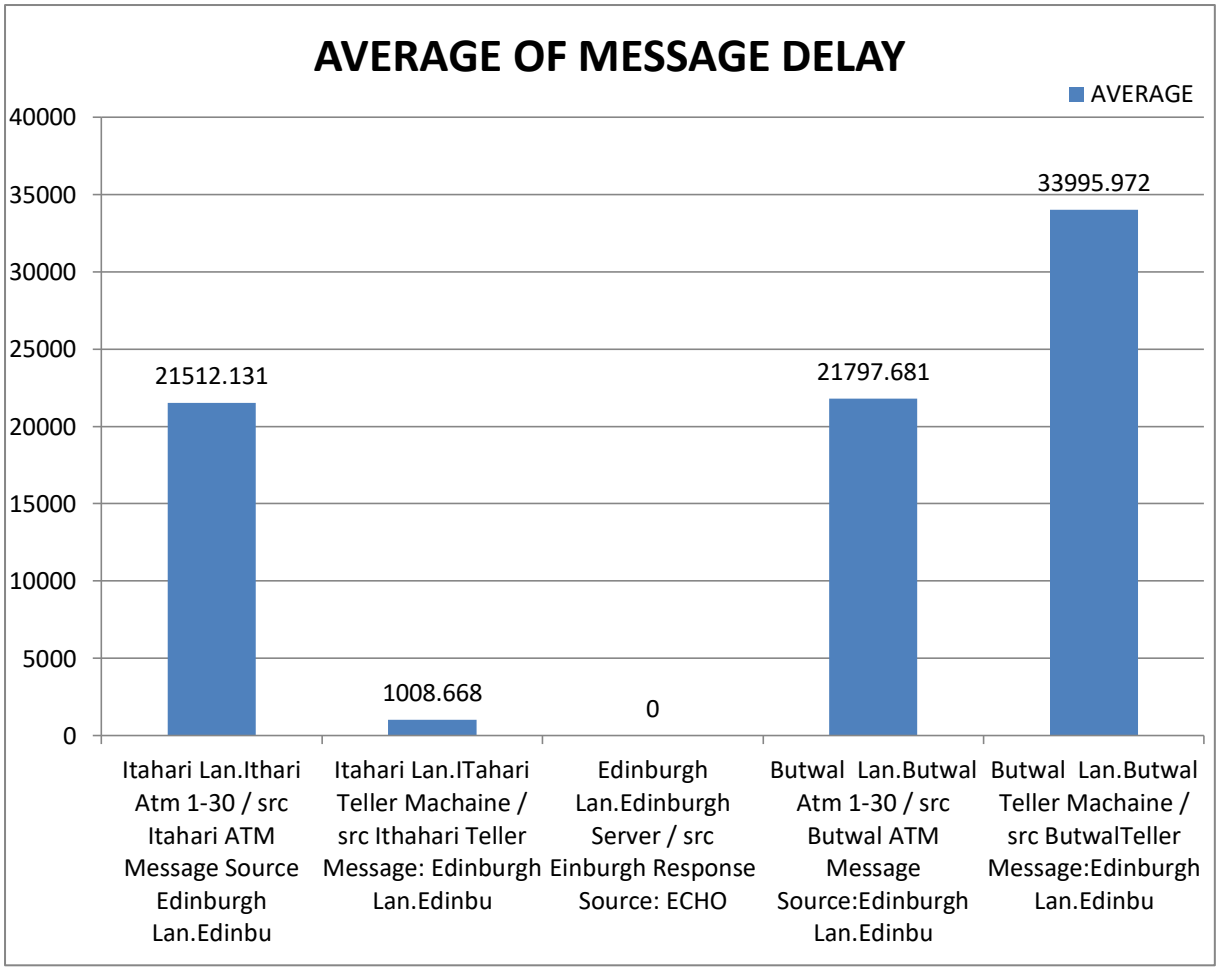


Figure 54: Message Delay Origin /Message Source Name/ Destination List vs average

From the above graph we see that the highest and lowest average message delay the highest message average delay is of Butwal Lan.Butwal Teller Machaine / src ButwalTeller Message: Edinburgh Lan.Edinburgh 33995.972 and the second highest average message delay is of Butwal Lan.Butwal Atm 1-30 / src Butwal ATM Message Source: Edinburgh Lan.Edinburgh 21797.681 and the third highest average message delay is of Itahari Lan.Ithari Atm 1-30 / src Itahari ATM Message Source: Edinburgh Lan.Edinburgh 21572.132, the least average message delay is of Edinburgh Lan.Edinburgh Server / src Einburgh Response Source: ECHO is 0.

1.4Conclusion

After completing the Task, I came to know how real-world simulation is performed through the use of virtual software called COMNET III. In task awe have constructed a WAN model through which we have understood how wirelessly data are transferred even if the headquarter or the server is in another location or country. Here Itahari LAN and Butwal LAN are in Nepal but Edinburgh (Main LAN or server) in in LONDON and still we are able to transfer data and information related to ATM and banking system. How data are accessed from cloud and how proper traces of information is stored. We also get the knowledge about what types of configuration and what types of network devices are used for what purpose. A single respective network controlling device can control the whole LAN system and a far device can also be configured through wireless medium. And in future if we dive into the real world then we can do somewhat better due to this assignment, which gave the idea of Network simulation, network topology, devices used and configuration. I hope in future similar knowledgeable coursework will be provided to me for better understand of real world communication architecture**.** I found many difficulties while doing this coursework but after some research I found some ways of completing this coursework with enhanced my skills and knowledge. I found this coursework quiet amazing to complete.

2. Task B

2.1 INTRODUCTION

The network is the aggregation of numerous of machine that are intertwined with each other to allow the exchange of data such computer, server etc. Internet is a common example of a network that connects a mass of people all around the world. Devices or nodes can be of two type's wireless network or physical network (wired network) both the types of the network help us to communicate. Both of the media are good but the wireless network helps us to connect the multiple devices in a single signal but the wired network needs multiple wire and devices to connect the multiple devices and the main disadvantages of the wire are that the wire will cover that large amount of place and the place will not look nice but in the wireless, there is an only single wire connected which makes room little good and from the single device we can connect many devices at once. The key is that there are at slightest two segregated components, and they are associated. The main aim of this report is to know the different types of the wireless network when it was formed and the types of the different wireless network. The main key point is to know how the wireless network is used and how it is important the wireless network is. In the 21st Century, people mostly use only wireless devices. We can find the different types of the wireless devices but we mainly use LAN, WAN, PAN, MAN. The wireless network helps us to connect the electronic device wireless which lets us connect the internet in any part of the room, building, or world. Wireless devices help us to connect many devices at once. Wireless technologies are the devices which through the electronic wave signal that signal is connected to the electronic device which is known as Wi-Fi. The main objective of wireless technology is to connect people with the world with the help of different mediums of wireless devices like satellite, radio wave, Wi-Fi, 5G data speed, or Wi-Fi speed. (Hope, 2020) (Cisco, n.d.)

2.2 BACKGROUND

WI-FI is one of the eminent wireless networks. For sending the data and information from end users like mobile and laptop radio wave was used. In the cellular system 1G, 2G, 3G, 4G, and 5G are being used but the latest version of the cellular network is 5G. Developing of the cellular wireless network it has made the user so much

flexibility and reliability. Developing of the wireless route it has made so easy that many people can use the internet at once by using single wireless router. (group, 2016)

2.2.1 HISTORY

Before the development of wireless technology people used to communicate with help of the medium like a flare guns, smoke, fire, and many more. Wireless technology was developed by Heinrich Hertz (1857-1984) called electromagnetic waves. Samuel F.B. Morse (1791-1872) demonstrated the first wired network was changed in 1832 after many years it was replaced by the very first RF communication which was developed by Guglielmo Marconi in the late 1980s. First, transmit radio signal was send to the mobile receiver on the ship which was developed by Marconi early 1900s. The single wireless devices can transmit to hundred or thousand devices at once and can receive the message at once. Cellular infrastructure has evolved so far that users use networking systems for open garage doors, baby monitor and many more. The delivery infrastructure includes point-to – point microwave connection, wireless internet and satellite networks. (Krishnamurthy, 2020)

The first satellite test was launched by NASA AND Hughes in 1963. Later on there was new practice with the light weight devices to communicate easily. Then the scientist tried to send the data, application, etc. with the help of the satellite wireless network. (Jean Warland, 2000)

2.2.2 Wireless Networks

The wireless network is also known as Wi-Fi. Wi-Fi signals are augmented by access points, meaning a computer can be far from a router but still be linked to the network. Connect to the wireless network of that organization when we connect to a Wi-Fi hotspot at a cafe, a hotel, an airport lounge, or another public location. Wireless networks are the alternative for the cable or wired network. The wireless

network helps the user to take their devices freely to move and connect with the single network without any difficulties. Wireless network is divided into four categories they are as follows:

- Wireless Local Area Network (LAN): Two external linked to the wireless system sharing method to provide the network connectivity to the larger internet infrastructure offered by an access point.

- Wireless Metropolitan Area Network (MAN): Connection of the different or several wireless LANs network is known as MAN.

- Wireless Wide Area Network (WAN): Connection of the different large areas such as neighboring towns, cities, villages, and many more.

- Wireless Personal Area Network (PAN): Interconnected devices which is a short geographical span like within a person group.

Wi-Fi is used mainly used in the wireless network. Nowadays Wi-Fi is one of the most imperative parts of people's life. There are different types of wireless network devices like satellite, radio wave, microwave, Wi-Fi, and many more. The wireless networks made the world so easy that people can communicate and find any kind of information where they want or at any place. (Technopidea, n.d.)

2.2.1.2 ADVATAGES AND DISADVANTAGES

There are many any advantages and disadvantages to the wireless networks and some they are listed below:

Advantages of the wireless are follows:

- Improved Efficiency: It helps us to provide the better data communication which leads us to provide the faster information between the partners and customers within the organization. For example: it allows the organization and people to check on going stock price.
- Accessibility: Wireless technology helps users so they can move and communicate easily which does not require any kind of the cable or wire during the communication.

- Flexibility: in wireless network the people does not required to seat at one place and use the computer. Which will help the user to get their data at any time whenever required the user does not have to run in search of the computer to access the data?
- Cost-effective: Wireless network is a cheaper in cost and easy to install because it does not required to install at many place but in the wired or cable network we need to think of different wire and search the different kind of the wire. We need to install the wire in all the room where we want the access of the network.
- Increased opportunities: wireless network helps the growth of the new business and new products and services. For example: many people will go in the search of the Wi-Fi so they can do their work outside the home and have the good food at restaurant and complete their work.

Disadvantages of the wireless network:

- Security: Wi-Fi network needs to keep more secure because the wireless network can be attacked by any unsanctioned user at any time. We should be more careful using the Wi-Fi at any kind of the public place so that the attacker cannot access your data.
- Installation Issues: If the business organization or user are using wireless technology with in the same building who find the problem will connecting due to many users or sometimes the loss of the connection also have to faced which may result to huge loss.
- Speeds: speed of the wireless network is less than wired or cable network because in the wired network the single devices is used but in wireless network many devices are connected to the single devices from the which devices has to spread the speed equally.
- Coverage: wireless network does not have much coverage in the larger building or flats. From which they have to keep the multiple wireless device to the access of the internet. (Volyntseva, 2020)

2.1.2 IEEE 802.11 Architecture

IEEE 802.11 generally referred to as Wi-Fi which postulates the design and requirements of the wireless local area network (WLANs). To join both of the link

nodes, Wi-Fi or WLAN we have to use high frequency radio wave. The components of the IEEE 802.11archieture are:

- Stations (STA): Station is the amalgamation of all the devices and equipment which are connected to wireless LAN. There are two types of station WAP, client.
- Basic services set (BSS): It is a set of two group of station which communicates at the physical layer. BSS is of two types: Infrastructure BSS, Independent BSS.
- Extended service set (ESS): BSS is a connection of all the ESS.
- Distribution System (DS): ESS is a connection of all the DS. (Moumita, 2019)

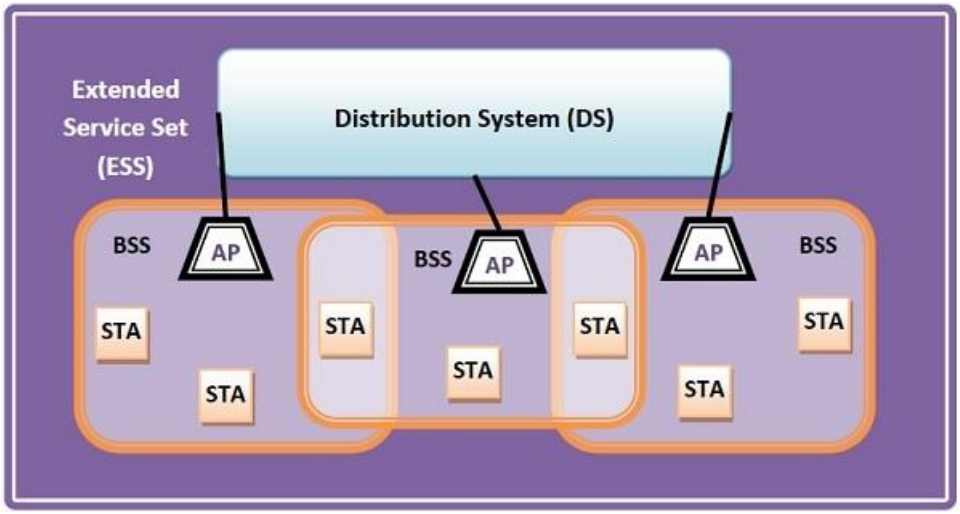


Figure 55: IEEE architecture 8021.11

(Moumita, 2019)

The frame format used by of IEEE 802.11 like:

- Frame Control: Frame control helps to store the control information of frame and the size of the bytes is 2 starting field and it is made f11 sub fields.
- Duration: It specifies the time period of the 2 bytes field time taken by the frame and acknowledgement occupy of the channel.
- Address fields: An Address field contains the address of the source, destination, and final endpoint. Address as three 6bytes fields for the storing address.
- Sequence: Sequence helps us to store the frame number by 2 bytes.

- Data: Data helps to carrier the data from upper layer and maximum size is of 2312 bytes.
- Check sequence: Check sequence helps us to find the error of the information which contains 4 bytes field. (Moumita, 2019) (Moumita, 2020)

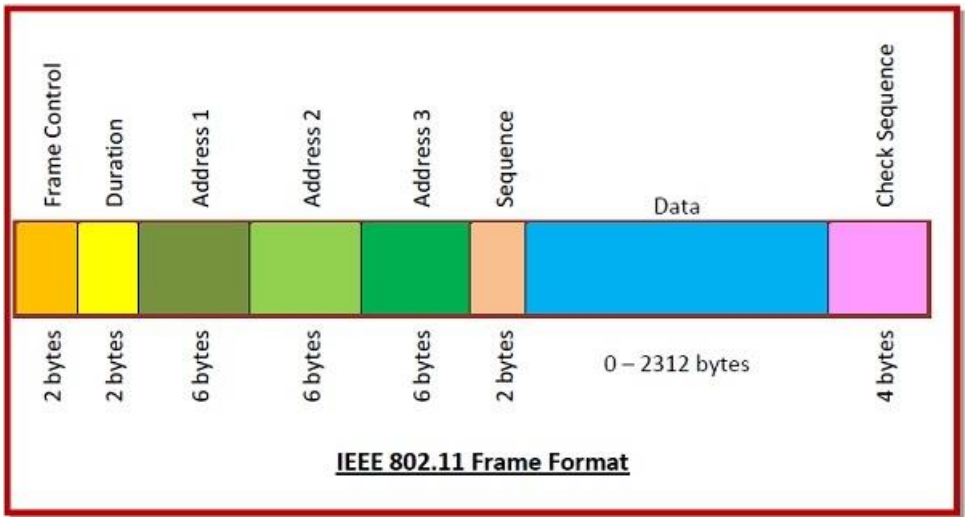


Figure 56: IEEE 802.11 Frame Format

(Moumita, 2019)

2.1.2.1 IEEE 802.11 Priorities

IEEE 802.11 is used for mac protocol. The maximum back off window size default value is 1024.The evasion back off value for 802.11b should be of 32timeslots and for 802.11 should be of 16 time slots. There is several specification of IEEE 802.11 like 802.11, 802.11a, 802.11b, 802.11g, 802.11n and 802.11p.All the standards use multiple access with collision avoidance (CSMA/CA) carrier-sense (Xiao, 2005)

Standard	Frequency	Maximum Speed	Backwards compatibility
802.11	2.4 GHz	2 Mbps	-
802.11a	5 GHz	54 Mbps	-
802.11b	2.4 GHz	11 Mbps	-
802.11g	2.4 GHz	54 Mbps	802.11b
802.11n	2.4 and 5 GHz	600 Mbps	802.11a/b/g
802.11ac	5 GHz	1300 Mbps	802.11a/n
802.11ad	2.4 GHz, 5 GHz and 60 GHz	7 Gbps	802.11a/b/g/n/ac

Figure 57: Table of 802.11comparison Standard

(Networkustad, 2020)

2.1.3 WIRELESS TECHNOLOGY

Wireless technology helps us to communicate between two or more person over the large distance without the using any kind of the wire or cabled network. Wireless technology uses radio frequency (RF) or infrared waves (IF). Wireless technology came up with of the solution like Wi-Fi, NFC, and Bluetooth, different version of the wireless network like 0G, 1G, 2G, 3G, 4G, and 5G. 5G is the latest version of the wireless network. Innovation of the wireless technology helped the industry because industry has to do lot of the research or have to get the access of the data at any time of the point so they have to search for the wired network when they have been installed and make different room to install the wired networks which make them hard to find the room or find the wire in case of the damage of the wire. (Oyj, n.d.) (Afolabei et al, 2018)

2.1.4 WAP

WAP stands for Wireless Application Protocol. WAP removes the breach between the mobile world and internet. A World Wide Web mobile rendering that allows developers to format screen sizes for mobile device adaptability is the WAP cascading style sheet (CSS). WAP is important because it helps to connect to find

the all the information what is happening in the world with the just the help of the application like price of the stock, cars and many more. WAP had made the people so lazy that now days that people do not go outside the market to buy the things or see the price of the things just they need to use the application which make their body sluggish and frail. WAP was developed by the leading companies of the wireless telecommunication by using internet standards and from standards. WAP architecture uses WML script. WAP architecture has to follow the following steps:

- Application Layer
- Session Layer
- Transaction Layer
- Security Layer
- Transport Layer

(Techopedia, 2020) (tutorialspoint, 2020) (BulBrook, 2001)

2.1.4.1 WML

WML stands for Wireless Markup Language. WML is most important part for WAP just like heart for the human. WML is much familiar as Hyper Text Markup Language (HTML) as it is written in plain text format. A wireless device does not have the features of display, computing power, and configuration of keys. These features are considered unique to the WML integrated devices.

Features of WML:

- Small wireless computing devices uses WML language.
- Variables can store the data in the form of string.
- For client-side scripting, WML uses WML script.
- Paralleled to HTML, WML has fewer codes.
- WML only supports WBMP image format. (techopedia, 2020) (Frost, 2000)

2.3 CONCLUSION

After completing this amazing coursework through a lot of research I came to know about the history, advantages and disadvantages, background, architecture of wireless network thus this research helped me improving my researching and knowledge several search on this topic wireless network then I was only able to complete my coursework because from the research I gained all the required knowledge and information on how to complete the coursework.

I found many difficulties while doing this coursework but after some research I found some ways of completing this coursework with enhanced my skills and knowledge. I found this coursework quiet amazing to complete.

3. REFERENCE AND BIBLOGRAPHY

Bibliography

Afolabei et al. (2018) Journal of telecommunication Systemand management. Evolution of wireless Network techhnologies , 7(3), p.5.

BulBrook, D. (2001) WAP: A Beginer'sGuide. In OSBORNE, ed. WAP: A Beginer'sGuide. USA: The McGraw_Hill Companies. pp.1-337.

Cisco. (n.d.) Cisco [Online]. Available from: https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking/wireless-network.html [Accessed 2020].

compuare. (2000) COMMNET III. In C. Corporation, ed. COMMNET III TUTORIAL WITH DISTURBED SOFTWARE MODULE. 2000th ed. 31440 Northwestern Highway Framington Hills,Mi 48334-2564: Compuare Corporation. p.216.

Frost, M. (2000) Learning WML and WML Script. 1st ed.

group, T. (2016) Tunda center [Online]. Available from: https://www.tnuda.org.il/en/wireless-communication-network-%E2%80%93-wi-fi-background [Accessed 2020].

Halsall, F. (2005) Addison-Wesley. In Computer Networking and The Internet. 5th ed. Edinburgh Gate harlow England: Person Education limited. pp.222-67.

Hope, C. (2020) Computer Hope [Online]. Available from: https://www.computerhope.com/jargon/n/network.htm [Accessed 06 Febuary 2020].

Jean Warland, P.V. (2000) Wireless Network. High-performance communication network, second.

Khartit, K. (2020) Investopedia [Online]. Available from: https://www.investopedia.com/terms/n/near-field-communication-nfc.asp [Accessed 23 September 2020].

Krishnamurthy, P. (2020) Encylopedia [Online]. Available from: https://www.encyclopedia.com/computing/news-wires-white-papers-and-books/wireless-technology [Accessed 13 December 2020].

Moumita. (2019) tutorialspoint [Online]. Available from: https://www.tutorialspoint.com/what-are-ieee-802-11-networks [Accessed 30 August 2019].

Moumita. (2020) tutorialpoint [Online]. Available from: https://www.tutorialspoint.com/what-are-the-ieee-802-11-wireless-lan-standards [Accessed 9 Jannuary 2020].

Networkustad. (2020) Networkustad [Online]. Available from: https://networkustad.com/2019/11/16/ieee-802-11-standards/ [Accessed 2020].

Oyj, N. (n.d.) Industrial-grade private wireless for industry 4.0 application. white paper , p.9.

Shaw, k. (2020) Networkworld [Online]. Available from: https://www.networkworld.com/article/3238664/80211x-wi-fi-standards-and-speeds-explained.html [Accessed 23 April 2020].

Technopidea. (n.d.) techopedia [Online]. Available from: https://www.techopedia.com/definition/26186/wireless-network.

Techopedia. (2020) techopedia [Online]. Available from: https://www.techopedia.com/definition/5103/wireless-application-protocol-wap [Accessed 12 Jannuary 2011].

techopedia. (2020) techopedia [Online]. Available from: https://www.techopedia.com/definition/2994/wireless-markup-language-wml [Accessed 2020].

tutorialspoint. (2020) tutorialspoint [Online]. Available from: https://www.tutorialspoint.com/wireless_communication/wireless_communication_wap.htm [Accessed 2020].

Volyntseva, Y. (2020) Businesstech weekly [Online]. Available from: https://www.businesstechweekly.com/operational-efficiency/wireless-

networks/advantages-and-disadvantages-wireless-networks/ [Accessed 03 December 2020].

Xiao, Y. (2005) IEEE xplore [Online]. IEEE (4) Available at: https://ieeexplore.ieee.org/document/1512111 [Accessed 4 july 2005].

4. APPENDIX

APPENDIX-A SCREENSHOTS OF SIMULATION REPORT

1. Simulation of Received message count

Compuware COMNET III Release 2.5.2.814 Sun Dec 20 21:11:18 2020 PAGE 3

19031269-Anshul-Agarwal

NODES: RECEIVED MESSAGE COUNTS

REPLICATION 1 FROM 0.0 TO 60.0 SECONDS

RECEIVER	COUNT	MESSAGE NAME
Edinburgh Lan.Edinburg	980	Itahari ATM Message Source
Edinburgh Lan.Edinburg	997	Butwal ATM Message Source
Edinburgh Lan.Edinburg	1	Ithahari Teller Message
Edinburgh Lan.Edinburg	2	ButwalTeller Message
Butwal Lan.Butwal Atm	1	Butwal ATM Message Source

Figure 58: Screenshots of Received message count report

This above picture is all about the data which was generated after the simulation was done this picture says about how many message is receive in 1minutes in the received message count.

2. Simulation of channel utilization

Compuware COMNET III Release 2.5.2.814 Sun Dec 20 21:11:18 2020 PAGE 13

19031269-Anshul-Agarwal

LINKS: CHANNEL UTILIZATION

REPLICATION 1 FROM 0.0 TO 60.0 SECONDS

LINK	FRAMES DELIVERED	RST/ERR	TRANSMISSION DELAY (MS) AVERAGE	STD DEV	MAXIMUM	% UTIL
Itahari Lan.Itahari Li	19022	0	0.073	0.028	0.722	2.2547
Edinburgh Lan.Edinburg	12737	0	0.038	0.014	0.082	0.8031
Butwal Lan.Butwal Lin	19064	0	0.073	0.028	0.756	2.2559

Figure 59: Simulation report of channel utilization

This above picture is all about the data which was generated after the simulation was done this picture says about how much percent utility channel is being used in 1minutes in the channel utilization.

3. Simulation of frame delay by VC

Compuware COMNET III Release 2.5.2.814 Sun Dec 20 21:11:18 2020 PAGE 20

19031269-Anshul-Agarwal

WAN CLOUDS: FRAME DELAY BY VC

REPLICATION 1 FROM 0.0 TO 60.0 SECONDS

CLOUD: VC	FRAME DELAY (MS) AVG	STD	MAX	BURST SIZE (kb) AVG	MAX
WAN Cloud					
Itahari-Edinburgh	1164	697	2518	158	320
Edinburgh-Itahari	17	0	17	111	243
Edinburgh-butwal	17	0	22	111	251
Butwal-Edinburgh	1168	701	2522	159	320

Figure 60: Screenshot of the frame delay by VC

This above picture is all about the data which was generated after the simulation was done this picture says about frame delay vs. virtual circuit we only see the frame delay average from the table.

4. Simulation of frame count by VC

Compuware COMNET III Release 2.5.2.814 Sun Dec 20 21:11:18 2020 PAGE 21

19031269-Anshul-Agarwal

WAN CLOUDS: FRAME COUNTS BY VC

REPLICATION 1 FROM 0.0 TO 60.0 SECONDS

CLOUD: VC: FRAMES / KILOBITS	ACCEPTED NORMAL	ACCEPTED DE	DROPPED NORMAL	DROPPED DE
WAN Cloud	(TOTAL KILOBITS TRANSMITTED =	5265)		
Itahari-Edinburg Frm	1616	1570	0	9459
kb	803	810	0	4656
Edinburgh-Itahar Frm	2304	882	0	0
kb	737	282	0	0
Edinburgh-butwal Frm	2303	880	0	0
kb	737	282	0	0
Butwal-Edinburgh Frm	1600	1582	0	9569
kb	804	808	0	4692

Figure 61: Screenshot of the frame delay by VC

This above picture is all about the data which was generated after the simulation was done this picture says about frame count vs. virtual circuit we only see the frame accepted normal from the table.

5. Simulation of WAN CLOUD: Access link states

Compuware COMNET III Release 2.5.2.814 Sun Dec 20 21:11:18 2020 PAGE 22

19031269-Anshul-Agarwal

WAN CLOUDS: ACCESS LINK STATS

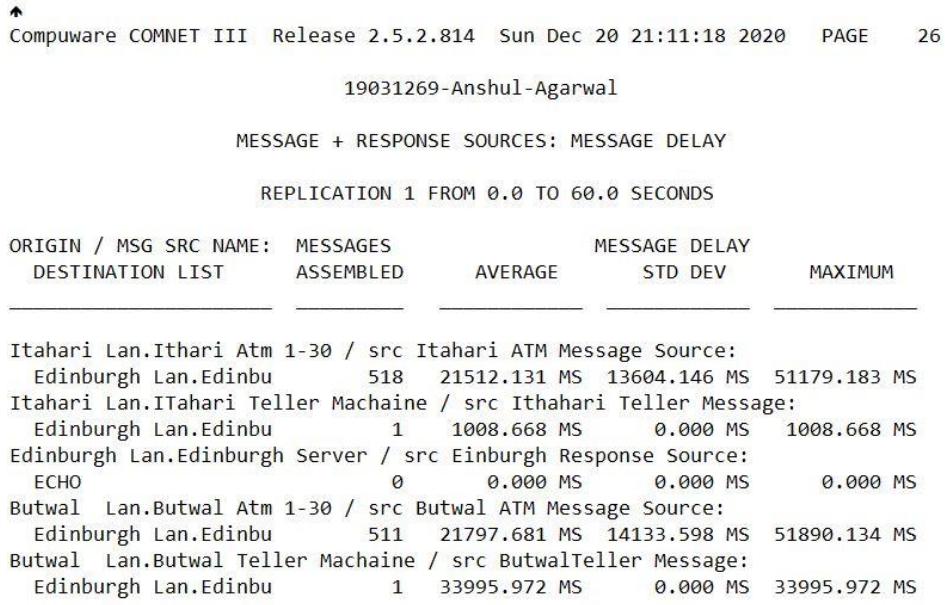
REPLICATION 1 FROM 0.0 TO 60.0 SECONDS

CLOUD: ACCESS LINK	(ENTRY) (EXIT)	FRAMES ACCEPTED	FRAMES DROPPED	BUFFER (BYTES) MAX	BUFFER (BYTES) AVG	BUFFER (BYTES) STD	% UTIL
WAN Cloud							
Itahari Access	Entry	3186	9459	N/A	N/A	N/A	97.44
	Exit	3186	0	80	7	15	17.26
Edinburgh Access	Entry	6369	0	N/A	N/A	N/A	34.50
	Exit	6368	0	33930	7808	10305	49.97
Butwal Access	Entry	3182	9569	N/A	N/A	N/A	98.03
	Exit	3183	0	123	7	15	17.25

Figure 62: Screenshot of the Access Link Stats

This above picture is all about the data which was generated after the simulation was done this picture says about WAN Cloud Access link in this we have to only see the percentage utility of wan cloud entry and exit.

6. Simulation of message + response source= message delay



```
Compuware COMNET III  Release 2.5.2.814  Sun Dec 20 21:11:18 2020   PAGE    26

                          19031269-Anshul-Agarwal

                MESSAGE + RESPONSE SOURCES: MESSAGE DELAY

                  REPLICATION 1 FROM 0.0 TO 60.0 SECONDS

ORIGIN / MSG SRC NAME:  MESSAGES                MESSAGE DELAY
  DESTINATION LIST      ASSEMBLED      AVERAGE       STD DEV       MAXIMUM
_____________________   _________   ____________  ____________  ____________

Itahari Lan.Ithari Atm 1-30 / src Itahari ATM Message Source:
  Edinburgh Lan.Edinbu        518   21512.131 MS  13604.146 MS  51179.183 MS
Itahari Lan.ITahari Teller Machaine / src Ithahari Teller Message:
  Edinburgh Lan.Edinbu          1    1008.668 MS      0.000 MS   1008.668 MS
Edinburgh Lan.Edinburgh Server / src Einburgh Response Source:
  ECHO                          0       0.000 MS      0.000 MS      0.000 MS
Butwal  Lan.Butwal Atm 1-30 / src Butwal ATM Message Source:
  Edinburgh Lan.Edinbu        511   21797.681 MS  14133.598 MS  51890.134 MS
Butwal  Lan.Butwal Teller Machaine / src ButwalTeller Message:
  Edinburgh Lan.Edinbu          1   33995.972 MS      0.000 MS  33995.972 MS
```

Figure 63: Screenshot of the message + response source: message delay

This above picture is all about the data which was generated after the simulation was done this picture says message + response source: message delay in this above data we have to just see the message delay average.

APPENDIX- B ADDITIONAL OF TASK B

Bluetooth

Bluetooth is an open standard which was published by an industry based association called Bluetooth Special Interest Group (SIG). Bluetooth helps to join the multiple devices at once. Bluetooth does not too much high range. In today world the Bluetooth is a built-in function of the all the devices. (Halsall, 2005)

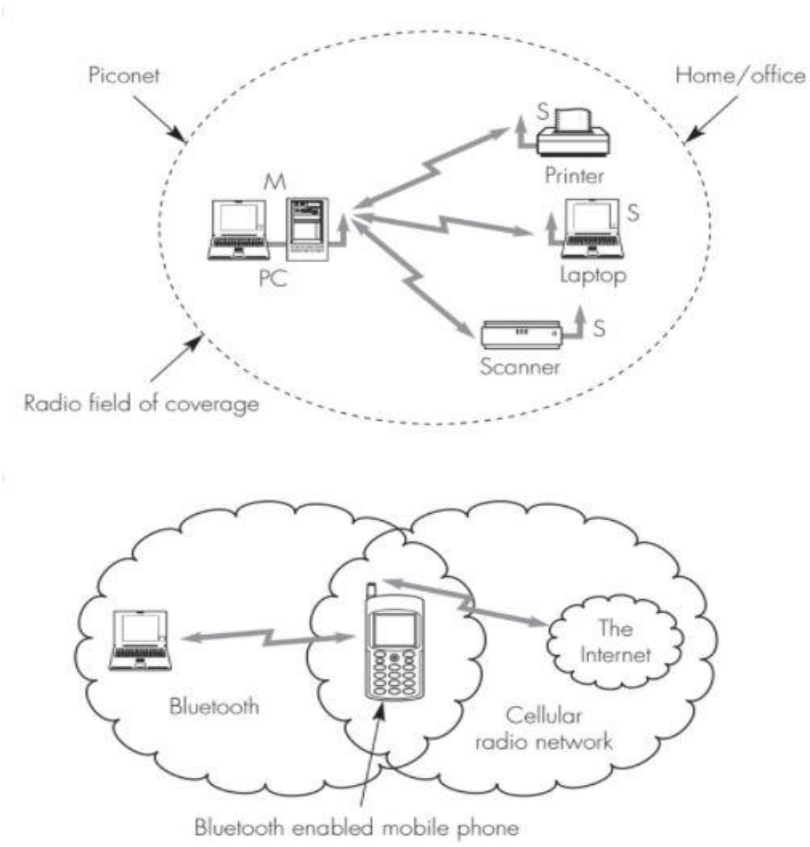


Figure 64: Bluetooth

(Khartit, 2020)

NFC

NFC stands for Near Field Communication (NFC). NFC works only in the short distance. NFC helps us to transfer information between devices quickly with the single touch for example: while paying bills with the help of the visa card with contains NFC chip, exchanging information between two devices for example NFC

speaker can be directly connected to the mobile with the single touch. Now days the Bluetooth is being diapered and NFC is used for now days because the NFC helps to connect device easily with the single touch only. In 2004 Nokia (NYSE:NOK), Philips (NYSE:PHG), and Sony (NYSE:SNE) came together to form NFC Fourm a non-profit organization. Nokia was the first one two release the first NFC phone in 2007. In 2010 telecommunication sector to launched 100 NFC pilot projects. In 2017 New York City use NFC card to pay subways fare. The first airplane to allow carrying NFC phone was Japan Airlines (OTCMKTS: JAPSY) to pass the boarding gate just like the paper for example: while boarding of 450 person at plane using the NFC card helped to board in just 15 minutes rather than taken 40 minutes to board without using NFC card. (Khartit, 2020)

802.11 ah

802.11 ah are also known as WI-FI HaLow. 802.11 ah aim is to extended the Wi-Fi range up to 347 Mbps remember that lower frequency is 2.4 GHz and longer range is 5GHz. 802.11 ah was approved in September 2016 and published in May 2017.

802.11ad

802.11ad was approved in December 2012. It can deliver up to 6.7 Gbps of data over the 60 GHz frequency. 802.11ad has the range of 3.3 meter (only 11 feet) from the access point.

802.11ac (Wi-Fi 5)

In some of the home there has been use of the 802.11ac which operates in 5GHz frequency space. There are multiple antennas (Multiple Input, Multiple Output) one for sending or receiving device to reduce speed which only support standard rate up to 3.46Gbps. Some of the older devices only use 802.11b/g/n and radio wave.

802.11g

802.11g was approved in June 2003. 802.11 g is the successor to 802.11b which is able to reach the speed up to 54 Mbps in the bandwidth of 2.4 GHz.

802.11n (Wi-Fi 4)

802.11n was the first to achieve the Multiple Input and Multiple Output. 802.11n was approved in October 2009. The routers use two bandwidth frequencies of 2.4GHz and 5GHz which can give the speed of 600Mbps.

802.11a

802.11 a uses the frequency of 5Ghz that data rates is up to 54Mbps.802.11 a came later than the 802.11b. 802.11a adopted and specified in June 1997.

802.11b

The first home router was 8021.11b which was developed in September 1999. The frequency rate is of 2.4GHz and the data rate is up to 11 Mbps.

802.11-1997

80211-1997 was the first standard providing rate up to 2Mbps in the 2.4GHz frequency. The distance it can covered is up to 66 feet of indoors and 330 feet outdoors. This type of the router is only used in a single room.

There are many Wi-Fi standards which have been left pending like 802.11aj, 802.11ak, 802.11ax (Wi-Fi 6), 802.11ay 802.11az, 802.11ba and many more. (Shaw, 2020)

Many kind of the wireless router has been developed that now days that the router size has been reduced and can be kept pockets to use this type of this router they just they have to keep the sim-card inside that router and charge the router batter and carry anywhere they want. Now days we can people using the mobile hotspot to share the internet with other which helped the people do to their work where they cannot find the Wi-Fi just they have to open the mobile hotspot and connect to the laptop by searching the mobile hotspot name in the Wi-Fi gallery.

APPENDIX-C GLOSSARY (DIFFICUIT WORDS IN CW ASK B MEANING)

1. Accessibility: Entered
2. Efficiency: Organization
3. Cellular: Relating to or contesting of living cell
4. Augmented: Having been made greater in size or value.
5. Collision: Crash
6. Render: Provide
7. Cascade: To pass information frequently
8. Integrated : With various parts or aspects linked
9. Demonstration: An act of showing that something exits
10. Myriad: Countless
11. Alignment: Arrangement in straight line
12. Frail: Gap
13. Evasion: Default
14. Breach: Gap
15. Sluggish: Lazy
16. Constituent: Element
17. Retort: Response
18. Amalgamation: Combination
19. Postulates: Specifies
20. Unsanctioned: Unauthorized
21. Imperative: Important
22. Eminent: Famous