Network Analyzer and Report Generation Tool for NS-2 using TCL Script

Mr. Farendrakumar S. Ghodichor[1], Mrs. Bhagyashree Madan[2]

[1]M.Tech. Student, Department of CSE
Wainganga College of Engineering and Management Nagpur M.S. India
[2]Assistant Professor, Department of CSE
Wainganga College of Engineering and Management Nagpur M.S. India

***

Abstract – *Network Simulation tool is a solution for our complex network scenario generation. TCL (Tool Command Language) scripts are mostly used in the NS-2 simulation tool. The network simulation uses to create TCL scripts for setting up of wired or wireless network scenarios in the framework of NSG2.1 and then run these TCL scripts with the help of Network Simulation-2 tool for getting the network simulation results. The paper is focusing on the TCL script generator, its development, save TCL script and run by using NS-2 and I introduce some unique features of "TCL Script Generator" with performance issues like throughput, delay & jitter and discuss various features of its compared with NSG-2 (NS-2 Scenarios Generator2).*

Key Words: TCL scripts; Network Simulator-2 (NS-2); NSG-2; Throughput; Delay; Jitter.

1. INTRODUCTION

The Network Simulation give the result of network design, but it brings a lot of queries from about network standards and various producers of material which have an efficiency of future network design model. Many Designers use some special software to get the solution of a problem or queries of the network, but communication network simulation is the most powerful available and fruitful way to develop productivity of a network in the field of network design. Now many of simulation software are available in the market. All type of simulators has a same set of skills with few of the modifications in the application language for the user interface, user design, user function, etc.

Network simulation is the best method of evaluation in the field of communication networks. This is mostly useful for the improvement of new communication design building and design of network protocols. Network simulator that is NS-2 is the most used open source discrete-event simulator, which is most useful, extensible and efficiently design handling network simulation design tool for communication network research area and informative use. Use of NS-2 we can execute or implement our new network protocols with the help of design of network scenarios and compare their performance with TCP. This kind of powerful simulation tool allows the user to test their ideas of communication network before it implements in the real-world experiments.

Out of these entire network design architecture input of network design for NS-2 simulation tool, generate TCL scripts with giving more consideration to researchers. Network Simulator-2 is an open source discrete-event simulator which mostly used by all the technical research community for network research area. NS-2 was established at California University at Berkeley [1]. NS-2 can most likely support to both wired as well as wireless networks scenarios and simulate various network design protocols such as Transmission Control Protocol (TCP), User Datagram Protocol (UDP), multicast routing, etc.

The aim of this Network Analysis project is to develop GUI that is Graphical User Interface as like NSG2.1 for reducing time to design model and user is generate TCL script file in a very stretchy style which can run in NS-2. The building of network model and its use is going to develop an effective task in the form network design. This is very cost effective in the market because it's an open source for its efficiency. Networks are the essential aspect of all kind of informative schemes of the business. So the requirements of network performance comparatively are a very growing field in the market for the communication network. The cost of the communication network building, extension of network and support to them are growing too.

Some Features of this application: [1]

- Providing GUI for Generating TCL Script
- Converting model of network scenarios from graphical notation into TCL Script file
- Run that TCL script in NS-2.

2. SIMULATION MODEL

Our network scenario evaluations are based on the simulation using NS-2. NS-2 is a discrete event simulator that simulates a variety of IP networks topologies. But firstly simulation used in the existing systems using NSG2. With the help of this simulation is done in the proposed system result also with analyzing the performance of the network.

A. Simulation Environment

Simulation environment consists of wired or wireless nodes forming an ad-hoc network. Simulation is one of the important technologies in advanced era. The liveliness in computer can model speculative and real-activity objects in a computer as a result that it can be studied. The network is simulated on the computer. A network simulator is a technique of implementing the network as regards the computer. In this section, we have described about the performance metrics and implementation details of network topologies.

a. Performance Metrics

The performance of any system needs to be evaluated on certain criteria, these criteria then decide the basis of performance of any system. Such parameters are known as performance metrics. The following performance metrics are considered for evaluation of network topologies:
1) Throughput: It is the amount of traffic that a network can carry.
2) Delay: It is defined as how longer time it takes to deliver packet to the destination. The Delay should be as low as possible.
3) *Jitter:* It is defined as the variation in delay for the packets belonging to the same flow.

b. Simulation Steps

Write a TCL (Tool Command Language) script and simulate script with NS2 [3] to analyze the given problem. To use NS2, a user programs in the OTcl (Object Tool Command language) script language. An OTcl script will do the following.

- Initiates an event scheduler.
- Sets up the network topology using the network objects.
- Tells traffic sources when to start/stop transmitting packets through the event scheduler.

Depending on the user's purpose for an OTcl simulation script, simulation results are stored as trace files, which can be loaded for analysis by an external application:
1) A NAM trace file (file.nam) for use with the Network Animator Tool.
2) A Trace file (file.tr) for use with XGraph [4] or TraceGraph [5].

c. Implementation

The main simulation and network configuration inNS2 takes place in the TCL script. After describing the network to NS2 using the TCL script is run and the output files are analyzed for results. There are two main output files, a trace file with all the events such as send, receive, packet drop, etc. and a NAM file which can then be used by the network animator to view the simulation in graphical mode. In our experiment we analyzed the trace file using acknowledgement and calculated the needed network parameters such as throughput.

B. NS2 Generic Script Structure

1. Create Simulator object
2. [Turn on tracing]
3. Create topology
4. [Setup packet loss, link dynamics]
5. Create routing agents
6. Create application and/or traffic sources
7. Post-processing procedures (i.e. NAM)
8. Start simulation

3. PROPOSED SYSTEM

In proposed system I have developed a new TCL script generator tool, named "ARGT for NS2", to get authority users to generate Tool Command Language (TCL) scripts file in a direct and flexible way and it has Graphical User Interface (GUI). This tool has a very user-friendly interface to make wired as well as wireless communication design network constraints. After the parameters or constraints are entered, the tool is repeatedly created TCL scripts file, which can be run in the NS-2 communication network atmosphere forgives the network simulation output in the form of simulation for the provided network scenarios which being studied [1].

My work is to continue to improve the functions (Report Generation and Trace Analyzer) of such a program. The program was designed using Java language (java swings) so that it is compatible in different operating systems because of platform independent. The Authors did not implement trace analyzer. After reviewing the author's document as well as an understanding of network communication fundamentals and trace analyzer, I have implemented network simulation report generation and trace analyzer design.

In my project, a user is able to an integrated framework for network simulation easily, and the TCL scripts report generation and analyzer tool for statistical analysis of the simulated data with the ARGT (Analyzer and Report Generation Tool) for theNS-2 program.

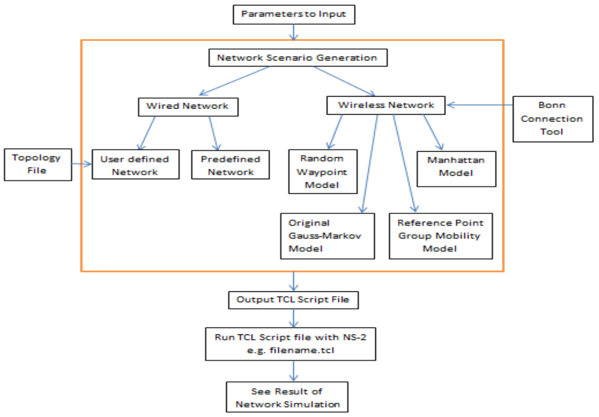


Figure1: Flow of events for a TCL file

4. SIMULATION RESULTS AND PERFORMANCE ANALYSIS

Environment development requirements are:

i. Personal computer with Fedora/RedHat operating system.
ii. NS-2 version 2.35
iii. C/C++ editor
iv. Gcc compiler

Network Simulation tool used to generate TCL scripts file to design wired as well as wireless scenarios of a communication network in a very efficient and flexible manner, and then execute these TCL scripts on the Network Simulator-2 for getting the result of network simulation.

TCL scripts file are generally used in NS-2 network simulation tool. In the existing system of NSG2 (Network Simulator Scenario Generator 2) possibility to draw the computer network topology according to the scenario and its TCL script is generating but it cannot save or run that network topology.

So my project problem statement is to develop a new tool for TCL script generator according to network scenario to run and save topology by using NS2.

NS-2 Scenarios Generator 2 (NSG2) is established by one of the great author Peng-Jung Wu at the University of National Sun Yat-Sen, Taiwan [1]. NSG2 provide supports to set up a wired and wireless network scenario by making network nodes and communication links using a drag and drop option facilities that are the GUI form of the tool.

Some of the network features provided in the NSG2 is given below:

- Simplex and duplex communication links used for the wired network; chain, random, and grid topologies; TCP as well as UDP agents are used.
- Provide supports of TCP Tahoe, TCP Vegas, TCP Reno and TCP New-Reno.
- Provide supports of Ad-hoc network routing protocols like AODV, DSDV, and DSR; File Transfer Protocol and Constant Bit Rate applications.

The disadvantages of the NSG2.1 are support very less number of network protocol, not good differentiate between topology available in wired network communication environment that is Star, Ring, Line, Bus, Mesh etc., not well discriminate between models also available in wireless network scenario, different steps for creating network scenarios do not provide a clear picture of model and never assist any kind of help for knowing the GUI system [1].

4.1 Requirement Analysis:

The Network Analysis framework has evolved throughout the development process with significant increments in the functionalities of the tool. At this application, there are four parts tasks. One was done by Peng-Jung Wu. Now I am going to be cover the work done by Peng-Jung Wu and do rest of another. Here is a list of network system functions which the program must include in my network application as follows.

Phase I: This phase consists of only a GUI designing for the development of graphical network scenarios and Report generator (TCL Script Generator). The users can create network simulation scenarios in the placement of current working area through drag and drop methods. The Report Generated TCL script can be saved to the disk for future reuse.

Phase II: This phase consists of Report generator (TCL Script Generator) with added functionalities of saving network simulation scenarios on the disk and reuse of saved scenarios. Also, the user can directly provide the generated TCL script as an input to the NS2 for simulation purpose.

Phase III: This phase consists of integrated Analyzer (Statistical Trace Analyzer) which can evaluate network performance parameters such as throughput, jitter, end-to-end packet delay, packet loss and customized parameters designed by users.

Phase IV: This phase consists of multiple files handling for the single graphical output of analysis developed by users.

4.2 Simulation Result:

In the results of my project I show you how the program working and look like, and I also give some personal opinion about it. In this chapter I try to explain how each part of this program works.

The ARGT tool for NS2 provides GUI grid view where user can placed number of nodes and creates the different scenarios. ARGT provided standard tool bar on the GUI by which we can add nodes, connect number of nodes using links (simplex/duplex), and define the protocols which is be used for communication by adding agents and finally add applications which is carry out the actual communications between the nodes.

The ARGT tool provides the features of customizable protocols as well as customizable agents.

The customizable protocols and agents will work only when the proper configuration of network simulator 2 by checking it dependencies of files while recompiling installation process.

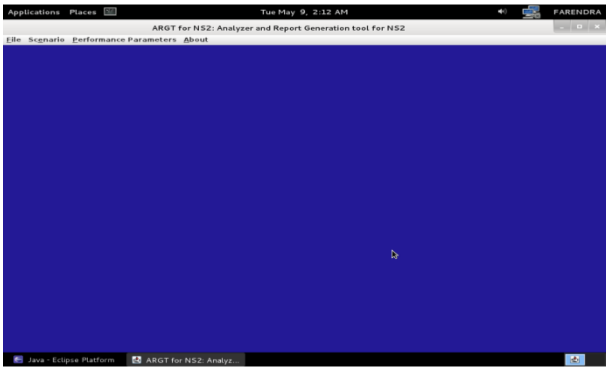

Applications Places
Tue May 9, 2:12 AM
FARENDRA
ARGT for NS2: Analyzer and Report Generation tool for NS2
File Scenario Performance Parameters About
Java - Eclipse Platform
ARGT for NS2: Analyz...

Figure 4.2.1 Main Window

Above figure 4.2.1 shows the main window of ARGT. In the Title it has a name of program. Below there is a menu which has following items. File (Open and Exit), scenario (Wired and Wireless), Performance parameters (Open and Multiple files), and about. While selecting scenario either wired or wireless the window will appear with the grid by the difference of link tab as shown below.

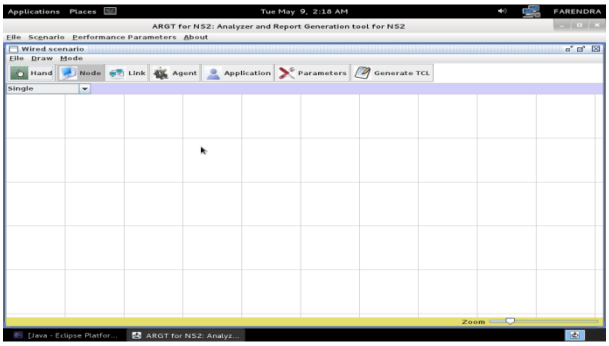
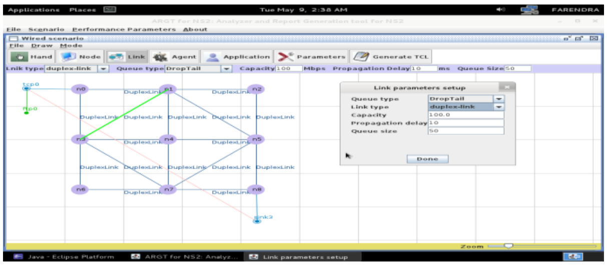


Figure 4.2.2 Main Window with scenario grid

The user can add many numbers of nodes while creating a scenario. Considering wired scenario, the nodes can be connected using links; simplex or duplex. Various protocols have been included such as TCP/Sink, TCP/Newreno, UDP, etc. and applications like FTP (File Transfer Protocol) application, CBR (Constant Bit Rate) application have been included. We should first define an agent and then the application that uses it.

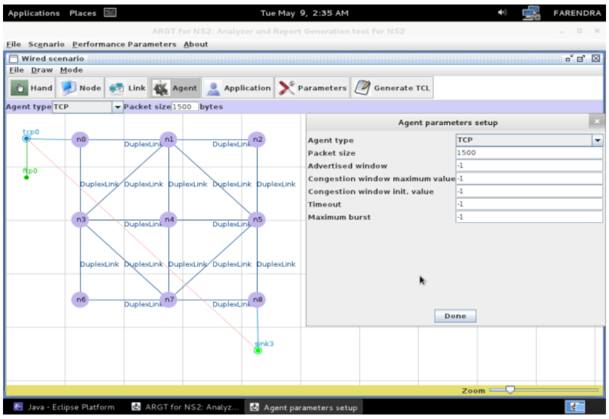
We can then set other parameters such as packet size, rate of flow of packets, etc. Also we can define simulation parameters such as simulation time, trace file and NAM file name.


Lnik type duplex-link Queue type DropTail Capacity 100 Mbps Propagation Delay 10 ms Queue Size 50

Link parameters setup

Queue type DropTail
Link type duplex-link
Capacity 100.0
Propagation delay 10
Queue size 50

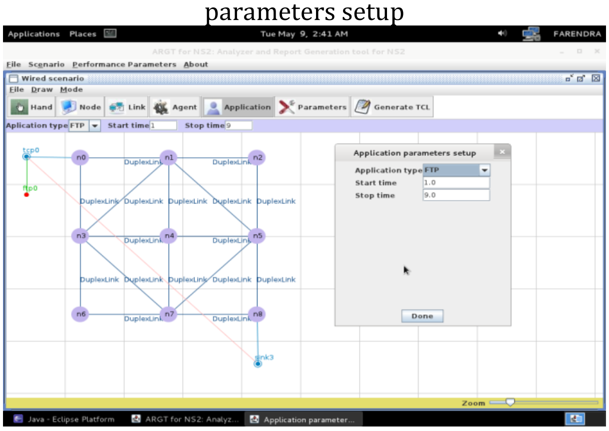
Figure 4.2.3Wired scenario with defining Link parameters


Agent type TCP Packet size 1500 bytes

Agent parameters setup

Agent type TCP
Packet size 1500
Advertised window -1
Congestion window maximum value -1
Congestion window init. value -1
Timeout -1
Maximum burst -1

Figure 4.2.4 Wired scenario with defining Agent parameters setup


Aplication type FTP Start time 1 Stop time 9

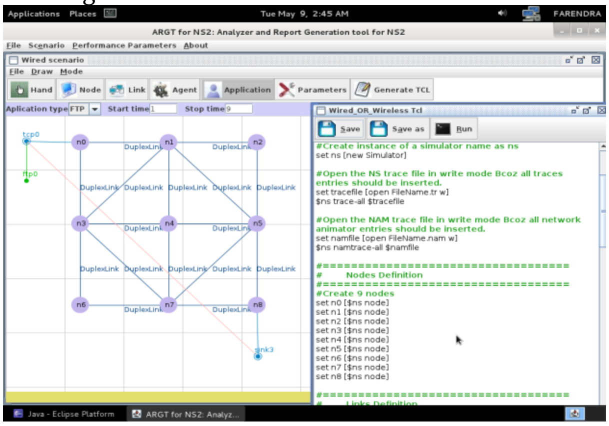
Application parameters setup

Application type FTP
Start time 1.0
Stop time 9.0

Figure 4.2.5Wired scenario with defining Application parameters setup

This project is started by creating node, agent and application with different parameters setup as shown above figures.

Finally user whenever presses the Generate TCL tab, the report has been generated in another window as shown in the nest figure.

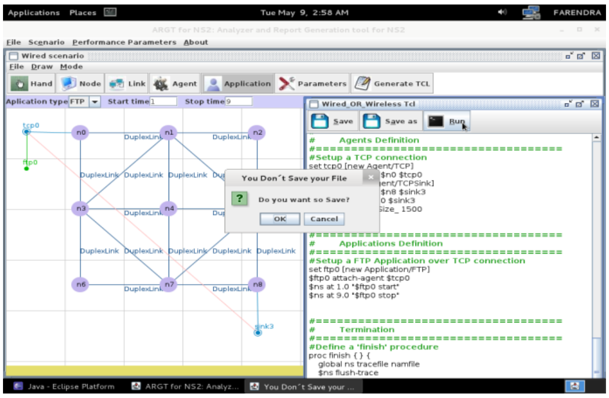

Aplication type FTP Start time 1 Stop time 9

Wired_OR_Wireless Tcl

```
#Create instance of a simulator name as ns
set ns [new Simulator]

#Open the NS trace file in write mode Bcoz all traces entries should be inserted.
set tracefile [open FileName.tr w]
$ns trace-all $tracefile

#Open the NAM trace file in write mode Bcoz all network animator entries should be inserted.
set namfile [open FileName.nam w]
$ns namtrace-all $namfile

#=====================================
#       Nodes Definition
#=====================================
#Create 9 nodes
set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]
set n6 [$ns node]
set n7 [$ns node]
set n8 [$ns node]

#=====================================
#       Links Definition
```

Figure 4.2.6 Generate TCL script report for Wired scenario

After the complete scenario has been created, we can now generate the report for TCL script with the help of generate TCL button. A Generate TCL button is provided on the GUI standard tool bar. It is provide the skeleton of the TCL script which is required for network simulator 2. To this skeleton we have to add our own logic, without which the TCL code is incomplete. Once we have appended our logic within the TCL skeleton code, we can now run it with NS2. Report Generated (TCL Script) with skeleton as shown in figure 4.2.4. We have directly integrated with NS2; thus we can run the code directly by just a click of a Generate TCL button from the toolbar. When we run the code in NS2, two files are generated; name as FIleName.tr for trace file and FileName.nam for NAM file.


Applications Places
Tue May 9, 2:58 AM
FARENDRA
ARGT for NS2: Analyzer and Report Generation tool for NS2
File Scenario Performance Parameters About
Wired scenario
File Draw Mode
Hand Node Link Agent Application Parameters Generate TCL
Aplication type FTP Start time 1 Stop time 9
tcp0 ftp0 n0 n1 n2 n3 n4 n6 n7 n8 sink3
DuplexLink
Wired_OR_Wireless Tcl
Save Save as Run
Java - Eclipse Platform ARGT for NS2: Analyz... You Don´t Save your ...

```
#       Agents Definition
#===================================
#Setup a TCP connection
set tcp0 [new Agent/TCP]
                 $n0 $tcp0
                 ent/TCPSink]
                 $n8 $sink3
                 0 $sink3
                 ize_ 1500

#===================================
#       Applications Definition
#===================================
#Setup a FTP Application over TCP connection
set ftp0 [new Application/FTP]
$ftp0 attach-agent $tcp0
$ns at 1.0 "$ftp0 start"
$ns at 9.0 "$ftp0 stop"


#===================================
#       Termination
#===================================
#Define a 'finish' procedure
proc finish { } {
   global ns tracefile namfile
   $ns flush-trace
```

You Don´t Save your File
Do you want so Save?
OK Cancel

Figure 4.2.7 Generate TCL script report and run it with NS2

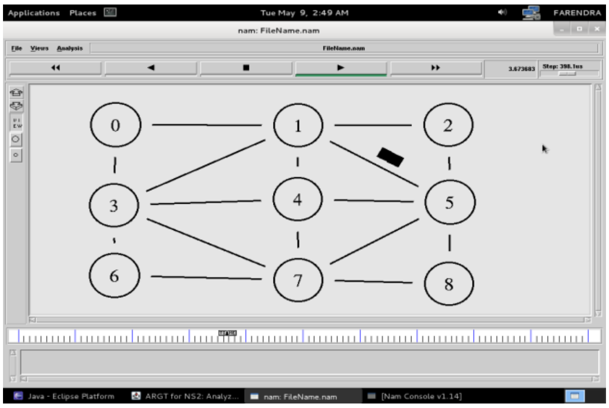
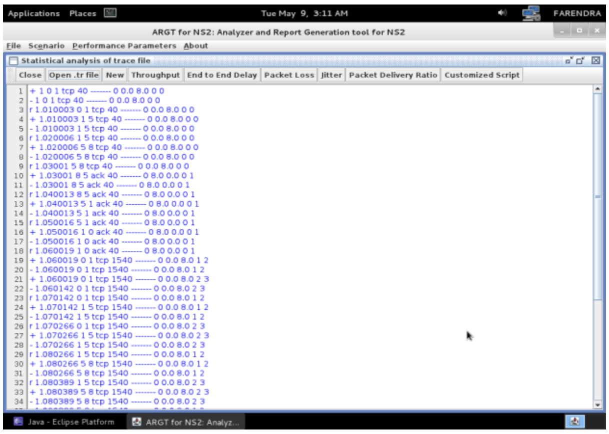


Figure 4.2.8 NAM for TCL script report generated code simulated in NS2

Above figure shows animation of generated tcl while click on run tab.

4.3 Statistical Analysis

As we have seen earlier, trace file is generated after we run the TCL script in NS2. This TCL script contains raw data. This raw data is used for carrying out the statistical analysis of the network topology. The GUI provides file opening facility by which we have to select the trace file of which we want to perform analysis. Further the GUI provides the list of the different parameters of which we can carry out analysis. By just a click of button we can get the analysis results. Also we can specify the parameters for which we want to perform the analysis.

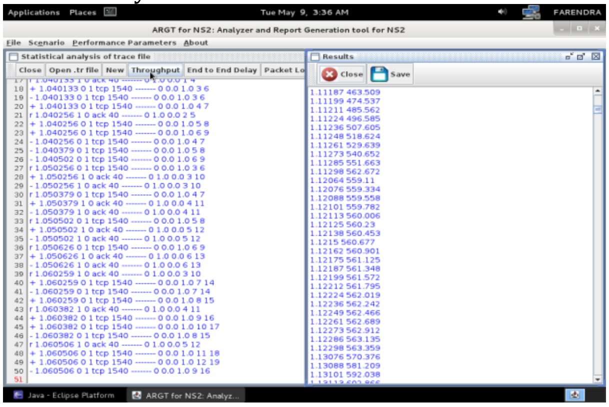

Applications Places
Tue May 9, 3:11 AM
FARENDRA
ARGT for NS2: Analyzer and Report Generation tool for NS2
File Scenario Performance Parameters About
Statistical analysis of trace file
Close Open .tr file New Throughput End to End Delay Packet Loss Jitter Packet Delivery Ratio Customized Script
Java - Eclipse Platform ARGT for NS2: Analyz...

```
+ 1 0 1 tcp 40 ------- 0 0.0 8.0 0 0
- 1 0 1 tcp 40 ------- 0 0.0 8.0 0 0
r 1.010003 0 1 tcp 40 ------- 0 0.0 8.0 0 0
+ 1.010003 1 5 tcp 40 ------- 0 0.0 8.0 0 0
- 1.010003 1 5 tcp 40 ------- 0 0.0 8.0 0 0
r 1.020006 1 5 tcp 40 ------- 0 0.0 8.0 0 0
+ 1.020006 5 8 tcp 40 ------- 0 0.0 8.0 0 0
- 1.020006 5 8 tcp 40 ------- 0 0.0 8.0 0 0
r 1.03001 5 8 tcp 40 ------- 0 0.0 8.0 0 0
+ 1.03001 8 5 ack 40 ------- 0 8.0 0.0 0 1
- 1.03001 8 5 ack 40 ------- 0 8.0 0.0 0 1
r 1.040013 8 5 ack 40 ------- 0 8.0 0.0 0 1
+ 1.040013 5 1 ack 40 ------- 0 8.0 0.0 0 1
- 1.040013 5 1 ack 40 ------- 0 8.0 0.0 0 1
r 1.050016 5 1 ack 40 ------- 0 8.0 0.0 0 1
+ 1.050016 1 0 ack 40 ------- 0 8.0 0.0 0 1
- 1.050016 1 0 ack 40 ------- 0 8.0 0.0 0 1
r 1.060019 1 0 ack 40 ------- 0 8.0 0.0 0 1
+ 1.060019 0 1 tcp 1540 ------- 0 0.0 8.0 1 2
- 1.060019 0 1 tcp 1540 ------- 0 0.0 8.0 1 2
+ 1.060019 0 1 tcp 1540 ------- 0 0.0 8.0 2 3
- 1.060142 0 1 tcp 1540 ------- 0 0.0 8.0 2 3
r 1.070142 0 1 tcp 1540 ------- 0 0.0 8.0 1 2
+ 1.070142 1 5 tcp 1540 ------- 0 0.0 8.0 1 2
- 1.070142 1 5 tcp 1540 ------- 0 0.0 8.0 1 2
r 1.070266 0 1 tcp 1540 ------- 0 0.0 8.0 2 3
+ 1.070266 1 5 tcp 1540 ------- 0 0.0 8.0 2 3
- 1.070266 1 5 tcp 1540 ------- 0 0.0 8.0 2 3
r 1.080266 1 5 tcp 1540 ------- 0 0.0 8.0 1 2
+ 1.080266 5 8 tcp 1540 ------- 0 0.0 8.0 1 2
- 1.080266 5 8 tcp 1540 ------- 0 0.0 8.0 1 2
r 1.080389 1 5 tcp 1540 ------- 0 0.0 8.0 2 3
+ 1.080389 5 8 tcp 1540 ------- 0 0.0 8.0 2 3
- 1.080389 5 8 tcp 1540 ------- 0 0.0 8.0 2 3
```

Figure 4.3.1 List of performance parameters

Above figure 4.3.1 shows the list of performance metrics parameters panel. In the tool bar of statistical analysis of trace file having number of tab buttons. To open the trace file for analysis purpose, I have click on "open.tr file" tab and trace file information has displayed.

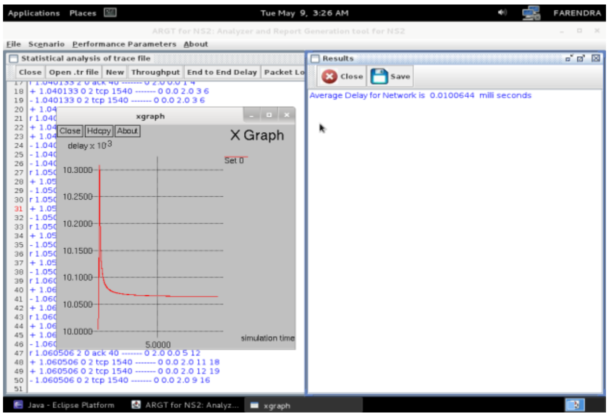
We get the results for the performance parameters by choosing performance parameters tab. The results may be in the form of graph (throughput) or simple numeric results (packet loss). The general flow of steps for carrying out statistical analysis is show below.


Applications Places
Tue May 9, 3:36 AM
FARENDRA
ARGT for NS2: Analyzer and Report Generation tool for NS2
File Scenario Performance Parameters About
Statistical analysis of trace file
Close Open .tr file New Throughput End to End Delay Packet Lo
Results
Close Save
Java - Eclipse Platform ARGT for NS2: Analyz...

```
+ 1.040133 0 1 tcp 1540 ------- 0 0.0 1.0 3 6
- 1.040133 0 1 tcp 1540 ------- 0 0.0 1.0 3 6
+ 1.040133 0 1 tcp 1540 ------- 0 0.0 1.0 4 7
r 1.040256 1 0 ack 40 ------- 0 1.0 0.0 2 5
+ 1.040256 0 1 tcp 1540 ------- 0 0.0 1.0 5 8
+ 1.040256 0 1 tcp 1540 ------- 0 0.0 1.0 6 9
- 1.040256 0 1 tcp 1540 ------- 0 0.0 1.0 4 7
- 1.040379 0 1 tcp 1540 ------- 0 0.0 1.0 5 8
- 1.040502 0 1 tcp 1540 ------- 0 0.0 1.0 6 9
r 1.050256 0 1 tcp 1540 ------- 0 0.0 1.0 3 6
+ 1.050256 1 0 ack 40 ------- 0 1.0 0.0 3 10
- 1.050256 1 0 ack 40 ------- 0 1.0 0.0 3 10
r 1.050379 0 1 tcp 1540 ------- 0 0.0 1.0 4 7
+ 1.050379 1 0 ack 40 ------- 0 1.0 0.0 4 11
- 1.050379 1 0 ack 40 ------- 0 1.0 0.0 4 11
r 1.050502 0 1 tcp 1540 ------- 0 0.0 1.0 5 8
+ 1.050502 1 0 ack 40 ------- 0 1.0 0.0 5 12
- 1.050502 1 0 ack 40 ------- 0 1.0 0.0 5 12
r 1.050626 0 1 tcp 1540 ------- 0 0.0 1.0 6 9
+ 1.050626 1 0 ack 40 ------- 0 1.0 0.0 6 13
- 1.050626 1 0 ack 40 ------- 0 1.0 0.0 6 13
r 1.060259 1 0 ack 40 ------- 0 1.0 0.0 3 10
+ 1.060259 0 1 tcp 1540 ------- 0 0.0 1.0 7 14
- 1.060259 0 1 tcp 1540 ------- 0 0.0 1.0 7 14
+ 1.060259 0 1 tcp 1540 ------- 0 0.0 1.0 8 15
r 1.060382 1 0 ack 40 ------- 0 1.0 0.0 4 11
+ 1.060382 0 1 tcp 1540 ------- 0 0.0 1.0 9 16
+ 1.060382 0 1 tcp 1540 ------- 0 0.0 1.0 10 17
- 1.060382 0 1 tcp 1540 ------- 0 0.0 1.0 8 15
r 1.060506 1 0 ack 40 ------- 0 1.0 0.0 5 12
+ 1.060506 0 1 tcp 1540 ------- 0 0.0 1.0 11 18
+ 1.060506 0 1 tcp 1540 ------- 0 0.0 1.0 12 19
- 1.060506 0 1 tcp 1540 ------- 0 0.0 1.0 9 16
```

```
1.11187 463.509
1.11199 474.537
1.11211 485.562
1.11224 496.585
1.11236 507.605
1.11248 518.624
1.11261 529.639
1.11273 540.652
1.11285 551.663
1.11298 562.672
1.12064 559.11
1.12076 559.334
1.12088 559.558
1.12101 559.782
1.12113 560.006
1.12125 560.23
1.12138 560.453
1.1215 560.677
1.12162 560.901
1.12175 561.125
1.12187 561.348
1.12199 561.572
1.12212 561.795
1.12224 562.019
1.12236 562.242
1.12249 562.466
1.12261 562.689
1.12273 562.912
1.12286 563.135
1.12298 563.359
1.13076 570.376
1.13088 581.209
1.13101 592.038
```

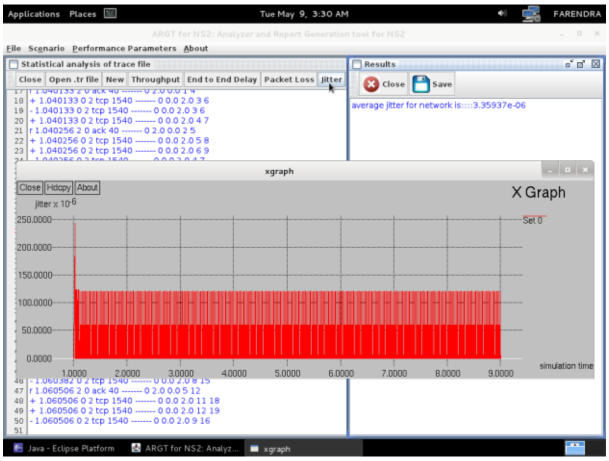
Figure 4.3.2 Statistical analysis with XGraph performance metrics "throughput"


Applications Places
Tue May 9, 3:26 AM
FARENDRA
ARGT for NS2: Analyzer and Report Generation tool for NS2
File Scenario Performance Parameters About
Statistical analysis of trace file
Close Open .tr file New Throughput End to End Delay Packet Lo
Results
Close Save
xgraph
Close Hdcpy About
X Graph
delay x 10^3
Set 0
10.3000
10.2500
10.2000
10.1500
10.1000
10.0500
10.0000
5.0000
simulation time
Java - Eclipse Platform ARGT for NS2: Analyz... xgraph

```
+ 1.040133 0 2 tcp 1540 ------- 0 0.0 2.0 3 6
- 1.040133 0 2 tcp 1540 ------- 0 0.0 2.0 3 6
r 1.060506 2 0 ack 40 ------- 0 2.0 0.0 5 12
+ 1.060506 0 2 tcp 1540 ------- 0 0.0 2.0 11 18
+ 1.060506 0 2 tcp 1540 ------- 0 0.0 2.0 12 19
- 1.060506 0 2 tcp 1540 ------- 0 0.0 2.0 9 16
```

Average Delay for Network is 0.0100644 milli seconds

Figure 4.3.3 Statistical analysis with XGraph performance metrics "Delay"



```
+ 1.040133 0 2 tcp 1540 ------- 0 0.0 2.0 3 6
- 1.040133 0 2 tcp 1540 ------- 0 0.0 2.0 3 6
+ 1.040133 0 2 tcp 1540 ------- 0 0.0 2.0 4 7
r 1.040256 2 0 ack 40 ------- 0 2.0 0.0 2 5
+ 1.040256 0 2 tcp 1540 ------- 0 0.0 2.0 5 8
+ 1.040256 0 2 tcp 1540 ------- 0 0.0 2.0 6 9
```

```
- 1.060382 0 2 tcp 1540 ------- 0 0.0 2.0 8 15
r 1.060506 2 0 ack 40 ------- 0 2.0 0.0 5 12
+ 1.060506 0 2 tcp 1540 ------- 0 0.0 2.0 11 18
+ 1.060506 0 2 tcp 1540 ------- 0 0.0 2.0 12 19
- 1.060506 0 2 tcp 1540 ------- 0 0.0 2.0 9 16
```

```
average jitter for network is::::3.35937e-06
```

Figure 4.3.4 Statistical analysis with XGraph performance metrics "Jitter"

5. CONCLUSION

In this system, mainly the TCL script file generator, its growth towards network design scenario and I am presenting the precise characteristics of "Network simulation analysis with TCL Script file Generator" and work with its very standard features compared with NS-2 Scenarios Generator2 (NSG-2).

And hence, I am presenting my project structure as "Network Analysis using NS-2 and NSG-2.1" which is slightly same as earlier NSG-2.1,but some other extra features are going to provide together with realistic Graphical User Interface (GUI). The system of Simulation is given help to the user without programming who is working on the project; it provides a user-friendly output of simulation representation, analysis of simulation result, and it gets avoiding common drawbacks.

The system can be next extended for various multiple simulation applications as given below:

- Provide support to satellite project simulation
- Simulation error model
- Intelligent system for vehicle tracking

  And much more same kind of simulation applications hence, this system may show to be very helpful in the future of applications.

REFERENCES

[1] Gouse, Sheikh, and RhitulKumbhar. "Network Simulation with TCL Script Generator for NS-2."International Journal of Emerging Trends in Science and Technology 1.06 (2014).

[2] Mohammad Reza Nouri rad, Reza Kourdy "Tools for Creating TCL script in Network Simulator 2 (NS-2)" – 2012.

[3] NeetuSikarwar"Performance Comparison Of Ad Hoc Network With Ns2 Simulator"-2015.

[4] Payal, J. S. K. "TCP traffic based performance investigations of DSDV, DSR and AODV routing protocols for manet using ns2." Int. J. Innov. Technol. Explor. Eng 3.2 (2013): 2278-3075.

[5] Mukeshkumar, Ganesh Kumar "To Analyze and Compare Ring and MeshTopologies with Varying Traffic Patterns" IJSHER,2347-4890, 289,Volume 1, Issue 2, Jan 2016.

[6] Naval KishorLodhi"Development and Validation of a NS-2 Protocol at Network Layer" IJARCSSE, ISSN: 2277 128X, Volume 5, Issue 6, June 2015.

[7] Nikita, Shikha Gupta "Analyzing the Congestion and Flow Controlin UDP Protocol Using NS2"IJCSMC,ISSN 2320-088X,Vol. 5, Issue. 5, May 2016.

[8] Pallavi S. Katkar, Dr. Vijay R. Ghorpade "Comparative Study of Network Simulator: NS2 and NS3" IJARCSSE, ISSN: 2277 128X, Volume 6, Issue 3, March 2016.

[9] NS official manual: Kevin Fall & Kannan Varadhan, 2008 <URL: http://www.isi.edu/nsnam/ns/doc/>

[10] NS by Example: Jae Chung & Mark Claypool, 2008

<URL: http://nile.wpi.edu/NS/>

[11] NS-2 for wireless: Wu Zhibin, 2007

<URL:http://www.winlab.rutgers.edu/~zhibinwu/html /network_simulator_2.html>

[12] Xgraph - http://www.isi.edu/nsnam/xgraph/