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A Comparative Study of Network Simulators

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Abstract: A network simulator is a tool that can simulate and analyze the behavior of computer networks.
They are widely used by the research community to test and evaluate the performance of networks in a virtual environment before deploying them in the real world. The simulators allow the users to test the network without the need to physical hardware or any real time connections. We have studied and compared the detail features of the Network Simulators including the Qualnet simulator which we have implemented in our college.
The focus of this paper is to compare the network simulators based on some parameters.

I. INTRODUCTION

Simulation is performed by analyzing the relations between the various network entities that include links, switched, routers, nodes, access points.

The results are presented by graphs and trace files.

The paper provides insight on comparative analysis of two open-source network simulators, namely ns-2, ns-3 and the commercial simulators are opnet and qualnet

II. NETWORK SIMULATORS AND THEIR COMPARISON

A. NS-2

Network Simulator-2 (NS-2) is an open-source simulator.

It is licensed under version 2 of the GNU (General Public License) and is popularly known as NS2.

It is written in C++ and OTCL/TCL which makes it object-oriented. The architectural design is combined with NS-1 and Real Network simulator. The architecture of NS-2 is represented by Tool Command language (TclCL) with classes in NS-2, that is linked to C++ and OTCL simulation objects. The simulation is visualized through Network Animator.

Its features include:

It supports protocols including TCP, FTP, UDP, HTTPS, and DSR for simulation. It is capable of both wired and wireless networks simulation.
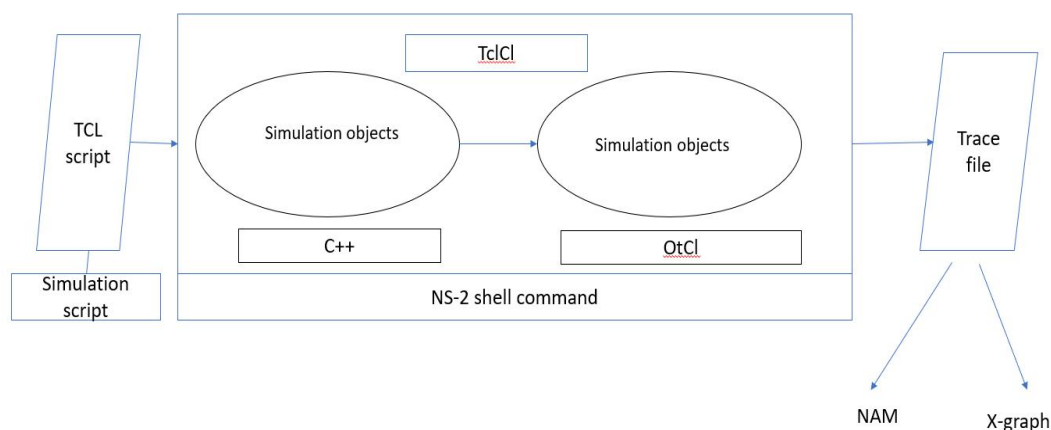

Fig. (1) NS-2 Architecture

B. NS-3

An advanced version of NS-2 simulator is the Network Simulator-3 (NS-3). It is an open-source platform.

It is licensed under version 2 of the GNU (General Public License). The architecture includes the combination of the following network simulators i.e., NS-2, GTNETS, YANS. Programming language used is C++ or Python.

For visualization purpose Network Animator software package is used. A Python-based simulation visualizer PyViz runs network simulations for NS-3.

Using NS3 Point to Point, Wireless, CSMA, etc connections between nodes can be created.
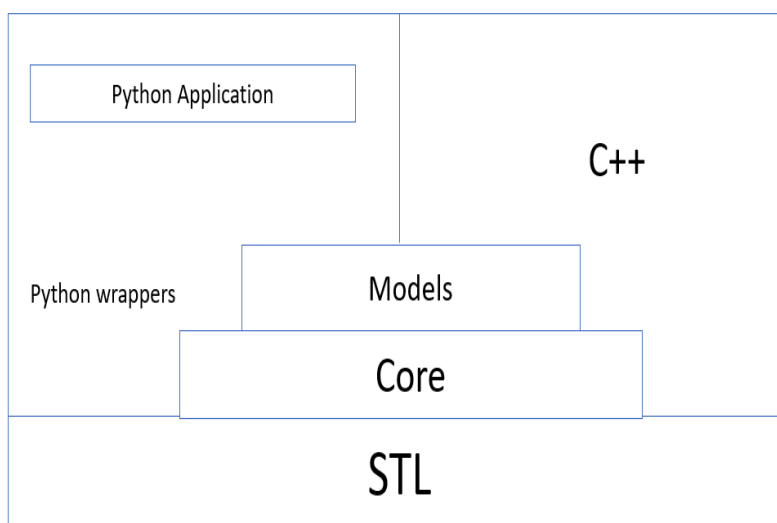

Fig. (2) NS-3 Architecture

C. OPNET

Opnet is an open-source commercial software.

The advantage of this simulator lies in power and versatility over others. It helps to create and simulation different network topologies. It includes both programming environment and GUI. New protocols or modifications for the existing ones as the set of protocols is fixed. The Simulation operation is at "packet-level". It provides an environment supporting the modelling of communication networks and distributed systems.

It features includes:

It supports C, C++ languages

Simulation of both Wired and Wireless protocols is possible

D. Qualnet

Qualnet is a commercial software which is a version of the GloMoSim, it runs on all common platforms (Windows, Linux, etc)

Qualnet simulator is the best choice for research scholars.

As it helps to create virtual models of voice, data and video network quickly and it accurately provides the model behaviour of real communication.

It is specialized in simulating all kinds of wireless applications.

The architecture of Qualnet includes: Command Line interface, Graphical user interface (with Analyzer, Packet Tracer, File Editor Model Libraries, Simulation Kernel, External interfaces

It features include:

Optimizing new and existing models.

Used to design new protocol models.

Perform what-if analysis to optimizes.

Table (i) Comparison of various Network Simulators

Simulation Tool	NS-2	NS-3	OPNET	Qualnet
Usage	Simulator	Simulator	Simulator	Simulator / Emulator
Purpose	Open Source	Open Source	Academic / Commercial	Academic / Commercial
Development Platform	OTCL / C++	C++	C / C++	C / C++
Support	Wired / Wireless Network	Wired / Wireless Network	Wired / Wireless Network	Advanced wireless and Wired Network
Scalability	Low	Low	Low	High (tested for upto 15000)
Emulation	No Support	No Support	No Support	Supports injunction of live IP Traffic through IPNE Software Module
Network Topologies	Routing, Multicast, TCP over WLANs	Routing, Multicast, TCP over WLANs	ATM, FDI, TCP/IP, Ethernet, WLAN	LAN, WLAN, WAN
Network Impairments	Congestion, Queuing, Routing	Congestion, Queuing	Link Models, LIFO, FIFO, Priority, Queuing	Protocol Evaluation

III. CONCLUSION

In the paper we have investigated different network simulators like Qualnet, OPNET, NS-2, NS-3 the simulators discussed supports network visualization tools. Trace files are created for all the simulators. Fast simulation capabilities are only supported by Qualnet and OPNET which are commercial simulator capable for larger networks, whereas NS-2, NS-3 are open source NS-2 consumes more amount of memory and NS-3 consumes lowest amount of memory.

IV. ACKNOWLEGEMENT

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