# **Global Mobile Information System Simulator in Fedora Linux**

Ayyaswamy Kathirvel<sup>a</sup>, Rengaramanujam Srinivasan<sup>b</sup>

 a Assistant Professor, Faculty of Computer Science and Engineering b Professor, Faculty of Computer Science and Engineering EmailID: a <u>kathir@crescentcollege.org</u>, b rsvaan@crescentcollege.org
 **B.S.Abdur Rahman University, Chennai – 600 048, Tamilnadu, India.**

#### Abstract:

Global Mobile Information System Simulator is a popular network simulation tool, which is frequently used in the study of the behavior of large-scale hybrid networks that include wireless, wired. and satellite based communications are becoming common in both in military and commercial situations. It is freely available without fee for education, or research, or to non-profit agencies. It is simple to install and use. It is available for various Linux flavors files include freebsd-3.3, aix, irix, redhat-6.0, redhat-7.2 and Solaris. This tool is not supported to fedora core Linux. This paper will help you get started.

**Keywords:** GloMoSim, Visualization Tool, GnuPlot and Parsec.

#### **1. INTRODUCTION**

Global Mobile Information System Simulator (GloMoSim) simulates networks with up to thousand nodes linked by a heterogeneous communications capability that includes multicast, asymmetric communications using direct satellite broadcasts, multihop wireless communications using ad-hoc networking, and traditional Internet protocols. Developers use these simulators to model the wired or wireless network design process [1][2]. It is being designed using the parallel discrete-event simulation capability provided by Parsec. This makes it possible to evaluate various design alterations and configurations before even deploying the actual devices and components. Based on the outcome of the validation process, simulations can once again be attempted for optimization of the hardware performance.

Most network systems are currently build using a layered approach that is similar to the OSI seven layer network architecture. The plan is to build GloMoSim using a similar layered approach [4]. Standard APIs will be used between the different simulation layers. This will allow the rapid integration of models developed at different layers by different people [13][14]. It usually made available on a standalone machine. The goal is to build a library of parallelized models that can be used for the evaluation of variety of wireless network protocols [5][7]. The proposed protocols stack will include models for the channel, radio, MAC, network, transport, and higher layers.

The simple approach to designing a network simulation would be to initialize each network node in the simulation as a Parsec entity [6]. We can view different entity initializations as being separate logical processes in the system. Hence each entity initialization requires its own stack space in the runtime. In GloMoSim, we are trying to build a simulation that will scale to thousands of nodes [4]. If we have to instantiate an entity for each node in the runtime, the memory requirements would increase dramatically [15]. The performance of the system would also degrade rapidly. Since there are so many entities in the simulation, the runtime would need to constantly context switch among the different entities in the system. This will cause significant degradation in the performance of the simulation [8][9]. Hence initializing each node as a separate entity will inherently limit the scalability and performance of the simulation [16][17].

To circumvent these problems network gridding was introduced into the simulation [18]. With network gridding, a single entity can simulate several network nodes in the system. A separate data structure representing the complete state of each node is maintained within the entity. Similarly we need to maintain the right level of abstraction. When the simulation code of a particular node is being executed it should not have access to the data structures of the other nodes in the simulation. The network gridding technique means that we can increase the number of nodes in the system while maintaining the same number of entities in the simulation [19]. In fact, the only requirement is that we need only as many entities as the number of processors on which the simulation is being run. Hence if we are running a sequential simulation we need to initialize only one entity in the system. We also don't meet the memory or context switching problems that limit the simulation [20]. The rest of the paper is organized as follows. In the following section, we give the software required to install GloMoSim. Section 3 describes the Visualization Tool. Section 4 describes the simulation Result analysis. We draw our conclusions in Section 5.

# 2. SOFTWARE REQUIRED TO INSTALL GLOMOSIM

To install GloMoSim Software we required following software's include

1.Linux of Java 1.3 or higher versions.

2.Parsec compiler

3.GloMoSim software

Usually GloMoSim software is come along with parsec compiler if so no need to download parsec compiler separately. Otherwise download parsec compiler separately.

GloMoSim tool and Parsec compiler can be downloaded free of cost from the URL [http://pcl.cs.ucla.edu/projects/glomosim/] also for online help refer to URL [http://pcl.cs.ucla.edu/projects/parsec/] and URL [http://pcl.cs.ucla.edu/projects/glomosim]. The tool has long been available for various Linux flavors include freebsd-3.3, aix, irix, redhat-6.0, redhat-7.2 and Solaris. Though GloMoSim are available for the Windows platform, it is recommended you install the tool on Linux. Similarly java [10] compiler for Linux can be



[http://www.java.com/en/download/manual.jsp].

#### 2.1 Installing GloMoSim

Before installing GloMoSim you have to install java for Linux. Simply double click jdk-1\_5\_0\_07-linux-i586rpm.bin it shows at fig1 the following screen, press Run in Terminal button. It is automatically installed at the directory /usr/java/jdk1.5.0\_07

Fig 1: Installation of jdk1.5 in Linux

After downloading the tar.gz file, simply issue the Linux commands listed below at the command prompt, to install the tool.

#tar xvfz glomosim-2.03.tar.gz
// to uncompress the glomosim software archive

This will create a new directory under the root directory named glomosim-2.03. Inside the glomosim-2.03 directories, which consist of two subdirectories, can be found namely glomosim and parsec. Inside the parsec directory various Linux flavors files include freebsd-3.3, aix, irix, redhat-6.0, redhat-7.2 and Solaris. Note that downloaded software is not supported to fedora. If you are run this tool in fedora, copy all files inside the redhat-7.2 directory, paste it in /parsec directory. You can find the .makefile(make) executable file at the following directory /glomosim-2.03/glomosim/main.

#cd /glomosim-2.03/glomosim/main

#make

# vi .bash\_profile

// to open the .bash\_profile to customize glomosim
software

#### 2.2 Customizing GloMoSim

As such, the path of glomosim could be anywhere on the file system. However, it is recommended you install glomosim on the file system of a user other than root. In order to allow glomosim to run from the user's file system, you may need to make a few changes to the .bash\_profile file under the home directory of the user. This will also allow you to use glomosim without having to log in as the all-powered root user. The following changes then should be made to the file .bash\_profile.

# User specific environment and startup programs

PATH=\$PATH:\$HOME/bin:/usr/java/jdk1.5.0\_07/bin:/gl omosim-2.03/glomosim/main :/glomosim-2.03/glomosim/include:/glomosim-2.03/glomosim/bin:/glomosim-2.03/parsec/bin:/glomosim-2.03/parsec/include

PCC\_DIRECTORY=/glomosim-2.03/parsec export PATH PCC\_DIRECTORY

It may be noted that the installation process in its final response will suggest these changes.

#### 2.3 Simulate a network using glomosim

After successfully installing GloMoSim, a simulation can be started by executing the following command in the BIN subdirectory.

./glomosim inputfile > bell.trace

The inputfile contains the configuration parameters for the simulation (an example of such file is CONFIG.IN). A file called GLOMO.STAT is produced at the end of the simulation and contains all the statistics generated.

### **3. THE VISUALIZATION TOOL**

GloMoSim has a visualization tool that is platform independent because it is coded in java [3]. To initialize the visualization tool, we must execute from the java\_gui



directory the following: java GlomoMain. This tool allows to debug and verify models and scenarios; stop, resume and stop execution; show packet transmissions, show mobility groups in different colors and show statistics at fig2, fig3 and fig4.

Fig 2: Visualization Tool to open bell.trace file

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<ul> <li>✓ Networkip         <ul> <li>Node: 23, Layer: Networkip, Average Hop Count Assuming 64 Inital TTL 1.000002</li> <li>Layer: Networkip, Nubber Fragents dropped because lobe was Unreach Node: 23, Layer: Networkip, Nubber Fragents dropped because lobe was Unreach Node: 23, Layer: Networkip, Nubber fragents dropped because lobe was Unreach Node: 26, Layer: Notifiel Inant, Nubber of routing table broadcasts = 80 a Node: 28, Layer: Notifiel Inant, Nubber of routing table undates = 80 a Node: 28, Layer: Notifiel Inant, Nubber of routing table undates = 80 a Node: 28, Layer: Notifiel Inant, Nubber of routing table undates = 80 a Node: 28, Layer: Notifiel Inant, Nubber of routing table undates = 80 a Node: 28, Layer: AppChServer, (0) Cleff address: 10 a Node: 28, Layer: AppChServer, (0) Cleff address: 10 a Node: 28, Layer: AppChServer, (0) Cleff address: 10 a Node: 28, Layer: AppChServer, (0) Cleff address: 10 a Node: 28, Layer: AppChServer, (0) Cleff address: 10 a Node: 28, Layer: AppChServer, (0) Cleff address: 10 a Node: 28, Layer: AppChServer, (0) Cleff and Node: 28, Layer: AppChServer, (0) Cleff and Inaber of packets received: 42 (51; 127, 406532008 Node: 28, Layer: AppChServer, (0) Cleff and Inaber of Packets received: 42 (51; 127, 406532008 Node: 28, Layer: AppChServer, (0) Cleff and Inaber of Packets received: 42064 Node: 28, Layer: AppChServer, (0) Cleff an Unbaber of Packets received: 47 Node: 20, Layer: AppChServer, (0) Train nubber of Packets received: 47 Node: 20, Layer: Networkip, Nubber of Packets Node: 61 Node: 29, Layer: Networkip, Nubber of Packets technet For Mode: 0 Node: 20, Layer: Networkip, Nubber of Packets Delivered Packets: 22055</li> <li>✓ AppCbristerer</li> <li>Node: 23, Layer: Networkip, Nubber of Packets Delivered Packets: 22054</li> </ul></li></ul>		Node:	29,	Layer:	NetworkIp,	Average Hop Count Assuming 64 Inital TTL 1.000000		
<ul> <li>✓ Networklp Node: 23, Layer: Networklp, Average Hop Count Assuming 64 Inital TTL 1.000002 10062: 33, Layer: Networklp, Nubber Fragents dropped because Node was Unreach Node: 23, Layer: Notroklp, Nubber Fragents dropped because Node was Unreach Node: 23, Layer: Notroklp, Nubber Fragents dropped because Node was Unreach Node: 23, Layer: Notroklp, Nubber Fragents dropped because Node was Unreach Node: 23, Layer: Notroklp, Nubber Fragents dropped because Node was Unreach Node: 23, Layer: Notroklp, Nubber Fragents dropped because Node was Unreach Node: 24, Layer: Notroklp, Nubber of routing table Undesse = 30 Node: 24, Layer: Notroklp, Nubber of routing table Undesse = 100000000000000000000000000000000000</li></ul>		Node:	29,	Layer:	NetworkIp,	Total of the TTL's of Delivered Packets: 22995		
<ul> <li>Networkip Node: 23, Layer: Networkip, Average Hop Count Assuming 64 Inital TTL 1.000002 Hode: 23, Layer: Networkip, Nubber Fragents dropped because Hole was Unreach Node: 23, Layer: Networkip, Nubber Fragents dropped because Hole was Unreach Node: 24, Layer: Networkip, Nubber Fragents dropped because Hole was Unreach Node: 26, Layer: Notify Blanar, Nubber of routing table undates - 33 Node: 28, Layer: Notify Blanar, Nubber of routing table undates - 33 Node: 28, Layer: NotifyBellmark, Nubber of routing table undates - 33 Node: 28, Layer: NotifyBellmark, Nubber of routing table undates - 830 Node: 28, Layer: NotifyBellmark, Nubber of routing table undates - 830 Node: 28, Layer: AppChServer, (0) Client address: 10 Node: 28, Layer: AppChServer, (0) Client address: 10 Node: 28, Layer: AppChServer, (0) Average end-to-end delay [31: 0.00758]/X07 Node: 28, Layer: AppChServer, (0) Average sing status tables trackets received: 4064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: AppChServer, (0) Tal nubber of bytes received: 24064 Node: 28, Layer: Networkip, Nubber of Packets Node Toreard for AppChServer, (0) Node: 28, Layer: Node: 29, Layer: Note Node: 20, Layer: Node: 20, Layer: Node: 20, Layer: Node: 20, Layer</li></ul>		Node:	29,	Layer:	NetworkIp,	Number of Packets Delivered To this Node: 365		
<ul> <li>Networkip Node: 23, Layer: Networkip, Average Hop Count Assuming 64 Inital TTL 1.000002 foot: 23, Layer: Networkip, Number Fragents dropped because Node was Unreach Node: 23, Layer: Networkip, Number Fragents dropped because Node was Unreach Node: 23, Layer: NoticityBellinant, Number of routing table bradacts = 90 Node: 23, Layer: NoticityBellinant, Number of routing table bradacts = 90 Node: 23, Layer: NoticityBellinant, Number of routing table bradacts = 90 Node: 23, Layer: NoticityBellinant, Number of routing table trigger updates = 3 Node: 23, Layer: NoticityBellinant, Number of routing table trigger updates = 3 Node: 23, Layer: NoticityBellinant, Number of routing table trigger updates = 3 Node: 23, Layer: AppChrServer, (0) Client address: 10 Node: 24, Layer: AppChrServer, (0) Client address: 10 Node: 28, Layer: AppChrServer, (0) Client address: 10 Node: 28, Layer: AppChrServer, (0) Last packet received at [5]: 82.466832008 Node: 28, Layer: AppChrServer, (0) Sestion status: Closed Node: 28, Layer: AppChrServer, (0) Throughout (clists preserved: 24064, Node: 28, Layer: AppChrServer, (0) Throughout (clists preserved: 24064, Node: 28, Layer: AppChrServer, (0) Throughout (clists preserved: 24064, Node: 28, Layer: AppChrServer, (0) Throughout (clists preserved: 24064, Node: 28, Layer: AppChrServer, (0) Throughout (clists preserved: 24064, Node: 28, Layer: AppChrServer, (0) Throughout (clists preserved to be Senver, AppChrServer, (0) Sestion status: Closed Node: 34, Layer: AppChrServer, (0) Throughout (clists preserved to be Senver, AppChrServer, (0) Throughout (clists preserved to be Sen</li></ul>	AppCbrServer	Node:	29,	Layer:	NetworkIp,	Number of Packets Routed For Another Node: 0		
<ul> <li>Network/p</li> <li>Node: 25, Layer: Network/p, Average Hop Count Assuming 64 Initial TTL 1.000002</li> <li>Node: 26, Layer: Network/p, Number Fragents dropped because Hoe was Unreach Node: 28, Layer: Network/p, Number Fragents dropped because Hoe was Unreach Node: 28, Layer: Network/p, Number Fragents dropped because Hoe was Unreach Node: 28, Layer: NotingBellman, Number of routing table tridger updates = 3 Node: 28, Layer: RoutingBellman, Number of routing table tridger updates = 400 Node: 28, Layer: RoutingBellman, Number of routing table updates = 40 Node: 28, Layer: RoutingBellman, Number of routing table updates = 40 Node: 28, Layer: RoutingBellman, Number of routing table updates = 40 Node: 28, Layer: AppChFerrer, (0) First packet received from UDP = 83 Node: 28, Layer: AppChFerrer, (0) First packet received at [5] 121,046832008 Node: 28, Layer: AppChFerrer, (0) First packet received at [5] 121,046832008 Node: 28, Layer: AppChFerrer, (0) Session status: Closed at [5]: 0.007821767 Node: 28, Layer: AppChFerrer, (0) Session status: Closed Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets received: 47 Node: 28, Layer: AppChFerrer, (0) Tail number of packets</li></ul>		Node:	29,	Layer:	NetworkIp,	Number of Packet Attepted to be Sent to NAC: 91		
Retwork/p Node: 25, Layer: Network/p, Average Hop Count Assuming 64 Inital TTL 1.000002 foot: 25, Layer: Network/p, Nubber Fragents dropped because Node was Unreach Node: 25, Layer: Network/p, Nubber Fragents dropped because Node was Unreach Node: 25, Layer: Noticipal Inan, Nubber of routing table broadcasts = 90 Node: 25, Layer: Noticipal Inan, Nubber of routing table trigger undages = 3 Node: 26, Layer: Noticipal Inan, Nubber of routing table trigger undages = 3 Node: 26, Layer: Noticipal Inan, Nubber of routing table trigger undages = 3 Node: 26, Layer: Noticipal Inan, Nubber of routing table trigger undages = 3 Node: 26, Layer: Noticipal Inan, Nubber of routing table trigger undages = 3 Node: 26, Layer: Noticipal Inan, Nubber of routing table trigger undages = 3 Node: 26, Layer: AppCoFServer, (0) Inter address: 10 Node: 28, Layer: AppCoFServer, (0) Inter address: 10 Node: 28, Layer: AppCoFServer, (0) Inter gene Inter-Ondage Indages 21, 197, 406832008 Node: 28, Layer: AppCoFServer, (0) Inter address: 10 Node: 28, Layer: AppCoFServer, (0) Inter gene Inter-Ondages 12, 197, 406832008 Node: 28, Layer: AppCoFServer, (0) Inter address: 10 Node: 28, Layer: AppCoFServer, (0) Inter address: 10 Node: 28, Layer: AppCoFServer, (0) Inter address 12, 197, 406832008 Node: 28, Layer: AppCoFServer, (0) Inter address 12, 197, 406832008 Node: 28, Layer: AppCoFServer, (0) Inter address 14, 27, 2064 Node: 28, Layer: AppCoFServer, (0) Inter address 14, 27, 2064 Node: 28, Layer: AppCoFServer, (0) Inter address 14, 27, 2064 Node: 28, Layer: AppCoFServer, (0) Inter Inte		Node:	28.	Laver:	AppCbrServer.	(0) Throughput (bits per second): 1674		
<ul> <li>✓ Networklp Node: 23, Layer: Networklp, Average Hop Count Assuming 64 Inital TTL 1.000002 Hold: 23, Layer: Networklp, Number Fragents dropped because Hoe was Unreach Node: 23, Layer: Networklp, Number Fragents dropped because Hoe was Unreach Node: 26, Layer: Networklp, Number of routing table broadcasts = 90 Hode: 26, Layer: NotingBellman, Number of routing table broadcasts = 90 Hode: 26, Layer: NotingBellman, Number of routing table trigger updates = 3 Hode: 28, Layer: NotingBellman, Number of routing table updates = 80 Hode: 28, Layer: NotingBellman, Number of routing table updates = 180 Hode: 28, Layer: RoutingBellman, Number of routing table updates = 180 Hode: 28, Layer: AptChFarrer, (0) First packat received from UDP = 833 Hode: 28, Layer: AptChFarrer, (0) First packat received is [31: 28, J46932000 Hode: 26, Layer: AptChFarrer, (0) First packat received is [31: 10, J46932000 Hode: 26, Layer: AptChFarrer, (0) Session status: Closed is 10, Layer: AptChFarrer, (0) Session status: Closed is 10, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 28, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Closed (10: 0, 00782167) Hode: 26, Layer: AptChFarrer, (0) Session status: Clos</li></ul>		Node:	28.	Laver:	AppCbrServer.	(0) Total number of packets received: 47		
☑ Networklp Node: 23, Layer: Networklp, Average Hop Count Assuming 64 Inital TTL 1.000002 (a) Layer: Networklp, Nubber Fragents dropped because lobe was Unreach Node: 23, Layer: Networklp, Nubber Fragents dropped because lobe was Unreach Node: 23, Layer: Networklp, Nubber fragents dropped because lobe was Unreach Node: 24, Layer: Networklp, Nubber fragents dropped because lobe was Unreach Node: 26, Layer: Notifyellinant, Nubber of routing table undates = 830 Node: 28, Layer: Notifyellinant, Nubber of routing table undates = 830 Node: 28, Layer: Notifyellinant, Nubber of routing table undates = 830 Node: 28, Layer: Notifyellinant, Nubber of routing table undates = 830 Node: 28, Layer: Notifyellinant, Nubber of routing table undates = 830 Node: 28, Layer: AppChServer, (0) Clent address: 10 Node: 28, Layer: AppChServer, (0) Clent address: 10 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,48632008 Node: 28, Layer: AppChServer, (0) Last packet received at [5]: 82,		Node:	28.	Laver:	AppCbrServer.	(0) Total number of bytes received: 24064		
☑ Networkůp kode: 25, Láver: Networkůp, Average Hop Count Assuving 64 Inital TTL 1.000002 foloči 25, Láver: Networkůp, Nuběr Fragents dropped because Nede was Unreach Node: 28, Láver: Networkůp, Nuběr Fragents dropped because Nede was Unreach Node: 28, Láver: Networkůp, Nuběr of routing table bradicats – 90 Node: 28, Láver: NotingBellmanf, Nuběr of routing table trigger updates = 3 Node: 28, Láver: NotingBellmanf, Nuběr of routing table updates = 400 Node: 28, Láver: NotingBellmanf, Nuběr of routing pable updates = 400 Node: 28, Láver: NotingBellmanf, Nuběr of routing pable updates = 400 Node: 28, Láver: NotingBellmanf, Nuběr of routing pable updates = 400 Node: 28, Láver: NotingBellmanf, Nuběr of routing pable updates = 400 Node: 28, Láver: Apurt.pp:Forerv, (0) Last paster received from UDP = 833 Node: 28, Láver: AppChrSenver, (0) Last paster received at [51: 197.46833000 Node: 28, Láver: AppChrSenver, (0) Last paster received at [51: 197.46833000 Node: 28, Láver: AppChrSenver, (0) Last paster received at [51: 197.46833000 Node: 28, Láver: AppChrSenver, (0) Last paster received at [61: 197.46833000 Node: 28, Láver: AppChrSenver, (0) Last paster received at [51: 197.46833000 Node: 28, Láver: AppChrSenver, (0) Last paster received at [61: 197.46833000 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.46833000 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.4683300 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.4683300 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.4683300 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.4683300 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.4683300 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.4683300 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.4683300 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.4683300 Node: 28, Láver: AppChrSenver, (0) Lást paster received at [61: 197.4683300 Node: 28,		Node:	28.	Laver:	AnnChrServer.	(0) Session status: Closed		
☑ NetworkUp Hode: 25, Layer: NetworkUp, Average Hop Count Assuming 64 Initial TTL 1.000002 Hode: 25, Layer: NetworkUp, Nubber Fragents dropped because Note was Unreach Hode: 25, Layer: NetworkUp, Nubber Fragents dropped because Note was Unreach Hode: 26, Layer: NetworkUp, Nubber Fragents dropped because Note was Unreach Hode: 26, Layer: Notifyellhand, Nubber of routing table broadcasts = 90 Hode: 26, Layer: Notifyellhand, Nubber of routing table trigger updates = 3 Hode: 26, Layer: Notifyellhand, Nubber of routing table updates = 480 Hode: 26, Layer: Notifyellhand, Nubber of routing packets received from UPP = 833 Hode: 26, Layer: AppChServer(n) (0) First packets received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer: AppChServer(n) (0) First packet received at [51:92.406332048 Hode: 26, Layer		Node:	28.	Laver:	AppCbrServer.	(0) Average end-to-end delay [s]: 0.007581767		
☑ Networkůp kode: 25, Láver: Networků, Average Hop Count Assuning 64 Inital TTL 1.000002 kode: 26, Láver: Networků, Nuběr Fragents dropped because Nede was Unreach Node: 28, Láver: Networků, Nuběr Fragents dropped because Nede was Unreach Node: 28, Láver: Networků, Nuběr of routing table bradicats = 90 Node: 28, Láver: NotingBellman, Nuběr of routing table trigger updates = 3 Node: 28, Láver: NotingBellman, Nuběr of routing table updates = 43 Node: 28, Láver: NotingBellman, Nuběr of routing pakie updates = 3 Node: 28, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 28, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 28, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NatingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies received from UDP = 83 Node: 18, Láver: NotingBellman, Nuběr of routing pakies se 18 Node: 18, Láver: NotingBellman, Nuběr of rou	🗹 RoutingBellmanf	Node:	28.	Laver:	AnnChrServer,	(0) Last market received at [s]: 197.496832008		
[2] Networklp Hode: 25, Layer: Networklp, Average Hop Count Assuming 64 Initial TTL 1.000002 Hode: 28, Layer: Networklp, Number Fragents dropped because Hode was Unreach Hode: 28, Layer: Networklp, Number Fragents dropped because Hote was Unreach Hode: 28, Layer: Networklp, Number of routing table bradicats - 90 Hode: 28, Layer: NotingBellman, Number of routing table trigger updates - 3 Hode: 28, Layer: NotingBellman, Number of routing table trigger updates - 3 Hode: 28, Layer: NotingBellman, Number of routing table updates - 80 Hode: 28, Layer: NotingBellman, Number of routing table updates - 80 Hode: 28, Layer: NotingBellman, Number of routing packets received from UDP = 830 Hode: 28, Layer: NotingBellman, Number of routing packets received from UDP = 830		Node:	28	Laver.	annChrServer,	(0) First nacket received at [s]: 82 496392008		
☑ Networkůp kode: 25, Láver: Networků, Average Hop Count Assuning 64 Inital TTL 1.000002 kode: 28, Láver: Networků, Nubber Fragents dropped because Nobe was Unreach Node: 28, Láver: Networků, Nubber Fragents dropped because Nobe was Unreach Node: 28, Láver: Networků, Nubber Fragents dropped because Nobe was Unreach Node: 28, Láver: NotingBellmant, Nubber of routing table bradicats = 90 Node: 28, Láver: NotingBellmant, Nubber of routing table trigger updates = 3 Node: 28, Láver: NotingBellmant, Nubber of routing table updates = 30 Node: 28, Láver: NotingBellmant, Nubber of routing table updates = 180 Mps = 200		Node:	28	Layer.	App(brServer	(0) Client address: 10		
☑ Networklp lode: 25, Layer: Networklp, Average Hop Count Assuming 64 Initial TTL 1,000000 lode: 28, Layer: Networklp, Number Fragents dropped because Role was linerach lode: 28, Layer: Networklp, Number Fragents dropped because TL expired: 0 lode: 28, Layer: Networklp, Number of routing table brandcasts - 90 lode: 28, Layer: RoutingBellman, Number of routing table trigger updates - 3 lode: 28, Layer: RoutingBellman, Number of routing table trigger updates - 3 lode: 28, Layer: RoutingBellman, Number of routing table underse - 830.		Node:	28	Laver.	RoutingBellmanf,	Number of routing packets received from UDP = 830		
Network/p kode: 26, Layer: Network/p, Average Hop Count Assuming 64 Inital TTL 1.000000 kode: 28, Layer: Network/p, Nubber Fragents dropped because Note was Unreach Note: 28, Layer: Network/p, Nubber Fragents dropped because Note was Unreach Note: 28, Layer: Network/p, Nubber Fragents dropped because Note and Note: 28, Layer: Network/p, Nubber Fragents dropped because Note and Note: 28, Layer: Notifyel Inant, Nubber Fragents dropped because Note and Note: 28, Layer: Notifyel Inant, Nubber Fragents dropped because Note and Note: 28, Layer: Notifyel Inant, Nubber Fragents dropped because Note and Note: 28, Layer: Notifyel Inant, Nubber Fragents dropped because Note and Note: 28, Layer: Notifyel Inant, Nubber Fragents dropped because Note and Note: 28, Layer: Note: Note: 28, Layer: 28, Lay		Node:	20,	Layer:	RoutingBollmonf	Number of routing table undates - 230		
☑ Networkip Node: 28, Layer: Networkip, Average Nop Court Assuming 64 Inital TTL 1.000000 Node: 28, Layer: Networkip, Number Fragments dropped because Node was Unreach Node: 28, Layer: Networkip, Number Fragments dropped because TTL expired: 0		Node:	28,	Layer:	RoutingBellmant,	Number of routing table trianer undeter . 2		
☑ Networkip Node: 28, Layer: Networkip, Average Hop Count Assuming 64 Inital TTL 1.000000 Node: 28, Layer: Networkip, Number Fragments dropped because Node was Unreach	🗹 Networklp	Node:	28,	Layer:	Networkip,	Number Fragments dropped because IIL expired: U		
NetworkIp Node: 28, Layer: NetworkIp, Average Hop Count Assuming 64 Inital TTL 1.000000		Node:	28,	Layer:	Networkip,	Number Fragments dropped because Node was Unreachable:		
A Make and the second		Node:	28,	Layer:	Networkip,	Average Hop Count Assuming 64 Inital IIL 1.000000		
Node: 28. Laver: NetworkIp. Total of the TTL's of Delivered Packets: 55204		Node:	28,	Layer:	NetworkIp,	Total of the TTL's of Delivered Packets: 55204		
Node: 28, Layer: NetworkIp, Number of Packets Delivered To this Node: 877		Node:	28,	Layer:	NetworkIp,	Number of Packets Delivered To this Node: 877		
Node: 28, Layer: NetworkIp, Number of Packets Routed For Another Node: 0		Node:	28,	Layer:	NetworkIp,	Number of Packets Routed For Another Node: O		

Fig 3: Visualization Tool to run bell.trace file

The radio layer is displayed in the visualization tool as follows: when a node transmits a packer, a yellow link is drawn from this node to all nodes within its power range. As each node receives the packet, the link is erased and a green line is drawn for successful reception and a red line is drawn for unsuccessful reception. No distinction is made between different packet types (ie. Control packets vs regular packets etc). Note that bell.trace file which is available at ./bin directory copied into ./java\_gui directory.





### 4. RESULTS ANALYSIS

The output data of the network is generated and stored in glomo.stat file. In these cases we use other tools to do an analysis of the glomo.stat file. For example, the following shell program and awk programs is used to display packet data ratio, percentage of loss rate and packets sent.

### Shell program:

File Name : result1.sh

Cat \$1 | grep App | grep Total | grep packets | awk -f analysis.awk

# AWK program:

File Name: analysis.awk

### BEGIN{

```
sumcountsent = 0;
sumcountrcv = 0;
}
{
if($10 == "sent:") sumcountsent+=$11;
else if ($10 == "received:") sumcountrcv+=$11;
}
END{
```

 $\label{eq:printf} printf("Loss Packet Percentage= \%f \ \ \ n",100-((sumcountrev*100)/sumcountsent));$ 

 $\label{eq:printf} printf("Packet Delivery Ratio = \%f \n, n", sumcountr-cv/sumcountsent);$ 

printf("Packet Received = %d \n", sumcountrcv);
printf("Packet Sent = %d \n\n", sumcountsent);
}

An example of the execution of these programs the result as follows

#sh result1.sh glomo.stat

Loss Packet Percentage = 36.891678 %Packet Delivery Ratio= 0.678990Packets Received= 15233Packets Sent= 24300

To obtain the Average Delay and the Control Packets generated by the AODV routing protocol, the following programs can be used:

## Shell program: File Name : result2.sh

cat \$1 | grep AppCbrServer | grep end-to-end | grep delay | awk -f delay.awk

# AWK program: File Name: delay.awk

### BEGIN{

```
sumdelay=0;
countdelay=0;
}
{
sumdelay +=$10;
countdelay++;
}
```

# END{

printf("Average Delay

sumdelay/countdelay);}

An example of the execution of these programs the result as follows

\n",

%f

#sh result2.sh glomo.stat Average Delay = 12.191678 %

We can even obtain some interesting graphs from simulations. Lets suppose we want to obtain a graph of the variance of packets delivered to final destination, with networks of different size (30,50,70,100 and 200 nodes) and nodes move at different speeds (1,5,10 amd 20 m/s). We can run several simulations (each with a specified node number and speed of the mobility model). To shorten the simulation time, the tests can be executed at the same time, thus obtaining the following table.

spee	30	50	70	100	200
d	nodes	nodes	nodes	nodes	nodes
				57890	
1	12884	34890	56899	9	67989
5	15927	33098	43898	37989	67700
10	14989	22890	34900	34900	49090
20	12322	20323	29000	23798	29009

If the data of this table is used in a file (e.g data.txt), then we may use graphic tools such as GnuPlot [11] to obtain an appropriate graph. In the case of GnuPlot [12], we can execute the following commands to obtain the graph represented at fig5 and contained in file graph.eps.

set terminal postscript eps

set size 1/1., 1/1. set title "Performance" set output "graph.eps" set xlabel "Speed (m/s)" set ylabel "Packets" plot [0:20][8000:75000] "data.txt" using 1:2 title '30 nodes' with linespoints, \ "data.txt" using 1:3 title '50 nodes' with linespoints, \ "data.txt" using 1:4 title '70 nodes' with linespoints, \ "mobil.txt" using 1:5 title '100 nodes' with linespoints, \

"data.txt" using 1:6 title '200 nodes' with linespoints



Fig 5: Packet delivery ration using Gnu Plot

GloMoSim is a popular simulation tool that is freely available for education, or research, or to non-profit agencies, which means you can enhance it to suit your own requirements.

#### **5. CONCLUSION**

Detailed, high fidelity models of large networks represent a significant challenge for the networking community. This paper presented a simulation library called GloMoSim whose goal is to support accurate performance prediction of large-scale network models using parallel execution on a diverse set of parallel computers. The library has already been used to simulate networks with thousands of wireless nodes and provides a rich set of models for both existing and novel protocols at multiple layers of the protocol stack.

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Author Biographies:



A.Kathirvel - born in 1976 in Erode, Tamilnadu, India, received his B.E. degree from the University of Madras, Chennai, in 1998 and M.E. degree from the same University in 2002. He is currently with B.S.Abdur Raahman University, in the Department of computer science and Engineering and pursing Ph.D. degree with the Anna University, Chennai, India. He is a member of the ISTE. His research interests are protocol development for wireless ad hoc networks, security in ad hoc networks.



Rengaramanujam Srinivasan -- born in 1940 in Alwartirunagari, Tamilnadu, India, received B.E. degree from the University of Madras, Chennai, India in 1962, M.E. degree from the Indian Institute of Science, Bangalore, India in 1964 and Ph.D. degree from the Indian Institute of Technology, Kharagpur, India in 1971. He is a member of the ISTE and a Fellow of Institution of Engineers, India. He has over 40 years of experience in teaching and research. He is presently working as a Professor of Computer Science and Engineering at B.S.Abdur Raahman University, Chennai, India and is supervising doctoral projects in the areas of data mining, wireless networks, Grid Computing, Information Retrieval and Software Engineering.