SIMULATION OF ROUTING INFORMATION PROTOCOL

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Bonafide Certificate

Certified that this project report titled **Simulation Of Routing Information Protocol** is the bonafide work of **Mr. Senthil Nathan.K** who carried out the research under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

22/6/07

PROJECT GUIDE

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Submitted for the University Examination held on 03.07.2007

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TO WHOMESOEVER IT MAY CONCERN

This is to certify that **Mr.K.Senthil Nathan** Final year M.C.A student bearing the Register No.71204621043 of Kumaraguru College Of Technology, Coimbatore has successfully completed the project titled "**Simulation Of Routing Information Protocal** " for the period from **03.01.2007 to 08.06.2007**. He completed the project under the supervision and guidance of **Mr.S.Sankar,** at **tetcos, Bangalore**. During this period his conduct and work was good.

For **tetcos**

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ABSTRACT

Simulation is a process of producing a computer model that imitates the behavior and conditions of a real world environment. The simulators are largely used for training and testing. The User Interface in the simulator should represent the entire capabilities of the system and should help the user build an intuitive sense of the system works. Building an effective User Interface is very important for simulation.

NetSim is a Network Simulator that simulates the working of Network protocols. **"Simulation Of Routing Information Protocol"** facilitates user to create a routing environment for simulation that uses RIP for routing. RIP is a routing protocol, which is based on distance vector routing and routing tables that uses Bellman-Ford algorithm. The System configures and re-configures environment with NetSim, using WAN components like CPEs, Routers, Physical Medium and by defining properties like data transmission rate, error rate, simulation period etc. The configured environment will be connected to business logic part for simulation.

The routing environment can be classified into two types namely, Static & Dynamic. In static or normal routing the environment to be simulated is built and components of a network are placed and connected to each other. In dynamic routing the environment can be changed and re-configured over a simulation period. Users can give any scenario combination with minimum of two CPEs and a Router.

At the end of the simulation a report of the configured network's performance is generated. The simulated environment is saved and can be retrieved back for further use. The Analysis part compares various parameters of different environments and outputs are produced through Graphs, Charts etc. The Java Version 2 Platform Standard Edition 5.0 and MS-Access is used for developing this project.

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LIST OF ABBREVATIONS AND NOMENCLATURE

NetSim	Network Simulator, which simulates the behavior of network protocols
RIP	Router Information Protocol
UID	User Interface Development
CPE	Customer Premises Equipment
WAN	Wide Area Network

CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

The main aim of this project is to build and simulate a routing environment that uses Routing Information Protocol (RIP) for routing. The routing environment will be configured by the user through dragging and dropping of components from the component List on Environment Builder in the NetSim. The routing environment has the following components in it.

- CPE - It is the fundamental component of a Wide Area Network. The data & protocol reside in this component.
- Router – It connects the CPEs in a geographical area to form a Wide Area Network.
- Physical Medium – It is used to connect two devices of the network.

The Network will be configured by defining the properties of its components. The user interface of routing environment will get the following properties from the user.

- Traffic Generator properties
- Router properties
- Link properties

The **"Simulation Of Routing Information Protocol"** will be a core system for developing UID and for simulating routing environment, which would leverage the process of handling user interactions most effectively and easily. The beneficiaries of the system are easy to understand and also to use. It meets the expectations of technically skilled as well as unskilled user's expectations.

1.2 ORGANIZATION PROFILE

The education training and consulting (tetcos) incorporated and headquartered in Bangalore, provides hardware and software utilities for domains spanning networking, instrumentation, electronics and communications. The tetcos have been playing the role of a trusted IT service to clients since 1981. It has opened its new branch in USA recently.

The products of tetcos include Network Simulation software – NetSim, ĐAC communication trainers and LAN Trainer. It offers cost-effective and intelligent IT products to clients. NetSim version 2.0 is one of the successful products of tetcos and around 140 Engineering colleges in Tamil Nadu are using NetSim for training and also to learn network protocols.

The service offerings of tetcos comprise of product engineering – A concept to market R & D and engineering services and application development in the networking and communications space. From inception it firmly believed in ensuring the highest quality and security for products that tetcos deliver to clients.

The academic products of tetcos are designed with a view of catering to diverse requirements of the students, researchers and academicians. Committed to innovation, It works with premier research institutes, technology groups such as IEEE and the ITU as well as industry majors to design and develop the latest in network simulation.

1.3 SYSTEM SPECIFICATION

The system is developed by using the following software and hardware specifications. The specifications are selected based on the system's requirements, performance and the reliability they provide to user.

1.3.1 SOFTWARE SPECIFICATION

Front end	:	Java 2 PSE 5.0(Core & JFC Swing)
Back end	:	MS – Access 2003, Files
IDE	:	NetBeans 4.1
Operating System	:	Microsoft Windows XP

1.3.2 HARDWARE SPECIFICATION

Processor	:	Intel Pentium IV
Operating Frequency	:	2.4 GHz
RAM	:	256 MB
Hard Drive	:	1 GB
Communication Device	:	NetSim Dongle V2.1

1.4 PROGRAMMING ENVIRNOMENT

ABOUT JAVA

The Java Programming Language is a general-purpose, concurrent, strongly typed, class-based object-oriented language. It is normally compiled to the byte code instruction set and binary format defined in the Java Virtual Machine Specification.

JAVA PLATFORM & FEATURES

The basic features that make Java a powerful and popular programming language:

- **Platform Independence**
  - The *Write-Once-Run-Anywhere* is the concept here
- **Object Oriented**
  - Object oriented throughout - no coding outside of class definitions, including main().
  - An extensive class library available in the core language packages.
- **Compiler/Interpreter Combo**
  - Code is compiled to byte codes that are interpreted by Java virtual machines (JVM).
  - This provides portability to any machine for which a virtual machine has been written.

- **Security**
  - Programs run inside the virtual machine sandbox.
  - Security manager - determines what resources a class can access such as reading and writing to the local disk.
- **Good Performance**
  - Interpretation of byte codes slowed performance in early versions, but advanced virtual machines with adaptive & just-in-time compilation gives good speed.

ABOUT JAVA SWING

Swing is the part of the Java Foundation Classes (JFC) software that implements a set of GUI components with a pluggable look and feel. Swing is implemented entirely in the Java programming language, and is based on the JDK™ 1.1 Lightweight UI Framework.

FEATURES OF JAVA SWING

- Lightweight - Not built on native window-system windows.
- Much bigger set of built-in controls - Trees, image buttons, tabbed panes, sliders, toolbars, color choosers, tables, text areas to display HTML or RTF, etc.
- Much more customizable – We can change border, text alignment, or add image to almost any control. We can customize how minor features are drawn. We can separate internal representation from visual appearance.
- "Pluggable" look and feel - We can change look and feel at runtime, or design own look and feel.

MS ACCESS 2003

Microsoft Access is a commercial, desktop, relational database system from Microsoft, widely used for small businesses & Desktop applications. Its ease of use and powerful design tools gives even the non-professional programmer to use it easily.

FEATURES OF MS ACCESS 2003

→ Incorporate a wide range of data sources - Access 2003 supports a variety of data formats, including Extensible Markup Language (XML), OLE, Open Database Connectivity (ODBC), and Microsoft Windows SharePoint Services.

→Update properties automatically - Change a field property in a table and all the forms or reports that have controls bound to it can be updated automatically.

→Analyze your information in powerful ways - Drag controls onto your Access 2003 form to create a Microsoft PivotTable or Microsoft PivotChart view, or a spreadsheet.

→Easily back up your information - In Access 2003, save a copy of the database you're working on to another location.

CHAPTER 2

SYSTEM ANALYSIS

2.1 INTRODUCTION

Analysis is a detailed study of the various operations performed by the system and their relationships within and outside of the system. The simulator's objectives, functionalities, interactions and requirements to implement them were identified in this phase.

2.2 METHODOLOGY

Methodology followed in this project is **Spiral Model**. This model is an evolutionary software process model that couples the iterative nature of prototyping with the controlled and systematic aspects of Water Fall model. The Spiral model is divided into number of phases, also called as "task regions", which are given below.

i) Customer Communication

The tasks required to establish effective communication between developer and customer.

The proposed system has established communications through the tasks like conducting interviews, asking questionnaires to users.

ii) Planning

The tasks required to define resources, timelines, and other project related information. The system allocates resources, sets deadlines based on the user, management needs and technical needs to implement it.

iii) Risk Analysis

Tasks required to asses both technical and management risks. The proposed system is analyzed for following risks.

- Technical Risks – Memory and Time management in implementing dynamic routing and providing good performance and reliability to user.
- Management Risks – Since the proposed system is a new one, it has risk in maintaining the deadlines, handling marketing and sales of the product.

iv) Engineering

Tasks required to build one or more representations of the application.

The system's tasks like designing the structure of the user interface, properties, designing simulation process helps in producing representations of the system.

v) Construction and Release

The tasks required to construct, test, install, and provide user support.

The proposed system has tasks like configuring network, defining properties, validating the network supports in construction and in release.

vi) Customer Evaluation

The tasks required to obtain customer feedback based on evaluation of the software representations created during the engineering stage and implemented during the installation stage.

The tasks like usability test and user acceptance test in the system allows the customer to evaluate the routing environment.

2.3 STUDY OF EXISTING SYSTEM

The existing system NetSim 2.0 routing protocol simulation is able to create an environment for simulation but the simulation process and user interface used for simulation is hard to train & learn. It does not allow the user to re-configure the network dynamically (Dynamic routing), Once the network is configured, it cannot be changed. The existing system has few properties to define on network components. The alignment & validation of the component's properties are below the user interface design standards. The user interface design is not compatible with computer resolution changes.

The existing system requires lot of time to simulate a configured environment. The NetSim 2.0 was developed using Visual Basic 6.0 & MySQL as back end. It does not provide features like analyzing, IP configuration on network components. These disadvantages cause inconvenience to users and also requires a lot of time to generate an environment for simulation.

2.4 STUDY OF PROPOSED SYSTEM

"Simulation Of Routing Information Protocol" in effect aims at simulating a router environment and developing a user interface that let the users to build an environment for simulation which is easy to understand and also to use. It allows the environment for simulation to be configured dynamically over a simulation period (Dynamic routing).

The concept of object serialization in Java used to implement dynamic routing. The advanced properties of components allow the user to define and configure the network more efficiently. The proposed system has followed UID design guidelines for standardization and it is compatible with resolution changes.

2.4.1 FEATURES OF PROPOSED SYSTEM

→ The proposed system develops a routing environment that uses RIP for routing. It gives more flexibility to user by allowing them to configure and re-configure network efficiently.

→ The Simulated environment is analyzed and the output is produced efficiently to user through Graphs, Charts etc.

→ The concept of Online Frame Generation graph is introduced here, which will show the production of frames over a simulation period.

→ Since the proposed system is developed using Java, it is platform independent and is not vendor specific.

→ The Scope of the expandability of the system to client-server architecture and also to web is high.

2.5 FEASIBILITY ANALYSIS

Feasibility analysis is the measure of how beneficial or practical the development of Information System will be to the Organization. Once the scope of the problem has been identified and the initial analysis of the system has been completed, the feasibility of the project and the software to be developed is put under the test. This is done at this point to basically verify whether the software which is to be developed meets the scope and whether the project is feasible to do.

The proposed system has conducted three stages of feasibility analysis and they are described below.

2.5.1 Technical Feasibility

Technical Feasibility is the measure of practicality of a specific technical solution and the availability of technical resources and expertise.

The proposed system has been identified that it is technically feasible to do and the results of the feasibility study is described below.

- The Java language and its rich API have many features that support the implementation of the proposed system.
- For e.g., the object serialization in Java can be used to implement dynamic routing, which allows the re-configuration of network.
- The resources required by the system are minimal.
- The features of Java 5.0 & MS-Access 2003 can store and handle the required data and huge data efficiently.
- The Scope of the expandability of the proposed system is very high. Because the web and network based features of Java allows the system to expand to client-server architecture and also to web.

2.5.2 Operational Feasibility

Operational Feasibility asks if the system will work when it is developed and installed.

The proposed system is operationally feasible because it meets the requirements of the users. The Java technology let the simulator to meet its requirements. The proposed system has found encouraging from skilled users to non skilled users. The proposed system also follows standard UID guidelines. So it will work fine when it is developed and installed.

2.5.3 Economic Feasibility

Economic feasibility is the measure of the cost-effectiveness of the proposed system.

The concept of dynamic routing, online frame generation graph and many analyzing features of the proposed system are entirely new to NetSim. So the benefits of the system will outweigh the costs to be incurred during system development.

The system does not require any additional hardware facilities for development. In addition, the system can incorporate future enhancements like moving NetSim to two-tier architecture or to web. So the proposed system is economically feasible to implement.

2.5.4 Users of the System

The users are classified into two types, they are as follows.

- Administrator
- Users

The Administrator is a user who will create users, authenticate users, and assign roles. The users should be registered first to use NetSim. The registered users can directly create, configure environments for simulation by giving the login and password details.

CHAPTER 3

SYSTEM DESIGN AND DEVELOPMENT

3.1 INTRODUCTION

System design is a meaningful engineering representation of the system going to built. The design focuses data, architecture, interfaces and components. The design is an iterative process through which requirements are translated into "blueprint" or "prototype" for constructing the system.

3.2 ELEMENTS OF DESIGN

During the design of the proposed system the following areas are considered:

- What are the inputs required and the outputs produced?
- How should the data be organized?
- What will be the processes involved in the system?
- How should the screen look?

The steps carried out in the design phase of the proposed system are as follows:

- Modular Design
- Input and Output Design
- File Design
- Database Design
- Prototyping
- Usability test of Design

3.2.1 MODULAR DESIGN

A software system is always divided into several subsystems which make it easier to develop and perform tests on the whole system. The subsystems are known as the modules and the process of dividing an entire system into subsystems is known as Decomposition.

The modules identified for the proposed **"Simulation Of Routing Information Protocol"** are as below:

- Create environment
- Configure & validate environment
- Re-Configure environment
- Simulating the environment
- Analyze environment
- Save & Retrieve and Change environment

Module Description

i) Create Environment

The Main functionalities this module is

- Drag and Drop Components
- Component connections

Drag and Drop Components:

The components like CPE, Router are dragged from the component list on the window and dropped on the Environment Builder (A Container). The components positions can be changed and placed. The user can use at most 20 routers and 50 CPEs to configure a routing environment.

Component Connections:

The placed components are connected using physical mediums (Links).

Two types of links are used for connection.

- DSL Type – To connect CPEs with Routers.
- RJ 45 Type – To connect Routers with Routers

The CPEs can be connected with Routers but not directly with other CPEs. By clicking any of two components consecutively we can link them.

ii) Configuring Environment

This module configures network by defining the properties to its components. The following properties are defined here.

- Traffic Generator properties
- Router properties
- Link properties
- Simulation & Metrics period Details

Traffic Generator Properties:

Traffic generator is defined on the CPEs, which transmits packets in the network. The properties defined are,

→ IP Address

→ Inter Arrival Time – Time delay to generate a new packet

→ Destination – The CPE that receives the transmitted packet

→ Start Time & End time – Denotes the packet generation period.

Users can select these inputs from combo boxes & can give inputs to Text Fields.

Router Properties:

The Router will connect CPEs in the network and forms a WAN. It has properties like

→ IP Address – The unique address of a router port. A typical router has 8 ports or interfaces in it. These ports connect CPEs in the network.

→ Buffer Size - The buffer limit of the router's buffer which holds data or packets for routing.

→ Switching Technique – These are the techniques used to select a packet for transmission. The techniques used are FIFO and priority scheduling.

Link Properties:

The Link determines Data Transmission Rate & Error Generation Rate.

→ Data Transmission Rate – It is the rate at which data transmitted on the network.

→ Error Rate – It is the rate at which error packets are generated.

The data Rate will differ based on the physical medium used for connection.

Metrics Period Details:

The performance metrics are the output of the configured network. The Metrics time Details will have metrics start time and metrics end time values. The scenarios in between this metric time will only be considered for dynamic routing simulation.

iii) Re-Configure Environment

The concept of dynamic routing allows the user to change network settings or configuration over the simulation period. Different environments are created here for simulation through successive re-configurations of the initial environment. All these environments details are linked to business logic part for simulation.

iv) Simulating the Router Environment

The generated environment for simulation is connected to Business Logic part of the simulation. The properties of the components are transmitted to logic part. Based on the defined properties, packets are generated and routing tables are constructed for routers using Router Information Protocol. The router table contains three fields namely destination address, next hop, hop count. The environment is processed and performance metrics of the network will be returned.

v) Analyze Environment

The configured network's metrics and performance will be analyzed through Graphs and charts. The performance metrics include reliability, transmission time, number of packets generated, number of packets has errors and collided packets. The online Frame generation graph shows the generation of frames with respect to time. It will also analyze the link by link performance of the configured environment.

vi) Save & Retrieve and Change Environment

The simulated environment is saved using database and object serialization. The concept of File association is used and the saved files are associated with NetSim. This module also allows the simulated environment to be changed in between static and dynamic routing.

3.2.2 Input Design

Input design is the process of converting user-originated inputs to computer-based format. The proposed system's input data are collected and similar data are organized into groups through objects. For e.g., the router input data are organized into router objects. Validations are made for each and every data entered in the screens for data accuracy.

The entire project is implemented using Java. On each click of the controls used the respective screens are opened. Each screen has Textboxes, Label and Buttons, Combo boxes. All the screens are interactive with the user in accepting and displaying data requested by the user. The designs are shown in Appendix 2 for reference.

3.2.3 Output Design

Computer output is the most important and direct source of information to the user.

The types of output used in this system are internal output, interactive output, and data items. The analyze part in the simulator is produces output to the user. The graphs and charts are efficiently designed to show the status of the simulation process. The output screens are shown in Appendix 3.

3.2.4 File Design

The objectives of the file design are to provide effective auxiliary storage and to contribute to the overall efficiency of the proposed system. The files are the key source of information in the system. The concept of dynamic routing is achieved through Object Serialization, which stores objects state into files. The serialized file contains different objects states (CPEs, Routers) in a binary format. The system requires file organization considerations and decided to use **Random Access File** for accessing its contents.

3.2.5 Database Design

A database is a collection of inter-related data stored with minimum redundancy to serve users quickly and efficiently. The general objective of database design is to make the data access easy, inexpensive and flexible to the user.

The details about the relevant data for the system are first identified. According to their relationship, tables are designed by defining the data type for each data item and the table is decided. The tables used in the proposed system are shown in Appendix 1 for reference.

3.2.6 Prototyping

A Blue print or a model of the system is developed to understand the system functionalities. The identified behavior of the prototype is compared with user requirements and differences are identified. The identified errors are discussed and corrected before next prototype release.

CHAPTER 4

SYSTEM TESTING AND IMPLEMENTATION

4.1 SYSTEM TESTING

Testing is a critical element of software quality and assurance and represents the ultimate review of specification design and coding. The feedback received from these tests can be used for further enhancement of the system under consideration.

The proposed system uses user interface standard procedures to test the user interface of the system. Test cases are generated for each Traffic generator, router inputs, simulation process, etc. These test cases will cover every possibility which could result in both positive and negative results.

The main types of tests carried out are:

- Unit Test
- Integration Test
- System Test

4.1.1 Unit Testing

Module or Unit Testing is the process of testing all the program units that make up a system. Unit testing focuses to uncover all the errors made logically and while coding in the module.

Each screen in routing environment was considered as unit and tested separately as a unit. Initially the flow of control of the screens and data through that screen is checked. The result is stored in the test plan.

In a screen, each control was further tested in unit testing. The process was done in all the screens of the system. After rectifying the errors, the testing procedure is repeated with same test cases to ensure this hasn't produced new errors.

For e.g., the configure environment module was unit tested by checking whether the configured traffic generator values, router values are validated correctly, they saved into objects and these values will be passed to logic part for simulation.

Test Cases for the Login Screen:-

Sl.No	Test Case	Expected Result	Observed Result	Status
1	User Name : Admin Password : simulator	Login successful	Login successful	Pass
2	User Name : test44 Password : net	Login successful	Login Successful	Pass
3	User Name : Xyz, Password : abc	Invalid Login	Invalid Login	Pass

4.1.2 Integration Testing

Integration testing tests the process of integrating the various modules to form the completed system. Integration starts with a set of units each individually tested in isolation and ends when the entire application has been built.

In this project top-down integration testing is followed. Modules were linked to the main menu in a sequence as required in the real time operating mode of the system. Menu items were created as and when required for the integration. The same procedure is followed in other modules in the same level at first. Then the upper level is taken into action. A change of data made in one screen should have reflected in all other screens.

This process was continued from the page level to module level, finally to the system level. In the final stage, the whole system is taken together and tested for integration. A change in one place should be reflected through out the system. The projects each and every module were combined and the program is tested as the whole. Microsoft's Visual Source Safe 6.0 is used for Integration.

4.1.3 System Testing

System testing is actually a serious of different tests, whose primary purpose is to fully exercise the computer-based system. This helps in verifying that all the system elements have been properly integrated and perform the allocated functions. The proposed system has used following system tests.

4.1.3.1 Security Testing

Security testing is important in system testing. The system in no way shall be accessible to unauthorized users. Testing was done to ensure that a user with respective rights can only view the simulated environments and metrics presented by the system. If users try to perform something beyond his assigned rights corresponding messages should be displayed.

4.1.3.2 Load Testing and Performance Testing

Load Testing executes a system in a manner that demands environment to be simulated in abnormal quantity or volume. The project was load tested with 50 CPEs, 20 routers and with by defining maximum limits on components properties. It was done in the company and in user premises to understand the reliability and performance of the proposed system.

4.1.4 Regression Testing

The regression testing is next level of testing. This testing involves adding new features to the existing system and then testing them. Addition of new features would bring many new errors.

The concept of dynamic routing is new to NetSim and it was regression tested to check whether it affects other parts of the NetSim. This testing was conducted at the final level after completing all other tests.

4.1.5 Output Testing

The outputs generated or displayed (property screens, output screens etc.) by the system were tested along with the users about the correctness and format of the output required by them.

4.1.6 Usability Testing

Usability testing system was done by the user and it is the key factor of success. The system is tested for usability by constantly keeping in touch with the prospective system users at time of developing and making changes whatever required. The input, output screen designs and user interfaces are tested for usability.

4.2 SYSTEM IMPLEMENTATION

System Implementation is the part of the software engineering life cycle, where, the design artifacts are converted to a working application. Coding is done in this stage using Java programming language, which would develop user interface and simulates the environment in best way. The design is coded into a working application, it has verified, validated and tested in detail. The product is tested in the user environment.

The Swing concept in Java allows us to build an effective UID that is easy to use and easy to learn. The proposed system is implemented using the core Java concepts, Serialization and with JFC Swing. The object oriented concepts of Java lets to design the components like CPEs and Routers. The concept of object serialization saves the object state into files. It is used in dynamic routing, which allows the network to be re-configured at run time.

4.2.1 SYSTEM VERIFICATION

System Verification answers the question "Am I building the product right?" It includes the review of interim work steps and interim deliverables during a project to ensure they are acceptable.

Verification was made on the proposed system to check whether the system is consistent, adheres to standards, uses reliable techniques and performs the selected functions in the correct manner. In data access, it verifies whether the right data is being accessed and processed.

For e.g., the Router allows up to eight components connected to it. It should be verified by connecting components more than eight. In this project, verification is done during the development itself.

4.2.2 SYSTEM VALIDATION

Validation answers the question "Am I building the right product?" This checks whether the system is moving towards the actual intended product that was agreed upon in the beginning.

The Validation of the proposed system determines that the system complies with the requirements and performs simulation for the routing environment through RIP, for which it is intended and it also meets the organization's goals and user needs.

Functional validation was done in the proposed system to check whether each of the functions is done correctly as expected in every page. Each control in a Screen is designed to do some function. These functions are checked against the requirements stated for them. For e.g., clicking "Simulate" button should connect to the business logic and the values of the configured environment will be transferred. This level of validation can continue to all the controls in the system.

CHAPTER 5

CONCLUSION AND FUTURE ENHANCEMENTS

5.1 CONCLUSION

The **"Simulation Of Routing Information Protocol"** simulates a routing environment using routing protocol RIP, which is commonly used and simple routing protocol. The user interface was developed using UID design guidelines and standards. It also reflects the entire capabilities of the routing environment that has to be simulated. The system has met the needs of technically skilled persons and also unskilled normal users. It makes the Network Simulator (NetSim) easy to use and easy to learn and train users.

The developed system supports an entirely new concept called dynamic routing. It allows environment for simulation to be changed and re-configured. The advanced performance metrics, online frame generation graph, different types of charts are unique features of this system. The system was tested and implemented in customer workplaces and the performance was found to be good.

5.2 SCOPE FOR FUTHER ENCHANCEMENTS

The NetSim is a stand alone application. So, the developed User Interface for NetSim is for stand alone computers. The system can be still improved by using different routing protocols for simulation. The re-configuration feature of dynamic routing can be implemented to other network protocols.

The system can be extended in the future by making NetSim as a centralized application, so that the Business Logic part that perform simulation will reside on the server and user interface will reside on client and there will be request and response operation between client and server. The J2EE can be included in this project to make NetSim as centralized software. The system is designed such that it can be upgraded without much modification.

APPENDIX 1

TABLES

1.1 Table Name : Experiment Details

Description : This table describes about the details of the user and the simulated experiment.

Column Name	Data Type	Length
Exp No	Number	10
User Name	Text	25
Password	Text	15
Comp Identification	Text	2

1.2 Table Name : CPE Details

Description : This table describes about the CPE details and Traffic generator properties.

Column Name	Data Type	Length
Exp No	Text	10
CPE_Id	Number	2
Destination	Number	2
Start Time	Number	3
End Time	Number	3
Inter Arrival Time	Number	10
X Axis	Number	4
Y Axis	Number	4

1.3 Table Name : Router Details

Description : This table describes about the details of the routers that are present in the network

Column Name	Data Type	Length
Exp No	Number	10
Router ID	Number	2
Port No	Number	2
Connected Comp	Number	2
Buffer Size	Number	4
Switching Technique	Number	2
X Axis	Number	4
Y Axis	Number	4

1.4 Table Name: Metrics Details

Description : This table describes about the details of the output metrics of the configured network.

Column Name	Data Type	Length
Exp No	Number	10
Simulation Time	Number	30
Throughput	Number	20
Gen Packets	Number	20
Packets Received	Number	20
Used Links	Number	4
Packets Errored	Number	20
Start Time	Number	4

APPENDIX 2

DATAFLOW AND UML DIAGRAMS

LEVEL 0 DFD

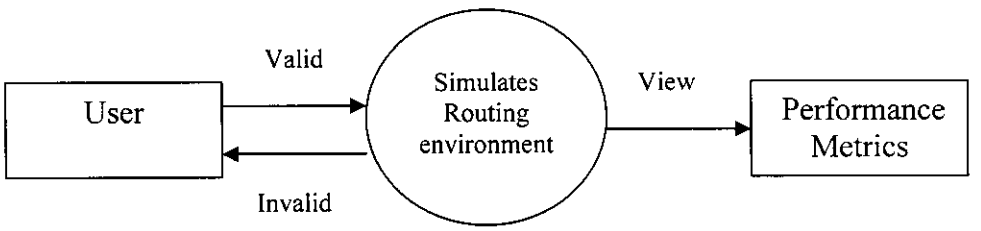

Fig. 2.1 Context Diagram

LEVEL 1 DFD

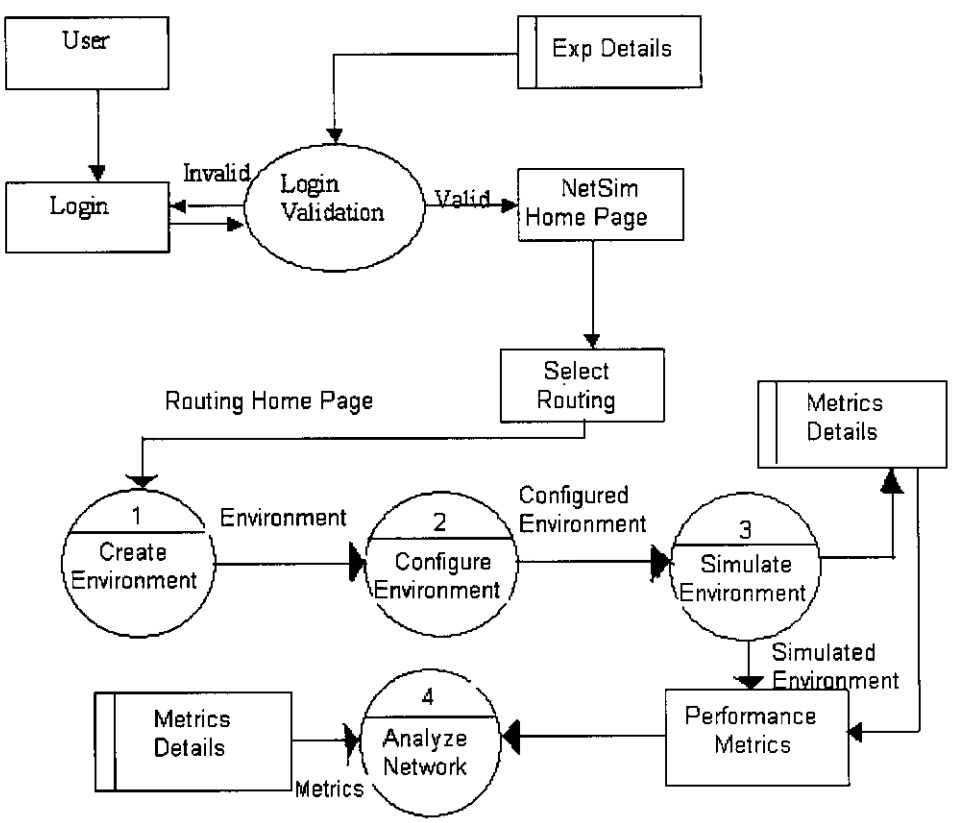

Fig. 2.2 Level 1 Data Flow Diagram

LEVEL 2 DFD

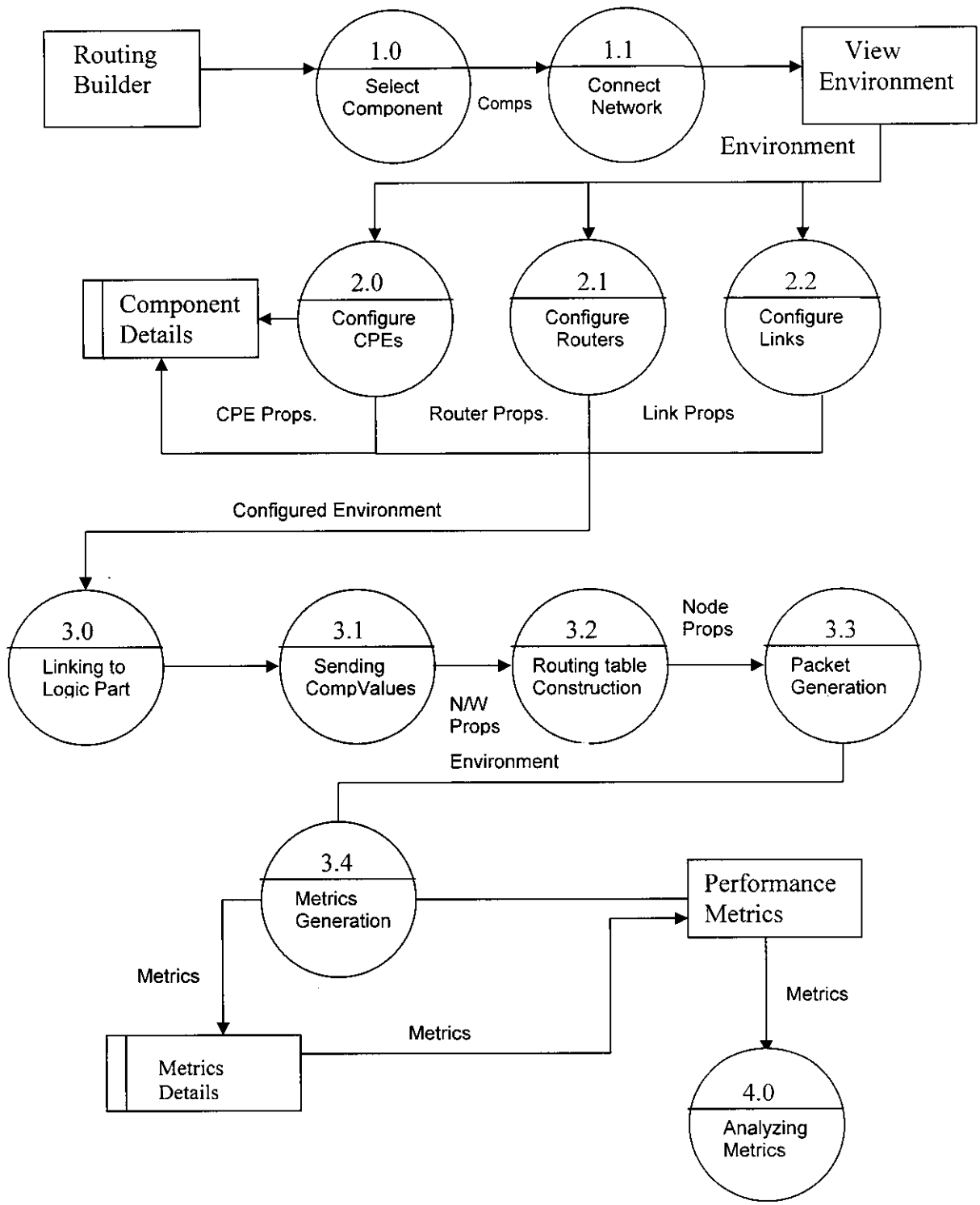

Fig. 2.3 Level 2 Data Flow Diagram

USE-CASE DIAGRAM

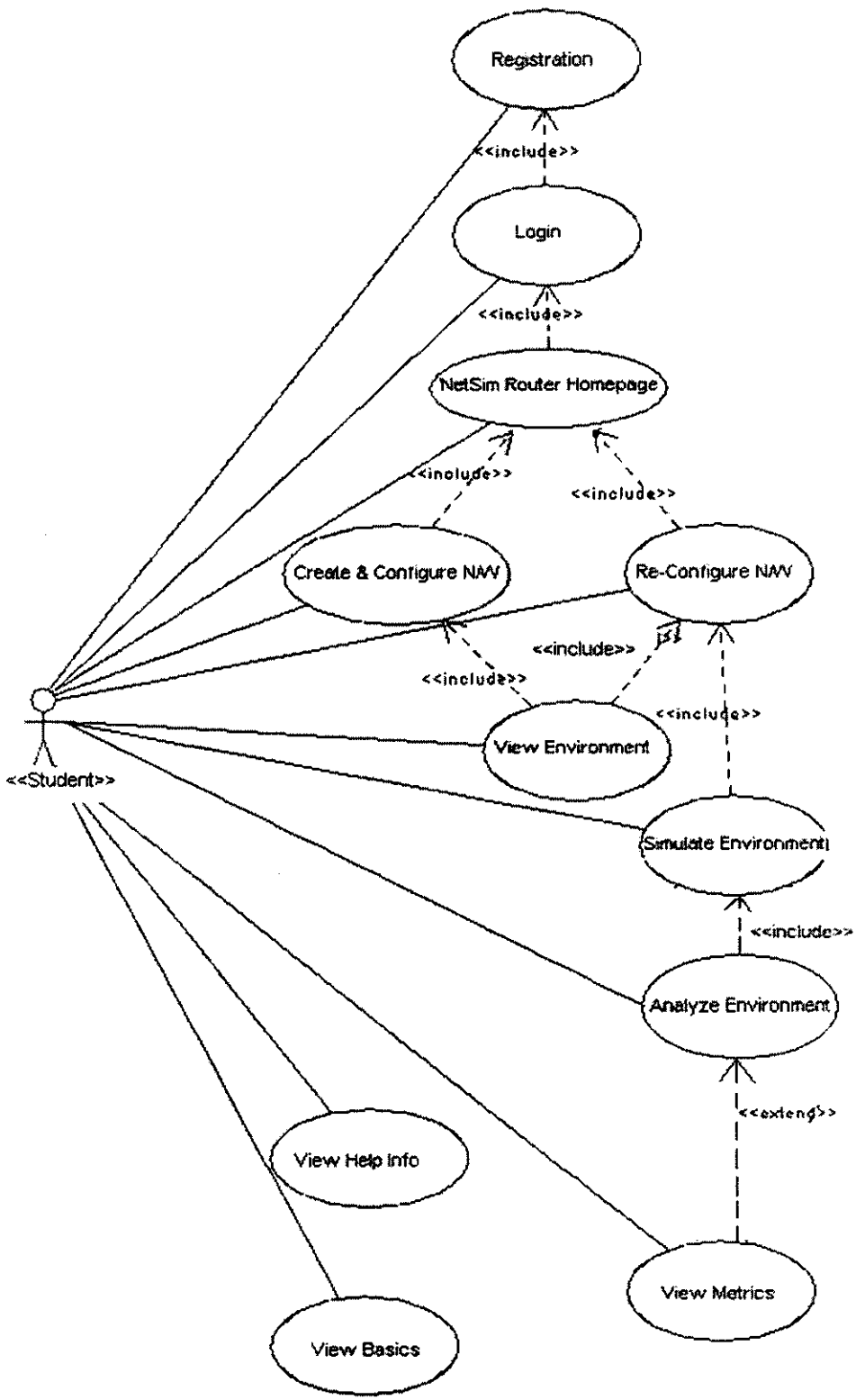

Fig 2.4 Use Case Diagram

ACTIVITY DIAGRAM

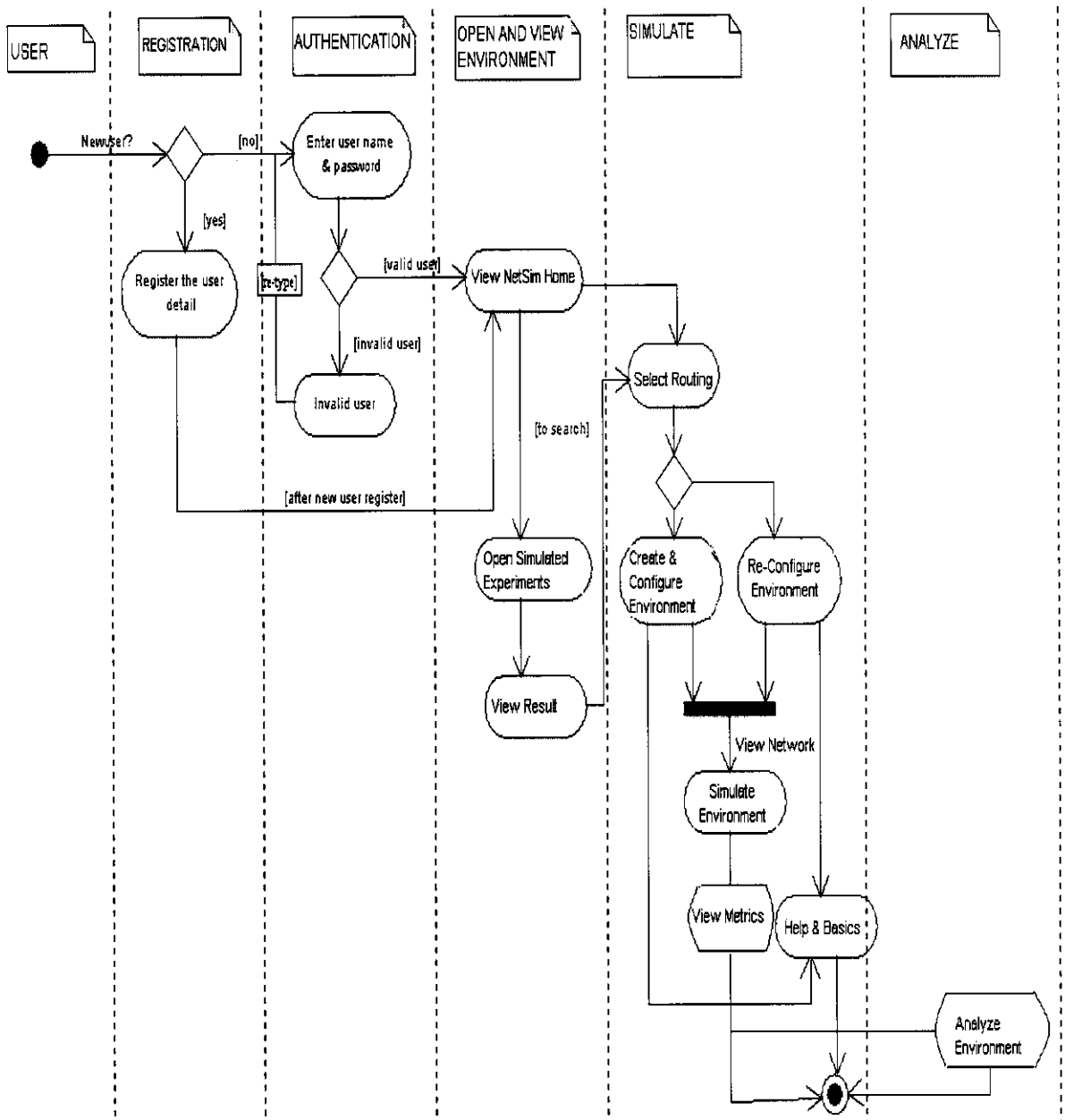

Fig. 2.5 Activity Diagram

APPENDIX 3

FORMS

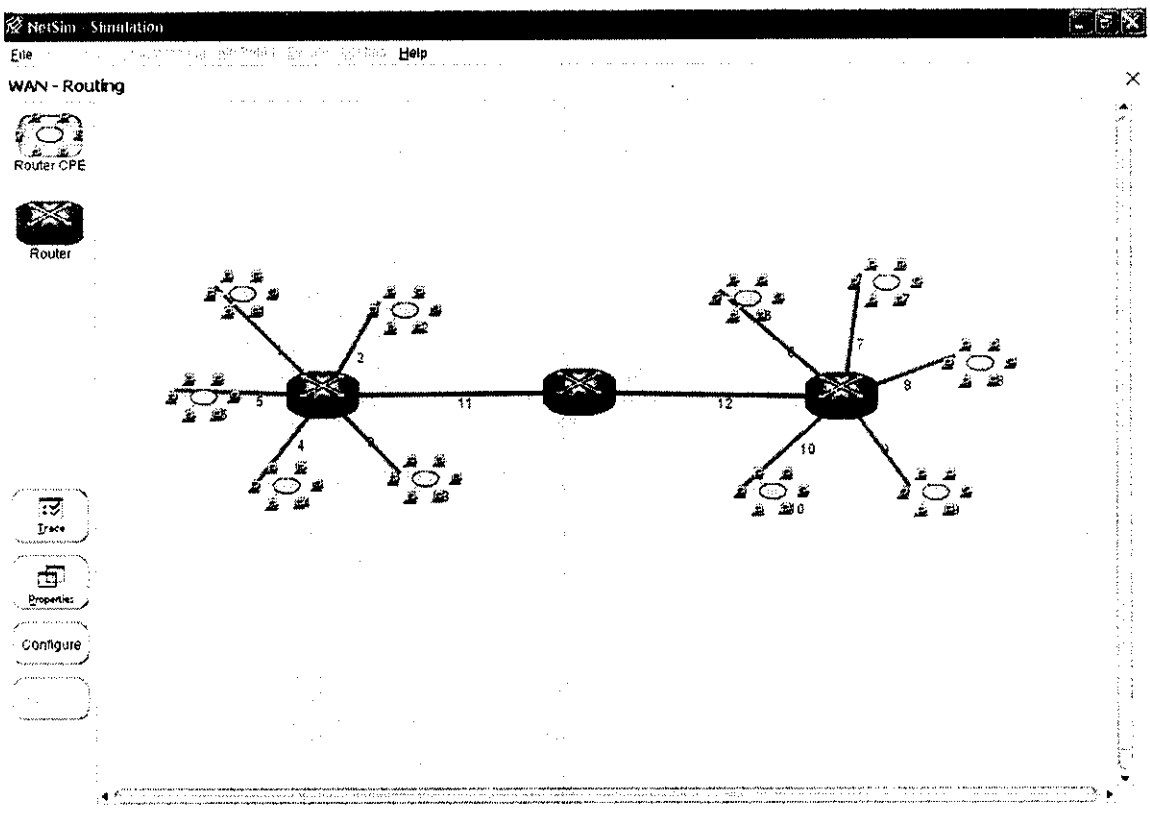

Fig 3.1 Creating Environment for Routing

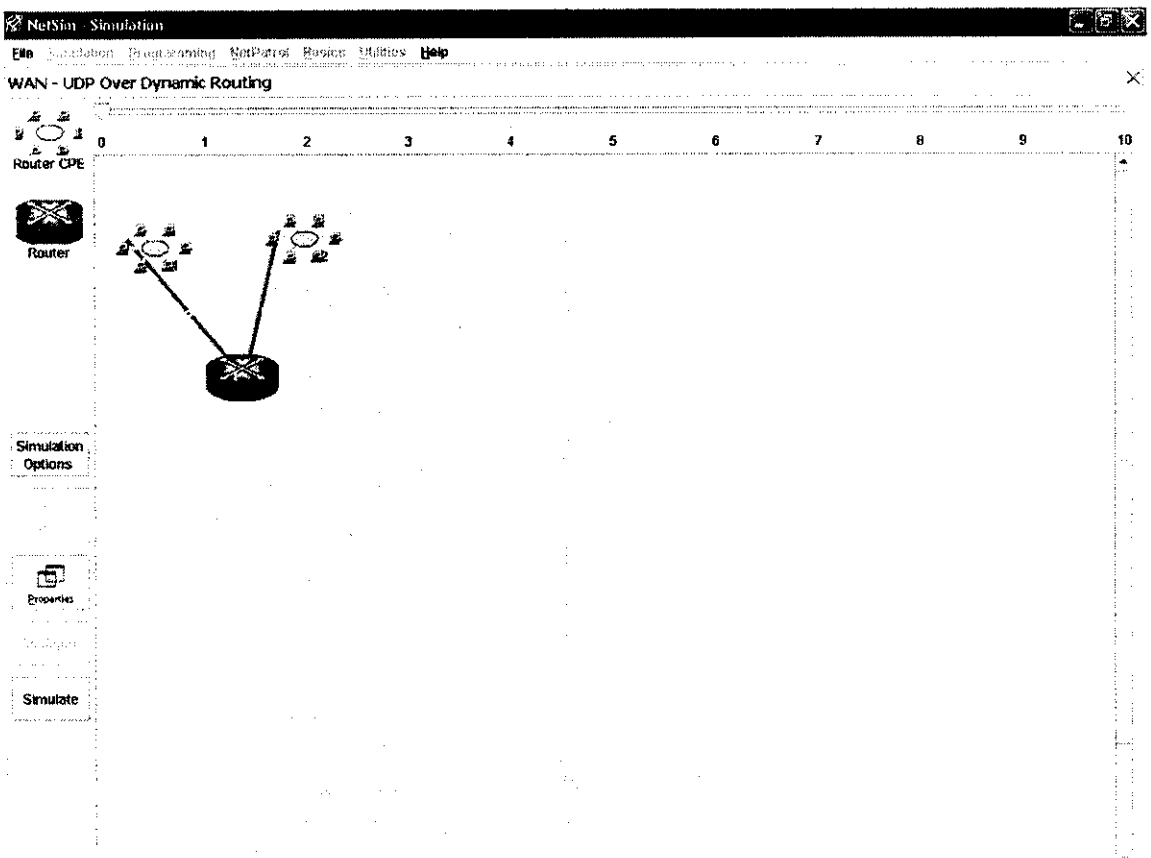

Fig. 3.2 Creating Environment for Dynamic Routing

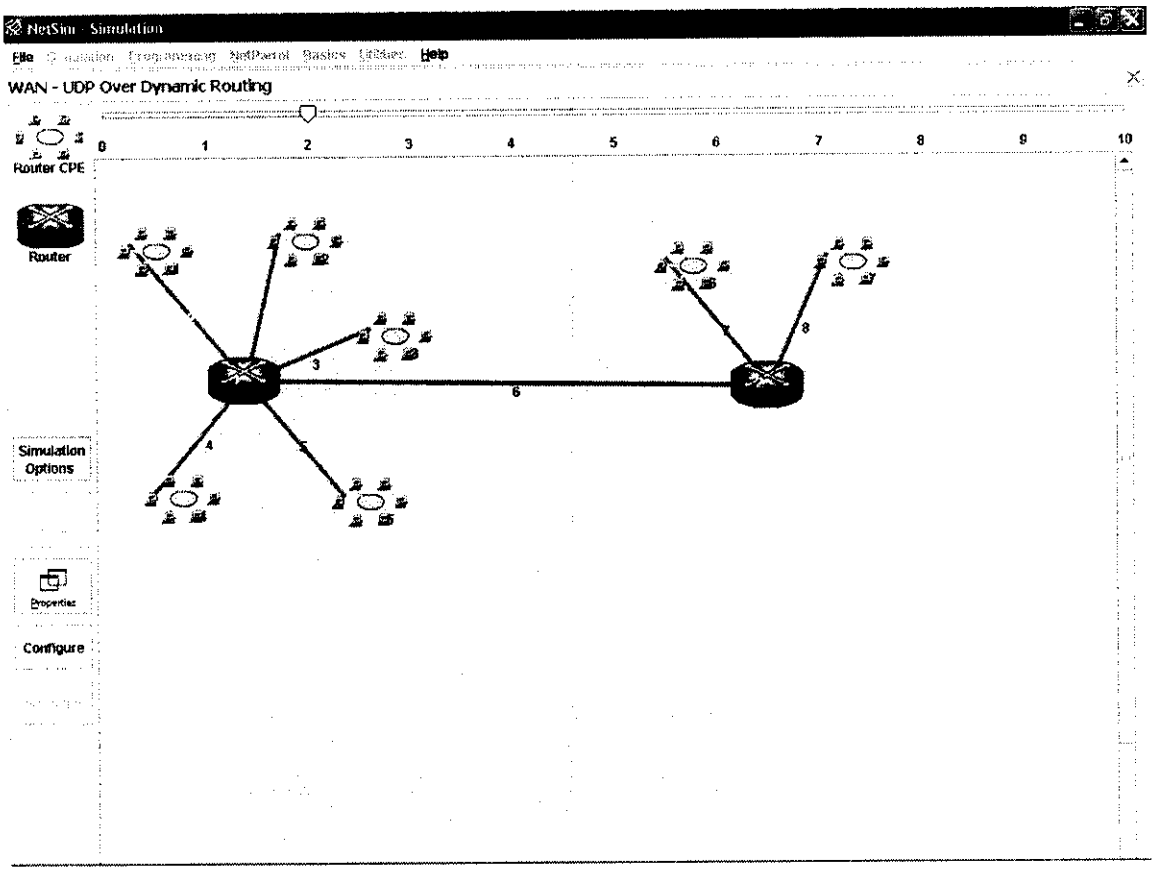

Fig. 3.2.1 Creating Environment for Dynamic Routing

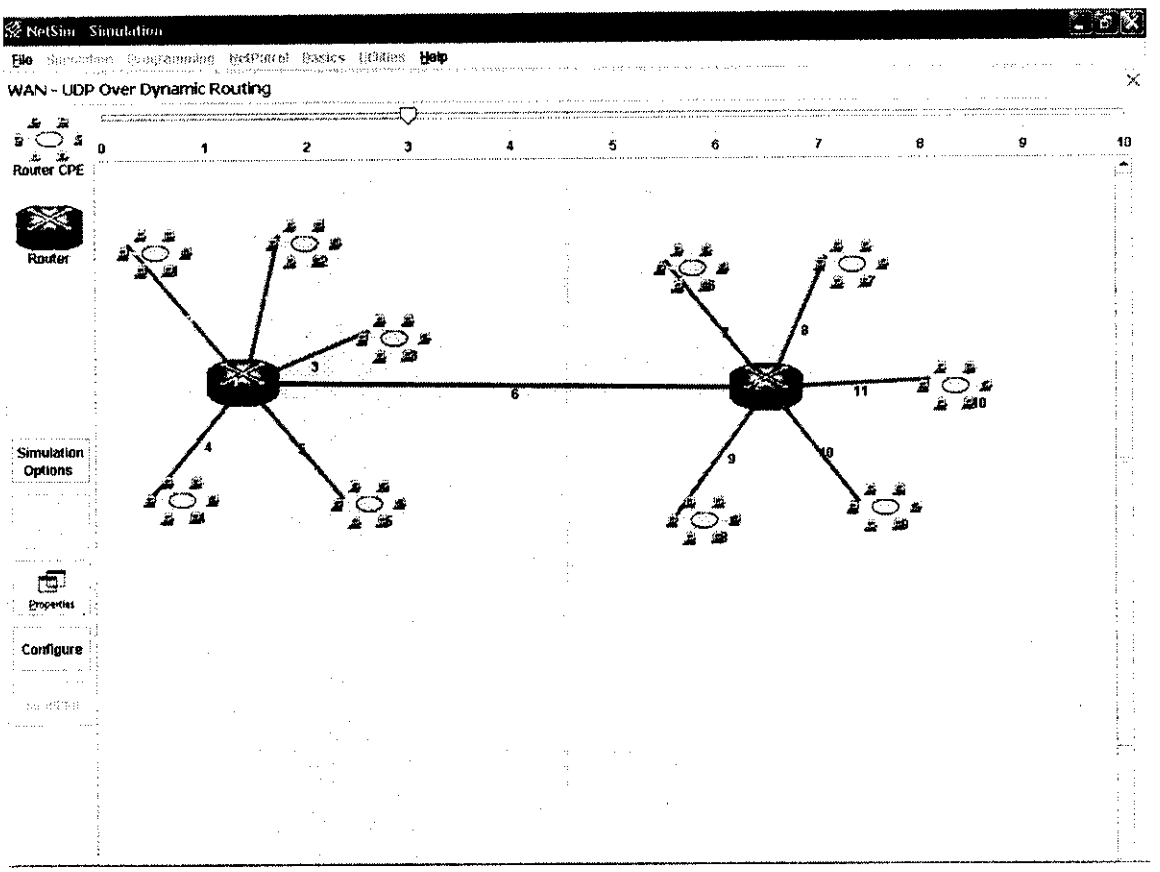

Fig. 3.2.2 Creating Environment for Dynamic Routing

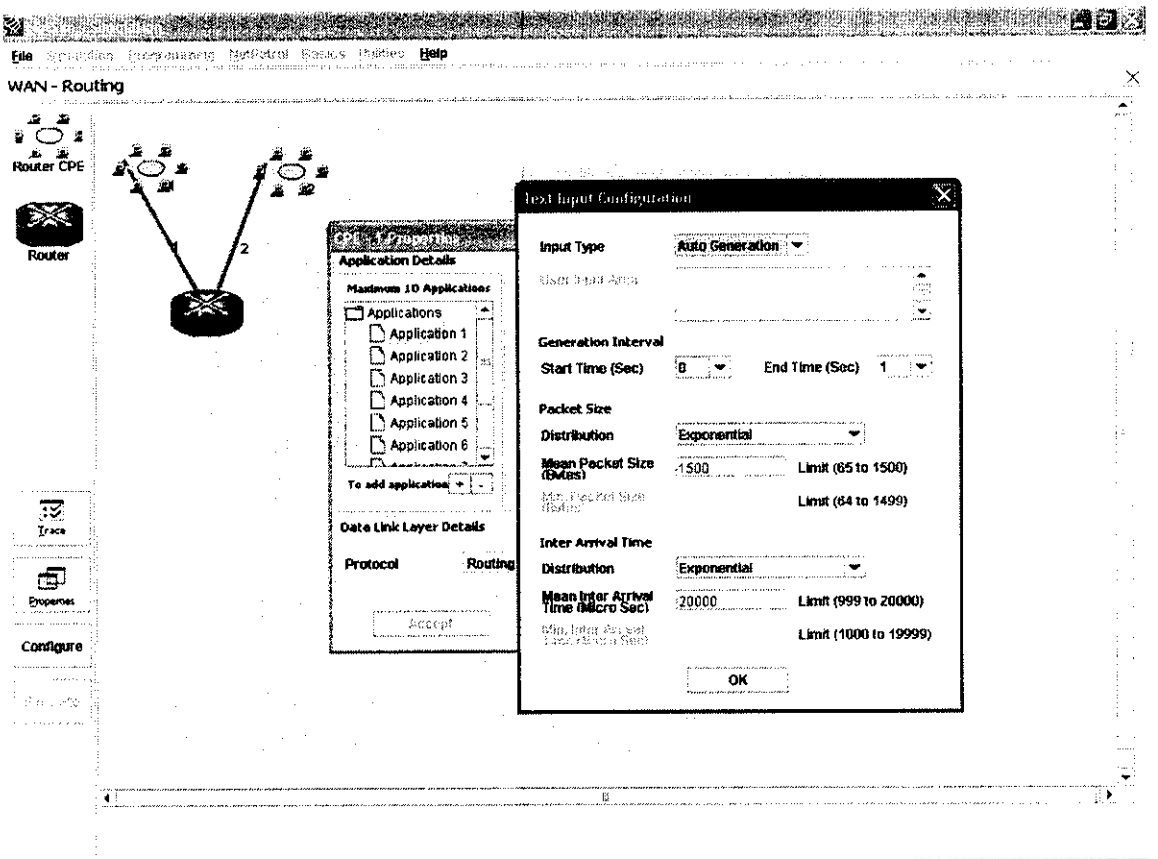

Fig. 3.3 Traffic Generator Properties

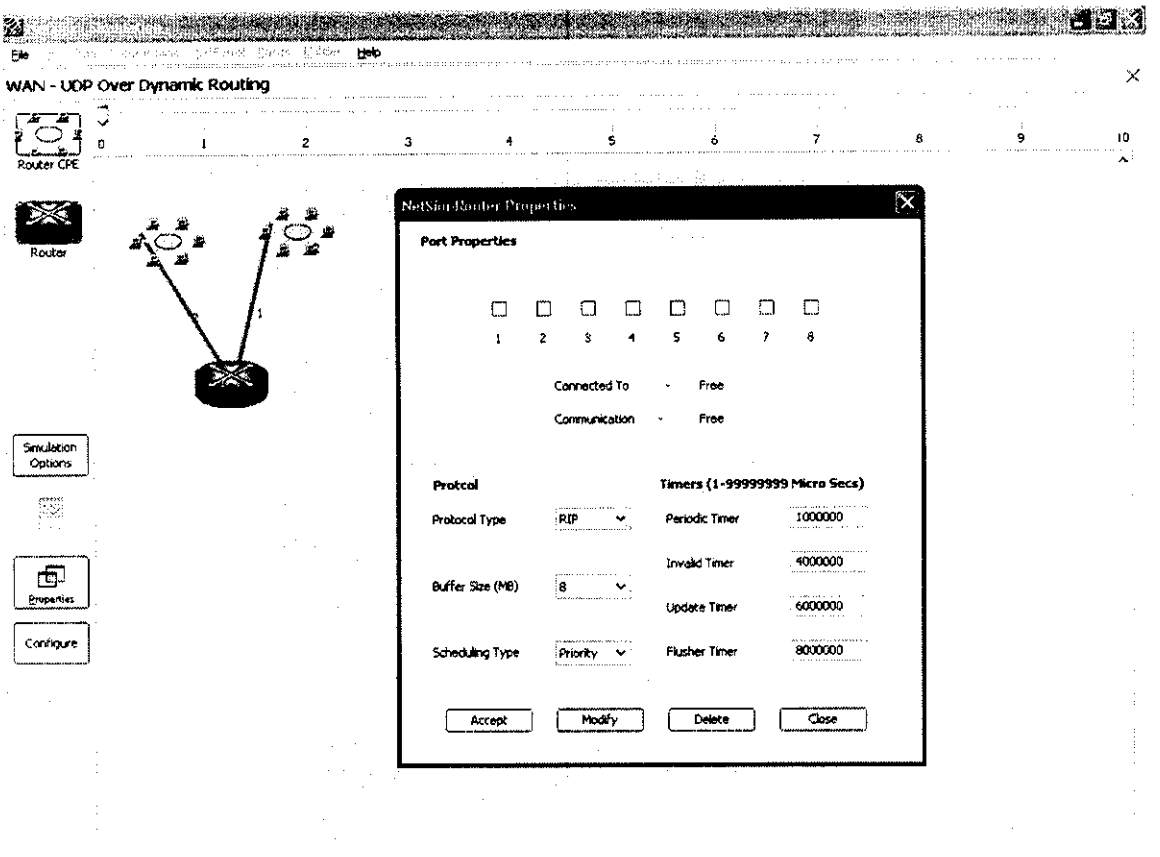

Fig. 3.4 Router Properties

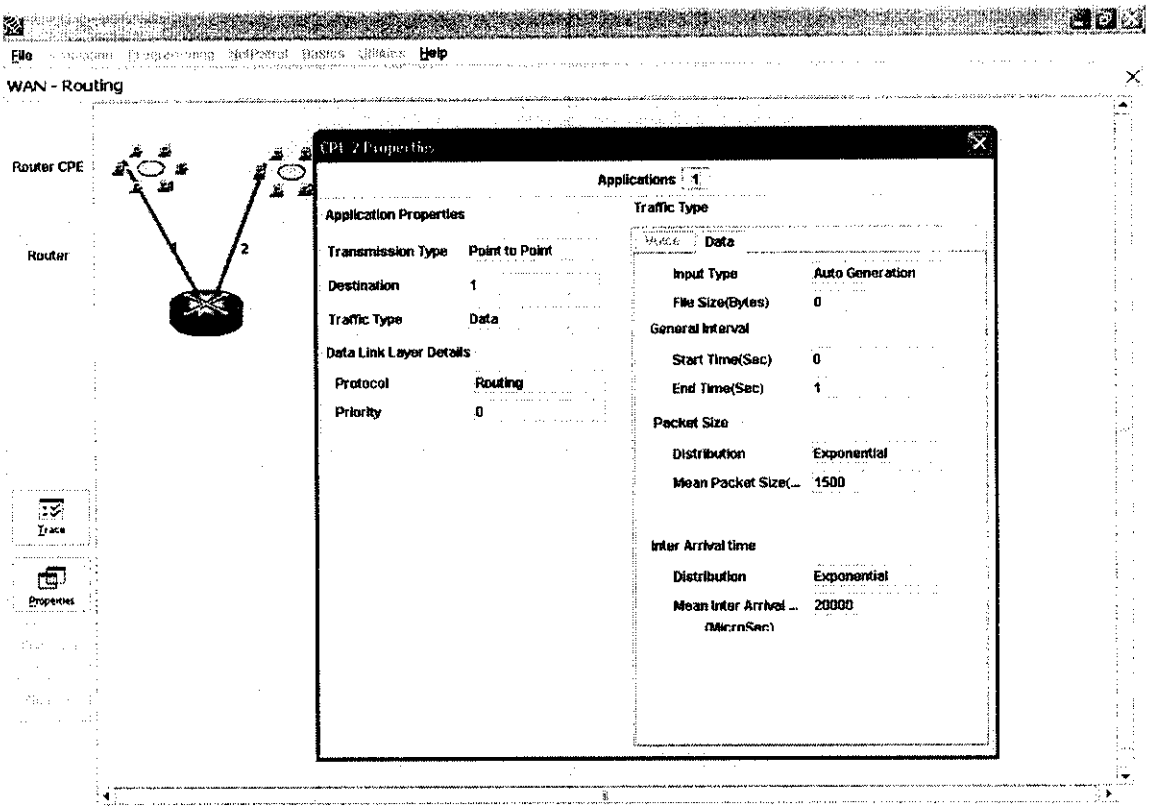

Fig. 3.5 Viewing Assigned Properties

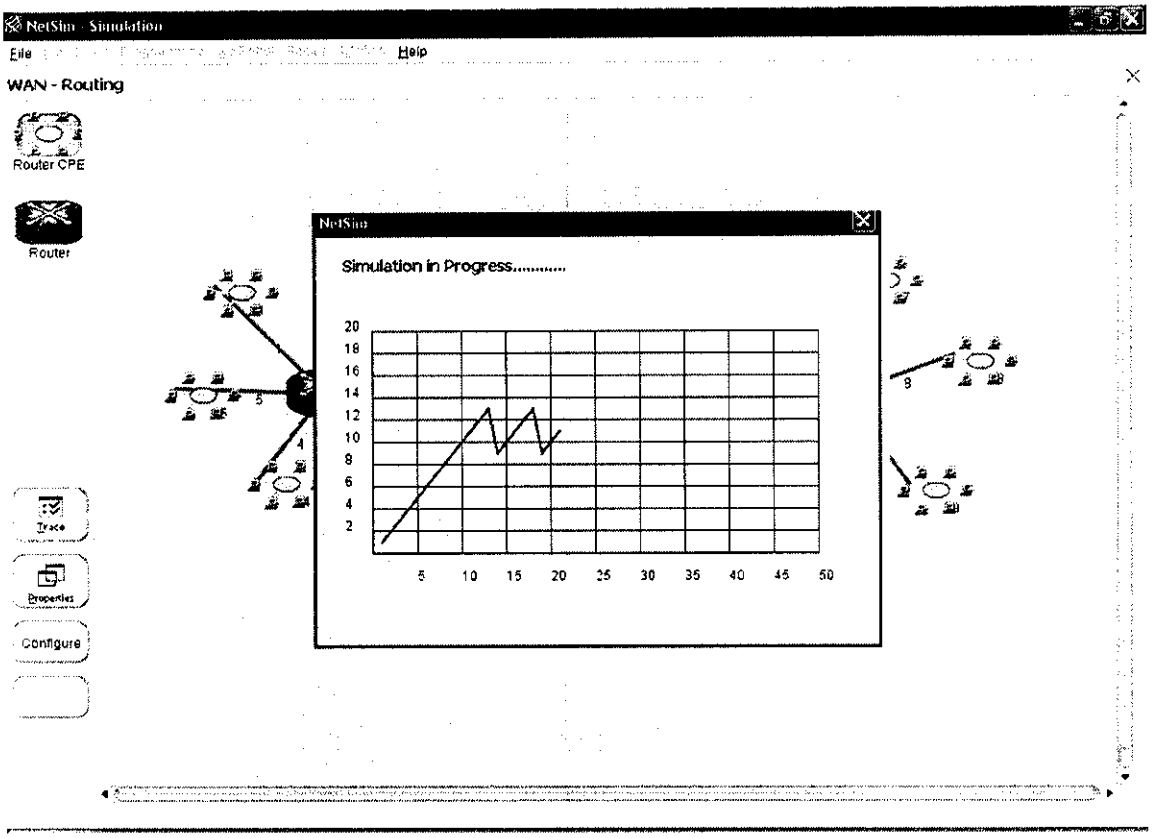

Fig. 3.6 Simulating Environment

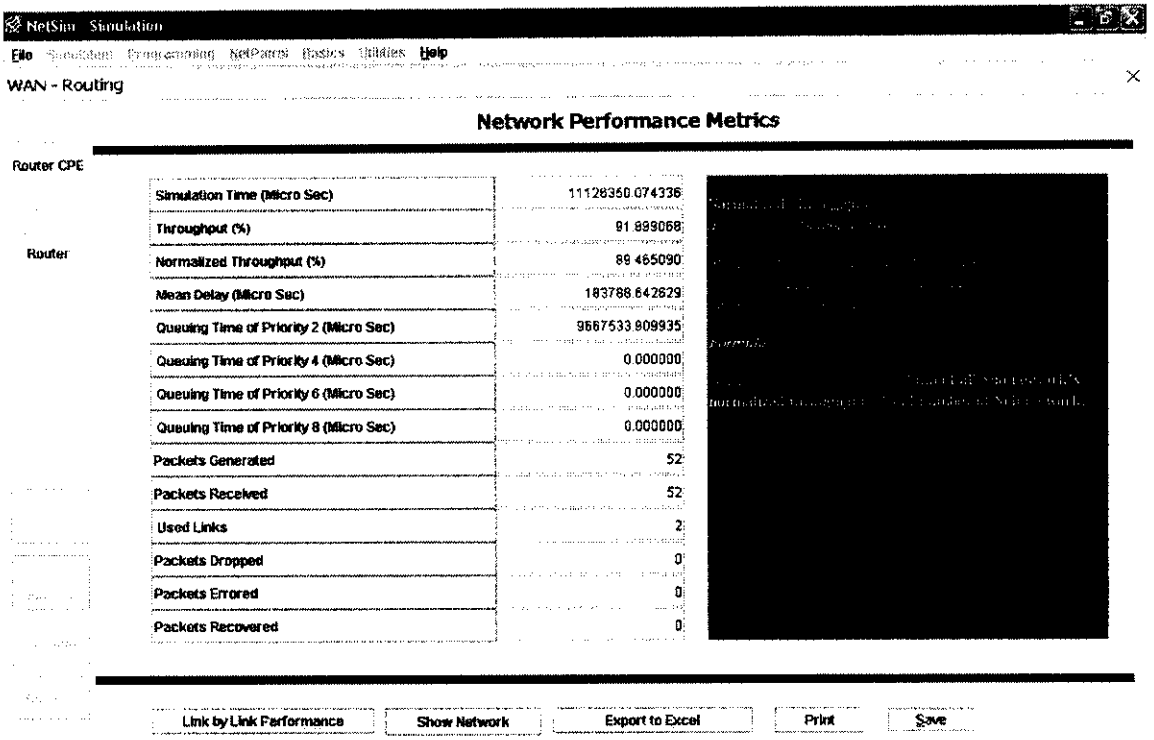

Fig. 3.7 Performance Metrics of the Simulated Environment

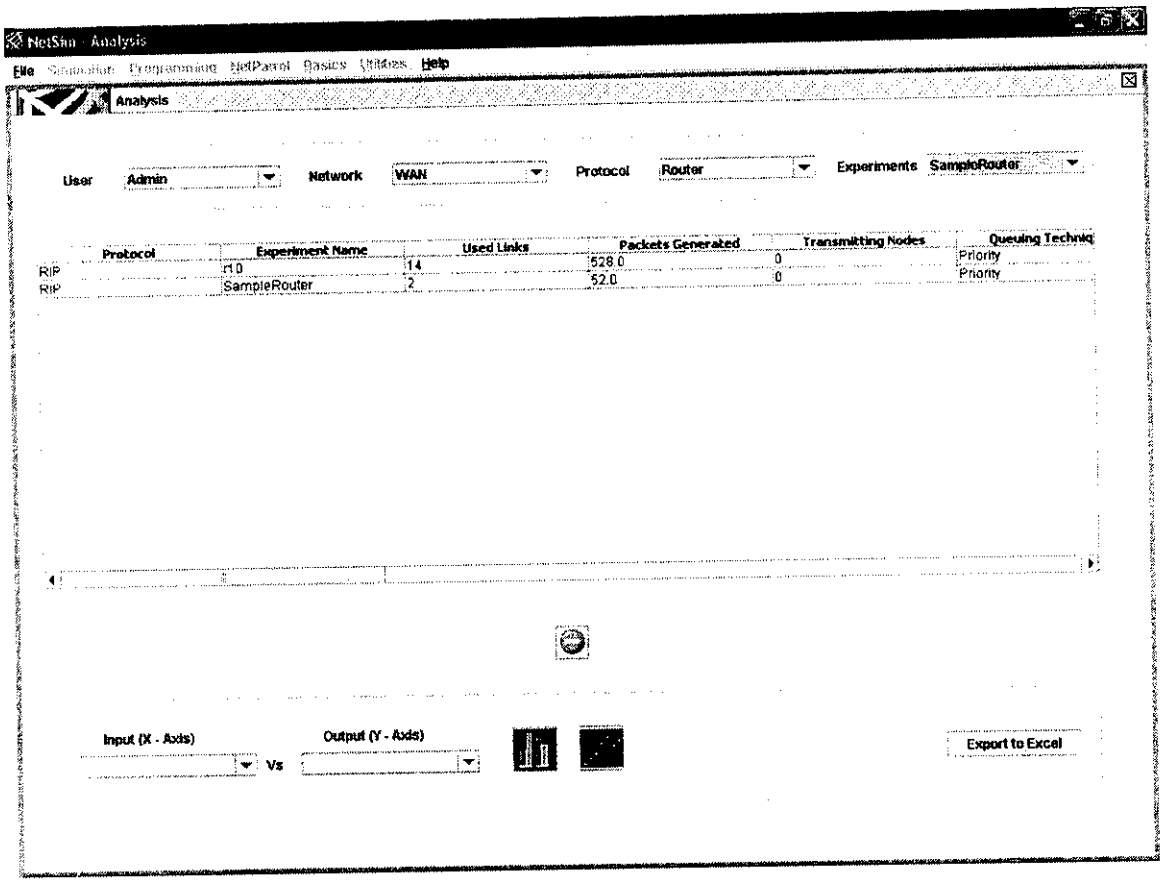

Fig. 3.8 Analyzing Environments

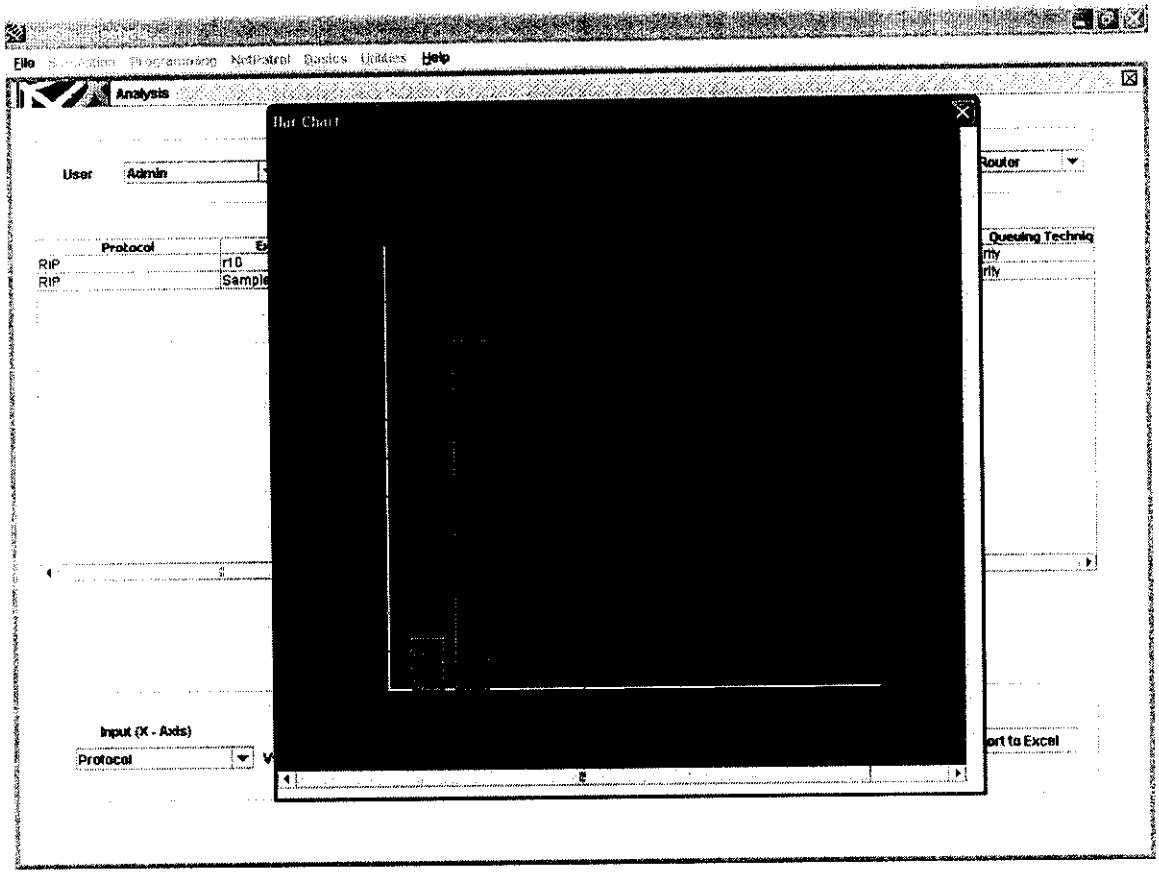

Fig. 3.8.1 Analyzing Environments

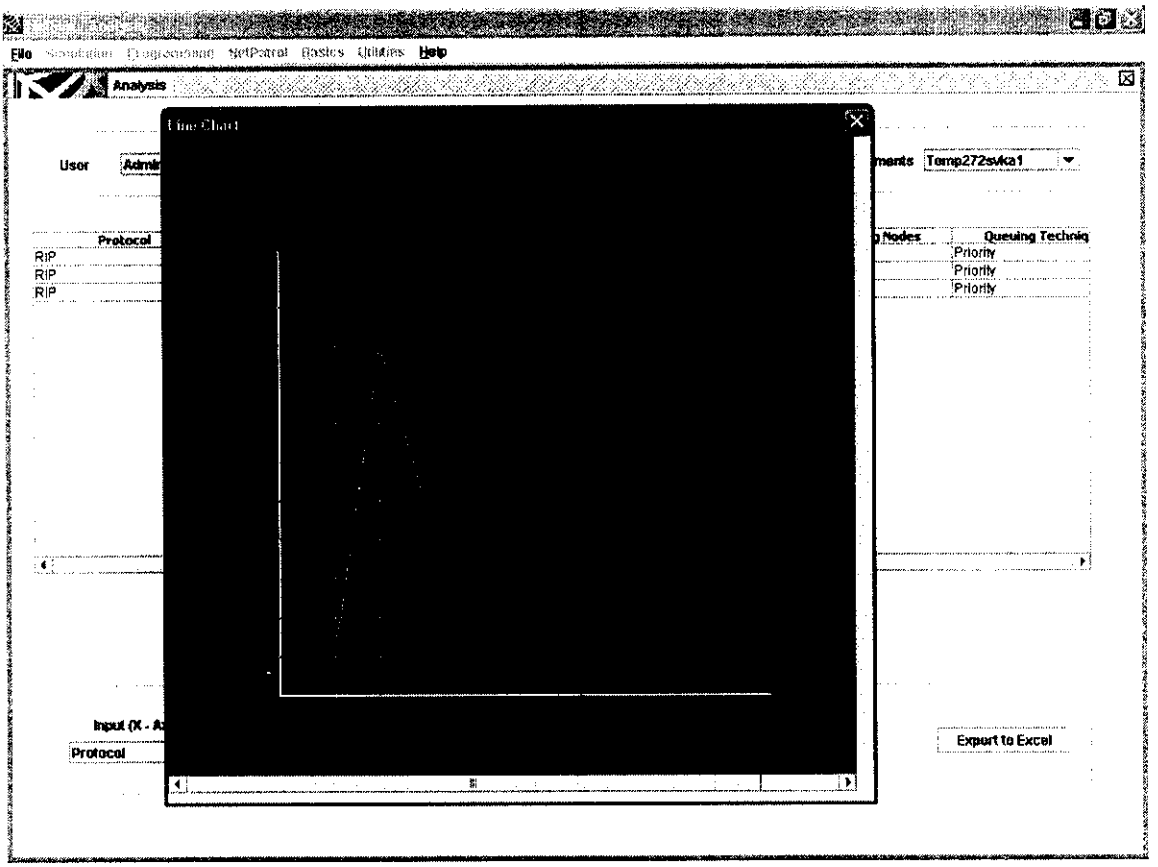

Fig. 3.8.2 Analyzing Environments

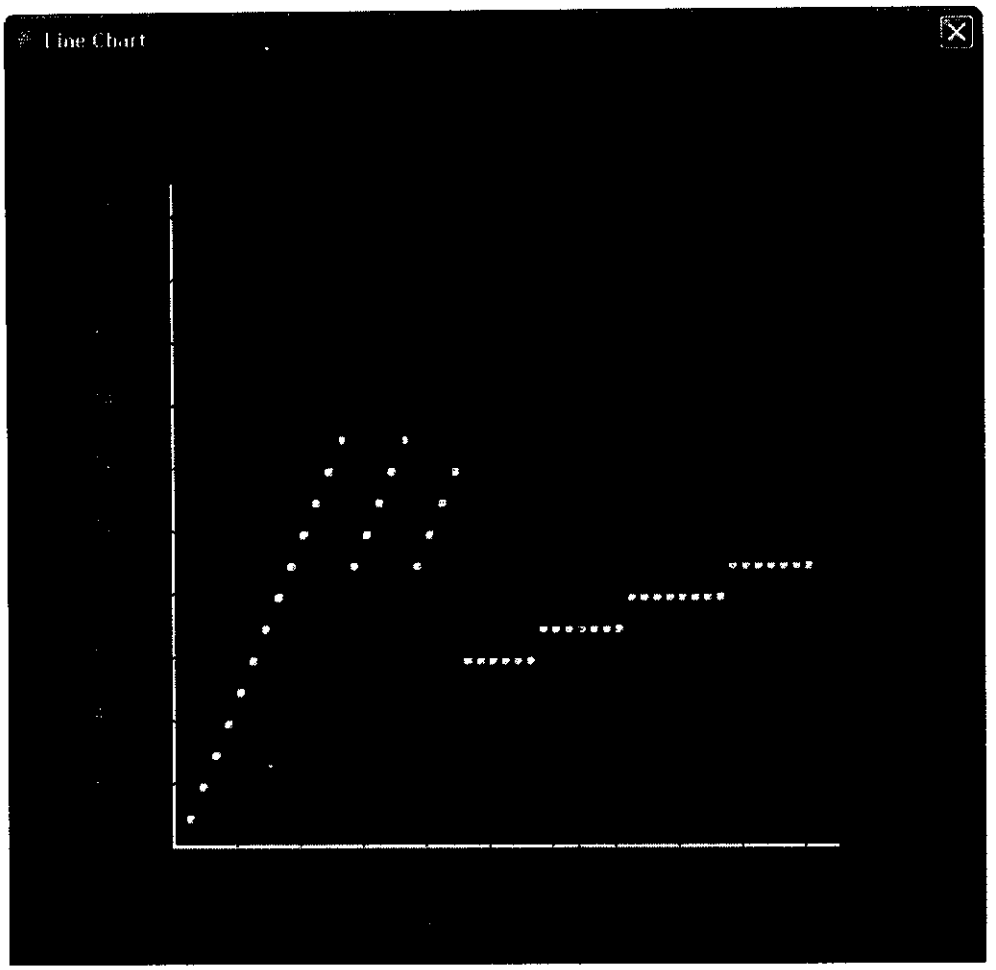

Fig 3.8.3 Analyzing Environments

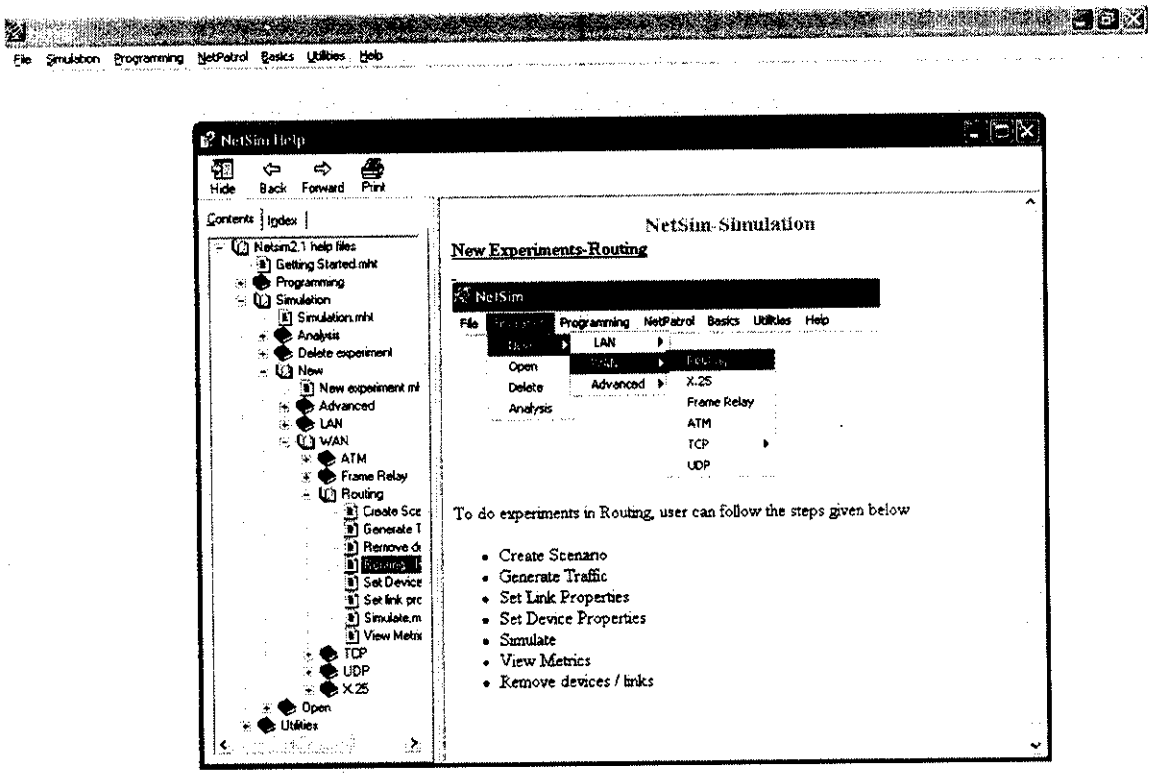

Fig. 3.9 Routing Help for Simulation

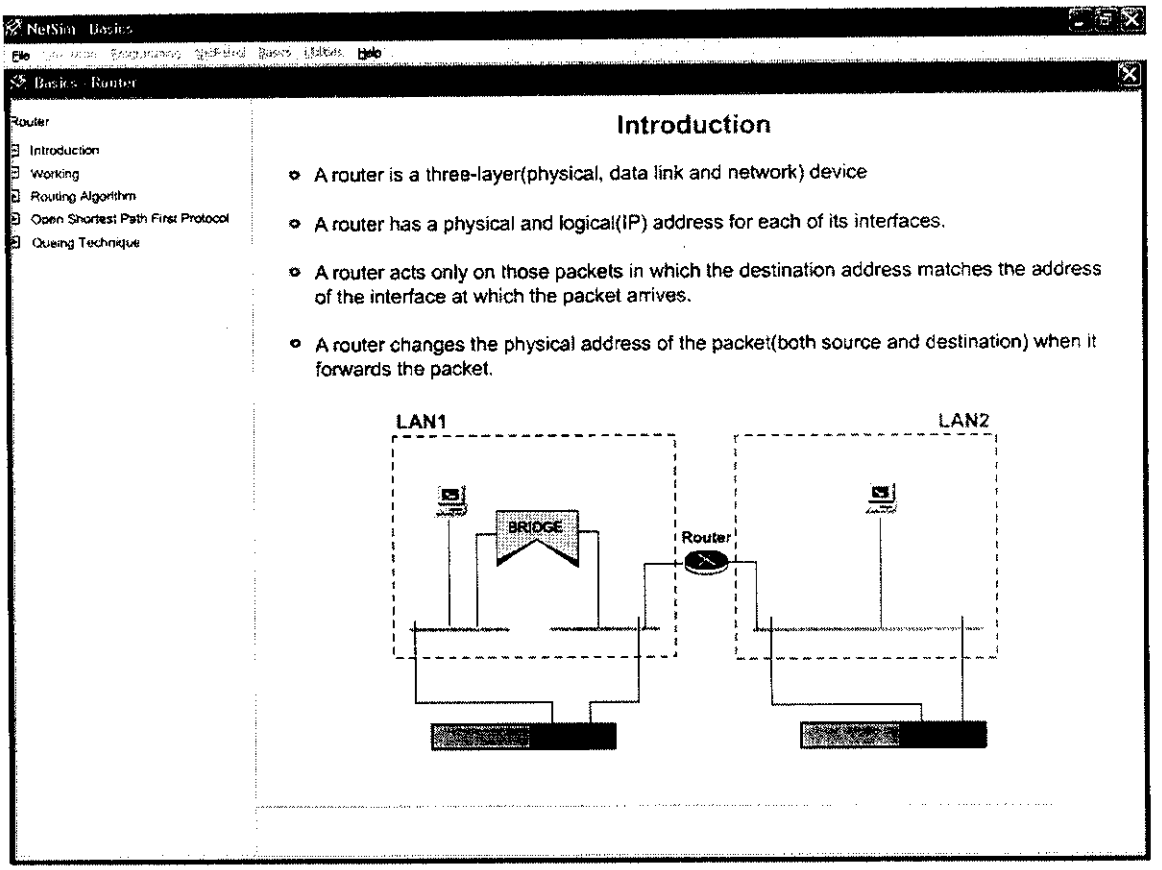

Fig. 3.10 Routing Basics for Simulation

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