



# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent unit of MAHE, Manipal)*

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

### CERTIFICATE

This is to certify that Ms/Mr. ....

Reg. No.: ..... Section: ..... Roll No.: .....

has satisfactorily completed the laboratory exercises prescribed for **Communication Networks Lab** [ECE-3212] of VI Semester B. Tech. (E & C Engg.) Degree at MIT, Manipal, in the academic year 2016 - 2017.

Date: .....

Signature  
Faculty in Charge

Signature  
Head of the Department



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**Total Number of Lab Classes: 10**

### **Course Objectives**

- CO1: To simulate the Wired and Wireless LANs and Wi-Max.
- CO2: To Configure and test the various Data Link Layer protocols.
- CO3: To simulate and verify the function of various Network Layer protocols.
- CO4: To Demonstrate TCP, UDP Communication Protocols.
- CO5: To Simulate the MANETs and WSNs and analyse their performance.

### **Course Outcomes**

*At the end of this course, student will be able to:*

- Analyse the congestion in Point-to-Point networks and Wireless LANs.
- Configure and test the ALOHA, CSMA, CSMA/CD, and CSMA/CA protocols.
- Simulate and verify the functioning of Dijkstra's and Bellman-ford algorithms.
- Demonstrate the different applications using TCP, UDP Communication Protocols.
- Verify the performance of various Error control protocols in Data Link Layer.

### **Evaluation Plan**

#### **Communication Network Lab**

- Internal Assessment Marks: **60 Marks**
  - ✓ Continuous evaluation component (for each experiment): **10 Marks**
  - ✓ Assessment is based on conduction of each experiment, exercise problems, answering the questions related to the experiment.
  - ✓ Total marks of the 10 experiments scaled to **60 Marks**
- End semester assessment: **40 Marks**

#### **Communication Network Project Lab**

- Internal Assessment: **60 Marks**
  - ✓ Continuous evaluation component (for each progress): **10 Marks**
  - ✓ Assessment is based on satisfactory progress in execution of project.
  - ✓ Total marks of the 6 evaluations is **60 Marks**
- End semester project demonstration: **40 Marks**

**Note: Final Grading is based on the average of marks scored in Communication Networks Lab and Project Lab.**

# PART A

## Experiment 1

### Point-to-Point Networks

#### Objective:

- A) To simulate a three point-to-point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
- B) To simulate the transmission of ping message over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.

#### Procedure:

Create a folder with your registration number under “C://qualnet/7.4/scenarios/user/”

A) Go to File→new→save as→ point-to-point

Select Scenario Properties → General Settings → Give Experiment name, Simulation Time

Click Apply, Ok

The screenshot shows the 'Scenario Properties (pointtopoint1.config)' dialog box with the 'General' tab selected. The 'General Settings' section is active, displaying a table of properties and their values.

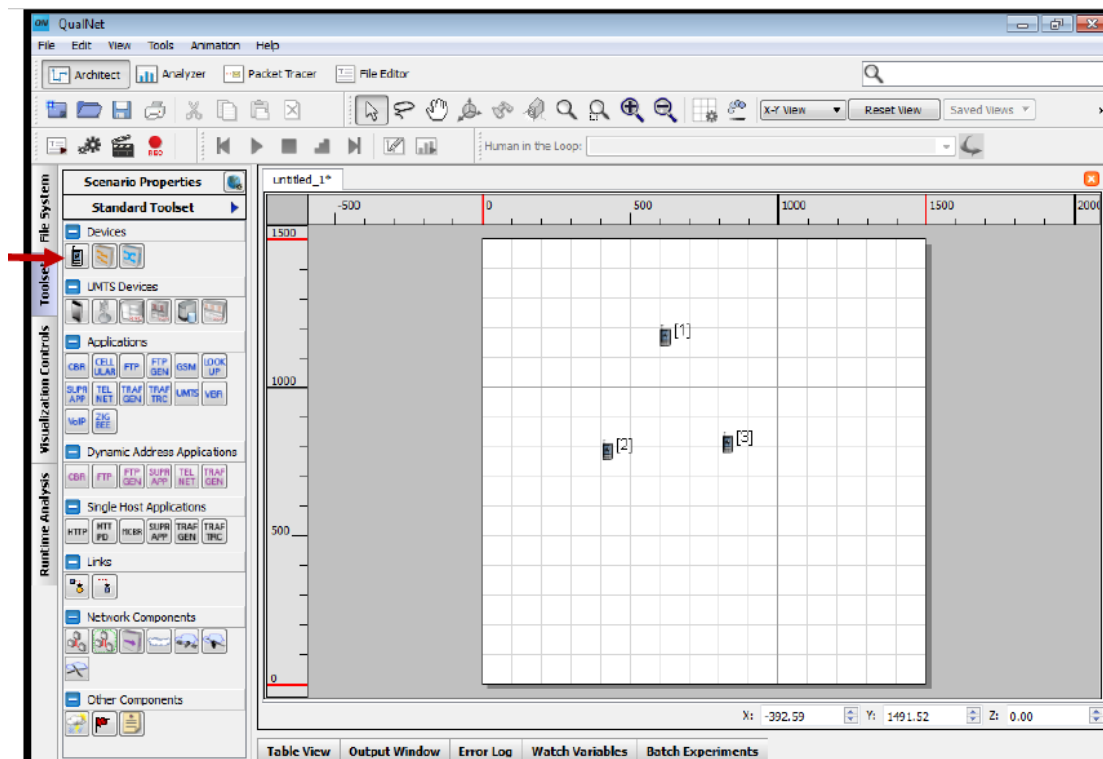
Property	Value
Experiment Name	point2point
Experiment Comment	NONE
Simulation Time	300 seconds
Seed	1
Scenario Background Image File	[Optional]
Disable Modifications to Scenario	NO

Set the Terrain Properties

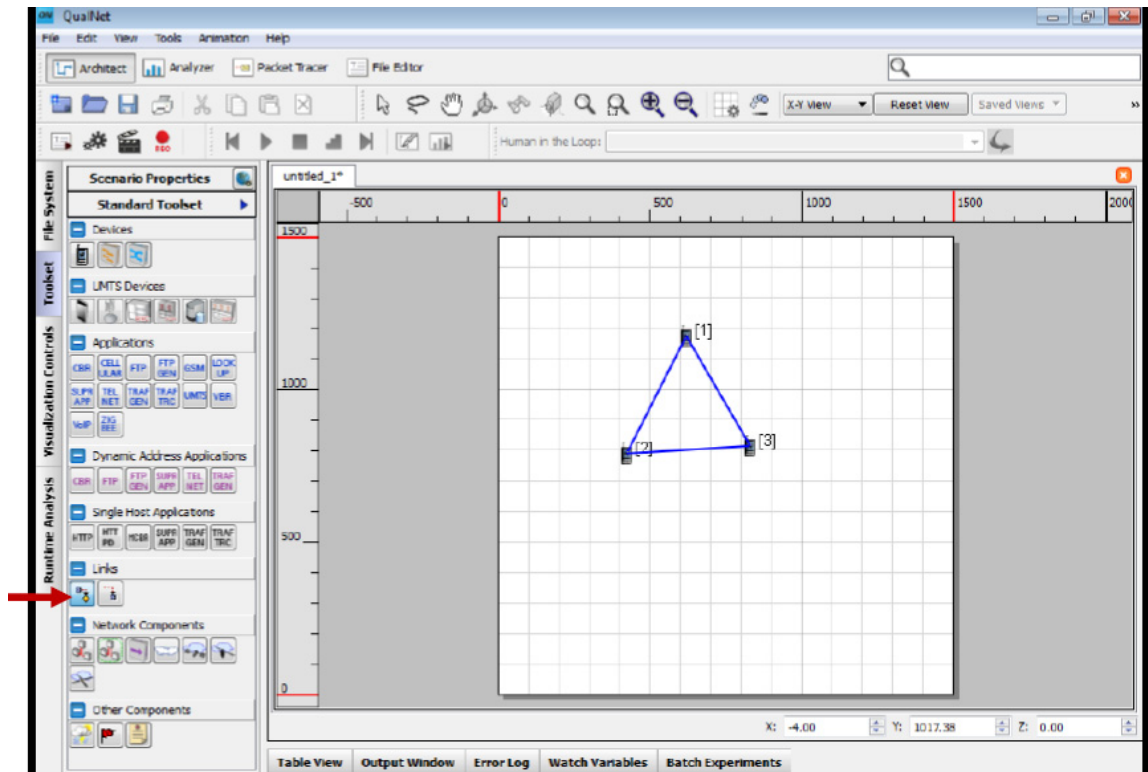
The screenshot shows the 'Scenario Properties' dialog box with the 'Terrain' tab selected. The 'Terrain' section is active, displaying a table of properties and their values.

Property	Value
[ - ] Coordinate System	Cartesian
Scenario Dimensions (meters)	X: 1500 Y: 1500
Altitude Range (meters)	Above Sea Level: 1500 Below Sea Level: 0
Terrain Data Format	None
Urban Terrain Format	None
Weather Mobility Interval	10 seconds

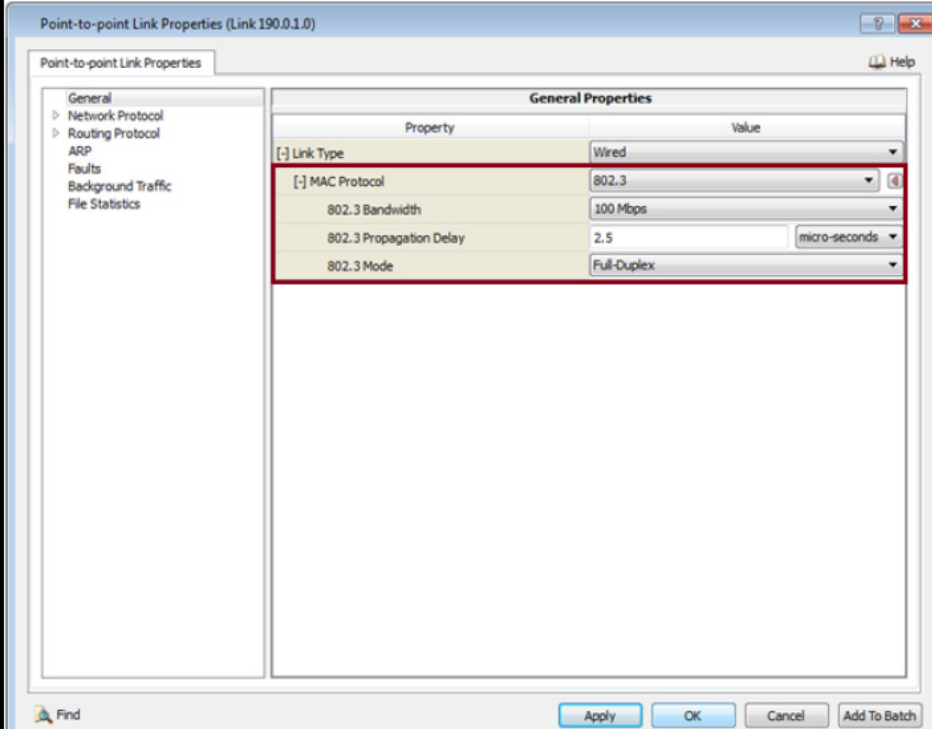
**Step 1:** Select Default icon from **Standard Toolset window**→ **Devices** and Place the three nodes on the canvas.



**Step 2:** Connect point-to-point link between three nodes using **link** from **Standard Toolset** window.

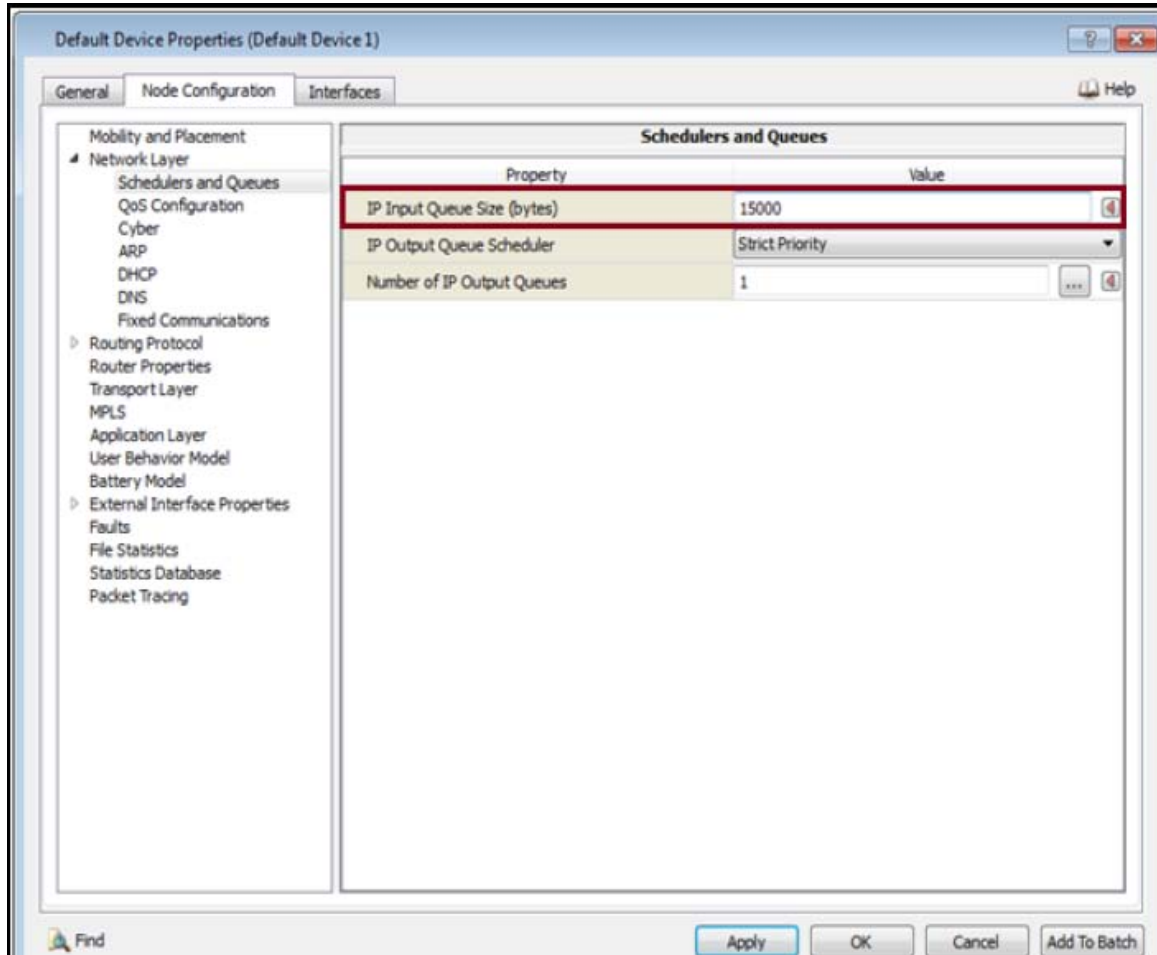


**Step 3:** Double click on the links to set duplex link and bandwidth between the nodes by configure 802.3 as MAC Protocol.



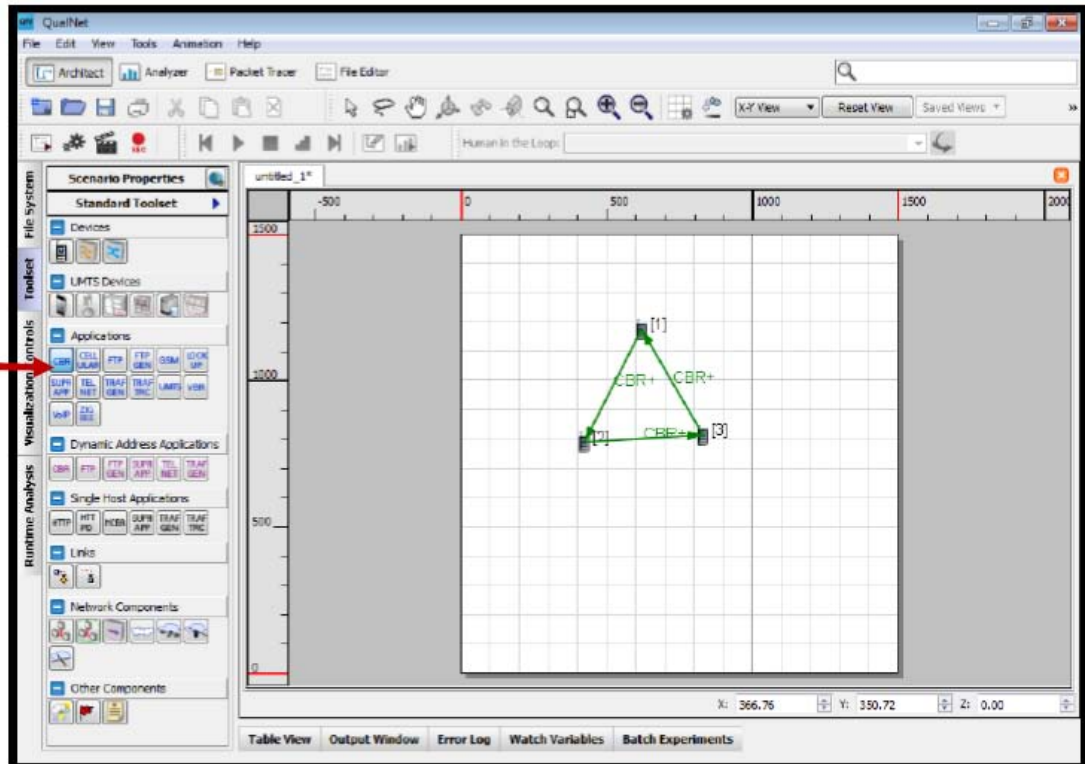


**Step 4:** To set queue size of each node in the scenario double click on the nodes, go to **Node Configuration tab**→**Network Layer**→**Schedulers and Queues**.



### Step 5: Select the **Applications** tab of **Standard Toolset** window

Select **CBR** and draw the application between Node 1 and Node 2. Similarly Node 2 to Node 3 and Node 3 Node 1.



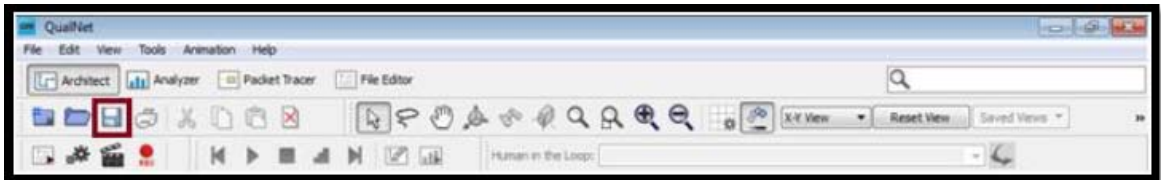
**Step 6:** To set CBR Application parameters, go to Table View (bottom panel of GUI)  
→ Application Tab → double click on CBR Application  
Set the number of CBR packets (Items to send) as per the user requirement.

The screenshot shows the 'CBR Properties' dialog box with the 'General' tab selected. The dialog has a title bar with standard window controls and a 'Help' button. The main area is a table titled 'General Properties' with two columns: 'Property' and 'Value'. The table contains the following entries:

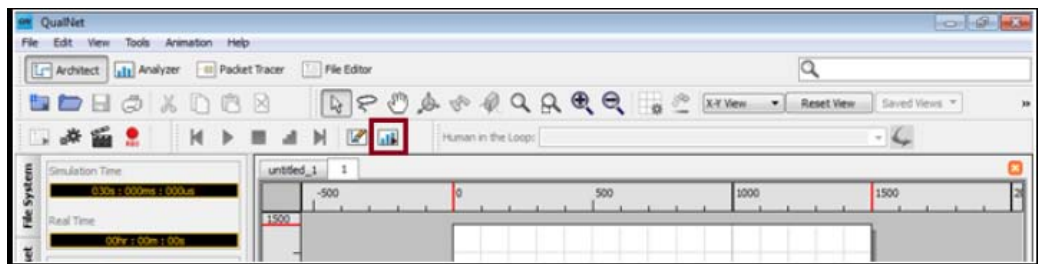
Property	Value
Source	1
Destination	2
Items to Send	100
Item Size (bytes)	512
Interval	1 seconds
Start Time	1 seconds
End Time	25 seconds
[.] Priority	Precedence
Precedence Value	0
Enable RSVP-TE	No
Enable MDP	No
Session Name	[Optional]

At the bottom of the dialog, there is a 'Find' button with a magnifying glass icon, and four buttons: 'Apply', 'OK', 'Cancel', and 'Add To Batch'.

**Step 7:** Save the changes by clicking on the **Save** button. Click on the **Run** button. Click on the **Play** button to execute the scenario.

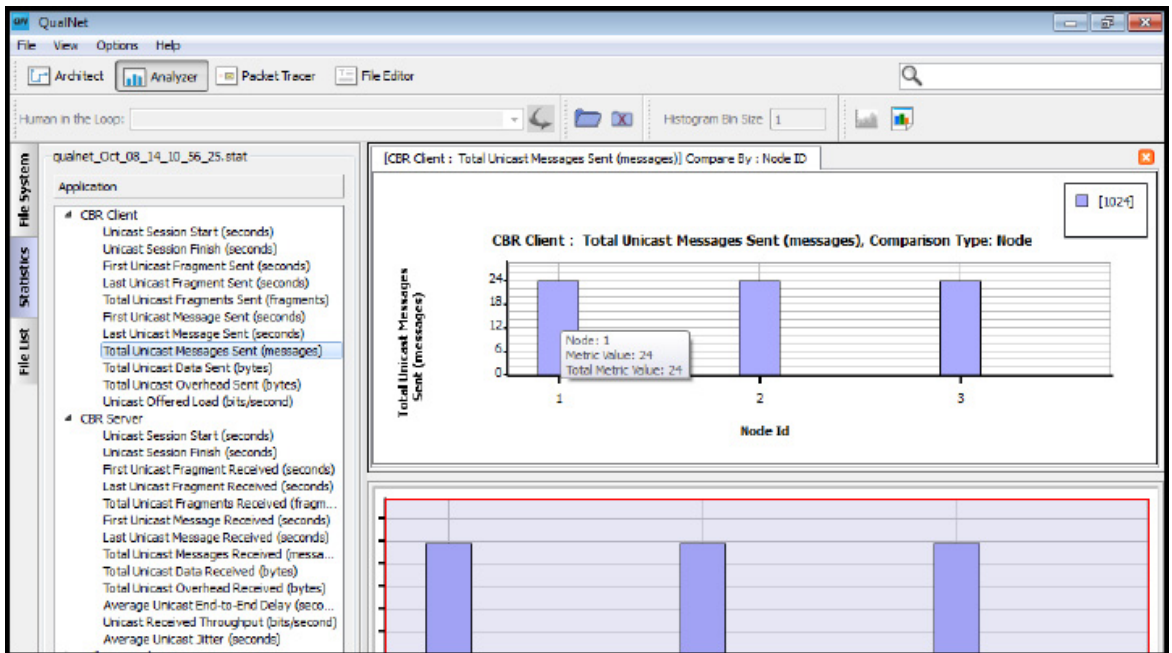


**Step 8:** On completion of the Scenario execution, check the corresponding Statistics for the desired results click on **Analyze Statistics of Current Scenario**.



**Step 9:** To check the no. of packets at sender, go to Application tab → CBR Client → Total Unicast Messages Sent

To check the no. of packets at receiver, go to Application tab → CBR Server → Total Unicast Messages Received



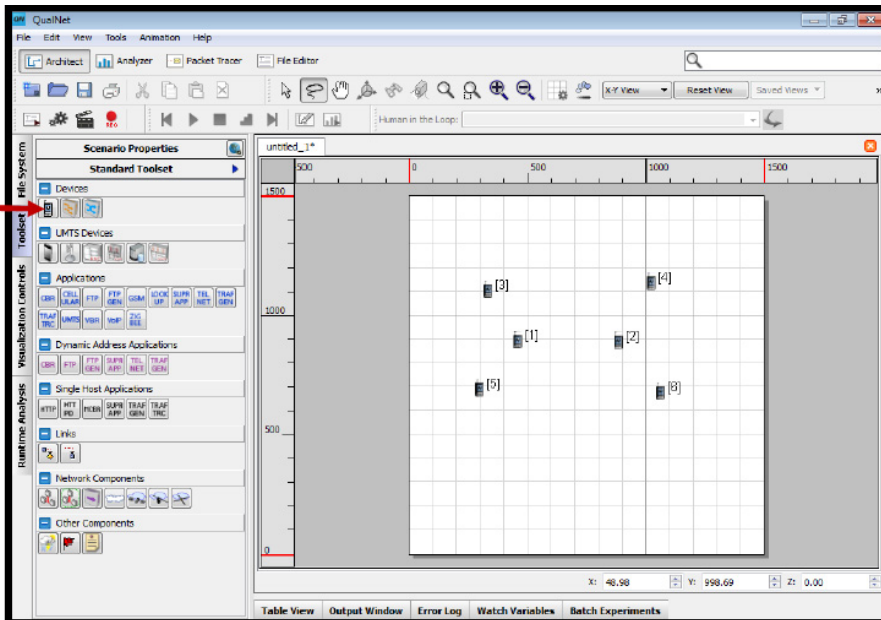
**Note:** The packet drop is calculated as follows:

Packet drop = Total no. of packets sent – Total no. of packets received

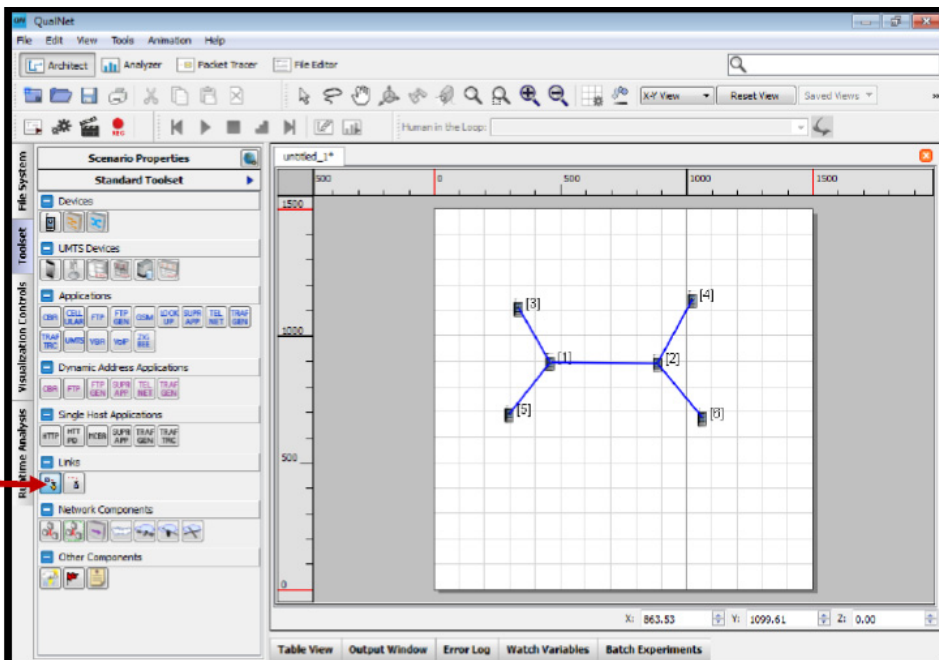
**B) Procedure:** Go to File → new → save as → congestion

Select Scenario Properties → General Settings → Give Experiment Name, Simulation Time Click Apply, Ok

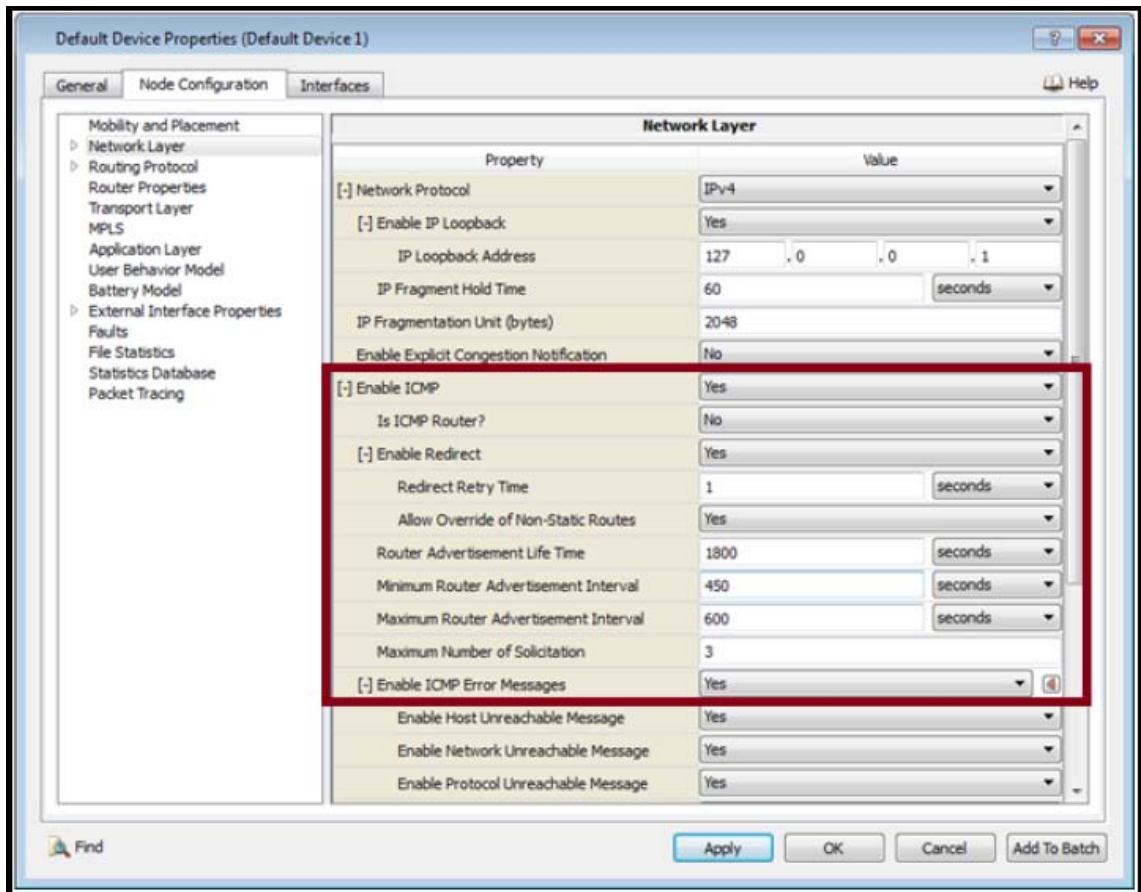
**Step 1:** Select Default icon from **Standard Toolset** window and Place the Six nodes on the canvas.



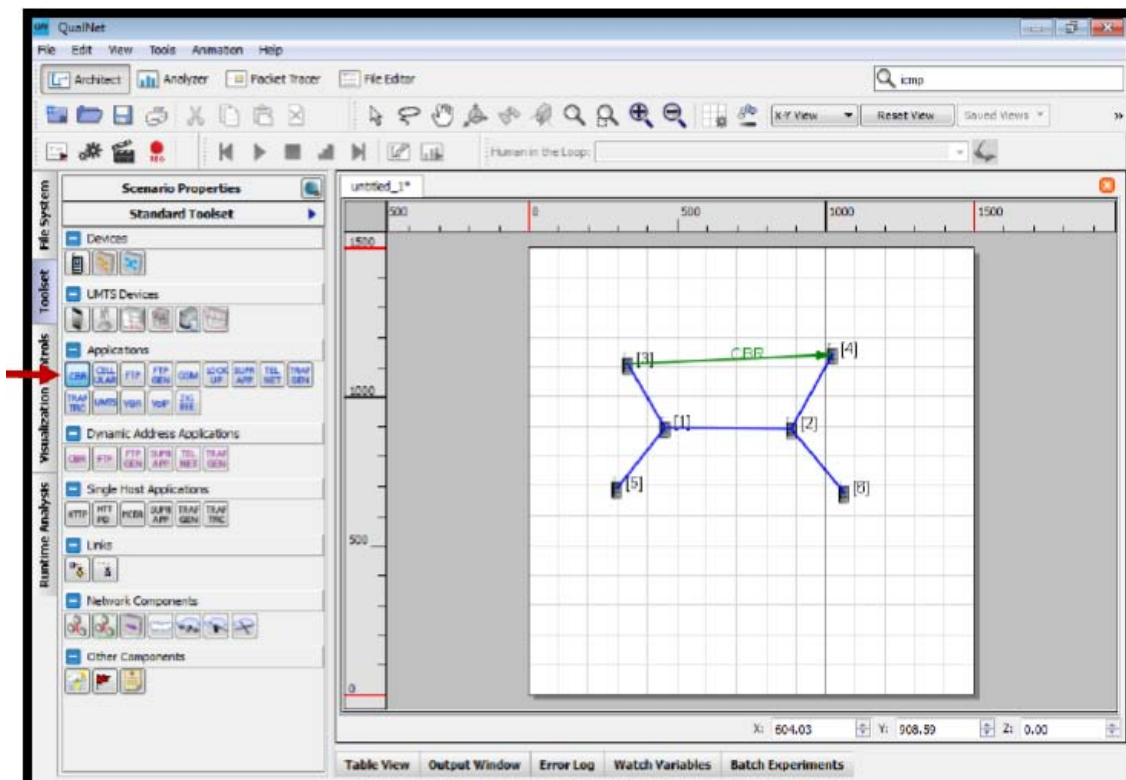
**Step 2:** Connect point-to-point link between three nodes using **link** from **Standard Toolset** window.



**Step 3:** To set ICMP of each node in the scenario double click on the nodes, go to Node Configuration tab→Network Layer→Enable ICMP.



**Step 4:** Select the **Applications** tab of **Standard Toolset** window  
Select **CBR** and draw the application between Node 3 and Node 4.



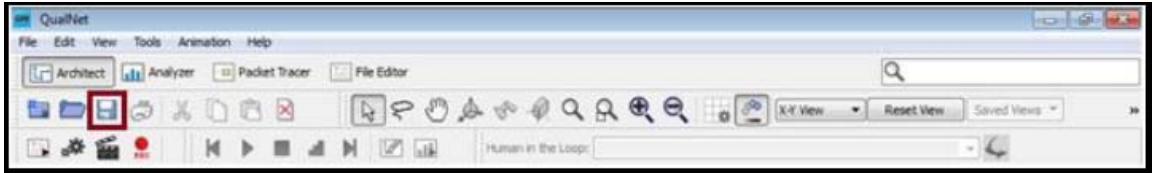


**Step 5:** To set CBR Application parameters, go to Table View (bottom panel of GUI)  
→ Application Tab → double click on CBR Application.  
Set the number of CBR packets (Items to send) as per the user requirement.

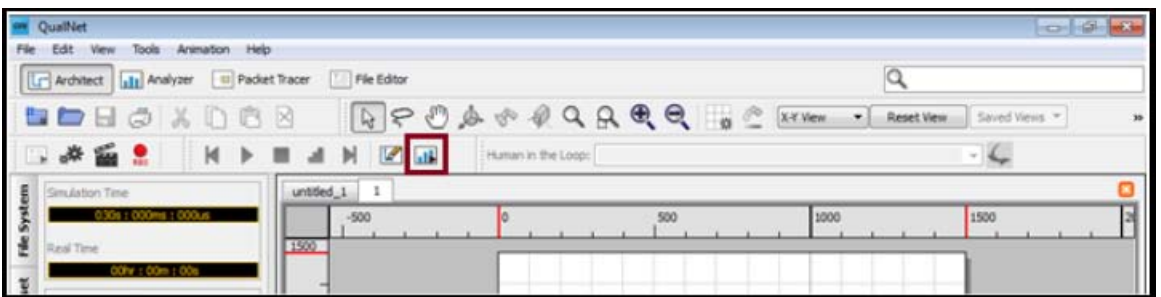
The screenshot shows the 'CBR Properties' dialog box with the 'General' tab selected. The dialog has a title bar with a question mark and a close button. Below the title bar is a 'Help' button. The main area is titled 'General Properties' and contains a table with two columns: 'Property' and 'Value'. The table lists various parameters for the CBR application, including Source, Destination, Items to Send, Item Size (bytes), Interval, Start Time, End Time, Priority, Precedence Value, Enable RSVP-TE, Enable MDP, and Session Name. At the bottom of the dialog is a 'Find' button and four action buttons: 'Apply', 'OK', 'Cancel', and 'Add To Batch'.

Property	Value
Source	2
Destination	4
Items to Send	100
Item Size (bytes)	512
Interval	1 seconds
Start Time	1 seconds
End Time	25 seconds
[.] Priority	Precedence
Precedence Value	0
Enable RSVP-TE	No
Enable MDP	No
Session Name	[Optional]

**Step 6:** Save the changes by clicking on the **Save** button. Click on the **Run** button. Click on the **Play** button to execute the scenario.

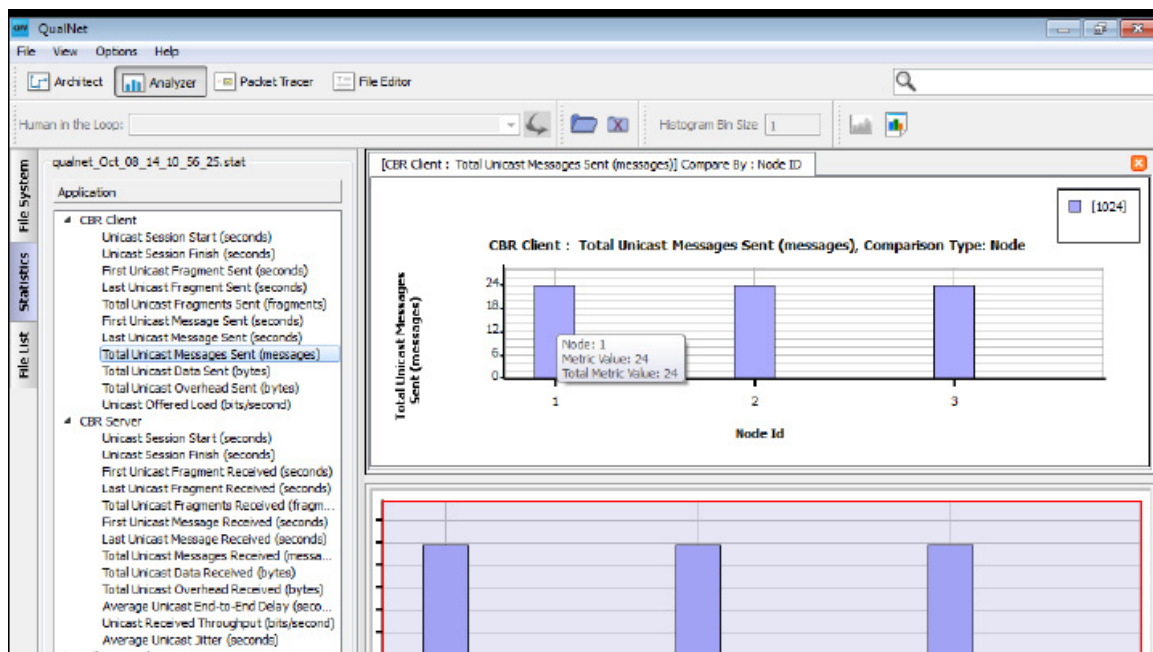


**Step 7:** On completion of the Scenario execution, check the corresponding Statistics for the desired results click on **Analyze statistics of Current Scenario**.



**Step 8:** To check the no. of packets at sender, go to Application tab→CBR Client  
→Total Unicast Messages Sent

To check the no. of packets at receiver, go to Application tab→CBR Server→Total Unicast Messages Received



Similarly, observe Average End-to-End Delay, Throughput, and Jitter.

**Note: The packet drop is calculated as follows**

Packet drop = Total no. of packets sent – Total no. of packets received

**Exercise 1:** Simulate a four node point-to-point network with the links connected as follows: n1-n3, n2-n3 and n3-n4, Apply TCP agent between n1-n4 and UDP between n2-n4. Apply relevant application over TCP and UDP agents changing the parameters and determine the number of packets sent by TCP/UDP.