



Emerging Network Technologies

NetSim

Exercise 1

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1. Introduction to NetSim

1.1 Introduction to network simulation through the NetSim simulation package

1.1.1 Theory:

☐ What is NetSim?

NetSim is a network simulation tool that allows you to create network scenarios, model traffic, and study performance metrics.

☐ What is a network?

A network is a set of hardware devices connected together, either physically or logically. This allows them to exchange information.

A network is a system that provides its users with unique capabilities, above and beyond what the individual machines and their software applications can provide.

☐ What is simulation?

A simulation is the imitation of the operation of a real-world process or system over time.

Network simulation is a technique where a program models the behaviour of a network either by calculating the interaction between the different network entities (hosts/routers, data links, packets, etc.) using mathematical formulae, or actually capturing and playing back observations from a production network. The behaviour of the network and the various applications and services it supports can then be observed in a test lab; various attributes of the environment can also be modified in a controlled manner to assess how the network would behave under different conditions.

☐ What does NetSim provide?

Simulation: NetSim provides simulation of various protocols working in various networks as follows: **Internetworks, Legacy Networks, BGP Networks, Advanced Wireless Networks, Cellular Networks, Wireless Sensor Networks, Personal Area Networks, LTE/LTE-A Networks, Cognitive Radio Networks, and Internet of Things**. Users can open the experiments and save the experiments as desired. The different experiments can also be analysed using the analytics option in the simulation menu.

Programming: NetSim covers various programming exercises along with concepts, algorithms, pseudo code and flowcharts. Users can also write their own source codes in C/C++ and can link them to NetSim.

Some of the programming concepts are Address resolution protocol (ARP), Classless inter domain routing (CIDR), Cryptography, Distance vector routing, shortest path, Sub netting etc.

1.2 Starting NetSim

1.2.1: Double click on the desktop icon to start NetSim; figure 1 show what the icon looks like.



Figure 1: NetSim desktop icon

1.2.2: Figure 2 shows the loading of the NetSim validation screen, once you double click on the above icon.

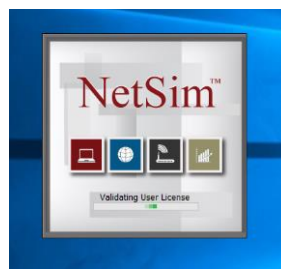


Figure 2: NetSim validation screen

1.2.3: Figure 3 shows the NetSim welcome screen and menu at the top left.



Figure 3: NetSim welcome screen

1.2.4: Figure 4 shows NetSim work environment; this is where you construct your network design.

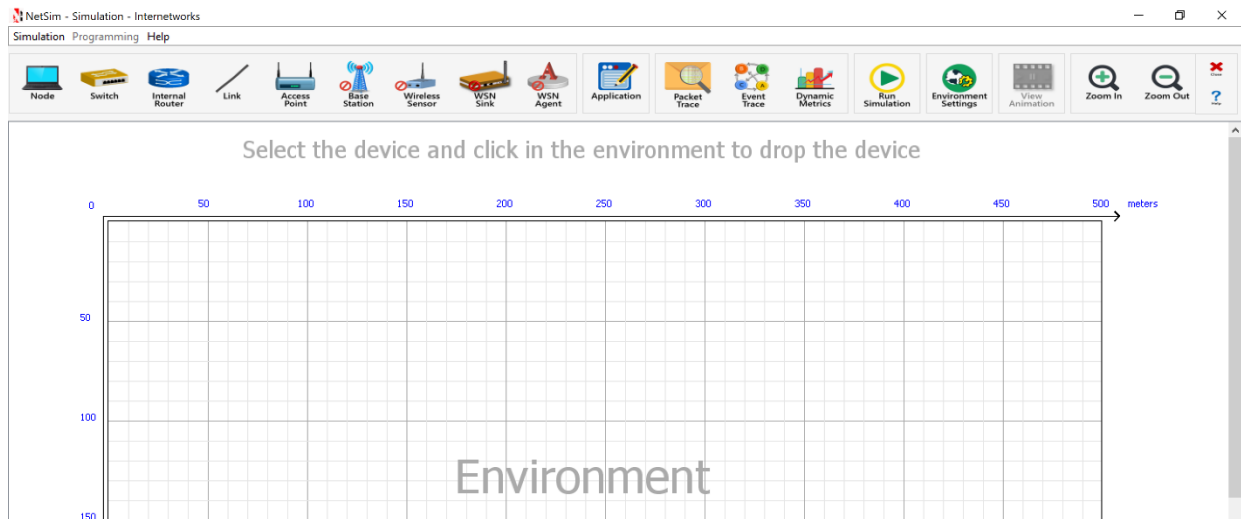


Figure 4: NetSim work environment

1.3 Design and configure a simple network model, collect statistics and analyse network performance.

1.3.1 Theory:

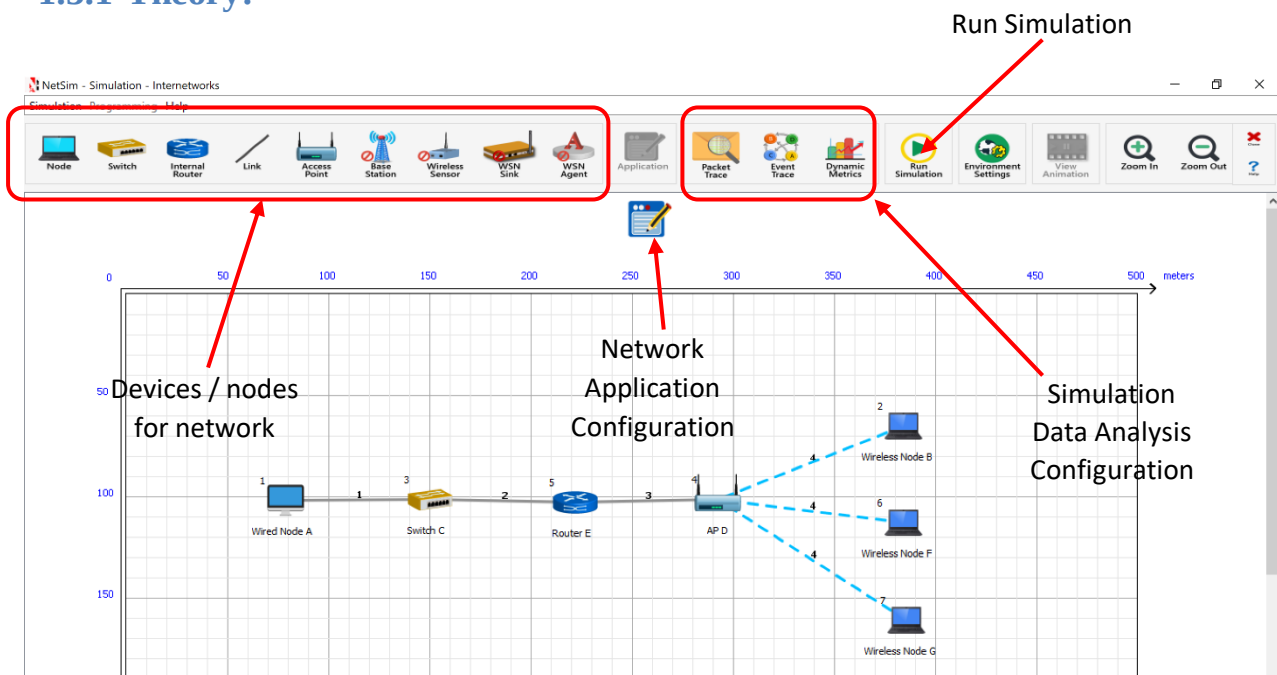


Figure 5: NetSim basic network

- **Network model:** A Network model as seen in figure 5 is a flexible way of representing devices and their relationships. Networking devices like hubs, switches, routers, nodes, connecting wires etc. are used to create a network model.
- **Scenario:** A Scenario is a narrative describing foreseeable interactions of types of input data and its respective output data in the system.

1.3.2 Node Application Properties:

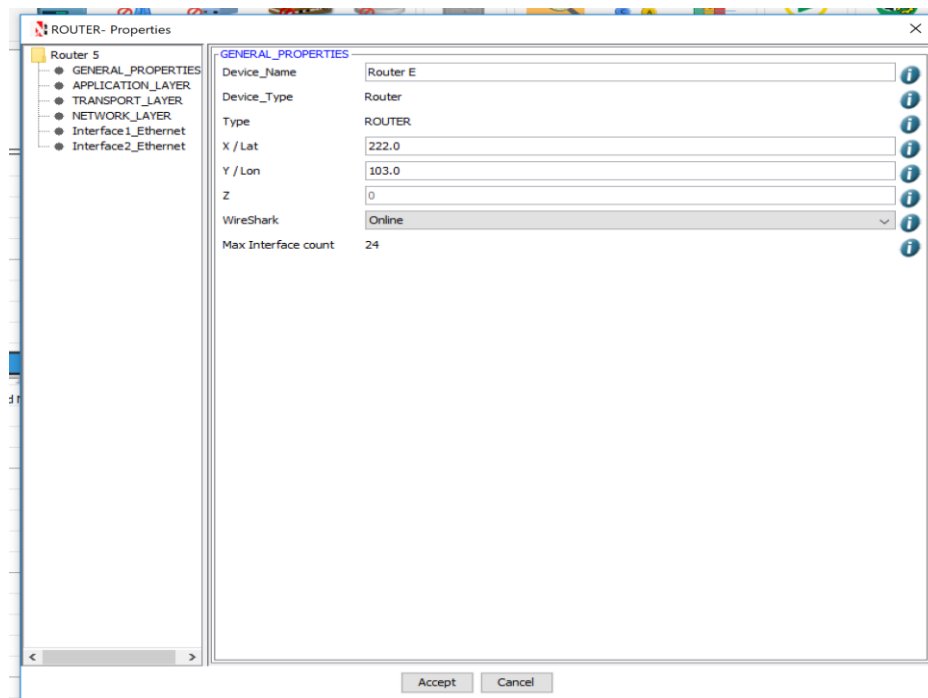


Figure 6: Node properties

- **Node properties:** Accessed by right clicking on any node within the network it is possible to configure a number of properties for the node contained within the network.
- **Wireshark:** In addition to the standard configuration areas is the 'Wireshark' option. This will allow for a user to analyse the network protocols and capture the raw network traffic.

1.3.3 Packet Trace, Event Trace and Dynamic Metrics:

Unlike the academic edition, NetSim standard allows the user to select metrics required for analysis. Figures 7, 8 and 9 show each of the configuration screens which can be utilised.

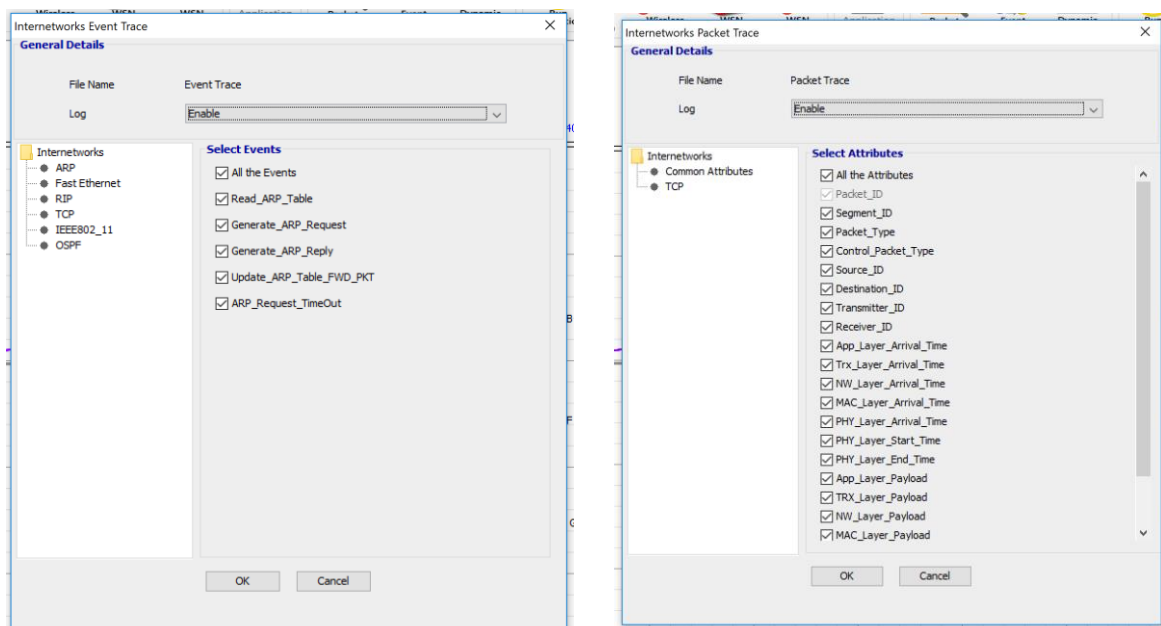


Figure 7 and 8: Event and Packet Trace properties

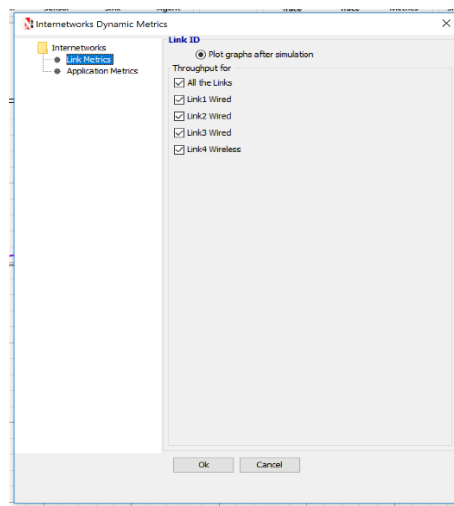


Figure 9: Dynamic Metrics properties

1.3.4 Running a Simulation:

After configuring the network variables and the metrics required for analyse click the 'Run Simulation' button. At this point a final properties screen appears (figure 10) this allows you to configure the Simulation time and Seed values.

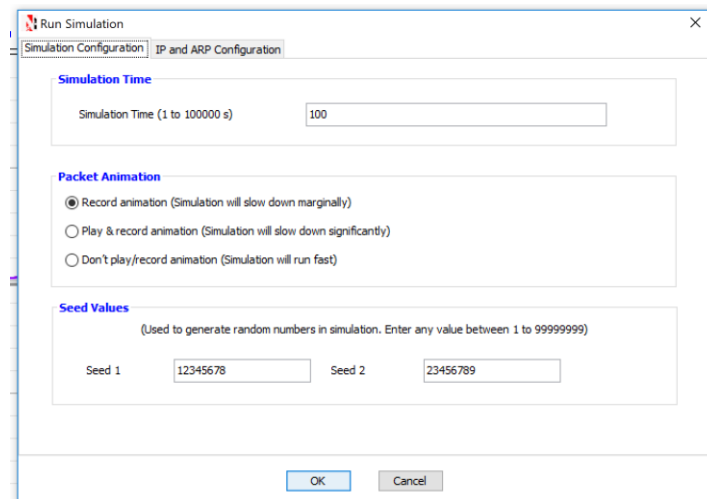


Figure 10: Run Simulation properties

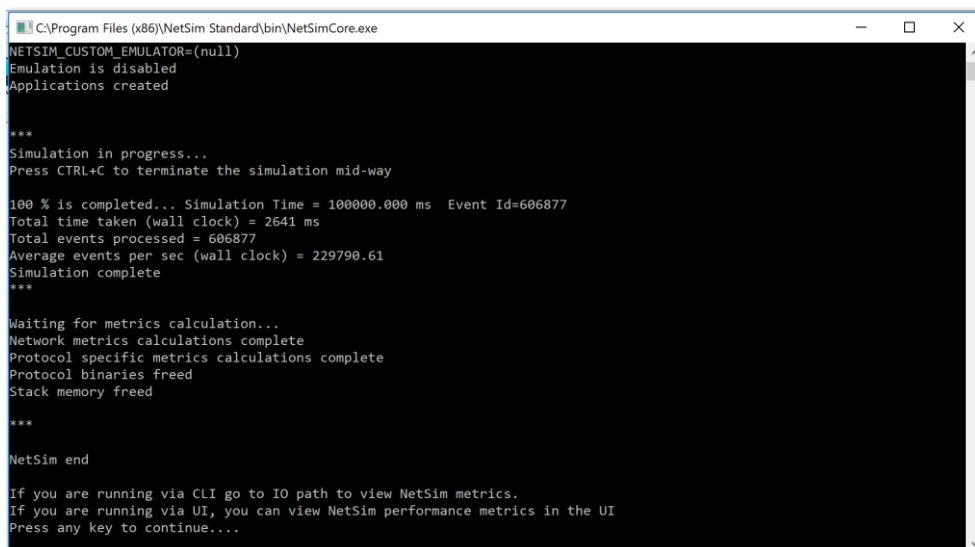


Figure 11: NetSim CLI screen

1.3.5 Simulation Results Analysis:

Upon completion of the simulation a screen showing the results will be displayed, this will be based on the metrics previously selected. Figure 12 below is an example of the results produced based on the basic network model created.

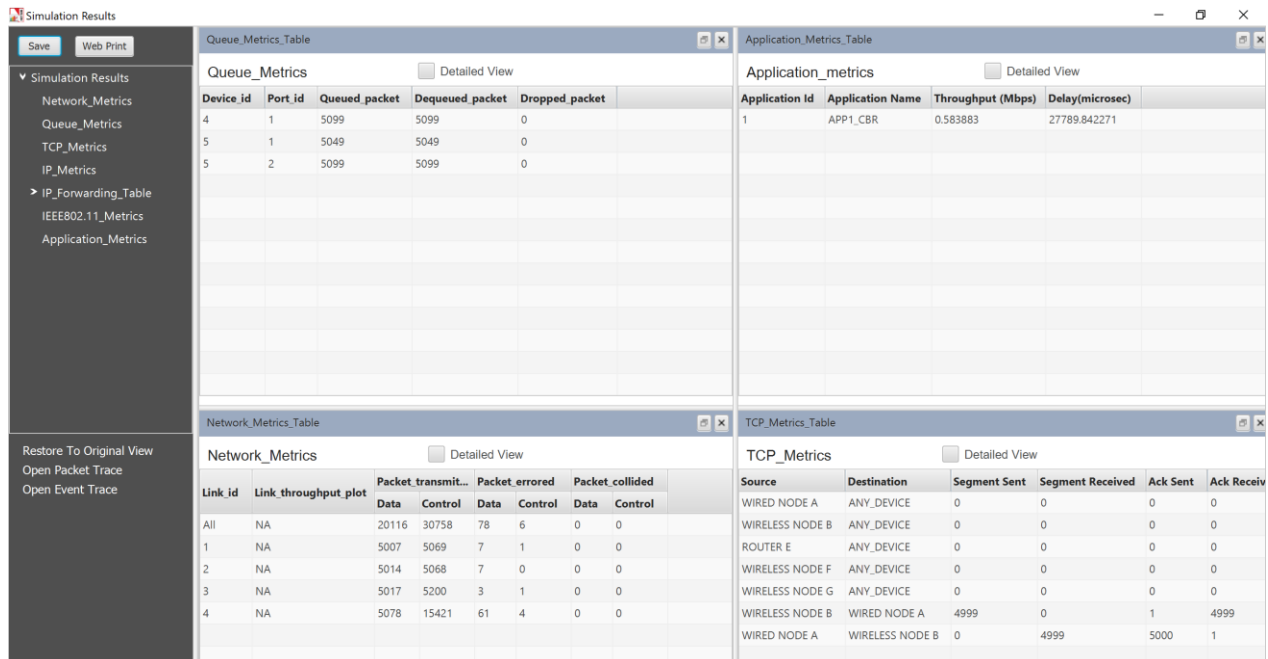


Figure 12: NetSim Simulation results display

The list located to the left of the display shows the chosen metrics, by clicking on any of the metrics it will show in a separate window in the form of data and graphical interface. It is possible to export this graph data by right clicking on a graph a selecting the ‘Open source data’ option. The raw data is displayed using a notepad file currently (an update will be due which should allow export to csv file format). Figure 13 shows the open source data taken from a displayed graph.

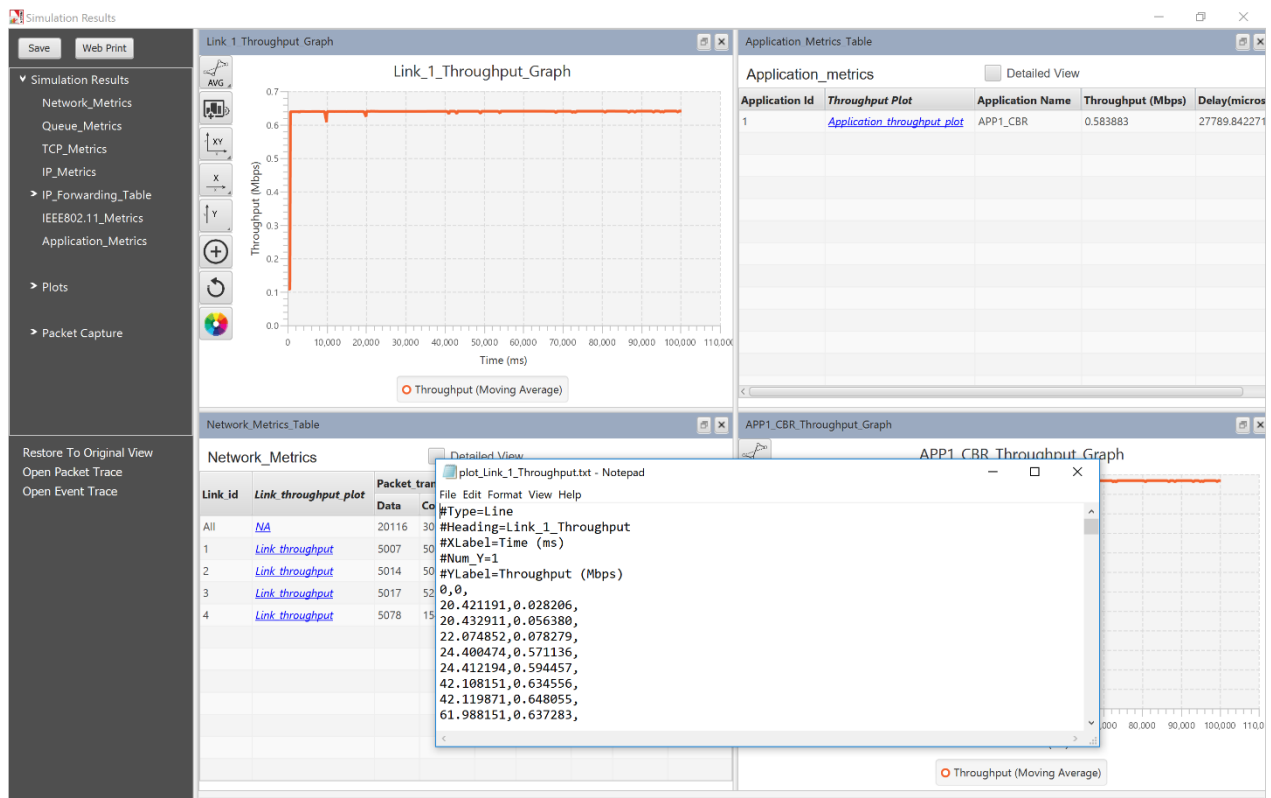


Figure 13: NetSim Simulation ‘Open source data’

1.3.6 NetSim Analytics:

- What is NetSim analytics used for?
- It is used to compare and analyse various protocols scenarios under Internetworks, Legacy Networks, BGP Networks, Advanced Wireless Networks – MANET and Wi- Max, Cellular Networks, Wireless Sensor Networks, ZigBee Networks, Internet of Things, LTE/LTE-A Networks and Cognitive Radio Networks. Parameters like utilization, loss, queuing delay, transmission time etc. of different sample experiments are compared with help of graphs.

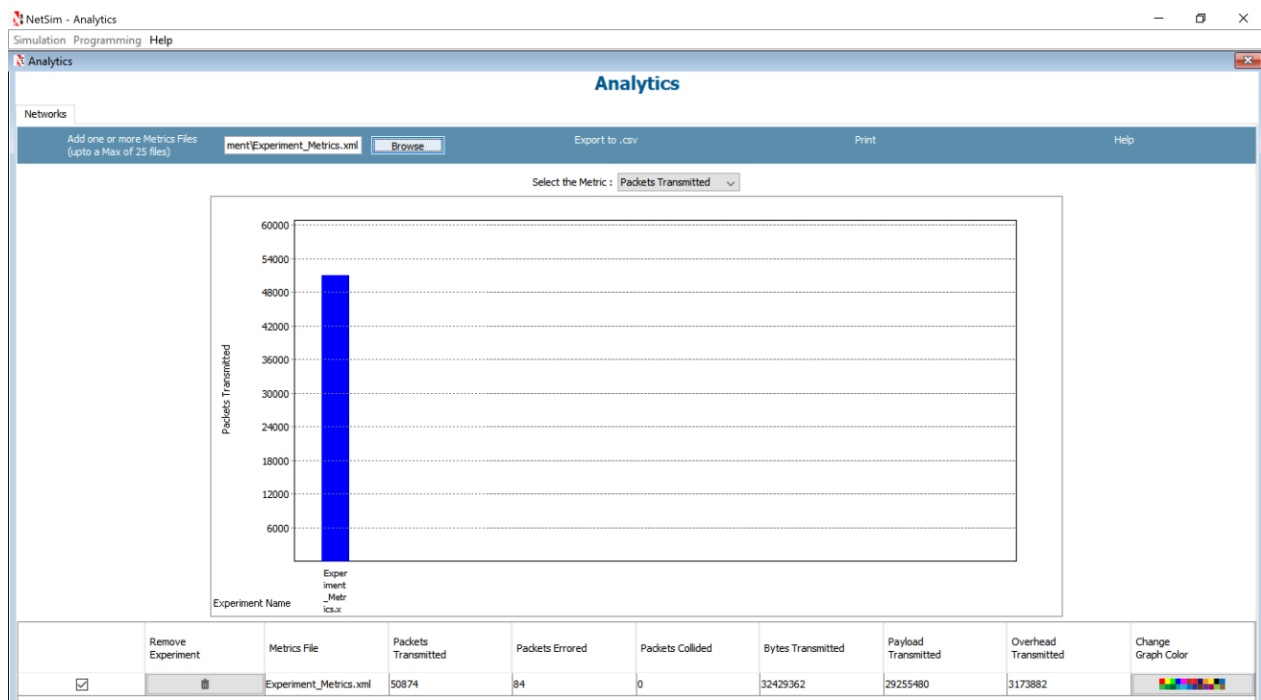


Figure 14: NetSim Analytics

- **Browse;** this will allow the user to select up to 25 scenarios for comparison
- **Export to CSV;** take the data into a format for use with Excel
- **Select Metric;** Packets Transmitted, Errored, Collided, Transmitted Bytes, Payload and Overhead

It needs to be considered that the analytics looks at the network as whole and not each individual link, if an in depth analysis is required consider utilising the simulation results screen to collate the metric data.

1.4: Use the demonstrations above to design the below model, run some statistics of your choice and try to analyse the graphical output of your statistics.

