Lab 1: Using OpNet and Generating Traffic

Introduction

OpNet is a network simulation package that has an easy to use GUI. Other simulators include NS2 and OMNet. Network simulators enable "what if" scenarios to be tested. This means that you can make changes to;

- the network architecture,
- the network management, or
- the traffic profiles

of an existing network and see the effect of making those changes.

The network components we will typically use

I would recommend using generic components rather than vendor specific models to ensure that you have all of the functionality required for the labs. You can find these components in the object palette.

subnet	This is a component that can be used to group together network components. It is a logical component and has no effect on the performance of the network.
APPL Application Definition — Application Config	This is the component that is used to define the applications that will be used on the network. It is used to specify the traffic that the network will carry.
APPL Profile Definition — Profile Config	This is the component that is used to specify how the applications are used (for example how long are the applications used for and when they are used).
IP QOS Attribute Definition — QoS Attribute Config	This is the component that is used to specify various QoS attributes – for example the queuing profiles that might be used in implementing DiffServ, buffer management algorithms and the characteristics of RSVP.
ethernet32_hub	This component emulates a hub with 32 Ethernet ports.
ethernet16_switch	This component emulates a switch with 16 Ethernet ports.
ethernet4_slip8_gtwy	This is a router with 4 Ethernet ports and 8 SLIP (Serial Line Internet Protocol) ports.

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ethernet_wkstn	This component emulates a workstation. The workstation must have the appropriate application profile applied to it to emulate a user using that workstation.
100BaseT_LAN	This component emulates many workstations. You set it up in a similar way to the ethernet_wkstn but with the additional attribute of setting the number of workstations that you want to generate traffic.
ethernet_station	This component has no TCP/UDP/IP stack therefore it cannot be used in a network with routers. It emulates a basic ON/OFF state traffic generator. NOTE that there is a difference between an ethernet_wkstn and an ethernet_station.
100BaseT PPP_DS3	These are cables that can be used to connect components. You must ensure that the component you are connecting a cable to has the correct interface on it. The 100BaseT cable using the Ethernet protocol so can only be connected to Ethernet interfaces. The PPP_DS3 cable uses the point to point protocol and should be connected to interfaces supporting SLIP.
IP_G726_Voice ip_ping_traffic ip_traffic_flow	This is a logical way to generate traffic without configuring the application configuration, profile configuration and the workstation.

Building a simple network

- Open OpNet, click on *File*->*New*... and create a new project. Click OK
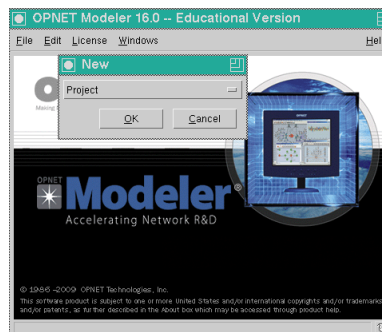
- Call the project *UP_number_ Lab_1* and name the scenario *Hub*.
- You must now create an *empty scenario*, click on *office*,
- Set the dimensions to X=50, Y=50 click *next* again
- Change the "*Ethernet*" parameter to *YES* by clicking in the field
- Click next again and then click *Finish*.
- You should now be presented with an empty network domain (workspace) and an object palette (internet_toolbox) that gives you a selection of objects that you can put onto the workspace. Close the object palette.

For this Lab

- Select **Topology**->**Rapid configuration** from the main menu and choose a **star** configuration, Click Next.
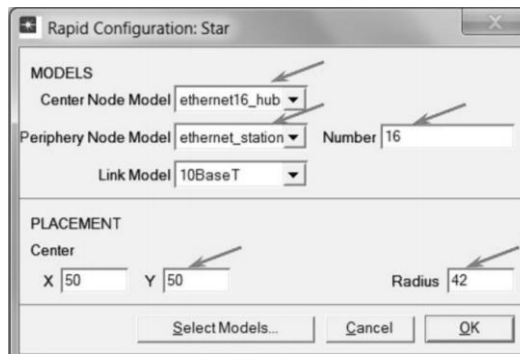
- The centre node for this experiment is going to be "**ethernet16_hub**"
- The periphery node model "**ethernet_station**", Number 16
- The connections will be "**10BaseT**".
- Set the dimensions to X=50, Y=50, Radius = 42
- Click OK

> If the components you are looking for is not visible Click "Select Models" choose the ethernet model Click OK. This should provide the options you are looking for

You should now have a star network located in your workspace (if not zoom out so you can see it).
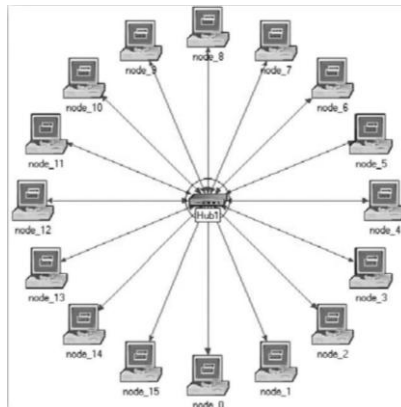

Configuring the Network Nodes

You will configure all of the nodes in your network to have the same properties.

Right click on node_16 (hub_1) select edit attributes, Change the name attribute to Hub_1

Changing the properties of the Nodes

Rather than setting the properties of each individual node you can do this automatically,

- Right-click on any workstation and click "***select similar nodes***". All nodes should now be selected.

- Right-click on any of the nodes that are selected and choose "***Edit Attributes***". You will be shown the nodes attribute box. It is from here that you can configure any node attribute (traffic generating attributes, router configuration etc).
- In order for the changes you make to this node to be applied to all other nodes you must check the "***Apply Changes to Selected Objects***" box.
- Expand the "***Traffic Generation Parameters***" (how traffic is generated) and the "***Packet Generation Arguments***" (how often packets are generated when the node is generating traffic).
- Set the ***ON state time*** to an ***exponential*** distribution with a mean of 100.0
- The ***OFF state time*** to a ***constant*** of 0.
- In the packet generation arguments set the ***Interarrival Time*** to a constant of 0.02
- The ***packet size*** to a ***constant*** of ***1500 bytes***.
- When you click OK the parameters should have changed for all of the nodes – **check this**.
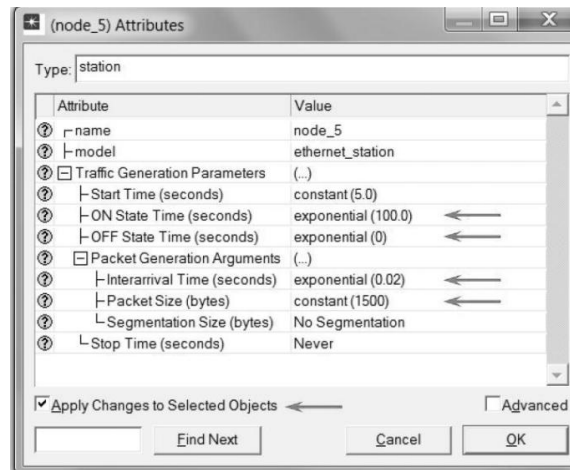
Choose Statistics

Before you simulate the network you must choose which statistics you want to record while the simulation is in progress.

- If you right-click anywhere in the workspace (though not on the objects)
- Select "**choose individual DES statistics**" you can select the statistics that you want to obtain for all of the nodes in the workspace.
- Expand the **global statistics box** and
- Select, **Ethernet delay** from Ethernet,
- Select **Traffic received (packets/sec)** traffic sink
- Select **Traffic sent (packets /sec)** from traffic source.
- Expand node statistics and ethernet and select **collision count**.
- Click OK
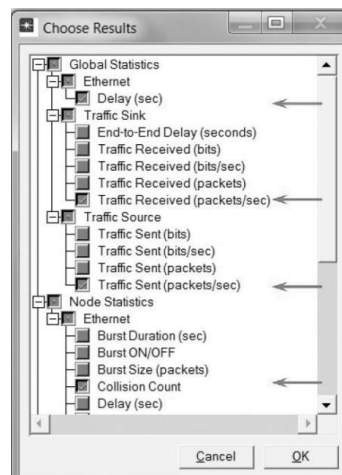
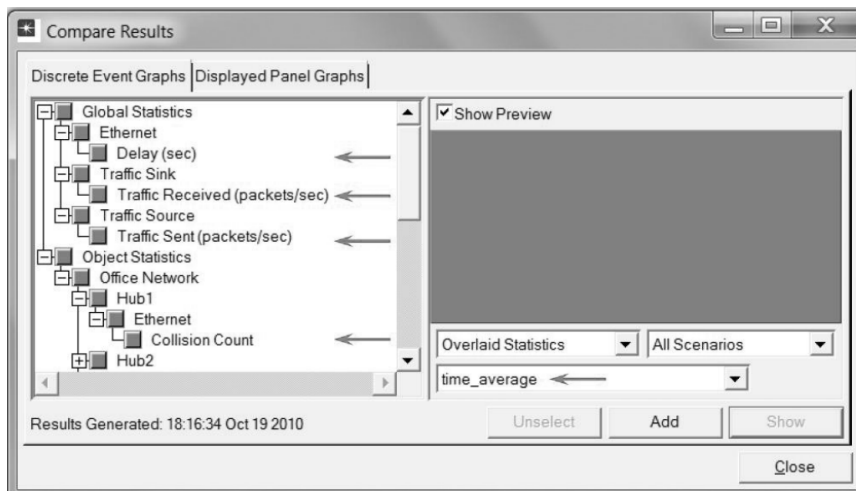## Configure the Simulation

Click on the configure/run simulation button and set the duration to 2 minutes.

View the Results

To view and analyze the results:

- Select Results Browser from the DES Panel

- Expand Glabal Statistics and select Ethernet -> Delay

- View the result using the Time Average presentation -> Unselect all

- Expand Traffic Sink -> traffic Received ->Hub Scenario

- View the result using the Time Average presentation -> Unselect all

- Expand Traffic Source -> traffic Sent ->Hub Scenario

- View the result using the Time Average presentation -> Unselect all

- Select Object Statistics -> Office Network -> select a node -> Ethernet -> Collison count

- View the result using the Time Average presentation

- Compare the nodes and hub collision count.