OPNET/Riverbed Modeler:
Configuring Object Attributes

Roman Dunaytsev

The Bonch-Bruevich Saint-Petersburg
State University of Telecommunications

roman.dunaytsev@spbgut.ru

Lecture № 4

Outline

Outline

Object Attributes

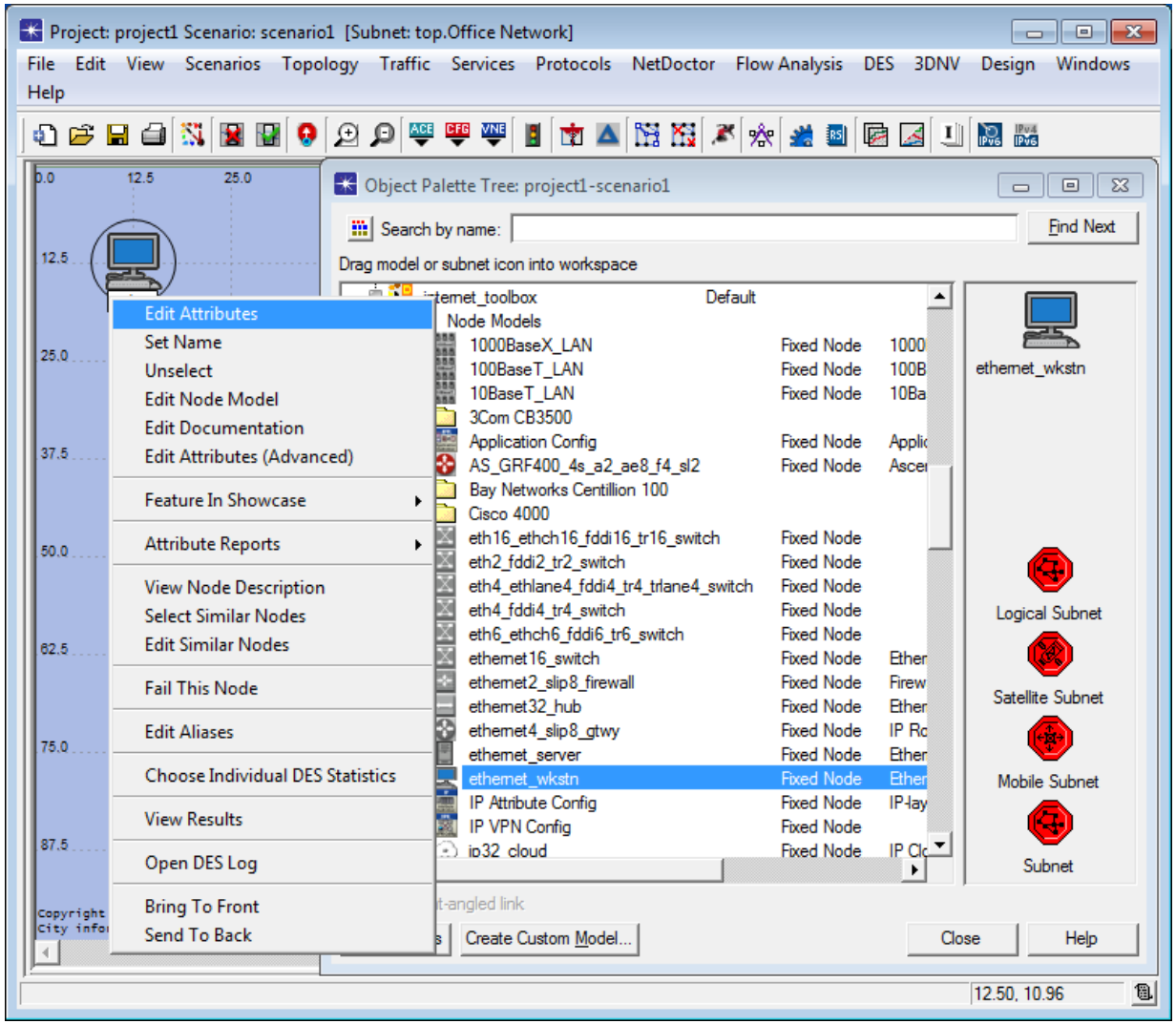
- Building a network topology is only the first step in developing a simulation study
- The subsequent steps include:
  - Configuring network elements
  - Adding traffic
  - Selecting simulation statistics and configuring simulation attributes
  - Running the simulation and examining the collected results
  - etc.
- In OPNET/Riverbed, every network element is represented as an object
- **Object** – an instance of its model
  - It exists independently from other objects and its characteristics conform to the model's specifications

Object Attributes (cont'd)

- Each object maintains a list of **attributes** that provide external control of the object's functions and behavior
- Configuration of network elements is performed by modifying their attribute values
- The accuracy of a simulation study greatly depends on correct configuration of the network elements in the created topology
- No need to specify the values of all attributes of all the protocols and technologies used in a simulation study
  - As a rule, each protocol is preconfigured with the most frequently used default values
- Usually, only some of those default values should be changed in a simulation study

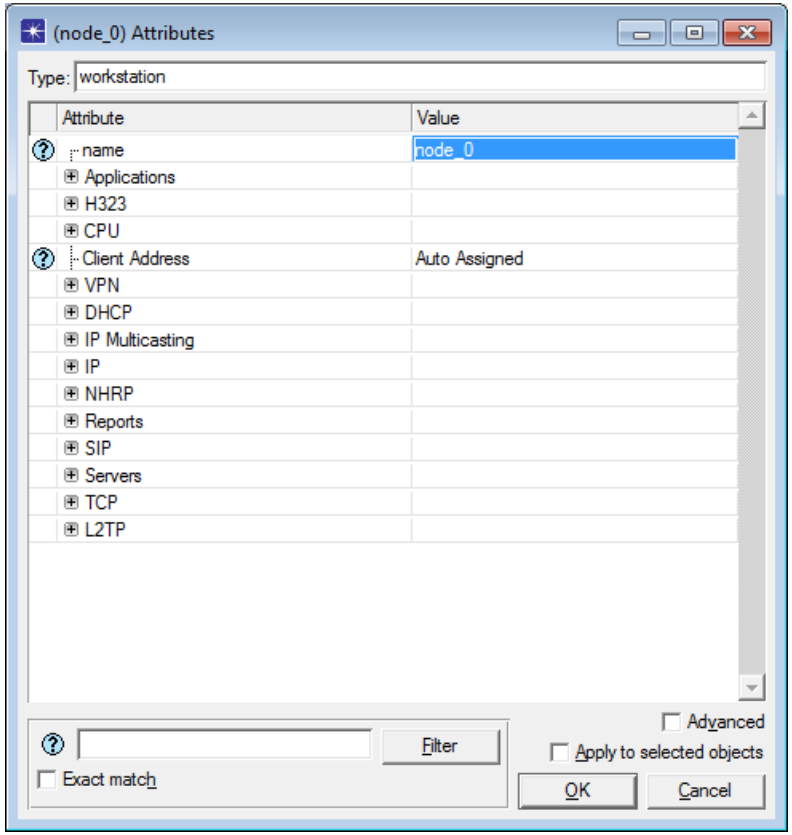
Object Attributes (cont'd)

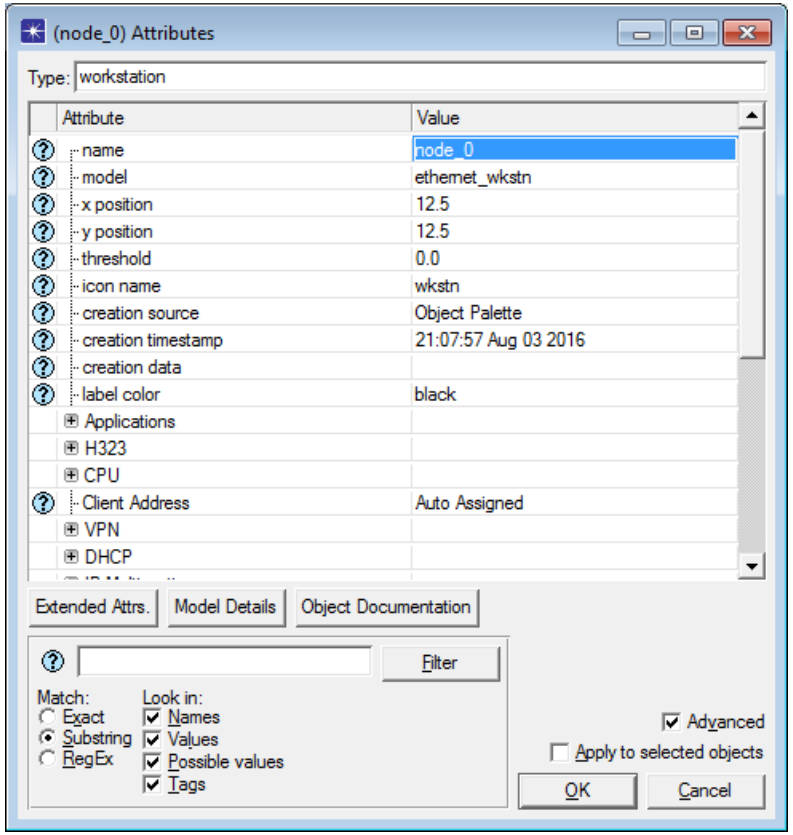
- Object pop-up menu



Object Attributes (cont'd)

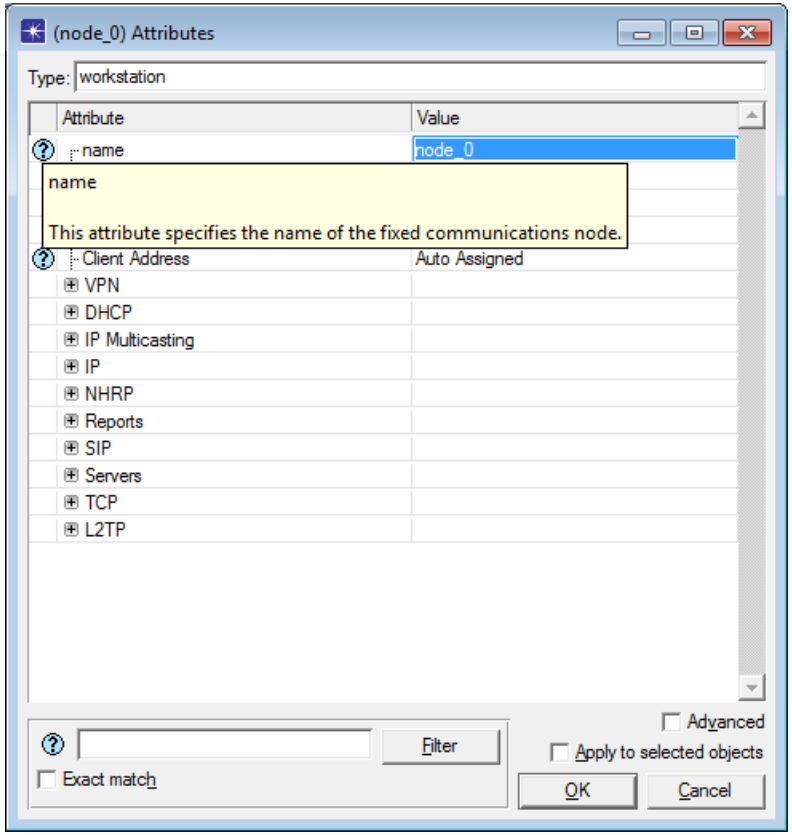
- 'Edit Attributes' vs. 'Edit Attributes (Advanced)' = 'Advanced'

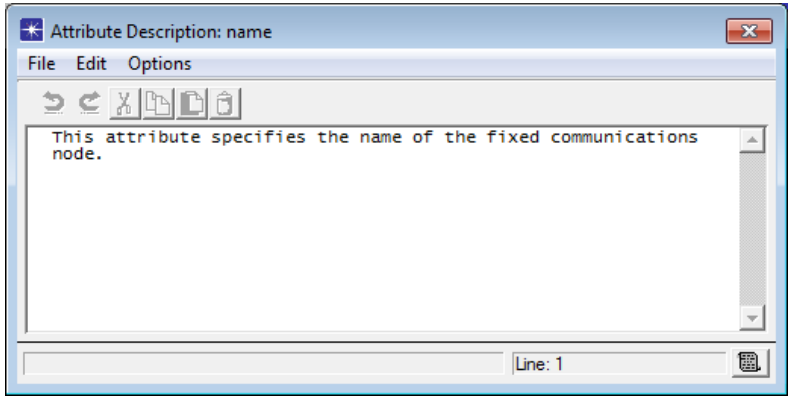




Object Attributes (cont'd)

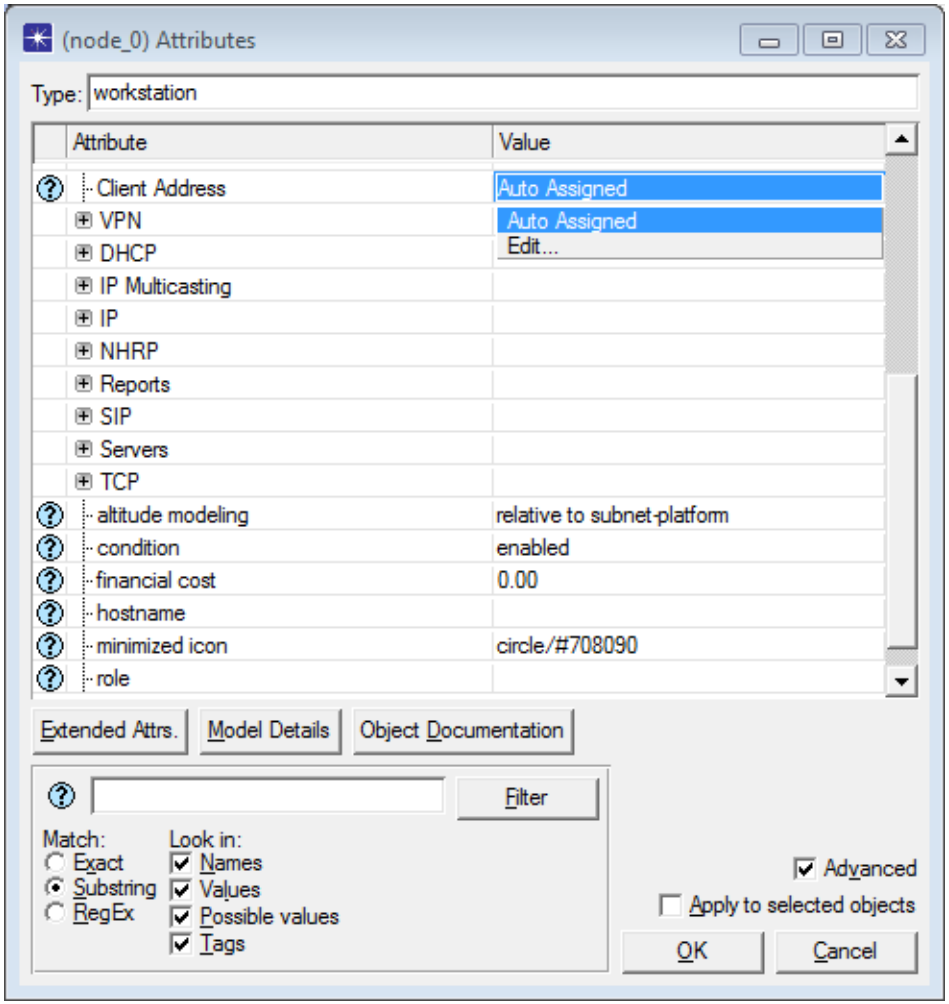
- Attribute description





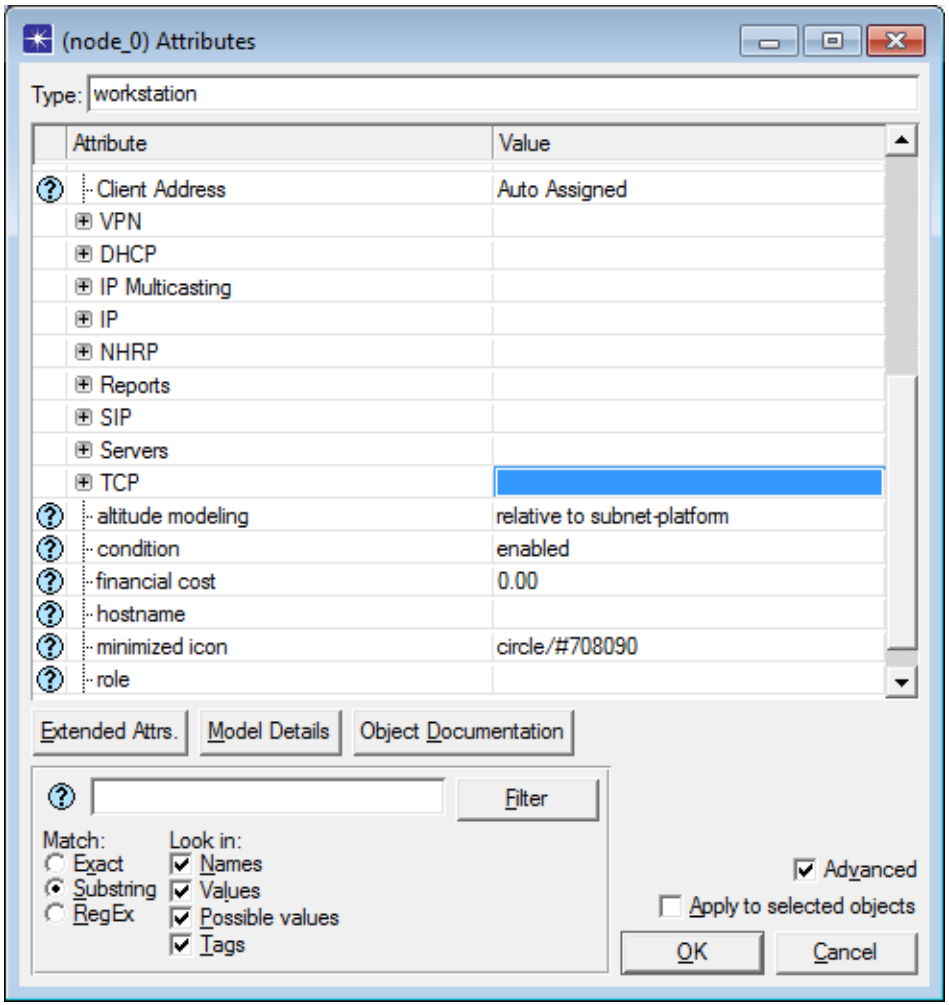
Object Attributes (cont'd)

- **Basic (noncompound) attribute** – contains no subattributes and has a single value assigned to it



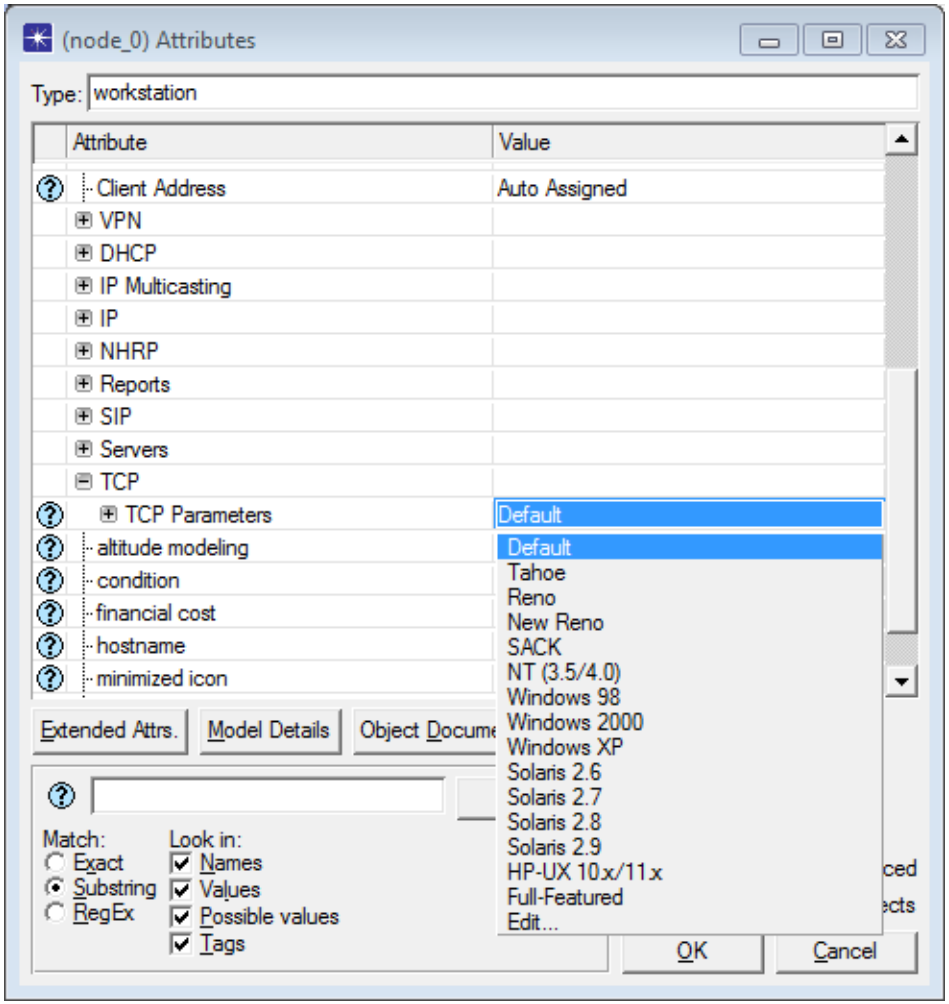
Object Attributes (cont'd)

- **Grouping attribute** – simply an attribute group and cannot have values associated with it



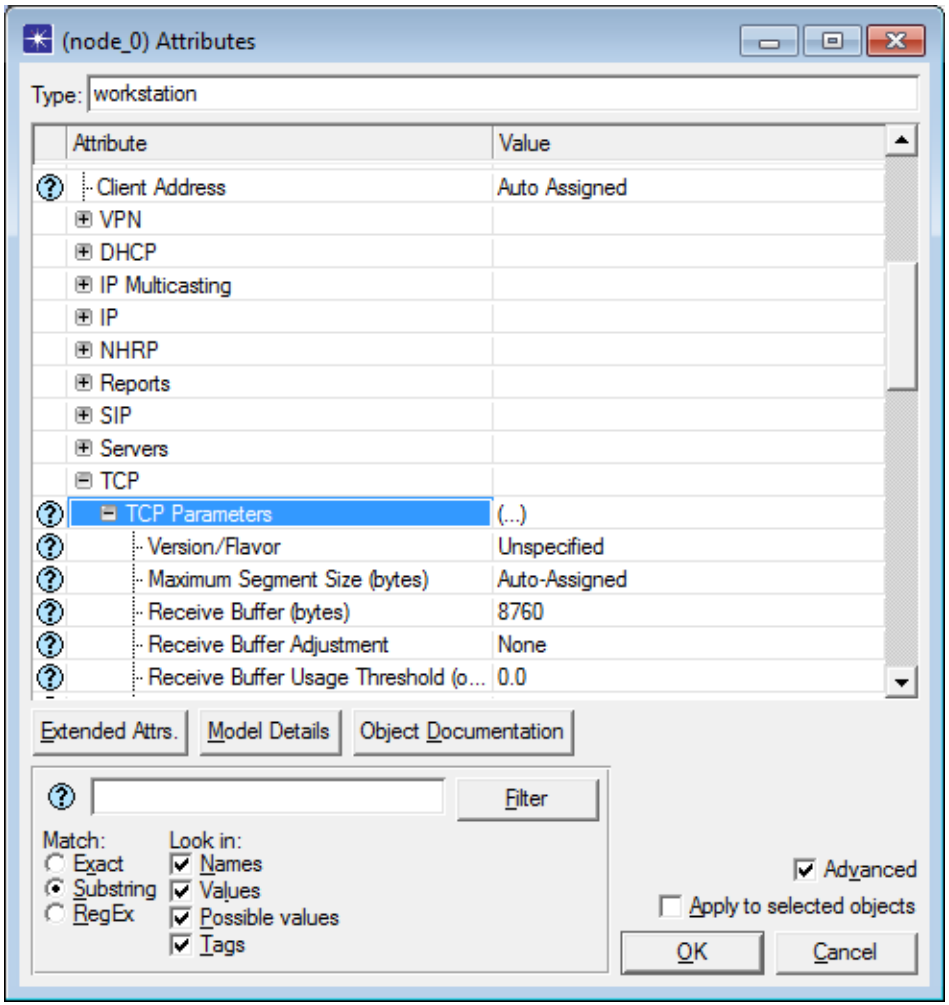
Object Attributes (cont'd)

- **Compound attribute** – contains one or more subattributes and may have a value assigned to it



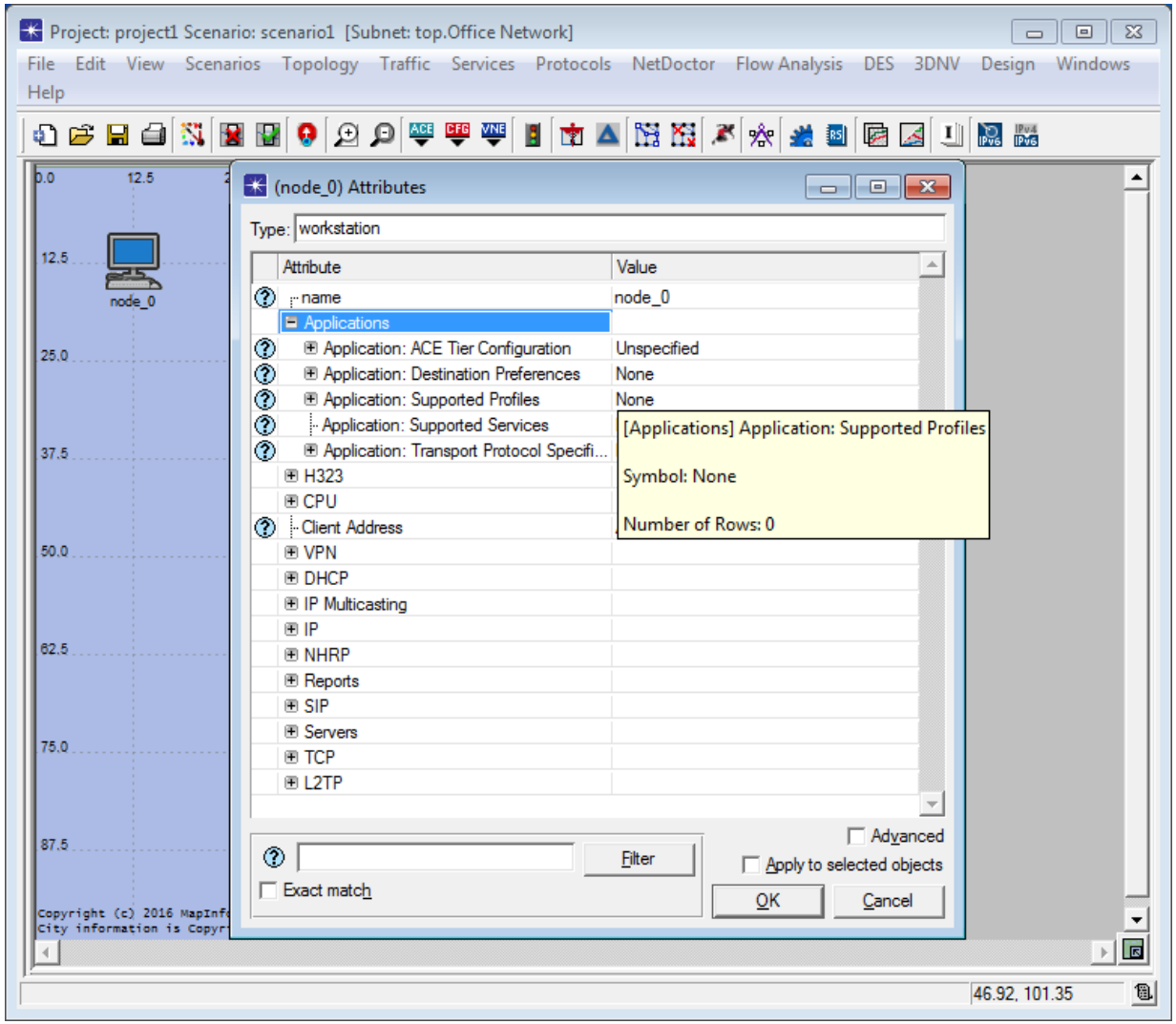
Object Attributes (cont'd)

- The value of a compound attribute is a collection of the values of all its subattributes



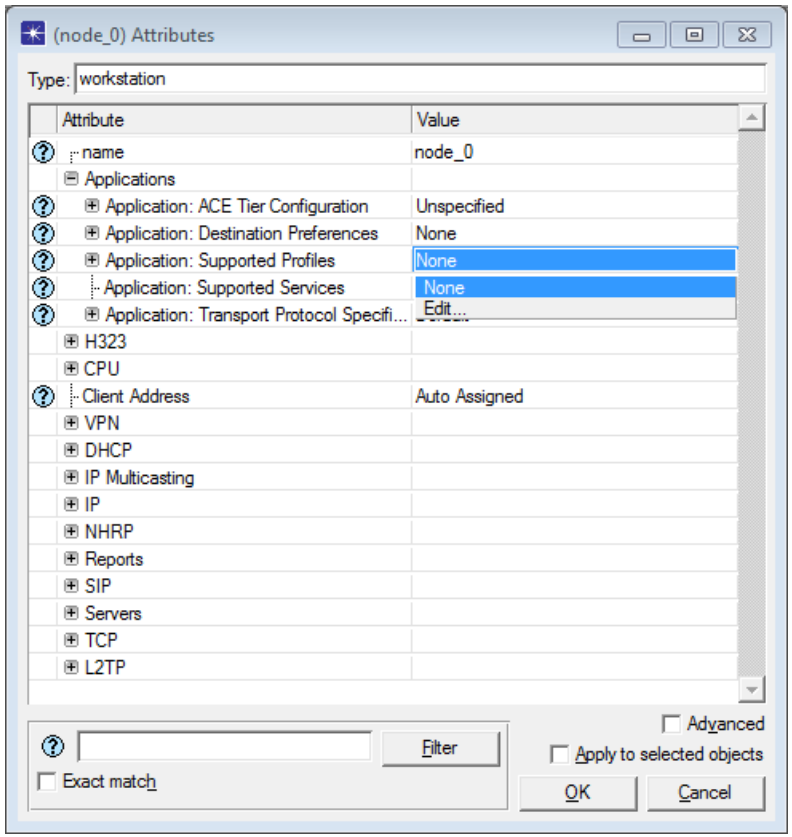
Object Attributes (cont'd)

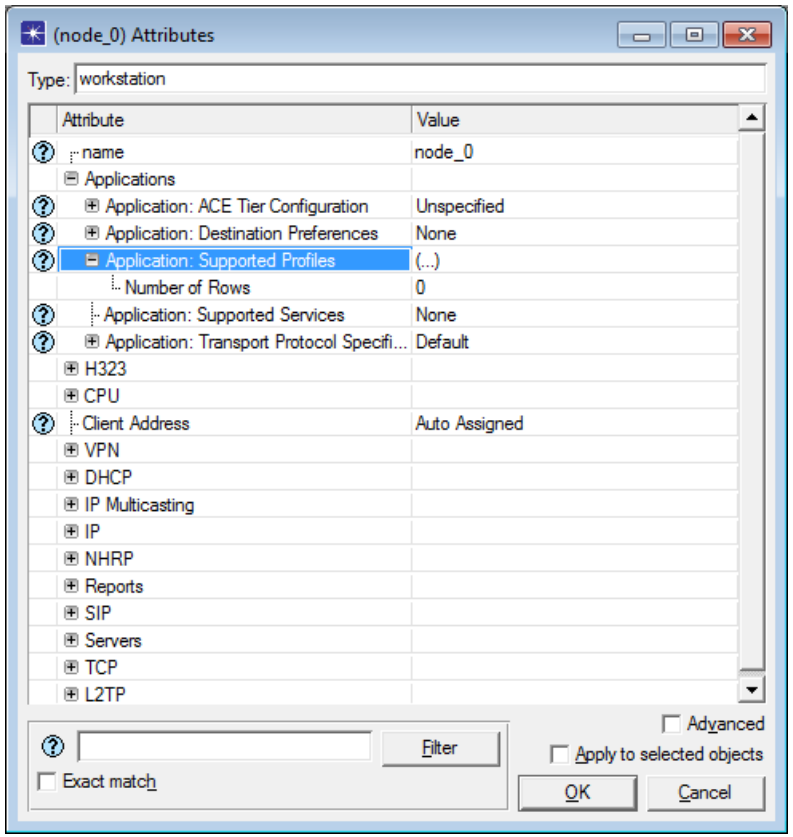
- Certain objects may contain multiple instances of the same attribute



Object Attributes (cont'd)

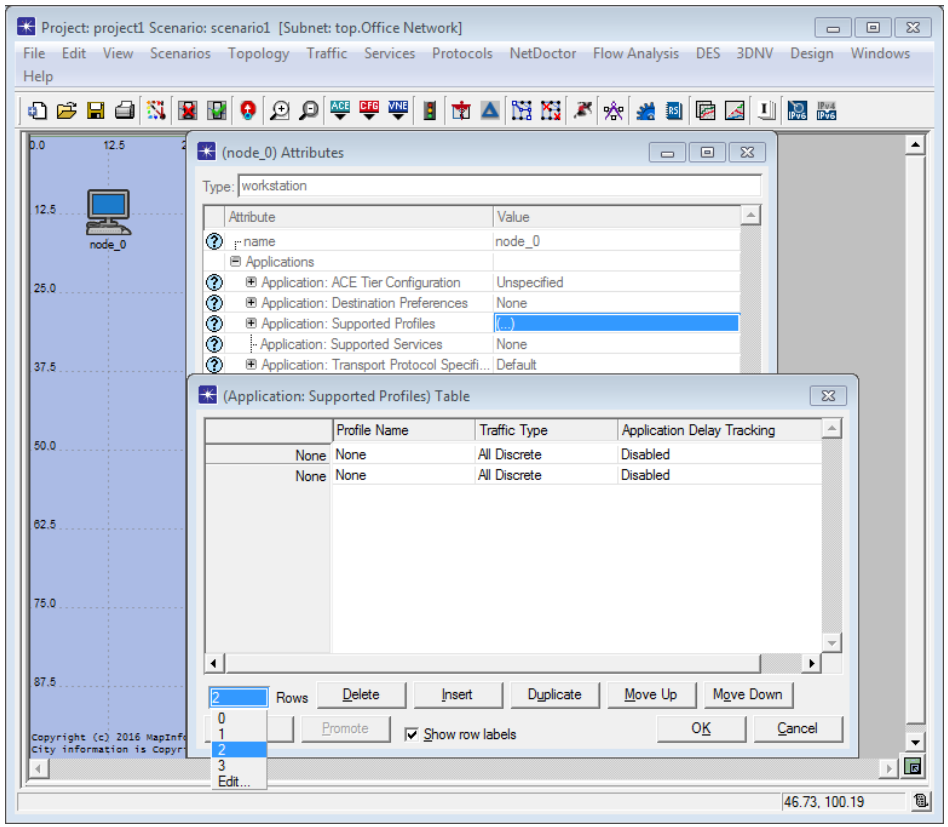
- **Number of Rows** = number of instances to be created
  - By default, this value for most attributes is 0

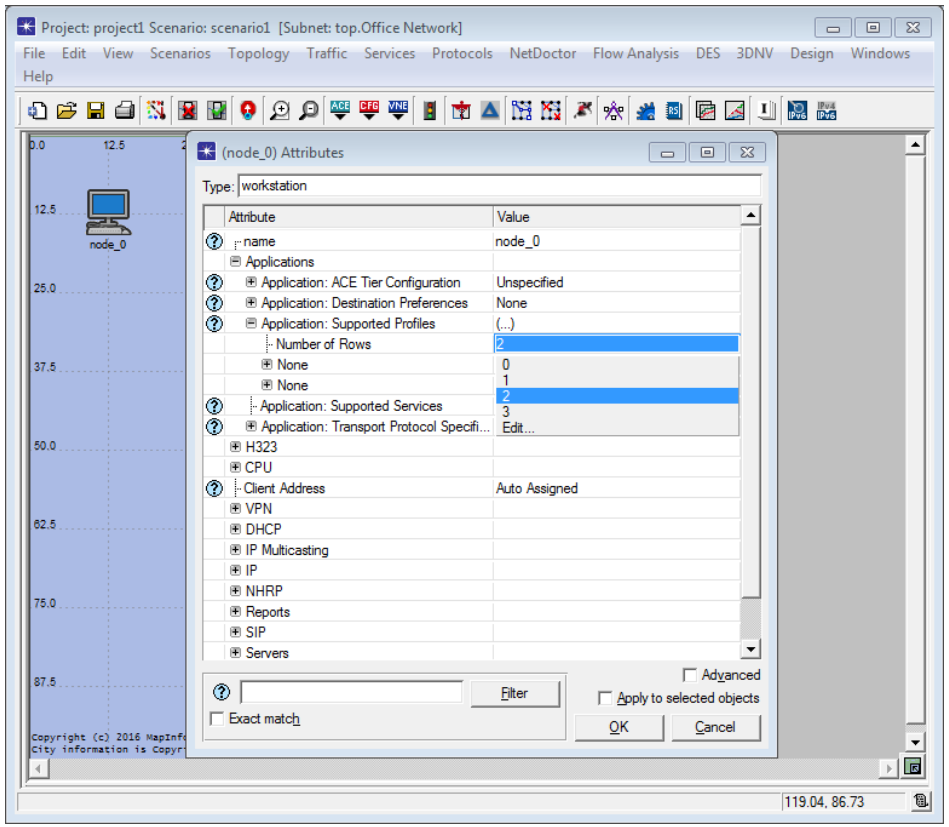




Object Attributes (cont'd)

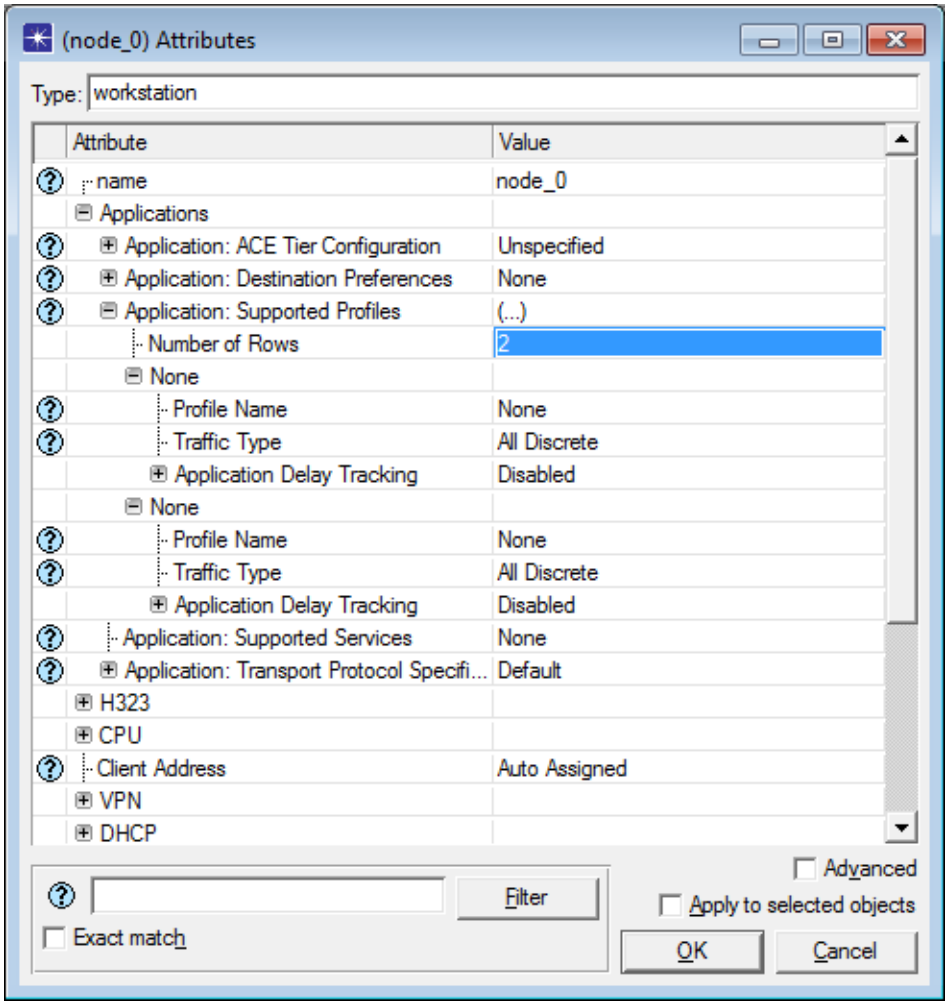
- **Example:** Number of Rows = 2





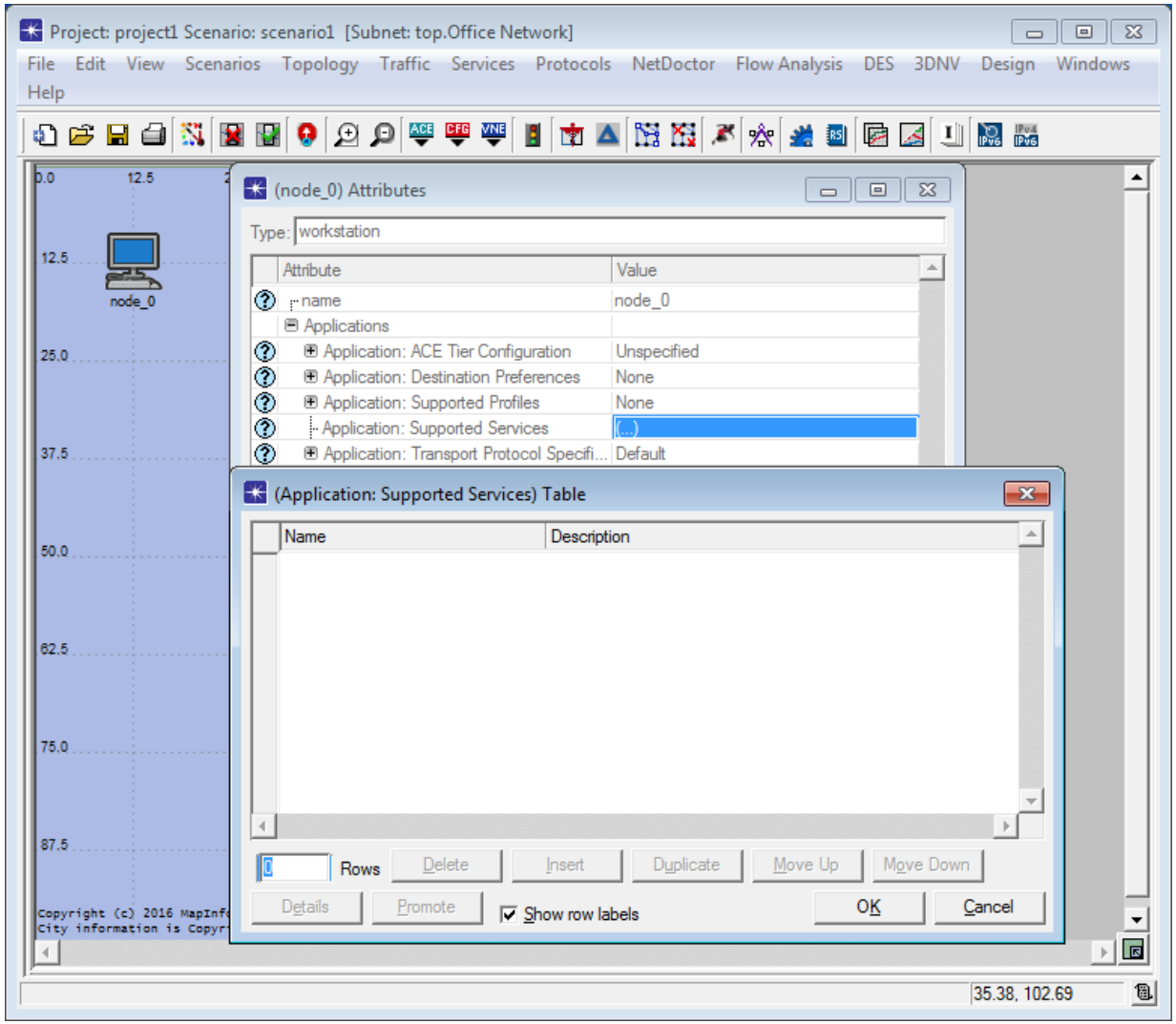
Object Attributes (cont'd)

- New compound attributes appear once the value is changed from 0



Object Attributes (cont'd)

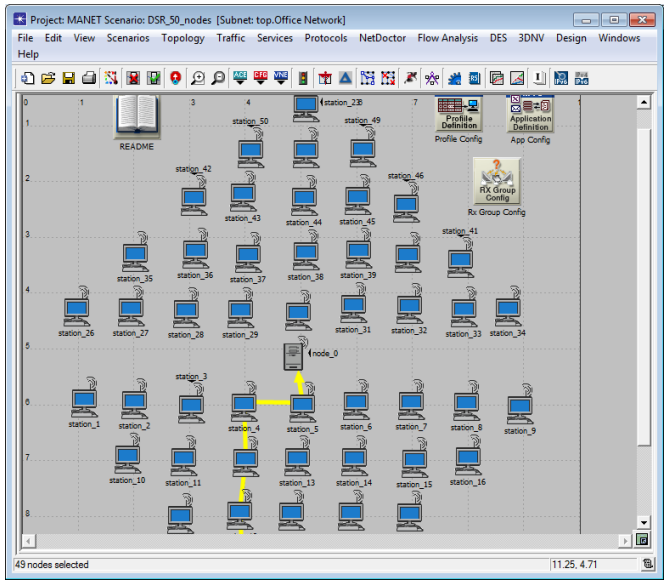
- Some attributes may be edited in tabular format only



Outline

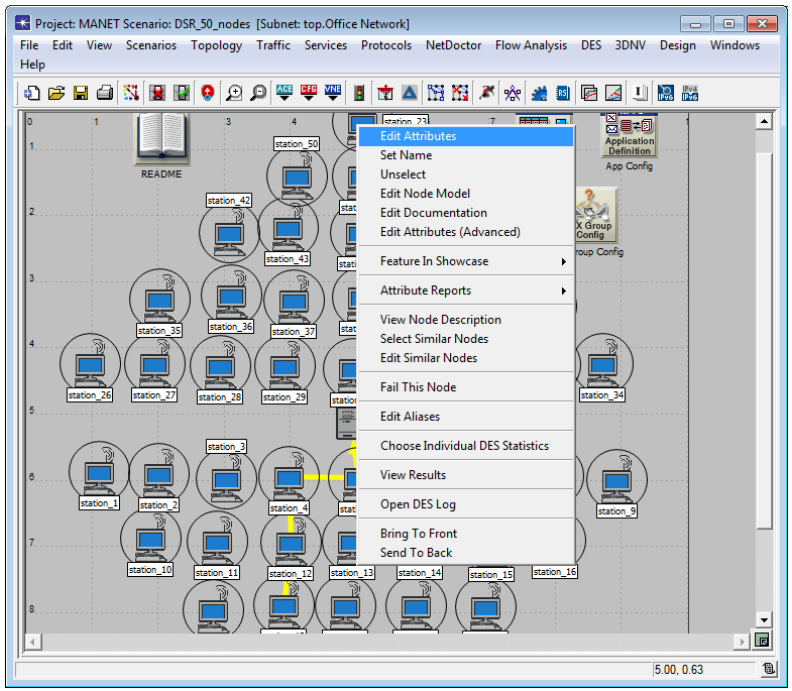
Configuring Multiple Objects

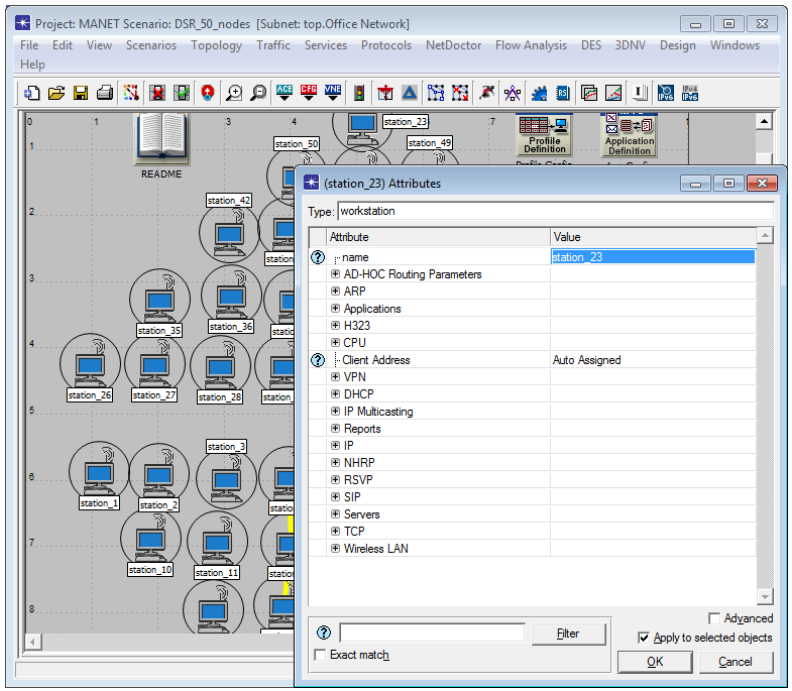
- OPNET/Riverbed provides several methods for configuring multiple objects simultaneously:
  - Left-click on the project workspace and then drag the mouse over the area where the objects of interest reside
  - While holding CTRL or SHIFT, left-click on the objects that you would like to select
  - Right-click on one of the objects to be selected and then choose 'Select Similar Nodes' or 'Select Similar Links'



Configuring Multiple Objects (cont'd)

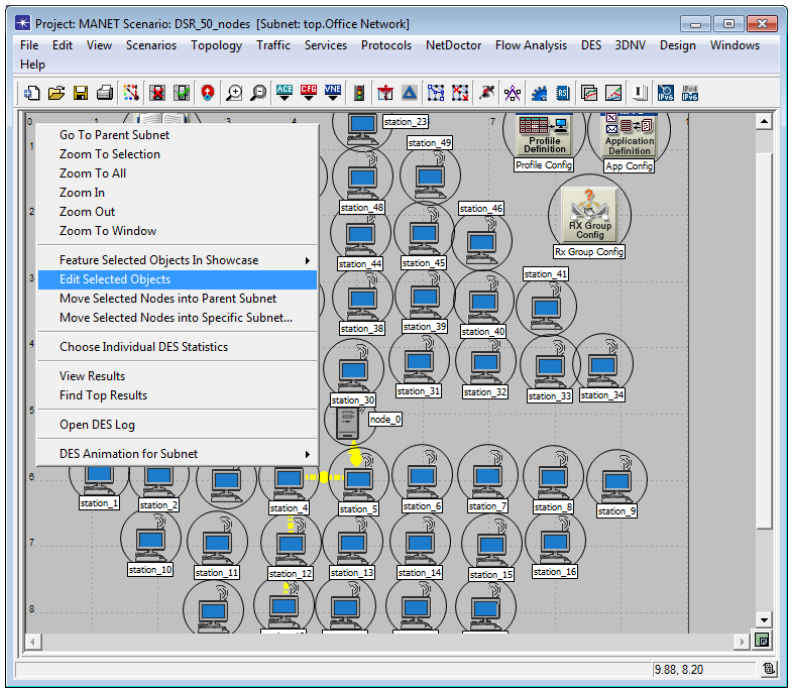
- Edit Attributes $\Rightarrow$ **Apply to selected objects**

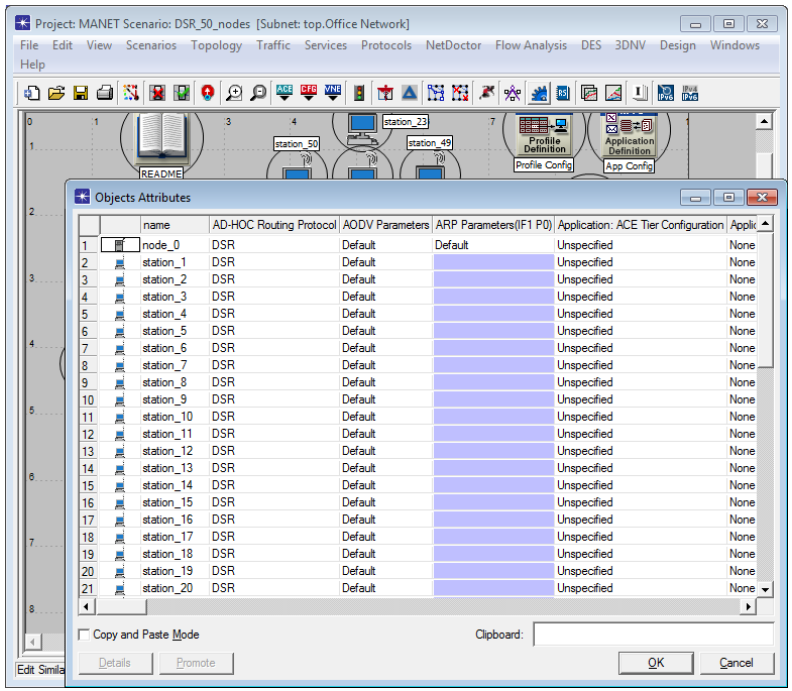




Configuring Multiple Objects (cont'd)

- Edit ⇒ Select All In Subnet ⇒ Edit Selected Objects
  - You can change the values of the attributes for any(!) of the objects in this table
  - If a particular object doesn't have a certain attribute, then an empty (blue) box appears instead





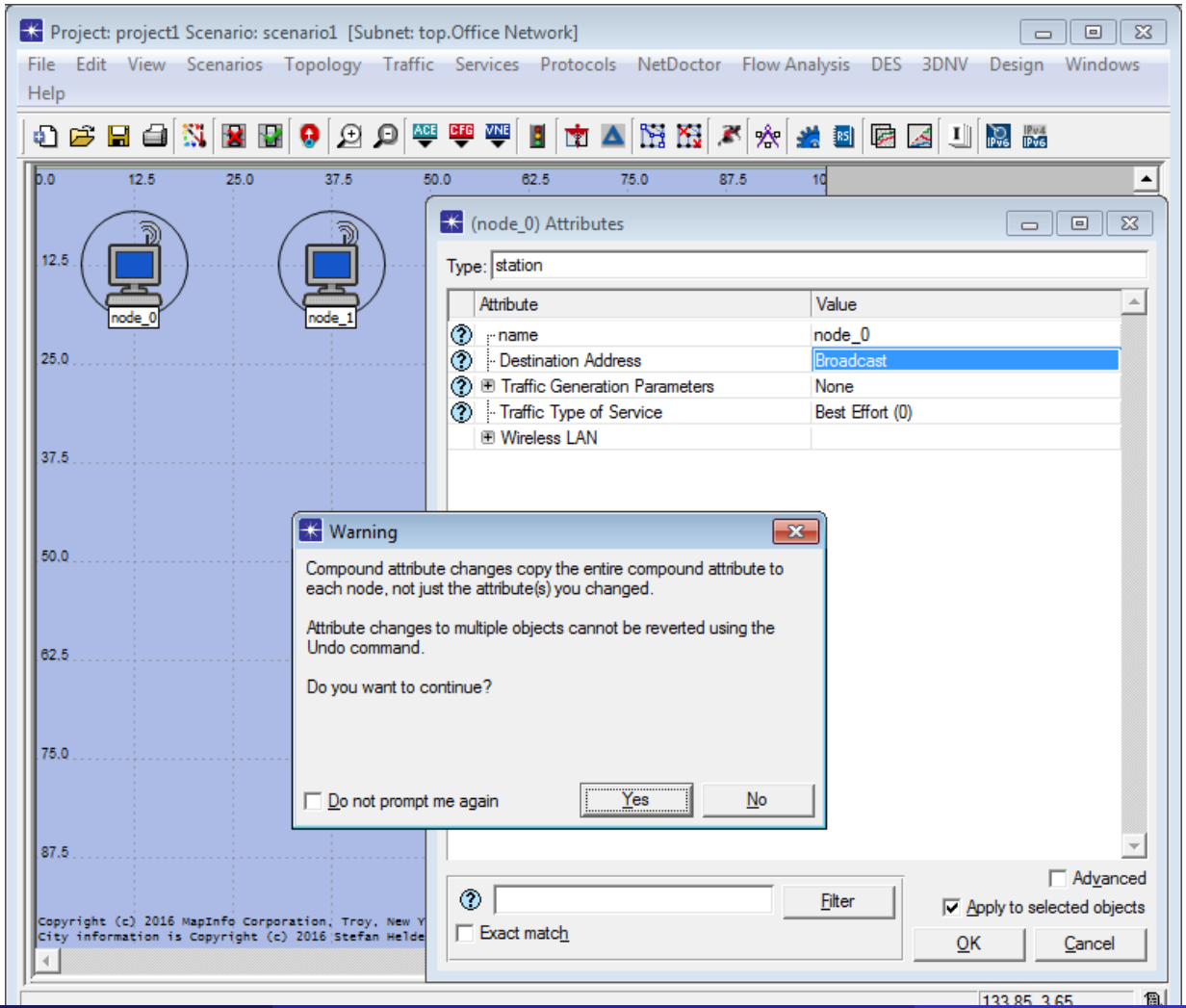
Configuring Multiple Objects (cont'd)

- **Common mistakes in configuring multiple objects:**

1. Forgetting to check the 'Apply to selected objects' checkbox will cause the changes to occur only in the one object that was right-clicked in the previous step and not in all the other preselected objects
2. If no changes were made to the right-clicked object, nothing will be copied to all the selected objects
3. Changing the value of any subattribute of a compound attribute results in the entire compound attribute being applied to all the selected objects
4. If the requested changes cannot be applied to one or more of the selected objects, then no changes will be made; however, you will not be notified about such a failure

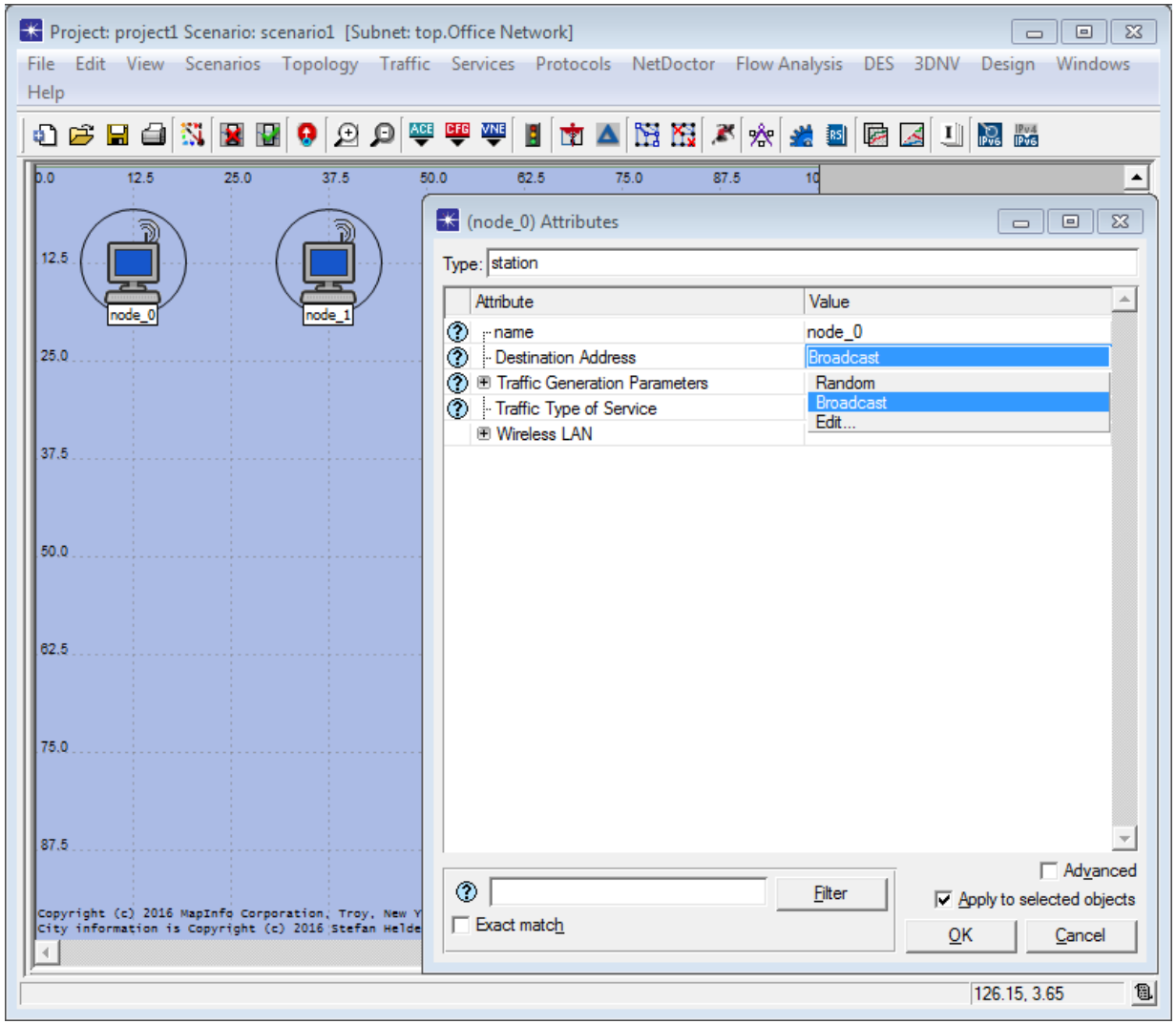
Configuring Multiple Objects (cont'd)

1. Use 'Apply to selected objects' so that changes performed on this node will propagate to all the nodes that were selected



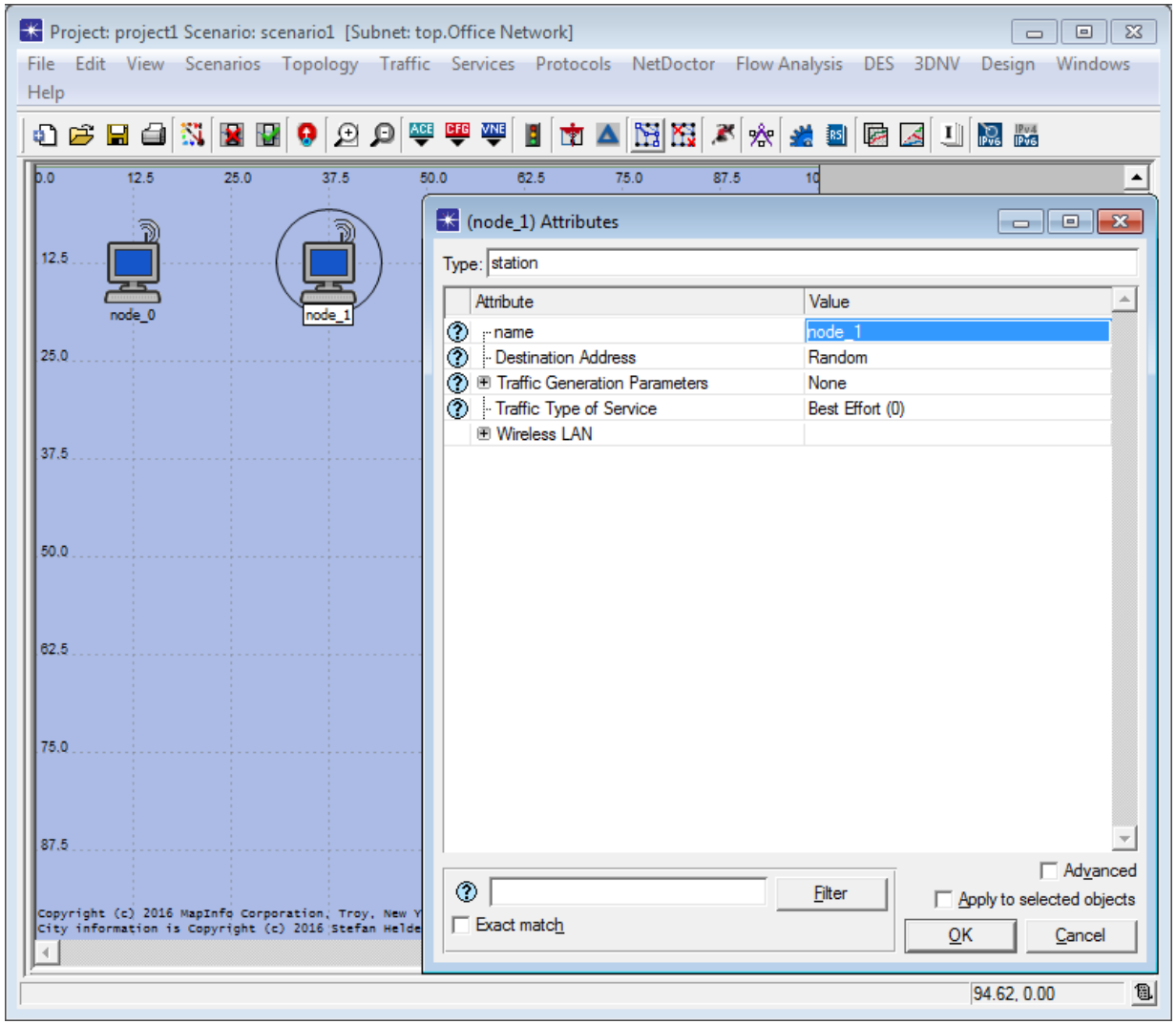
Configuring Multiple Objects (cont'd)

2. node_0 = Broadcast ⇒ Broadcast; node_1 = Random



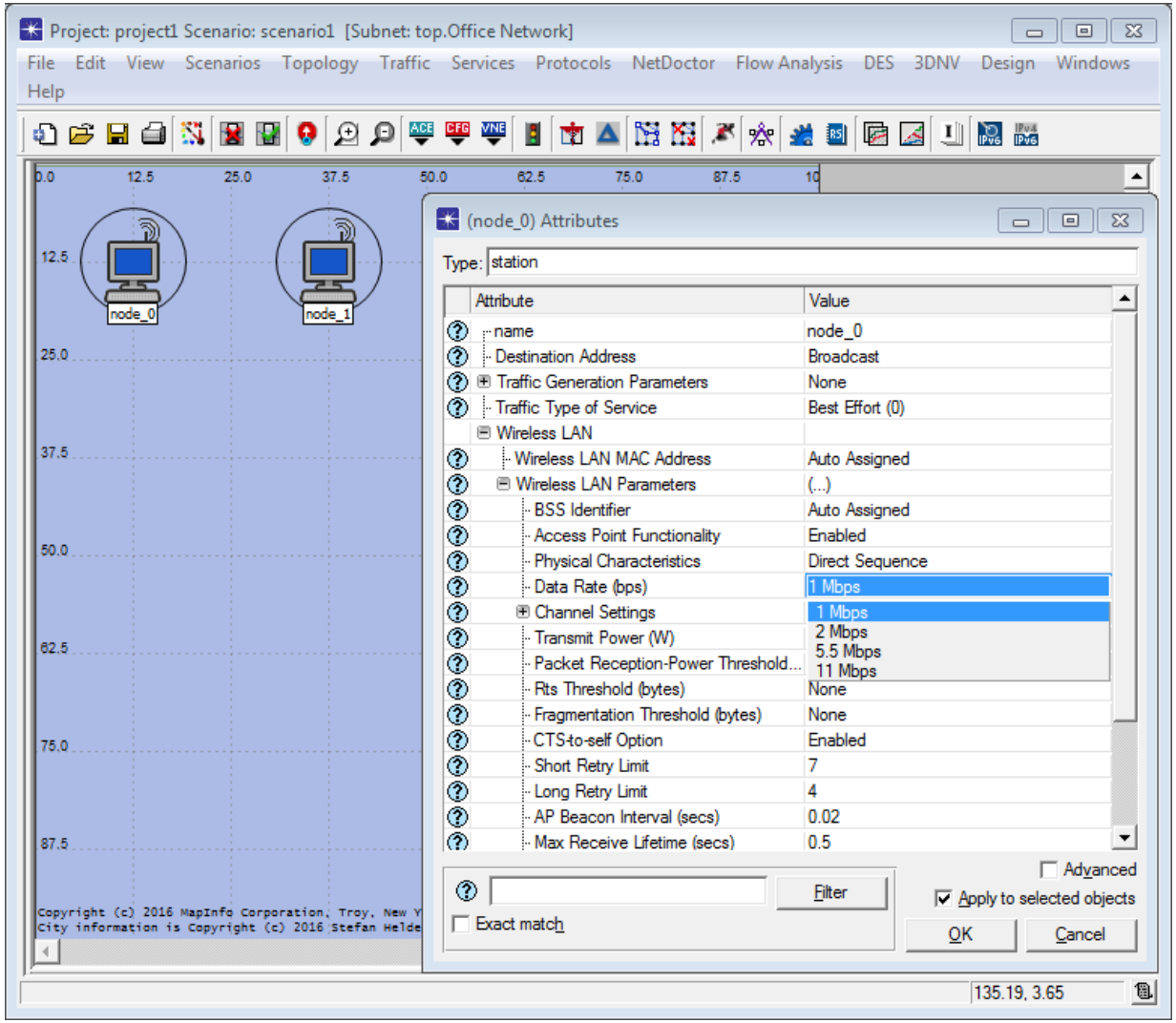
Configuring Multiple Objects (cont'd)

2. No ~~pain~~ change, no gain ☹



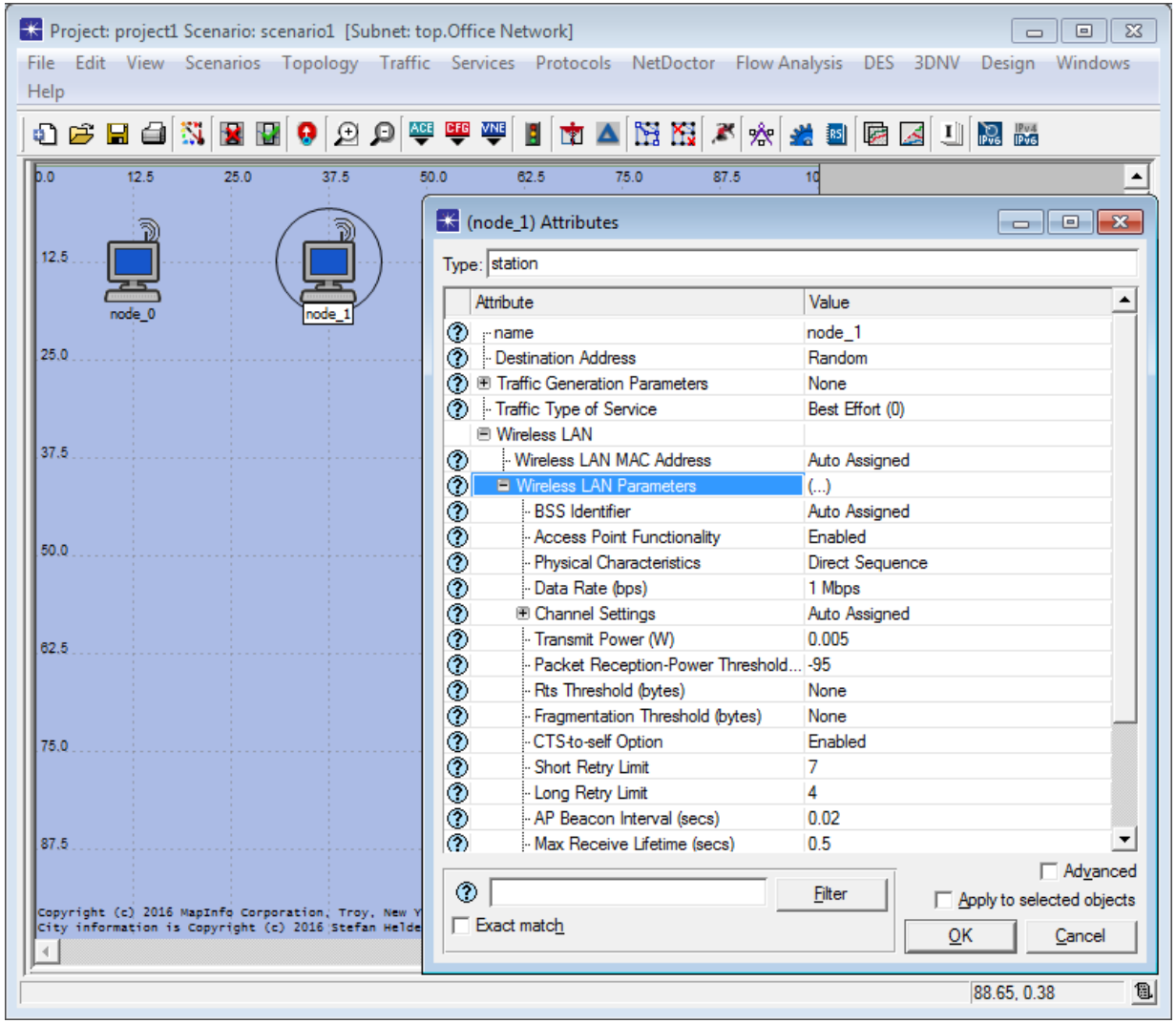
Configuring Multiple Objects (cont'd)

3. node_0 = AP/Broadcast; node_1 = STA/Random; 11 $\Rightarrow$ 1 Mbps



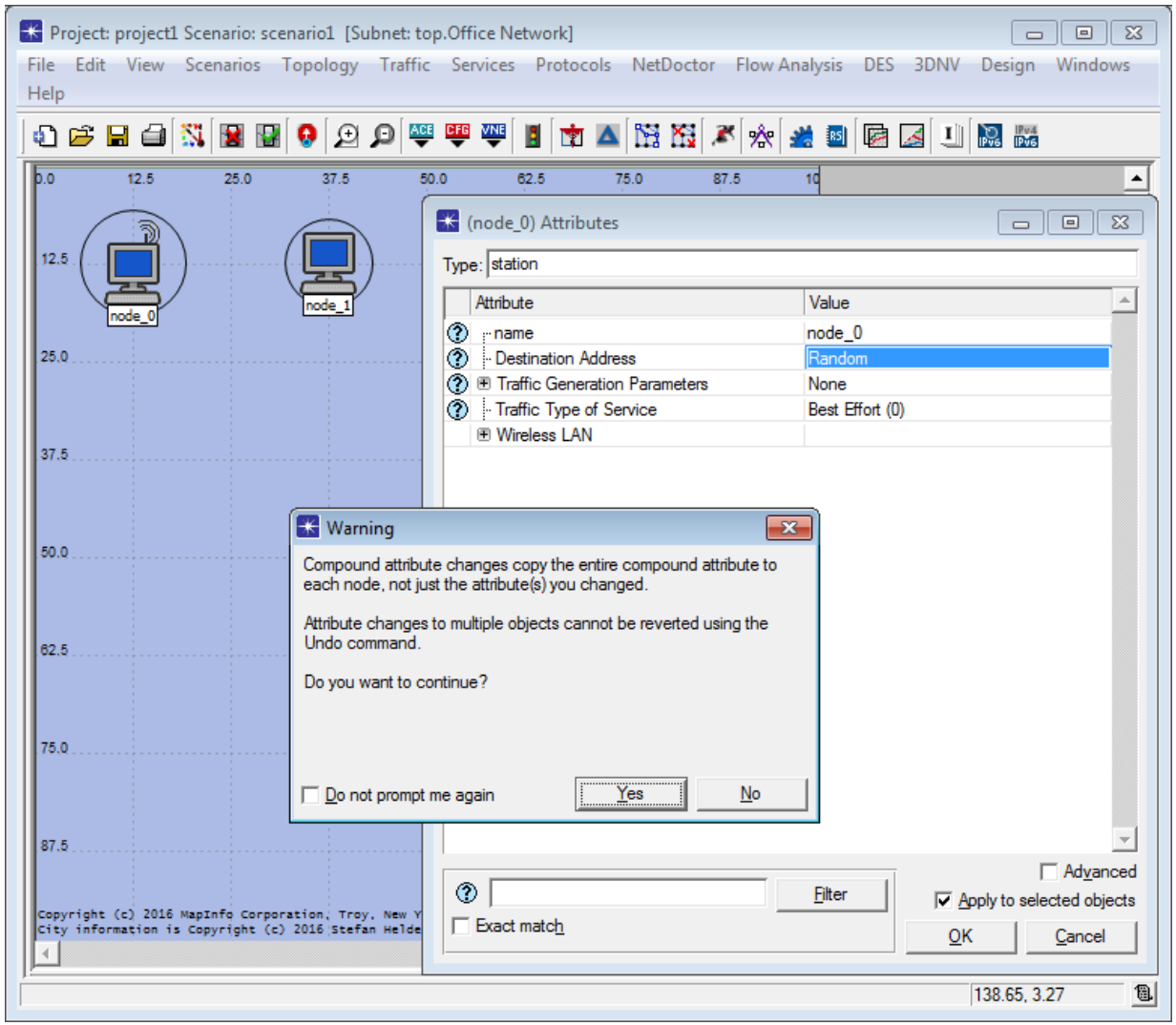
Configuring Multiple Objects (cont'd)

3. node_0 = AP/Broadcast; node_1 = AP/Random; 1 Mbps



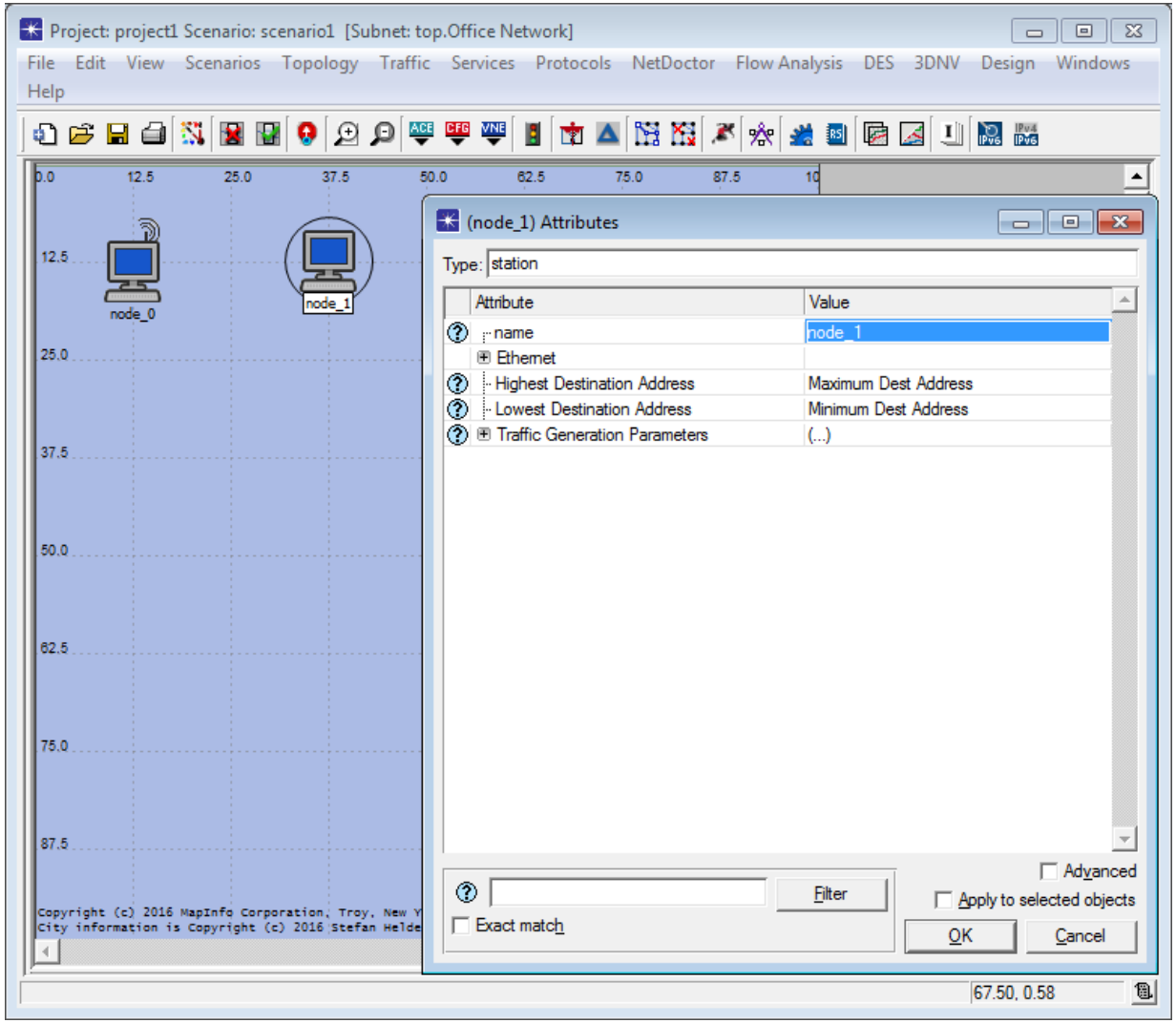
Configuring Multiple Objects (cont'd)

4. node_0 = Broadcast ⇒ Random; node_1 = Max/Min Dest Address



Configuring Multiple Objects (cont'd)

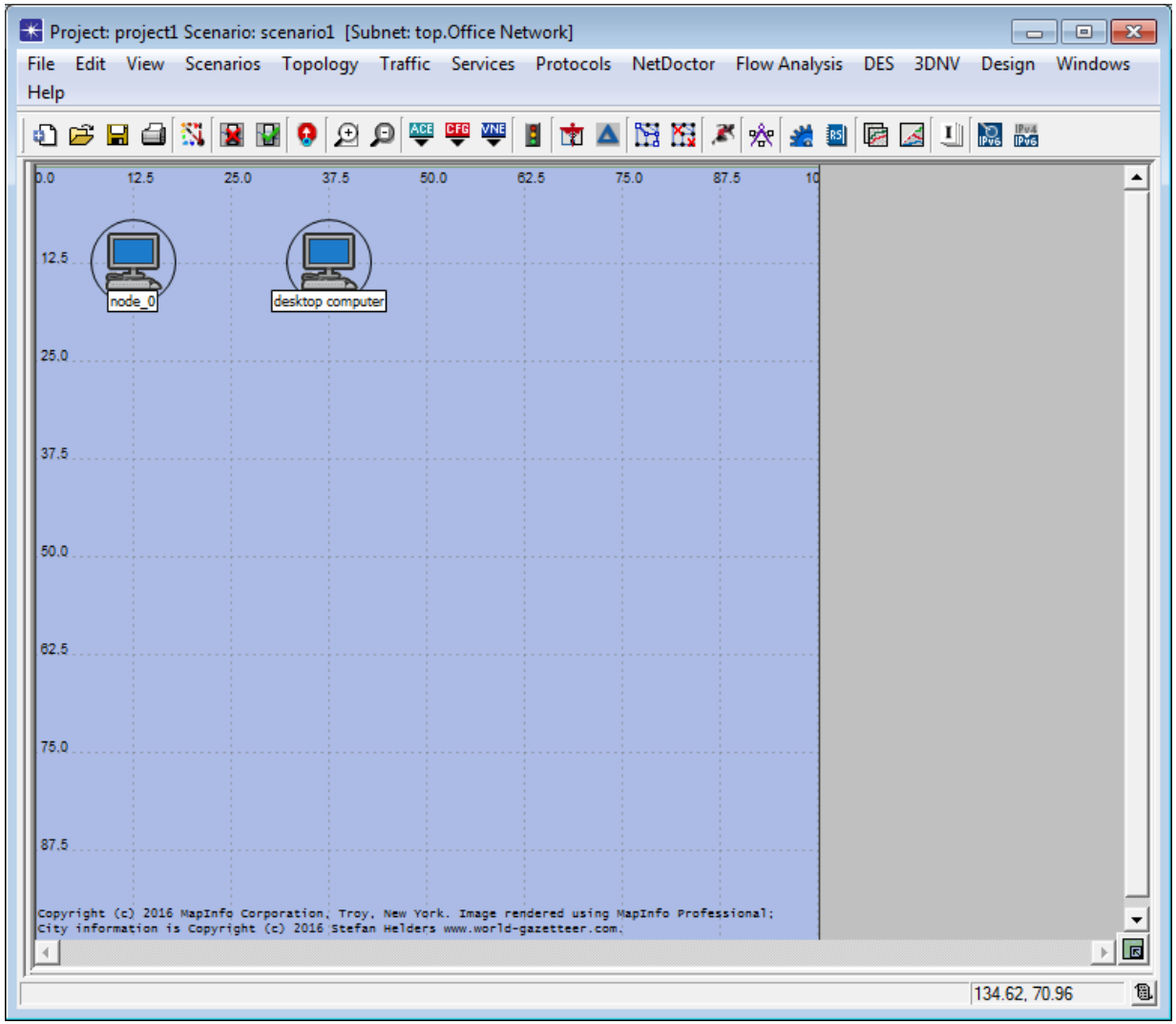
4. node_0 = Random; node_1 = Max/Min Dest Address



Outline

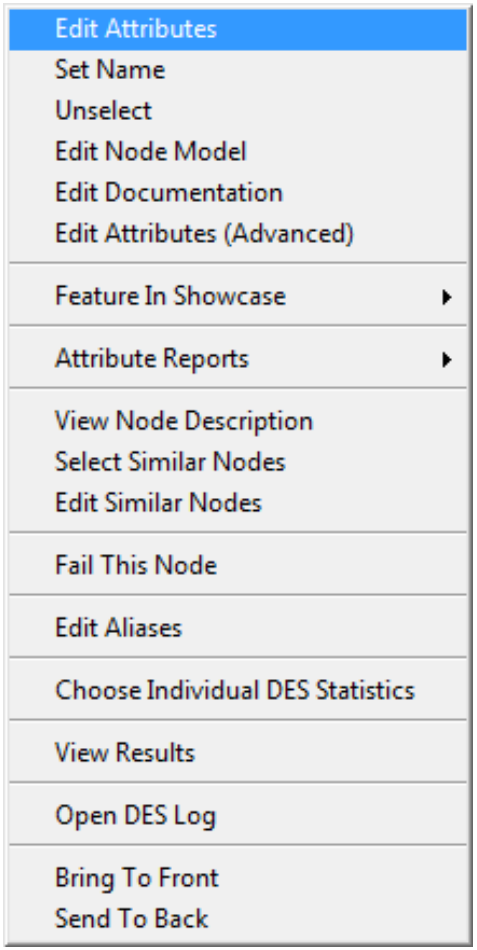
Tips and Tricks

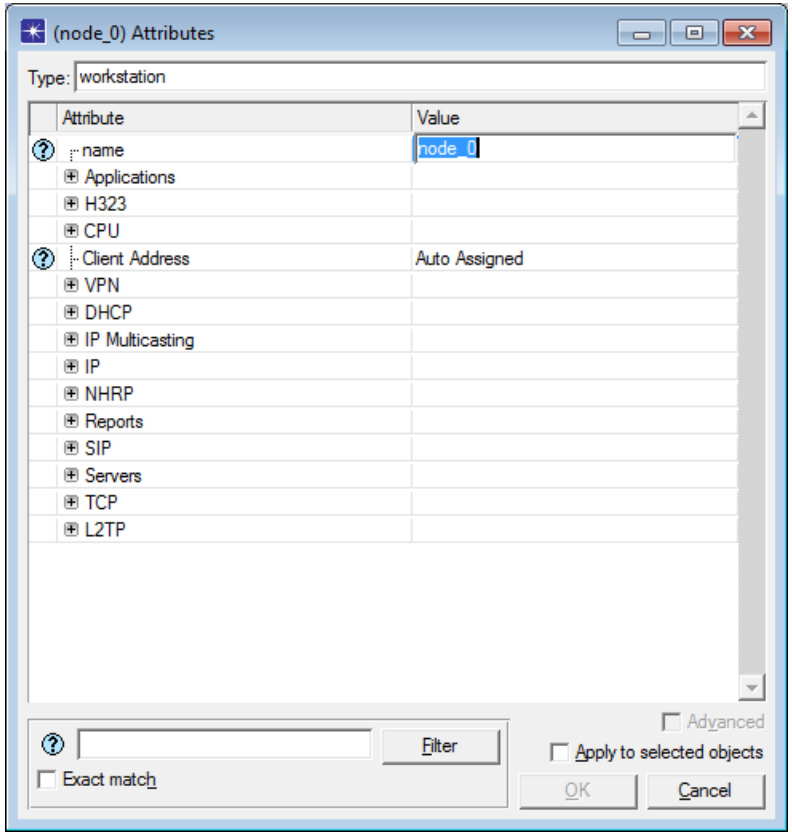
- 2 methods to change the object's name



Tips and Tricks (cont'd)

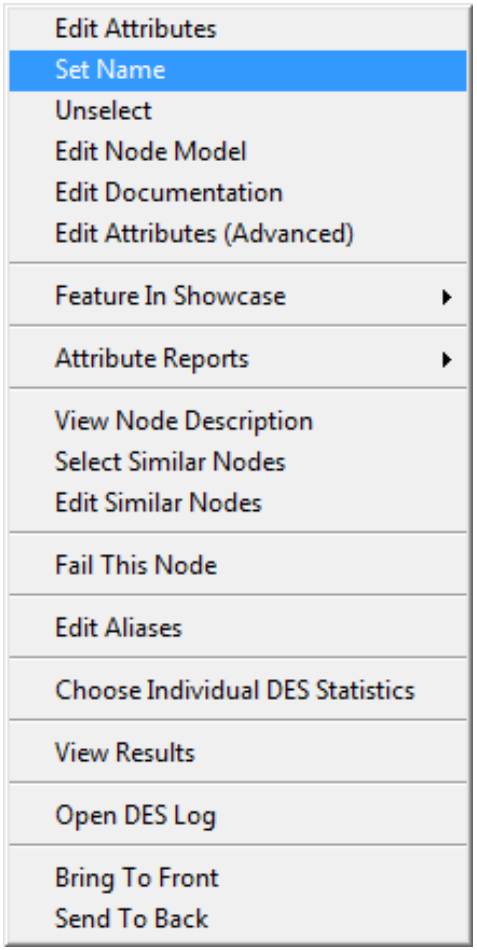
1. Edit Attributes $\Rightarrow$ Change the attribute 'name'

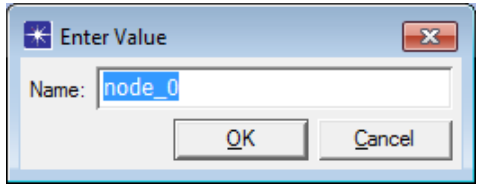




Tips and Tricks (cont'd)

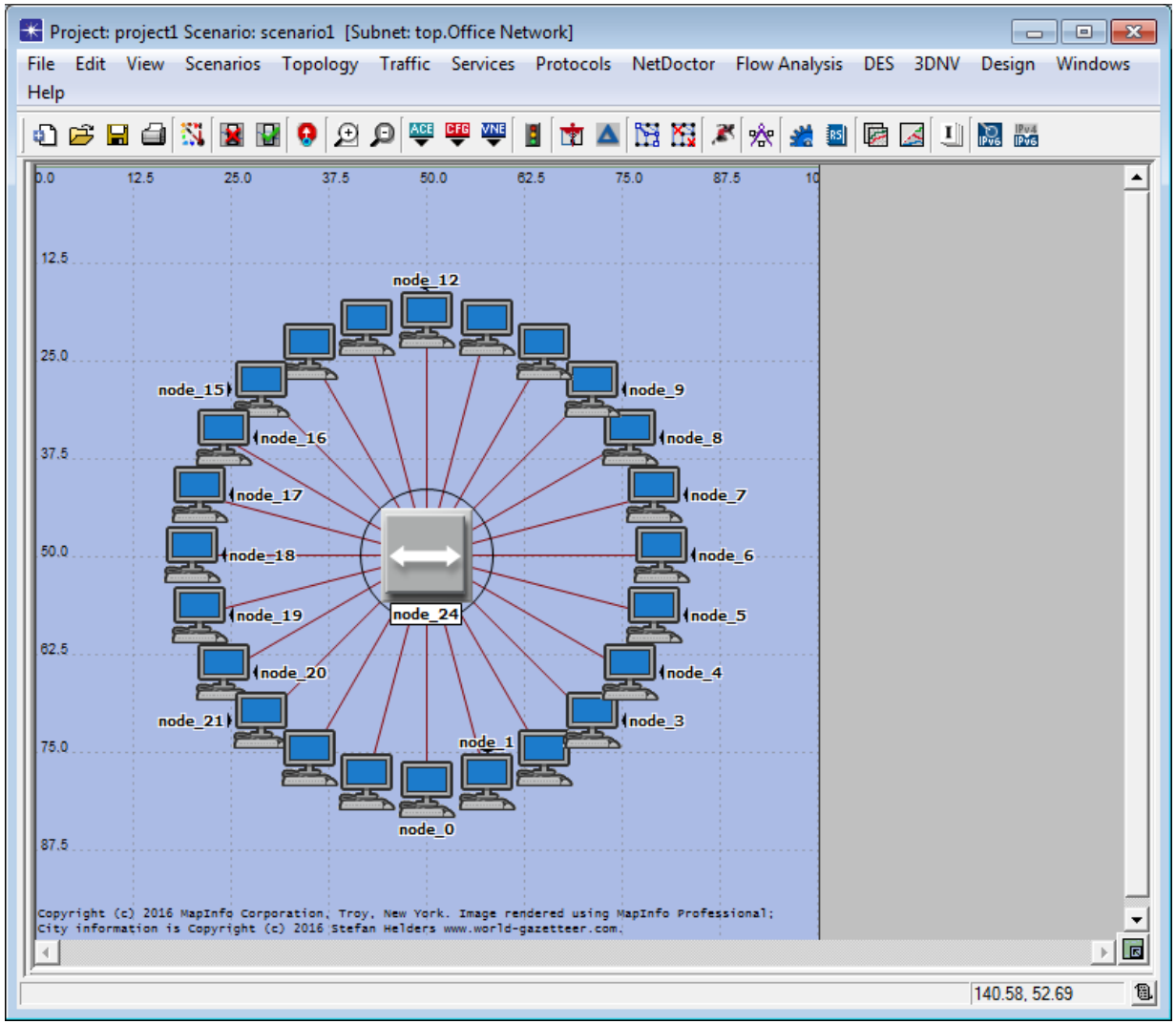
2. Set Name $\Rightarrow$ Enter Value





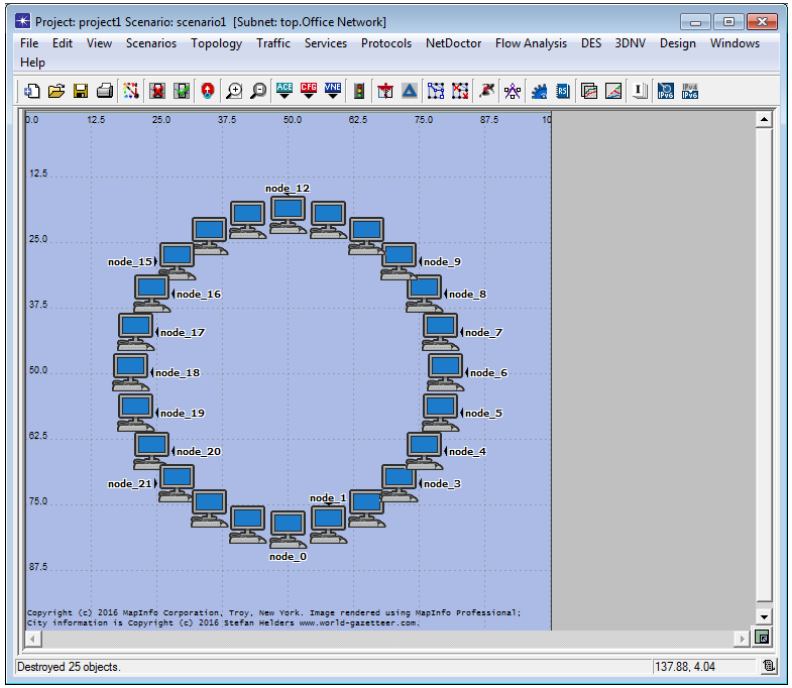
Tips and Tricks (cont'd)

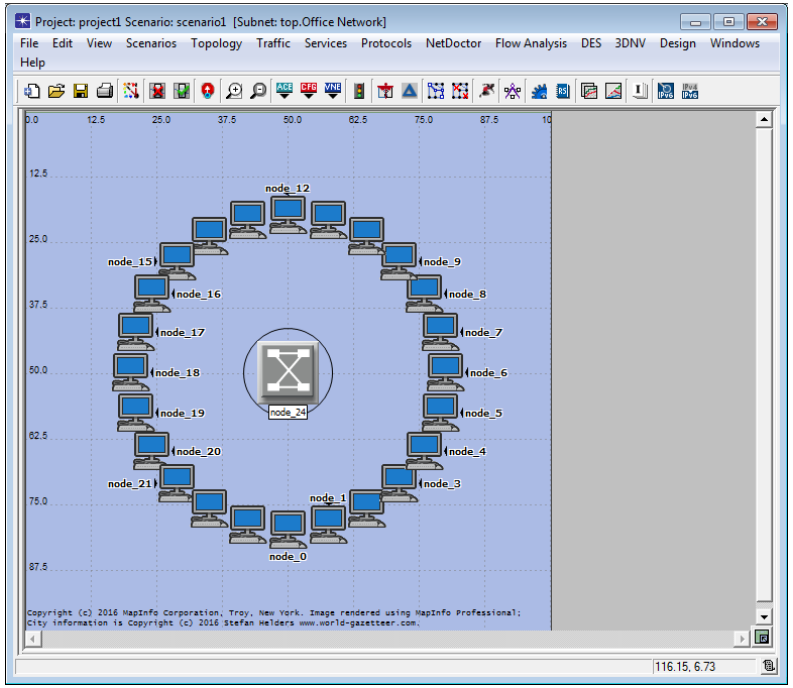
- 2 methods to change the object's model



Tips and Tricks (cont'd)

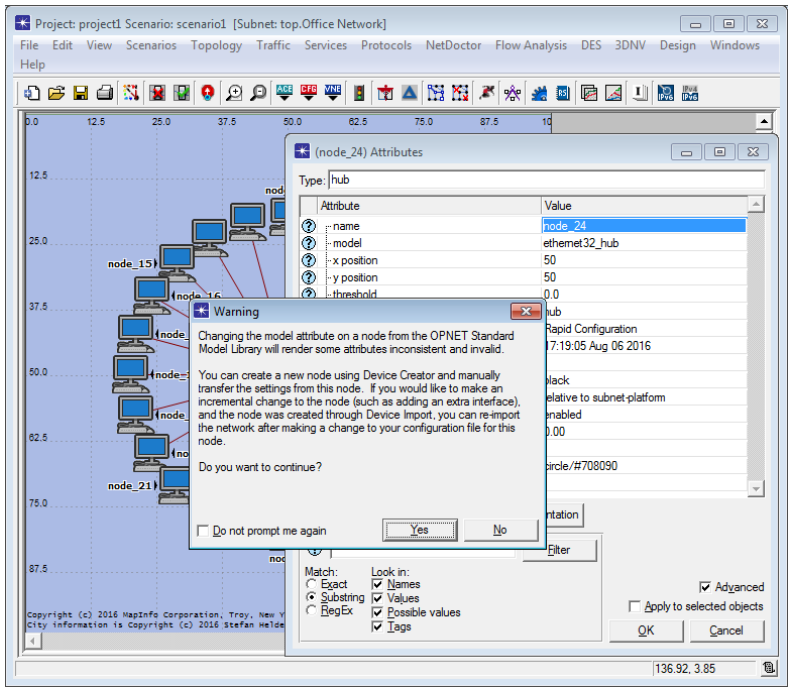
1. Delete the selected object and create a desired one

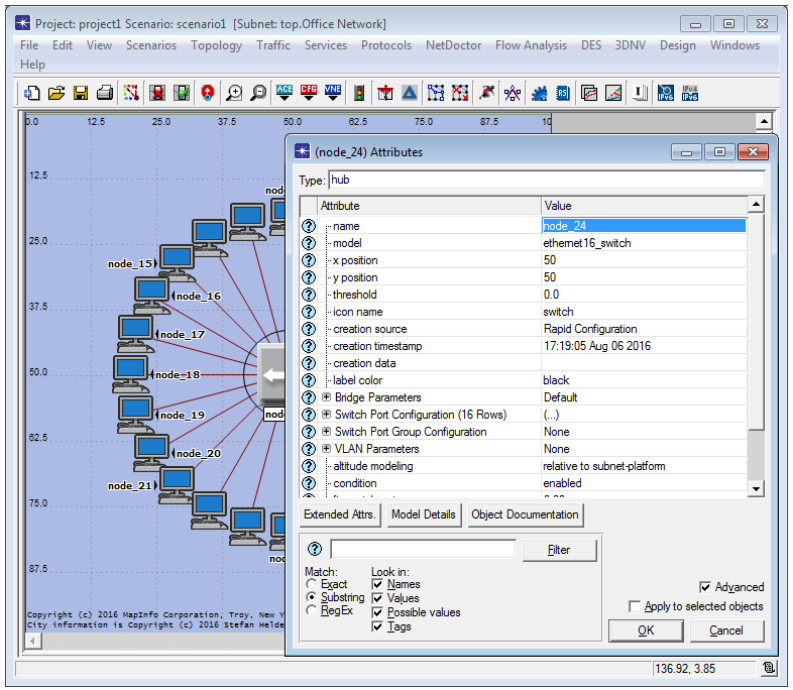




Tips and Tricks (cont'd)

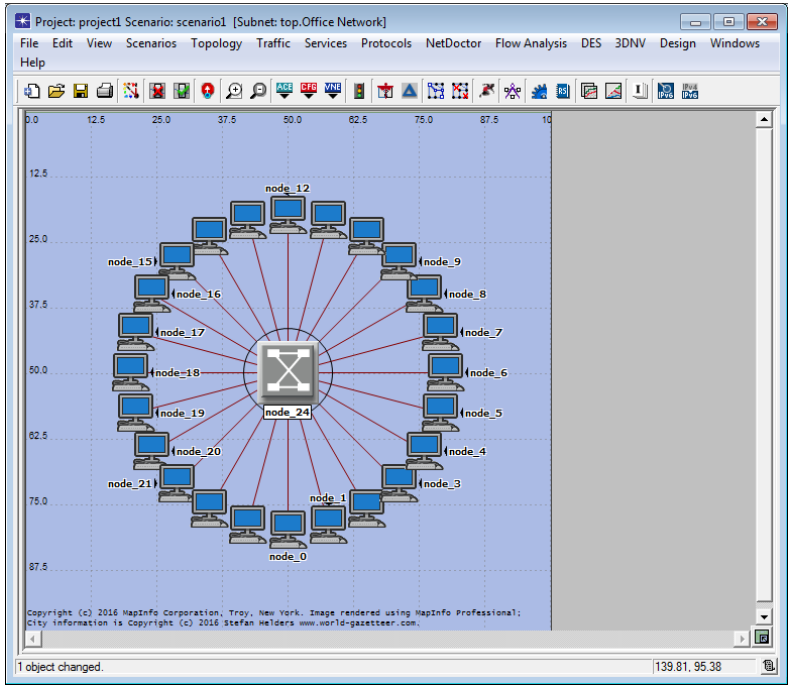
2. Edit Attributes (Advanced) $\Rightarrow$ Change the attribute 'model'

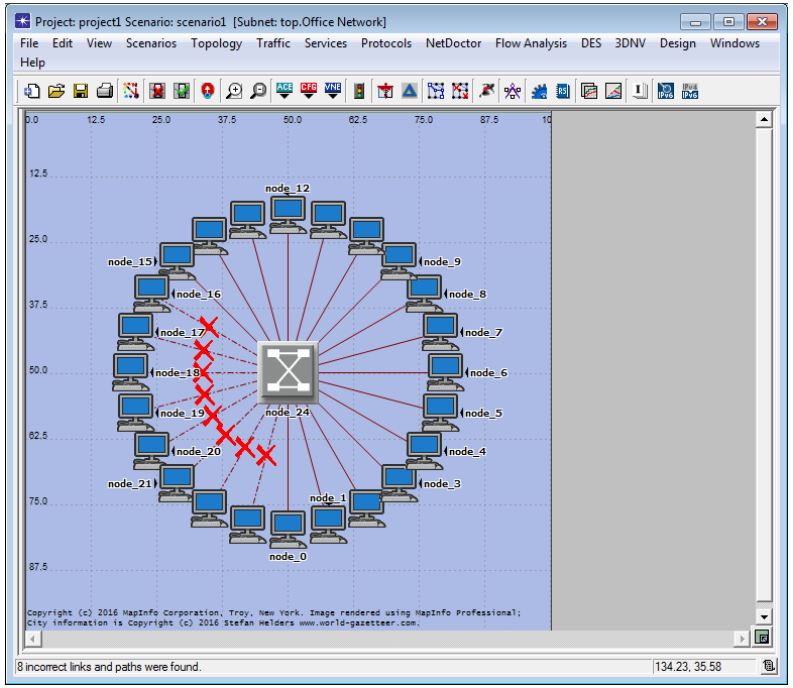




Tips and Tricks (cont'd)

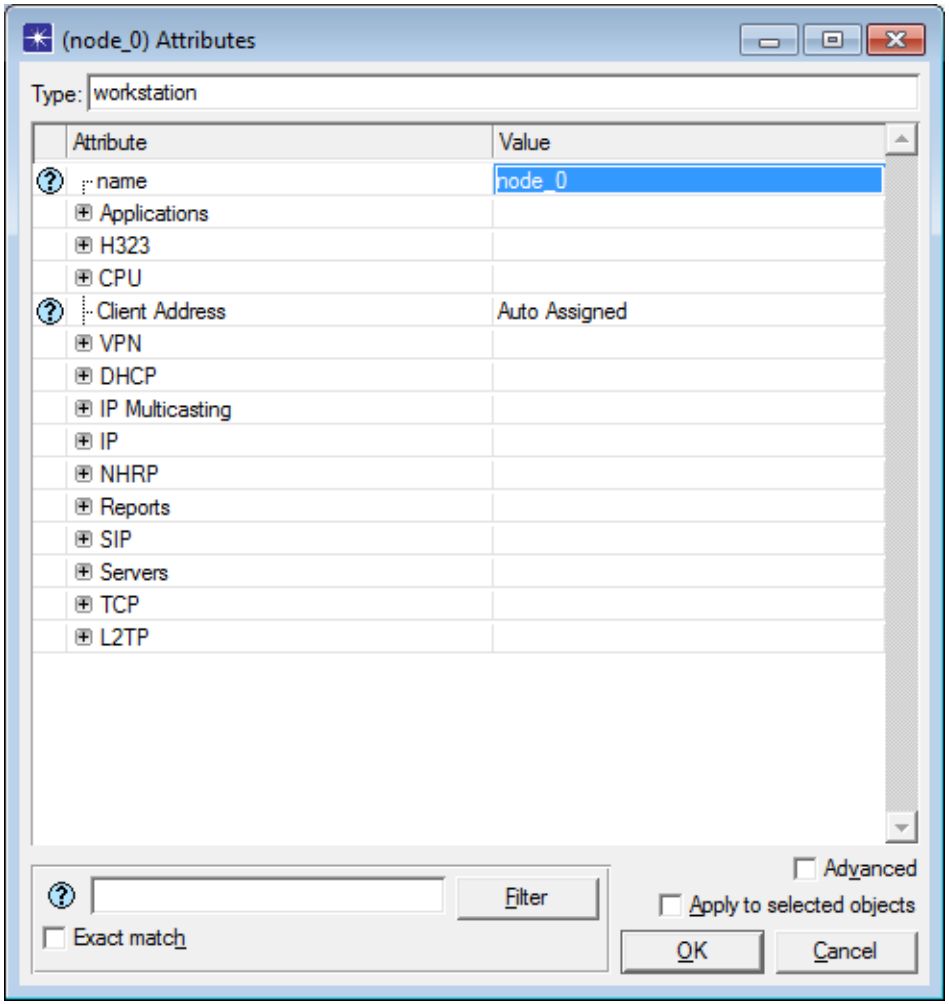
2. Do not forget to verify link connectivity after such changes!





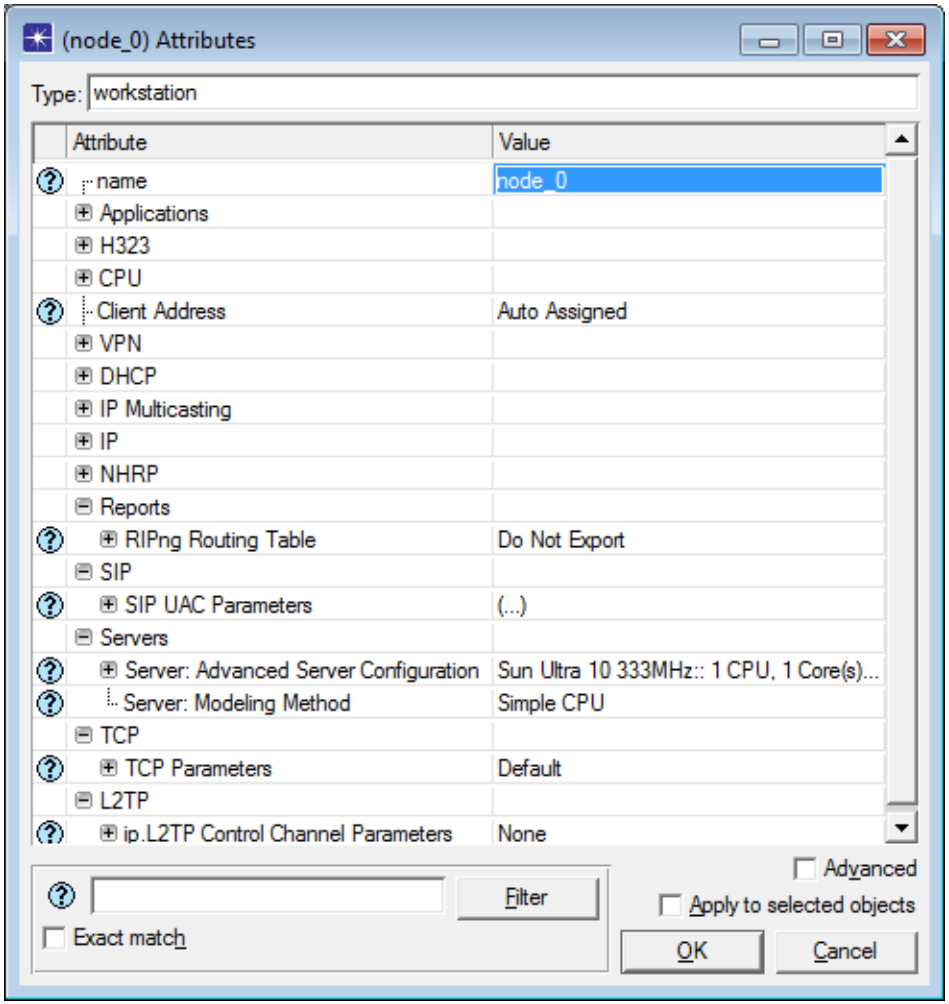
Tips and Tricks (cont'd)

- 2 methods to find the object's attribute of interest



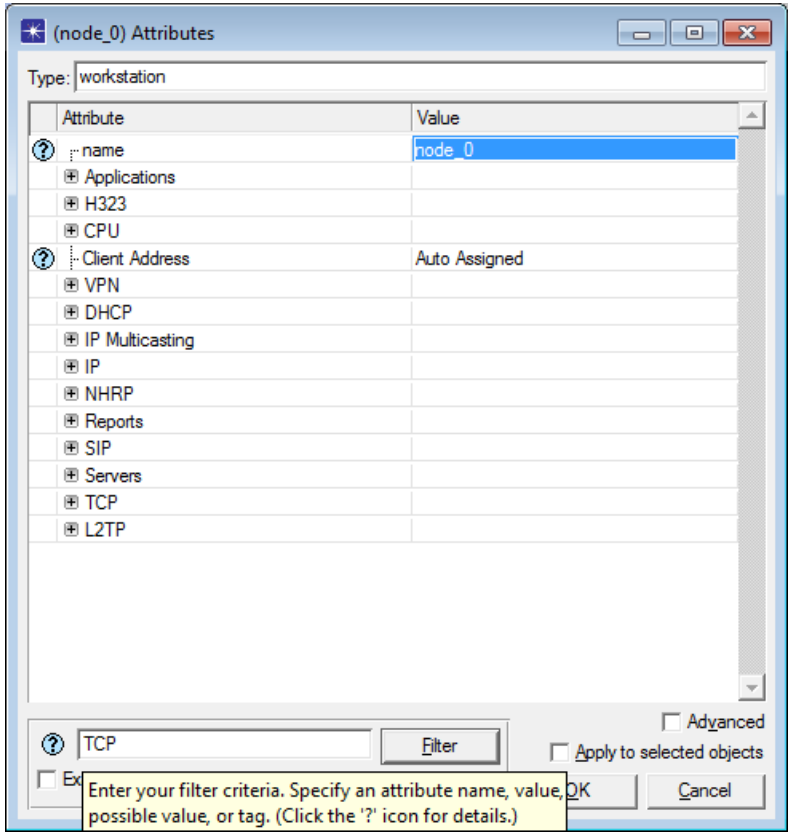
Tips and Tricks (cont'd)

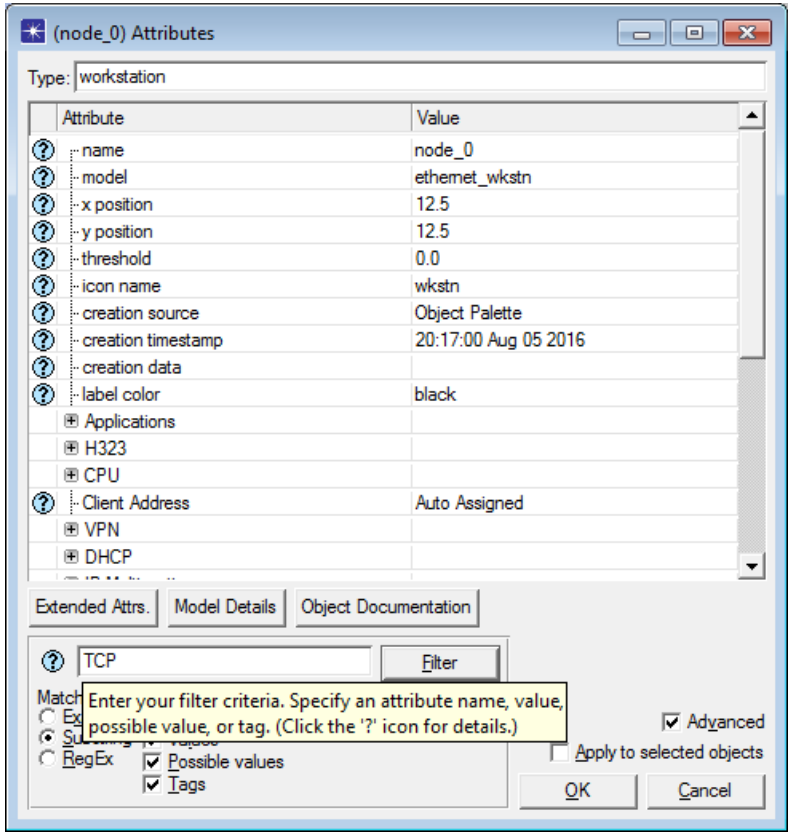
1. Browse through the attributes available in the dialog box



Tips and Tricks (cont'd)

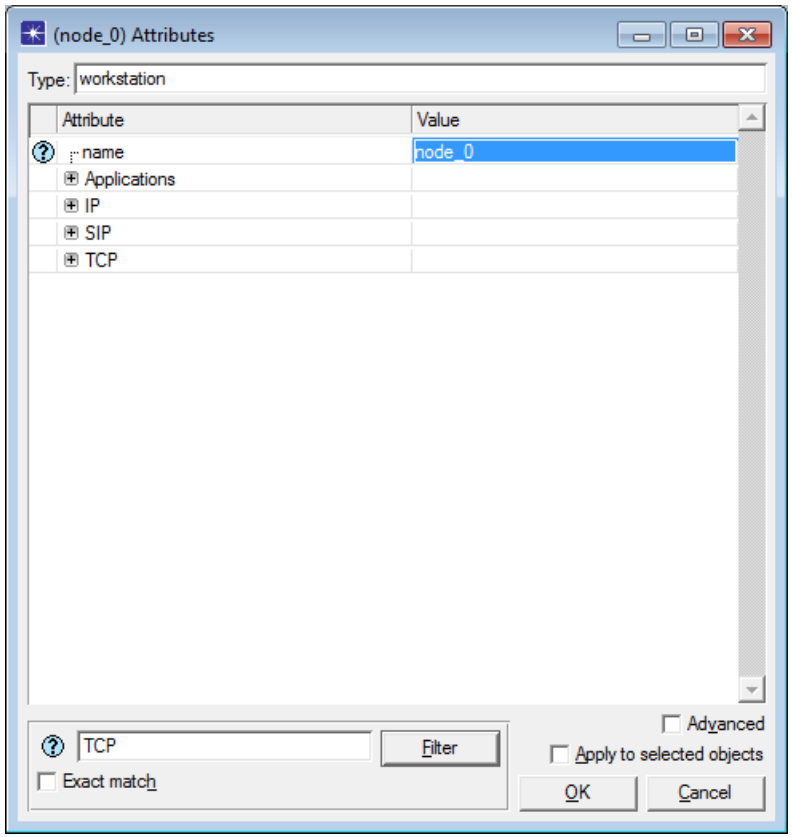
2. Filter attributes based on selection criteria

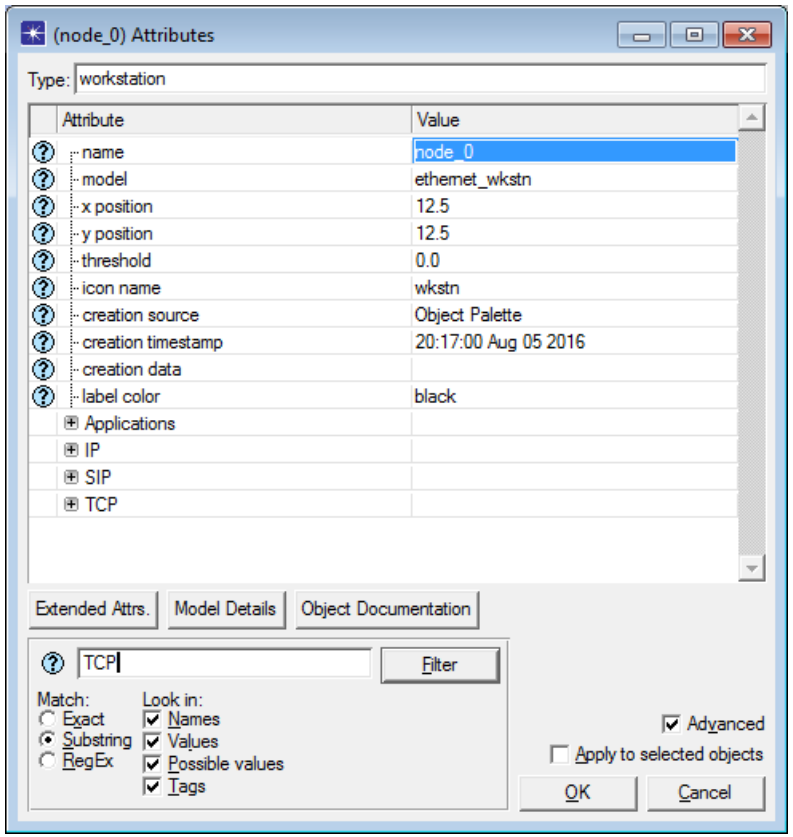




Tips and Tricks (cont'd)

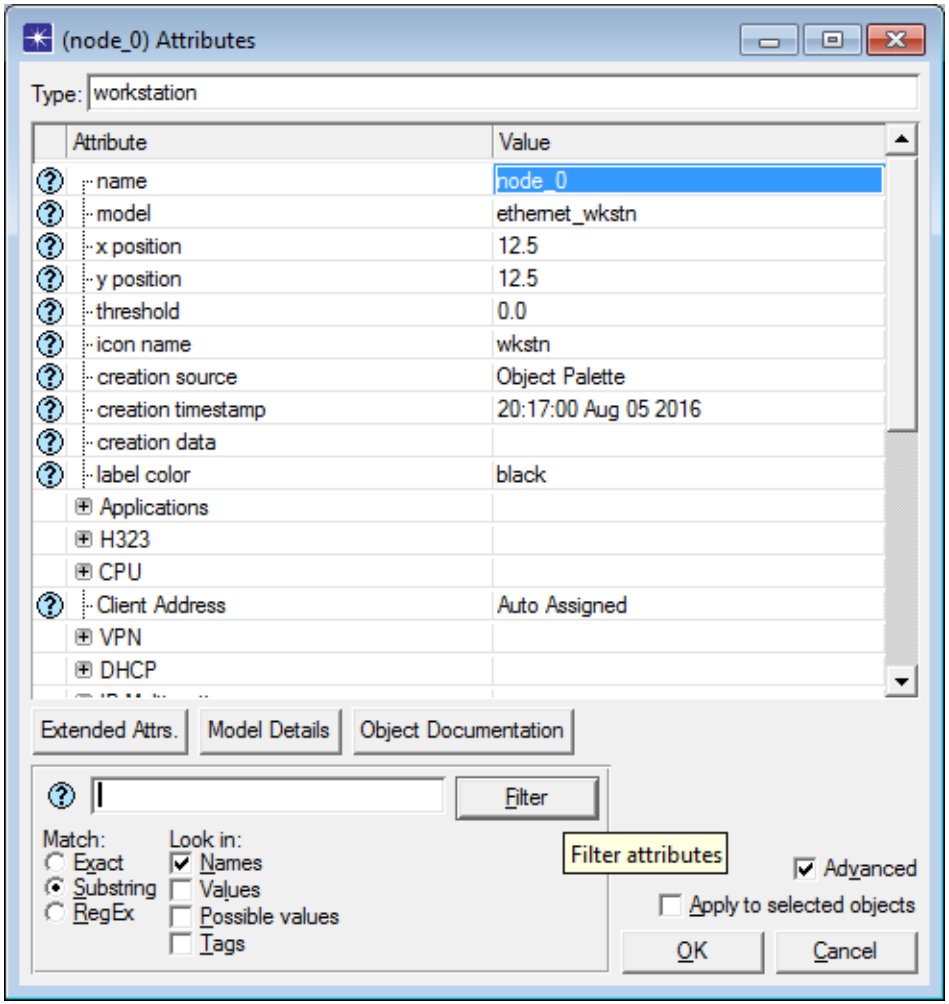
2. 'Edit Attributes (Advanced)' provides more filtering options
   - **RegEx (Regular Expression)** – a pattern-matching language that enables to define a flexible search pattern





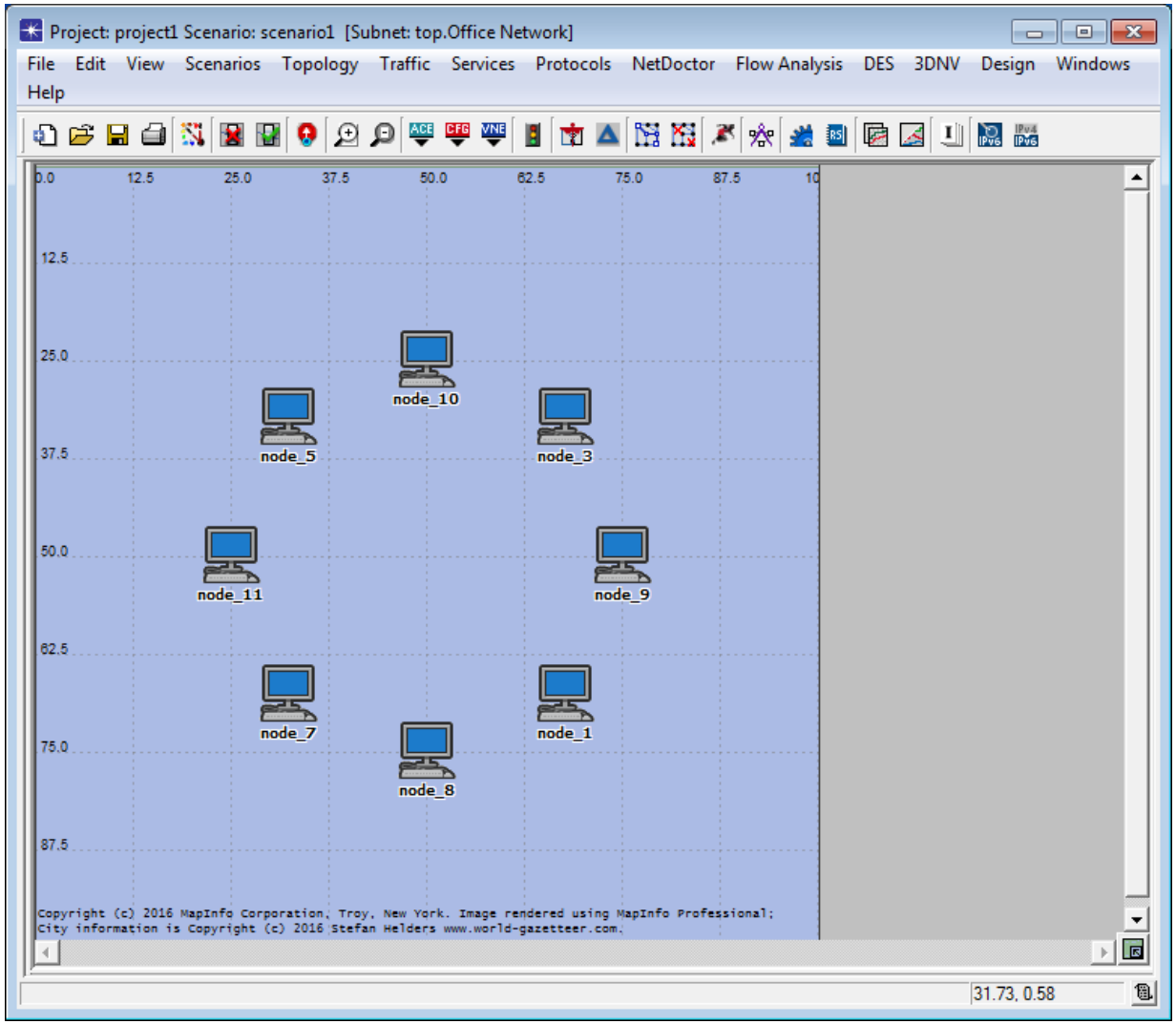
Tips and Tricks (cont'd)

2. To remove the filtering selection, clear the textbox and click 'Filter' again



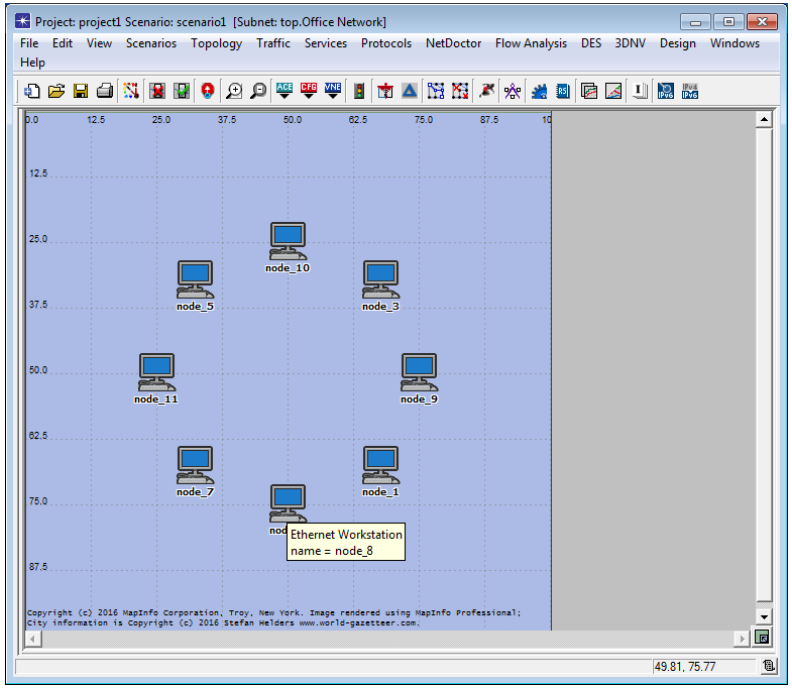
Tips and Tricks (cont'd)

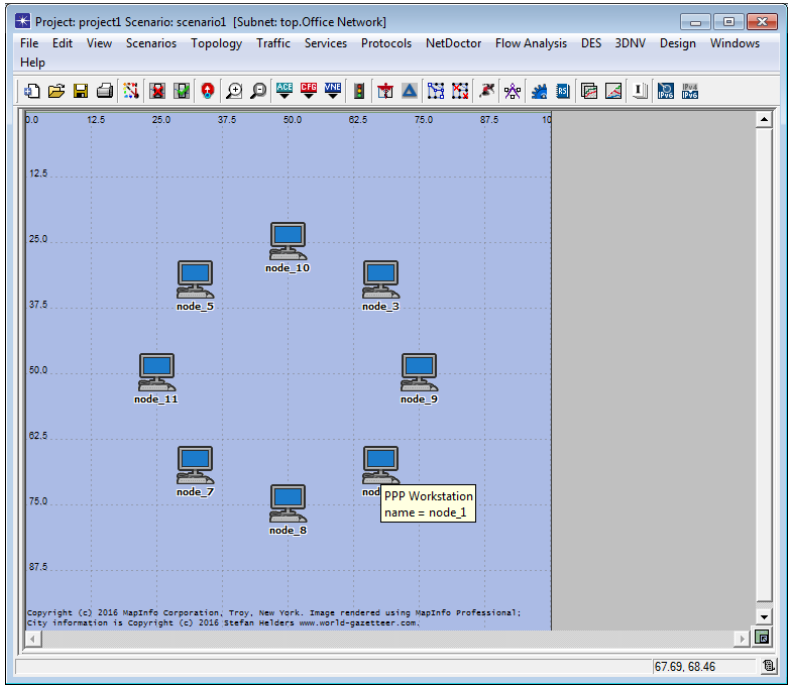
- 2 methods to compare the objects of interest



Tips and Tricks (cont'd)

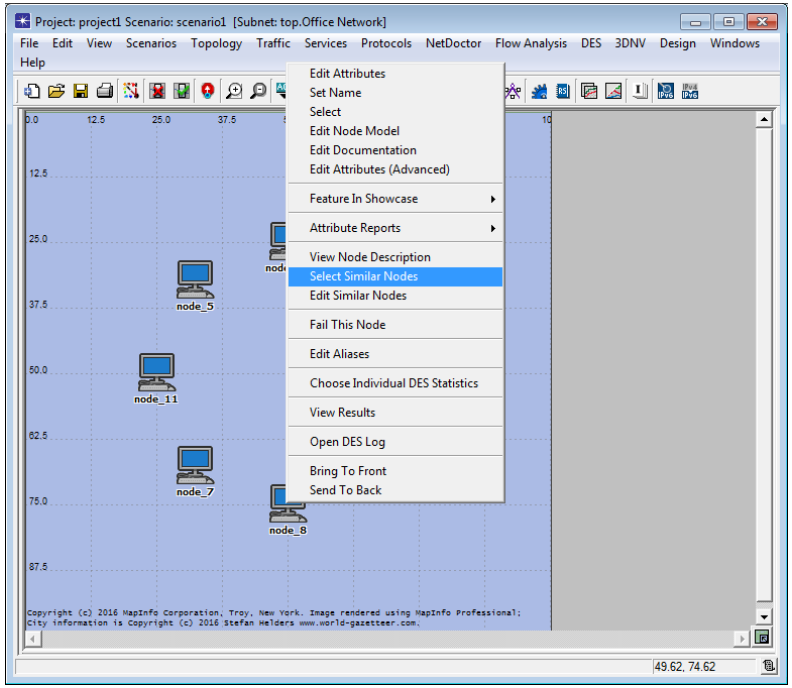
1. Check all the objects one by one

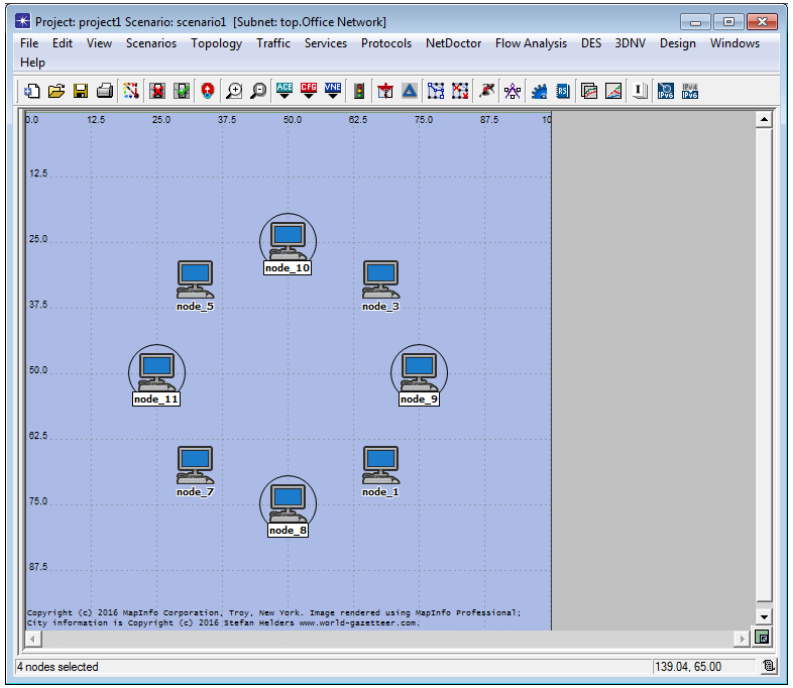




Tips and Tricks (cont'd)

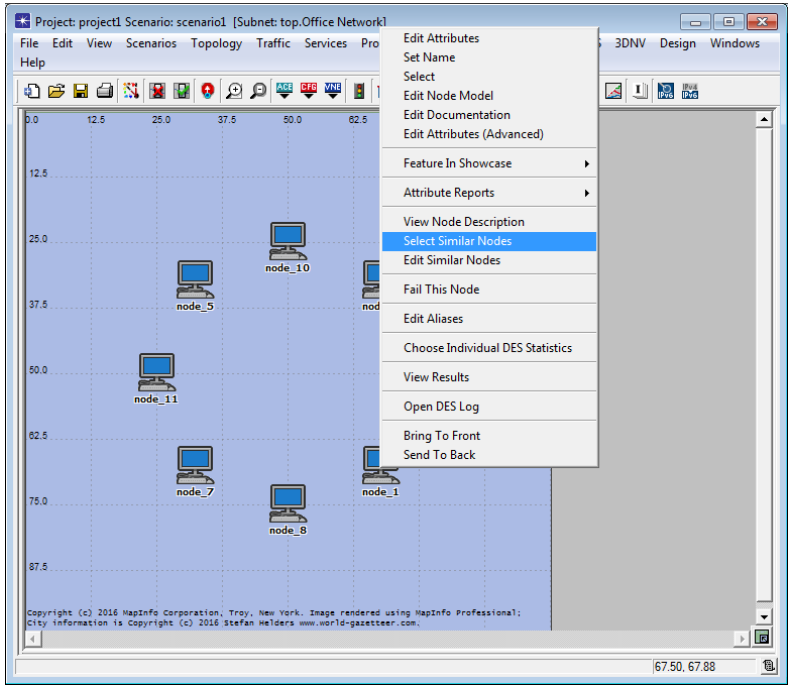
2. Edit Attributes ⇒ Select Similar Nodes/Links

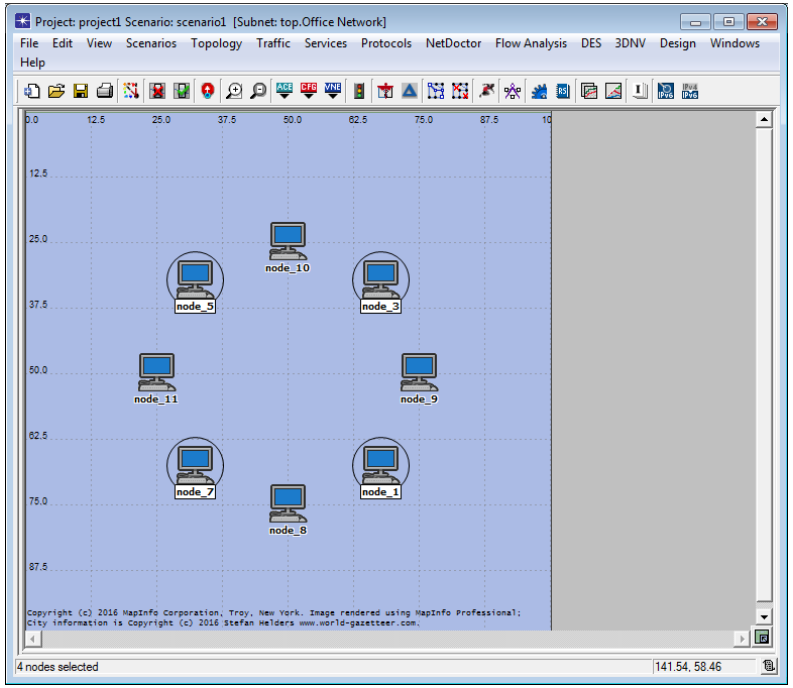




Tips and Tricks (cont'd)

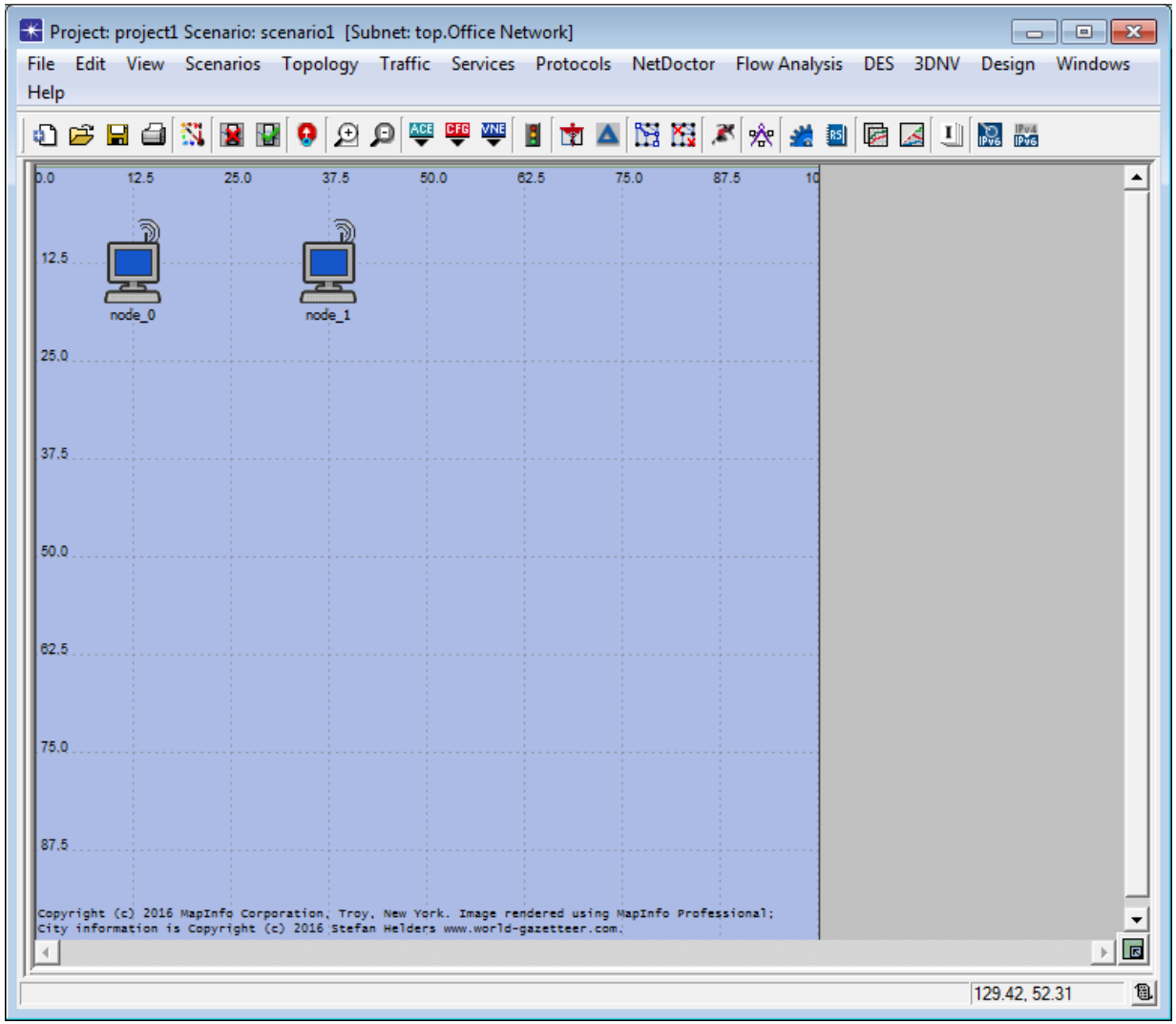
2. Edit Attributes ⇒ Select Similar Nodes/Links





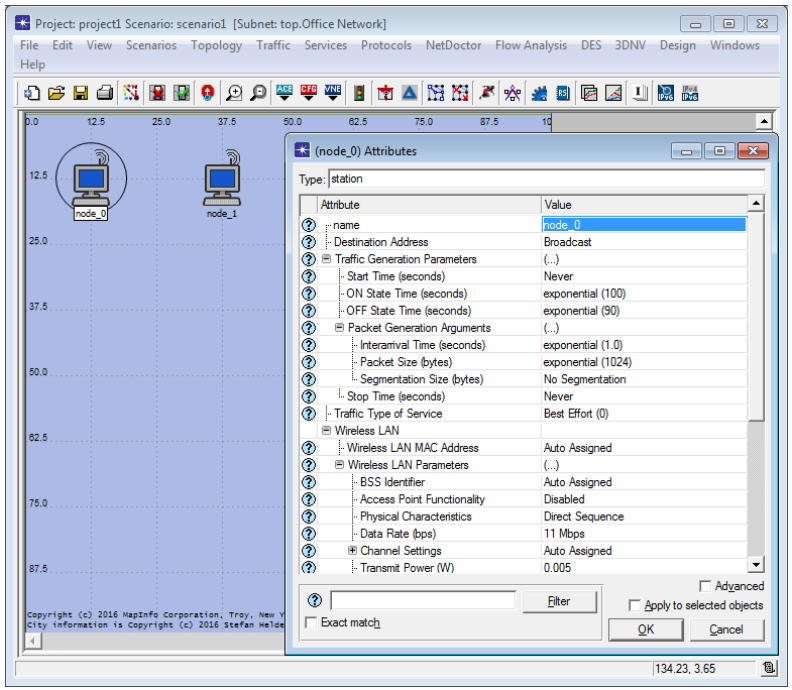
Tips and Tricks (cont'd)

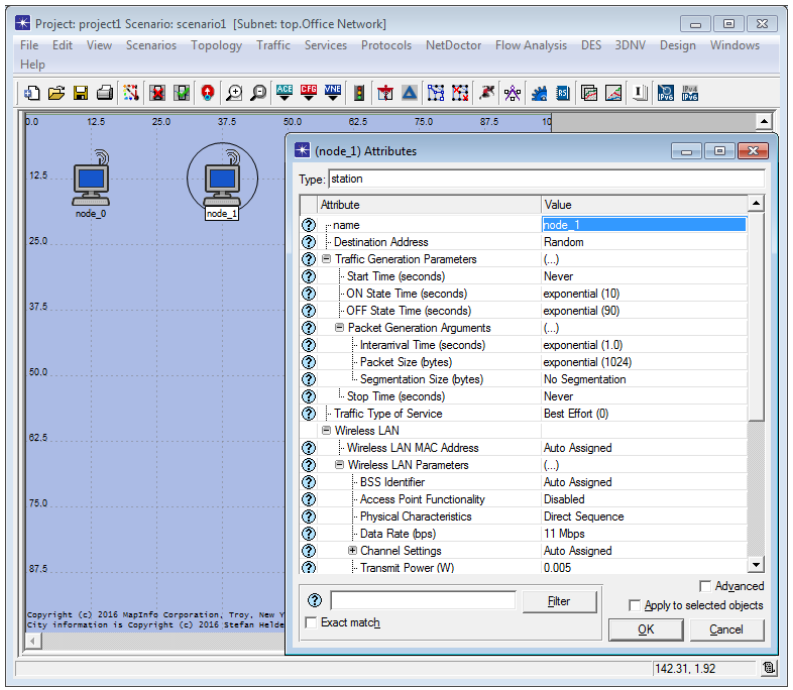
- 2 methods to compare attributes of the objects of interest



Tips and Tricks (cont'd)

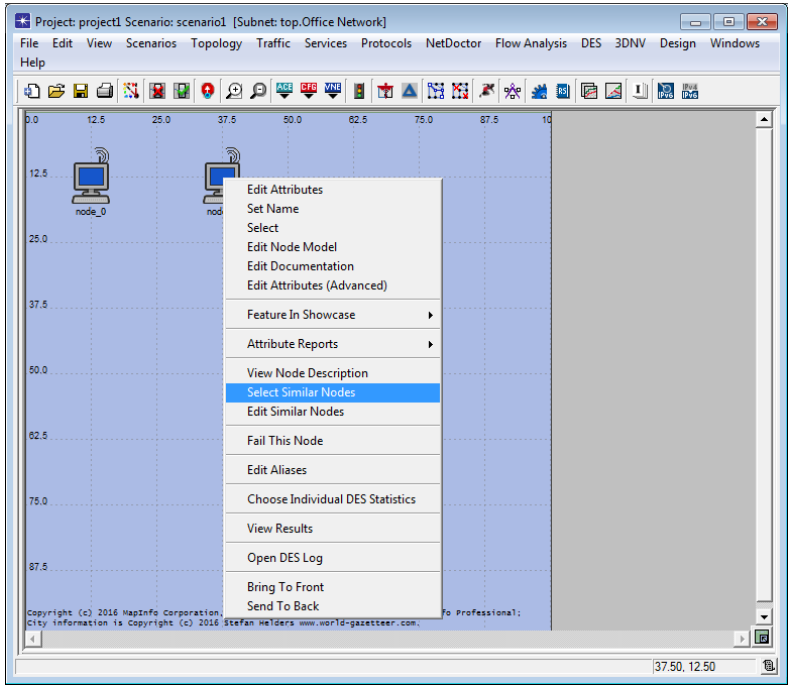
1. Check all the objects and their attributes one by one

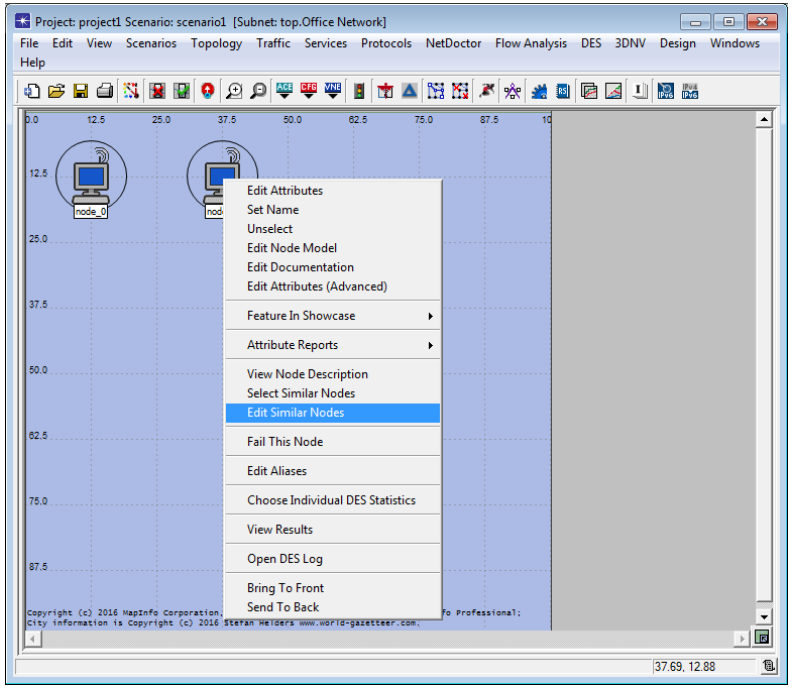




Tips and Tricks (cont'd)

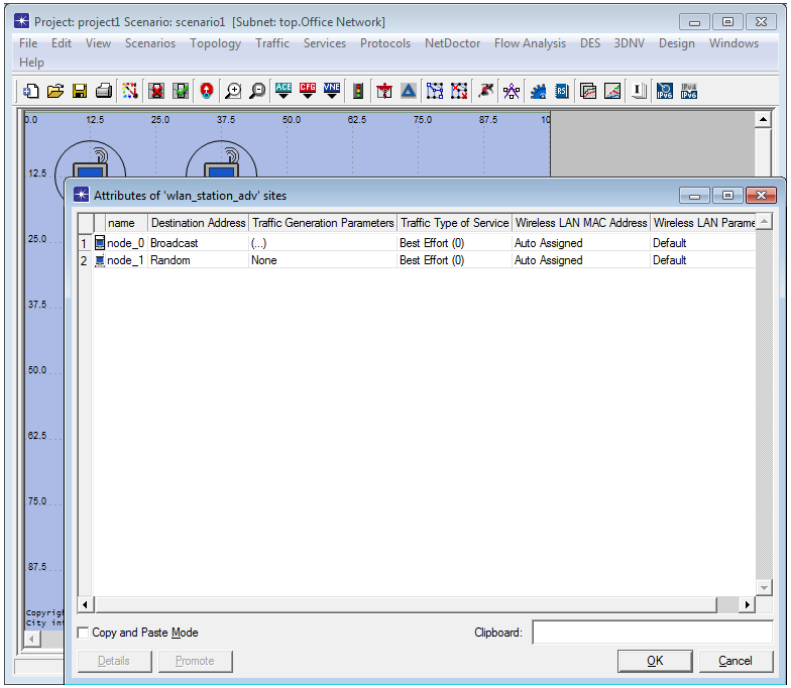
2. Select Similar Nodes ⇒ Edit Similar Nodes

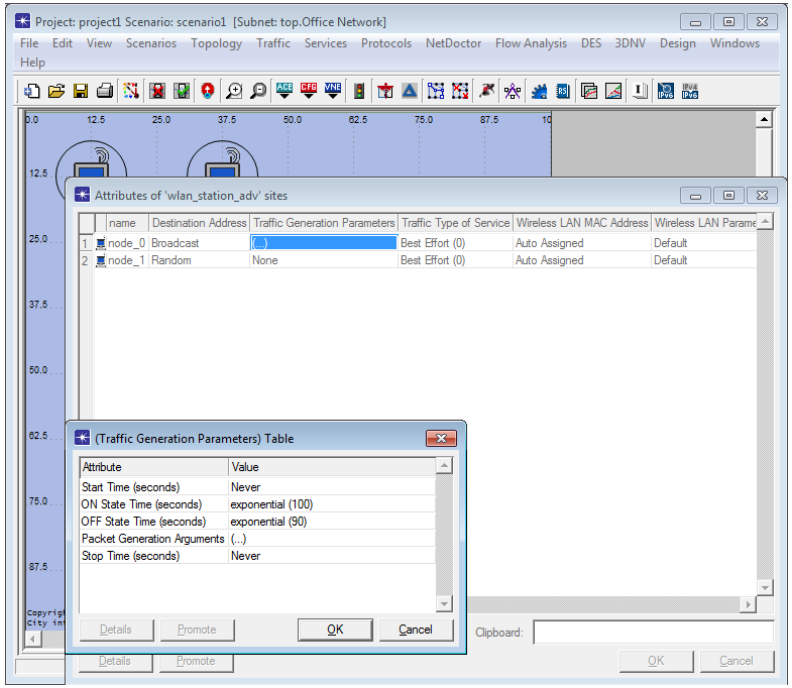




Tips and Tricks (cont'd)

2. Objects Attributes

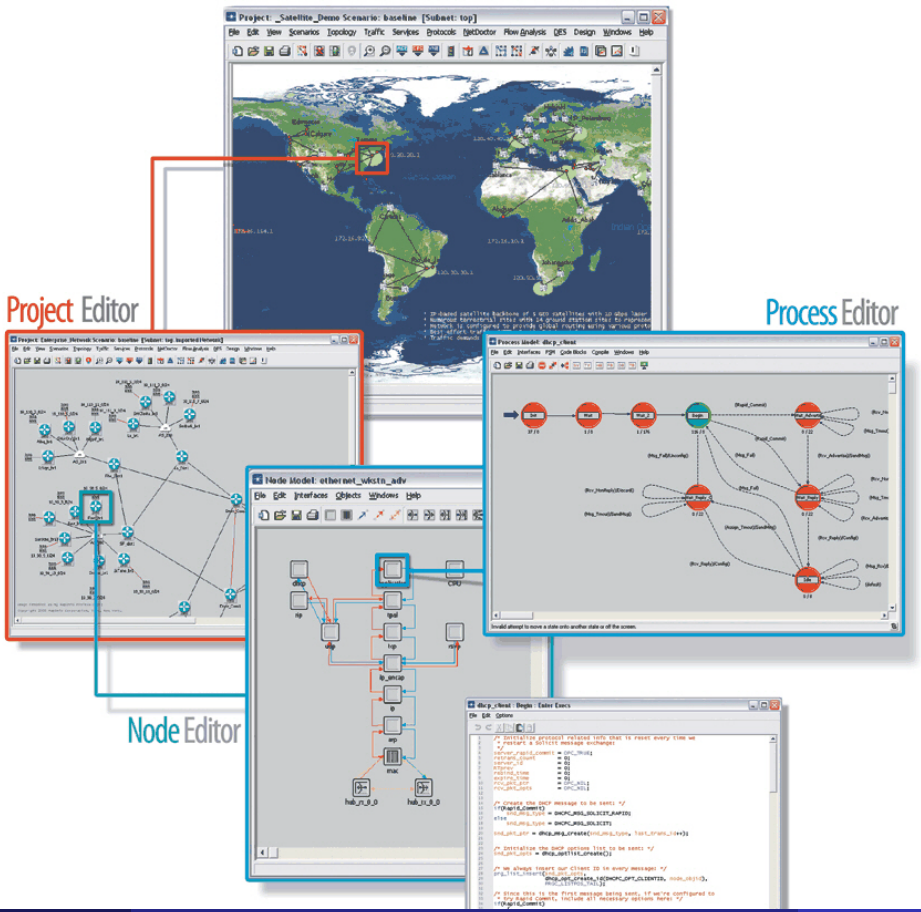




Outline

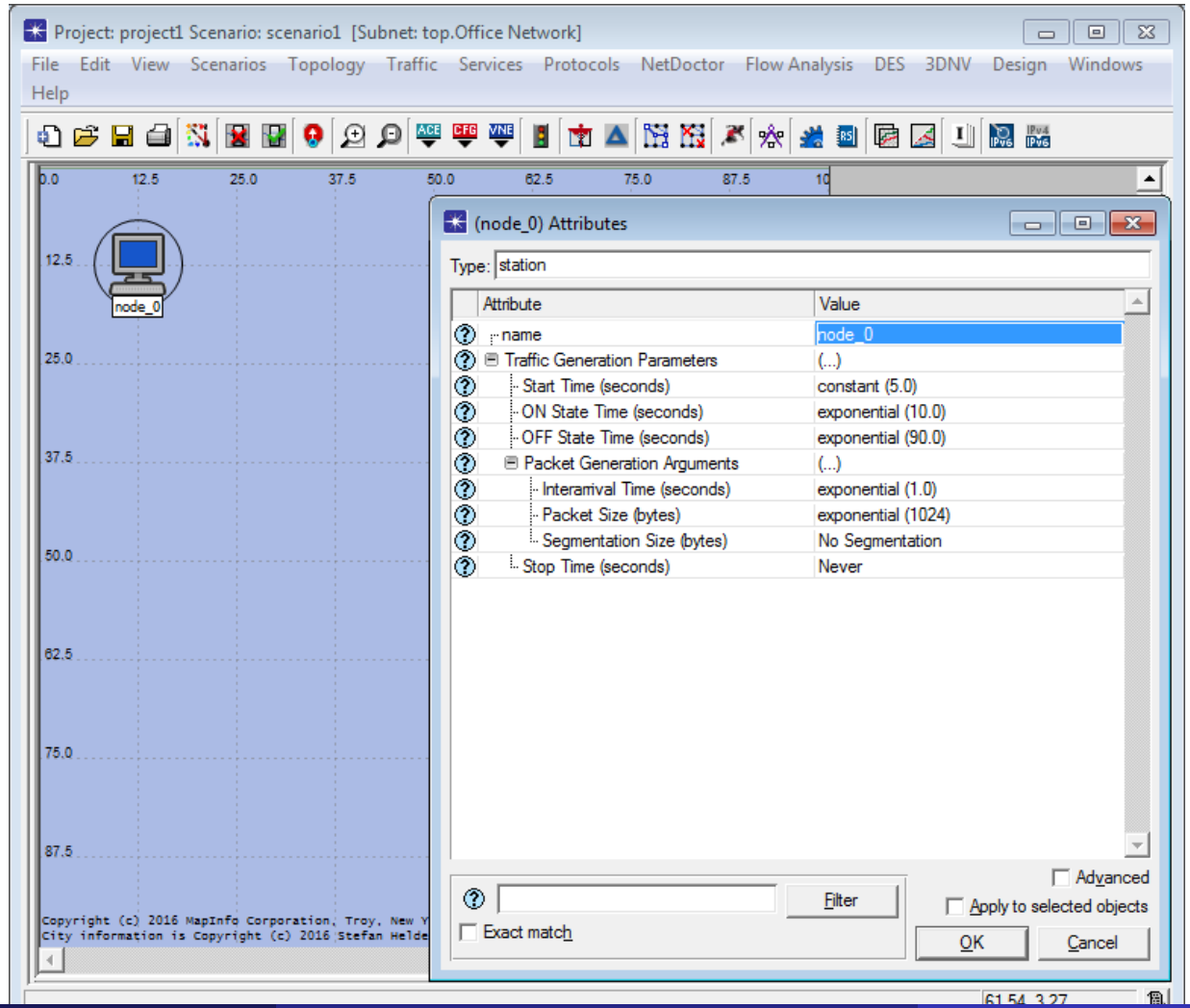
Promoting Attributes

- OPNET/Riverbed software relies on a model hierarchy that contains several levels of abstraction
  - Each level of the hierarchy usually has a special editor associated with it
  - The availability of these editors depends on the product



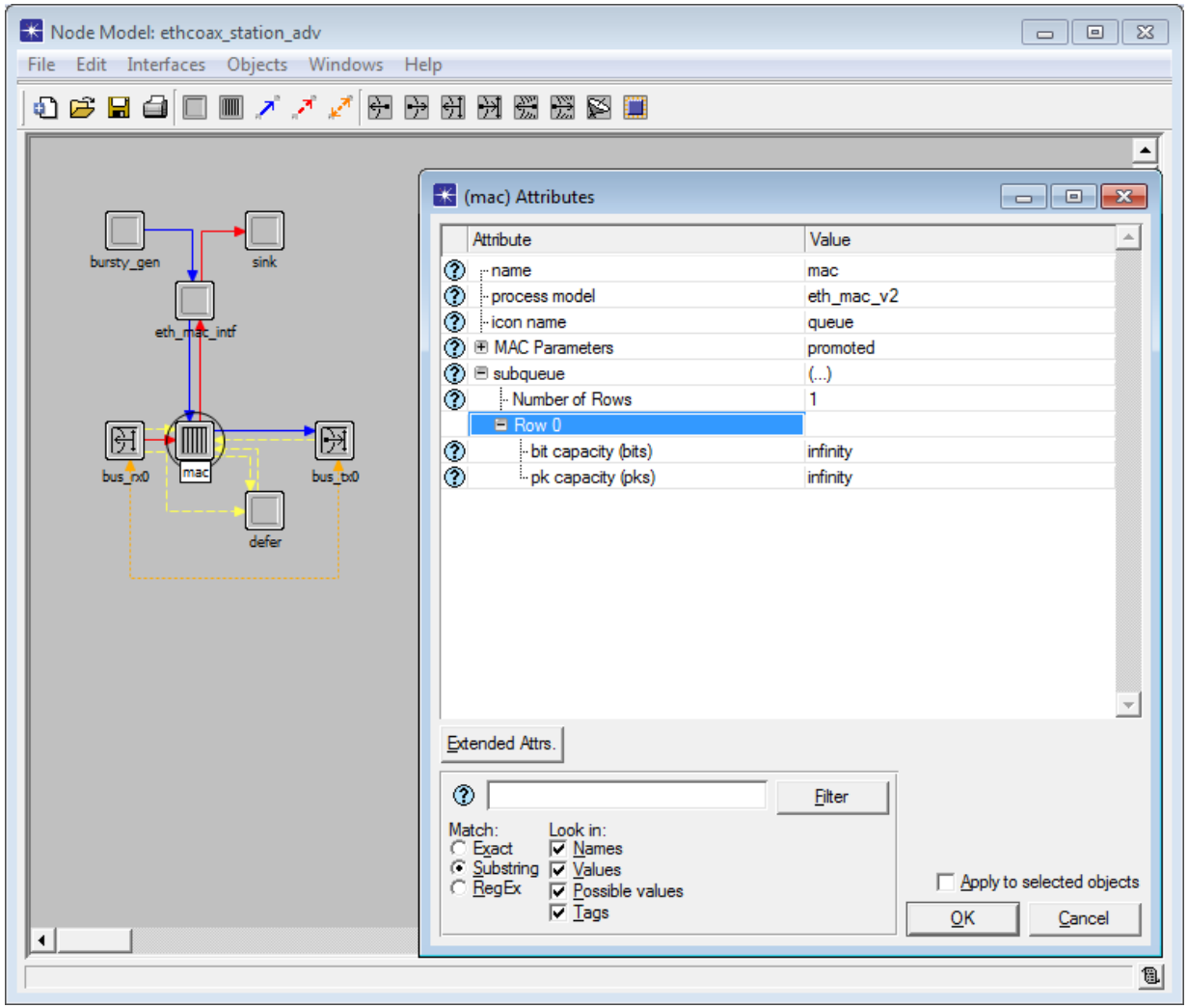
Promoting Attributes (cont'd)

- **Promotion** – the process of configuring model attributes so that their values can be specified at a higher level of the model hierarchy



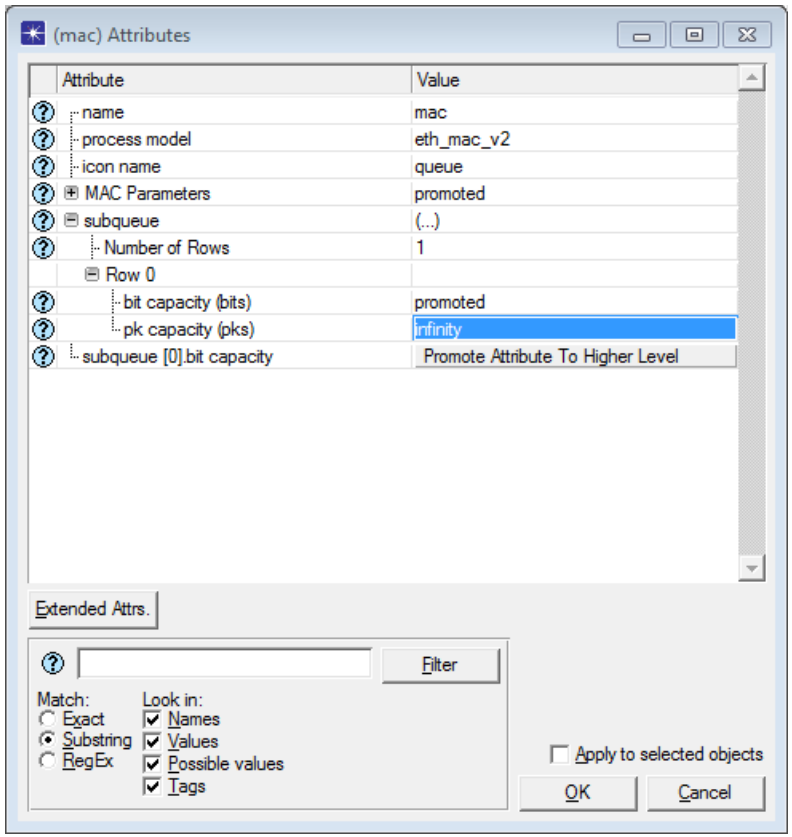
Promoting Attributes (cont'd)

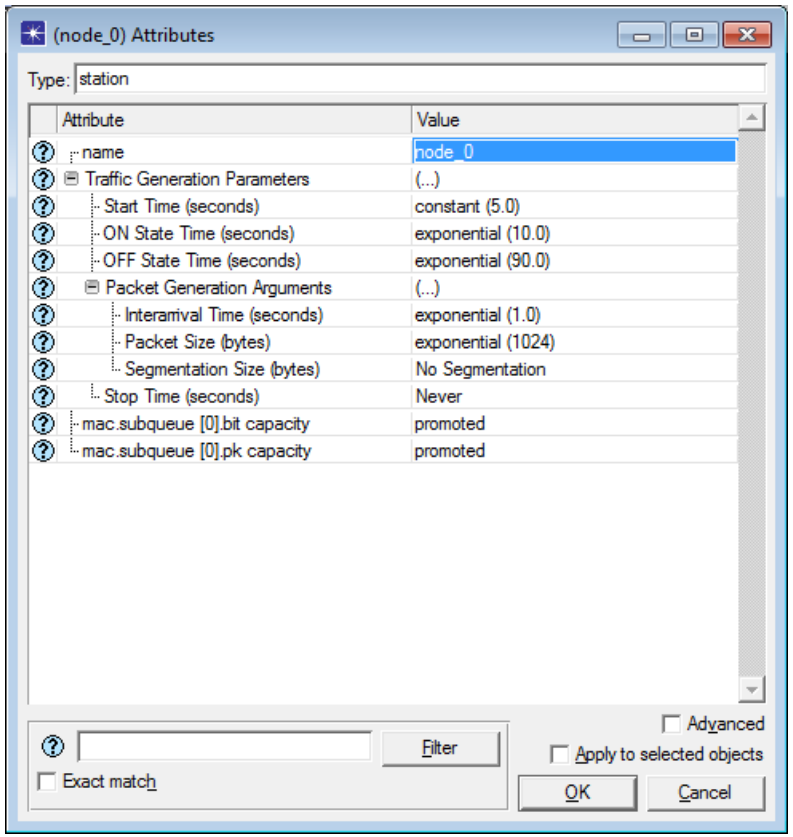
- **Node Editor** – used to specify the structure of network devices
  - **Modules** – represent particular functions of the node's operation



Promoting Attributes (cont'd)

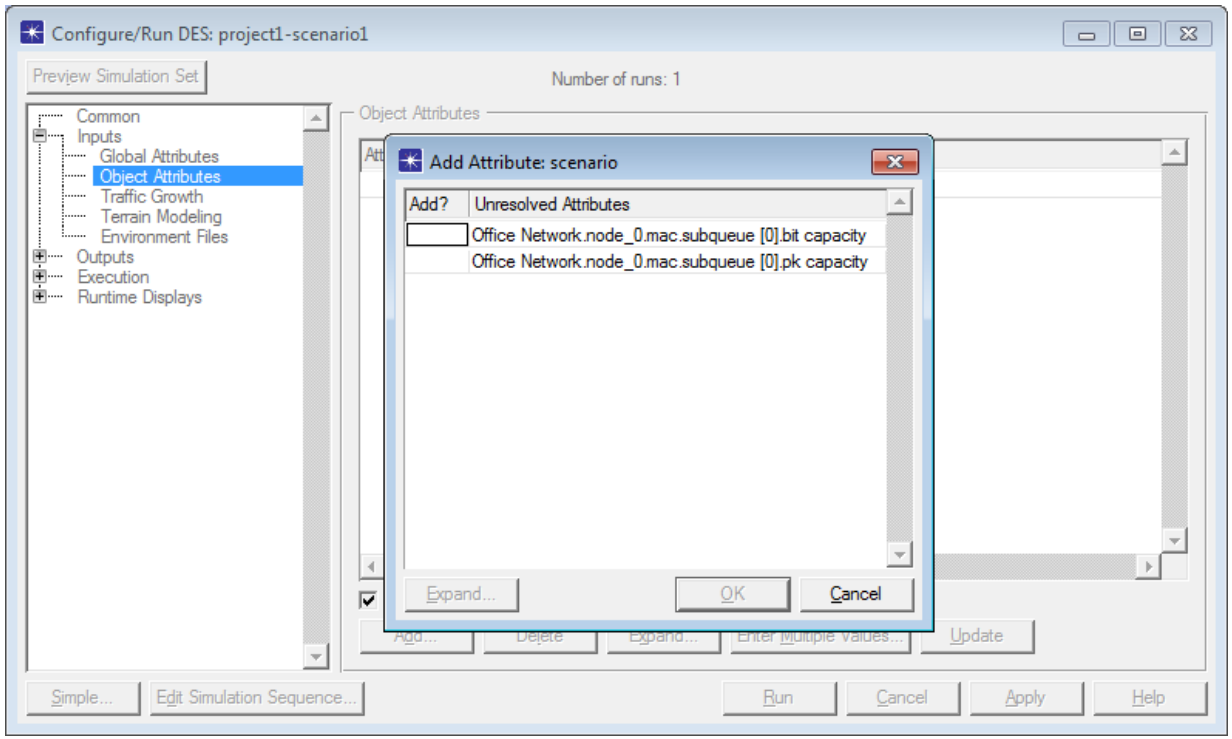
- A promoted attribute of a module within a node model appears on a node object in the network level





Promoting Attributes (cont'd)

- If the node object provides no assignment for that attribute, then it will promote to successively encompassing objects, up to the top subnet
- In this case, the attribute is considered an attribute of the overall system model and can be set at simulation run time



Promoting Attributes (cont'd)

- Promoting attributes to the simulation level is a very convenient feature because it allows for:
  - Changing commonly used parameters in a single place instead of clicking on various objects in the network topology
  - Iterating through a range of possible attribute values instead of duplicating scenarios and changing values of certain attributes
  - Setting up automated simulation runs with different attribute values

- No promotion allowed for:
  - Grouping attributes
  - Advanced attributes
  - The attribute 'name'

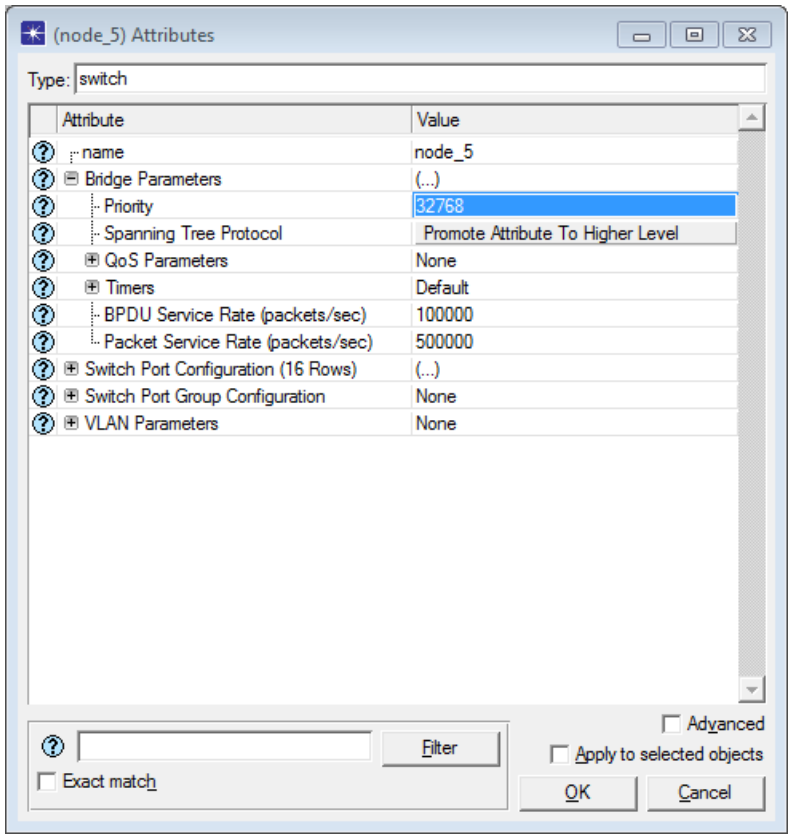
Promoting Attributes (cont'd)

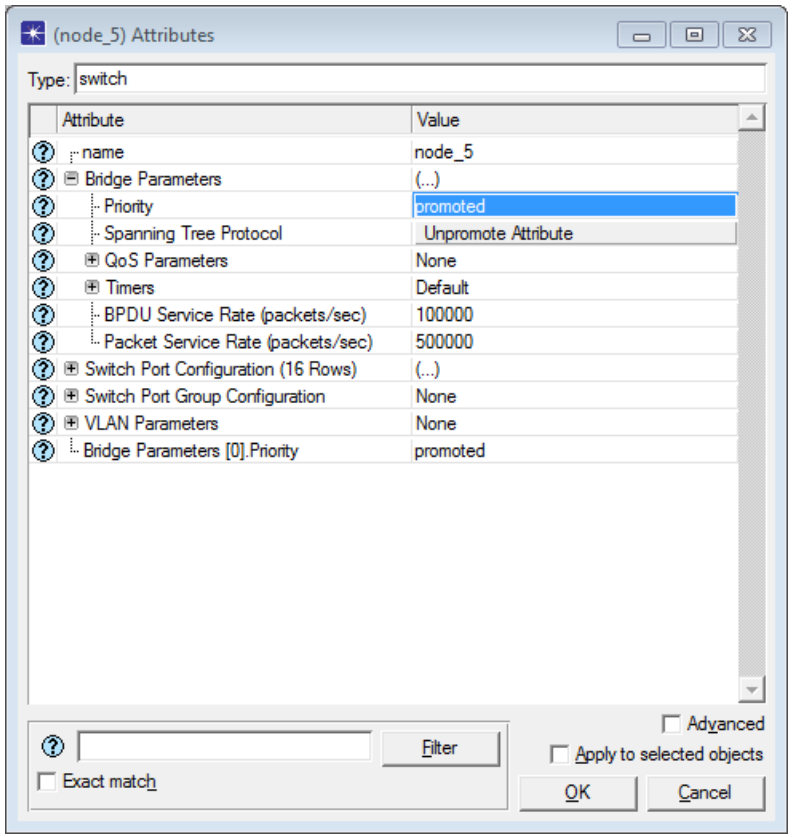
- Promoting an object attribute:
  - Right-click on the object of interest and choose 'Edit Attributes'
  - Right-click on the value field of the attribute of interest and select **Promote Attribute To Higher Level**
  - The value of the attribute will change to 'promoted'
  - You can promote as many attributes within the object as needed

- Unpromoting an object attribute:
  - Right-click on the object of interest and choose 'Edit Attributes'
  - Right-click on the value field of the promoted attribute of interest and select **Unpromote Attribute**
  - Or left-click on the value field of the promoted attribute, which will allow you to set a value for the attribute, automatically causing it to be unpromoted
  - You can unpromote as many attributes within the object as needed

Promoting Attributes (cont'd)

- Promoting and unpromoting attributes





Promoting Attributes (cont'd)

- Promoted attribute values can be set:
  - At the simulation level
  - At the parent subnet level

- Promoting attributes of objects within a subnet and then setting their values when you are in the parent subnet is very useful when you need to reconfigure attributes of objects in the subnet multiple times

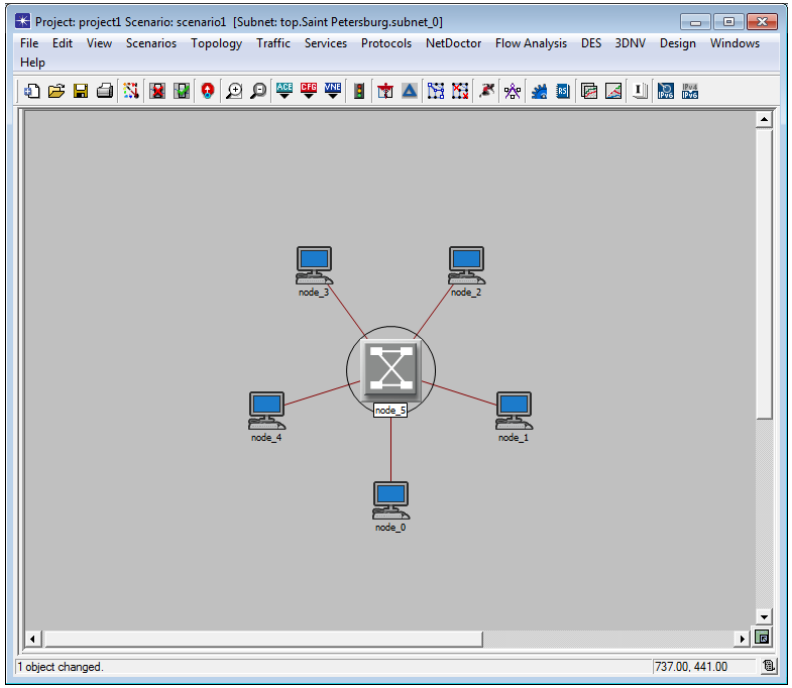
- Promoted attributes are not visible at the parent subnet level until they have been accessed or viewed through simulation-wide object attribute feature!

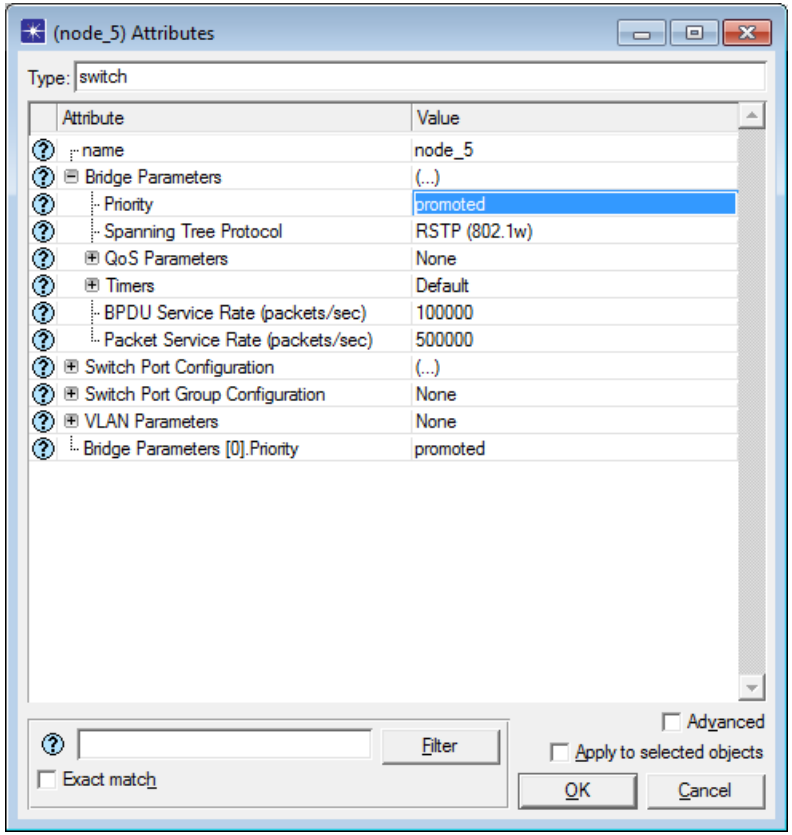
- As an attribute is promoted to different levels of the model hierarchy, its name changes according to the following naming conventions:

network_type.subnet_1.subnet_2. ... .node_name.attribute_name

Promoting Attributes (cont'd)

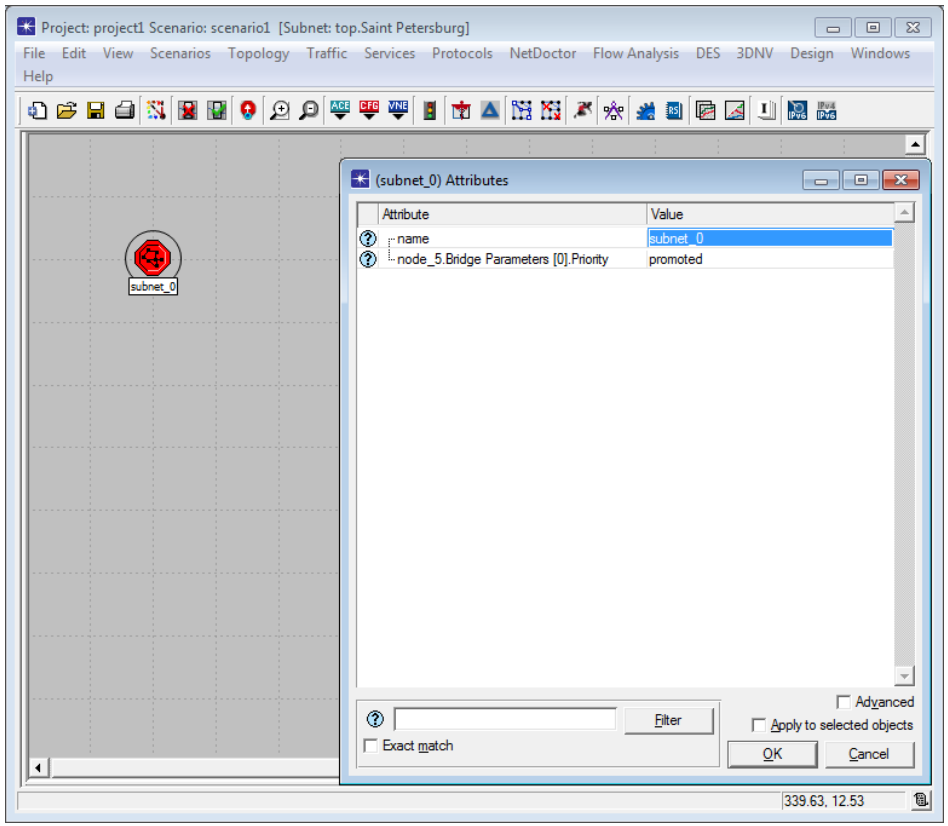
- Promoting an object attribute

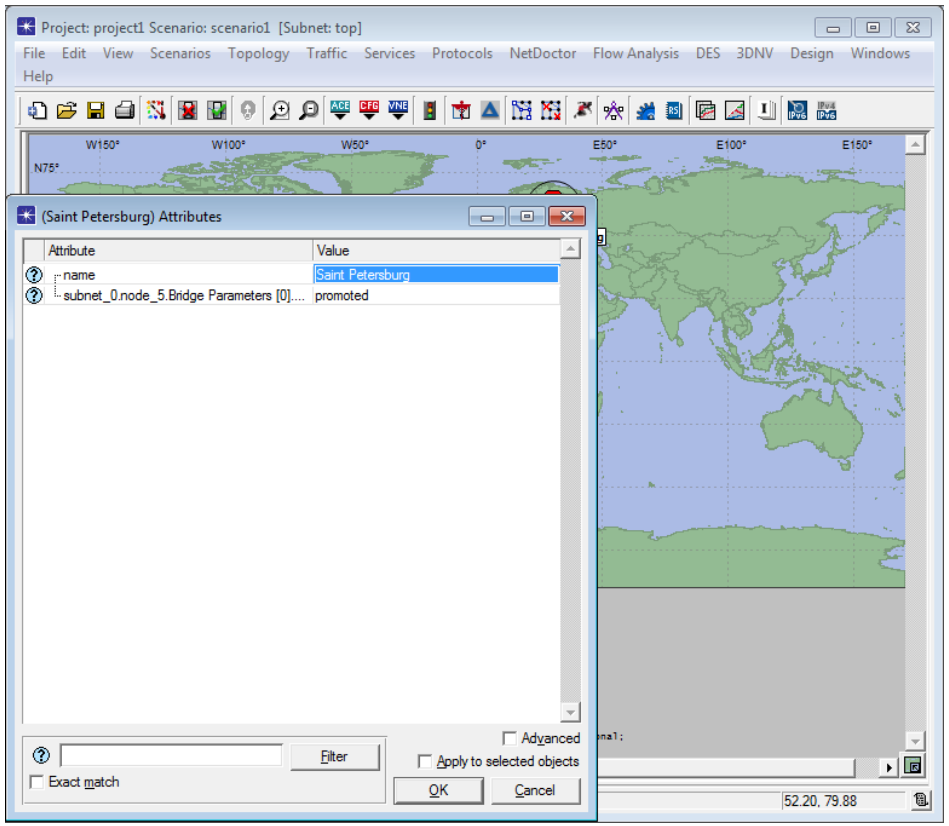




Promoting Attributes (cont'd)

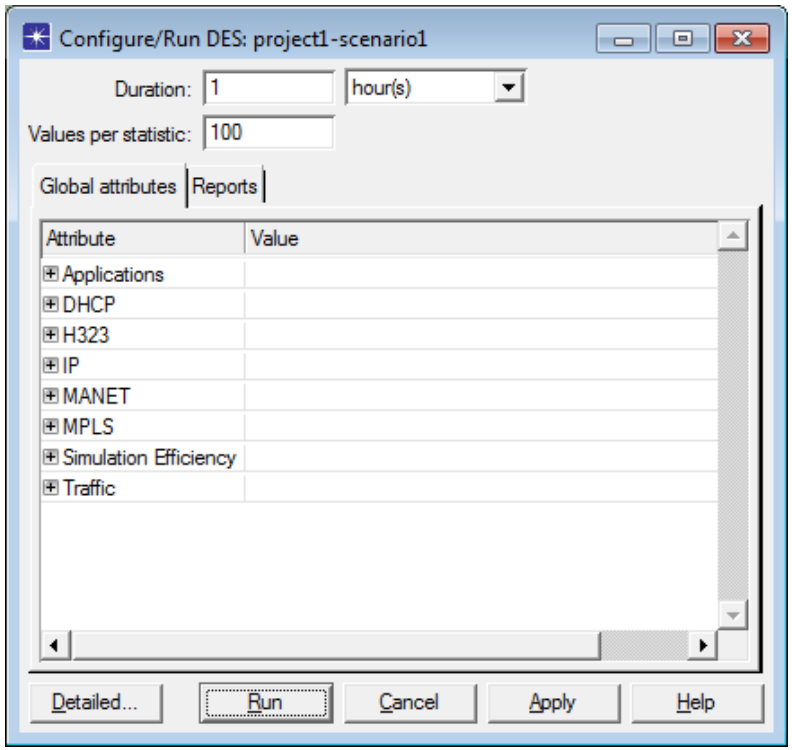
- Instead of drilling down into the subnet and then changing attribute values one object at a time, you can promote the attributes and then change them in one place as needed

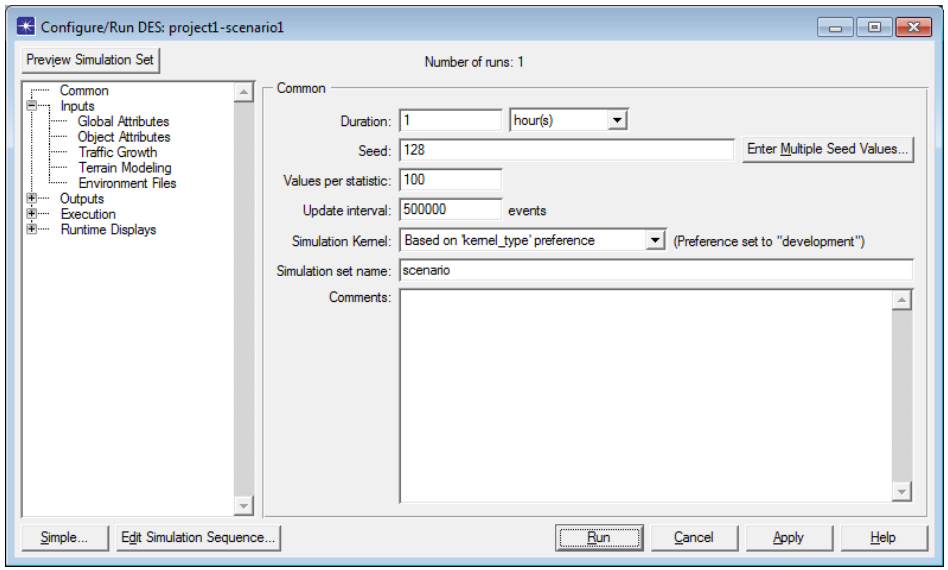




Promoting Attributes (cont'd)

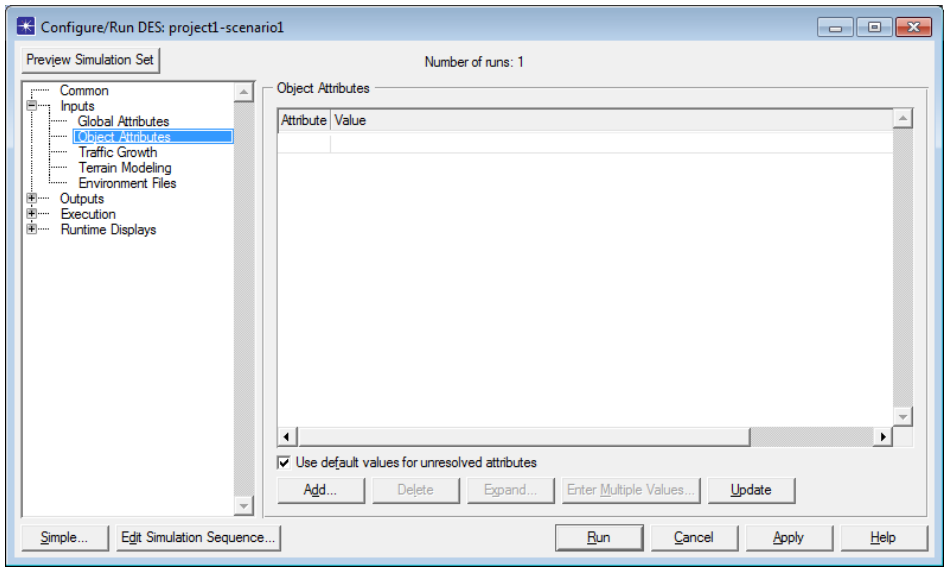
- Configure/Run Discrete Event Simulation (DES) ⇒ Detailed...

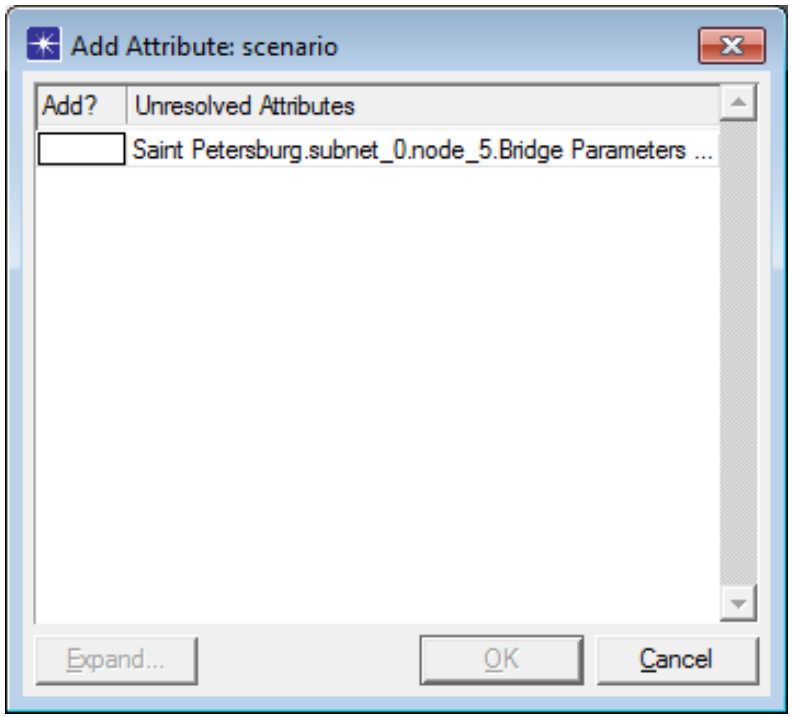




Promoting Attributes (cont'd)

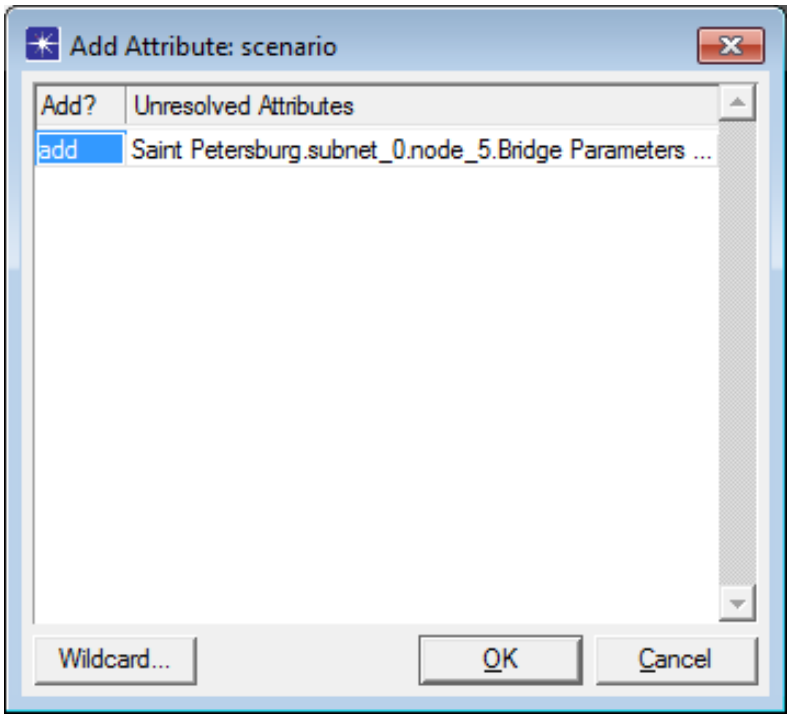
- Inputs ⇒ Object Attributes ⇒ Add...

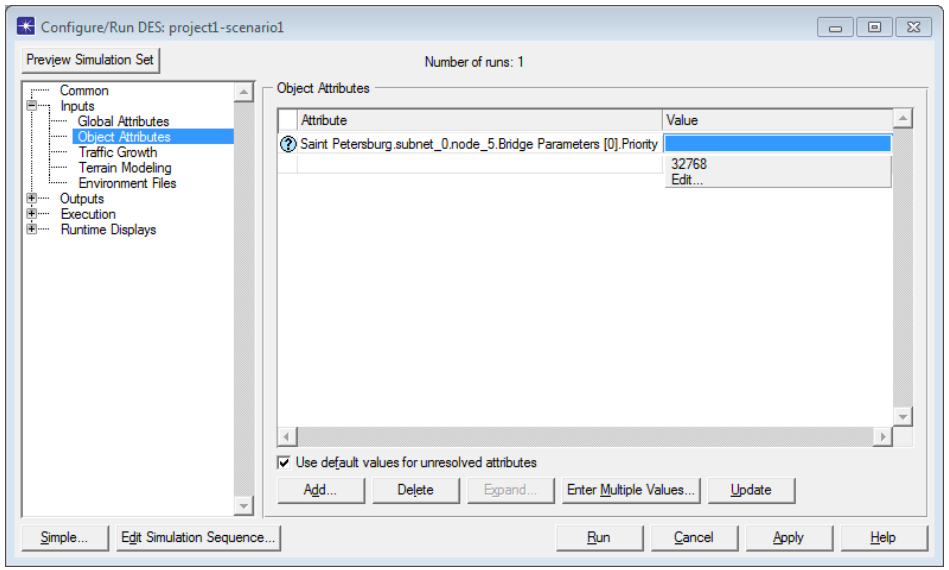




Promoting Attributes (cont'd)

- Add? $\Rightarrow$ OK

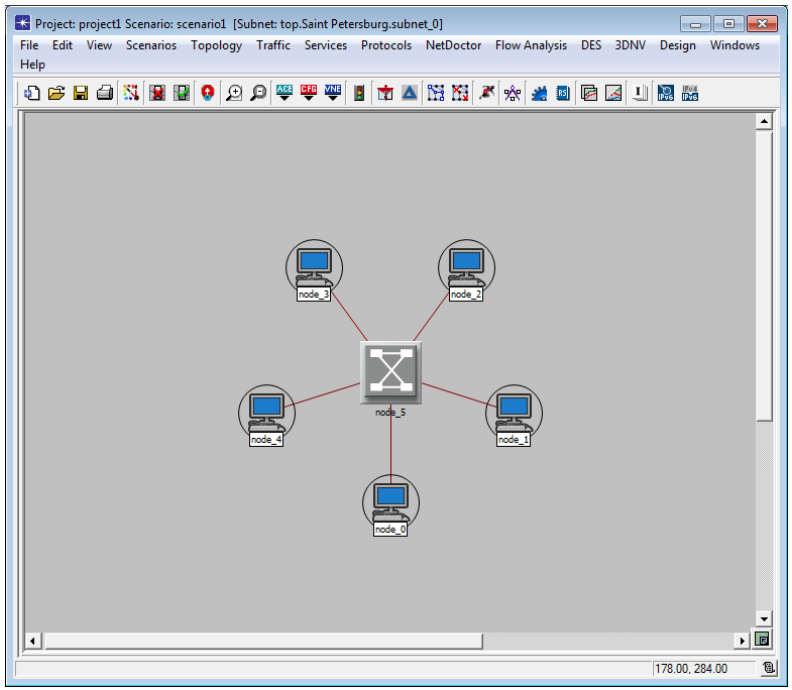


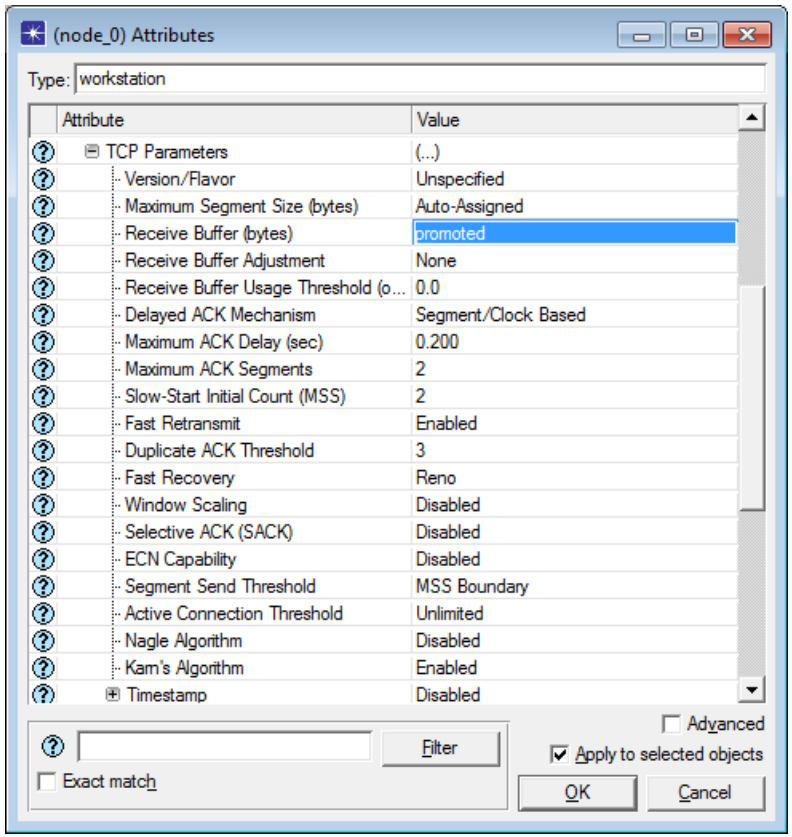


Outline

Wildcard

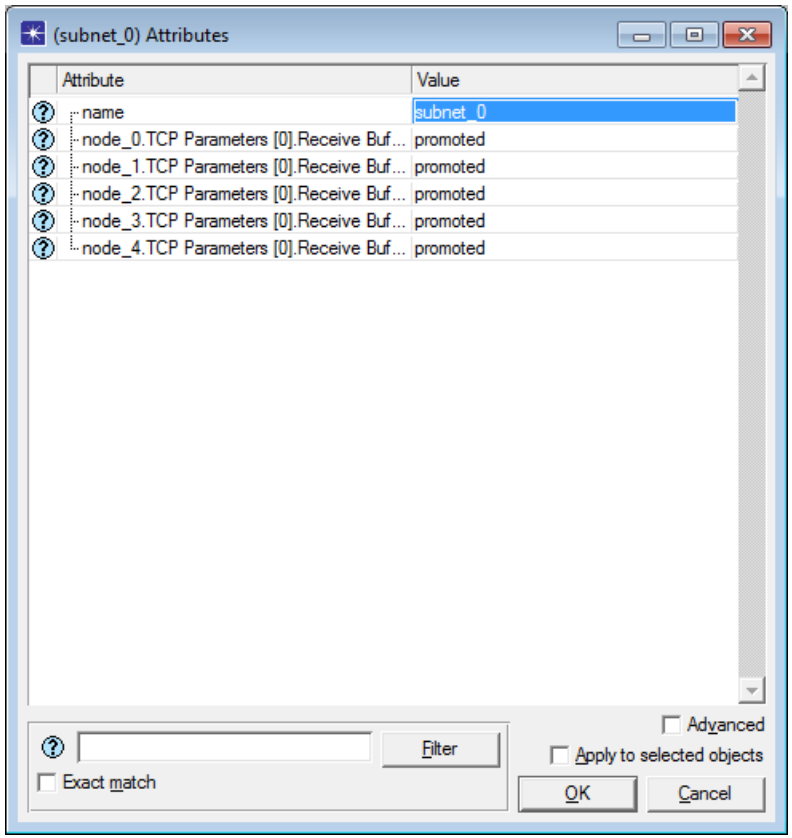
- Promote a desired attribute in objects within the current subnet

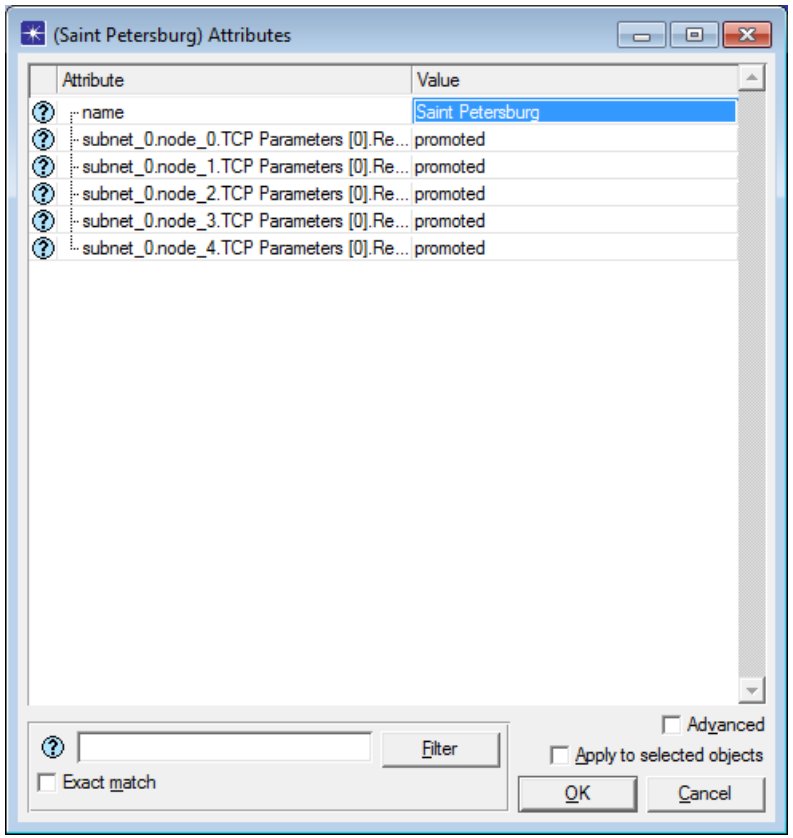




Wildcard (cont'd)

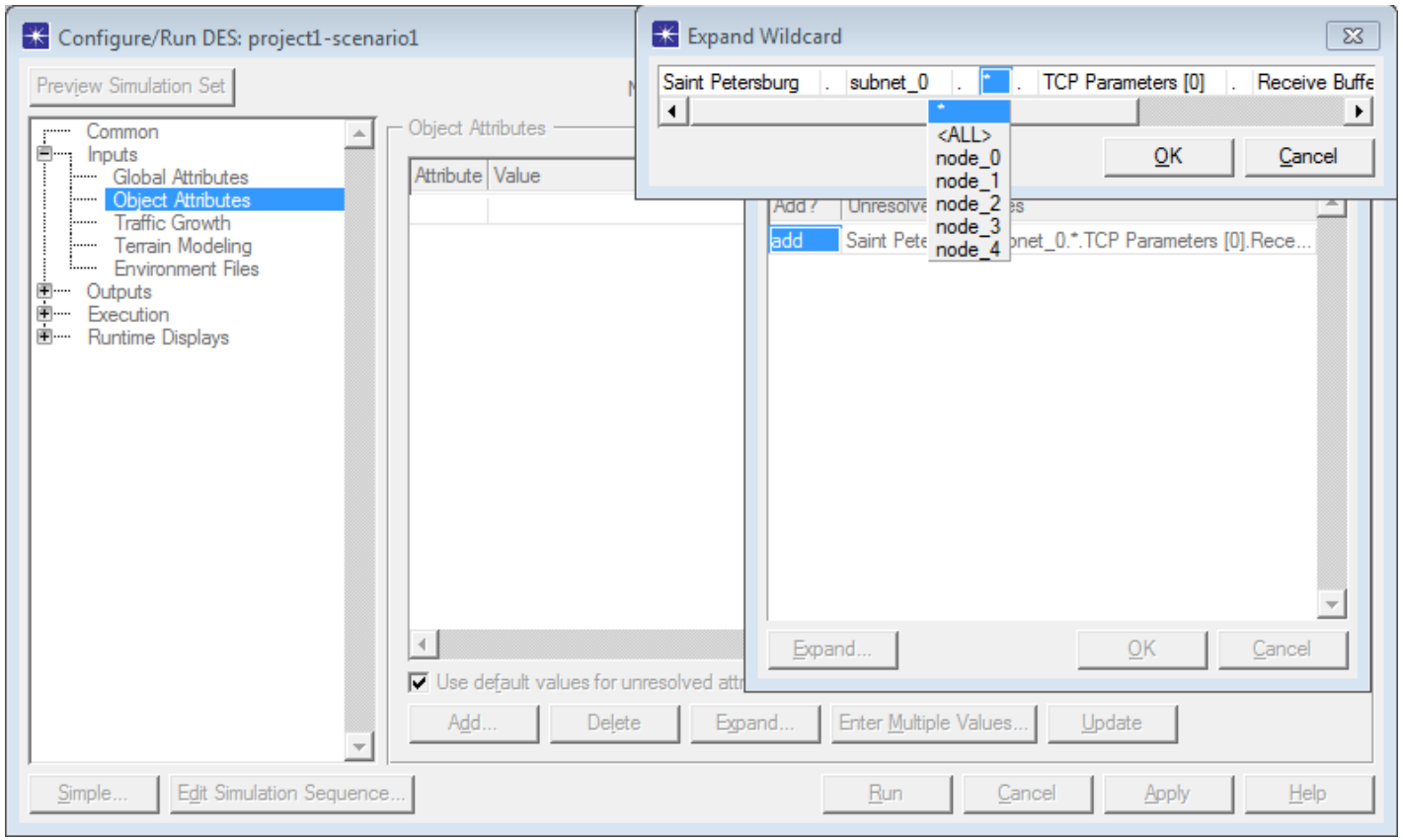
- Go To Parent Subnet ⇒ Edit Attributes
  - The names of these promoted attributes are the same with the exception of the node name to which each attribute belongs





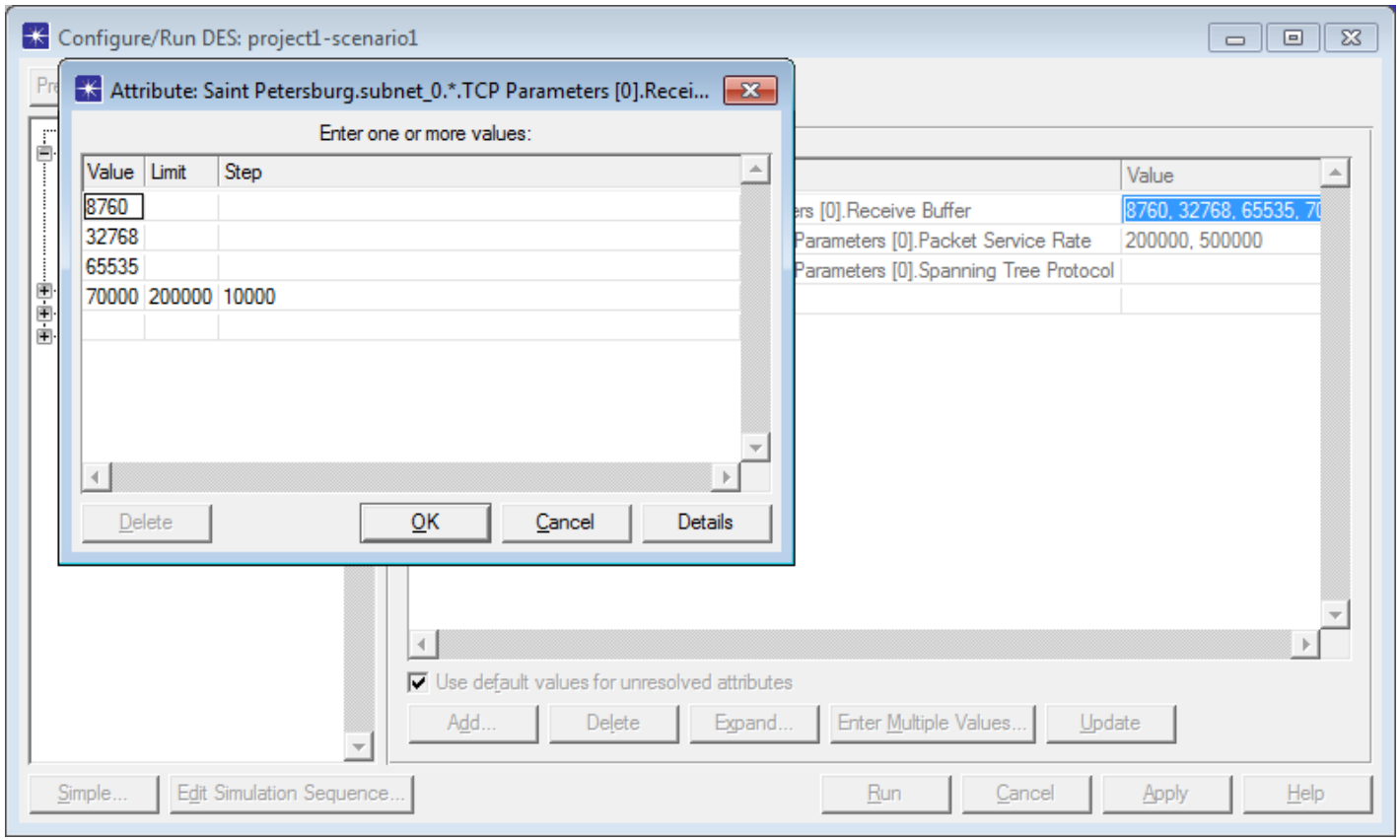
Wildcard (cont'd)

- **Wildcard** – allows to aggregate the promoted attributes that have the same name but belong to different objects
  - Attributes with the same name that have not been promoted are not influenced!



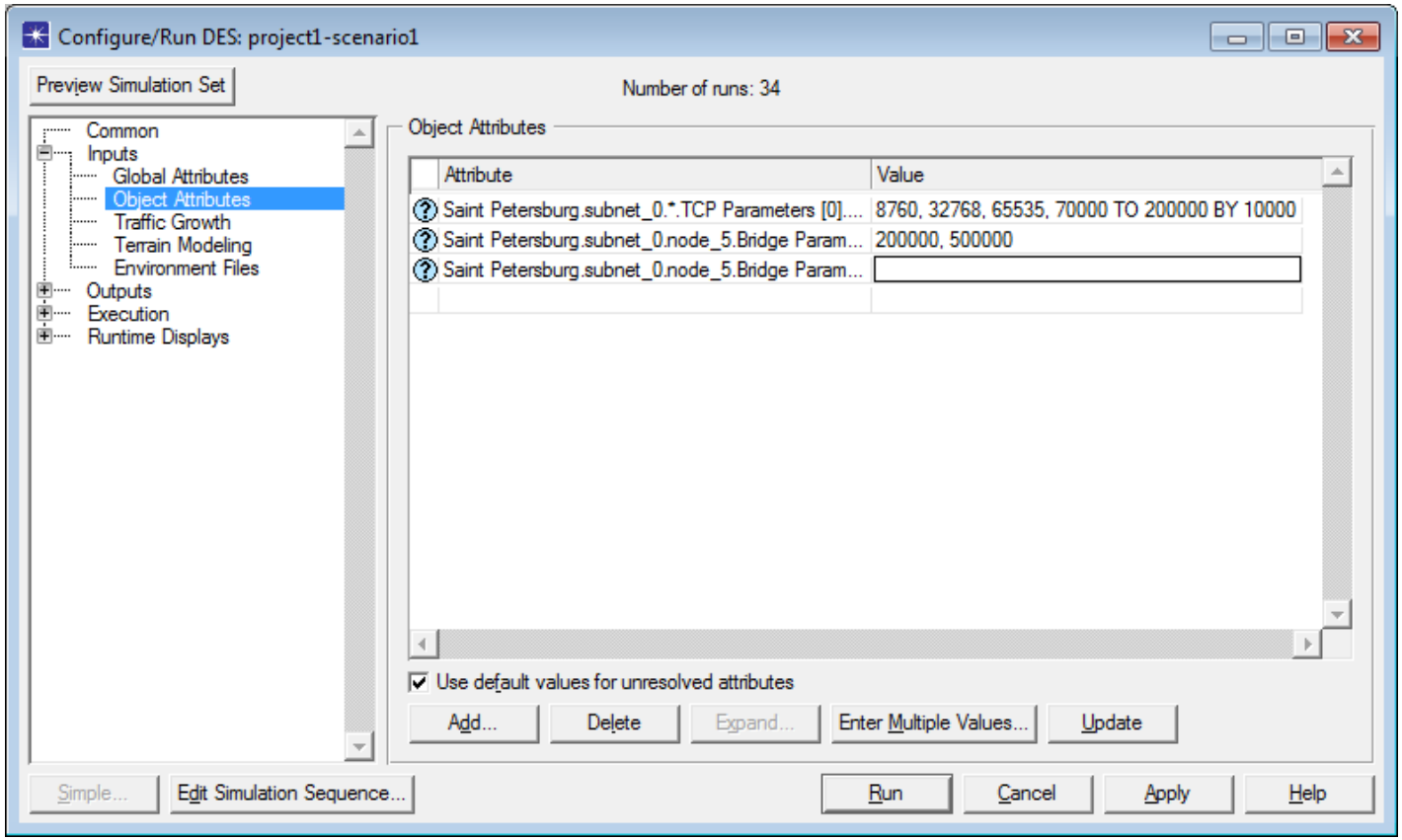
Wildcard (cont'd)

- **Enter Multiple Values** – used for setting multiple attribute values
  - Can be set either explicitly by specifying 1 value per row or by specifying the initial and maximum values with the incrementing step



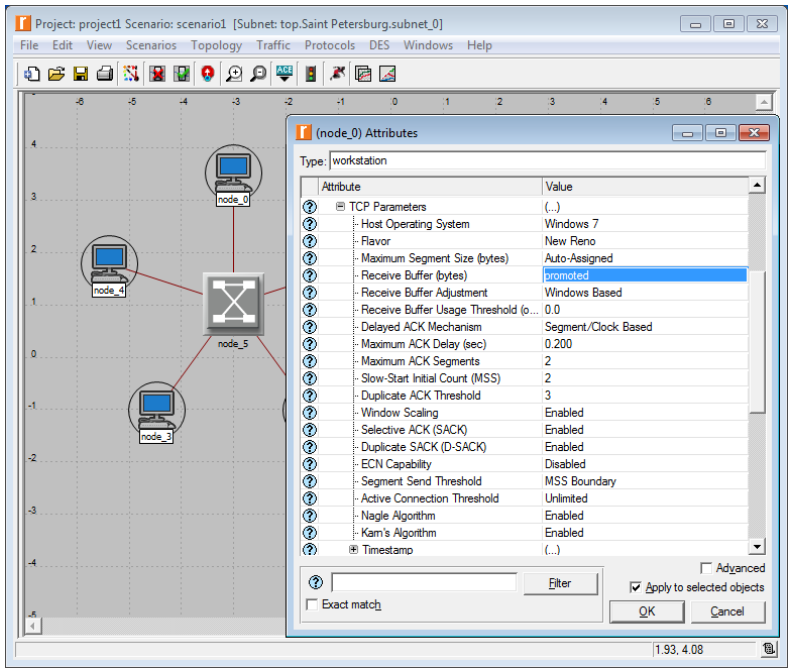
Wildcard (cont'd)

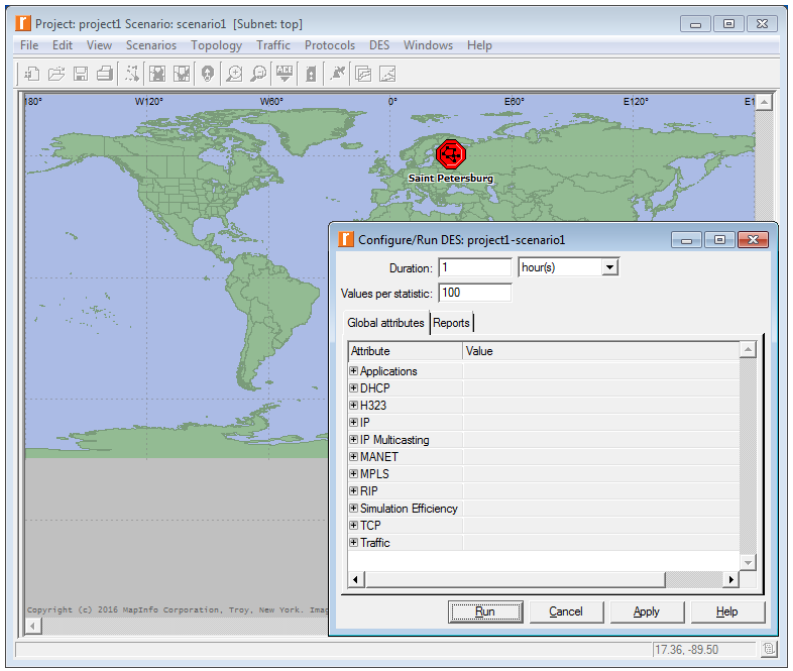
- The total number of simulation runs corresponds to the number of possible combinations
  - **Use default values for unresolved attributes** – ensures that all the attributes have set values



Wildcard (cont'd)

- **Riverbed Modeler Academic Edition**: no Object Attributes ☹





Wildcard (cont'd)

- OPNET IT Guru Academic Edition 9.1 (discontinued)