

OPNET/Riverbed Modeler: Configuring Object Attributes

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Lecture № 4

Outline

- 1 Object attributes
- 2 Configuring multiple objects
- 3 Tips and tricks
- 4 Promoting attributes
- 5 Wildcard

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- 1 Object attributes
- 2 Configuring multiple objects
- 3 Tips and tricks
- 4 Promoting attributes
- 5 Wildcard

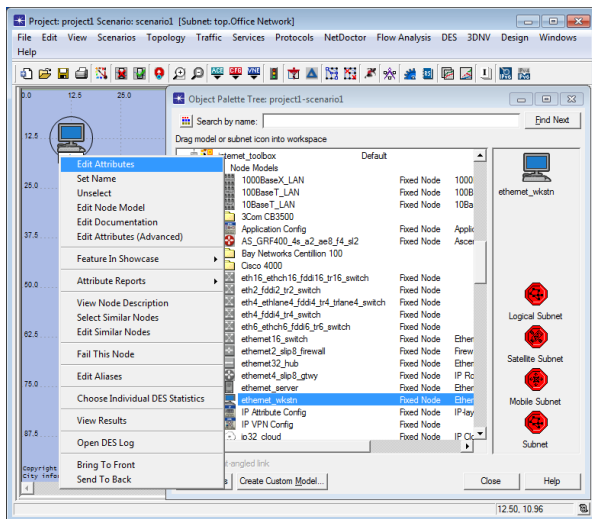
- Building a network topology is only the first step in developing a simulation study
- The subsequent steps include:
 - Configuring network elements
 - Adding traffic
 - Selecting simulation statistics and configuring simulation attributes
 - Running the simulation and examining the collected results
 - 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

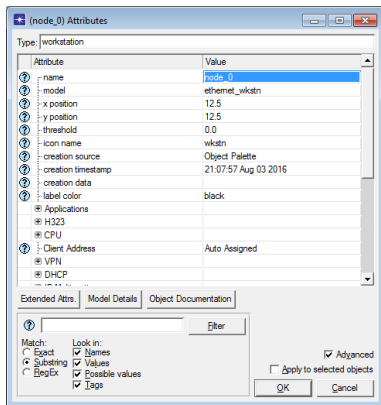
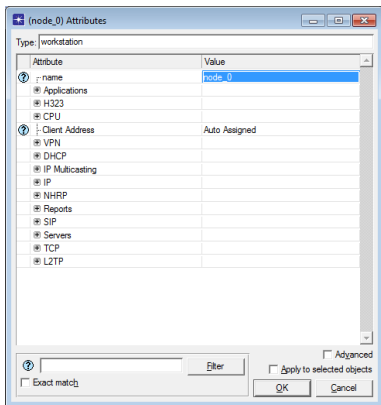
Object Attributes (cont'd)

- Object pop-up menu



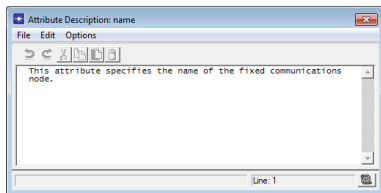
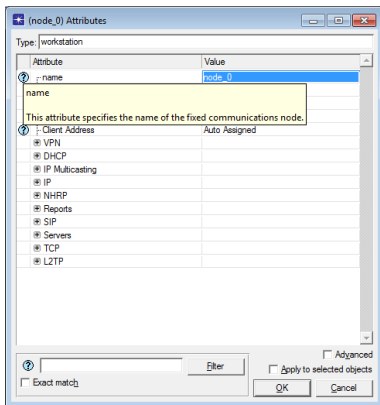
Object Attributes (cont'd)

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



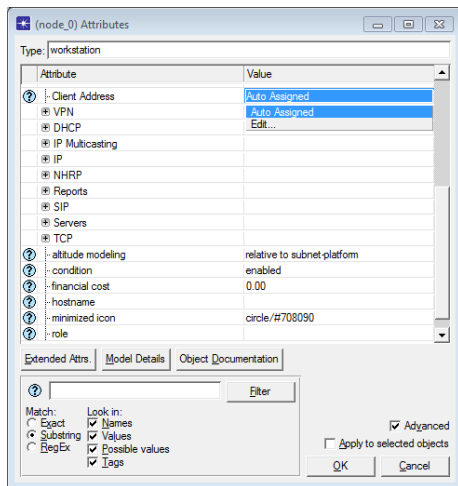
Object Attributes (cont'd)

- Attribute description



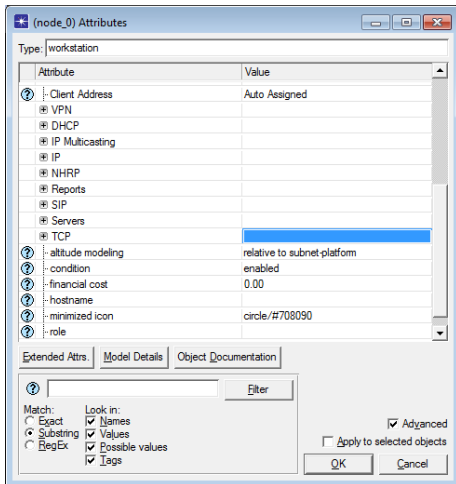
Object Attributes (cont'd)

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



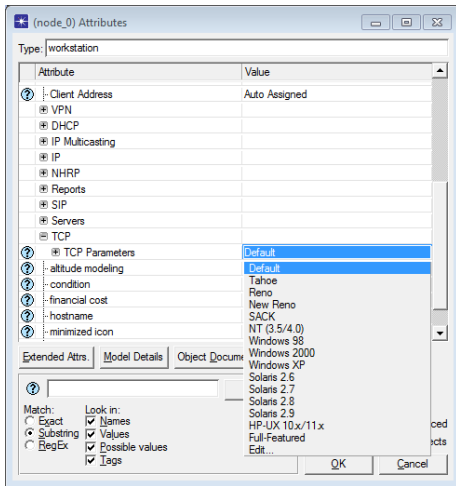
Object Attributes (cont'd)

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



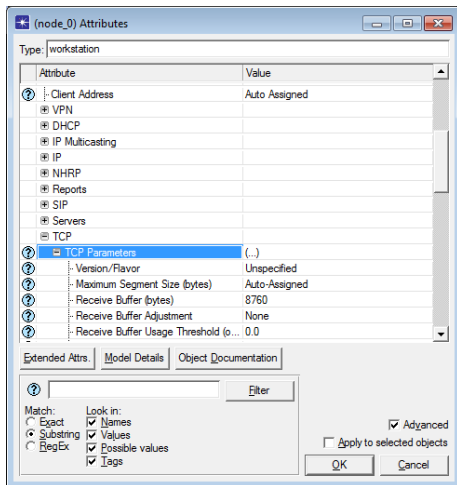
Object Attributes (cont'd)

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



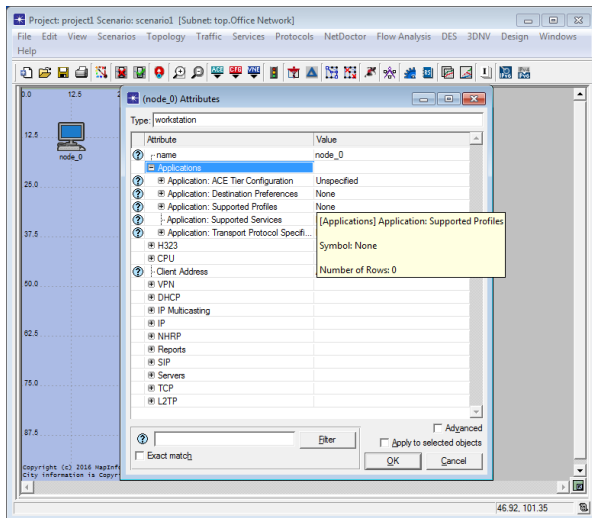
Object Attributes (cont'd)

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



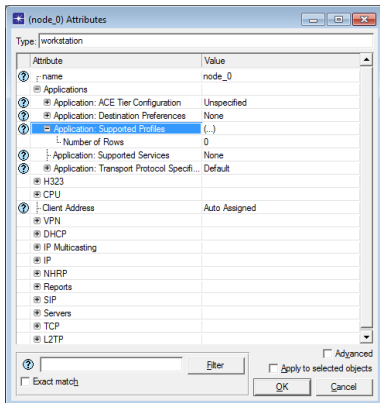
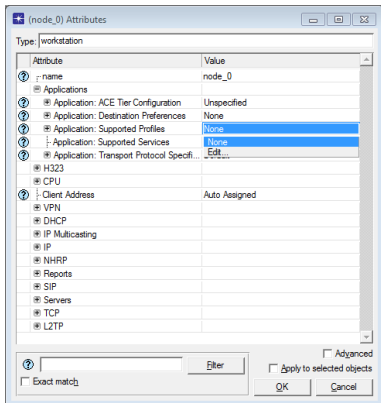
Object Attributes (cont'd)

- 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**

The screenshot shows the 'Application: Supported Profiles' dialog box. The 'Number of Rows' field is set to 2. The table below shows the configuration for supported profiles.

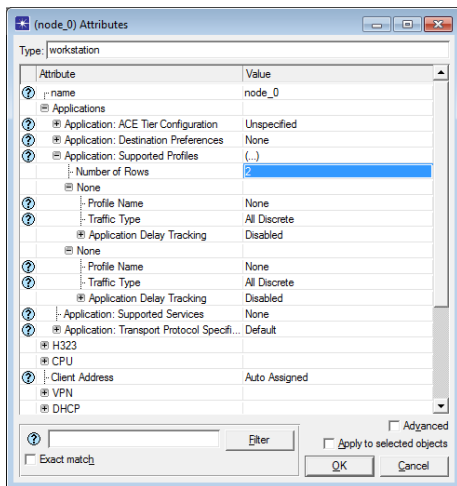
Profile Name	Traffic Type	Application Delay Tracking
None	All Discrete	Disabled
None	All Discrete	Disabled

The screenshot shows the 'Application: Supported Profiles' dialog box. The 'Number of Rows' field is set to 2. The table below shows the configuration for supported profiles.

Profile Name	Traffic Type	Application Delay Tracking
None	All Discrete	Disabled
None	All Discrete	Disabled

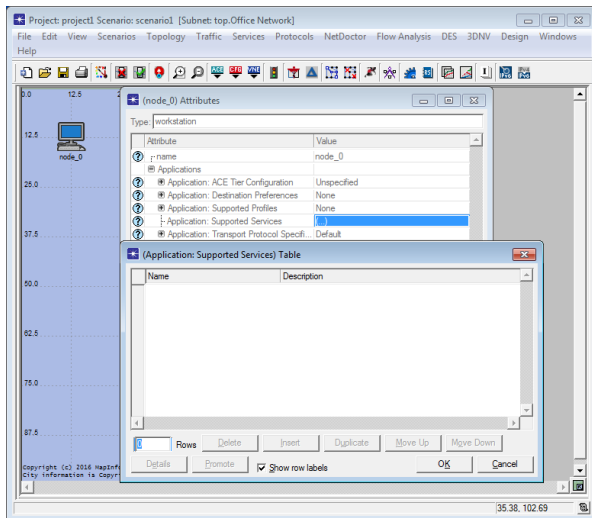
Object Attributes (cont'd)

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



Object Attributes (cont'd)

- Some attributes may be edited in tabular format only

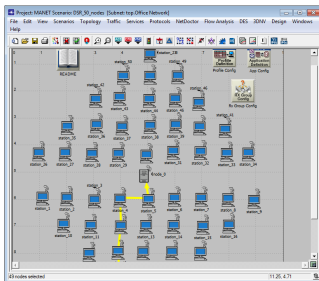


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- 2 Configuring multiple objects**
- 3 Tips and tricks
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- 5 Wildcard

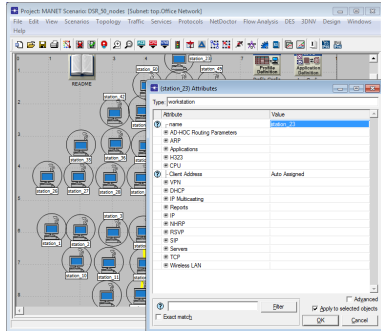
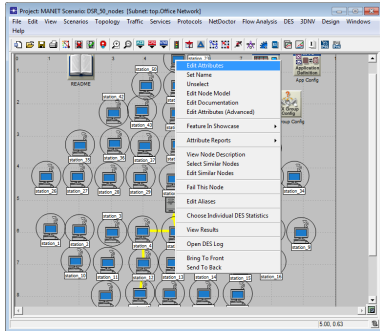
Configuring Multiple Objects

- 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'



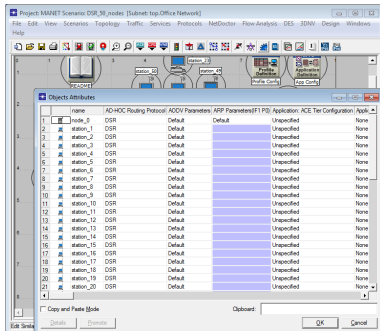
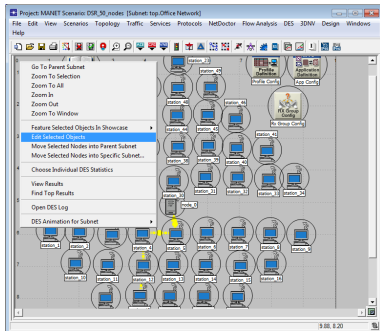
Configuring Multiple Objects (cont'd)

- Edit Attributes ⇒ **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

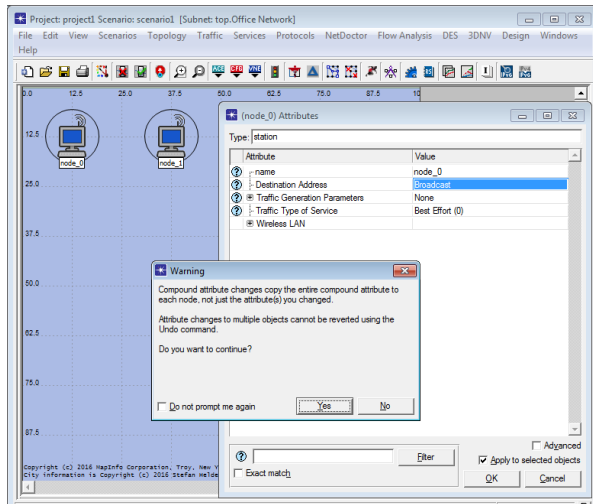


Configuring Multiple Objects (cont'd)

- **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 \Rightarrow Broadcast; node_1 = Random

The screenshot shows a network simulation software interface. The main window displays a grid with two nodes, node_0 and node_1, represented by computer icons. The 'Attributes' dialog for node_0 is open, showing the following table:

Attribute	Value
name	node_0
Destination Address	Broadcast
Traffic Generation Parameters	Random
Traffic Type of Service	Broadcast
Wireless LAN	Edit...

The dialog also includes an 'Advanced' checkbox (unchecked), an 'Apply to selected objects' checkbox (checked), and buttons for 'Exact match', 'Filter', 'OK', and 'Cancel'. The status bar at the bottom right shows the coordinates 126.15, 3.65.

Configuring Multiple Objects (cont'd)

2 No pain change, no gain ☹

The screenshot shows a network simulation software window titled "Project: project1 Scenario: scenario1 [Subnet: top.Office Network]". The main workspace displays a topology with two nodes, "node_0" and "node_1", on a grid. The "node_1" node is highlighted with a red circle. An "Attributes" dialog box is open for "node_1", showing the following configuration:

Attribute	Value
Name	node_1
Destination Address	Random
Traffic Generation Parameters	None
Traffic Type of Service	Best Effort (0)
Wireless LAN	

At the bottom of the dialog, there is an "Advanced" checkbox (unchecked), an "Apply to selected objects" checkbox (unchecked), and "OK" and "Cancel" buttons. The status bar at the bottom right of the window shows "94.62.0.00".

Configuring Multiple Objects (cont'd)

- ③ node_0 = AP/Broadcast; node_1 = STA/Random; 11 ⇒ 1 Mbps

Project: project1 Scenario: scenario1 [Subnet: top.Office Network]

File Edit View Scenarios Topology Traffic Services Protocols NetDoctor Flow Analysis DES 3DNV Design Windows Help

0.0 12.5 25.0 37.5 50.0 62.5 75.0 87.5 100.0

12.5 25.0 37.5 50.0 62.5 75.0 87.5

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(node_0) Attributes

Type: station

Attribute	Value
name	node_0
Destination Address	Broadcast
Traffic Generation Parameters	None
Traffic Type of Service	Best Effort (0)
Wireless LAN	
Wireless LAN MAC Address	Auto Assigned
Wireless LAN Parameters	(...)
BSS Identifier	Auto Assigned
Access Point Functionality	Enabled
Physical Characteristics	Direct Sequence
Data Rate (bps)	1 Mbps
Channel Settings	1 Mbps
Transmit Power (W)	2 Mbps
Packet Reception-Power Threshold	5.5 Mbps
Rts Threshold (bytes)	11 Mbps
Fragmentation Threshold (bytes)	None
CTS-to-self Option	Enabled
Short Retry Limit	7
Long Retry Limit	4
AP Beacon Interval (secs)	0.02
Max Receive Lifetime (secs)	0.5

Advanced
 Apply to selected objects

Exact match

Filter

OK Cancel

135.19, 3.65

Configuring Multiple Objects (cont'd)

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

The screenshot shows a network simulation software interface. The main window displays a topology with two nodes, node_0 and node_1, on a grid. Node_1 is highlighted with a red circle. A configuration window titled "(node_1) Attributes" is open, showing the following configuration:

Attribute	Value
Type	station
name	node_1
Destination Address	Random
Traffic Generation Parameters	None
Traffic Type of Service	Best Effort (0)
Wireless LAN	
Wireless LAN MAC Address	Auto Assigned
Wireless LAN Parameters	(...)
BSS Identifier	Auto Assigned
Access Point Functionality	Enabled
Physical Characteristics	Direct Sequence
Data Rate (bps)	1 Mbps
Channel Settings	Auto Assigned
Transmit Power (W)	0.005
Packet Reception-Power Threshold	-95
Rts Threshold (bytes)	None
Fragmentation Threshold (bytes)	None
CTS-to-self Option	Enabled
Short Retry Limit	7
Long Retry Limit	4
AP Beacon Interval (secs)	0.02
Max Receive Lifetime (secs)	0.5

The configuration window also includes an "Advanced" section with an "Exact match" checkbox and an "Apply to selected objects" checkbox. The "OK" and "Cancel" buttons are visible at the bottom right of the window.

Configuring Multiple Objects (cont'd)

- ④ node_0 = Broadcast \Rightarrow Random; node_1 = Max/Min Dest Address

The screenshot shows a network simulation software window titled "Project: project1 Scenario: scenario1 [Subnet: top.Office Network]". The main workspace displays a network topology with two nodes, "node_0" and "node_1", on a coordinate grid. A "Warning" dialog box is open in the foreground, displaying the following text:

Warning

Compound attribute changes copy the entire compound attribute to each node, not just the attribute(s) you changed.

Attribute changes to multiple objects cannot be reverted using the Undo command.

Do you want to continue?

Do not prompt me again

Yes No

At the bottom of the software window, there is an "Advanced" section with an "Apply to selected objects" checkbox checked, and "Exact match" and "Filter" options.

Configuring Multiple Objects (cont'd)

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

The screenshot shows a network simulation software interface. The main window displays a network topology with two nodes, node_0 and node_1, on a grid. The x-axis ranges from 0.0 to 100.0, and the y-axis ranges from 0.0 to 100.0. Node_0 is located at approximately (12.5, 12.5) and node_1 is at (37.5, 12.5). A dialog box titled "(node_1) Attributes" is open, showing the configuration for node_1. The dialog has a "Type" field set to "station". Below this is a table of attributes and their values:

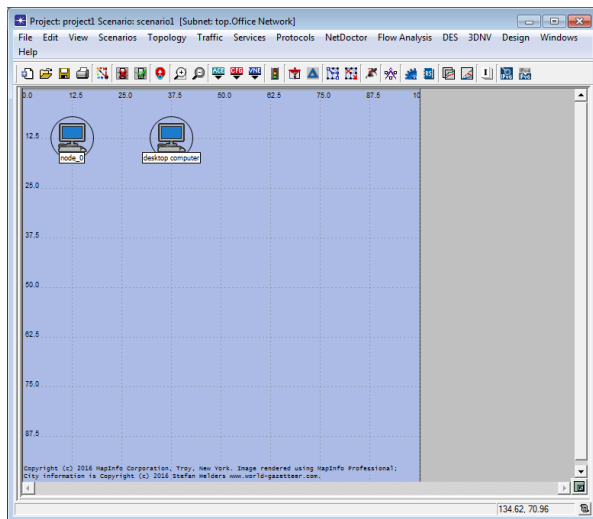
Attribute	Value
name	node_1
Ethernet	
Highest Destination Address	Maximum Dest Address
Lowest Destination Address	Minimum Dest Address
Traffic Generation Parameters	(...)

At the bottom of the dialog, there are several options: "Exact match" (unchecked), "Filter" (button), "Advanced" (checkbox, unchecked), "Apply to selected objects" (checkbox, unchecked), "OK" (button), and "Cancel" (button). The status bar at the bottom right of the main window shows "67.50, 0.58".

Outline

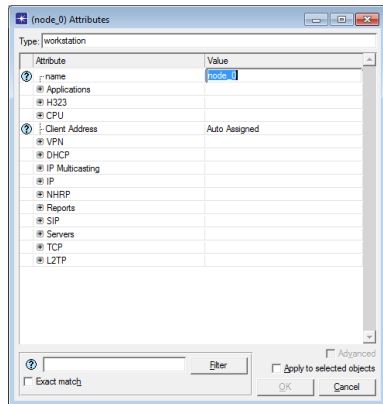
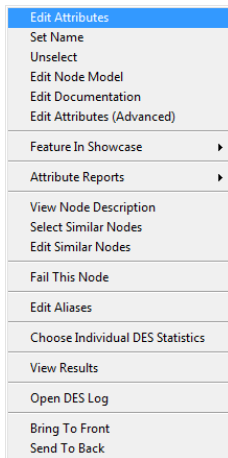
- 1 Object attributes
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- 2 methods to change the object's name



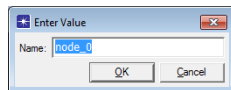
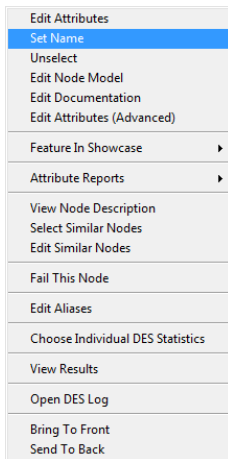
Tips and Tricks (cont'd)

1 Edit Attributes ⇒ Change the attribute 'name'



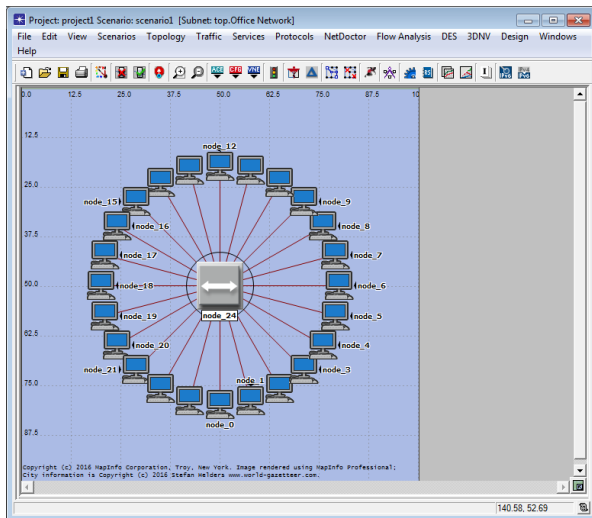
Tips and Tricks (cont'd)

2 Set Name ⇒ Enter Value



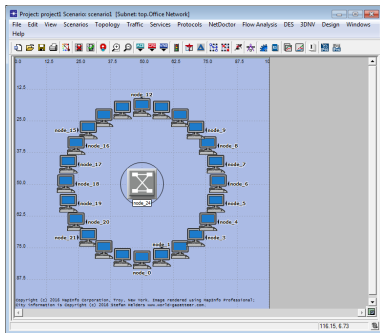
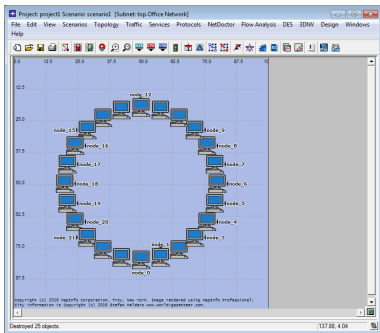
Tips and Tricks (cont'd)

- 2 methods to change the object's model



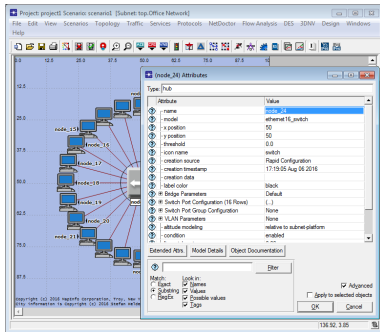
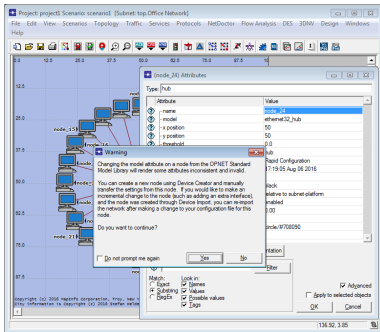
Tips and Tricks (cont'd)

- 1 Delete the selected object and create a desired one



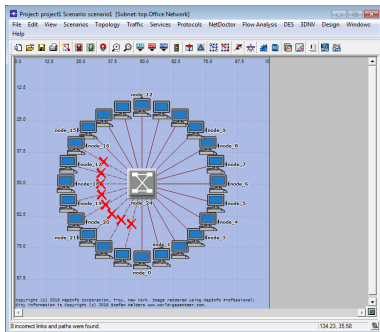
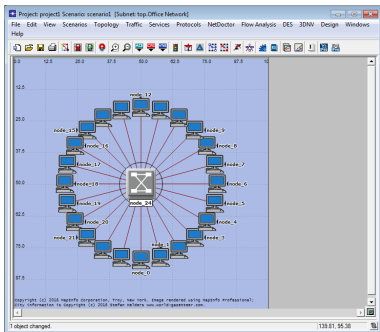
Tips and Tricks (cont'd)

2 Edit Attributes (Advanced) ⇒ Change the attribute 'model'



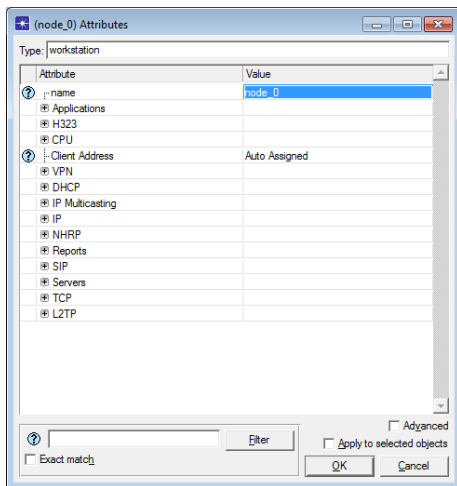
Tips and Tricks (cont'd)

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



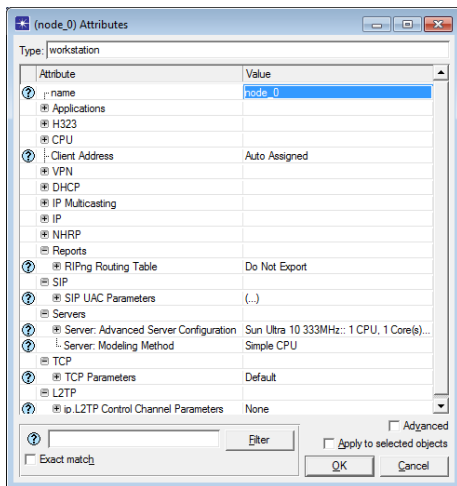
Tips and Tricks (cont'd)

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



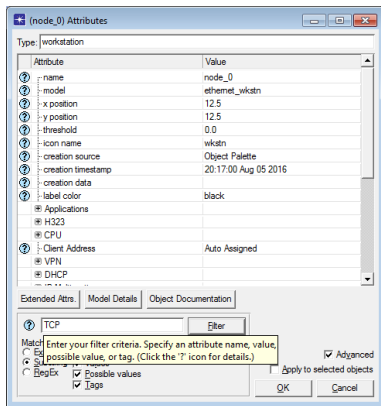
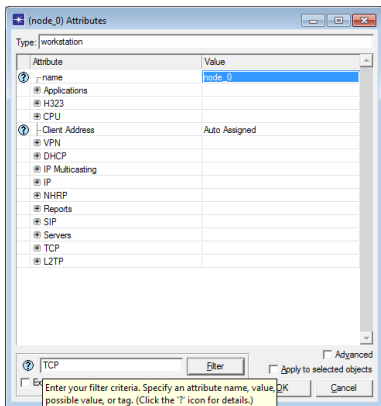
Tips and Tricks (cont'd)

- 1 Browse through the attributes available in the dialog box



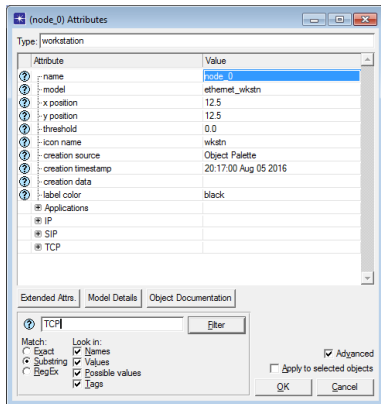
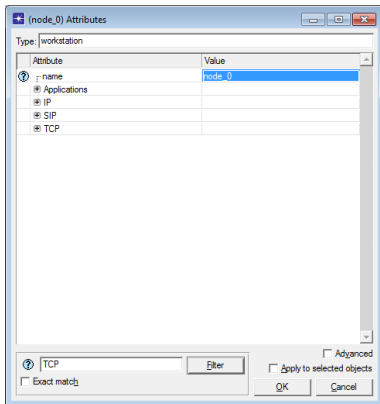
Tips and Tricks (cont'd)

2 Filter attributes based on selection criteria



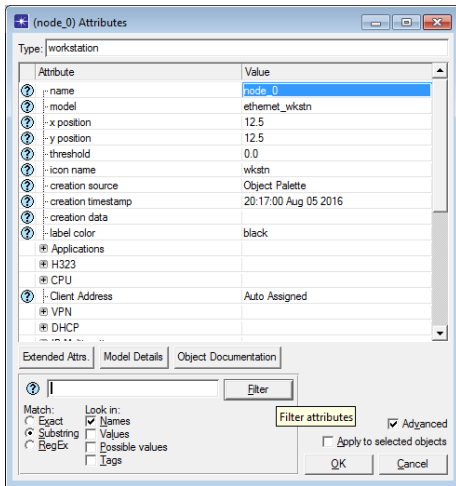
Tips and Tricks (cont'd)

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



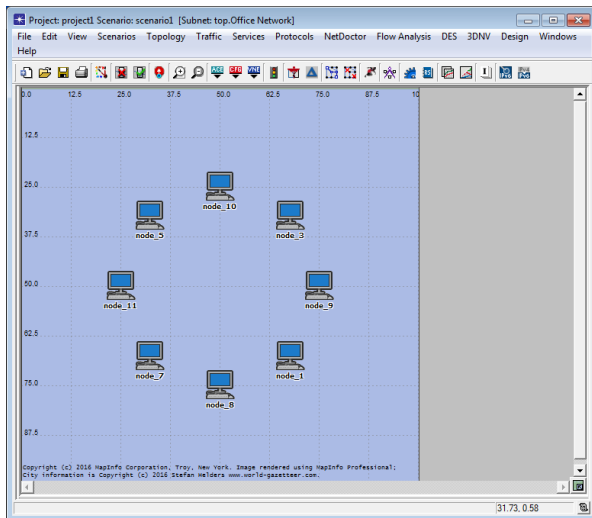
Tips and Tricks (cont'd)

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



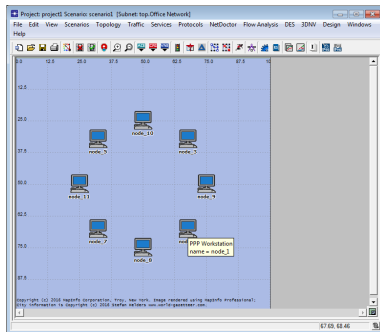
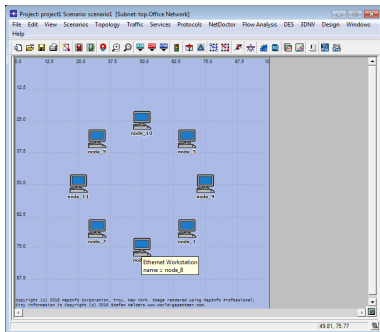
Tips and Tricks (cont'd)

- 2 methods to compare the objects of interest



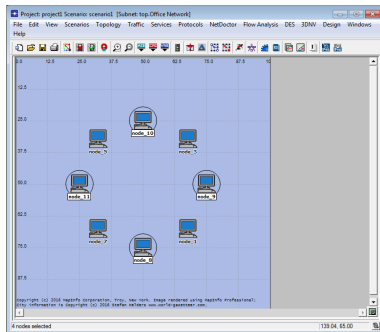
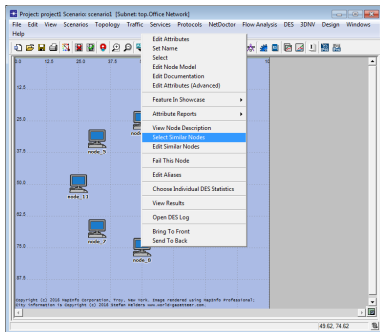
Tips and Tricks (cont'd)

- 1 Check all the objects one by one



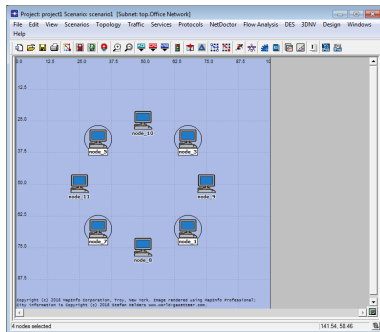
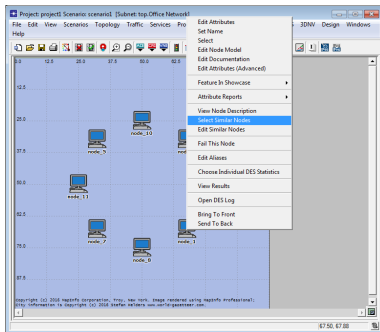
Tips and Tricks (cont'd)

2 Edit Attributes ⇒ Select Similar Nodes/Links



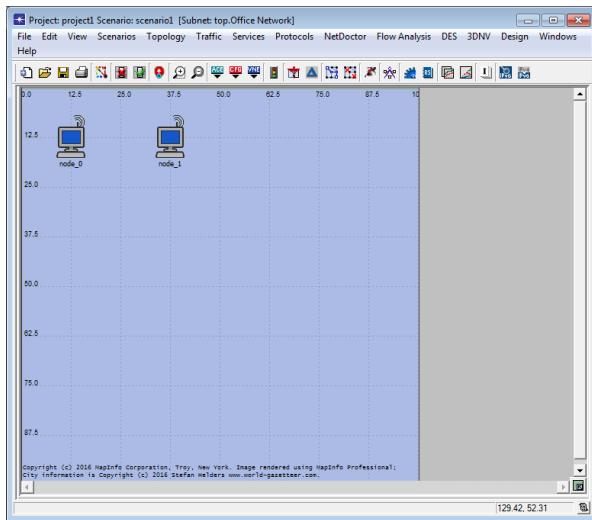
Tips and Tricks (cont'd)

2 Edit Attributes ⇒ Select Similar Nodes/Links



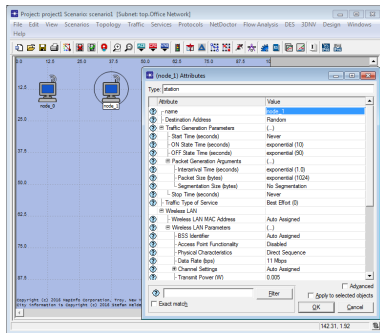
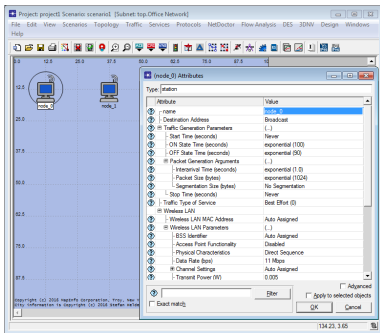
Tips and Tricks (cont'd)

- 2 methods to compare attributes of the objects of interest



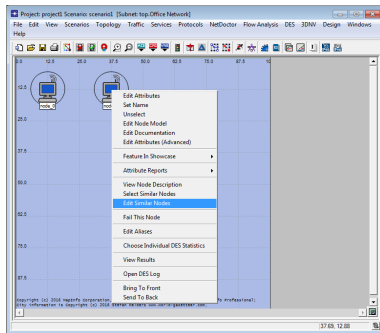
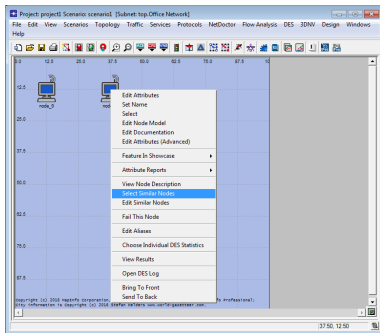
Tips and Tricks (cont'd)

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



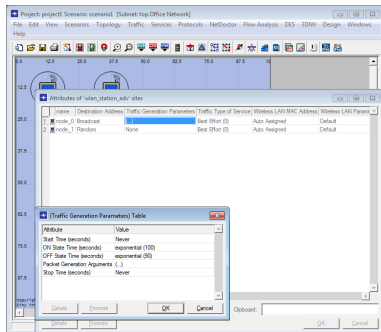
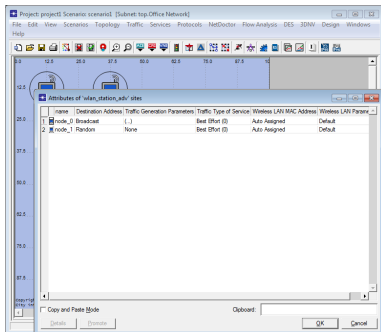
Tips and Tricks (cont'd)

2 Select Similar Nodes ⇒ Edit Similar Nodes



Tips and Tricks (cont'd)

2 Objects Attributes

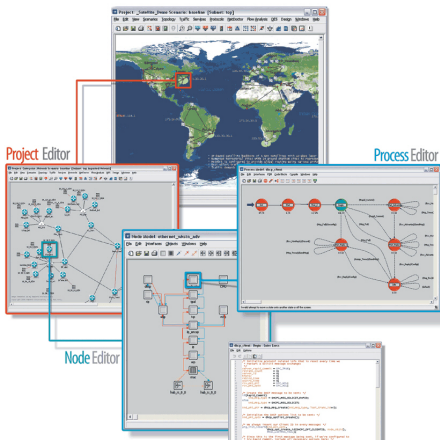


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Promoting Attributes

- 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

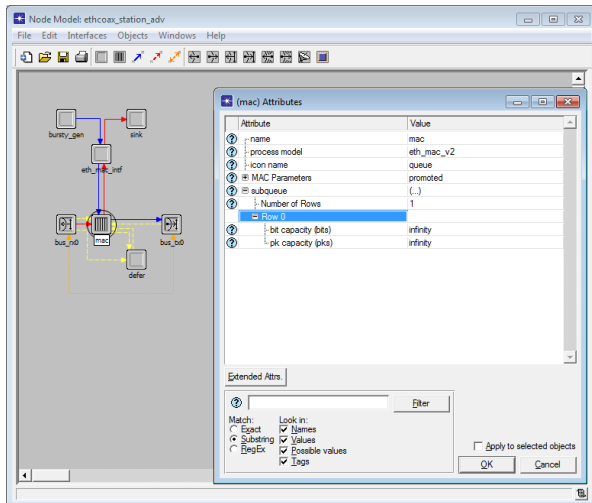
The screenshot displays a network modeling software window titled "Project: project1 Scenario: scenario1 [Subnet: top.Office Network]". The main workspace shows a grid with a node labeled "node_0" at the 12.5 position. A dialog box titled "(node_0) Attributes" is open, showing a table of attributes for the selected node.

Attribute	Value
r name	node_0
Traffic Generation Parameters	(...)
Start Time (seconds)	constant (5.0)
ON State Time (seconds)	exponential (10.0)
OFF State Time (seconds)	exponential (90.0)
Packet Generation Arguments	(...)
Interarrival Time (seconds)	exponential (1.0)
Packet Size (bytes)	exponential (1024)
Segmentation Size (bytes)	No Segmentation
Stop Time (seconds)	Never

At the bottom of the dialog box, there is an "Advanced" checkbox, an "Apply to selected objects" checkbox, and buttons for "Filter", "Exact match", "OK", and "Cancel".

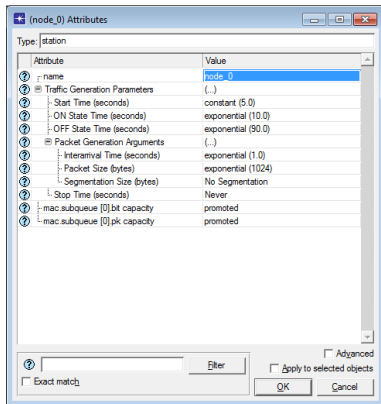
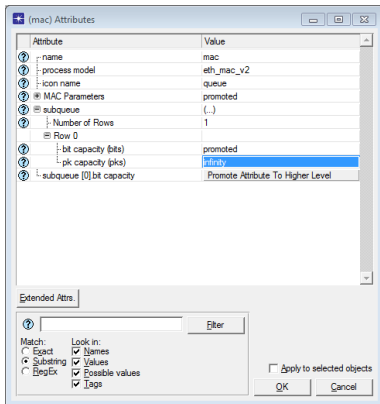
Promoting Attributes (cont'd)

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



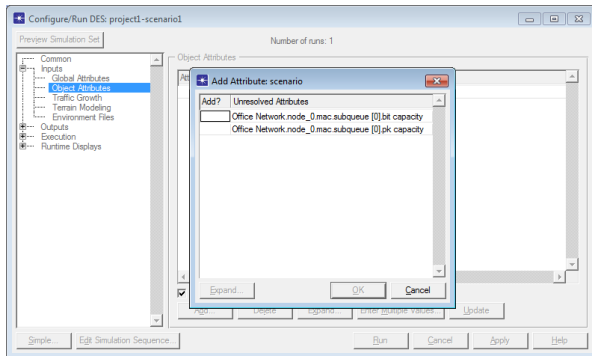
Promoting Attributes (cont'd)

- 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'

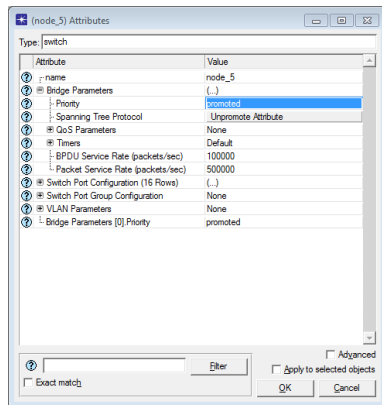
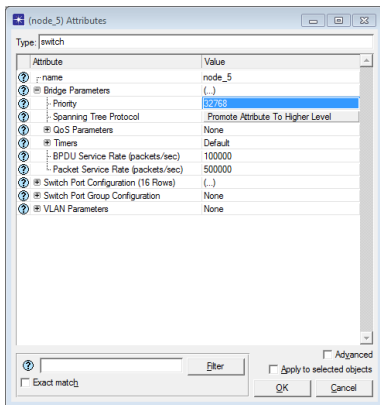
Promoting Attributes (cont'd)

- 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



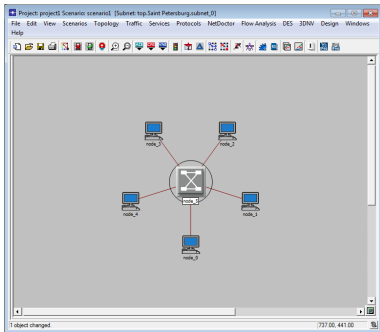
Promoting Attributes (cont'd)

- 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



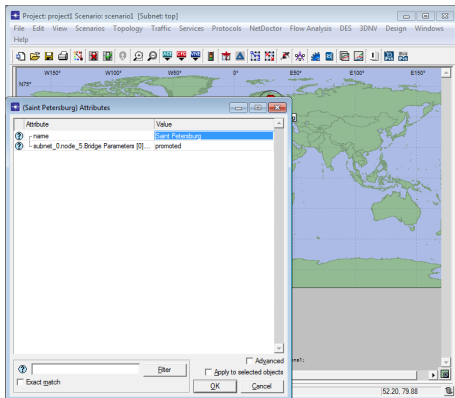
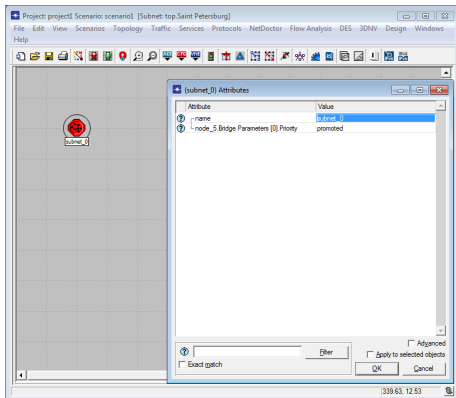
The screenshot shows the '(node_5) Attributes' dialog box. The 'Type' is set to 'switch'. The dialog contains a table of attributes and their values:

Attribute	Value
name	node_5
Bridge Parameters	(...)
Priority	promoted
Spanning Tree Protocol	RSTP (802.1w)
QoS Parameters	None
Timers	Default
BPDU Service Rate (packets/sec)	100000
Packet Service Rate (packets/sec)	500000
Switch Port Configuration	(...)
Switch Port Group Configuration	None
VLAN Parameters	None
Bridge Parameters [0] Priority	promoted

At the bottom of the dialog, there is an 'Advanced' checkbox, an 'Apply to selected objects' checkbox, an 'Exact match' checkbox, an 'Filter' button, and 'OK' and 'Cancel' buttons.

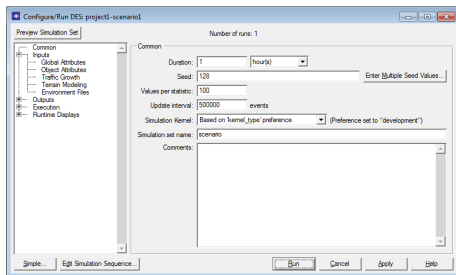
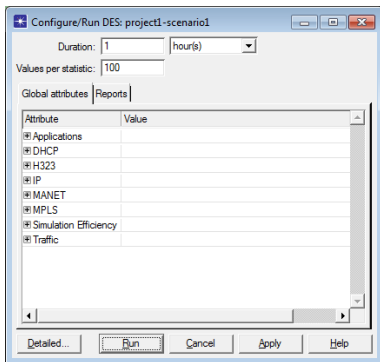
Promoting Attributes (cont'd)

- 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



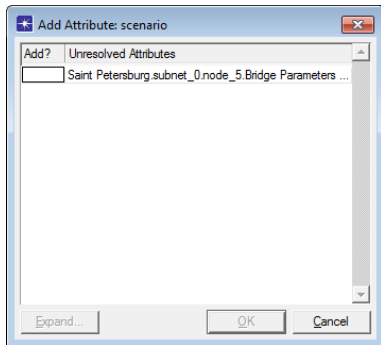
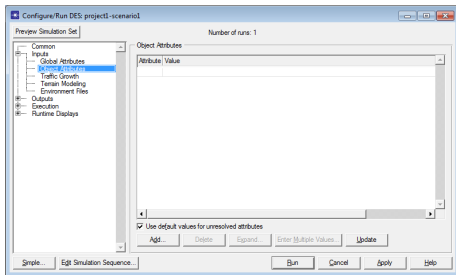
Promoting Attributes (cont'd)

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



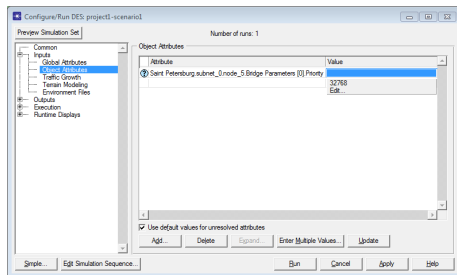
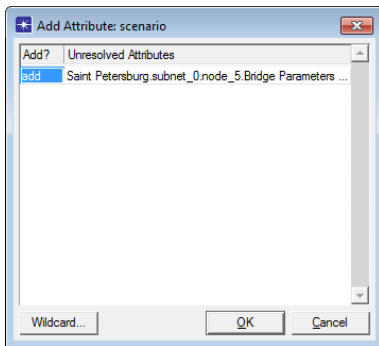
Promoting Attributes (cont'd)

- Inputs \Rightarrow Object Attributes \Rightarrow Add...



Promoting Attributes (cont'd)

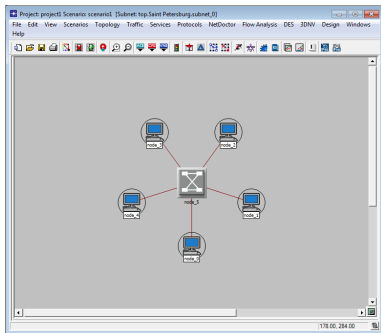
- Add? ⇒ OK



Outline

- 1 Object attributes
- 2 Configuring multiple objects
- 3 Tips and tricks
- 4 Promoting attributes
- 5 Wildcard**

- Promote a desired attribute in objects within the current subnet



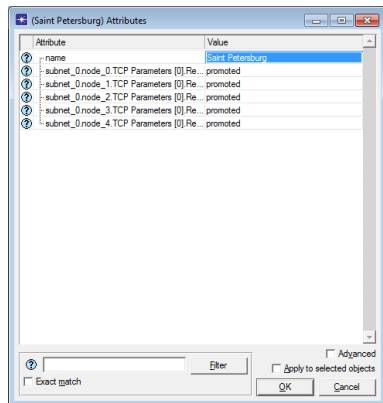
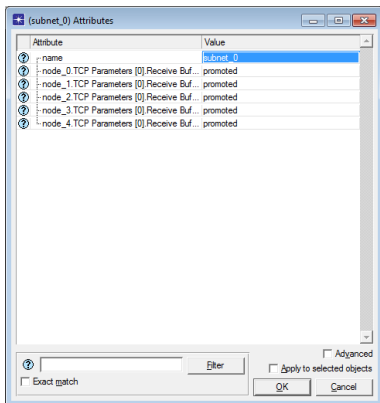
The screenshot shows the "(node_0) Attributes" dialog box. The "Type" is set to "workstation". The dialog contains a table of attributes and their values:

Attribute	Value
TCP Parameters	(...)
Version/Flavor	Unspecified
Maximum Segment Size (bytes)	Auto-Assigned
Receive Buffer (bytes)	promoted
Receive Buffer Adjustment	None
Receive Buffer Usage Threshold (p...	0.0
Delayed ACK Mechanism	Segment/Clock Based
Maximum ACK Delay (sec)	0.200
Maximum ACK Segments	2
Slow-Start Initial Count (MSS)	2
Fast Retransmit	Enabled
Duplicate ACK Threshold	3
Fast Recovery	Reno
Window Scaling	Disabled
Selective ACK (SACK)	Disabled
ECN Capability	Disabled
Segment Send Threshold	MSS Boundary
Active Connection Threshold	Unlimited
Nagle Algorithm	Disabled
Kar's Algorithm	Enabled
Timestamp	Disabled

At the bottom of the dialog, there is an "Exact match" checkbox, an "Advanced" checkbox, and an "Apply to selected objects" checkbox. There is also an "Filter" input field and "OK" and "Cancel" buttons.

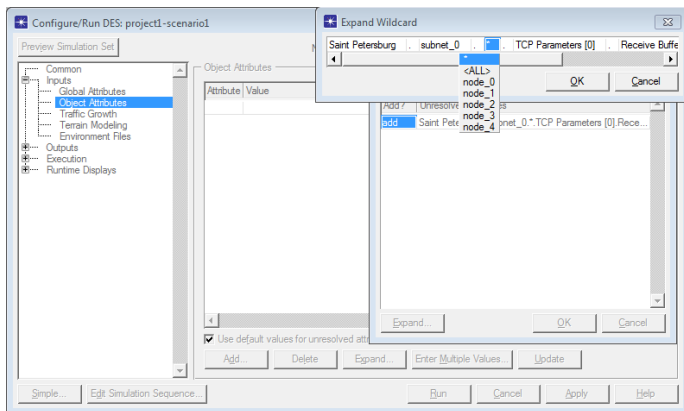
Wildcard (cont'd)

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



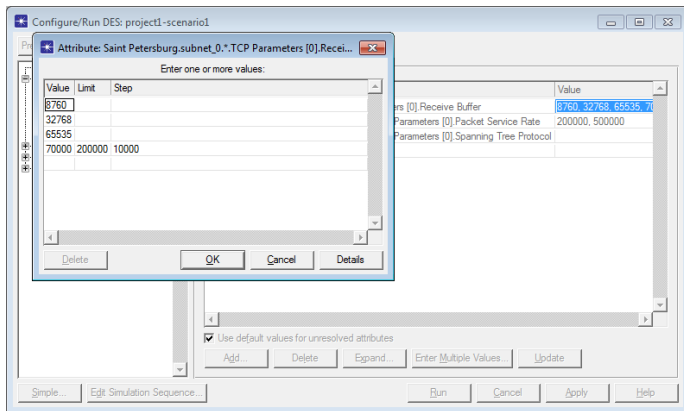
Wildcard (cont'd)

- **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!



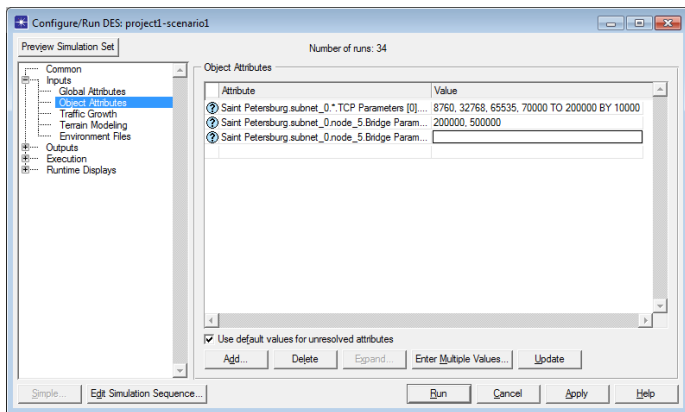
Wildcard (cont'd)

- **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



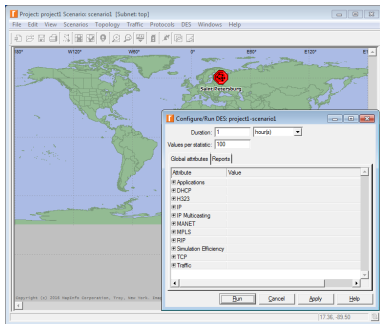
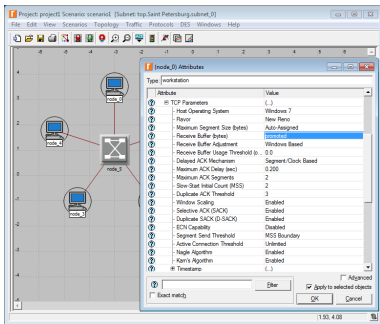
Wildcard (cont'd)

- 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 ☹️



- OPNET IT Guru Academic Edition 9.1 (discontinued)

