Tips for Troubleshooting Routing Issues in Modeler

Objective

This tutorial provides helpful checks when troubleshooting problems with routing simulations in Riverbed Modeler.

The following topics are covered:

- Getting started with routing simulations
- Checking the IP Interface Addresses
- Exporting routing tables
- DES Log messages
- Using IP traffic flows
- Routing simulation efficiency
- IP Auto-configuration menu options
- Where can I get more help?

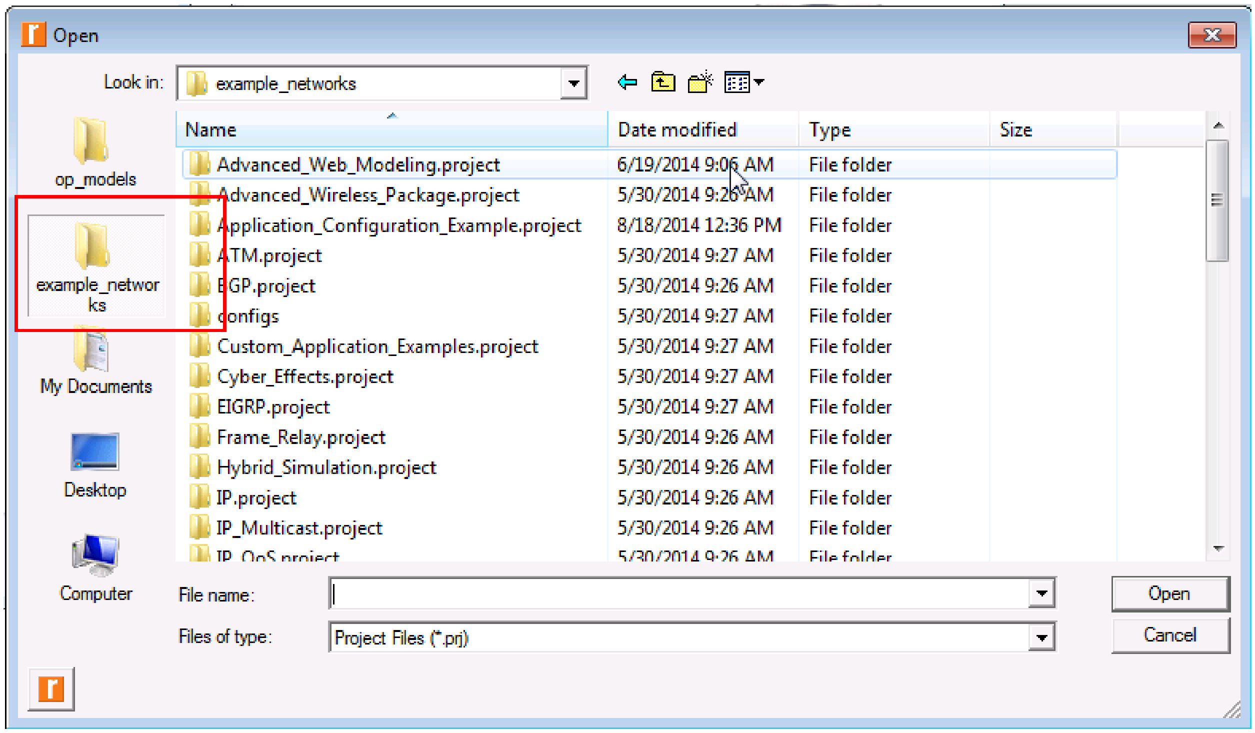
1. Getting started with routing simulations

Riverbed Modeler provides you with a modeling and simulation environment for designing communication protocols and network equipment. Network technology designers that use Modeler gain a better understanding of design trade-offs earlier in the product development process. This reduces the need for time-intensive and expensive hardware prototyping.

The best place to start from when simulating routing in Modeler is from the example projects shipped with the software. These can be accessed by:

1. Start *Riverbed Modeler Academic Edition*.

2. Select **File/Open…** then click on the "example_networks" folder to the left



3. This shows a list of example projects that are shipped with the software. You may use these projects to explore different configurations. You may look at these projects for simulation of different routing/IP related protocols/features:

- BGP
- EIGRP
- IP
- IP Multicast
- IP QoS
- IPv6
- ISIS
- Load Balancer
- Mobile_IP
- OSPF
- RIP
- Routing

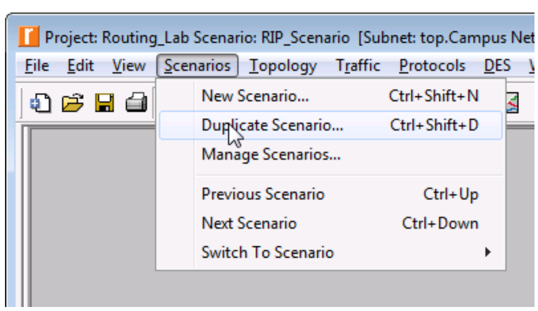
2. Problem Definition

In this tutorial, we will be applying different troubleshooting tips on a scenario to determine why a client cannot find a route to a server after 500 seconds into the simulation. Our suspicion is that something is broken in the routing, so we will use different approaches to find the root-cause of the problem, and resolve this.

The project accompanying this tutorial (**Routing_Lab**) consists of an FTP application deployed between a client and a server. The two devices communicate across a backbone on which RIP is deployed. **FTP_Client** is able to send and receive traffic from **FTP_Server** without any issues as shown in the graph below. However, 500 seconds (8 minutes) into the simulation the two nodes are not able to communicate because a route cannot be found. So what happens to RIP midway through the simulation?

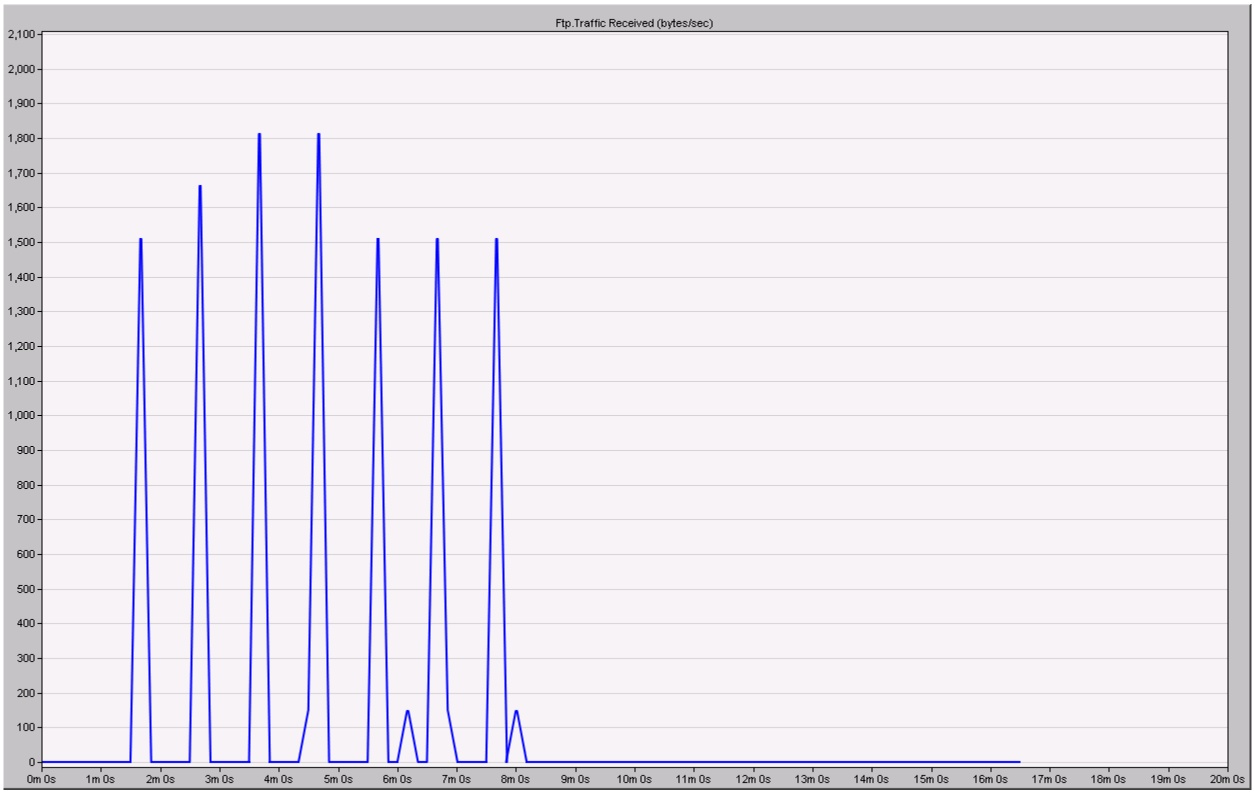
First let us explore the project:

1. Start **Riverbed Modeler Academic Edition 17.5,** if it is not already open.
2. Select **File/Open** to open a project**.**
3. Select **Routing_Lab** and click Open.
    a. The project will open with the scenario named **RIP_Scenario**.
4. Maximize the project by clicking on the **Maximize** button on the top right corner of the project editor.
5. Duplicate this baseline scenario (**Scenarios> Duplicate Scenario…**) and call the new scenario **Rip_Scenario_duplicate.** You may go back to the original scenario from the **Scenarios> Switch to Scenario…** menu. [Note: Duplicating the scenario is important in case you want to go back to the unchanged version].



6. The IP Addresses for the nodes in this scenario have already been configured. Explore the IP related attributes on the nodes to familiarize yourself with the configuration.
7. Run the simulation through **DES> Configure/Run Discrete Event Simulation…** then click on **Run.**
8. Once the simulation run completes, open the results browser from **DES> Results> View Results…**

9. Expand **Global Statistics> Ftp> Traffic Received (bytes/sec)**

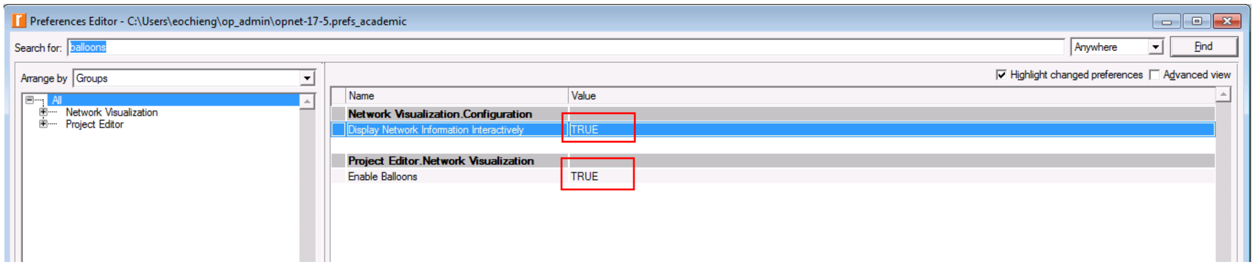


10. Notice the FTP traffic is only successfully received up to about 8 minutes into the simulation. Our goal is to determine why this is so, since FTP has been configured to run for the entire duration of the simulation.

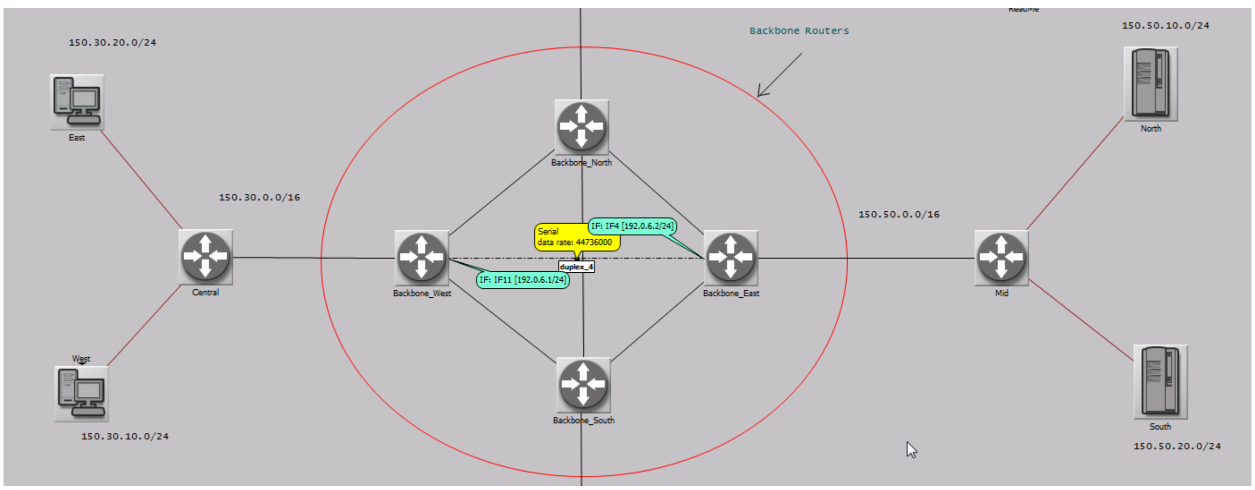
3. Checking the IP Interface Addresses

One of the most common causes of issues in routing projects is incorrect IP Address and subnet mask assignment. You may check the IP Addresses by going through the interface information attributes of all the nodes. Alternatively, it is much easier to enable *balloons* that will give you this information by simply clicking on the connecting links.

11. Go to **Edit> Preferences** to open the preference editor**.**
12. Search for *balloons* and make sure that both of the two resultant preferences are set to **True** as shown in the image below**.**
13. Click on **Apply** and save the changes.

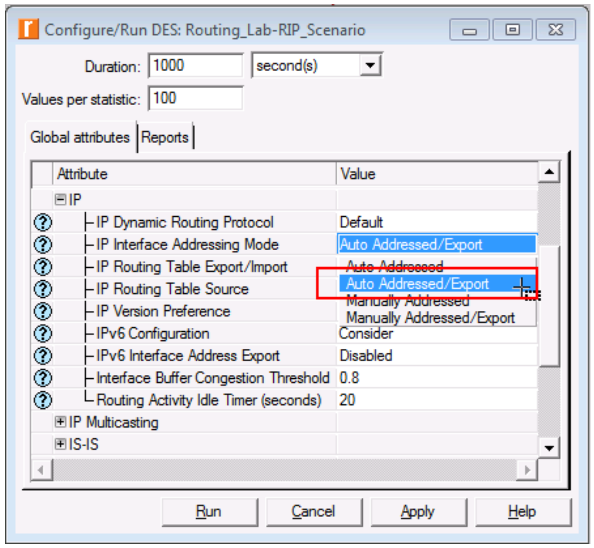


14. Click on the links between connecting devises and notice that the IP addresses and subnet masks are displayed.
15. This can be useful to quickly check against any possible misconfiguration resulting in routing problems.



NOTE: If you are running the full version of Modeler (not Riverbed Modeler Academic Edition), then you may also export all the configured IP interfaces in the simulation by following steps 16-19 below. This functionality is disabled for the Academic Edition.

16. Open the Configure/Run Des window to set the simulation attributes (**DES> Configure/Run Discrete Event Simulation…**).
17. Under **Global Attributes**, expand **IP> IP Interface Addressing Mode** and set it to **Auto Addressed/Export.**



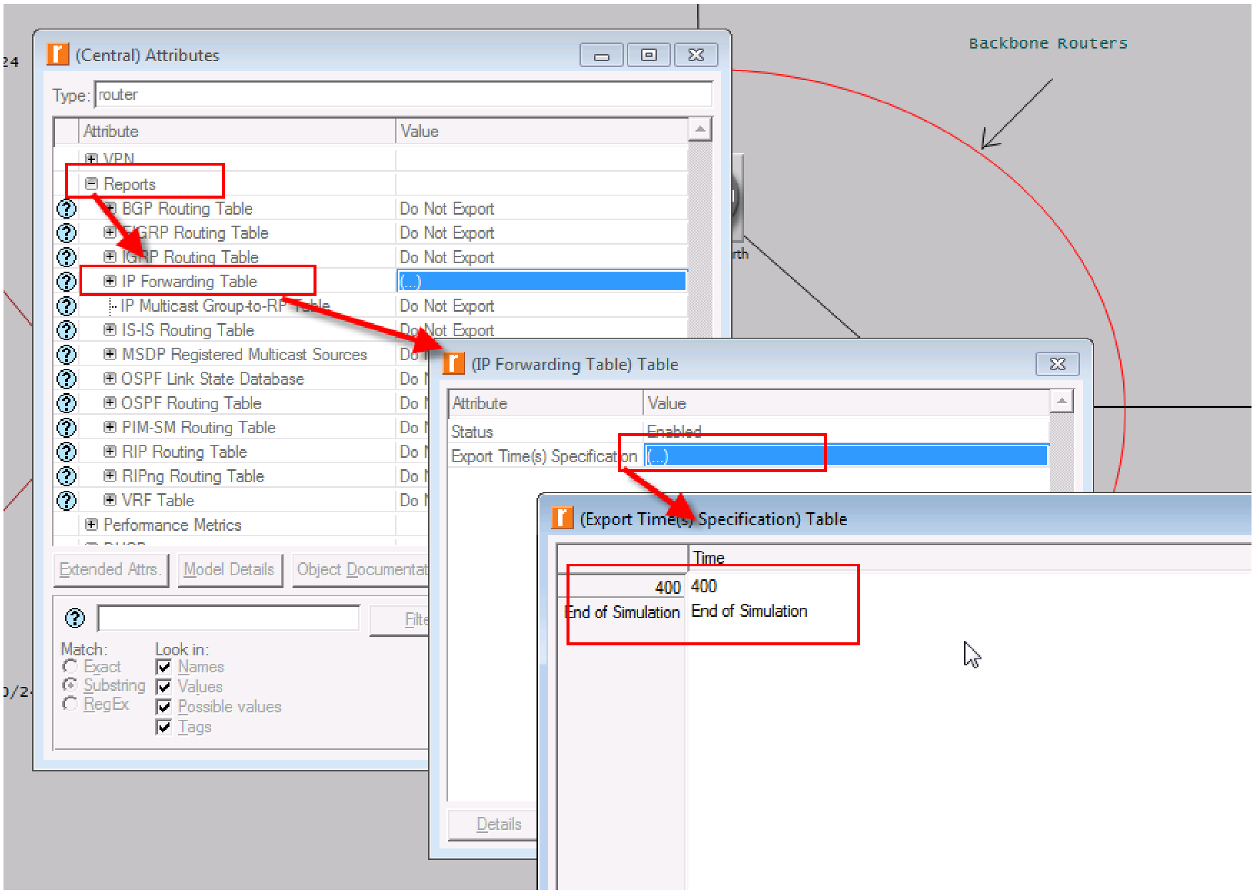
18. Run the simulation.
19. The auto-assigned IP interface addresses are exported to a text file (name of the file is <project-scenario-name>-ip_addresses.gdf and gets saved in the primary model directory.)

20. Notice that there doesn't seem to be anything wrong with the IP addressing, so let's move on to the next test.

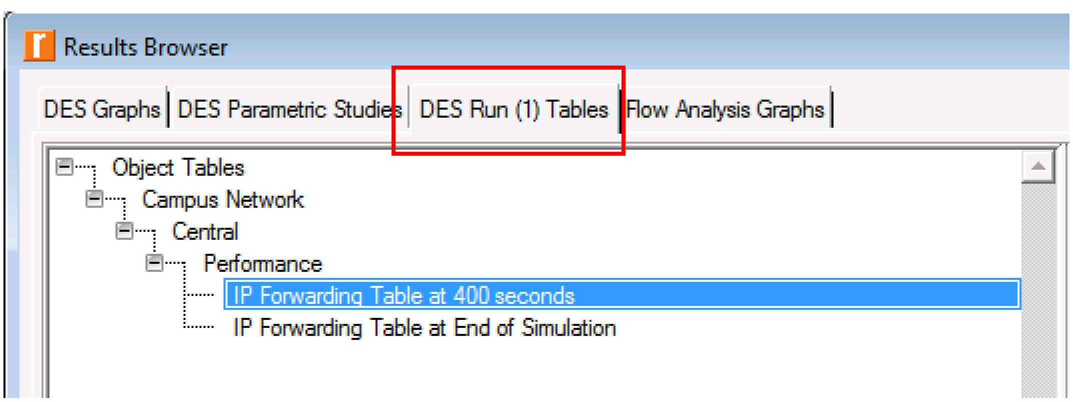
4. Exporting routing tables

Exporting routing tables generated during the simulation is one of the most important ways of troubleshooting routing issues. Let us focus on the routing table for the **Central** router.

21. To export this node's routing table, Right click on the **Central** router and select **Edit Attributes.**
22. Expand **Reports> IP Forwarding Table> Export Time(s) Specification.**
23. Add two columns into this table. Since traffic seems to be going through fine at first before the route is lost, let us print out the table before and after 500 seconds for comparison. Hence enter the first export time as *400 seconds* and the second as *End of Simulation.*
24. Click on **Okay** all through to save the attribute changes.
25. Now run the simulation again then open the results browser as described in steps 7-8 above.

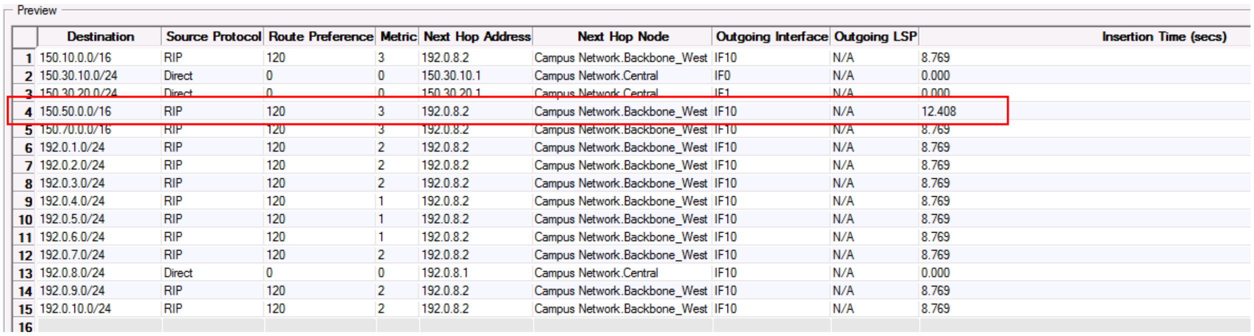


26. From the Results Browser, click on the **DES Run (1) Tables** tab. Then expand through the hierarchy to the IP Forwarding tables.



27. Study the table at 400 seconds compared to the one at the end of the simulation. Do you see any difference?

28. Notice that the earlier forwarding table has a route to 150.50.0.0/16 which is the network in which the FTP_Server belongs. The later forwarding table does not have a route to this network.



Preview

	Destination	Source Protocol	Route Preference	Metric	Next Hop Address	Next Hop Node	Outgoing Interface	Outgoing LSP	Insertion Time (secs)
1	150.10.0.0/16	RIP	120	3	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
2	150.30.10.0/24	Direct	0	0	150.30.10.1	Campus Network.Central	IF0	N/A	0.000
3	150.30.20.0/24	Direct	0	0	150.30.20.1	Campus Network.Central	IF1	N/A	0.000
4	150.50.0.0/16	RIP	120	3	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	12.408
5	150.70.0.0/16	RIP	120	3	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
6	192.0.1.0/24	RIP	120	2	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
7	192.0.2.0/24	RIP	120	2	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
8	192.0.3.0/24	RIP	120	2	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
9	192.0.4.0/24	RIP	120	1	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
10	192.0.5.0/24	RIP	120	1	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
11	192.0.6.0/24	RIP	120	1	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
12	192.0.7.0/24	RIP	120	2	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
13	192.0.8.0/24	Direct	0	0	192.0.8.1	Campus Network.Central	IF10	N/A	0.000
14	192.0.9.0/24	RIP	120	2	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
15	192.0.10.0/24	RIP	120	2	192.0.8.2	Campus Network.Backbone_West	IF10	N/A	8.769
16									

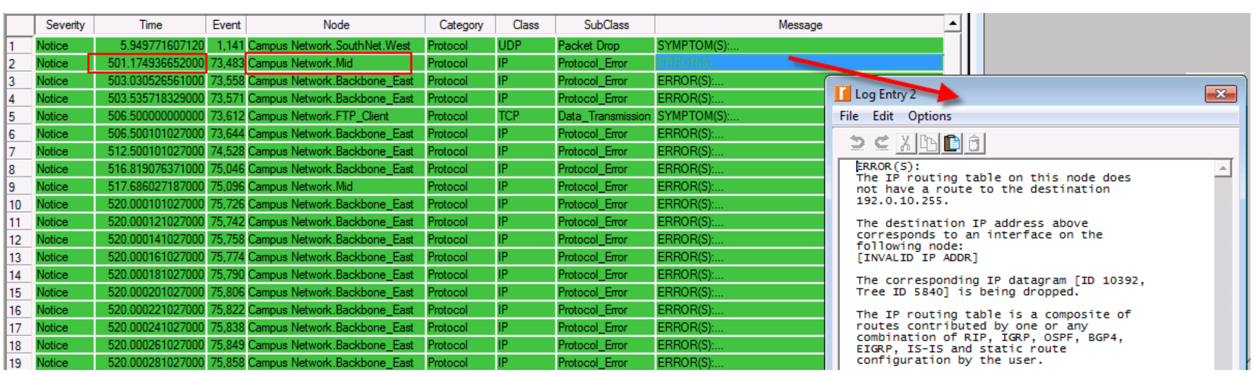
29. This proves that the problem with our FTP application is surely a routing issue.

30. You may export routing tables for different nodes and different protocals in the network in order to establish why the route is never shared to the **Central** router. For purposes of this tutorial, let us proceed to other alternative troubleshooting methods.

5. DES Log messages

These are messages contained in a log that include warnings, errors, and information pertaining to the simulation run. It is accessible from the **DES> Open DES Log** menu. This should always be among the first places to check for any hints on improper configurations.

Looking at the DES Log in our project, notice that there are numerous IP errors after 500 seconds. Read through some of the error messages, and try to understand the suggestions offered in the logs.

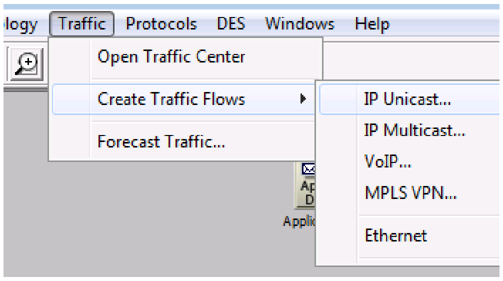


	Severity	Time	Event	Node	Category	Class	SubClass	Message
1	Notice	5.949771607120	1,141	Campus Network.SouthNet.West	Protocol	UDP	Packet Drop	SYMPTOM(S):...
2	Notice	501.174936652000	73,483	Campus Network.Mid	Protocol	IP	Protocol_Error	ERROR(S):...
3	Notice	503.030526561000	73,558	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
4	Notice	503.535718329000	73,571	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
5	Notice	506.500000000000	73,612	Campus Network.FTP_Client	Protocol	TCP	Data_Transmission	SYMPTOM(S):...
6	Notice	506.500101027000	73,644	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
7	Notice	512.500101027000	74,528	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
8	Notice	516.819076371000	75,046	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
9	Notice	517.686027187000	75,096	Campus Network.Mid	Protocol	IP	Protocol_Error	ERROR(S):...
10	Notice	520.000101027000	75,726	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
11	Notice	520.000121027000	75,742	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
12	Notice	520.000141027000	75,758	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
13	Notice	520.000161027000	75,774	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
14	Notice	520.000181027000	75,790	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
15	Notice	520.000201027000	75,806	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
16	Notice	520.000221027000	75,822	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
17	Notice	520.000241027000	75,838	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
18	Notice	520.000261027000	75,849	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...
19	Notice	520.000281027000	75,858	Campus Network.Backbone_East	Protocol	IP	Protocol_Error	ERROR(S):...

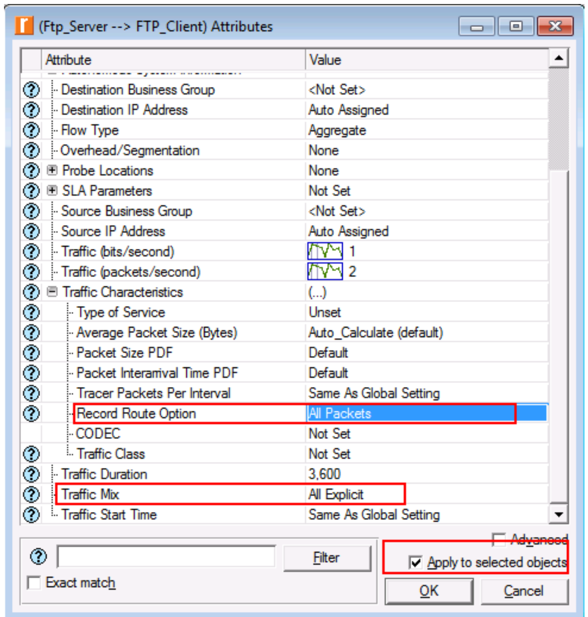
6. Using IP traffic flows

IP Traffic flow demands are used to model application in a network. Additionally, they can also be useful in recording route information by using their packets as tracer packets. To deploy IP Traffic flows, follow the steps below:

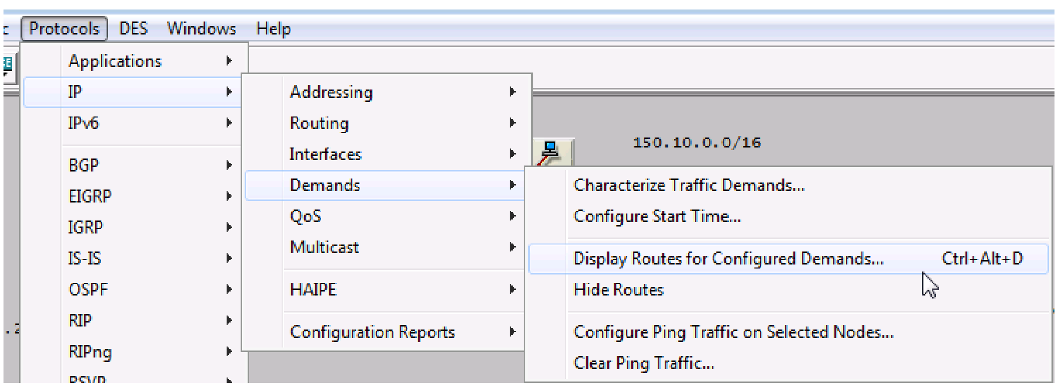
31. Hold the Control key and click on the FTP_Server and FTP_Client nodes so that they are both selected.
32. Go to **Traffic> Create Traffic Flows> IP Unicast…**



33. Reduce the **Packets/sec** to 1 and **Bits/sec** to 1200. This is very important to reduce unnecessary simulation load from this traffic. Read through the other settings in the wizard, and then click on **Create** then **Ok** to deploy the flows.
34. To display the demands, go to **View> Demands> Show All.**
35. Now right click on one demand and choose **Select Similar Demands.** This will select both unicast flows so that you can edit them at the same time.
36. Right click on the demand (with both selected now after step 35) and select **Edit Attributes.**
37. Change the **Traffic Mix** to **All Explicit.**
38. Expand **Traffic Characteristics** and set the **Record Route Option** attribute to **All Packets.**
39. Make sure the **Apply to all selected** check-box is set.
40. Your attributes should be the same as the ones below



41. Click on **OK** and **Yes** to save the settings. Run the simulation.
42. Now, view the demand routes from the **Protocols> IP> Demands> Display Routes for Configured Demands…**



43. Expand the route report as shown in the image below and display the route at any point before 500 seconds.
44. Notice that the flow made it successfully from the FTP_Client to the server.
45. Clear the route display by clicking on the **Clear all routes** button at the bottom left.
46. Now repeat the same for a flow after the 500 second mark. Notice that the flows could only make it to the **Backbone_East** router.
47. Hence, this could give you hint to investigate why Backbone_East is not able to pick up a route to the **Mid** router.

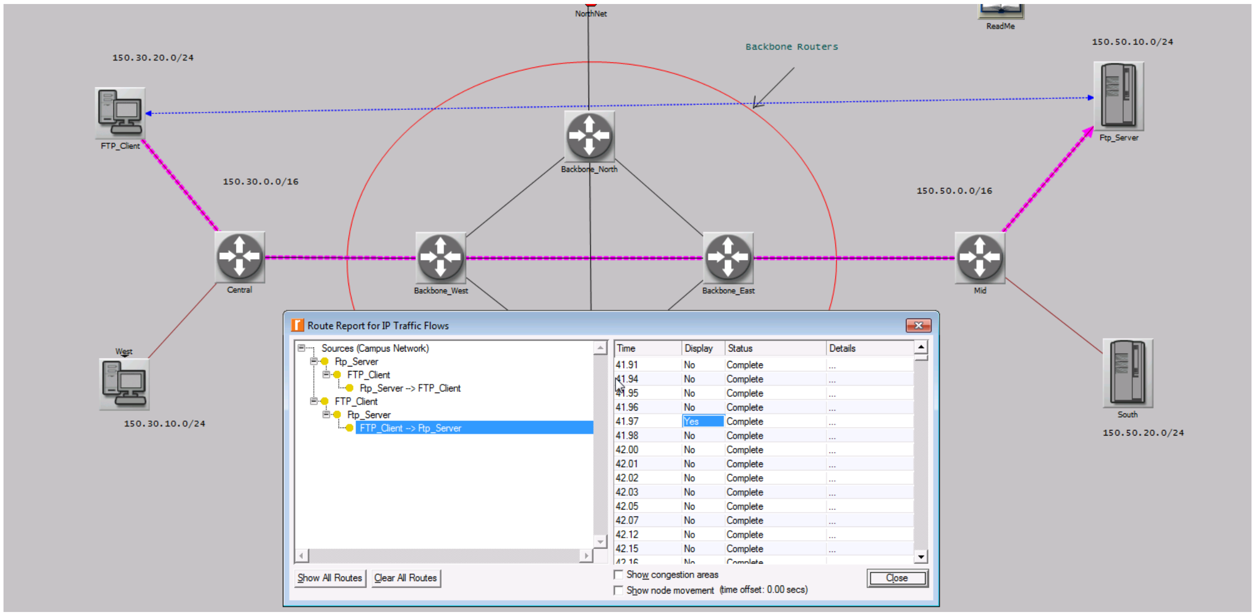


Figure: Demand Route at 40 seconds

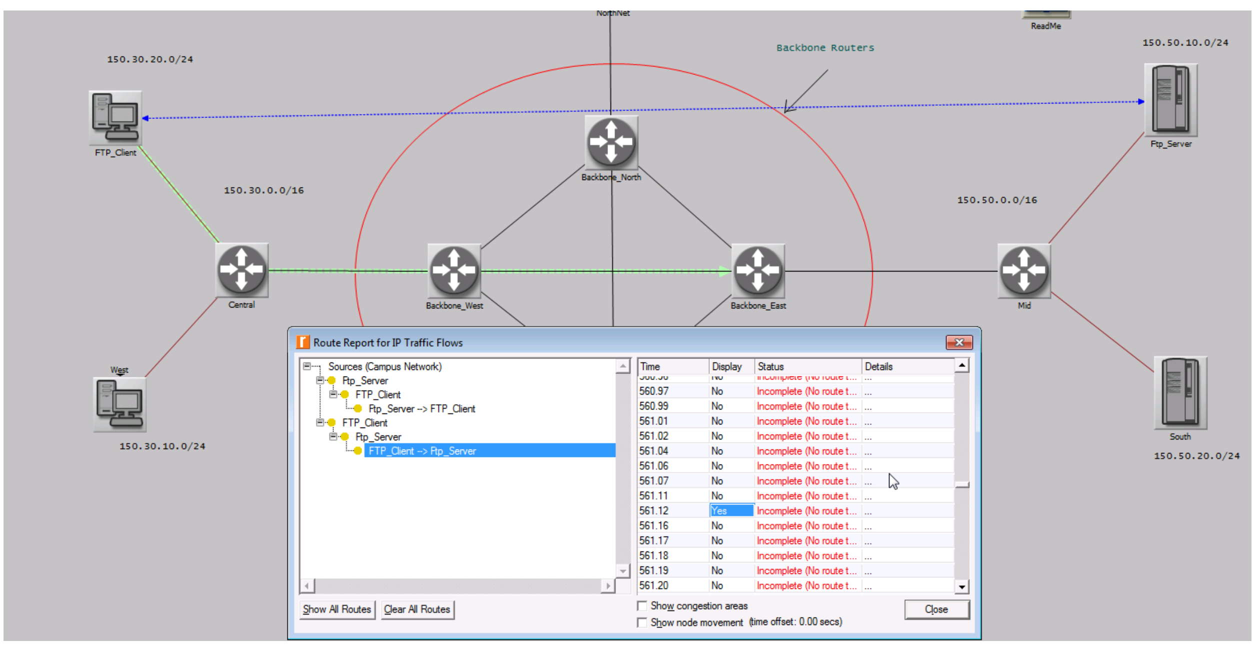
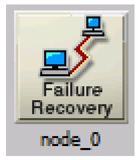


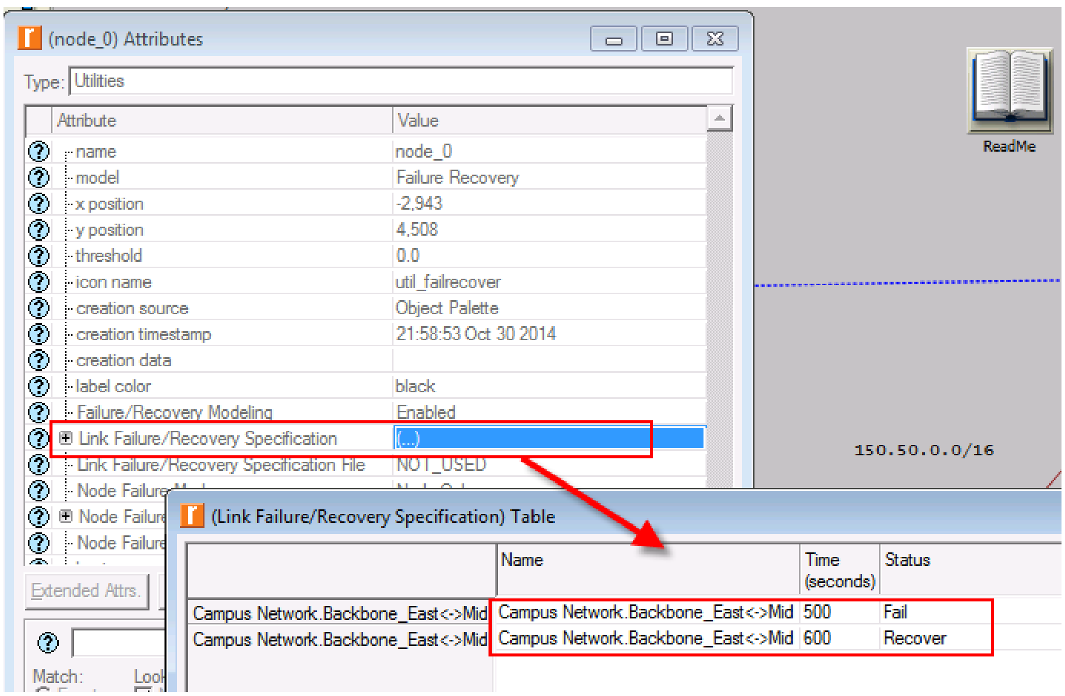
Figure: Demand route after 500 seconds

7. Failure/Recovery and Routing simulation efficiency

So far, we have determined that there is a problem with the topology between the Backbone_East and Mid routers. Also, this problem seems to start after 500 seconds. From this description, it is very likely that we are dealing with a link or node failure after 500 seconds. Hence, by inspecting the network more carefully, you will notice the presence of a failure/recovery utility.



Notice that this failure/recovery utility is in fact configured such that the link between Backbone_East and Mid routers will fail after 500 seconds and then recover at 600 seconds. It looks like we have found the answer to our mystery!

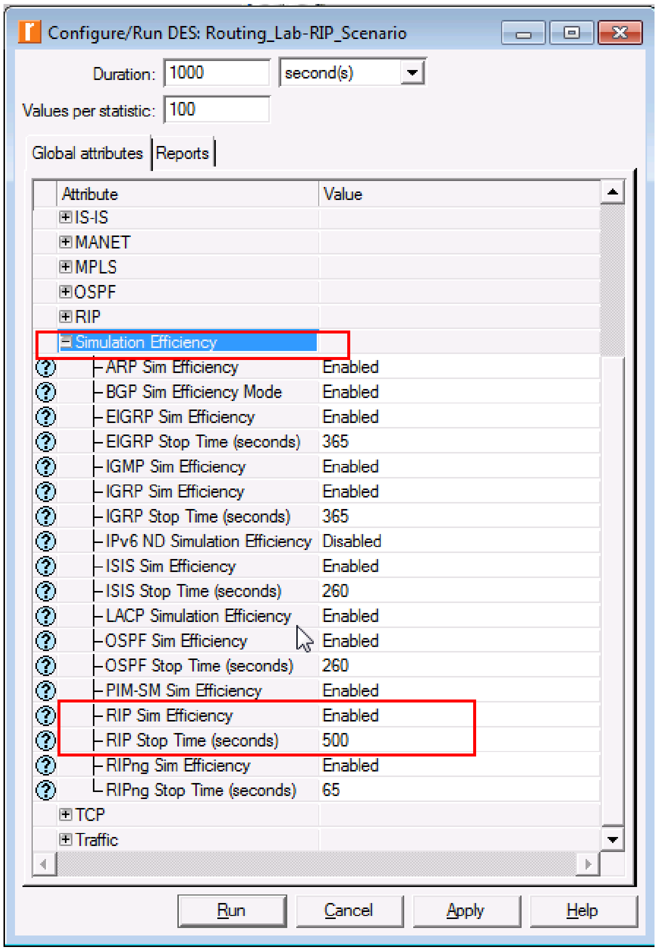


But then again, if the link is scheduled to recover after 600 seconds, how come FTP traffic never resumes after the link recovers (the application is set up such that new TCP connections are opened for each request – so a connection rest is not the cause).

Going back to exporting the routing tables, you will realize that the forwarding tables never get updated after 500 seconds regardless of these changes from the link failure and recovery. This usually implies that simulation efficiency has been enabled. Simulation efficiency settings are meant to save the cost from explicitly running all events during the simulation at the benefit of faster execution.

You may check and disable simulation efficiency settings from:

48. Open the Configure/Run Des window to set the simulation attributes (**DES> Configure/Run Discrete Event Simulation…**).
49. Under **Global Attributes**, expand **Simulation Efficiency** and set **RIP Sim Efficiency** to **Disabled.**



50. Run the simulation.
51. Now view the results and notice that FTP traffic is received successfully throughout the simulation, except for the duration between 500-600 seconds when the link is intentionally failed.

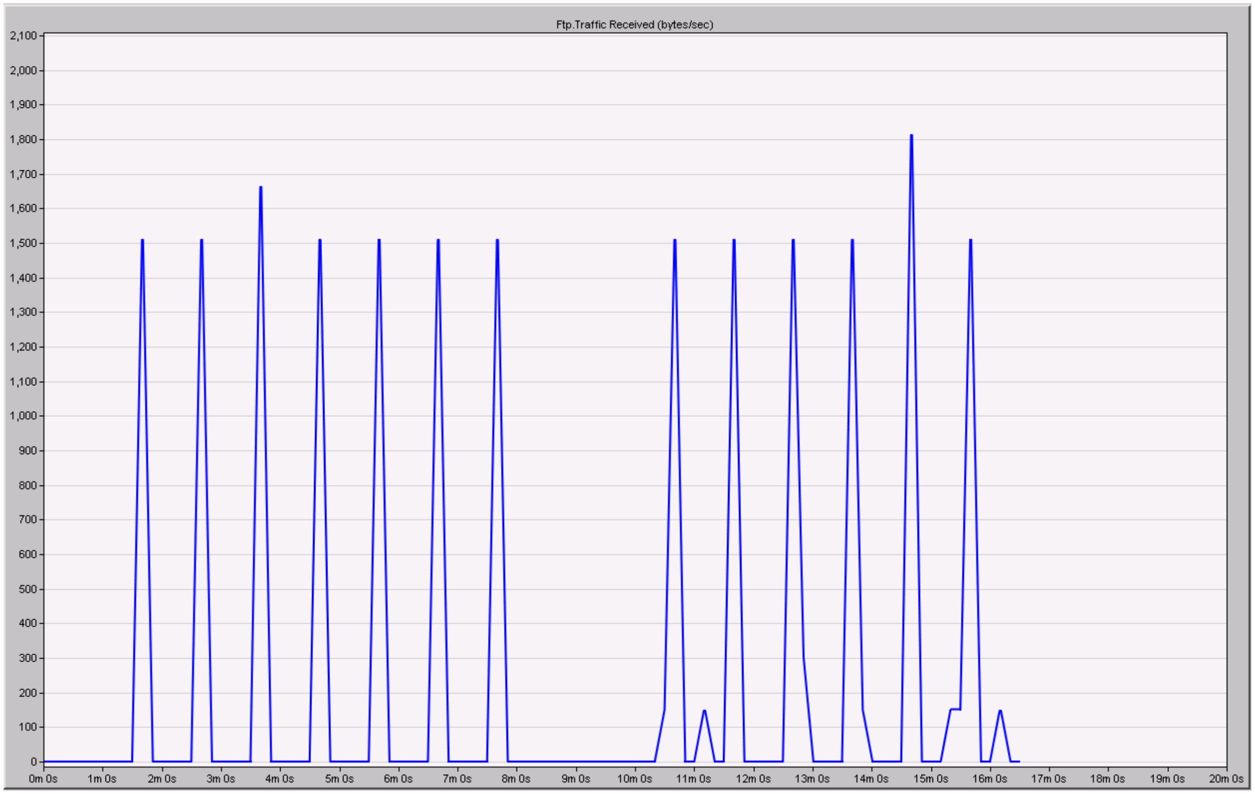


Figure: FTP Traffic received throughout the simulation (expect during link failure)

8. IP Auto-configuration menu options

The protocols menu option provides useful utilities for automatic configuration of different IP settings. For instance, routing protocols, redistribution, Multicast, Addressing, among many more things can be easily configured using these menu options.

Sometimes when troubleshooting, you can quickly check for addressing problems or even improper routing protocol settings by simply replacing the current configurations with automatic configurations.

These can be attained from the **Protocols> IP > Addressing…** and **Protocols> IP> Routing…** menu options. An example of where this might come in handy; a large network where a subnet mask is unknowingly entered as /16 instead of /24 leading to a lot of errors. A quick fix/check is to simply auto assign addresses to the devices (or a select set of interfaces), and observe if the issue gets resolved. This will then give you a good footing on where the problem could be.

9. Where can I get help?

The Modeler user community on splash has many users like you who encounter similar problems in their daily use of the software. You may post questions and suggestions to the community from the links below:

- University support Center on splash:

  https://splash.riverbed.com/community/product-lines/steelcentral/university-support-center/

- Modeler splash site:

  https://splash.riverbed.com/community/product-lines/steelcentral/modeler

- Other Riverbed Modeler Academic Edition tutorials:

  https://splash.riverbed.com/community/product-lines/steelcentral/university-support-center/academic-edition-tutorials