CHAPTER 5

# NMT Execute Commands

This chapter provides instructions for using the NMT modeling commands found in the Execute menu.

## Using the Route Command

Selecting **Route** from the **Execute** menu finds routes by using the same Automatic Routing Management and PNNI (Private Network-to-Network Interface) algorithms that are used in the switches. Only those links that have a Links table Keep field value of 1 or more are used in the topology. (The Keep field in the Links table tells the system which links must be part of the final topology, even if they have no traffic passing through them.) This selection performs two processes: it builds sites and routes connections.

## AutoRoute

When modeling an AutoRoute network, the following must be done in the CNF tables:

- Specify the type of AutoRoute algorithm used by each site in the Routing Algorithm (RA) field of the site table. Enter **H** for minimum hoops, **C** for least cost, or **CD** for least cost with delay.
- Enter **Y** in the AR field of the Link Table to enable **AutoRoute** on the links.
- Set the RT_Metrics field in the Bursty Connection table to **AutoRoute**.

**Note** The Model setting delay parameters can be adjusted if need be. (See Config/Model Settings.)

## AutoRoute Least Cost Routing

The Least Cost Routing feature introduces the concept of cost based routing into the interface. It was developed to prevent selection of a route which exceeds an acceptable cost.

Refer to Table 5-1 for information on Least Cost Routing.

*Table 5-1 Least Cost Routing Configuration*

| Topic | Required Settings | Comments |
|---|---|---|
| **Specifying a Least Cost Route** | **Sites table**<br>RA (Routing Algorithm) field: Enter C (least cost) or CD (least cost with delay as a cost) | Any site can have a least cost or least hops routing rule. |
| | **Links table**<br>Cost field: Enter a value between 1 and 50. | The weight of the trunk to be used in the routing algorithm. |
| | **Voice, Data, and Bursty Traffic tables**<br>Cost field: Enter a value between 1 and 100. | The maximum allowable cost of the route for this connection. |

# Preferred and Directed Routes

NMT allows you to provide any connection with a path through the network, called a preferred route. If the preferred route is available, NMT will follow it for that connection. If the preferred route is not available (common during Failure Analysis), NMT routes the connection any way it can. NMT also models a directed route - a special case of a preferred route in which a connection must take its preferred route, or not be routed at all.

To create a preferred route, enter a route in the Preferred_Route field in the Traffic tables. The route is a series of cross-connects (Xcon), separated by equal signs (=), i.e, Xcon1[=Xcon2]...[=XconN].

A cross-connect consists of an optional In-trunk PortID (slot/port identifier) followed by a forward slash (/), a mandatory Site Name, and an optional forward slash followed by an Out-trunk PortID. That is, you represent a cross-connect as: [In-trunkPortID/]SiteName[/Out-trunkPortID].

When you specify either of the PortID's in an Xcon, you specify a unique trunk. If NMT has a choice of trunks between two nodes, specify the one NMT should use. You do not have to specify each Xcon to the same level of detail; one may have no PortID, the next both PortID, etc.

For a connection from Denver to Paris, the following are all valid preferred routes.

```
Paris
3.1/Paris
Denver=Paris
Denver/4.1=Paris
Denver/4.1=3.1/Paris
Denver=Paris
4.1/Denver=Paris
4.1/Denver=4.1/Paris
4.1/Denver/3.1=4.1/Paris
Denver/3.1=4.1/Boston/3.1=4.1/Paris
```

**Note** NMT provides help entering preferred routes. When you press the Help key while in the preferred route field, NMT shows all the valid trunks between nodes. Select the one you want by pressing Return. When you press the Help key again, NMT shows all the valid trunks to other nodes. A suggestion: first, model your network without preferred routes. Then open the map. Now go back to configure your connections for preferred routes. You will be able to see which trunk to pick based on the map.

See Table 5-1 for more information on modeling preferred and directed routes.

*Table 5-2 Preferred and Directed Route Configuration*

| Topic | Required Settings | Comments |
|---|---|---|
| **Modeling Preferred or Directed Routes** | **Voice, Data, and Bursty Traffic tables**<br>DR field: Enter **Y** if the connection has the directed routing feature, and **N** otherwise. | If the Preferred_Route field is left blank or is invalid, this field is ignored. |
| | Preferred_Route field: Enter a series of node cross-connects, separated by equal signs (=). | All site names must be in the Site Table, and each consecutive pair of sites must have a trunk in the Link Table. The originating and terminating sites are optional. |

The NMT has an Actual Route field with the same format as Preferred Routes. CET Extractions fill in the Actual Route, which is the tree route of the connection at that time. The *Used Preferred Routes* option in Execute Settings determines which set of routes to use with the route command. Preferred routes are always used in failure analysis commands.

# PNNI Routing

When modeling a PNNI Network, the following must be done in the CNF tables:

- Enter **Y** in the PNNI field of the Site Table to enable PNNI at each site.
- If the PNNI network is a multi group, specify the peer group each site belongs to in the PNNI_PG field. For multi-level peer group networks, each peer group must be entered in the PNNI domains table, with its level and parent defined.
- If you want a specific site to be a peer group leader, enter **Y** in the PGL field for that site. If none are selected, NMT will select a leader for you.
- Enter **Y** in the PNNI field of the Link Table to enable PNNI on the links.
- Set the RT_Metrics field in the Bursty Connection table to one of the three types of PNNI routing algorithms. The choices are **AW** for administrative weight, **CTD** for Cell Transfer Delay, or **CDV** for Cell Delay Variance.

**Note** The Model setting PNNI parameters can be adjusted.

# Partitioned AutoRoute/PNNI Network

If the modeled network has AutoRoute and PNNI connections, use the steps in the "AutoRoute" and "PNNI Routing" sections above to configure each portion of the network. If any links are partitioned, the partitions are defined in the Interface table. The link Port IDs cross reference the interface table entries. If no partitions are specified, the NMT will optimize the partition based on the connection demand.

**Note** MPLS partitions can also be specified. However, the NMT model does not consider traffic on MPLS partitions.

# Fail Analysis Command

Selecting **Fail Analysis** from the **Execute** menu allows you to create a situation where one or more lines fail. You can also generate a situation where the lines are failed one at a time (see the **Simulate All** menu choice). By failing a line, you can force the NMT to create alternative routes; the NMT does this by using the Automatic Routing Management algorithm.

Using this algorithm, the NMT can reveal whether network links have enough extra bandwidth, according to values in the configuration, to support extra traffic if one or several links go down. To conduct a fail analysis, you must first select **Route** or **Optimize** from the **Execute** menu.

The **Fail Analysis** submenu has the following choices:

- **Fail**: Fails one or more connections in the network. A location can be a node, card, or port. Failing a port will fail the link using that port.

  **Note** In this case, the HELP key is useful guide. Enter HELP once to select the site. Enter Help a second time to select a port.

- **Alternate Route**—Attempts to reroute the connections after failing the network locations specified above. Its output results to the following tables in the **Display** menu: **Total Links Load**, **Routes**, and **No Routes**.
- **Results**—Displays reports that summarizes the alternative routes from the above reroute.
- **Generate**—Generate a file with the reports from above.
- **Simulate All**—Automatically fails each link, card, site, or port, and produces a report. When you select **Simulate All**, you are asked to enter a name for the report; the NMT fails each element one at a time, and you can display the report by selecting **View** from the **Report** menu.
- **View**—View any failure analysis report from a disk.
- **Option**s—Allows you to specify whether the system should ignore IMATM trunks or virtual trunks when performing a fail analysis.

If all connections do not reroute as a result of link failure or a set of link failures, add additional capacity to the links by increasing the size of existing links, the link count, or adding new links. You can use TPI and WANDL to help design a resilient topology.

# Build Sites Command

Selecting **Build Sites** from the **Execute** menu allows you to provision the sites without routing the connections. You have the option of building all sites or one specific site. If all links and connections are not provisioned, the command will display link and connection ends that could not be built.

# Optimize Command

The NMT provides several tools for optimizing network models that allow you to create a least-cost topology with selected links. When you select **Optimize** from the **Execute** menu, the NMT processes your configuration to design a least-facilities-cost network. The **Optimize** command eliminates unused links (links that are not used for routing traffic) from the topology. Although the unused links are eliminated from the topology, they remain in the links table for possible later use. The process works as follows:

1. The system calculates all possible topologies and selects the one in which all traffic is routed at the lowest possible cost. During this process, the Optimizing Topology message box displays a running tally of the number of topologies tried, the last two most recent costs, and the least cost so far If a connection fails, the router breaks the routing loop.

   Initial Topology is the starting point for building all other topologies that the optimizer can generate and analyze. It is generated from your specified data, including all sites, links that have positive values in the 'Keep' field and links specified in the preferred routes for the connections.

2. The connections are routed and the complete path is verified. During this process the Routing Connections message box displays the total number of network connections and maintains a running tally of the number of connections successfully routed.

3. The program generates several reports. These include informatory messages which describe the algorithm used to generate the resulting topology (initial, connection based, minimum span tree, or Link table).

**Note** If the optimizer fails to find a topology based on initial topology and the minimum span tree algorithm, it will build a topology based on the Link table. All links marked as removable will be removed by the optimizer; otherwise, they will be used for connections.

You can stop the optimize process by pressing **Escape**. If you press **Escape** during the first step when the system is calculating all the possible topologies, you are given the option to cancel all processes or continue with the second process using the best topology found so far.

If the NMT approach to optimization is insufficient, consider using the TPI to translate your network into WANDL format. WANDL offers several different optimization methods. (See Chapter 12, "Third-Party Interface.")

Optimize will write up an informatory message describing which algorithm it used to obtain optimal topology.

***Table 5-3 Optimize Informatory Messages***

| Message | Meaning |
|---|---|
| Initial Topology | Existing Facilities were sufficient to route all connections. No new links were added. |
| Connection Based | Actual/preferred route information was used to obtain starting topology. |
| Minimum Span Tree | Minimum span tree algorithm was used to generate an initial tree topology. |
| Link Based | Links were sorted. |

**Note** Optimize is not supported for PNNI Networks.

# NMT Command Results

Table 5-4 lists the possible reasons connections are not being routed over links with the **route** command.

***Table 5-4 Possible Causes for Connections not Routed Over Links***

| Cause | Solution |
|---|---|
| Link has a zero in the keep field. This indicates the link is a candidate for the optimize command to add to the network, but it does not exist in the network and will not be considered by the route command. | Set the keep field to one or higher. |
| Link is not enabled for the routing protocol required by the connection, in either AutoRoute or PNNI. | Set the PNNI or AR flag to Y in the link table. To check what protocol the connection requires, check the RT_Metrics field in the connection table. |
| For AutoRoute Least Cost Routing or PNNI, the Cost field in the Connection table has too low a maximum value for a route to be found with that cost or lower. | Raise the value in the cost field of the connection table, or set it to zero to remove the restriction. |
| Link is constrained by either the Receive Rate field, or the VT_Rate field if the link is a Virtual Trunk. | Raise the values in these fields, or set them to 0 to remove the restriction. |
| With AutoRoute, the stat reserve is excluding too much bandwidth | Reduce the stat reserve fields. |
| Link is unavailable for this type of connection because of a restricted media (Satellite, for example) or the trunk has not been configured for a specific type of traffic | For AutoRoute, check the Ad field in the Connection Table to see if that connection must avoid any link media types. Set this field to blank for no restrictions. Check the Traffic field in the Link Table to see what traffic types can travel on that link. If it is blank, all types are allowed. |

The following tables describe how to troubleshoot problems with Execute commands.

| | |
|---|---|
| **Symptom** | IGX Links are using more bandwidth than expected for voice and data calls. |
| **Probable Causes** | Voice and Data (TS and NTS) connections on the IGX are translated into fast packets. When these 24 byte packets with 20 bytes of payload are inserted into cells, the packet header is not removed, and either one or two packets are inserted into the cell. The static administration load assumes either one or two packets, based on the combine time-out value for the particular type of connection. |
| **Solution** | Combine time-outs are network global parameters that can be configured under Configure/Model Settings menu. The parameters are specified in the units of 0.125 usec.<br>Set the combine time outs to the largest value possible to optimize bandwidth usage in the model. |

| | |
|---|---|
| **Symptom** | Changing the Least Cost Weights does not effect the routes of the connections. |
| **Probable Causes** | CNF file may have preferred routes, or (if it was a CET extraction) it may have actual routes. These route fields are checked first. If there is a route in that field, the model will use it before running AutoRoute. |
| **Solution** | Remove the actual route, or the preferred route. This can be done using F6 in that field for each connection. Or you can remove all routes in the CONFIG/UTILITIES/CLEAR DATA menu.<br>Also check the setting of Use Preferred Routes in the EXECUTE/SET menu. If this flag is **Y**, preferred routes will try to be used first. If it is set to **N**, then actual routes will be used first. |

| | |
|---|---|
| **Symptom** | Links have an unbalanced load when routed with AutoRoute. |
| **Probable Causes** | The site table has a bundle field that routes a specified number of connections at the same time in a bundle. the default number of connections per bundle is 24. |
| **Solution** | Set the bundle field in the site table to 1. |