

Promina Models User's Guide

7.0

Contract DASW01 03 D 0008



Disclaimer: As of October 2007, NETWARS was redesignated by the Program Manager Office as the Joint Communications Simulation System (JCSS). JCSS was selected as the new industry name to better reflect the inherent joint communication capabilities of the software. Users should be aware that no software updates were conducted as part of the software name change.

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1 Overview

This document describes key features, attributes, usage, and statistics of the Promina device models shipped as part of the NETWARS model. Promina is a family of devices that provides circuit-based layer-2 connectivity between the other devices connected to Promina nodes. Multiple technologies can connect to the Promina network through the LAN ports (“Ports” in Promina nomenclature) of the Promina devices and be transferred over that network via logical links connecting the WAN ports (“Trunks”) of the Promina devices.

1.1 Intended Use

This document is intended for NETWARS users who have a reasonable level of knowledge about Promina family of devices and their use in Tactical network. This document is written to help the engineer learn about configuration of Promina devices in NETWARS and the types of interfaces, attributes, and statistics available in both the Discrete Event Simulation and Capacity Planning use cases.

1.2 Feature Summary

This section provides a list of the main features available in the Promina model.

Table 1: Promina Features

Feature	Description	Support
LAN ports		Serial and Ethernet ports are supported
WAN ports		Serial (T1, E1, ...) trunks and ATM (SCLX) trunks are supported
Node Parameters		
Domain ID	This number is assigned to a node to indicate that the node is part of a particular domain	Supported
Node ID	Unique integer identifier for each node in a domain	Supported
Gateway Node	A node that is part of two domains	Not supported
Transit Domain	A call can only pass-through at most one domain, called the transit domain, to reach its destination.	Not Supported (No domain limits on Inter-domain calls)
Backplane Bandwidth	Total bits per second supported by the Promina device	Supported
Max. Calls on Node	Maximum number of calls that can pass through, originate, or terminate on the node.	Supported
Max Call Setup Retries	Number of attempts that are made to initiate a call when alternate routing is desired.	Supported
Max. Hops Per Call	Maximum number of nodes through which a call originating on this node can go to reach its destination.	Supported
Max Satellite Hops	Number of satellites through which a call can go to reach its destination	Supported
Max Hops Per	Maximum number of hops that can exist between	Not Supported

Interdomain Call	the two ends of an interdomain call	
Sync retry Time	This parameter specifies how often the software will attempt to reconnect a permanent data call when the connection attempt fails or the call is disconnected (due to a failure).	Supported
Reconnect Timeout	This parameter specifies the time within which calls must be reconnected in the event of a failure.	Supported
Preempt Control	This parameter specifies the number of hops that are added to the least-hop path so that the call can be placed without preempting other calls.	Supported
LAN Port (Port) Parameters		
Port Types		Generic Serial and Ethernet LAN ports to model HSD-2 and LWX modules
Orig/Ans Mode	This parameter allows you to specify whether the subrate port can originate and answer calls, answer calls only, or originate calls only.	Not Supported
Destination Port	The port ID of the destination port	Supported
Call Type	Demand or Permanent	Supported (Permanent, Demand)
Call Priority	The order in which a call originating from this port is reconnected when the port is interrupted for any reason.	Supported
Preempt Priority	When there is not enough bandwidth to complete a call. The pre-empt priority value assigned to the call is compared to the call priority value assigned to other calls on the link to determine which calls should be pre-empted.	Supported
Secondary Call Priority	Used when the optimal path is not available	Not Supported
Secondary Preempt Priority	Used when the optimal path is not available	Not Supported
Port Speed		Supported
Ter routing	Controls whether the call is required, preferred, preferred not, or don't care to use each particular type of route	Supported
Enc routing		Supported
Fib routing		Supported
ATM routing		Supported
SCLX routing		Supported
Selected Path	This parameter overrides the system and allows to specify the path the call takes through the network.	Supported
Data Flow Direction	Controls the direction (two way, one way) of the call	Supported
Time of Day Restriction	The time-of-day restriction specifies a start and end time for the port.	Supported (in the form of Start-Time and Stop-time during the simulation)
Other Not Supported Features		Call Orig Signal, DTE/DCE, RTS/CTS, Data Format, Encoding Format
WAN Port (Trunk) Parameters		
Trunk Types		Generic Serial WAN interface to model SA-TRK trunk module. ATM WAN interface to model

		SCLX module.
Neighbor Node	A Promina node that is connected to a WAN port on this node	Automatically detected by each WAN port
Sat/Terr	Routing attributes that will be used with routing options under port parameters	Supported
Encryption		Supported
Fiber Option		Supported
Logical Slots	The selection for logical slots determines how much TBus bandwidth is allocated to trunk module	Supported
Transmit Trunk Rate		Supported
Receive Trunk Rate		Supported
SCLP Rate	The bandwidth set aside for SCLP signaling	Not Supported
Other Unsupported Features		Redundant Card, Alarm Features, BER Report, Clk Ref

1.3 Feature Description

Every Promina node is defined by both the types and the number of ports that it has on the LAN and WAN sides. A Promina network is defined by a number of Promina devices that are connected together through logical links between their WAN ports. External devices with different technologies (TDM, Analog Voice, Digital Voice, etc.) connect to Promina devices through the LAN ports and each signal will be delivered in its original format on a LAN port of another Promina device after transiting the Promina network encoded in Promina-specific packet/bit streams. The configurable parameters of a Promina device can then be divided into three main groups namely, LAN Port Properties, WAN Port Properties, and Node-level properties shared by all ports.

Many different technologies can connect to the Promina devices using various types of port interface cards (Circuit or LAN ports). The current Promina device models in NETWARS support two types of generic Circuit (LAN) ports namely Serial Circuit ports (to model T1, E1, E3, HSD-x port cards) and Ethernet Circuit ports (to model LWX ports). The two port types only differ in their interface type otherwise they share the same set of configurable attributes in terms of call configuration parameters. On the Trunk (WAN) side, the model supports Serial Trunk ports as well ATM Trunk ports to model SRA-TK trunk cards and SCLX/CX trunk cards respectively. Different Promina nodes models are then characterized by the number of Circuit (LAN) and Trunk (WAN) ports of each type that they support.

1.4 Limitations/Assumptions

Due to the proprietary nature of the protocols used in real Promina devices on the Trunk (WAN) links, the Promina model uses a generic segmentation/encapsulation method to carry the packet coming from the Circuit (LAN) ports over the Promina network. As in all other NETWARS models, the communications is strictly packet-based and the line signaling and clocking features are not modeled.

1.5 Model List

The standard NETWARS model library contains a number of node models representing various models of Promina devices. Those models can be located under the “Node Models” Directory of the “NETWARS Standard Model” palette and include the following models.

The model names are shown with the number of ports available for each port type.

Table 2: Promina Models

Model Name	LAN Ports		WAN Ports		
	Serial	Ethernet	Serial	CX	SCLX
Promina	20		5		
Promina-100	128		10		
Promina-200	200		20		
Promina-400	400		25		
Promina-800	600		25		
Promina_10l_5w_2eth_2sclx_2cx	10	2	5	2	2
Promina400_e180_sl180	180	180	25		
IDNX-20	200		20		
IDNX-90	400		25		

You can also create custom models with arbitrary number of ports of each type using the Device Creator utility explained later in this document.

1.6 Reference Documents

- “Node Management”, N.E.T. Promina 800 series manuals.
- “Promina 800 Installation and Maintenance”, N.E.T. Promina 800 series manuals.
- “Trunk Modules”, N.E.T. Promina 800 series manuals.
- “Data Modules”, N.E.T. Promina 800 series manuals.

1.7 Additional Information

For any additional information not provided in this document, consult the NETWARS Model Development Guide (MDG) or other NETWARS documentation. Information provided in the Model Development Guide includes interfacing with NETWARS models, using NETWARS traffic types, expected packet formats and interrupts, and suggested model development processes. This documentation is provided inside a standard NETWARS installation and can be found in the <NETWARS Installation Directory>\Documents directory (where <NETWARS Installation Directory> is the directory where NETWARS is installed).

Also, for any questions regarding OPNET specific functionality, consult the standard OPNET documentation. This documentation can be accessed inside NETWARS via the **Help > Documentation > ITGuru Documentation** menu.

Finally, Promina files can be located under the **<NETWARS Installation Directory>\Sim_Domain\op_models\netwars_std_models\circuits\promina** directory. These models and files can be accessed and modified using the OPNET Modeler software.

2 Configuration

One of the advantages of NETWARS is that it provides a great amount of flexibility when configuring network and device models. As Promina contains a large amount of functionality, several steps are needed when configuring this device.

2.1 Node Configuration

Currently, there are several types of Promina devices available inside the NETWARS palette. To find the available Promina models, open the object palette (**Topology > Open Object Palette**) and find the “NETWARS_Multiplexers” palette (shown below).

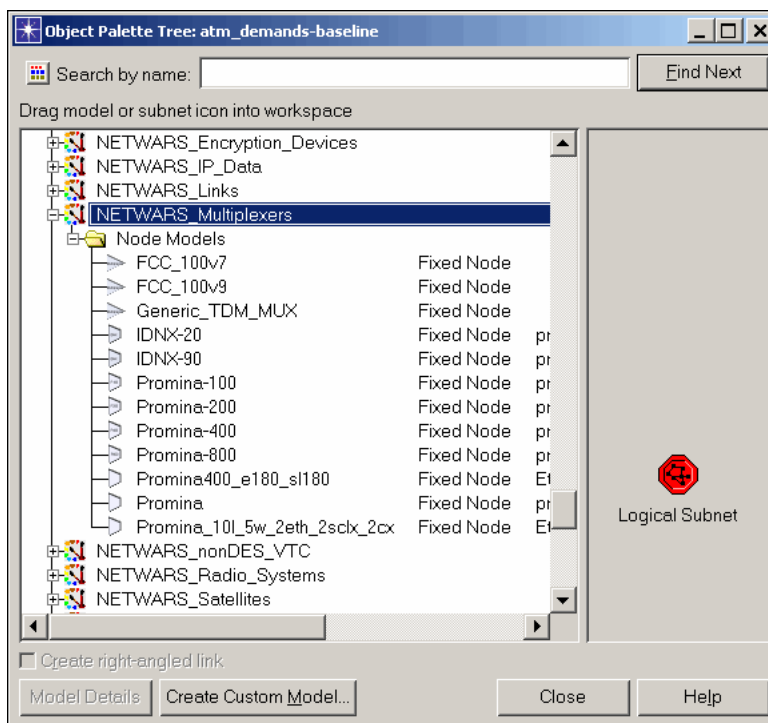


Figure 1: Promina Node Attributes

Once the particular Promina model is found, you can drag and drop the model into the scenario to successfully deploy the model. Once the model is deployed, attributes are available on the device which can be modified to activate certain Promina functionality. The following subsections discuss these Promina device attributes.

2.1.1 Promina Node Attributes

The Promina node attributes are all of the attributes which can be accessed by right-clicking on a particular Promina device and selecting the **Edit Attributes** menu. The following table describes the node attributes in detail. Any compound node attributes are left for subsequent tables as compound attributes contain another layer of attributes.

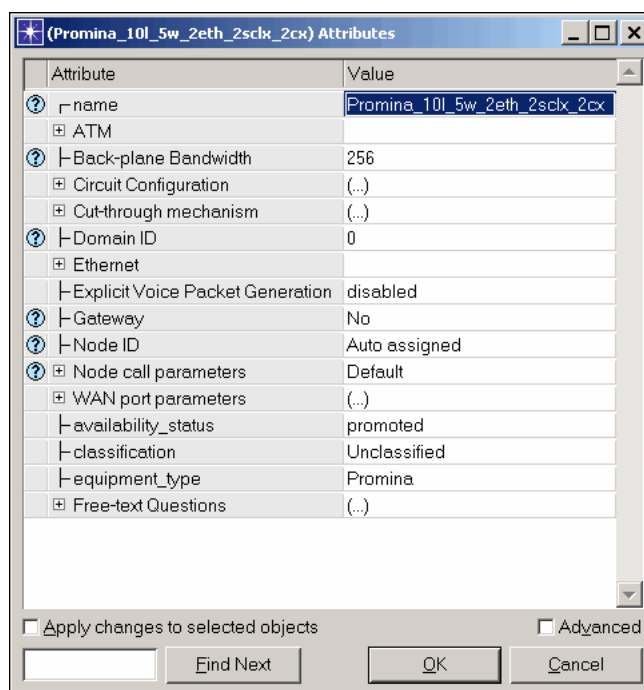


Figure 2: Promina Node Attributes

Table 3: Promina Node Attributes

Attributes	Description
Back-plane Bandwidth	The back-plane attribute allows you to define a maximum bandwidth for the ports on the particular Promina device (for Circuit/LAN and Trunk/WAN ports). This attribute is measured in Kbps. For example, if the attribute was set to 256 Kbps then no port on this Promina device could contain a Promina circuit (or data rate) higher than 256 Kbps (even though a higher speed could be defined for the circuit).
Cut-through Mechanism	This attribute allows you to modify (on a per port basis) whether this device will act as a store-and-forward node or as a cut-through device (i.e., circuit based). If the cut-through mechanism is enabled for a particular port, the transmission delay will not be calculated for this hop (i.e., it is zero) and the packet will immediately be forwarded to the next hop. If the cut-through mechanism is disabled, the packet will incur the normal transmission delays on this hop.

Domain ID	The domain ID refers to a network of Promina nodes. Each domain can contain up to 250 Promina nodes. Each domain has a single ID number (i.e., 1, 2, 3, ...) which is assigned by the user.
Explicit Voice Packet Generation	This attribute specifies whether this Promina device will load the particular network with voice data packets to represent the voice data. If the attribute is enabled, voice packets will be created and sent out at 1 packet per second to model the particular bandwidth (used for detailed studies). If the attribute is disabled, certain statistics will be updated analytically and no packets will be sent (less detail).
Gateway	This attribute specifies whether this Promina device acts as a gateway between the different Promina domains. If the attribute is set to "Yes" then this Promina will act as a gateway. If the attribute is "No" then this Promina will not act as a gateway. This attribute has no effect on a simulation.
Node ID	The node ID refers to this Promina's ID within a particular domain. Each node has a single ID number (i.e., 1, 2, 3, ...) which is assigned by the user. If the attribute is set to "Auto Assigned" then a number will be chosen dynamically during the simulation.
Availability Status	A NETWARS standard attribute, denotes whether the node is available to receive IER traffic during a simulation.
Classification	A NETWARS standard attribute, sets the classification level (i.e., Unclassified, Classified, etc.) of this particular Promina.
Equipment Type	A NETWARS standard attribute, sets the device type for NETWARS specific functionality. This attribute should always be set to "Promina."

2.1.2 Node Call Parameters

Promina devices look at circuits as “calls” between devices. The attributes specified by this compound attribute (located in the Promina node attributes) modify how the Promina device behaves to specified calls (i.e., circuits).

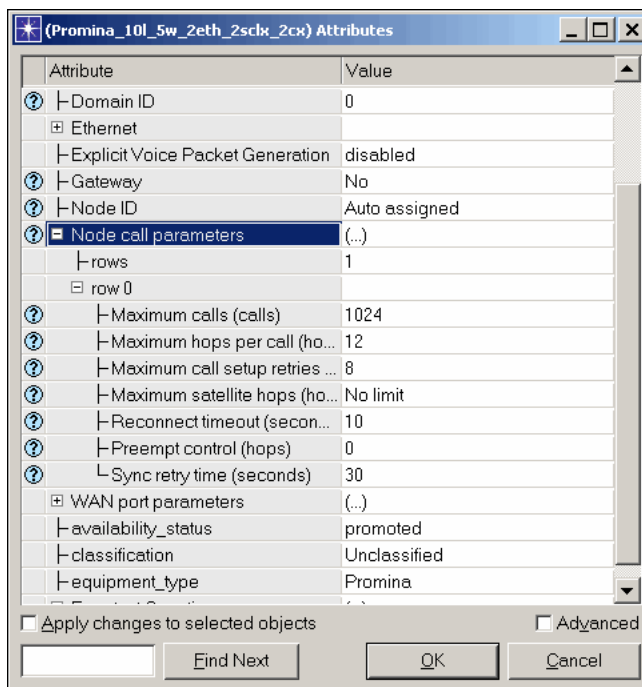


Figure 3: Node Call Parameters Table

Table 4: Node Call Parameter Attributes

Attribute	Description
Maximum Calls (calls)	This attribute specifies the maximum number of calls that can pass through, originate or terminate on this Promina device. The highest number of calls allowed is 4000 calls.
Maximum hops per call (hops)	This attribute specifies the maximum number of nodes a call (which has originated on this Promina) can traverse to reach its destination. This highest number of hops allowed is 12 hops.
Maximum call setup retries (tries)	This attribute specifies the maximum number of attempts made to initiate a call (which has originated on this Promina). This is used when alternate routing is desired. The highest number of retries allowed is 8 retries.
Maximum satellite hops (hops)	This attribute specifies the maximum number of satellite nodes a call (which has originated on this Promina) can traverse to reach its destination. If the attribute is set to “No Limit” then an infinite number of satellite hops are allowed.
Reconnect timeout (seconds)	This attribute specifies the amount of time which a call must be reconnected by in the event of a failure. This value can range from 1 to 60 seconds.

Preempt control (hops)	This attribute specifies the number of hops which can be added to the least-hop path so that the call can be placed without preempting other calls. This value can range from 0 to 11 hops.
Sync retry time (seconds)	This attribute specifies how often the Promina will attempt to reconnect a permanent data call when the connection attempt fails or the call is disconnected (due to a failure). The value can range from 10 to 255 seconds.

2.1.3 Circuit Configuration Parameters

Promina devices have two types of ports: Circuit (LAN-side) and Trunk (WAN-side). The attributes specified by this compound attribute (located in the Promina node attributes) modify how the Circuit (LAN) ports on the Promina device behave. Each row (or Source Port) in this compound attribute corresponds to the Circuit (LAN) port with the same number. For example, Port ID #2 would correspond to the Source Port “l_pt_2.” Both of these values would be pointing to the Circuit (LAN) Port #2 or “l_pt_2” in the node model. It is important to note that most of the attributes inside the “Circuit Configuration” compound attribute can be set through the Generic Circuit Wizard (see the “Promina (LAN) Circuit Configuration” section for more details).

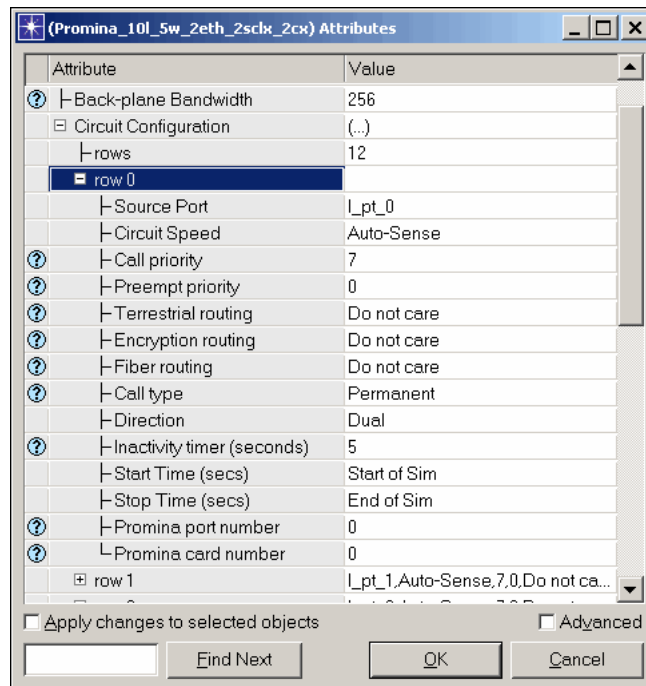


Figure 4: Circuit Configuration Parameters Table

Table 5: Circuit Configuration Parameter Attributes

Attribute	Description
Source Port	This attribute specifies the Circuit (LAN) port for this set of attributes. The string inside this attribute matches the name of the port inside the node model. This attribute is locked (non-editable) and drives much of the DES, Capacity Planner, etc. functionality for the Promina device.
Circuit Speed	This attribute specifies the maximum port speed for this port (circuit) in Kbps. If the attribute is set to "Auto-Sense" then the data rate of the link attached to this port will be used.
Call Priority	If multiple calls from the node have failed, the priority of call determines which calls get reconnected first. This attribute specifies the priority of any calls which are traversing this port. The range of values for this attribute is 0 to 15.
Preempt Priority	If there is not enough bandwidth available for a particular call, another call can be preempt or bumped based on the call priority. This attribute specifies the preempt priority for calls traversing this port. The possible range of values for this attribute is 0 to 15.
Terrestrial Routing	These attributes specify whether the calls which traverse this port are only specified for Satellite, Encryption, or Fiber routes. If the value is set to "Required" then a particular call must take this specified medium. If the value is set to "Do not care" then the call can be routed over this medium.
Encryption Routing	
Fiber Routing	
Call Type	This attribute specifies the call type during a simulation. A "Permanent" call will be set up at the beginning of simulation and is never torn down. A "Demand" circuit will be setup whenever demanded by the end devices connected. Also, a "Demand" circuit will be torn down if inactive for a period of time.
Direction	This attribute specifies the direction of the circuit. If the value is set to "Dual" the circuit is bi-directional. If the value is set to "1->2" then traffic can only flow from this device to the destination device. If the value is set to "2->1" then traffic can only flow from the destination device to this device.
Inactivity Timer (seconds)	This attribute specifies the amount of time (in seconds) where a "Demand" circuit will be torn down if inactive. Inactive means no packet exchange has occurred in the time specified by this attribute.
Start Time (secs)	This attribute specifies when (in seconds) this particular port is available or active. If the attribute is set to "Start of Sim" then the port will be active at the beginning of the simulation.
Stop Time (secs)	This attribute specifies when (in seconds) this particular port is no longer available or inactive. If the attribute is set to "End of Sim" then the port will be active from the specified start time to the end of the simulation.
Promina Port Number	This attribute holds the port number of the port in the real Promina device. This attribute number along with the "Promina Card Number" specifies a unique port on the Promina device. This attribute has no effect on the simulation.
Promina Card Number	This attribute holds the card number of the port in the real Promina device. This attribute number along with the "Promina Port Number" specifies a unique port on the Promina device. This attribute has no effect on the simulation.

2.1.4 WAN Port Parameters

Promina devices have two types of ports: Circuit (LAN-side) and Trunk (WAN-side). The attributes specified by this compound attribute (located in the Promina node attributes) modify how the WAN ports on the Promina device behave. Each row (or Port ID) in this compound attribute corresponds to the WAN port with the same number. For example, Port ID #2 would correspond to WAN port 2 (i.e., “w_pt_2”).

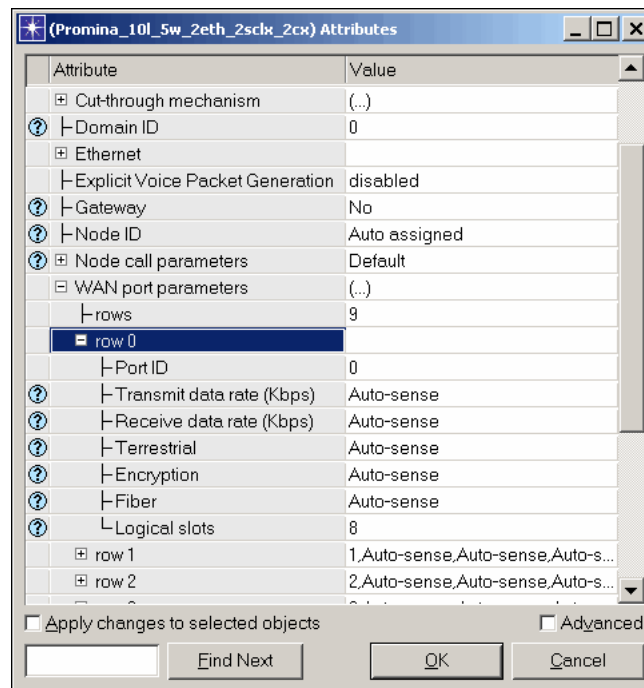


Figure 5: WAN Port Parameters Table

Table 6: WAN Port Parameter Attributes

Attribute	Description
Transmit Data Rate (Kbps)	This attribute specifies the transmission data rate (in Kbps) on this particular port. If the attribute is specified as “Auto-sense” then the node will automatically detect the transmission data rate during simulation.
Receive Data Rate (Kbps)	This attribute specifies the receiving data rate (in Kbps) on this particular port. If the attribute is specified as “Auto-sense” then the node will automatically detect the receiving data rate during simulation.
Terrestrial	These attributes specify whether Satellite, Encryption, or Fiber devices are located on this WAN port. The values for these attributes must match at both ends of the trunk (i.e., circuit). If the attribute is specified as “Auto-sense” then the node will automatically detect the network configuration during simulation.
Encryption	
Fiber	
Logical Slots	This attribute indicates how much of the back-plane bus bandwidth is allocated to the trunk module. Each logical slot takes up 2.048 Mbps of bandwidth. The possible values for the Promina 800 series are 1, 2, 4, and 8. For the Promina 200 and 400 series, the possible values are 1, 2, and 4.

2.1.5 ATM Parameters (CellXpress and SCLX Port Types)

Promina devices have ATM ports (CellXpress and SCLX ports) which allow the Promina to connect to an ATM network. The attributes specified by this compound attribute (located in the Promina node attributes) modify how the ATM ports on the Promina device behave. Each row in this compound attribute corresponds to the ATM port with the same number. For example, ATM Parameters (IF_1_5 P0) would contain attribute values which correspond to SCLX port 5 (i.e., “sclx_pt_5”). The ATM Parameters (IF_7 P0) would contain attribute values which correspond to CX port 7 (i.e., cx_pt_7”). These attributes reflect the standard attributes set inside the ATM layer of the OPNET COTS models. Refer to standard OPNET IT Guru manual for a description of these attributes.

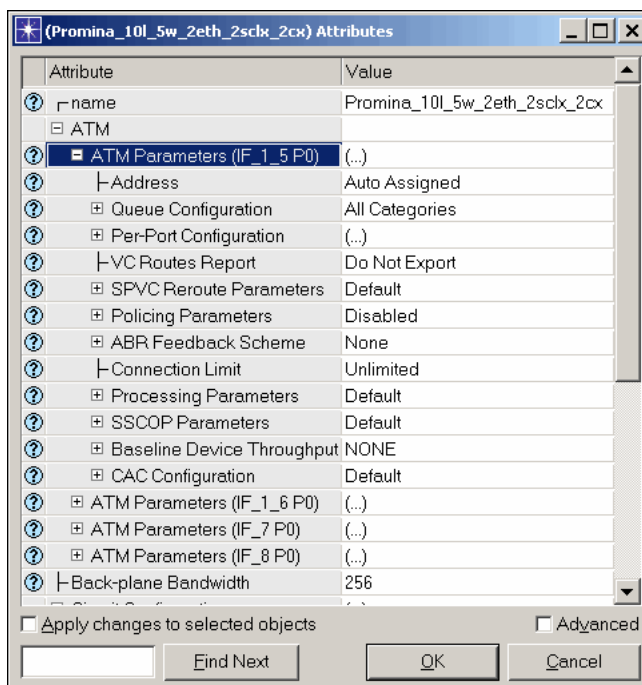


Figure 6: ATM Parameters Table

2.2 Link Configuration

As Promina can connect to several types of technologies, it also can also accept many different types of links. The link possibilities depend on whether you are trying to connect a device to the LAN-side or WAN-side of the Promina device. Currently, there are two ways to deploy links inside NETWARS:

1. Link Deployment Wizard (**Topology > Link Operations > Deploy Link** or **Ctrl + L**)
2. Object Palette (**Topology > Open Object Palette**)

Currently, the easiest way to connect a Promina and a LAN-side or WAN-side device is to use the Link Deployment Wizard (LDW). To accomplish a successful configuration, use the following steps (see the matching LDW figure below):

1. Select the two devices which need to be connected and press **Ctrl + L**.
2. When the Link Deployment Wizard appears, select an available link technology from the menu (if no matching ports exist, the Promina is unable to connect to this type of device).
3. Select the link which is appropriate for this technology. For example, if the specified technology is Serial then the DS0, DS1, T1, T3, etc. links are available. If the specified technology is Ethernet then the 10BaseT, 100BaseT, and 1000BaseT links are available.
4. Check to make sure the ports on both the connecting devices are acceptable. On the Promina device, if the port is "l_pt_#" or "eth_pt_#" then this device is connecting to the LAN-side of the Promina. If the specified port is "w_pt_#", "sclx_pt_#", or "cx_pt_#" then this device is connecting to the WAN-side of the Promina.
5. Change the bandwidth on the link. Selecting an initial link (i.e., DS0, 10BaseT, etc.) will set a default bandwidth in the wizard but you can select other bandwidth values as necessary.

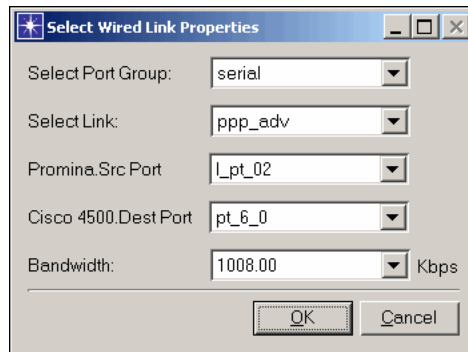


Figure 7: Link Deployment Wizard

Refer to the *NETWARS User's Manual* for further information on deploying links using the above methods.

2.2.1 Circuit (LAN) Connections

The Circuit or Local Area Network (LAN) side of a Promina refers to a collection of devices where the Promina device is acting as the gateway connection to an outside or external network. As Promina can provide several types of connections to devices residing inside the LAN, several types of link connections are available.

Typical Circuit or LAN side connections include Ethernet, Serial, and Voice (Circuit Switch). Therefore, devices such as IP routers, IP workstations, encryptors, multiplexers, and circuit switch nodes are all capable of directly connecting into the LAN-side ports of the Promina. The connections between the LAN-side device and the Promina would be provided by the standard links given for each type of technology (the list below is not complete as other custom links could be added by the user):

- Ethernet (10BaseT, 100BaseT, 1000BaseT)
- Serial (DS0, DS1, DS3, T1, T3, Wire PTP)
- Circuit Switch (Wire PTP)
- Encryptor (KIV19, KG94, KG75, KG95-2, KG194)
- Multiplexer (MUX Aggregate)

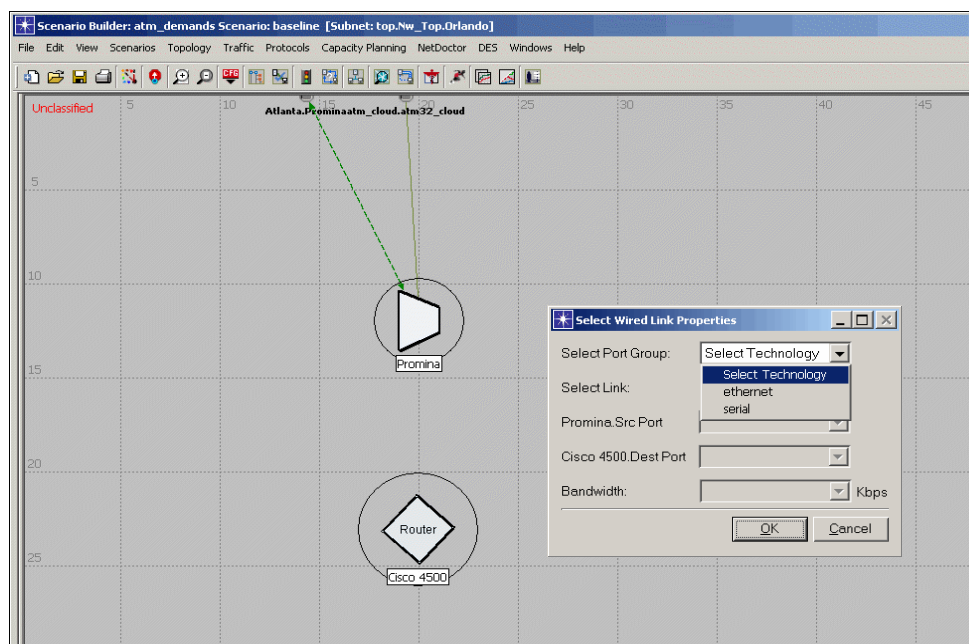


Figure 8: Promina LAN-side Link Configuration

2.2.2 Trunk (WAN) Connections

The Trunk or Wide Area Network (WAN) side of a Promina refers to a collection of devices which provide external network connectivity to a Promina. As Promina can provide several types of connections to devices residing inside a Promina Circuit (LAN) side, several types of link connections are available on the Trunk or WAN side as well.

Typical Trunk connections include ATM and Promina connections. Therefore, devices such as ATM routers and other Promina nodes are all capable of directly connecting into the Trunk (WAN) ports of the Promina. The connections between the Trunk (WAN) device and the Promina would be provided by the standard links given for each type of technology (the list below is not complete as other custom links could be added by the user):

- ATM (SONET OC1, OC3, OC12, OC24, OC48, ATM Generic)
- Promina (Promina WAN Link)

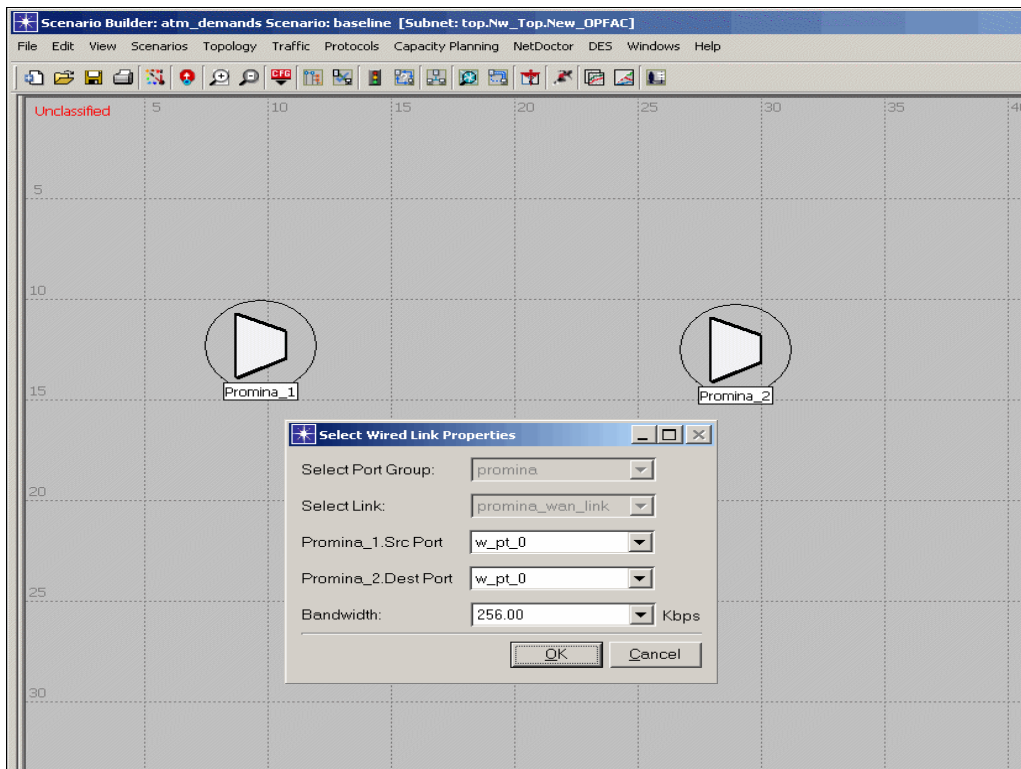


Figure 9: Promina WAN-side Link Configuration

2.3 Promina (LAN) Circuit Configuration

Users need to configure circuits between two promina devices for successful transmission of traffic. These circuits provide mapping of local circuit port on one promina device to remote port on remote (pair) promina device.

A new path model, *nw_circuit*, is created to represent circuits. Paths are standard OPNET objects that can connect two or more nodes in sequence. A custom path model is used so that the NETWARS generic circuit support does not interfere with the use of any OPNET path models.

The *nw_circuit* path model has following attributes:

Table 7: Promina Circuit Attributes

Name	Type	Description
Circuit Type	string	Describes the name of circuit
Port A	string	Name of the port used on the first end device
Port B	string	Name of the port used on the last end device

The *Port A/B* attributes record the port assignment for the circuit and should be set to values matching the *Circuit Configuration.Source Port* attributes of the end devices.

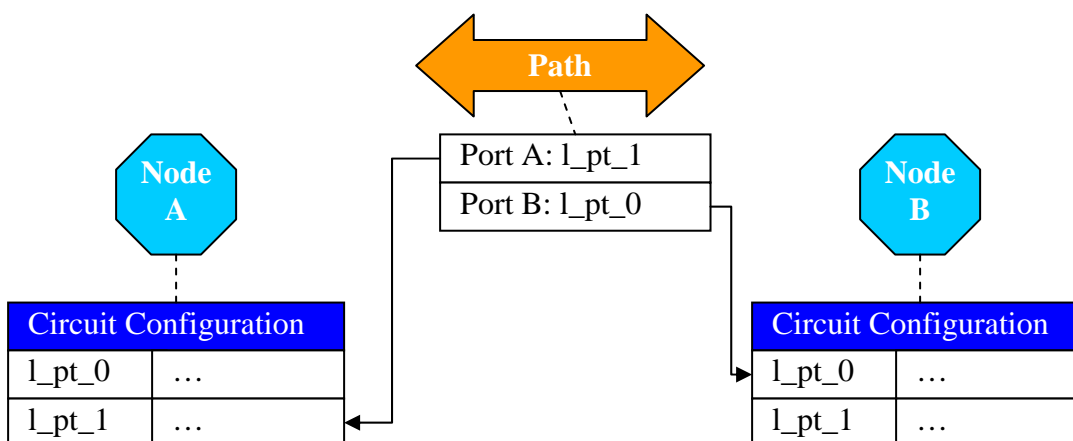


Figure 10: Promina Circuit Diagram

Promina devices use generic circuit framework (use of *nw_circuit* path object) for circuit configuration.

Circuits can be configured by two ways:

1. Use circuit wizard
 - a. Select two promina devices
 - b. Use *Topology -> Deploy Circuits* menu option or the keyboard short cut (*Ctrl + D*)

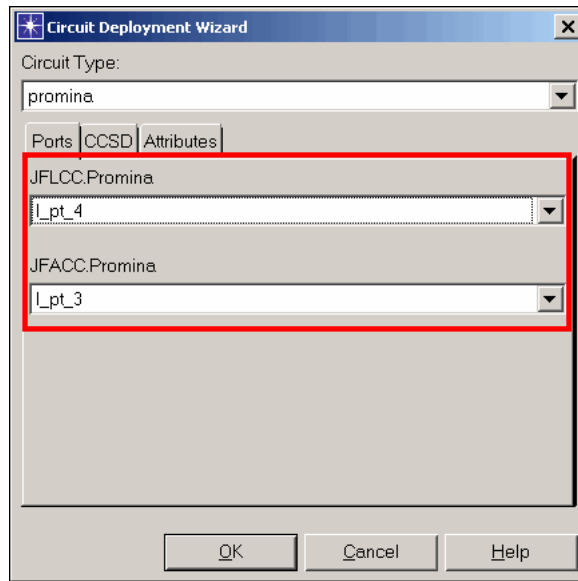


Figure 11: Promina Circuit Port Configuration

- c. Choose the two circuit ports (local and remote port)
- d. Users also have option to set the circuit related attributes (sub attributes of *Circuit Configuration* compound attribute)

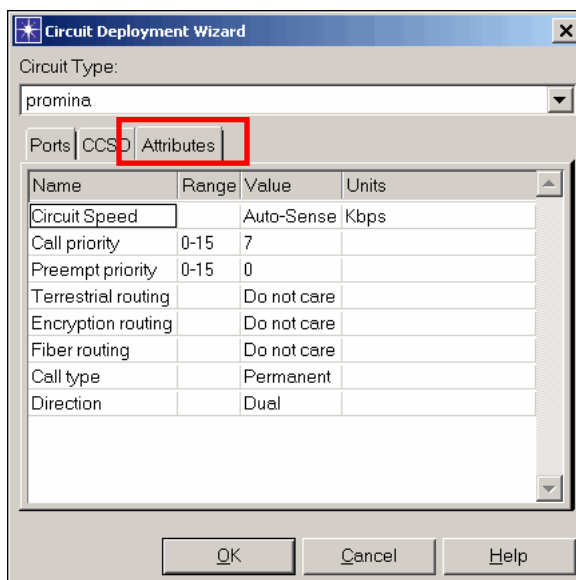


Figure 12: Promina Circuit Attributes Configuration

2. Drag and drop from palette:
 - a. Drag and drop a *nw_circuit_path* object from palette
 - b. Connect two end devices with this path object
 - c. Circuit Deployment Wizard dialog box will show up allowing users to choose the two ports and provide user with option to set circuit related attributes

2.4 ATM Trunk (WAN) Configuration

Promina allows the use of two types of ATM ports: CellXpress and SCLX. If you wish to use these two types of ports, an ATM SPVx (switched permanent virtual connections) or ATM CX (CellXpress) connection must be configured between two Promina devices. Inside NETWARS, you must deploy the proper ATM demand from the object palette to setup these types of ATM connections. To deploy an ATM demand, use the following steps:

1. Open the object palette (using the **Topology > Open Object Palette** menu) and find the “atm_promina_spvx” or “atm_cx” demand under the “NETWARS_ATM” palette.

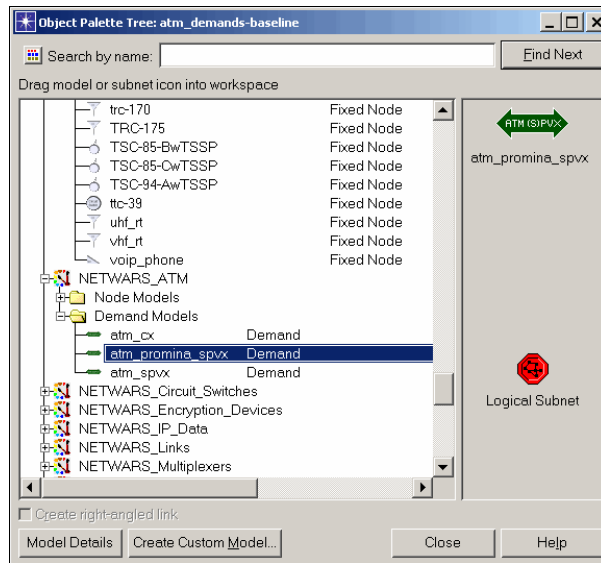


Figure 13: Promina ATM Demands

2. Deploy the Promina ATM demand between the two Promina nodes. Note that you may have to drill into the OPFAC first before connecting the demand to a particular Promina device.
3. After deploying the demand, right-click on the demand (i.e., the ATM circuit) and select “Edit Attributes”.

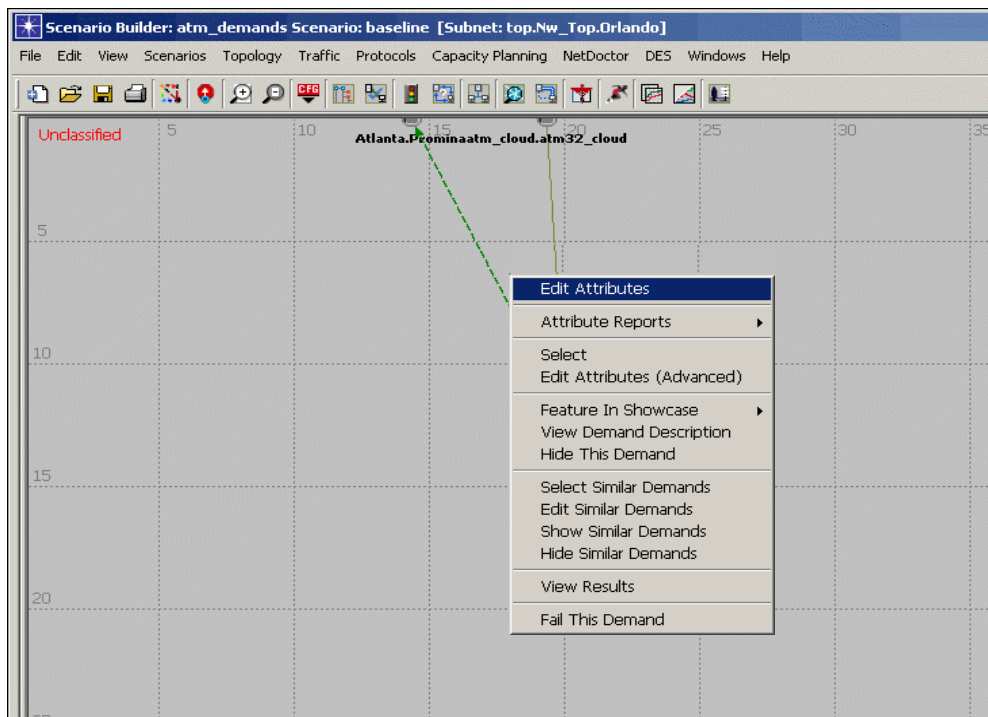


Figure 14: Promina ATM Demand Edit Attributes Menu

- Change the “Promina” attribute on the demand to reflect the necessary port information. The easiest way to do this is to look at the tooltip for each of the ATM links going into the Promina devices. To get the tooltip, move the mouse over the link and wait for information to appear. When the tooltip appears, you will see the necessary port information which includes the port names. The port name will then map directly into the “Promina” attribute on the ATM demand. Typical port names for the Promina ATM ports would include “sclx_pt_5” or “cx_pt_8.” For example, if the port name was “sclx_pt_5,” then the “Card Type” is SCLX and the “Port Index” is 5 (see the figure below).

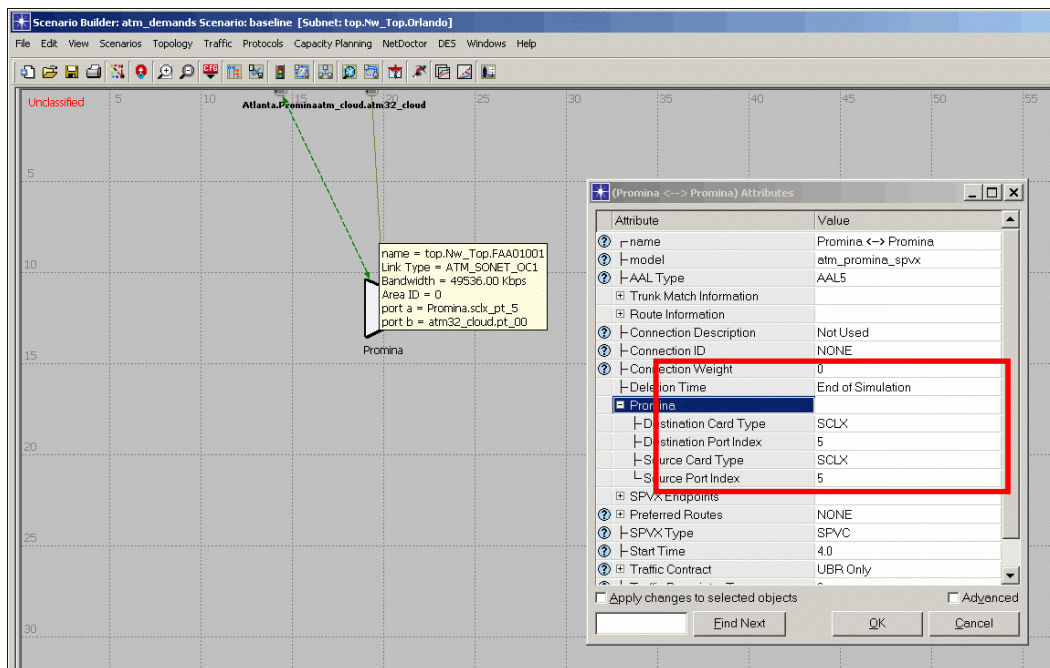


Figure 15: Promina ATM Demand Attributes and Link Tooltip

3 Usage

The Promina models allow you to model networks with Promina and IDNX nodes in both Discrete Event Simulations and Capacity Planner in NETWARS. Multiple types of LAN and WAN ports with different layer-2 interfaces (serial, Ethernet, ATM) with their main functional options are supported to model the operation of various types of Port and Trunk cards in a generic way. Various types of statistics measure the performance in the Node, Port, or Trunk level. The figure below shows an example tactical network with Promina nodes (JFACC, JFLCC, CFH, JFSOCC, MAGTF, JFMCC) providing a core network that connects other devices to each other. This scenario is available in NETWARS under the “UserGuide_CP_Scenario” name, and was chosen so that you can look at an example network using the Promina device.

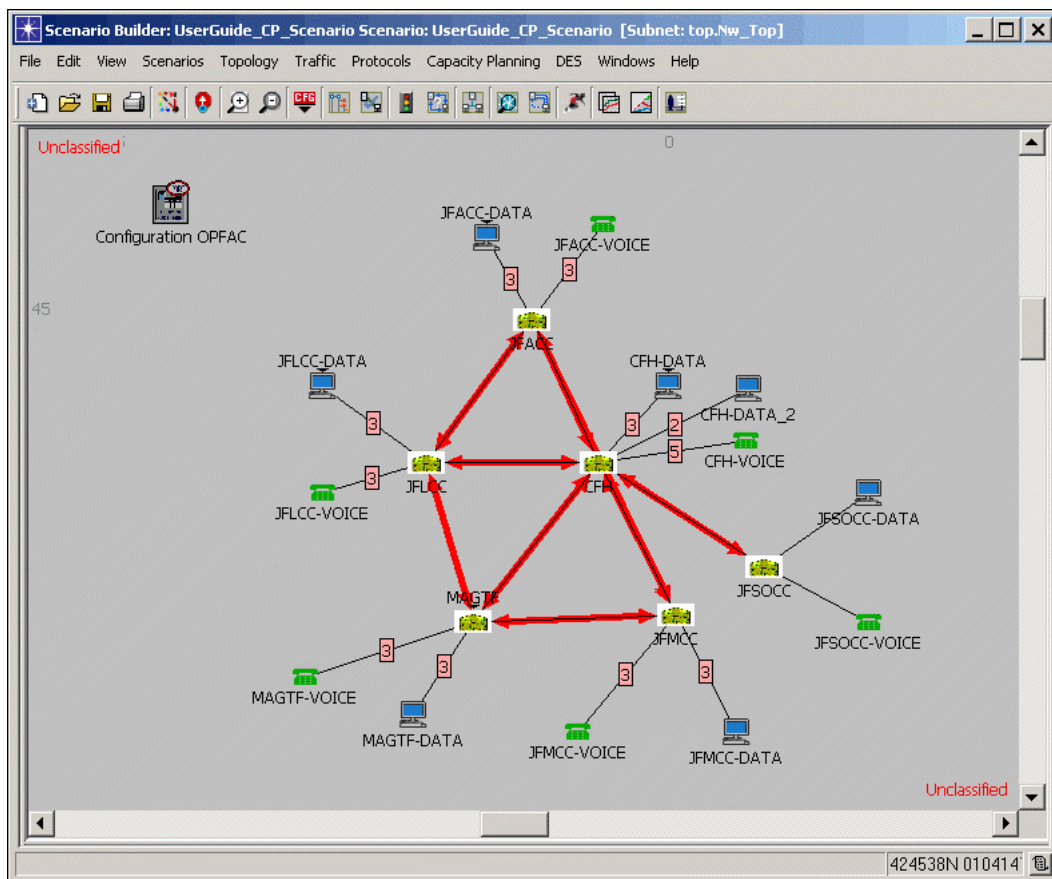


Figure 16: Main Network

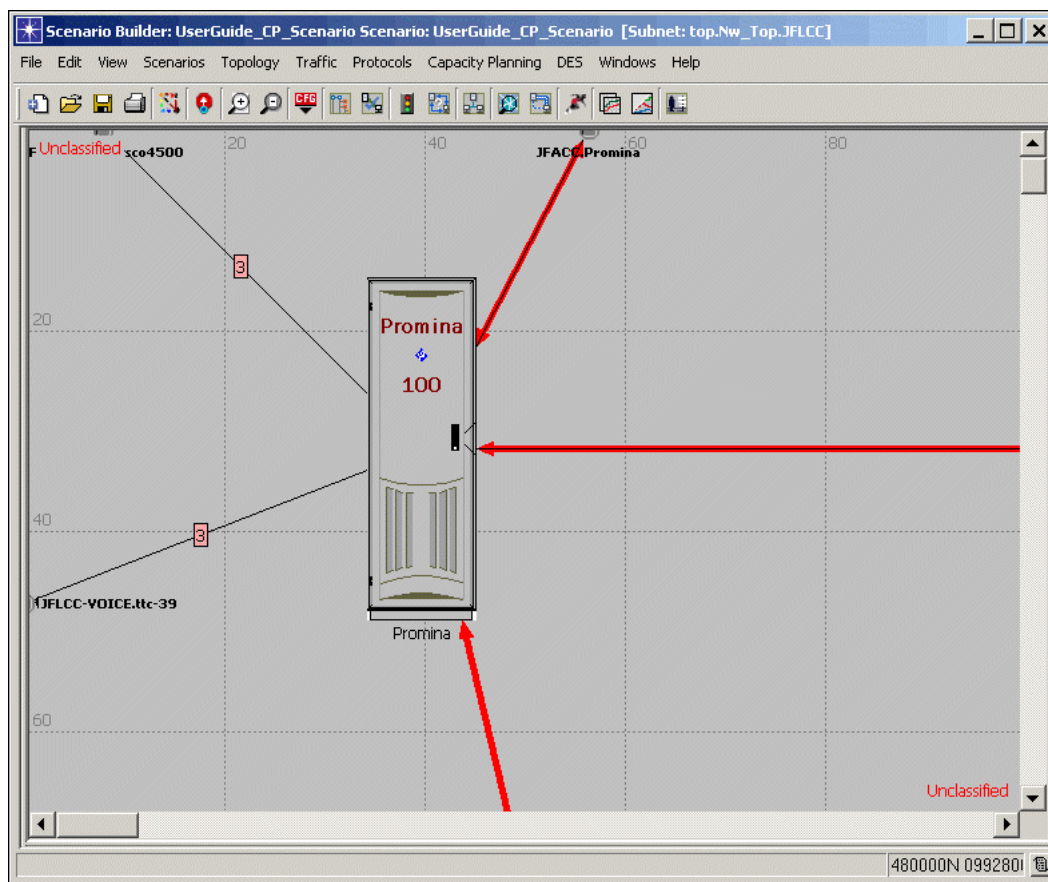


Figure 17: JFLCC Network

3.1 Capacity Planning Reports

The Capacity Planner is a tool which allows you to quickly study a network by analytically calculating the performance. This provides you with a large amount of studies such as failure, configuration, and capacity studies. Inside NETWARS, the Capacity Planner tool has been enhanced to generate Promina specific web reports. The web reports shown below are helpful when looking at the Promina device. The numbers and statistics inside the web report examples are based on Capacity Planner runs using the “UserGuide_CP_Scenario” project (shown above).

To run Capacity Planner on a network, click the **Capacity Planning > Evaluate...** menu after opening a particular NETWARS scenario. Refer to the NETWARS documentation for more information regarding how to use the Capacity Planner tool.

Once the Capacity Planner tool is run, a web report will be shown displaying the results from the analysis. There are two parts of the web report which are specific to Promina (the other parts are important but are not the focus of this discussion). The first report is the Executive Summary portion of the report. This is the first page that displays after the Capacity Planner tool has finished. This report discusses an overall view of the network and gives you high level points so that you can easily narrow down problems areas.

Inside the Executive Summary is a section titled “Circuit Performance.” This section shows the number of circuits defined and the number which were routed successfully. This gives you a quick method of checking whether the Promina circuits deployed in the network were setup correctly. Also, for Promina devices which use ATM Trunks, this section is also used for ATM circuits and provides the same functionality.

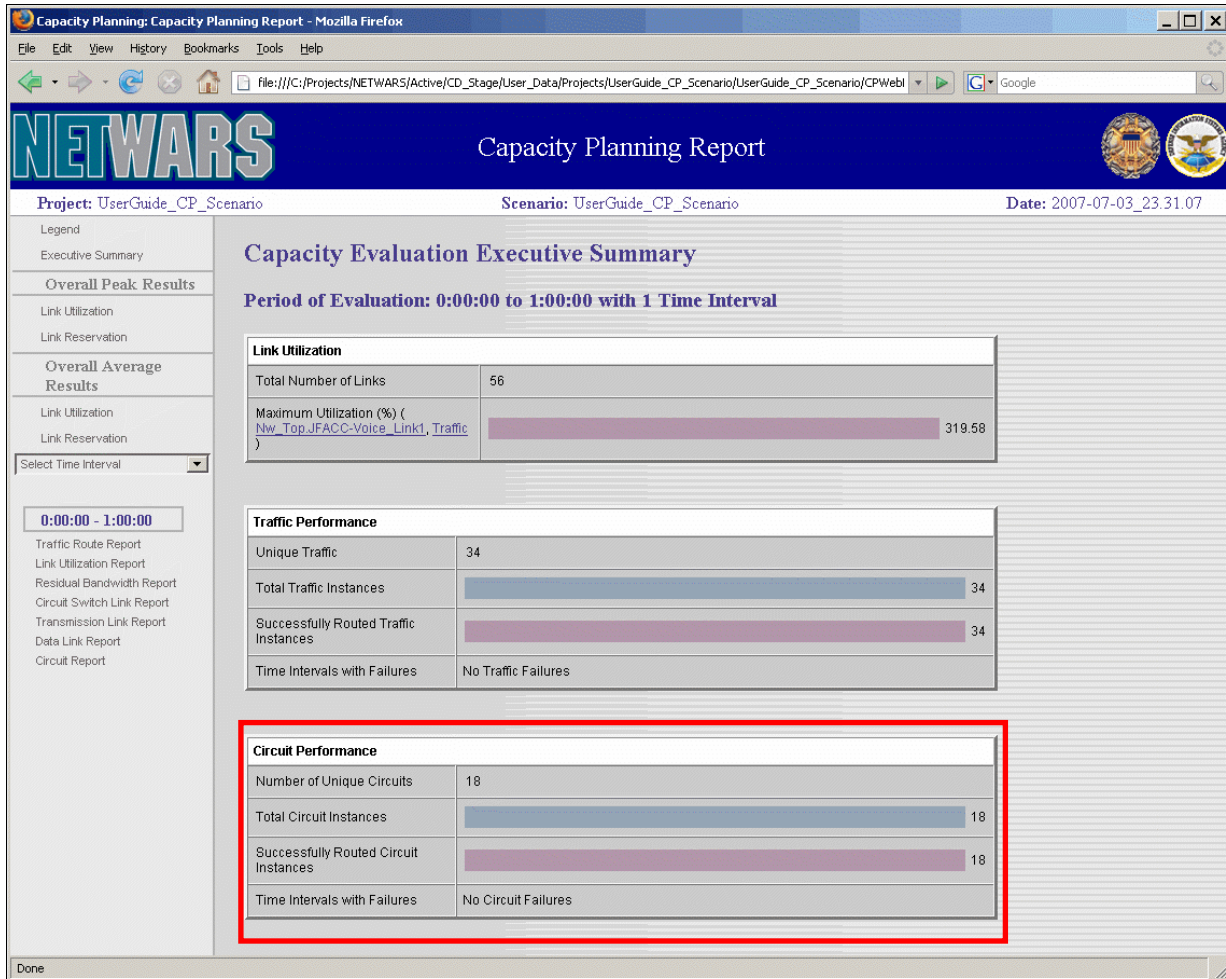


Figure 18: Capacity Planning Report Executive Summary

Secondly, the “Circuit Report” is another section inside the Capacity Planning report. This section can be accessed by clicking on the hyperlink located on the left side of the Capacity Planning report. The “Circuit Report” shows a complete list of circuits inside the network (including Promina LAN Circuits and ATM Circuits). It provides a quick way of seeing what circuits have been defined, what Promina ports the circuit is defined for, what devices are connected (or are subscribed) to that particular circuit, and information about the circuit (data rate, direction, etc.). This allows you to easily debug any problems where traffic is navigating that particular circuit. Also, much of the data displayed is shown in hyperlink form so you can click the necessary device or port in the

report and the Scenario Builder will display the relevant device. You are then able to check the necessary attributes or links to look for configuration issues.

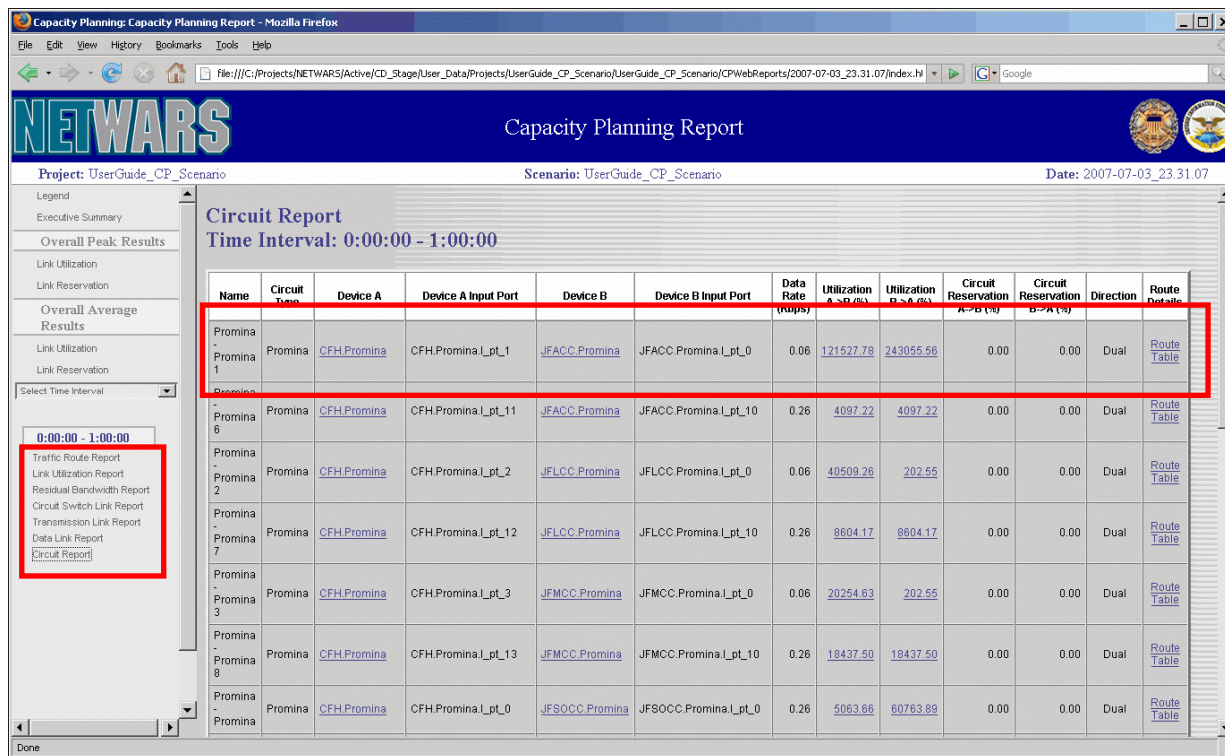


Figure 19: Capacity Planning Report Circuit Report

Finally, the “Transmission Link Report” is another section inside the Capacity Planning report. Similar to the “Circuit Report,” this section can be accessed by clicking on the hyperlink located on the left side of the Capacity Planning report. The “Transmission Link Report” provides the ability to look at the links connecting transmission devices such as Promina. This report is important for looking at data rate, utilization, and circuit reservation numbers for a particular link. This can help you determine how much of the available bandwidth on a transmission link is actually being used by the connected devices. Also, note that the links in the report are color coded to represent the utilization of the link (green is low, yellow is medium, and red is high utilization).

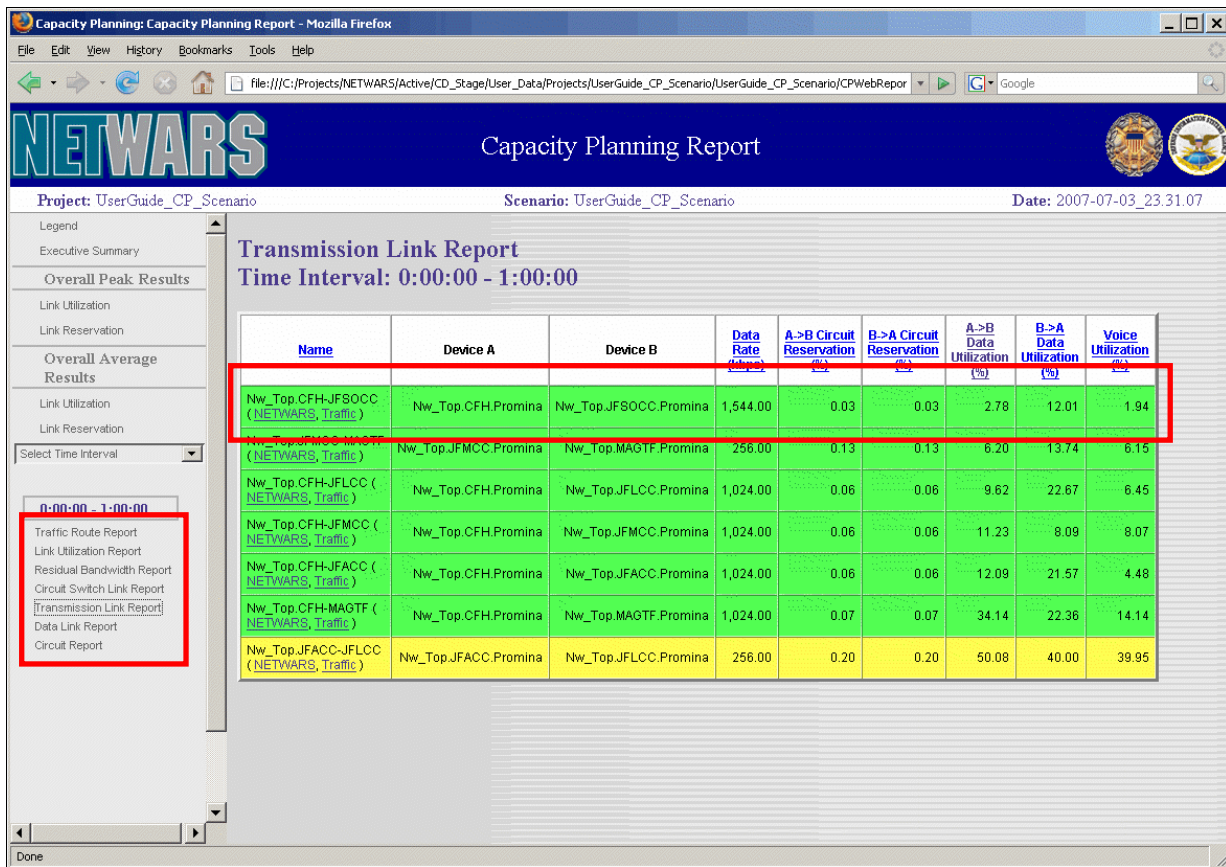


Figure 20: Capacity Planning Report Transmission Link Report

3.2 Discrete Event Simulation Statistics

The Discrete Event Simulation (DES) allows you to simulate the performance of a network in detail by actually sending packets and data across a created NETWARS scenario. The statistics gathered during this simulation allow you to gain specific details about how a network and particular devices are performing. This information provides you with a widespread picture of the simulated network and allows you to perform a wide variety of studies. The listed statistics below are the specific statistics available when using the NETWARS Promina models. Many other DES statistics are available based on the type of technologies deployed inside the scenario. However, as this document is based purely on the Promina device, the other available statistics are outside of the scope of this document. Refer to the NETWARS and OPNET IT Guru standard documentation for more details on other statistics.

Promina DES statistics refer to statistics that are defined on a per Promina node basis. To define these type of statistics, right-click on the Promina device and select the **Choose Individual DES Statistics** menu item. After the Choose Results dialog box displays, the Promina statistics (see table below) are shown (other ATM specific statistics are also available but are outside the scope of this document.)

Table 8: DES Promina Statistics

Statistic	Description
Promina LAN Ports.Rcv Throughput	Rate (bits/sec) of the incoming data to the node from each LAN port
Promina LAN Ports.Xmit Throughput	Rate (bits/sec) of the outgoing data from the node over each LAN port
Promina WAN Ports.Rcv Throughput	Rate (bits/sec) of the incoming data to the node from each WAN port
Promina WAN Ports.Xmit Throughput	Rate (bits/sec) of the outgoing data from the node over each WAN port
Promina Node.Originating Calls	Number of calls with the current node being the source of the call
Promina Node.Terminating Calls	Number of calls with the current node being the destination of the call
Promina Node.Transient Calls	Number of calls using the current node where this node is neither the source nor the destination
Promina Node.Throughput (packets)	Total packets/sec throughput of the node
Promina Node.Throughput (bits)	Total bits/sec throughput of the node

DES circuit statistics are also available, since Promina circuits use the generic circuit functionality. To define these type of statistics, right-click inside the scenario (not on a link or node) and select the **Choose Individual DES Statistics** menu item. After the Choose Results dialog box displays, the circuit statistics (see table below) are shown under the “Global Statistics > Circuits” statistic group.

Table 9: DES Circuit Statistics

Statistic	Description
Circuits.Throughput (bits/sec)	Total bits/sec throughput of all defined circuits in the scenario
Circuits.Throughput (packets/sec)	Total packets/sec throughput of all defined circuits in the scenario
Circuits.Utilization (%)	Total utilization of all defined circuits in the scenario

3.3 Logical Views

Logical Views provide the ability to filter the network so that you can look at particular layers or technologies more closely. In the case of Promina, you can look strictly at the Promina devices in the network by using the “Promina” layer. This layer can be located under the “Network Layer Filters” section of the logical links dialog box. Note that the logical links functionality can be found under the **View > Show Logical Views...** menu (dialog box shown below).

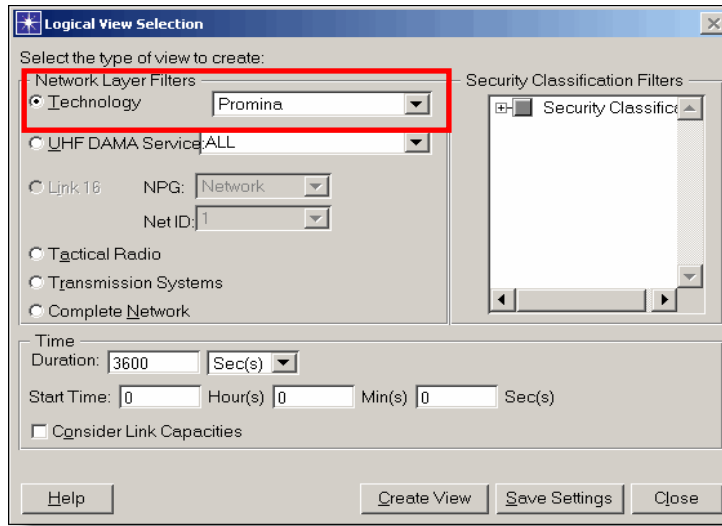


Figure 21: Logical View Dialog Box

Once a logical view of the Promina devices is created, you are able to see a graphical representation of the connectivity of the Promina devices inside the scenario. The figure provided below shows the Promina network of the “UserGuide_CP_Scenario” project. In this particular case, each of the Promina devices is connected directly using Promina WAN links (denoted by the solid black links). You may click the Promina devices and links in the logical view and modify these items as necessary.

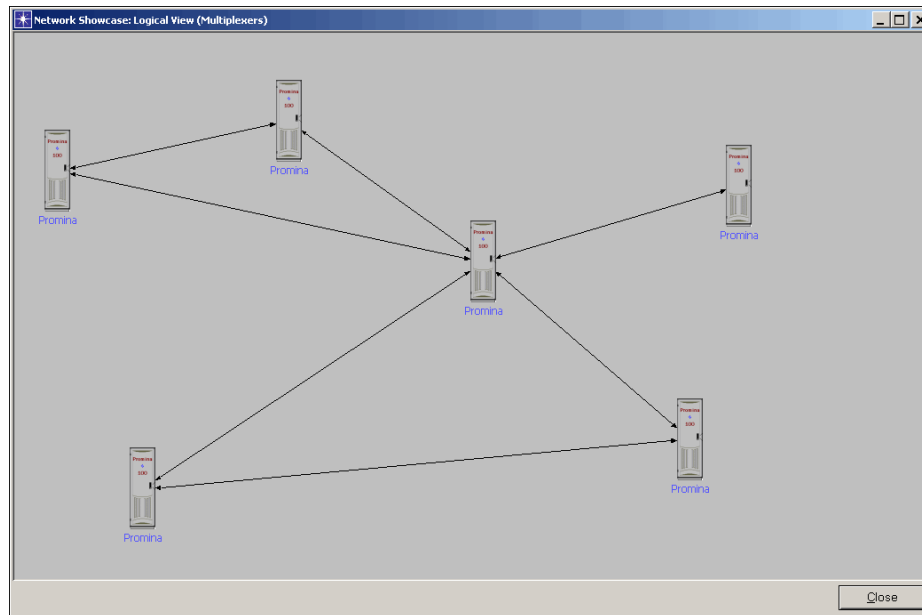


Figure 22: Promina Logical View Example

Also, if the Promina devices were connected through ATM connections, you can also create an “ATM” logical view. This would show the Promina device connectivity as viewed through the ATM network.

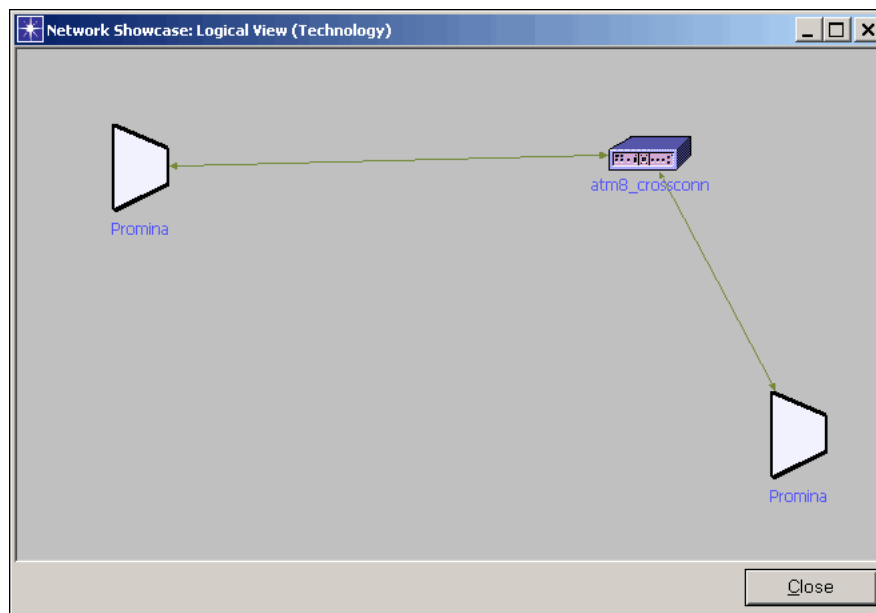


Figure 23: ATM Logical View with Promina Example

To view more information on the Logical Views functionality, refer to the *NETWARS User's Manual* for more details.

3.4 Nested Promina Support

Promina models have been enhanced to support nested Promina configuration. The figure below illustrates a simple nested configuration:

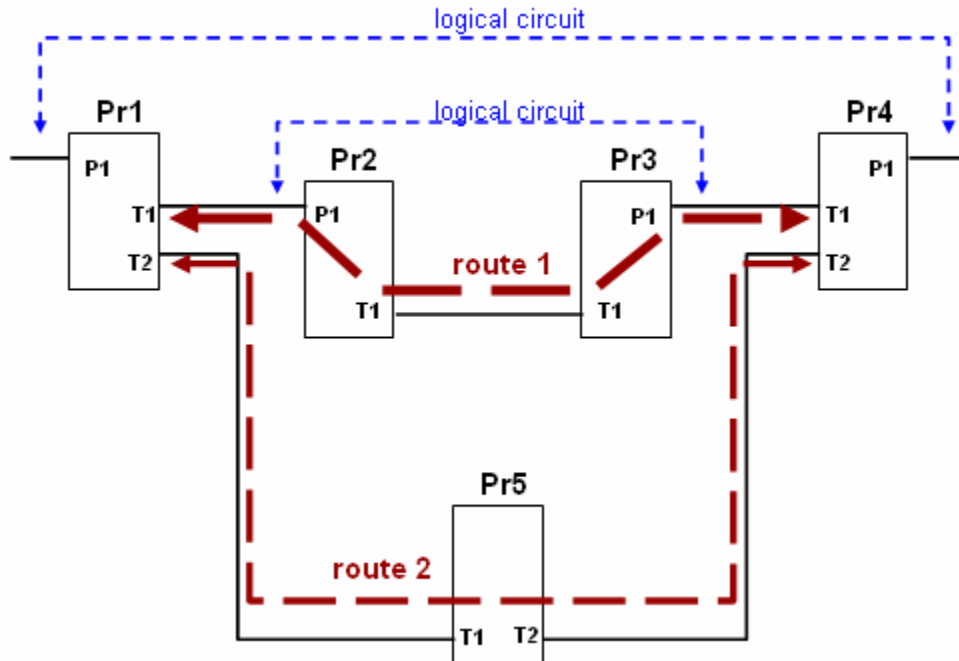


Figure 24: Nested Promina Support

There are two circuits configured in above example:

1. The outer circuit between Promina 1/LAN Port 1 (Pr1/p1) and Promina 4/LAN Port 1 (Pr4/p1).
2. The inner circuit between Promina 2/LAN Port 1 (Pr2/p1) and Promina 3/LAN Port 1 (Pr3/p1).

When routing the circuit between Pr1/p1 and Pr4/p1 (assuming that the circuit between Pr2/p1 and Pr3/p1 is routed correctly), the following routing decisions will be made:

1. Route 1 (Pr1-Pr2-Pr3-Pr4) will be considered a two hop route (the logical circuit between Pr2/p1 and Pr3/p1 will be transparent to Pr1 and Pr4).
2. Route 2 (Pr1-Pr5-Pr4) will be considered a three hop route.
3. Route 1 (Pr1-Pr2-Pr3-Pr4) will be considered the shortest route and it will be the preferred over Route 2 (Pr1-Pr5-Pr4).

4. If a “selected path” is specified for the circuit between Pr1/p1 and Pr4/p1, Pr2 and Pr3 can NOT appear in the path description. This is because both of these Promina devices (Pr2 and Pr3) will be assumed transparent (due to the inner circuit).

3.5 Supported Equipment Strings

Equipment strings are combinations of connected devices which can typically be found inside a network. The below equipment strings should be considered as normal use cases for the Promina device and are supported by NETWARS. Note that the arrows in red designate a Promina WAN-side connection, the blue arrows designate a Promina LAN-side connection, and any other arrows are links not attached to the Promina.

3.5.1 Circuit (LAN) Equipment Possibilities

The equipment strings in this subsection illustrate all of the Circuit (LAN) side equipment possibilities. Note that in each case, a single Trunk (WAN) link will be shown to represent the WAN side connection. It is important to note that this does not mean that only two Promina devices can connect together through a single WAN link. This representation is merely a way to simplify the equipment strings so that they are easier for you to read. The single Trunk/WAN link (colored red) can be replaced by any of the equipment string combinations in the next subsection (i.e., the “Trunk (WAN) Equipment Possibilities” section).

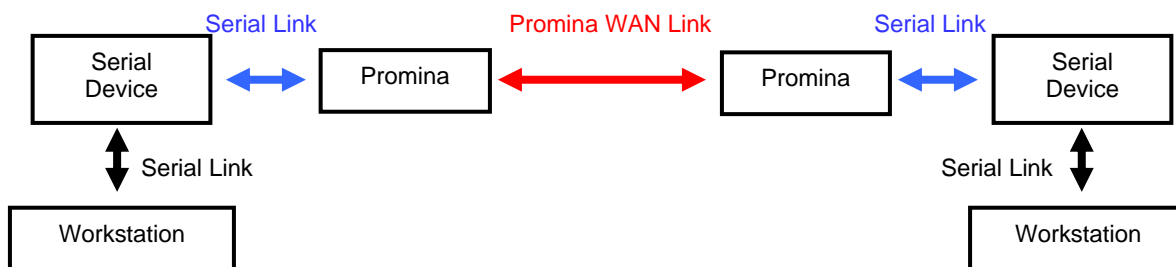


Figure 25: Serial into Promina Equipment String

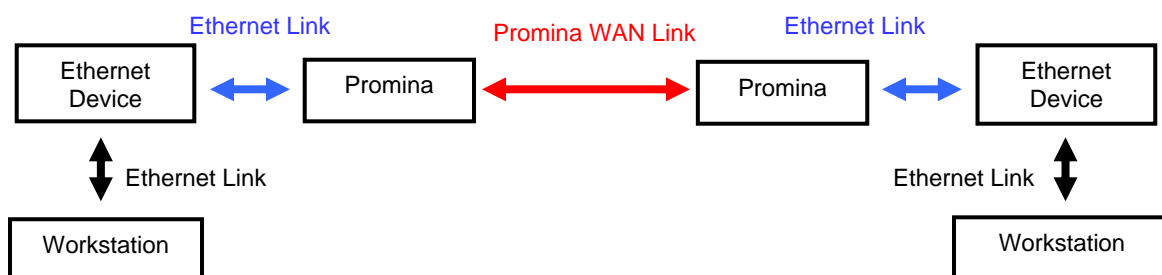


Figure 26: Ethernet into Promina Equipment String

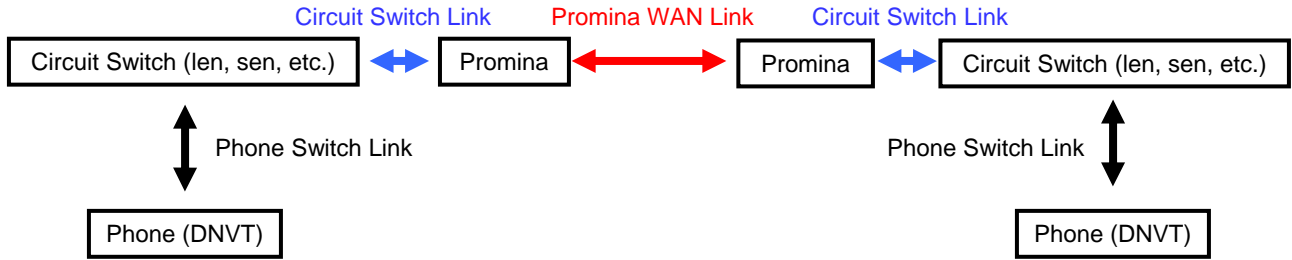


Figure 27: Circuit Switch into Promina Equipment String

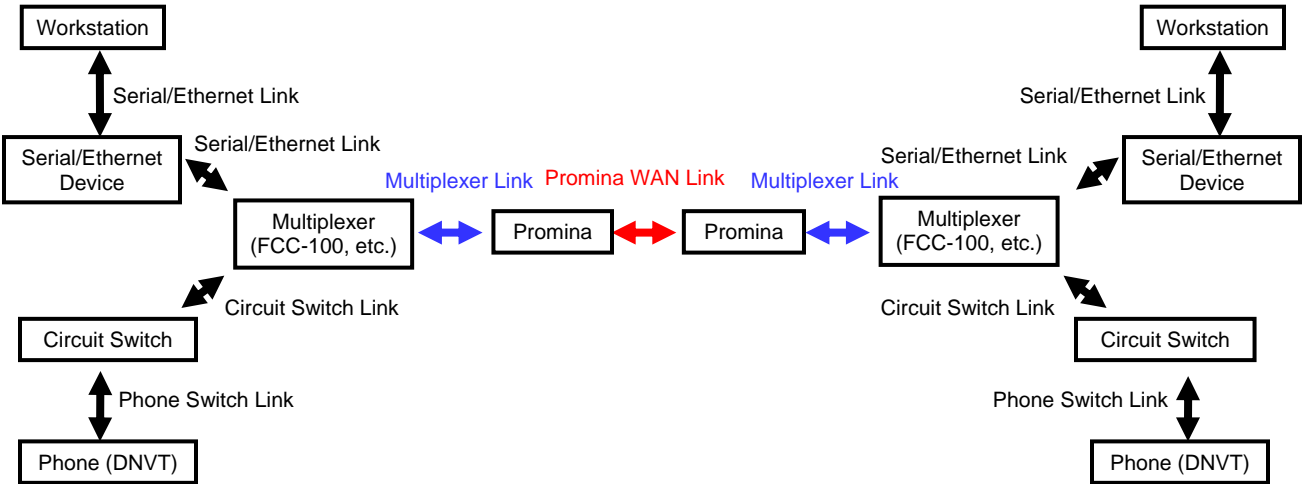


Figure 28: Multiplexers over Promina Equipment String

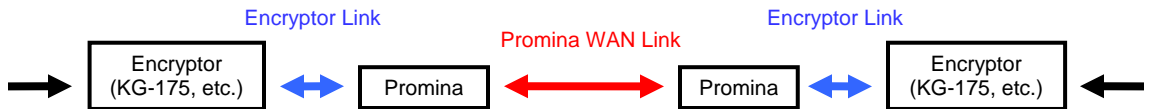


Figure 29: Encryptions over Promina over Encryptions Equipment String

3.5.2 Trunk (WAN) Equipment Possibilities

The equipment strings in this subsection illustrate all of the Trunk (WAN) side equipment possibilities. Note that in each case, a single Circuit (LAN) link (colored blue) will be shown to represent the LAN side connection into a Promina. This representation is merely a way to simplify the equipment strings so they are easier for you to read. The single Circuit/LAN link can be replaced by any of the equipment string combinations in the previous subsection (i.e., the “Circuit (LAN) Equipment Possibilities” section).

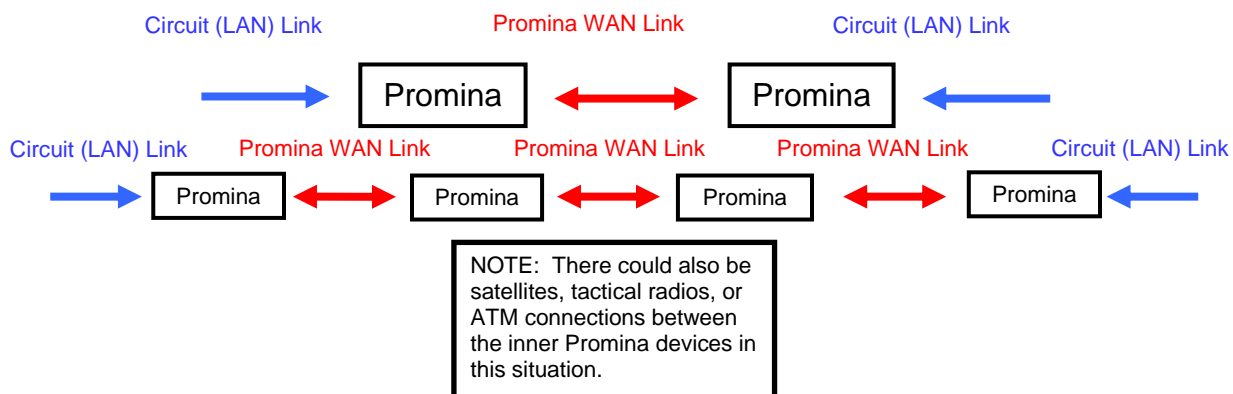


Figure 30: Promina WAN Link Equipment Strings



Figure 31: Promina over ATM Equipment String

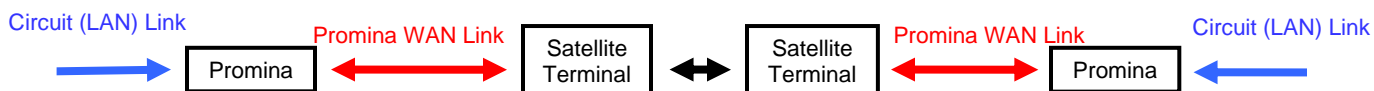


Figure 32: Promina over Satellite Terminals Equipment String

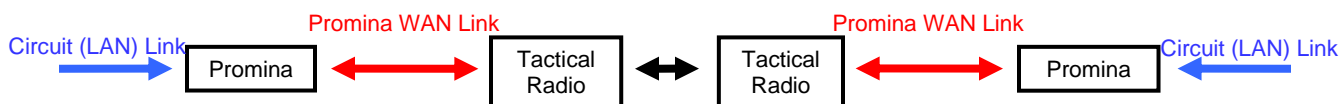


Figure 33: Promina over Tactical Radios Equipment String

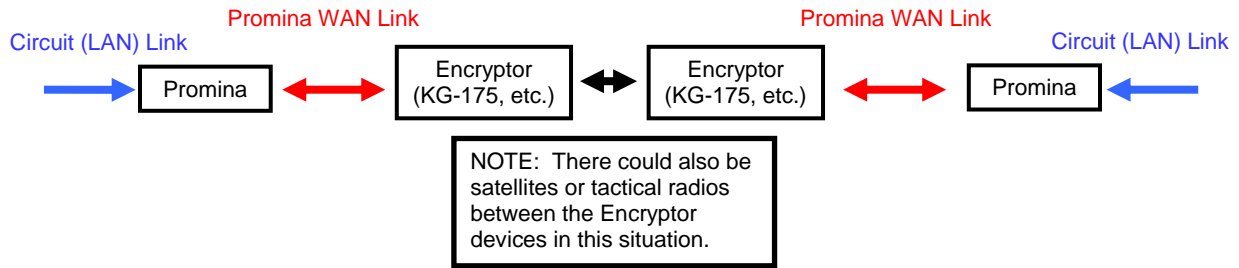


Figure 34: Promina over Encryptors Equipment String

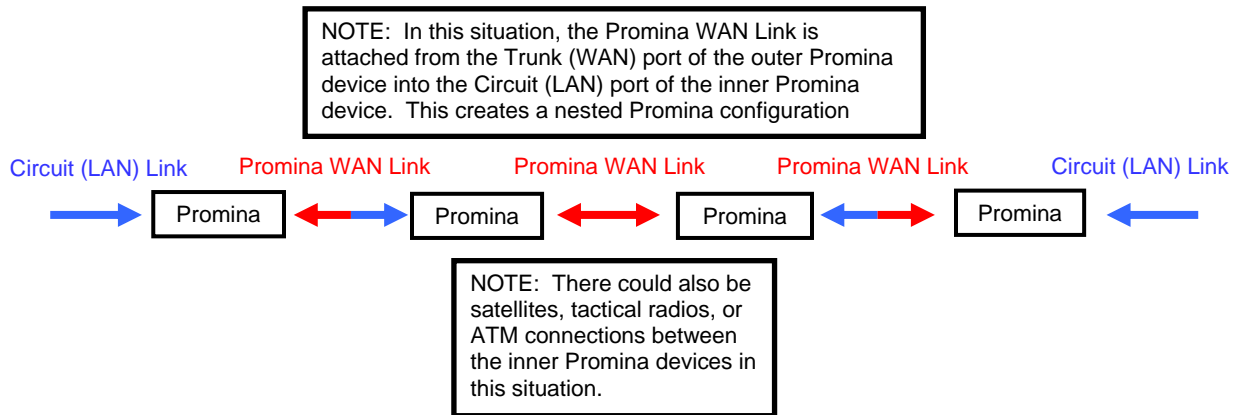


Figure 35: Nested Promina Equipment String

3.6 Traffic Usage

The Promina nodes treat the data coming to the Circuit (LAN) ports as a generic packet stream regardless of the underlying protocols in the packet. There is therefore no particular restriction on the traffic type from the Promina point-of-view. This means that the Promina node is able to handle NETWARS IERs, standard OPNET traffic (Applications, Flows, ACE, etc.), and even custom traffic types.

3.7 Usage in Modeler

It is possible to use the NETWARS Promina models in OPNET Modeler, provided that the necessary configuration settings are performed. In a combined NETWARS/Modeler environment where the NETWARS header files are already accessible by Modeler, the only change that is needed is to comment out the following line in the “netwars_stat_support.h” file as shown below:

```
Change...   #define NETWARS
To...       //#define NETWARS
```

For use in pure Modeler environment the following NETWARS header files need to be accessible by the Modeler (with the netwars_stat_support.h having been modified as above):

- circuit_switch.h
- flood_search_routing.h
- netwars_logical_link_support.h
- netwars_nato.h
- netwars_sdf_support.h
- netwars_stat_support.h
- netwars_support.h
- oe_env.h
- oe_se.h
- oe_stat_support.h
- oe_threads.h
- promina.h
- promina_rte.h
- promina_sup.h
- promina_sup_alt.h
- promina_topo.h
- promina_voice_sup.h
- sdf_parse.h
- trace_support.h
- USN_ckt_supp.h
- win32.h

4 Node Models

4.1 Architecture

The figure below shows the node model of a Promina device. This Promina device was created through the Device Creator functionality and provides an example of the full range of features available in the NETWARS Promina.

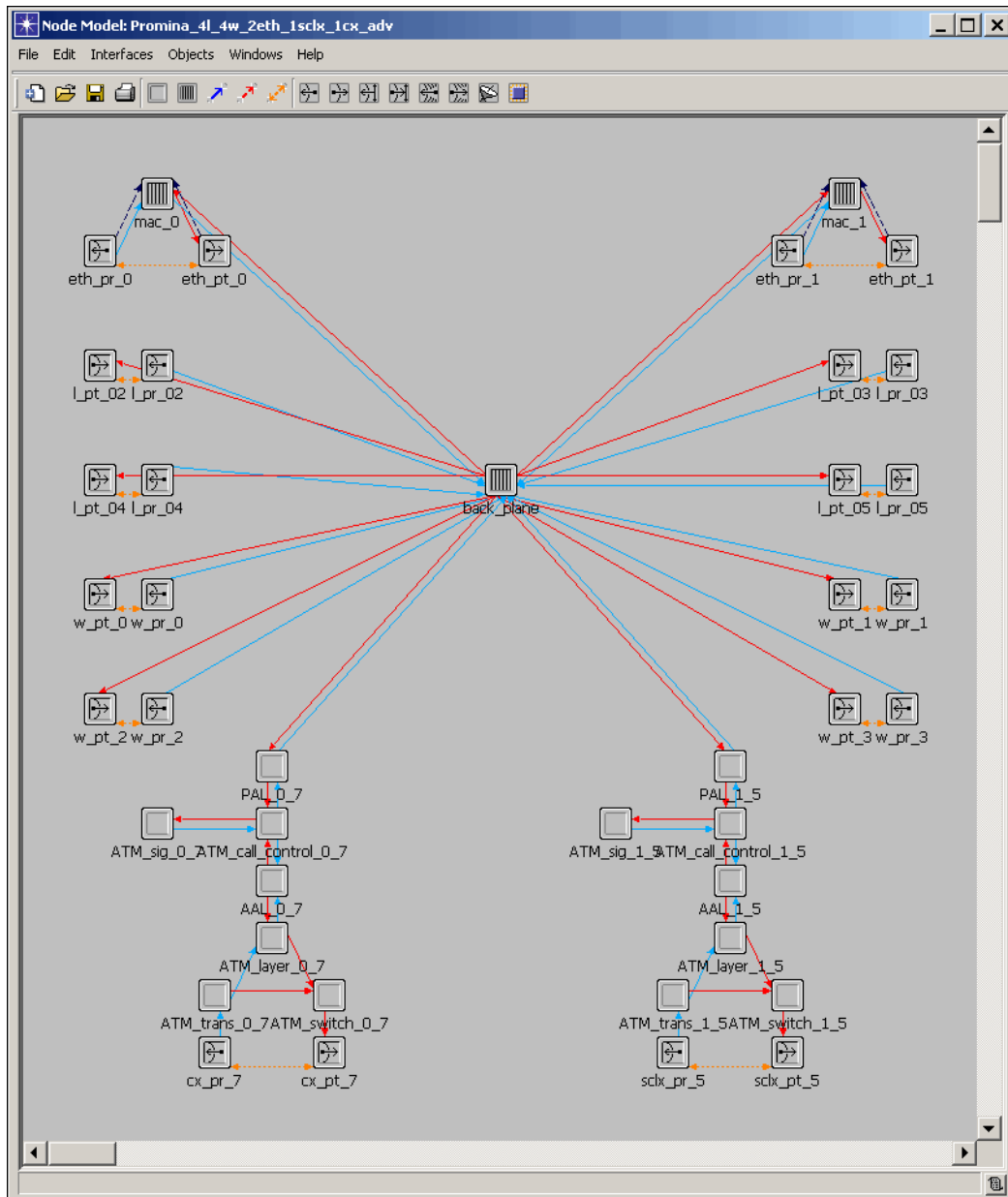


Figure 36: Promina Node Model

In this case, the Promina node contains two Ethernet ports (designated by the “eth_pt_#” name), four Circuit (LAN) ports (designated by the “l_pt_#” name), four Trunk (WAN)

ports (designated by the “w_pt_#” name), one ATM CellXpress port (designated by the “cx_pt_#” name), and one ATM SCLX port (designated by the “sclx_pt_#” name).

Each port connects to the “back_plane” module which contains the Promina forwarding logic through the use of several process models. The Promina specific process models are out of scope for this document but all of the Promina files can be located under the <NETWARS Installation Directory>\Sim_Domain\op_models\netwars_std_models\circuits\promina directory (where <NETWARS Installation Directory> is the directory where NETWARS is installed). Note that all of the files and models in this directory can be opened and modified using the OPNET Modeler software.

4.2 Device Creator

You can create custom Promina node models (with a desired number of ports for each technology) using the Device Creator utility available in Scenario Builder by selecting **Topology > Create Custom Device Model...**

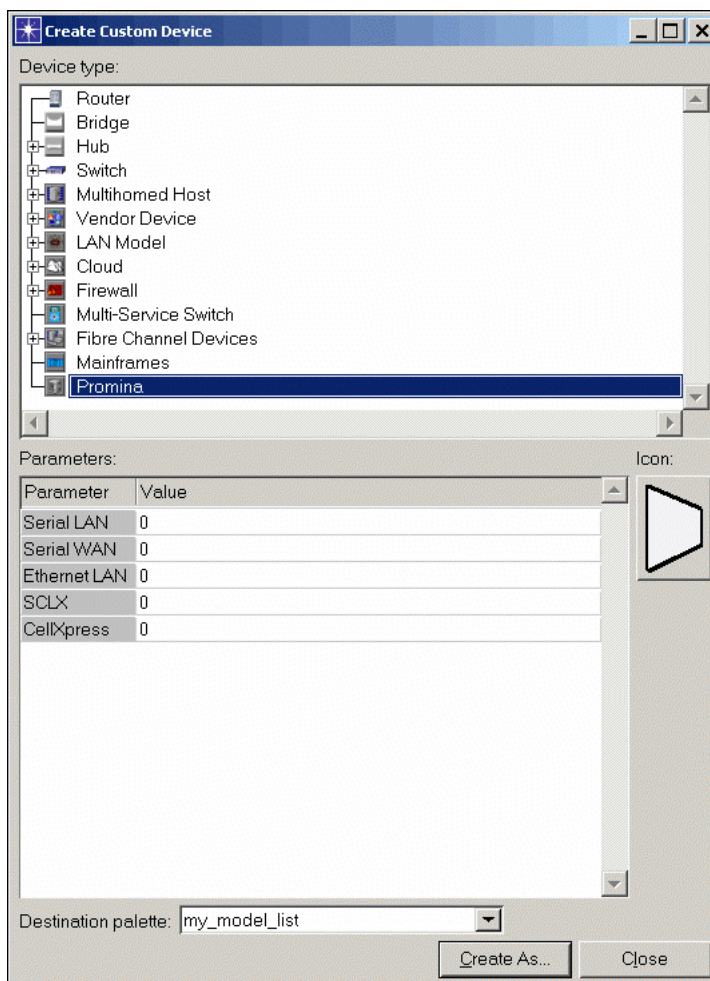


Figure 37: Create Custom Device Dialog Box