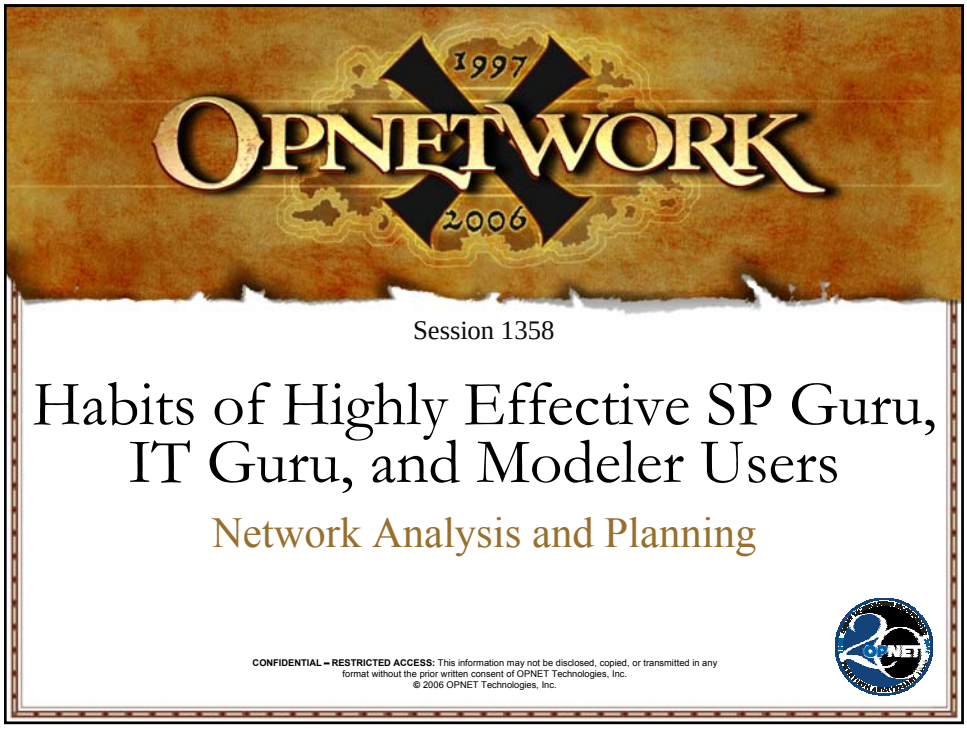


Session 1358

Habits of Highly Effective SP Guru, IT Guru, and Modeler Users

Network Analysis and Planning

Prerequisites

- Recommended
  - Familiarity with OPNET products
- Not Required
  - Detailed knowledge of various modules

Goals

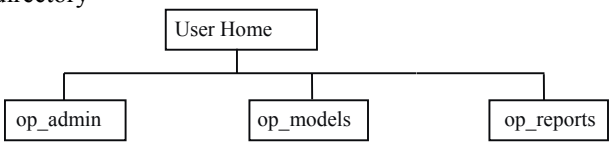
- Describe features to help you use OPNET software more effectively
- Focus of this session is on the Project Editor
- Provide hands-on experience using instructor demos and several interactive lab sessions

Agenda

- **Areas of focus**
  - ➔**File management**
  - Organizing topology
  - Configuration helpers
  - Visualization and navigation
  - Reporting
  - Exporting data

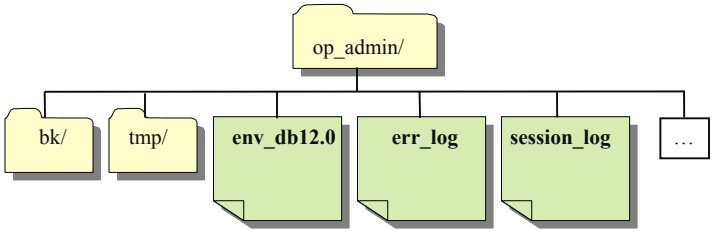
File Management: User Directories

- Home directory determined by 'opnet_user_home' preference
  - Defaults to setting of HOMEDRIVE and HOMEPATH environment variables (on Windows), or 'HOME' environment variable (on Unix)
    - To modify, add '-opnet_user_home <directory>' to startup command
      - Change the shortcut on Windows
      - Change the command at command-line on Unix
- Default user-directory organization
  - Administrative directory
  - Model directories
  - Reports directory



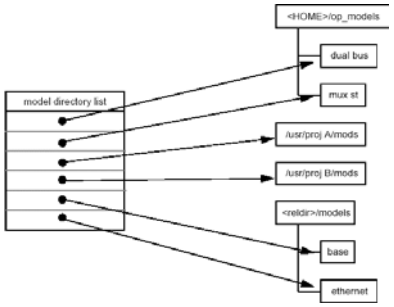
File Management: Administration Directory

- Administration files are located in <home dir>\op_admin
  - Preferences (env_db) file
  - Error log (err_log) and session log (session_log) files
  - 'bk' sub-directory contains backup files
  - 'tmp' sub-directory contains temporary OPNET-generated files



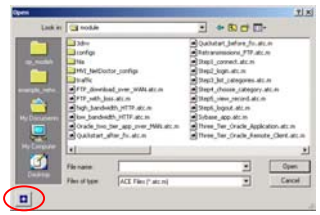
File Management: Model Directories

- Managing model directories
  - "mod_dirs" preference
  - First directory in mod_dirs is "Default Directory" – also called the *primary model directory*
  - Group-related projects into separate directories for easier maintenance
  - For more details, open the product documentation and use the table of contents frame to navigate to 'Reference Guide > System Environment'

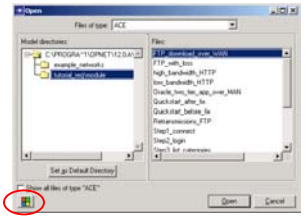


File Management: File Choosers

- Effective use of the file choosers
  - Use the OS file chooser to open models from any directory on file system



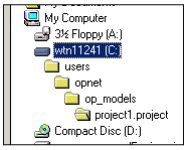
  - Use the OPNET file chooser to:
    - Navigate to models from previously configured model directories
    - Use 'All files of type' toggle to display list of model files of the selected type in all the model directories
      - Useful for type-ahead selection

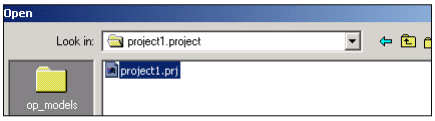


  - Use the lower left corner button to toggle between the file chooser types

File Management: Project Directories

- Project directories
  - Project-specific files are stored in .project directory
    - When you save new projects
    - When you 'save as' projects from previous OPNET versions
  - Navigate to inside the .project directory to open a project

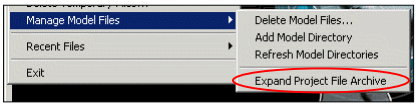


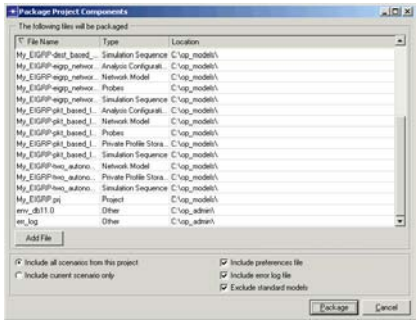


  - Common (not project-specific) files are not stored in the .project directory:
    - Examples are: device-creator generated files, model assistant files

File Management: Project Model Packaging

- Package project files
  - File → Manage Model Files → Create Project File Archive
  - Creates package (.opcfa) file containing relevant project-related files
  - Useful for:
    - Sending projects to team members
    - Sending files to OPNET technical support

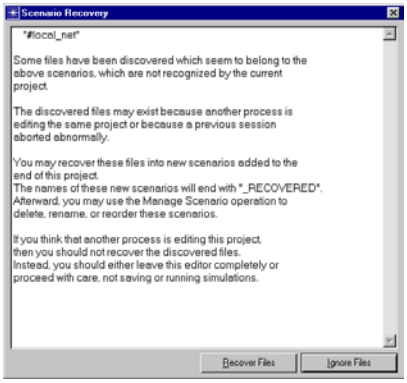




File Management: Scenario Recovery

- Scenario Recovery dialog box
  - Appears if OPNET crashes before project is saved
    - In this case, use "Recover Files" and either delete "_RECOVERED" scenarios, or replace the inconsistent scenarios with "_RECOVERED"
  - Appears if two users use the same project over a network
    - In this case, use "Ignore Files"

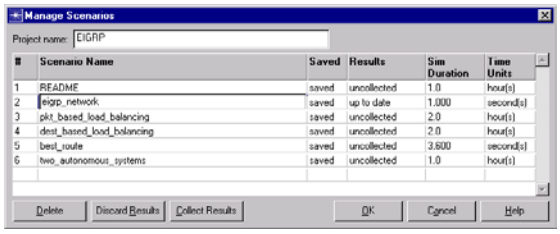
HINT: Use Ctrl-Up, Ctrl-Down to switch between scenarios



File Management: Scenario Management

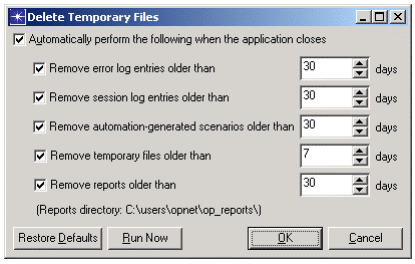
- Scenarios → Manage Scenarios
  - Delete scenarios
    - Click in the 'Saved' column and select 'Delete'
  - Reorder scenarios
    - Click in the '#' column and select from menu
  - Rename scenarios
  - Run multi-scenario Discrete-Event Simulations
    - Set the "Results" column to "collect" to run scenarios

HINT: Use Ctrl-1, Ctrl-2, …, Ctrl-9 to jump to specific scenario



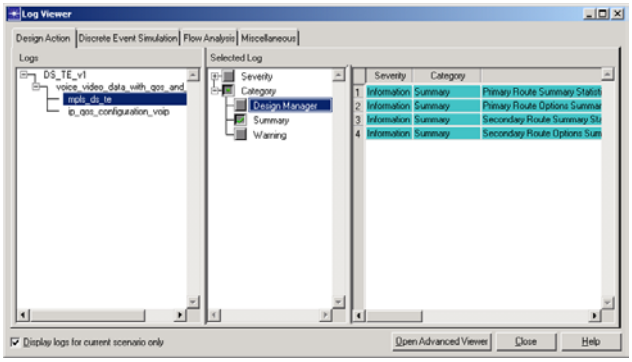
File Management: Temporary Files

- Delete temporary files
  - File → Delete Temporary Files
  - Automatically remove certain types of OPNET-generated files:
    - Temporary files from op_admin\tmp
    - Automation-generated scenarios from models directories
  - Automatically remove old error log and session log entries
  - Use 'Run Now' to perform cleanup immediately



File Management: Log Files

- View log files
  - Help → Show All Logs
  - Displays all the log files related to a scenario
  - Useful to compare and correlate log entries
  - Click **Open Advanced Viewer** button to see each log

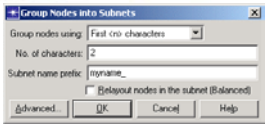


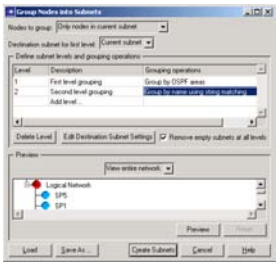
Agenda

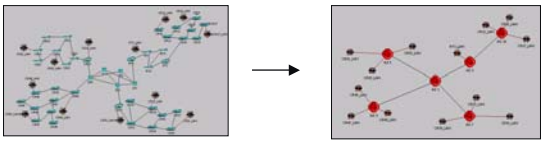
- **Areas of focus**
  - File management
  - **➔Organizing topology**
  - Configuration helpers
  - Visualization and navigation
  - Reporting
  - File exports

Organizing Topology: Node Grouping

- Group nodes into subnets
  - Topology → Group Nodes Into Subnets…
  - Use the simple dialog for straightforward single-level operations
  - Use the advanced dialog if needed:
    - Create multiple levels of subnet hierarchy
    - Customizable grouping algorithms (ODK Module Users)
  - Pre-defined grouping options:
    - OSPF Areas
    - AS Numbers
    - Node Names

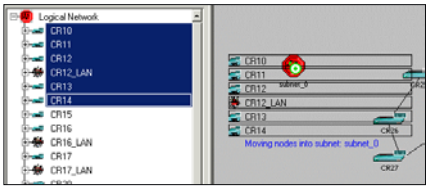


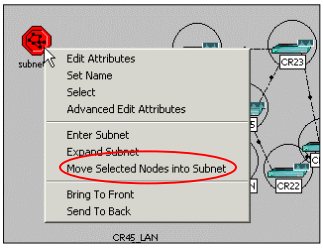




Organizing Topology: Subnet Hierarchy

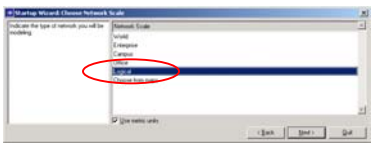
- Modify subnet hierarchy interactively
  - Drag and drop from network browser
  - Drag and drop within the workspace (use Shift key)
  - Right-click menu options
    - Move Selected Nodes into Subnet
    - Move Selected Nodes into Parent Subnet

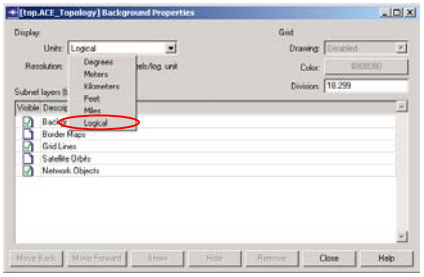




Organizing Topology: Logical Subnets

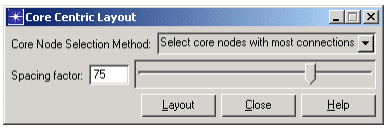
- Use logical subnets when geographic locations are not important
- Simulated locations of objects in logical subnet are set to subnet's position
- Subnet bound grows automatically
- Child subnets need to be logical also
- Use Background Properties dialog to change subnet units to logical



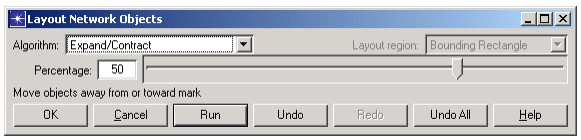


Organizing Topology: Layout Network

- Various automatic layout mechanisms
  - Balanced
  - Simple
  - Core-centric



- Use the interactive layout feature to fine-tune

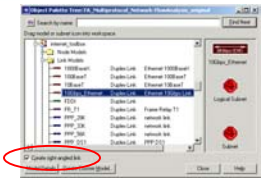


Organizing Topology: Model Assistant

- Problem 1: You changed the network layout after import, but now need to import again
- Problem 2: There's a change you need to apply to all scenarios in your project
- Solution: Model Assistant
  - What can it do?
    - Set object position, icon name, icon size, color
    - Create/remove objects
    - Change object hierarchies
    - Set object attributes
    - ASCII format allows for easy editing
  - Step 1: Create a model assistant file
    - Topology → Model Assistant → Save Current Topology to File, or
    - Topology → Model Assistant → Edit File
  - Step 2: Apply the file
    - Apply during XDI or VNE Server Import, or
    - Topology → Model Assistant → Apply File

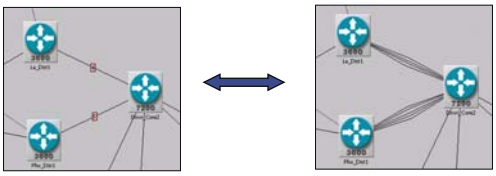
Organizing Topology: Organization Helpers

- Organization helpers
  - Use right-angled links to improve topology layout



  - Add helpful notes to network objects
    - Using attached annotations
    - Using object documentation (Right-click on object and select Edit Documentation)

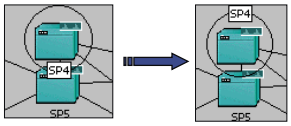
  - Expand and collapse link bundles to customize display of overlapping links



Organizing Topology: Icon Sizing

- Reduce workspace clutter
  - Enable automatic icon scaling
    - View → Layout → Automatic Icon Scaling
    - Adjusts icon sizes of adjacent nodes to remove overlap
    - Ignores node's 'threshold' attribute

  - Enable automatic label placement
    - View → Layout → Automatic Label Placement
    - Label positions automatically changed to prevent overlap with adjacent icons

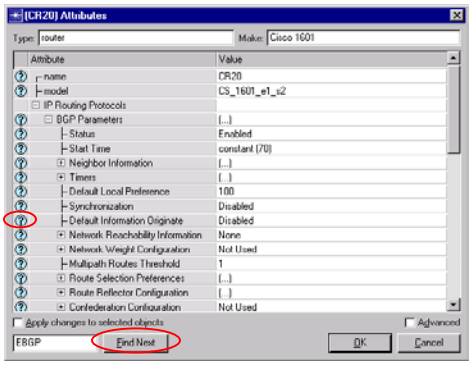


Agenda

- **Areas of focus**
  - File management
  - Organizing topology
  - ➔**Configuration helpers**
  - Visualization and navigation
  - Reporting
  - File exports

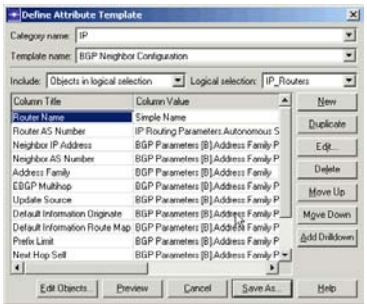
Configuration Helpers: Attribute Dialog Box

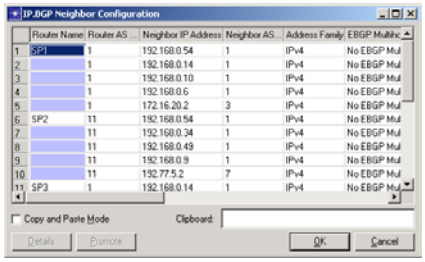
- "Edit Attributes" dialog box
  - Use the "Find Next" button to search for a given term
    - Searches the attribute names as well as the attribute values
  - Click on the '?' button to view details of an attribute
    - Same information is also displayed in the button's tooltip



Configuration Helpers: Group Editing of Attributes

- Edit objects using templates
  - Specify the attributes of interest
    - Edit → Edit Attribute Template
  - Display and edit the interesting attributes
    - Edit → Edit Objects Using Template
  - Attribute templates can also be used to generate user-defined reports

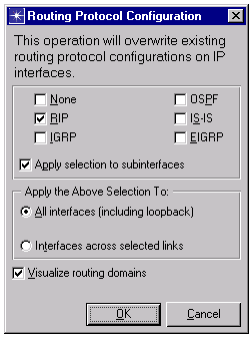




Configuration Helpers: Protocol Menu Features

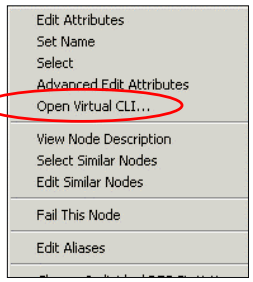
- Configuration menu items from Protocols menu
  - OSPF → Configure Areas…
  - IP → Addressing → Auto-Assign IP Addresses
  - IP → Routing → Configure Routing Protocols…

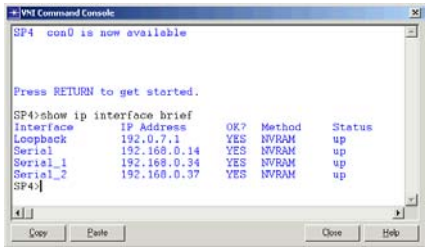
HINT: Use Ctrl-Shift-I to select node with specified IP address



Configuration Helpers: Virtual CLI

- Use the Virtual Command Line Interface (CLI)
  - Available in supported Cisco nodes' right-click menu
  - Use Virtual CLI to:
    - Configure attributes (e.g., shutdown interfaces, change IP address)
    - Display router configuration
    - Display simulation results (e.g., show IP route)



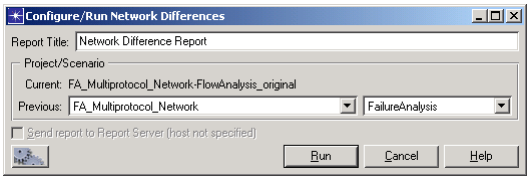


Configuration Helpers: Object/Attribute Differences

- Use "Object/Attribute Differences" to investigate model/structural-level differences between scenarios
  - Scenarios → Object/Attribute Difference Report → Generate Report
- Why would you need to do this?
  - Compare a modified scenario against its baseline scenario
  - Compare one project's version of a scenario to another project's version
  - Compare the in-memory version of a scenario to the on-disk version
    - Recall changes made since last save
      - Choose the current scenario as the "To" scenario
    - Evaluate the effect of model attribute converters
      - Switch to scenario and answer "No" to the conversion
      - Compare to on-disk version of the same scenario (which will be automatically converted)

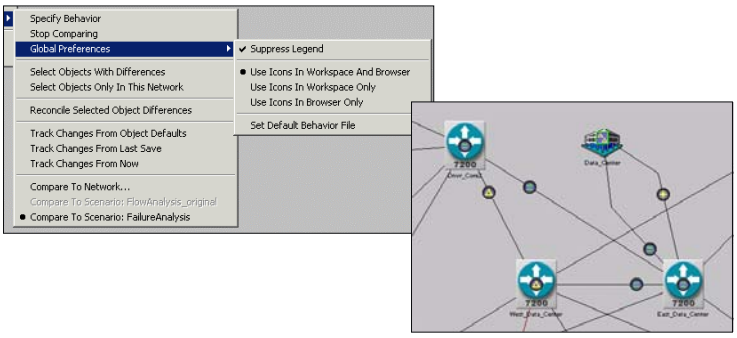
Configuration Helpers: Network Difference Report

- Use Network Difference Report to identify and report on high-level configuration differences
  - Scenarios > Network Difference Report > Generate Report
  - Inspect generated report
- Why would you need to do this?
  - Helps to answer, at a higher level, differences between two scenarios
    - How did the OSPF configuration change?
    - How did the access lists change?
  - View differences in the raw configuration files that may have caused these changes

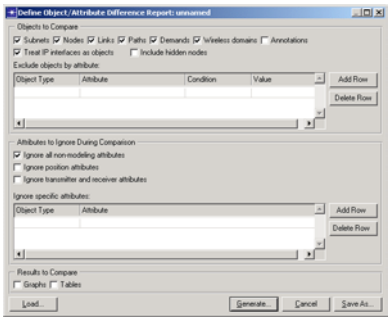


Configuration Helpers: Live Object/Attribute Differences

- Use "Live Object/Attribute Differences" to visualize differences
  - Scenarios → Live Object/Attribute Differences
  - Specify the differences of interest
  - Choose the comparison mode
  - Reconcile differences



Lab 1: Object/Attribute Differences



- Use Flow Analysis and Link Load Visualization to identify overloaded links
- Use Live Object/Attribute Differences to identify problematic configuration changes

Lab 1: Summary

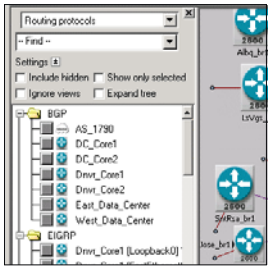
- Flow Analysis enabled you to evaluate network performance and identify overloaded links
- You used Live Object/Attribute Differences to track down a potentially disruptive network configuration error

Agenda

- **Areas of focus**
  - File management
  - Organizing topology
  - Configuration helpers
  - ➔**Visualization and navigation**
  - Reporting
  - File exports

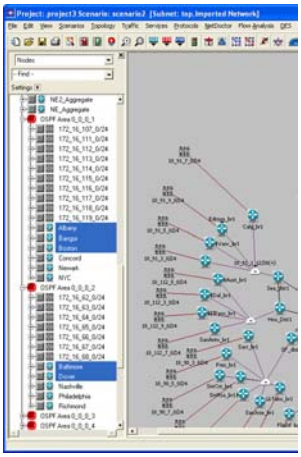
Visualization and Navigation: Network Browser

- Use the Network Browser
  - View → Show Network Browser ('Ctrl-B' keyboard shortcut)
  - Quickly select objects and operate on them
    - Right-click menu available for objects ("Edit Attributes", etc.)
    - Double-click on object in tree to show that object in the Project Editor window
  - Arrange treeview of network objects in logical groups
    - Objects can appear in multiple groups
    - You can add custom options to the menu, using ODK Module
    - Pre-defined options include:
      - Arrange by OSPF Areas
      - Arrange by Routing Protocols
  - Visualize LSP routes



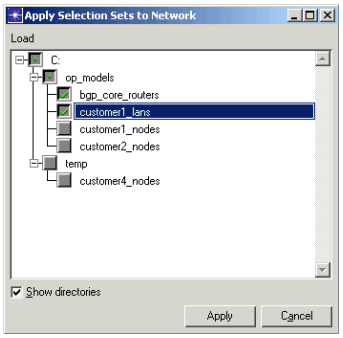
Visualization and Navigation: Object Selection

- Select multiple objects
  - Drag box around area of model
  - Ctrl-click and Shift-click
  - Right-click object and choose **Select Similar Nodes/Links/Demands/Paths**
  - Use **Edit > Select Objects**
- Tip: you can only cut/copy/paste a selection set that comes from a single subnet
- Tip: To create cross-subnet selection sets, use the network browser to select the objects in the treeview



Visualization and Navigation: Retaining Object Selections

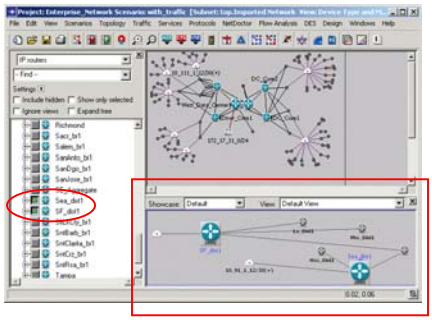
- Use Object Selection Sets to retain selection
  - Edit → Save/Load Object Selection Set
  - Save set of selected objects for later use
  - Combine multiple selection sets
  - Applying the selection set selects the objects in the current network



HINT: Use Ctrl-A to quickly select all objects in current subnet

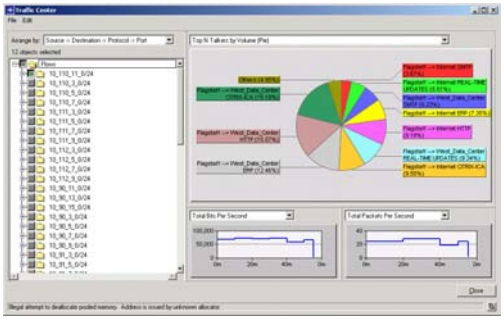
Visualization and Navigation: Network Showcase

- Use the Network Showcase to focus on objects of interest
  - View → Show Network Showcase
  - Featured objects and neighbors are displayed in the showcase
  - Objects in the showcase are laid out automatically
  - Object hierarchy is flattened
  - Multiple showcases can be associated with a scenario



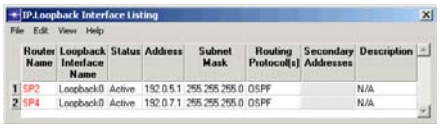
Visualization and Navigation: Traffic Center

- Use the Traffic Center to visualize and edit network traffic
  - Traffic → Open Traffic Center
  - Visualize traffic flows, baseline link, VC and LSP loads
  - Treeview can be arranged differently
  - Various visualization options are available in the multiple panes
  - Macro editing options available via the right-click menu on treeview elements

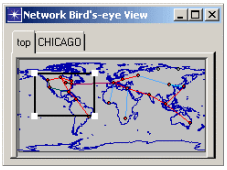


Visualization and Navigation: Bird's-Eye View, Live Report Tables

- Use Live Report Tables to display selected configuration information
  - Scenarios → User-Defined Reports → Open Live Report Table
  - Use 'Edit Attribute Template' to define attributes of interest
  - Desired attributes for selected objects are displayed in the live report

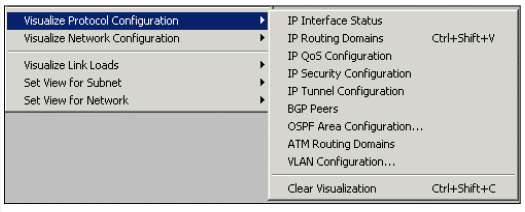


- Use the Bird's-eye View to quickly navigate the network
  - View → Show Bird's-eye View
  - Convenient way to pan and zoom within subnets

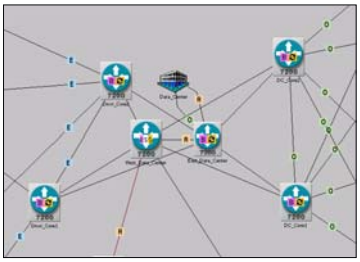


Visualization and Navigation: Protocol-Specific

- Visualize protocol configurations
  - View → Visualize Protocol Configuration

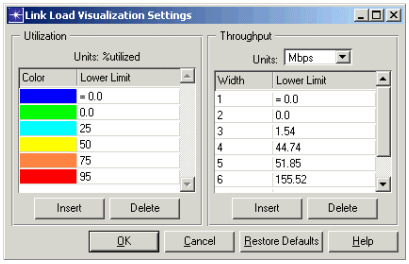


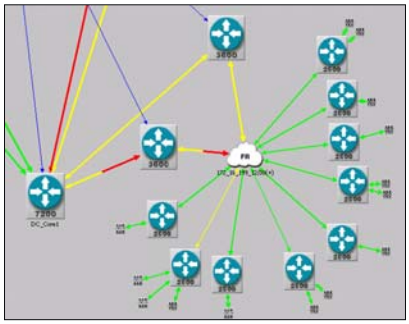
HINT: Use PageUp and PageDown keys to zoom out and zoom in



Visualization and Navigation: Link Loads

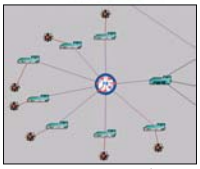
- Visualize link loads
  - View → Visualize Link Loads

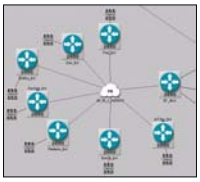




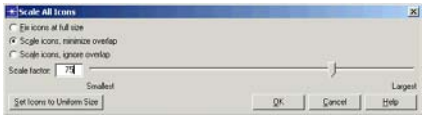
Visualization and Navigation: Object Displays

- Customize the appearance of objects
  - View → Edit Display Preferences
    - Change icon sizes
    - Enable/disable link arrowheads
    - Show/hide object labels
    - Toggle between chassis and symbolic node icons





- Interactively scale selected objects
  - View → Layout → Scale Node Icons Interactively
  - Icon minimizes when image is scaled below globally specified size
  - Minimized icon is a symbol/color specified by "minimized icon" attribute

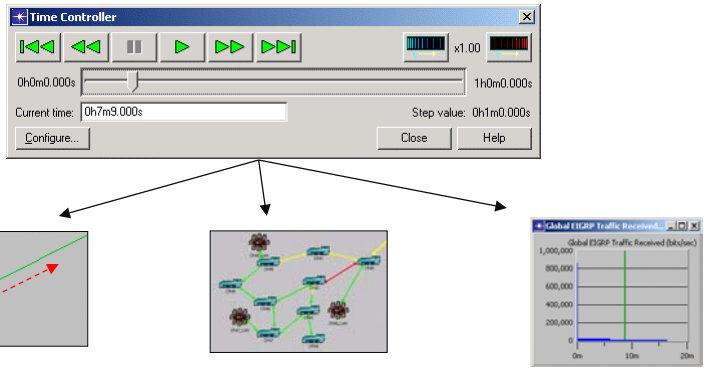


Visualization and Navigation: Views

- Use network/subnet views to filter objects in topology window
  - View → Set View for Subnet/Network
  - New views can be built using ODK module
  - Pre-defined views are available
  - Views can enhance the use of
    - Network browser
    - Results viewer
    - Web reports
    - Top N results: reports and graphs

Visualization and Navigation: Network Time

- Use the Time Controller to visualize effects of changing the network time
  - View → Show Time Controller
  - Mobile nodes move along their specified trajectories
  - If enabled, link load visualizations update based on the time
  - Current time indicator is displayed in results graphs and traffic profiles

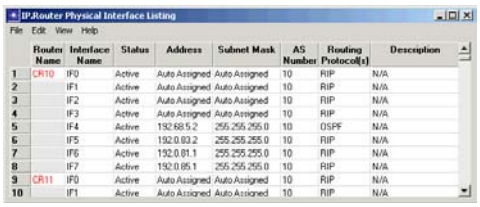


Agenda

- **Areas of focus**
  - File management
  - Organizing topology
  - Configuration helpers
  - Visualization and navigation
  - **➔Reporting**
  - File exports

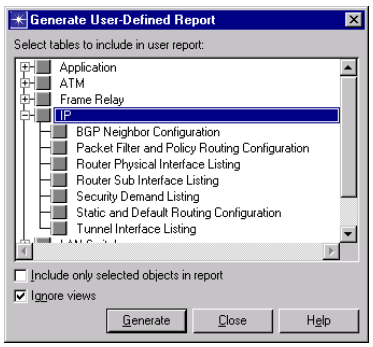
Reporting: User-Defined Reports

- User-Defined Reports
  - Purpose
    - Add/remove/rearrange columns from a standard report
    - Get a quick configuration overview of specific attributes
    - Generate a publishable HTML report
    - Report on only selected objects
  - Specify report columns using attribute templates:
    Edit → Edit Attribute Template
  - Generate the report: Scenarios → User-Defined Reports → Generate Report…



	Router Name	Interface Name	Status	Address	Subnet Mask	AS Number	Routing Protocol(s)	Description
1	CR10	IF0	Active	Auto Assigned	Auto Assigned	10	RIP	N/A
2		IF1	Active	Auto Assigned	Auto Assigned	10	RIP	N/A
3		IF2	Active	Auto Assigned	Auto Assigned	10	RIP	N/A
4		IF3	Active	Auto Assigned	Auto Assigned	10	RIP	N/A
5		IF4	Active	192.68.5.2	255.255.255.0	10	OSPF	N/A
6		IF5	Active	192.0.83.2	255.255.255.0	10	RIP	N/A
7		IF6	Active	192.0.81.1	255.255.255.0	10	RIP	N/A
8		IF7	Active	192.0.85.1	255.255.255.0	10	RIP	N/A
9	CR11	IF0	Active	Auto Assigned	Auto Assigned	10	RIP	N/A
10		IF1	Active	Auto Assigned	Auto Assigned	10	RIP	N/A

Lab 2: User-Defined Reports



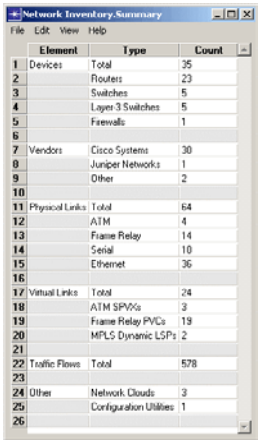
- Configure and generate a User-Defined Report to better understand the network configuration

Lab 2: Summary

- You visualized the network's OSPF Area configuration
- You generated a custom report to further investigate the OSPF configuration in detail

Reporting: Configuration Summary Reports

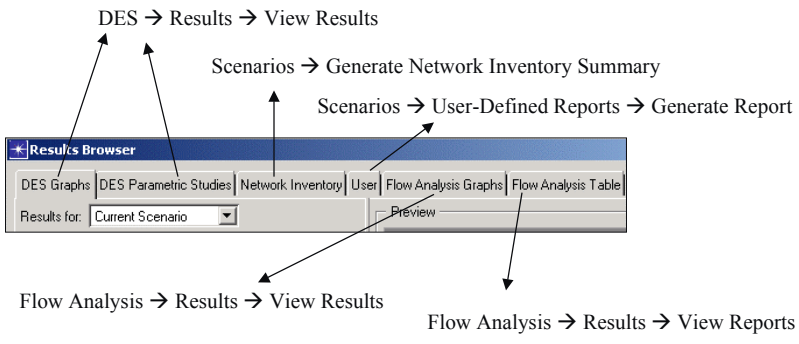
- Generate configuration reports
  - Scenarios → Generate Network Inventory Summary



	Element	Type	Count
1	Devices	Total	35
2		Routers	23
3		Switches	5
4		Layer-3 Switches	5
5		Firewalls	1
6			
7	Vendors	Cisco Systems	30
8		Juniper Networks	1
9		Other	2
10			
11	Physical Links	Total	64
12		ATM	4
13		Frame Relay	14
14		Serial	10
15		Ethernet	36
16			
17	Virtual Links	Total	24
18		ATM SPVCs	3
19		Frame Relay PVCs	19
20		MPLS Dynamic LSPs	2
21			
22	Traffic Flows	Total	578
23			
24	Other	Network Clouds	3
25		Configuration Utilities	1
26			

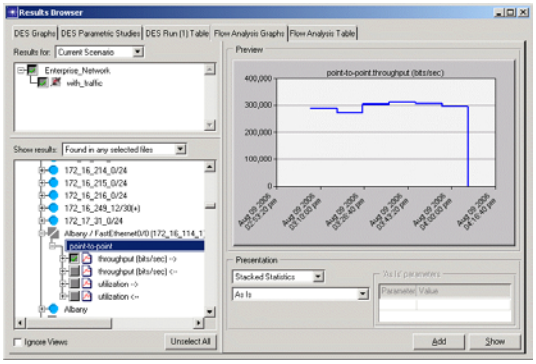
Reporting: View Results

- Results Browser
  - Tabbed interface
  - Each tab corresponds to a source of results information



Reporting: View Results (cont.)

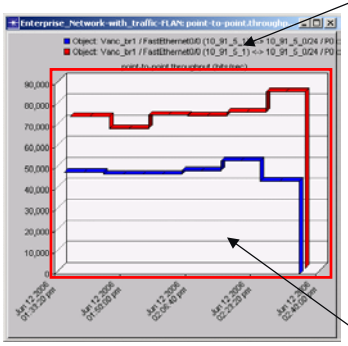
- Results Browser
  - Left side shows result hierarchy; right side shows preview
  - Table pages can generate web report
  - Right-click on objects in network to launch Results Browser with only the graphs and tables of that object

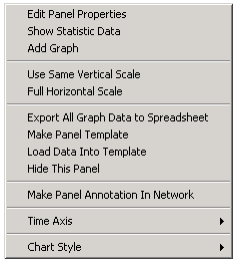


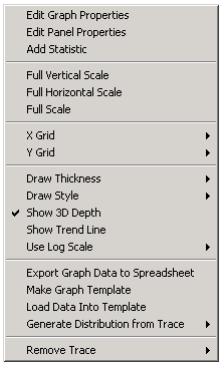
Reporting: Graph Results

- Output graph panels
  - Several functions available on right-click menus

Right-click in margin:







Right-click in graph area:

Agenda

- **Areas of focus**
  - File management
  - Organizing topology
  - Configuration helpers
  - Visualization and navigation
  - Reporting
  - ➔**File exports**

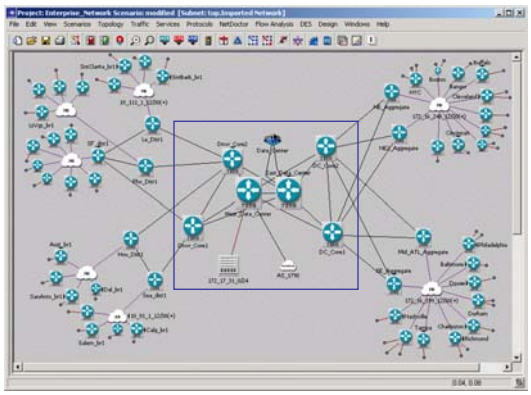
File Exports: Web Reports

- Generate HTML web reports
  - Some workflows that generate web reports:
    - NetDoctor
    - Network Differences
    - Scenario Web Reports
    - Flow Analysis
    - Survivability Analysis
    - VoIP Readiness Assessment
  - "Generate Web Report…" from the Results Browser
  - Generate HTML reports from the output table viewer and log viewer
  - …and more

File Exports: Screen Shots

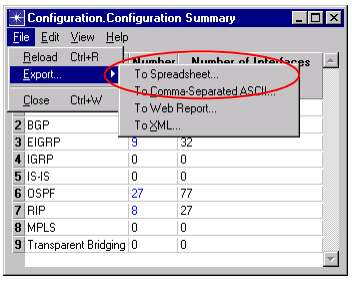
- Generate screen shots
  - Scenarios → Generate Scenario Bitmap
  - Ctrl-T to capture current dialog window
  - Ctrl-Shift-T to capture enclosed region of screen

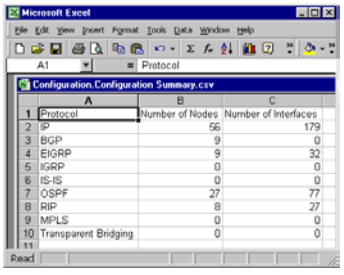
HINT: "File → Print All Subnets" to print layout of complete model



File Exports: Spreadsheet Output

- Export data to Excel
  - "Export All Graph Data To Spreadsheet" from graph margin right-click menu
  - "Export Graph Data To Spreadsheet" from graph right-click menu
  - File → Export → To Spreadsheet from output table panels

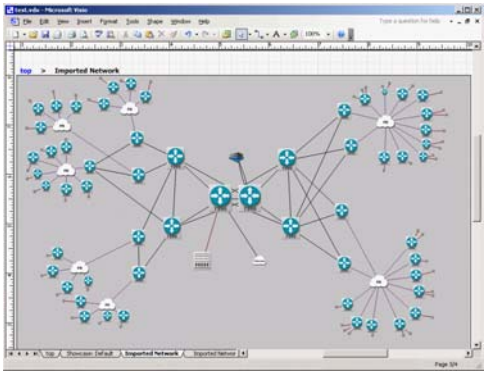




  - Traffic → Export Traffic Flows → To Spreadsheet
  - Export from any traffic folder in the Traffic Center
  - Topology → Export Topology → To Spreadsheet

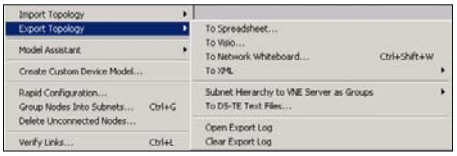
File Exports: Export to Visio

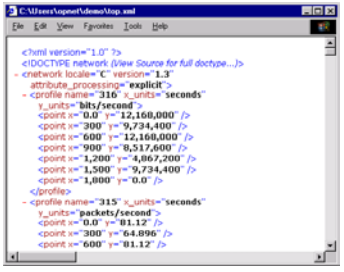
- Export topology to Visio
  - Topology → Export Topology → To Visio
  - Each subnet is exported as a separate page in Visio
  - Network showcases can also be exported



File Exports: Topology Round-Trip

- Round-trip exports
  - Topology → Export/Import Topology → To/From XML
    - OPNET DTD specification: <opnet_release_dir>\sys\etc\network.dtd





- "Topology → Export Topology → To EMA" (Modeler only)
  - EMA can be used to manipulate almost all OPNET model files
  - Alternatively, OMA (OPNET Model Access) API can be used to generate and read output vector and output table files

Technical Support

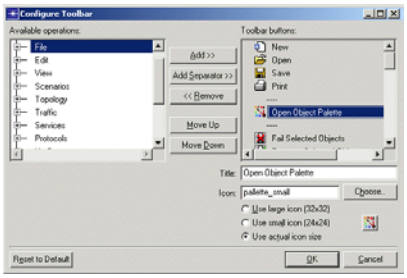
- Use the OPNET technical support website (http://www.opnet.com/support)
  - Search the extensive FAQ database for quick answers
  - Source for:
    - Software updates
    - Contributed models
    - Methodologies and Case Studies
    - And much more …
- Some useful FAQs
  - 1142: What do the various file type suffixes in OPNET represent?
  - 1072: How can I plot one statistic on the x-axis and another on the y-axis?
  - 1043: How can I display results for multiple runs of the same simulation on the same graph?
  - 1071: Can I import/export network, node or process models from/to XML?
  - 898: I know OPNET makes periodic backups of files? How can I restore files from backup?
  - 1061: How do I configure the IP protocol? What are some resources for getting started with IP models?

Take-Away Points

- OPNET provides a variety of features to increase your efficiency in your simulation and modeling projects
  - Manage and share projects using the model directory architecture and creating project file archives
  - Configuration helpers
    - Variety of keyboard shortcuts for common operations
    - Logical subnets, network browser, network showcase and bird's-eye view for navigating large networks
    - Traffic Center for efficiently viewing and manipulating large traffic datasets
    - Protocol visualizations, network views, and configuration wizards
  - Reporting infrastructure
    - User-Defined Reports to create custom reports
    - Network Difference reports to understand changes in your network configuration
    - Options for exporting reports/simulation output to spreadsheet and web reports

Appendix A: General UI Tools

- Configure your toolbar to add buttons for frequently used operations



- Use keyboard shortcuts
  - Ctrl-Alt-Z to zoom to all objects in subnet
  - Ctrl-B to open and close the network browser
  - Ctrl-Up and Ctrl-Down to switch between scenarios

Appendix B: Simulation Execution

- Automatically execute DES runs with multiple seed values
  - Automatically generates multiple simulation sets
  - Saves results for each simulation set