# NISTIR 7726

# Graphical User Interface (GUI) for Project 25: Inter-RF Subsystem Interface (ISSI) GUI Version 0.9.6

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# Disclaimer

Certain trade names or company products are mentioned in this document to specify adequately the software used for developing and supporting the Graphical User Interface for Project 25. In no case does such identification imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the software used is the best available for the purpose.

# 1 Overview

There are two parts to the Project 25: Inter-RF Subsystem Interface (ISSI) model:

1) The server program that models the behavior of the ISSI protocol(s), along with the server that allows interaction with the graphical user interface application (GUI).
2) The GUI allows for entering network topology configuration information destined for the server program; and it processes the output files from the server program to playback the simulation scenarios to the user.

The server program is meant to be used as is. This program simulates the behavior of the P25 ISSI protocol [1].

The GUI performs two distinct tasks: 1) It allows for designing and configuring simulated networks into projects that are used as inputs to the server program; 2) it processes the output files from the server program and presents the results in various forms to the user. Its playback mechanism also allows for visualizing the replay of the simulation projects via time lines.

This document covers the graphical user interface. The GUI is a window based application written in the Java programming language; it is used for creating and configuring P25 ISSI network scenarios. These scenarios are saved as simulation projects and their files are transmitted to the simulation server as input files to the server program. The server program generates output files from running the simulation projects; the GUI retrieves the output files from the simulation server, replays and presents the results to the user.

Section 2 contains a quick start guide to using the GUI. Section 3 provides an overall description of the GUI, followed by sections describing in depth details about specific panels offered by the GUI (Topology, Topology Configuration, Statistics, Media, Status and FileViewer panels). Section 10 explains the list of open projects. Section 11 explains how to run the simulation. Section 12 contains a description of the statistics that are collected and the methods used to compute these statistics. Section 13 explains versions and compatibility. Section 14 lists the supported shortcut keys or key-combinations. Section 15 lists the acronyms and section 16 lists references.

Appendix A provides some background information about networks, their compositions and how to build a network using the ISSI Network Simulation Tool and the GUI Application.

Appendix B provides an audio usage guide that describes how to use the audio tool to convert audio files into audio data, and how the audio data can be used in simulation projects.

Appendix C provides a list of common error messages with possible causes. Appendix D lists software tools used with the GUI and Appendix E lists the trademarks.

# 2 Quick start

The ISSI Network Simulation Tool software is written in Java and is supported by multiple platforms such as Windows and Linux. The following descriptions are for installations on the Windows platform:

Step 1:
Start the graphical user interface (GUI) by:

1) Opening "ISSI Network Simulation Tool" under the "Start->All Programs" menu,
2) Double clicking on the "ISSI Network Simulation Tool" shortcut icon on the desktop, or
3) Clicking its quick launch icon.

Step 2:

Step 2a:
Loading an existing project

To load an existing project:

1) Select "File->Open Project" from the main menu bar, or
2) Click the "Open Project…" button at the bottom of the GUI, or
3) Click the open project icon

This will open a browser window that allows for finding projects. Navigate to the appropriate directory (e.g., C:\Program Files\ISSI Network Simulation Tool\scenarios) and select a project to load.

NOTE: Projects are marked with a red diamond preceding the project's name.

Step 2b:
To create a new project, see the appendix for "Network Primer" for more details.

Step 3:
Preparing to run a simulation

Step 3a:
Configure the GUI with the server information (i.e., address and port) by selecting "Project->Project Properties" (Ctrl+P) from the main menu bar.

Step 3b:

Click on the Server button

located on the left hand side of the window to display the server information (i.e., address and port) to be configured

Step 3c:

Click on the Simulation button

located in the left hand side of the window to display the simulation information (i.e., simulation time and simulation seed, as well as debug options)

Step 3d:
Click the "OK" button to return to the main window

Step 4:

Click on the "Launch simulation in the server" icon and authenticate to the server. The menu option "Project->Launch Simulation" or the short cut key-combination "Ctrl-R" can also be used to launch the simulation in the server.

This action:

1) Transmits the project files from the GUI's platform to the server,
2) Runs the simulation in the server, and
3) Retrieves the output files from the server back to the GUI's platform.

IMPORTANT: The current project and its files containing the latest topology and configuration will be saved to the hard drive when any simulation run is done. If the user wishes to keep the original configuration of the project, it is recommended that a copy of the original project be saved using the "File->Save As…" function before making major modifications, then running simulations. However, the user may use the "Edit->Undo" function to revert back to the project's original configuration.

Step 5:
View results

The statistics window can be opened in the following manner:

1) Select "Window->Statistics" from the main menu bar
2) Click on the "Statistics" window tab

For more details on the available statistics, please refer to section 12 (Statistics Computation Methods).

For a comprehensive description of the layouts and actions available within the GUI please read the rest of this document.

# 3 Overall Description of the Application

## 3.1 Initial Window

Figure 1 shows the initial GUI window. The main menu bar is located at the top (File, Edit, Project, View, Tools, Windows, and Help). Below the main menu bar is the icon bar with an icon for opening an existing project file. At the bottom of the window, there are two buttons: "Create Project…" and "Open Project…"

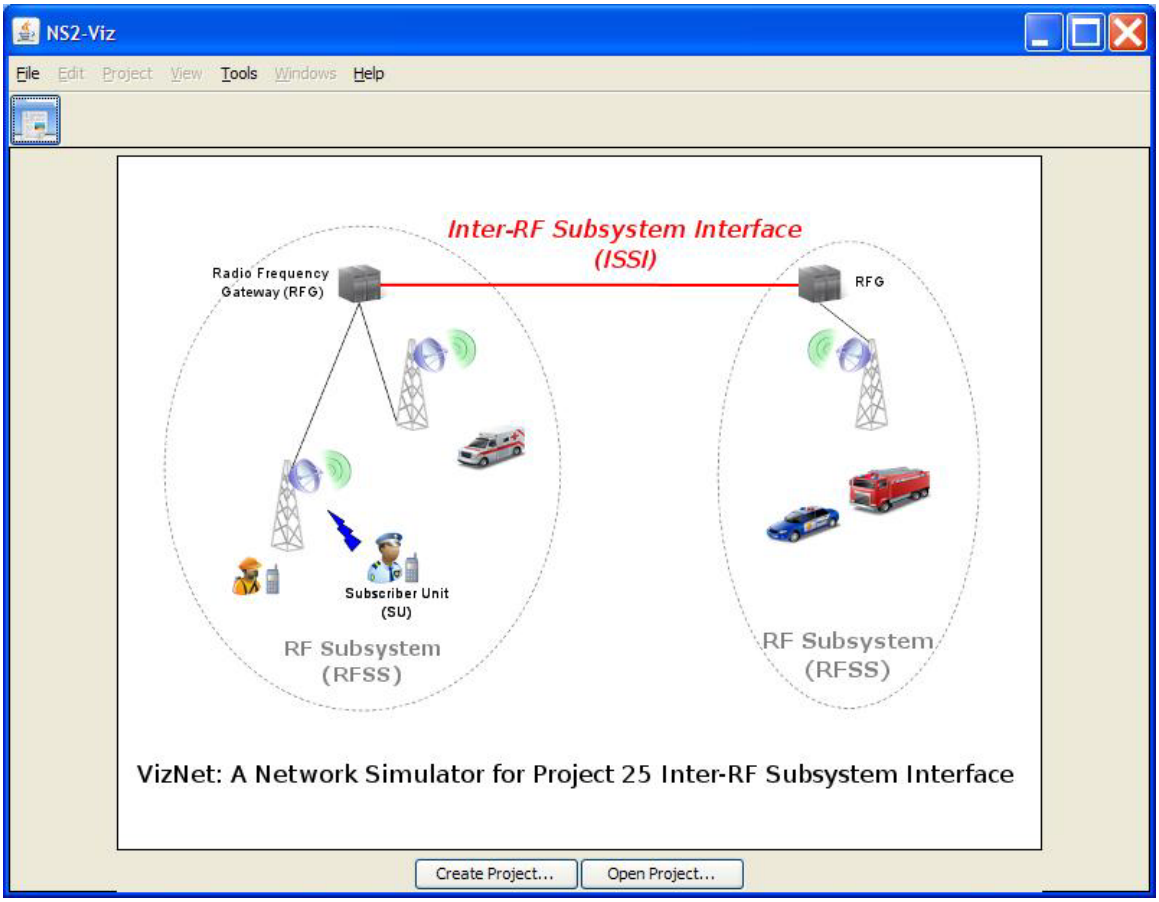
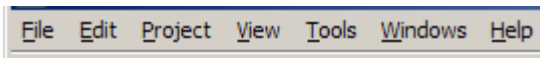



**Figure 1 – Initial GUI Window**

## 3.2 Main Menu bar




### 3.2.1 File Pull-down Menu

The "File" pull-down menu contains the following options:

- New Project (Ctrl+N): Allows for creating a new project (see section 3.4)
- Open Project (Ctrl+O): Opens an existing project
- Close Project (Ctrl+W): Closes the current project
- Save (Ctrl+S): Saves the current project

- Save As: Saves the current project to another directory, using another name, or both
- Exit: Exits the program

### 3.2.2 Edit Pull-down Menu

The "Edit" pull-down menu contains the following options:

- Undo (Ctrl+Z)
- Redo (Ctrl+Y)
- Search (Ctrl+F)
- Modify/Delete SUs
- Preferences (Ctrl+L)

#### 3.2.2.1 Undo/Redo

In design mode (see section 3.2.4.2), when edits have been done to a project's configuration then those edit actions will be displayed under the "Edit" menu item for the user to undo or redo. The number of edits stored for undo and redo is configurable under the "Edit->Preferences" menu option. See section 3.2.2.4.

#### 3.2.2.2 Search

Used to search the project for keywords in the topology objects' names; the results can be limited by selecting the type of objects to be searched (e.g., node, link, SU/group, or application). Selecting "Any" will allow for searching for keywords in all objects' names. See Figure 2.

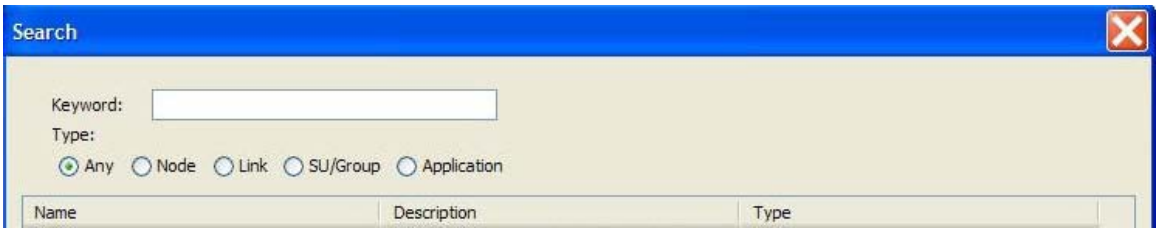



**Figure 2 - Search Parameters**

#### 3.2.2.3 Modify/Delete SUs

This option allows for processing multiple subscriber units (SUs) to do modifications and/or deletions. The term "bulk", used in this context, represents the group of SUs being processed.

Step 1 of 2 allows for choosing SUs by their groups, or by their radio frequency gateways (RFGs) (see Figure 3). Once the SUs have been chosen, the "Next" panel allows for either modifying the SUs' properties or for deleting the SUs, see Figure 4.

Step 2 of 2, if SU modifications were chosen from step 1 above then Figure 5 shows the "SU configuration" panel that allows for bulk SU modifications. Properties that are displayed as "Inherit" indicate that they have different values for the chosen SUs.

Properties that are displayed as anything other than “Inherit” indicate that all of the chosen SUs share those same values.

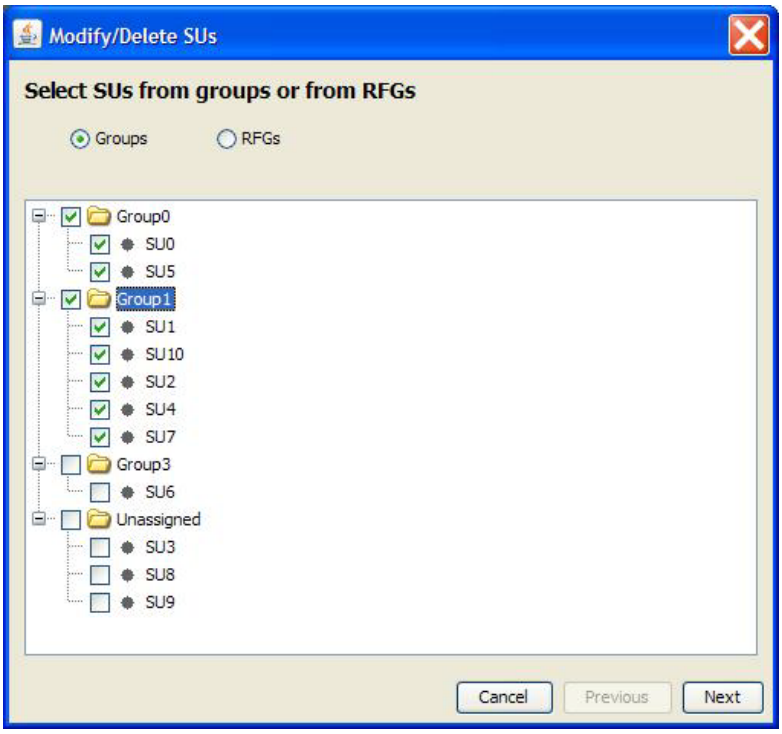



**Figure 3 - Modify/Delete SUs; selecting SUs**

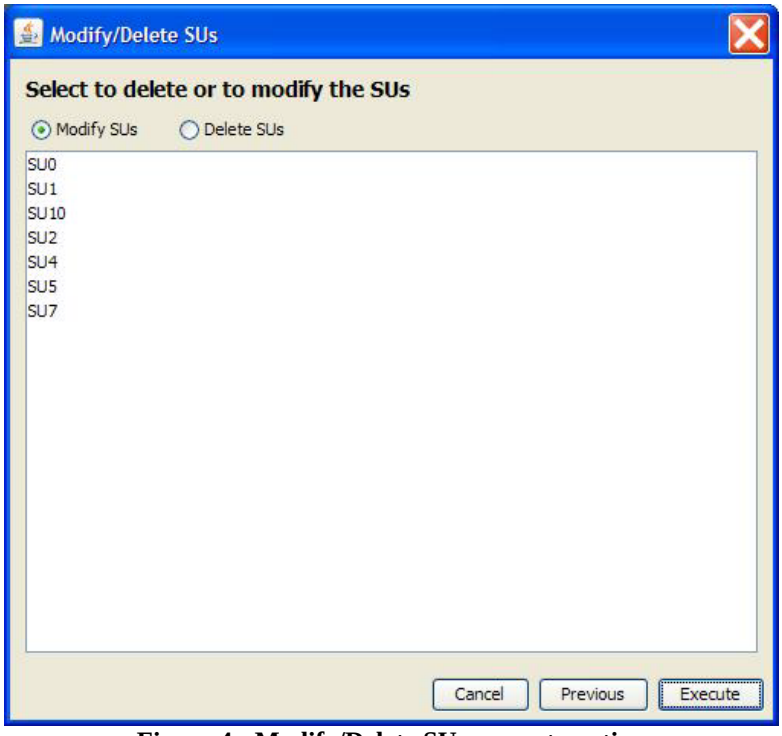



**Figure 4 - Modify/Delete SUs; execute option**

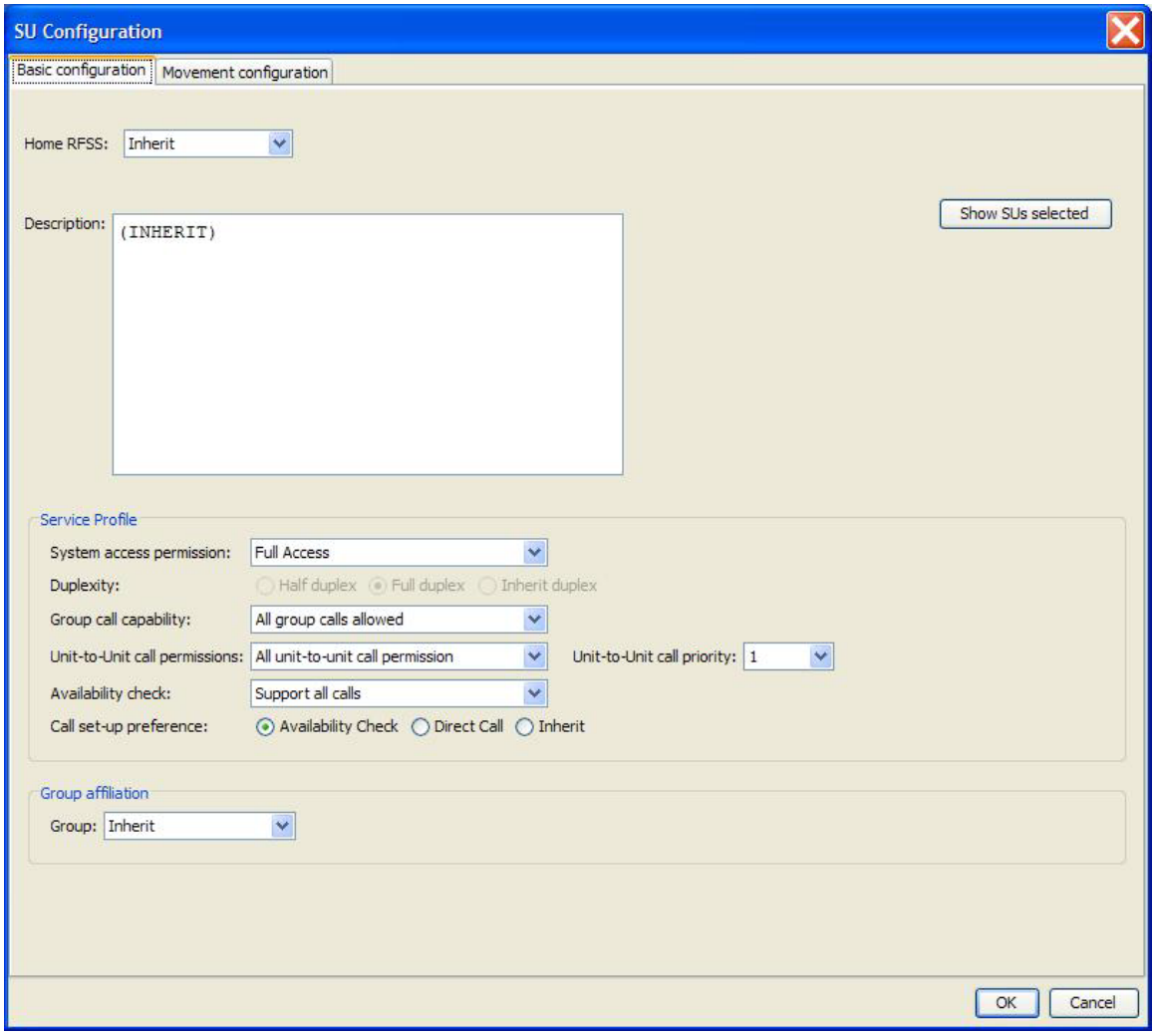



**Figure 5 - SU Configuration Window; modify mode.**

### 3.2.2.4 Preferences

Used to configure default properties for all "new" projects; there are four panels (Properties, Server, Simulation, and Maps).

The "Properties" panel (Figure 6) allows for:

- Configuring the list size for the "Edit->Undo/Redo" feature.
- Configuring additional image directories that are relative to the installation directory of the GUI. Note that background image files and icon image files should be stored in these directories. The search order for image files will start with the directories configured in this panel followed by the GUI's default "image" directory (i.e., from its installation directory).

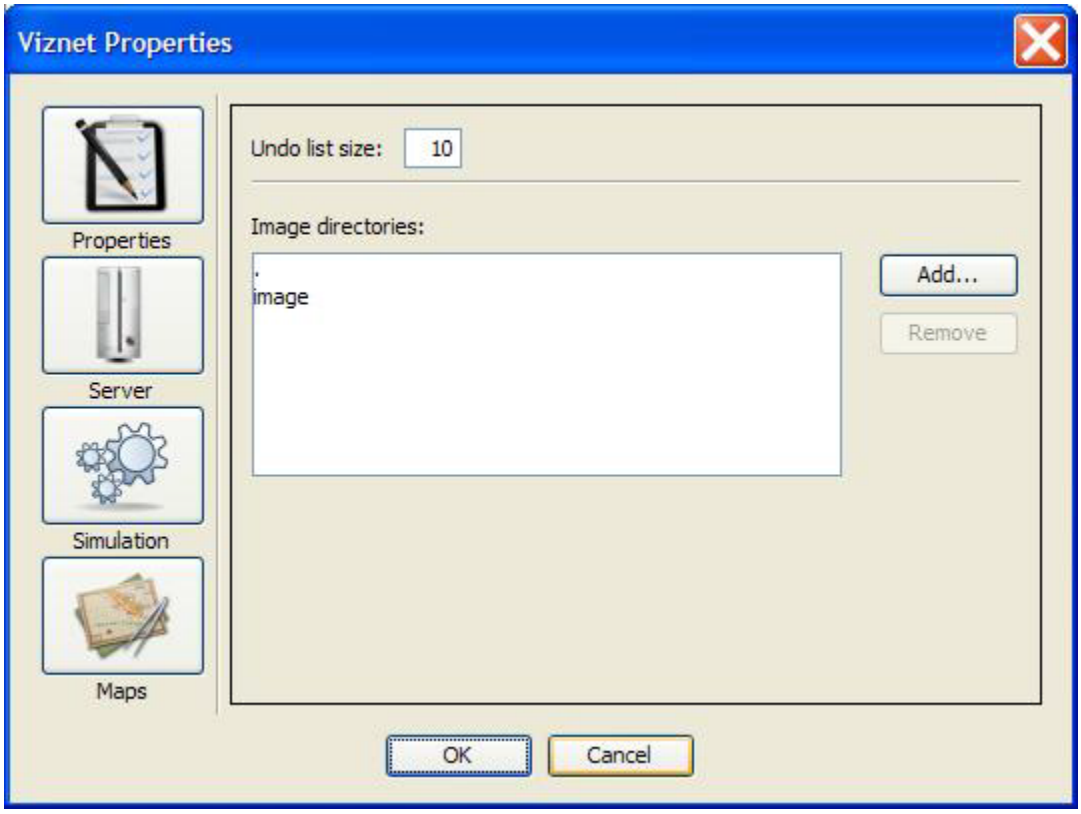



**Figure 6 - VizNet Properties; Properties Configuration**

The "Server" panel (same as under the "Project->Project Properties" main menu option) allows for configuring the default simulation server's address and port, as well as whether to keep or delete the output files on the server after the simulation run is completed. See section 3.2.3.4.2 for more details.

The "Simulation" panel (same as under the "Project->Project Properties" main menu option, except the simulation time is not applicable) allows for configuring the simulation's random number generator's seed, as well as specific debug features. See section 3.2.3.4.3 for more details.

The "Maps" panel allows for selecting existing image files, or for creating and importing maps for use in projects' backgrounds. See section 3.2.2.4.1 for more details.

### *3.2.2.4.1 Selecting or Importing Maps*

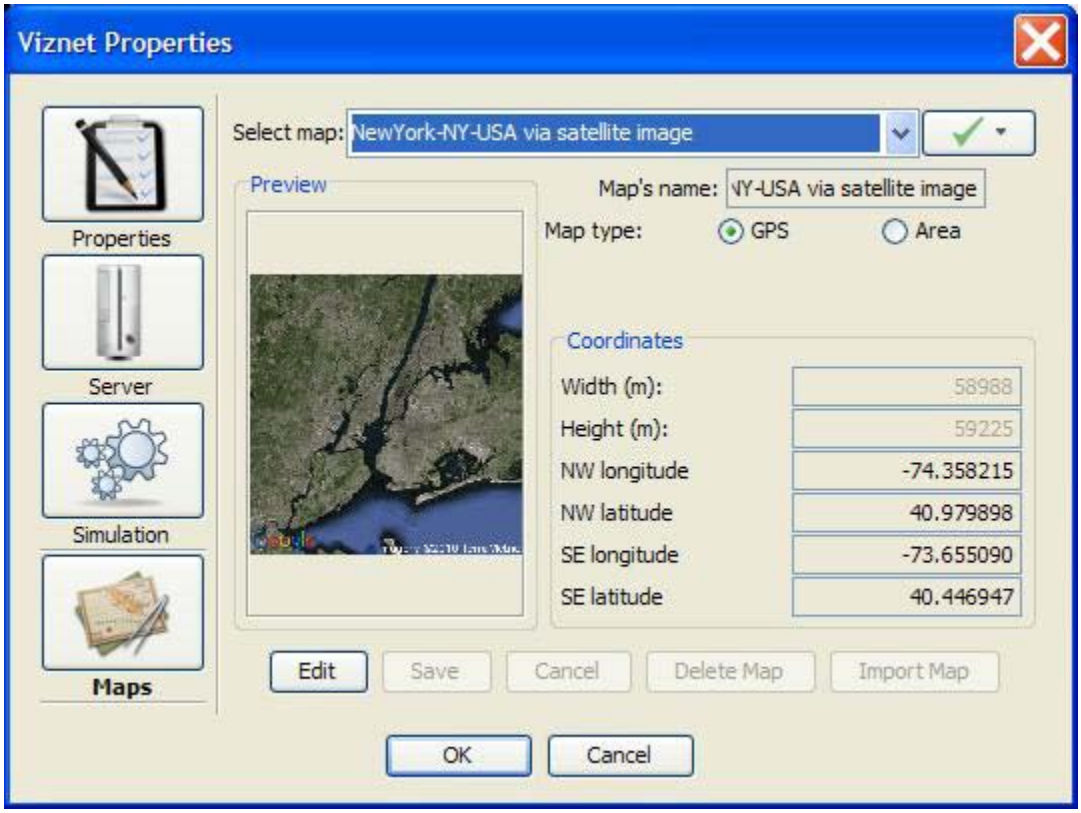



**Figure 7 - VizNet Properties; Maps Configuration**

The "Maps" panel is used to select a map from a set of previously configured and saved maps, or to create and import new maps. See Figure 7.

Use the select button along with the "Select File" dropdown option to open a browser window for importing preexisting map image files (.jpg or .png files). These types of selected maps are referred to as "user created" maps.

Parameters for a newly selected map image file must be entered before that map can be saved to the GUI's maps database. For "user created" maps, use the "Edit" button to update those map's parameters (e.g., the map's name and its type). A map of type Global Positioning System (GPS) uses the parameters NW longitude, NW latitude, SE longitude and SE latitude. A map of type area uses the parameters width and height to configure that area (in meters).

The select button along with the "Google Maps" dropdown option allows for creating and importing new map image files via the "Google Maps" feature. Maps that were imported using the "Google Maps" feature can only have their names modified, all other parameters are static. See section 3.2.5.1.1.1 for more details.

The “Save” button allows for saving the map’s configuration.

The “Cancel” button allows for discarding all changes made from the edit session.

The “Delete Map” button allows for deleting the selected map. A pop-up window will be displayed to confirm the deletion request.

The GUI’s maps database is keyed by map names, some projects may contain maps that are not yet available in the GUI’s maps database, the “Import Map” button allows for importing maps into the GUI’s map database. Figure 8 shows the “NewYork-NY-USA hybrid” map highlighted in green indicating that it can be imported. Once the green highlighted map is selected, the “Import Map” button will be enabled for import purposes.

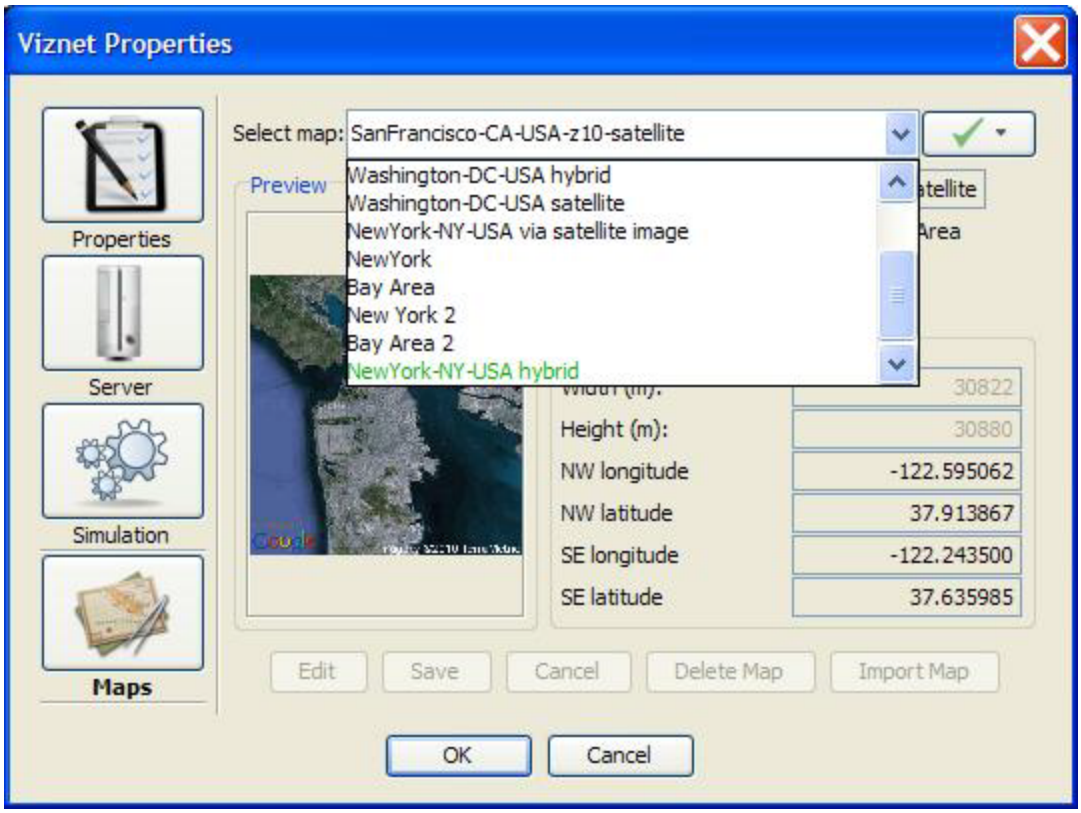



**Figure 8 - Importing a Map**

#### 3.2.2.4.1.1 Creating/Importing Maps Using the Google Maps Feature

From the “VizNet Properties; Maps Configuration” panel, use the select button along with the “Google Maps” dropdown option to open the “Google Maps” window (see Figure 9). For the “Address or Longitude, Latitude” field, enter the location of interest, e.g., “Washington, DC, USA” then click on the “Update” button. Select the desired “Map type” from the dropdown choices (roadmap, satellite, terrain or hybrid). Select the desired “Zoom” level, e.g., 10 then click on the “OK” button to exit the “Google Maps” window. Note that communication with the Google Maps’ servers must be available for this feature to function properly.

Imported maps must have unique names, otherwise the imported map (with its duplicate name) will be presented in the "VizNet Properties; Maps Configuration" panel so that the map's name may be changed. Select the "Save" button to save the new map's configuration to the GUI's maps database or select the "Cancel" button to discard the new map; select the "OK" or "Cancel" button to exit the "VizNet Properties" window.

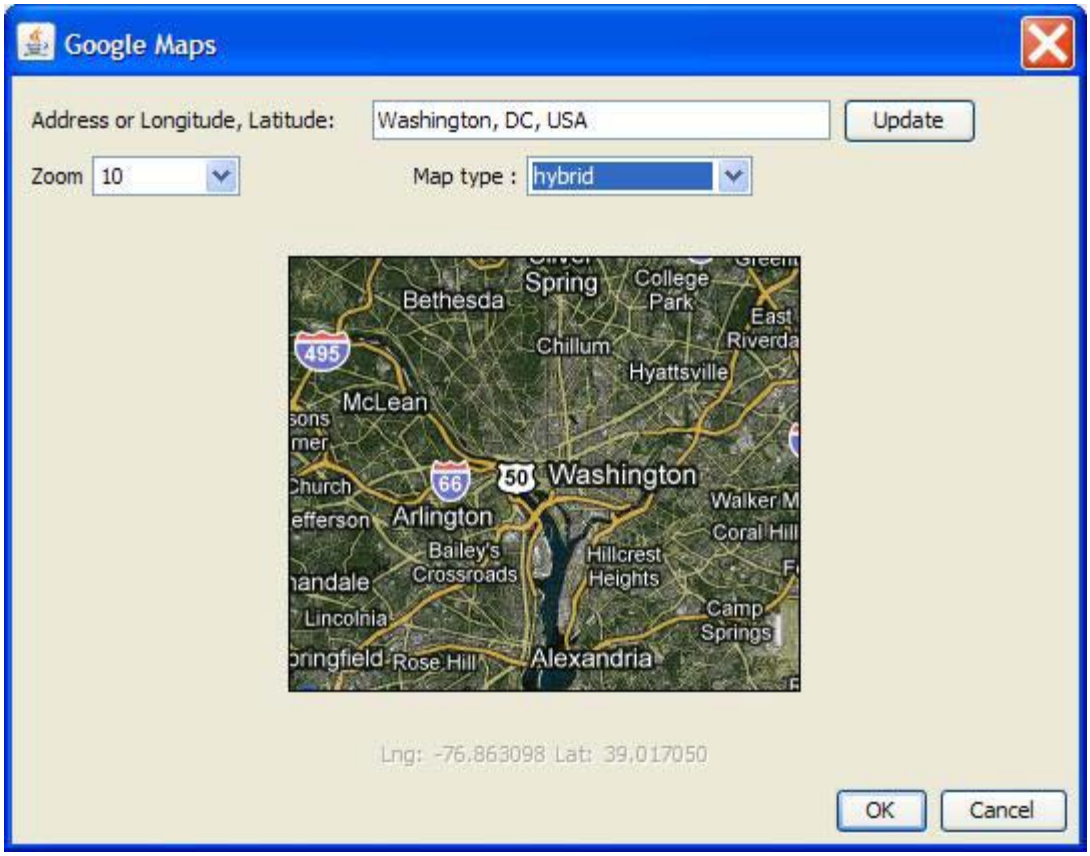



**Figure 9 - Google Maps Window for Creating and Importing Maps**

### 3.2.3 Project Pull-down Menu

The "Project" pull-down menu contains the following options:

- Launch Simulation (Ctrl+R)
- Project Analysis
- Generate Report
- Properties (Ctrl+P)

#### 3.2.3.1 Launch Simulation

Use this option (Ctrl+R) to launch a simulation run on the server.

#### 3.2.3.2 Project Analysis

Available in read-only mode (see section 3.2.4.2), this option loads the "Analysis Wizard" to display analysis results for the project. This section covers the various results that can be generated.

#### *3.2.3.2.1 Load Capacity Analysis Tab*

The load capacity analysis tab shown in Figure 10 displays the statistics about the traffic load per link as well as a suggested capacity to meet the load's criteria for the simulation project. There are two parameters available for computing the "Suggested capacity":

- The "Bandwidth limit" defines the maximum percent of the bandwidth that should be used to support the load. E.g., use up to 80% of the bandwidth to support the load.
- The "Time limit" defines the amount of time acceptable for the load to be greater than the bandwidth limit. E.g., the bandwidth limit can only be exceeded 0.1% of the time.

The "Suggested capacity" represents the link capacity required so that the traffic load on the link will not exceed the "Bandwidth limit" for a period of time greater than the "Time limit".

For requirement analysis, enter the appropriate values for the "Bandwidth Limit" and the "Time Limit" then select the "Compute" button to generate the results that will update the following columns accordingly:

- The name of the link identified by the source and destination node.
- The current capacity of the link (in bytes per second).
- The mean offered load measured from the simulation (in bytes per second).
- The variance of the offered load measured from the simulation (in bytes per second).
- The suggested capacity that could be used to satisfy the parameters set by the user.

Right-click on a cell in the "Suggested Capacity" column displays a pop-up menu option that allows the user to apply the recommended value to the simulation's scenario.

The lower part of the panel shows statistics for the selected link over time. The X-axis represents the time of the simulation and the Y-axis represents the offered load:

- The blue graph displays the offered load. Note that this graph is not continuous since it only displays data when there is traffic on the link.
- The green graph displays the mean offered load.
- The red graph displays the suggested capacity.

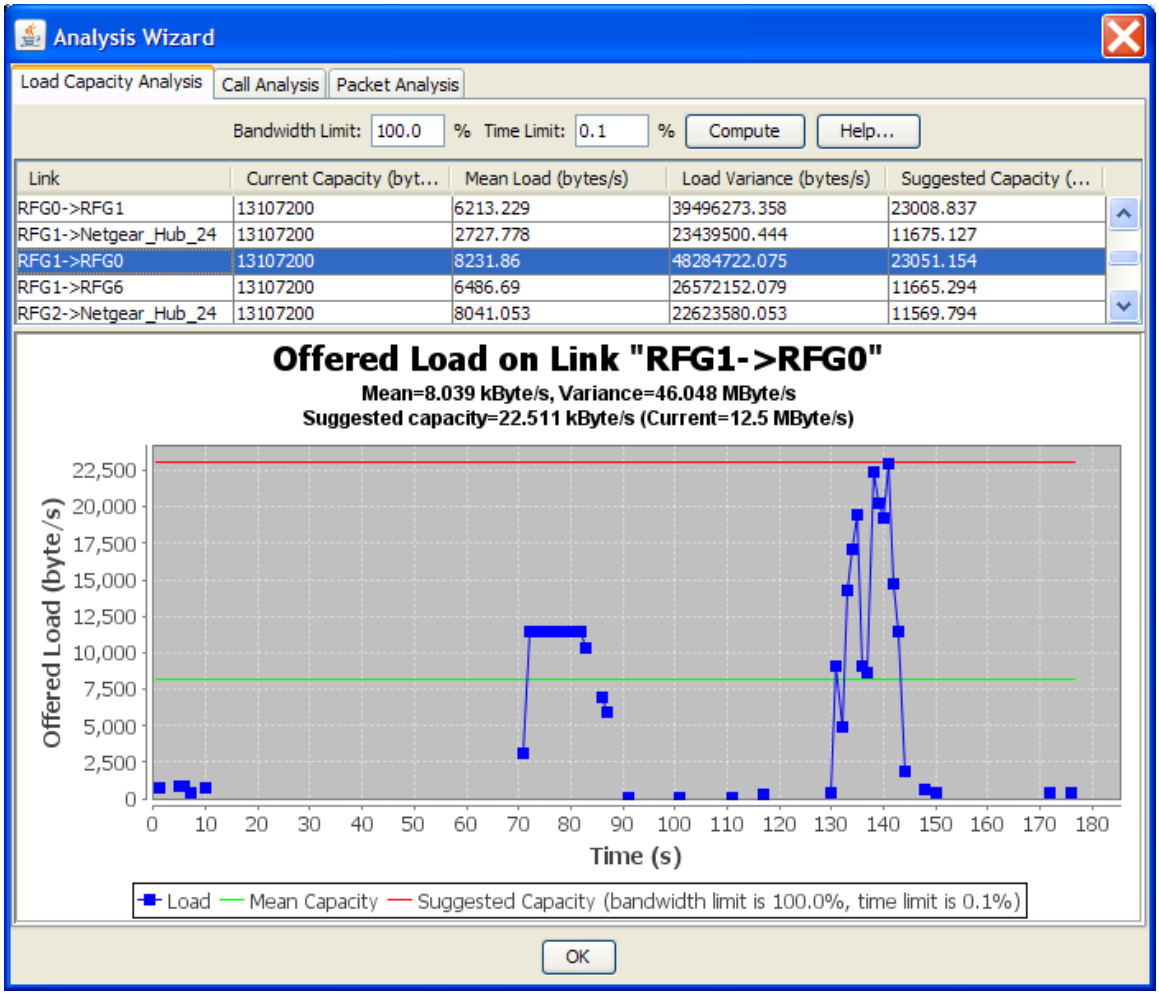



**Figure 10 - Analysis Wizard: Load Capacity Analysis**

### *3.2.3.2.2 Call Analysis Tab*

The "Call Analysis" tab contains two tabs: "Call Statuses" and "Call Delay"

- The "Call Statuses" tab shows the summary of the call statuses.
- The "Call Delay" tab shows the distribution of the call setup delays.

#### 3.2.3.2.2.1 Call Statuses Tab

The "Call Statuses" tab displays the statuses of the calls that occurred during the simulation. This information is provided in three graphical forms contained in their respective tabs: "Numbers", "Percent" and "Pie Chart".

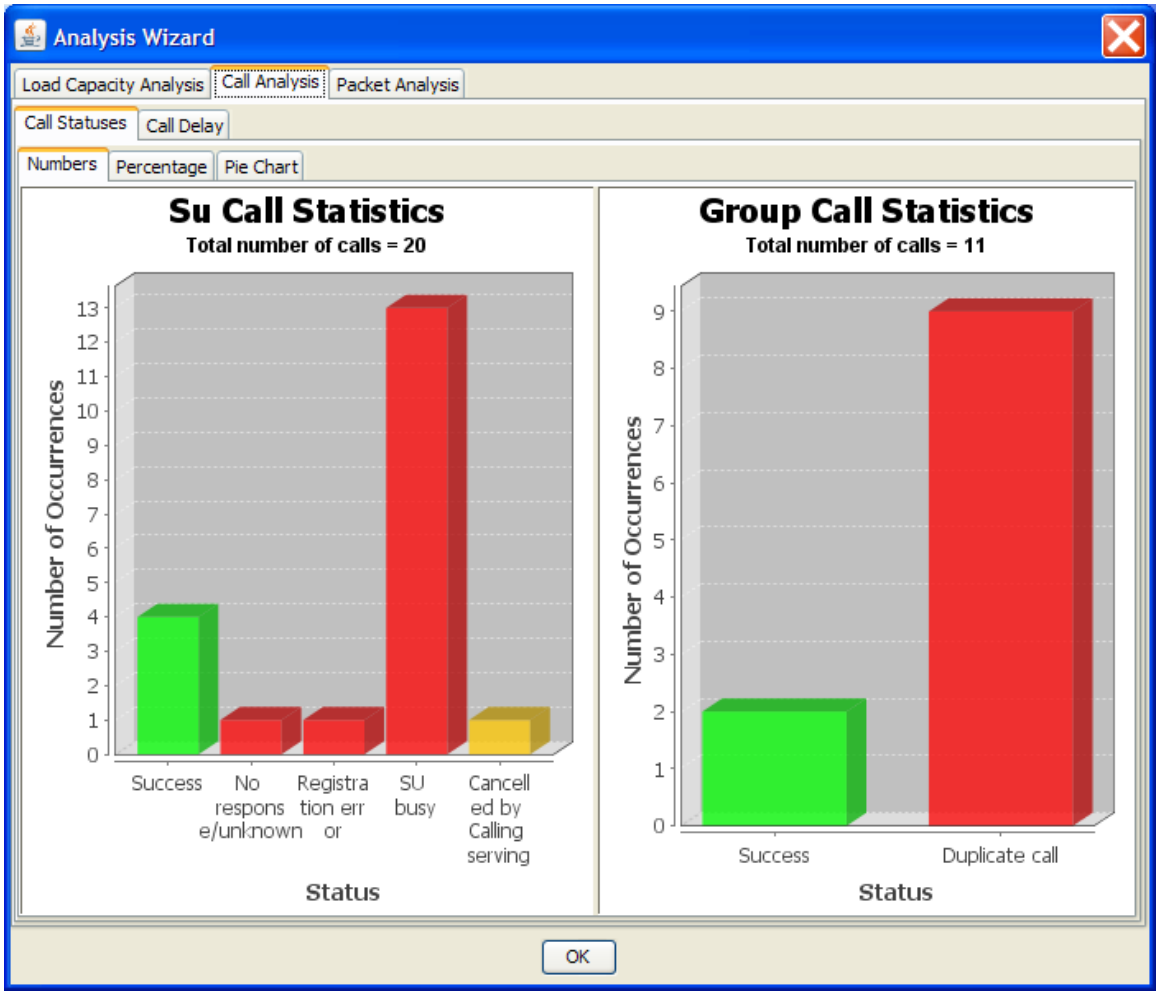



**Figure 11 - Call Statuses (Actual Counts)**

Figure 11 shows the call statuses using their actual counts from the simulation. Successful calls are in green, failed calls are in red, cancelled calls are in orange, all other statuses are in blue. The number of calls for each type of status is shown. The Unit-to-Unit calls are displayed on the left and the Group calls are displayed on the right.

Figure 12 shows the statuses in terms of percentage rather than their actual counts. It allows for immediate observation of the percentages of each status for Unit-to-Unit Calls and Group Calls.

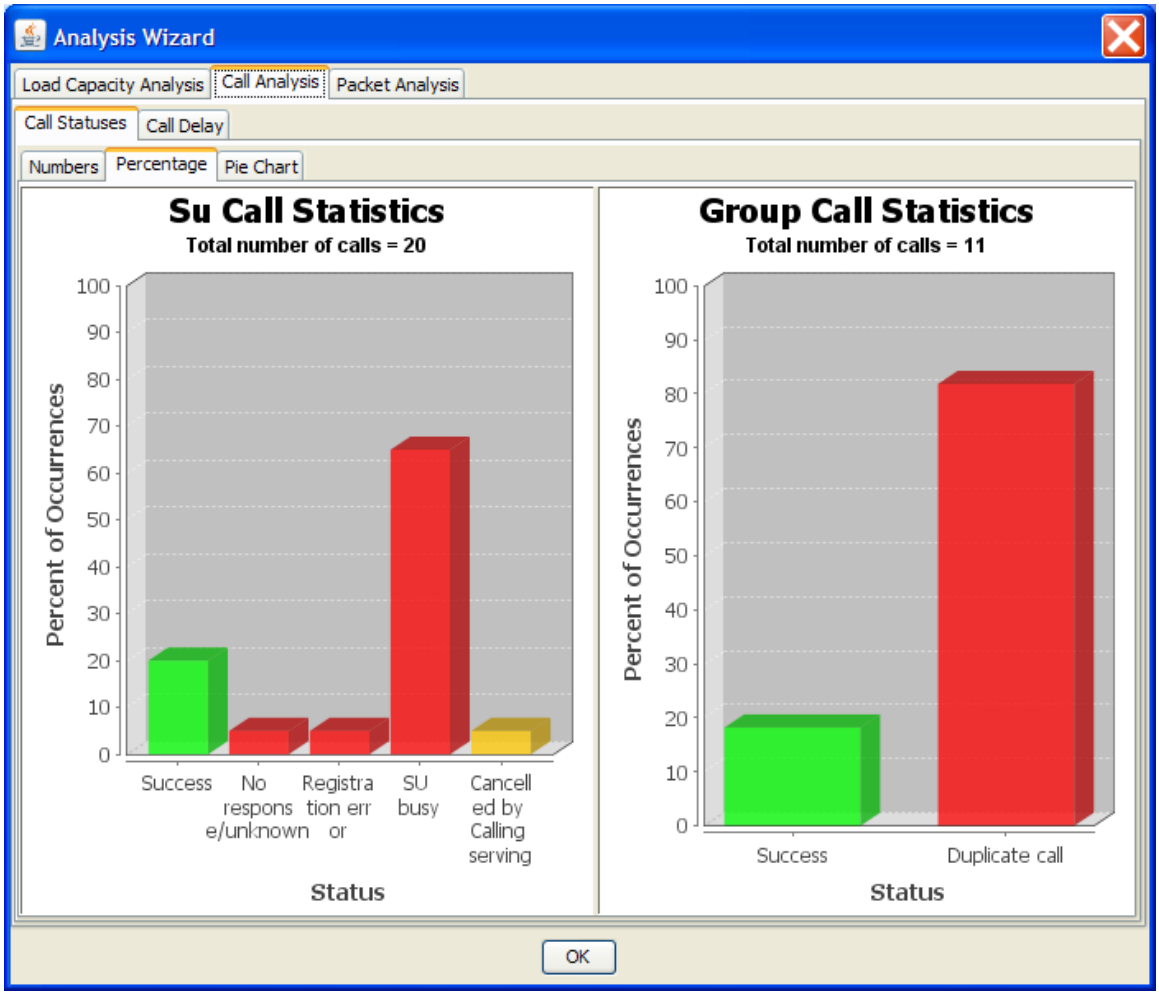



**Figure 12 - Call Statuses (Percentage)**

Figure 13 shows the percentage information using a pie chart diagram instead of a histogram.

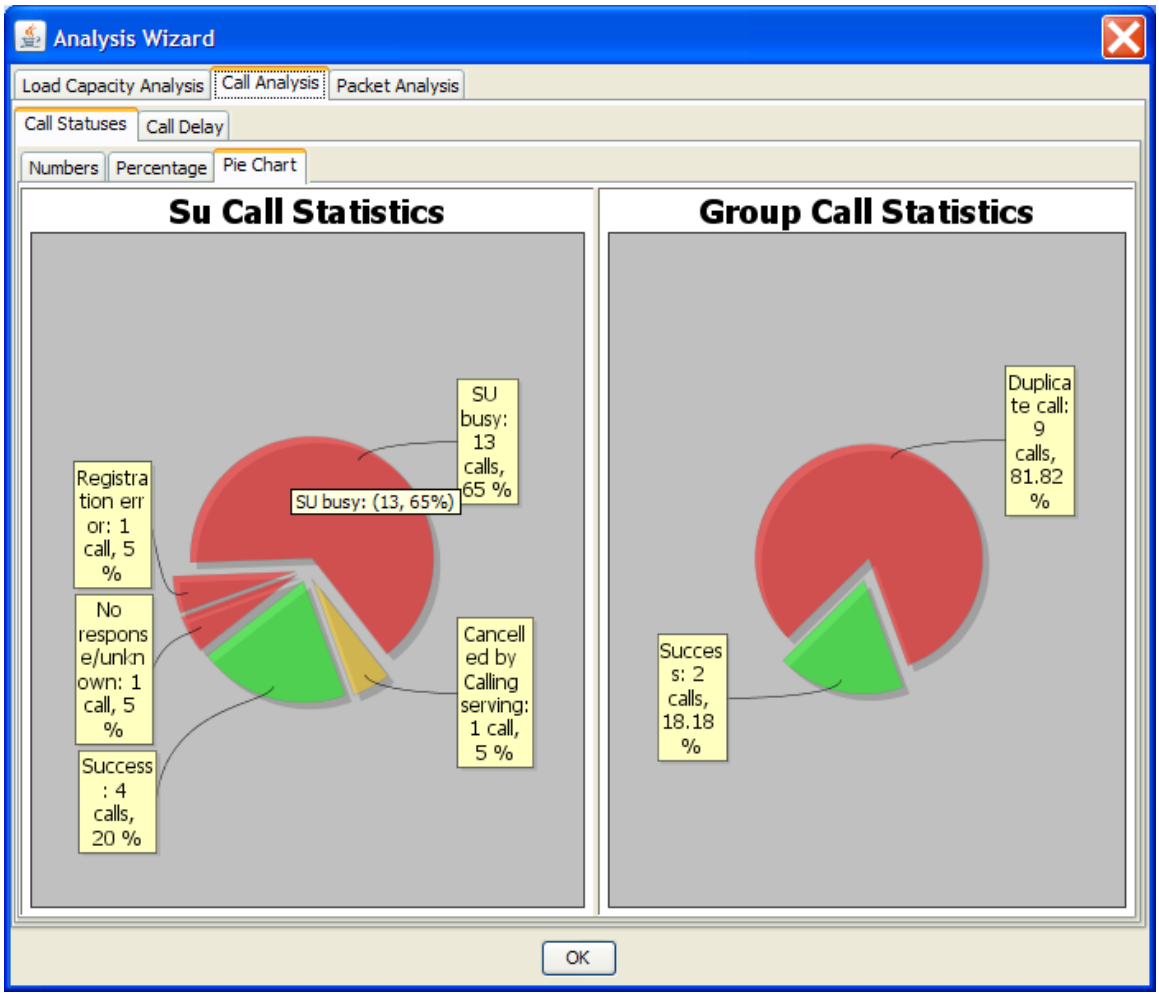



**Figure 13 - Call Statuses (Pie Chart)**

#### 3.2.3.2.2.2 Call Delay Tab

Figure 14 shows the call delay analysis. “Unit-to-Unit” calls (SU Calls) are displayed on the left and “Group” calls that are displayed on the right. The X-axis represents the delay time. The red data points indicate the number of calls versus the call delay. The graph represents the distribution of the delay. The blue line represents the cumulative percentage for the distribution of delays; it always starts at 0% and always ends at 100%. Figure 6 shows an example with 90% of the “Unit-to-Unit” calls having setup delays lower than 0.5 second.

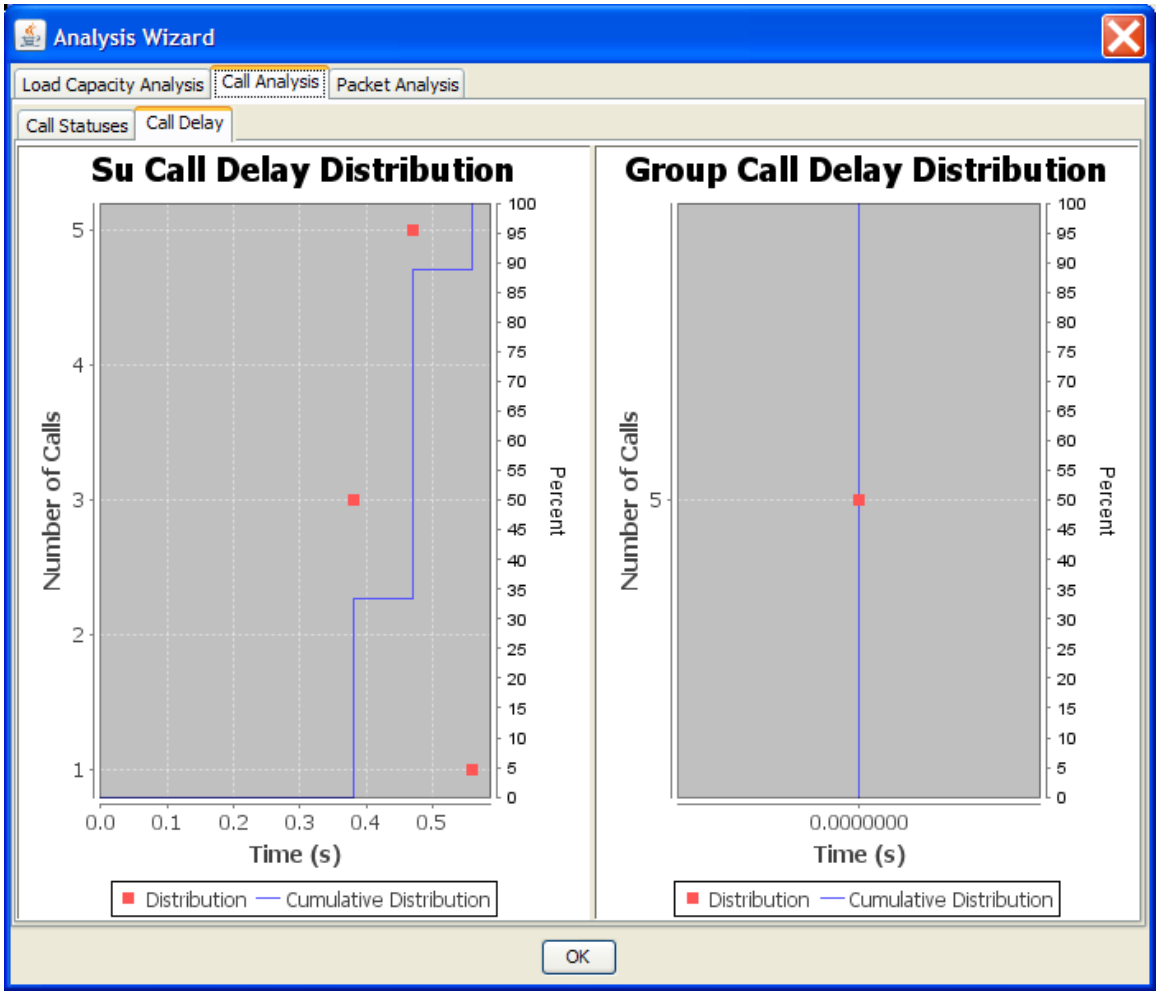



**Figure 14 - Call Delay**

### *3.2.3.2.3 Packet Analysis Tab*

The "Packet Analysis" graph shows information about the packets going through each link. The Y-axis shows the number of occurrences for:

- Packets sent (indicated in blue)
- Packets received (indicated in green)
- Packets dropped (indicated in red)

This graph can be helpful in finding busy or defective links (as shown in Figure 15). See section 12 (Statistics Computation Methods) for details on how statistics are calculated.

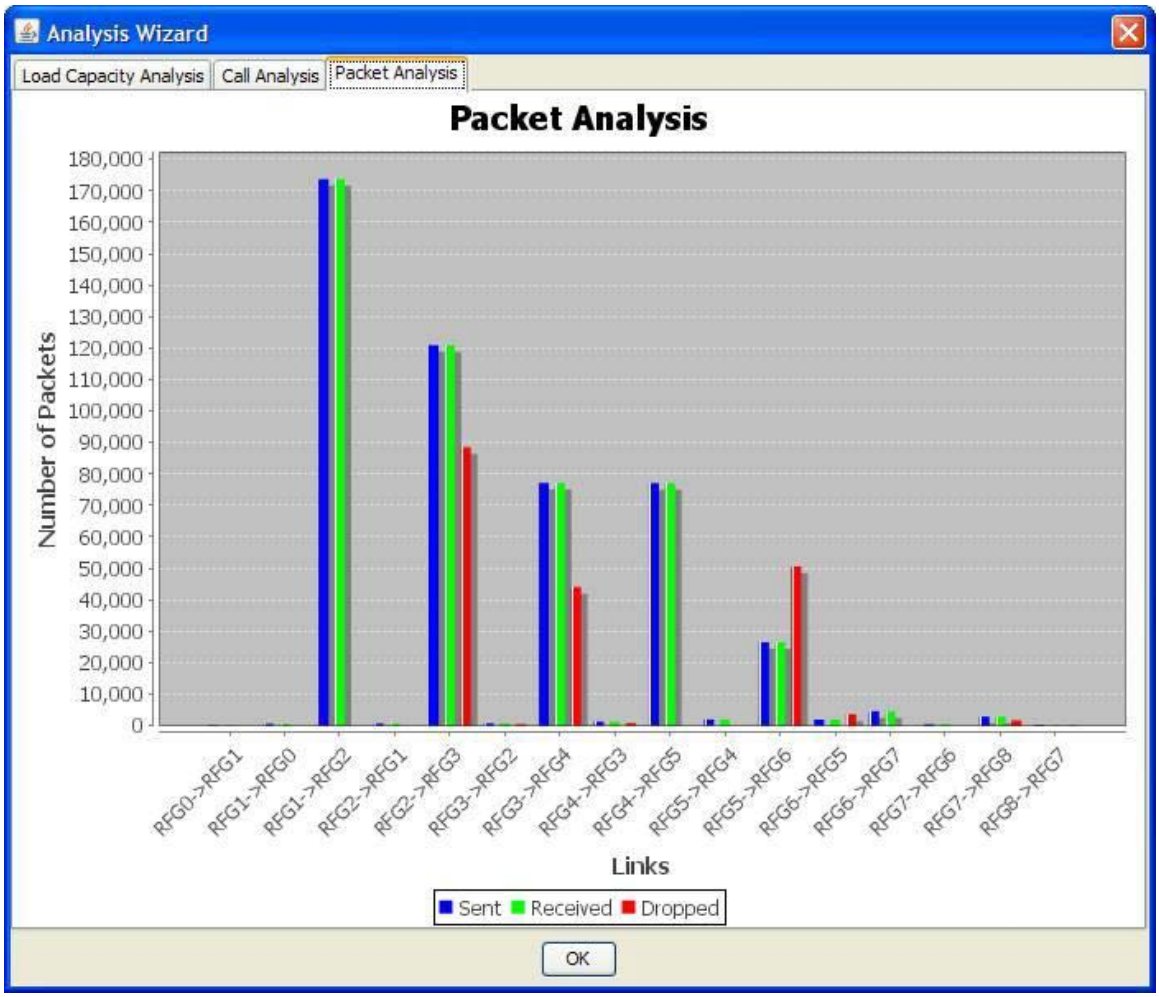



**Figure 15 - Packet Analysis**

### 3.2.3.3 Generate Report

Used to generate a Portable Document Format (PDF) report of the simulation topology and/or statistics; there are four panels for selecting the information to be present in the generated report.

Step 1 of 4 allows for selecting the topology items to be included in the report. Use the plus/minus icons to display more/less specificity. Click the “Next” button to go to the next step. See Figure 16.

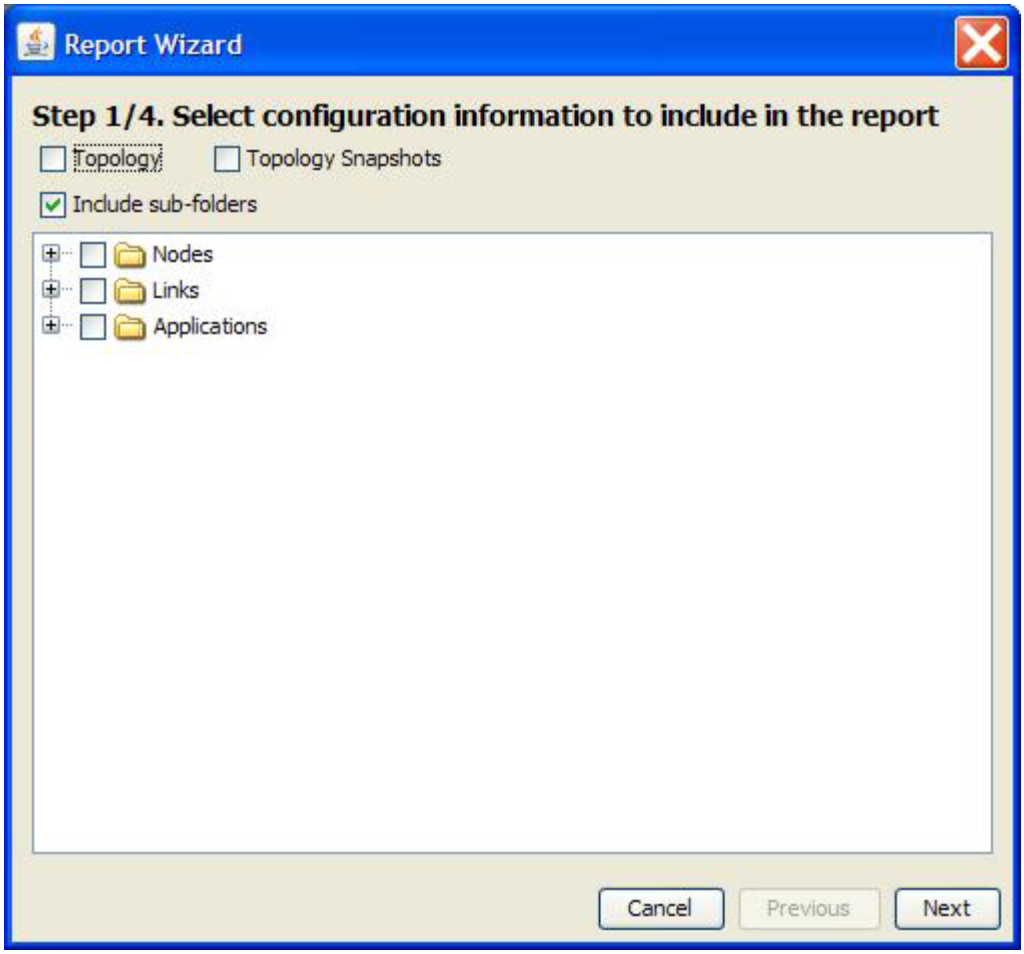



**Figure 16 - Generate report: Step 1 of 4**

Step 2 of 4 allows for selecting statistical items gathered from the simulation run. Use the plus/minus icons to display more/less specificity. If a simulation was not run, then there will be no statistics to report. Click the “Next” button to go to the next step. See Figure 17.

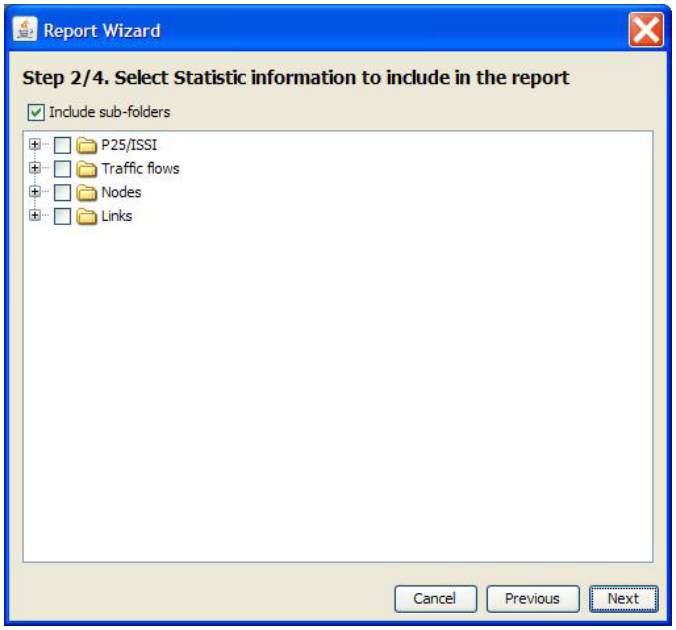



**Figure 17 - Generate report: Step 2 of 4**

Step 3 of 4 allows for selecting items from the simulation analysis to be included in the report. See section 3.2.3.1 for more details about the “Analysis Wizard”. Click the “Next” button to go to the next step. See Figure 18.

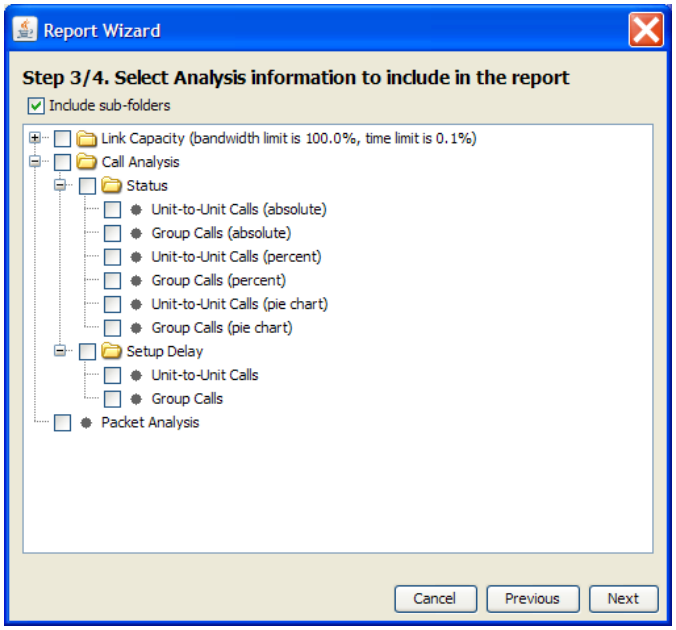



**Figure 18 - Generate report: Step 3 of 4**

Step 4 of 4 allows for configuring paging and printing options for the report. Click on the "Generate" button to bring up a browser window to specify the location and name for the report. See Figure 19.

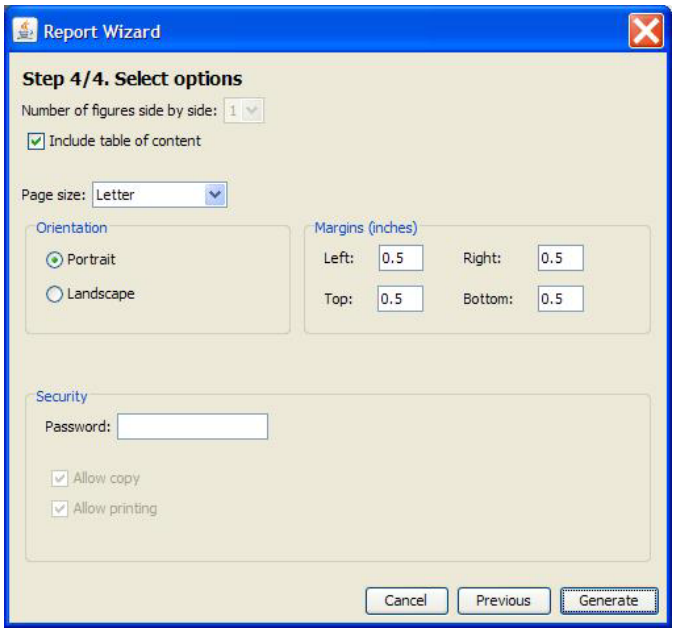



**Figure 19 - Generate report: Step 4 of 4**

## 3.2.3.4 Properties

Used to edit the project and configure the server and simulation information for the current project. There are three panels, one for each set of parameters. Navigation to each of the panels is done by clicking on one of the three buttons located on the left column of the window.

### *3.2.3.4.1 Properties Panel*

Used to modify the project's properties such as its title, description and topology; this is the default panel when selecting the "Project->Properties" menu option. See Figure 20.

NOTE: The "Project Name" represents its folder's name on the physical medium (i.e., the hard drive) and the "Project Title" is displayed along with its "Description" in the browser window when it is selected. See Figure 35.

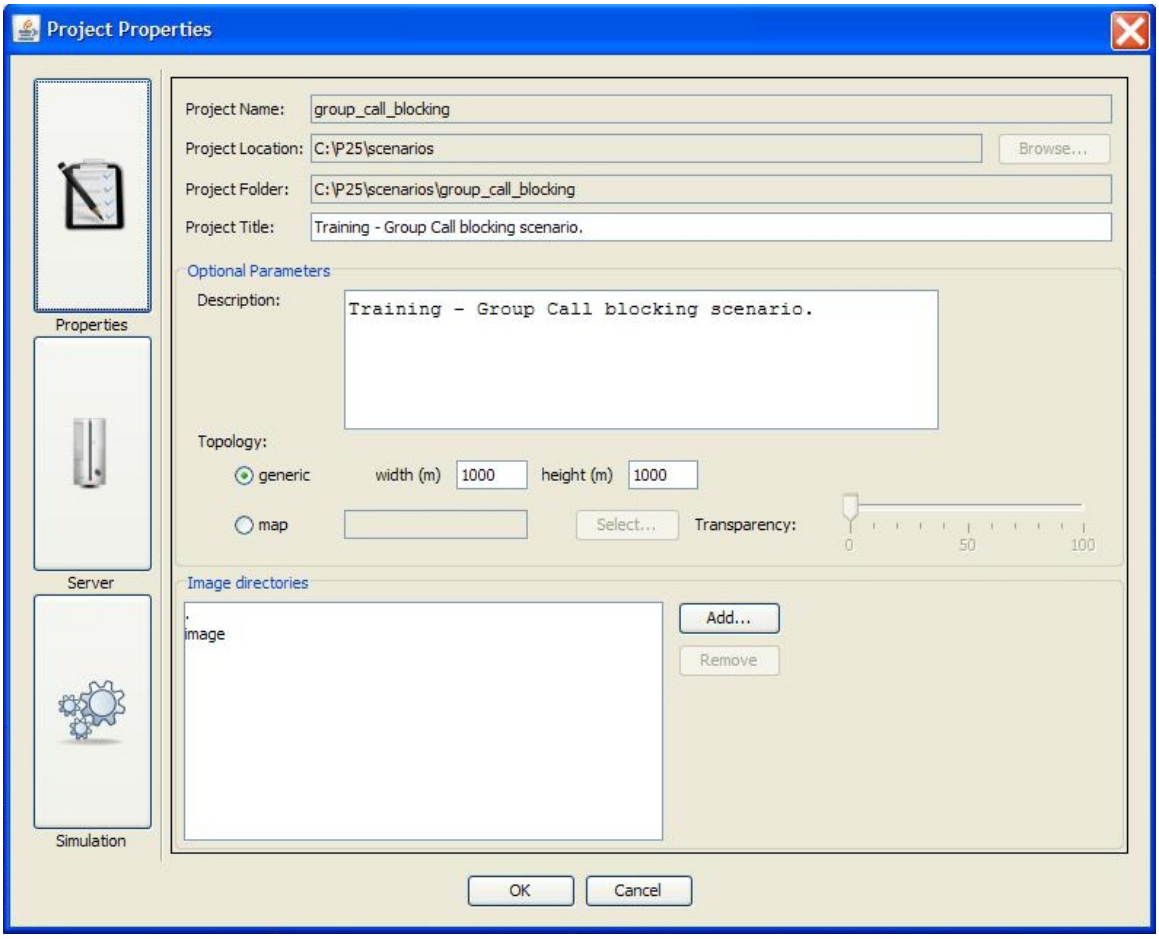



**Figure 20 - Project Properties; Properties Panel**

### *3.2.3.4.2 Server Panel*

Used to configure the GUI for communication with the server; the network address and port number are set here for the server that will run the ISSI Network Simulation program.

IMPORTANT: The Server information must be properly configured in order for the GUI to communicate with the server.

Enter the address (IP address or DNS name) and the port number for the server that will run the simulations (see Figure 21). The "Check" button may be used to check the validity of the server's address; if the server's address can be resolved and communication with the server can be established then a green check mark will appear next to the address; otherwise, a red X will indicate the communication error, see Figure 22 and Figure 23.

A checkbox is available to indicate whether to delete or not delete the results from the server after simulation runs are completed. Simulation results are downloaded to the GUI for display and analytical purposes after the server has finished processing them; leaving

the results/files on the server may be of use for debugging purposes, however by default the results/files are deleted from the server.

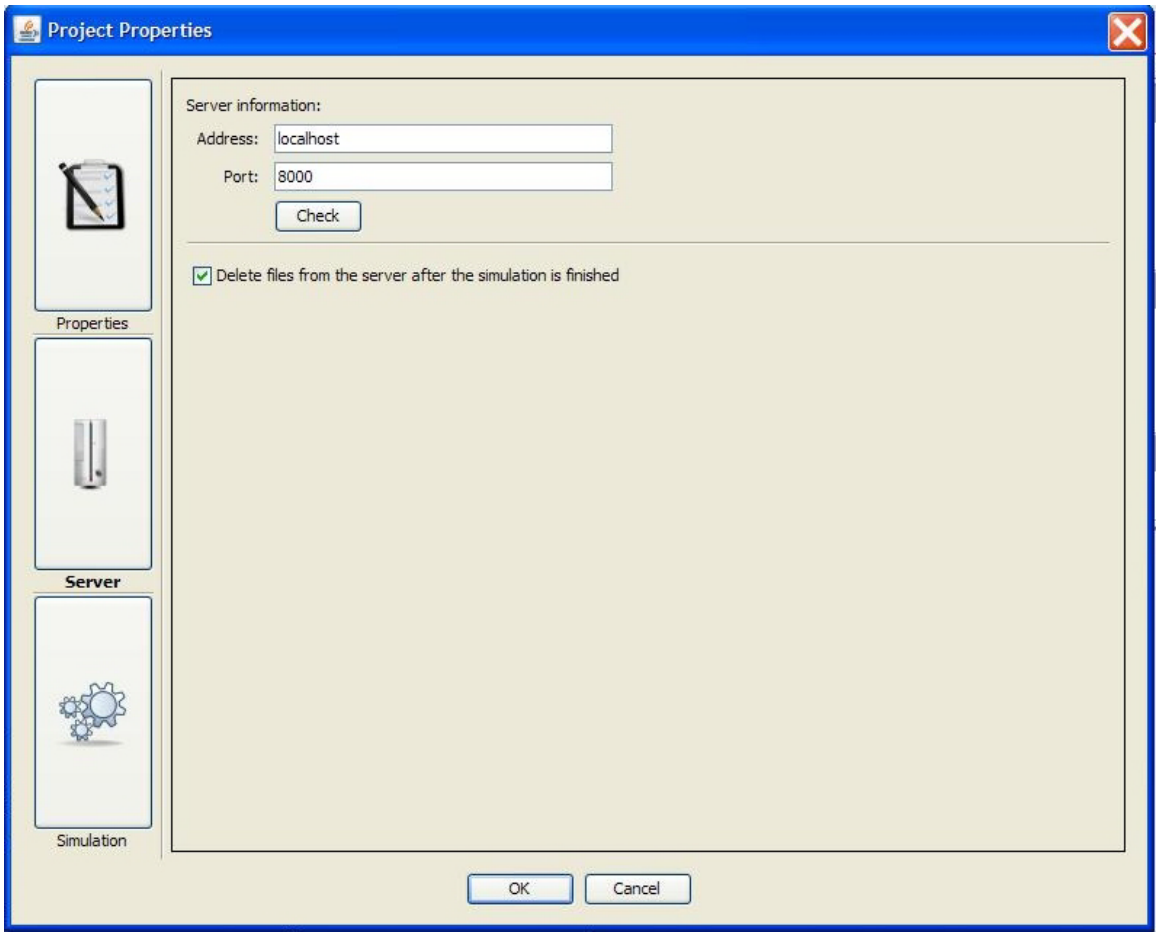



**Figure 21 - Project Properties; Server Panel**

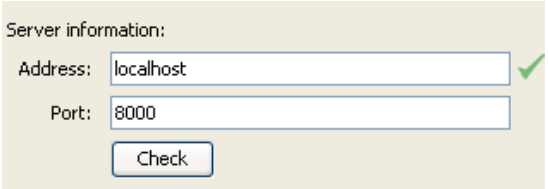



**Figure 22 - Server's Address Validated**

**Figure 23 - Invalid Server's Address**

#### *3.2.3.4.3 Simulation Panel*

The "Simulation Time" field is used to configure the amount of time (in seconds) that the program should simulate. The minimum value is one (1) second and the maximum value is 2,147,483,646 ($2^{31}$-2). See Figure 24.

The "Debug" checkboxes are used to indicate whether specific debug information will be captured during the simulation run. The debug information is displayed in the "FileViewer" window under the "Log File" tab after the simulation run is done.

The "Simulation seed" field is used to set the simulation's random number generator's seed value.

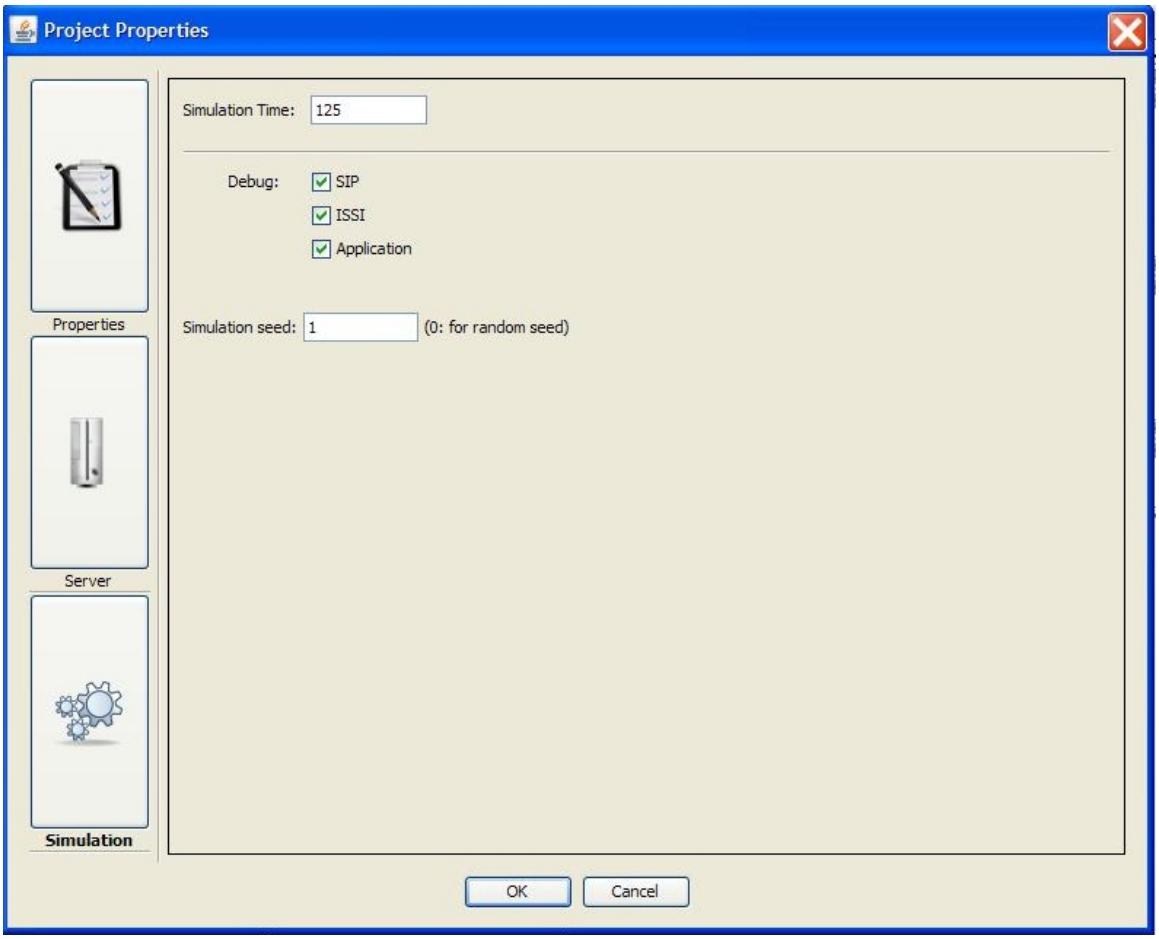



**Figure 24 - Project Properties; Simulation Panel**

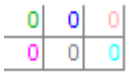
### 3.2.4 View Pull-down Menu

The "View" pull-down menu contains the following options:

- Display RFG statistics
- Switch Mode (Ctrl+M)

### 3.2.4.1 Display RFG statistics

This menu option is a toggle for viewing the radio frequency gateway (RFG) statistics. By default this option has a checkmark indicating that the RFG statistics are shown.

The RFG statistics matrix 

is displayed above the RFG icon; the colored numbers represent the following:

- Number of registered SUs (as home) - green
- Number of registered SUs (as serving) - blue
- Number of active SUs in SU-to-SU calls - orange
- Number of registered groups (as home) - pink
- Number of registered groups (as serving) - gray
- Number of active group calls - light blue

NOTE: Per P25 terminology [1], the "home" is the node that has access to directory information of an SU and it keeps track of the current location of the SU. The "serving" is the node that has successfully registered an SU.

### 3.2.4.2 Switch Mode

This option allows for switching between design and read-only mode. The design mode allows for activities such as creating and modifying the project's topology and its applications. The read-only mode disallows modifications and allows for activities such as playing back the simulation (once the simulation run is successfully completed from the server), running the project analysis tool ("Project->Project Analysis"), and viewing statistics and results via the "Statistics" panel.

### 3.2.5 Tools Pull-down Menu

The "Tools" pull-down menu contains the following option:

- Audio Trace Generator (Ctrl+G)

### 3.2.5.1 Audio Trace Generator

The Audio Trace Generator main window consists of three panels: The “Sound Graph” panel, the “Automatic Parsing Configuration” panel and the “Spurt Assignment” panel. See Figure 25.

- Sound Graph: Graphical display of the sound stream.
- Automatic Parsing Configuration: Allows for setting configuration values.
- Spurt Assignment: Allows for associating or disassociating audio spurts to user(s).

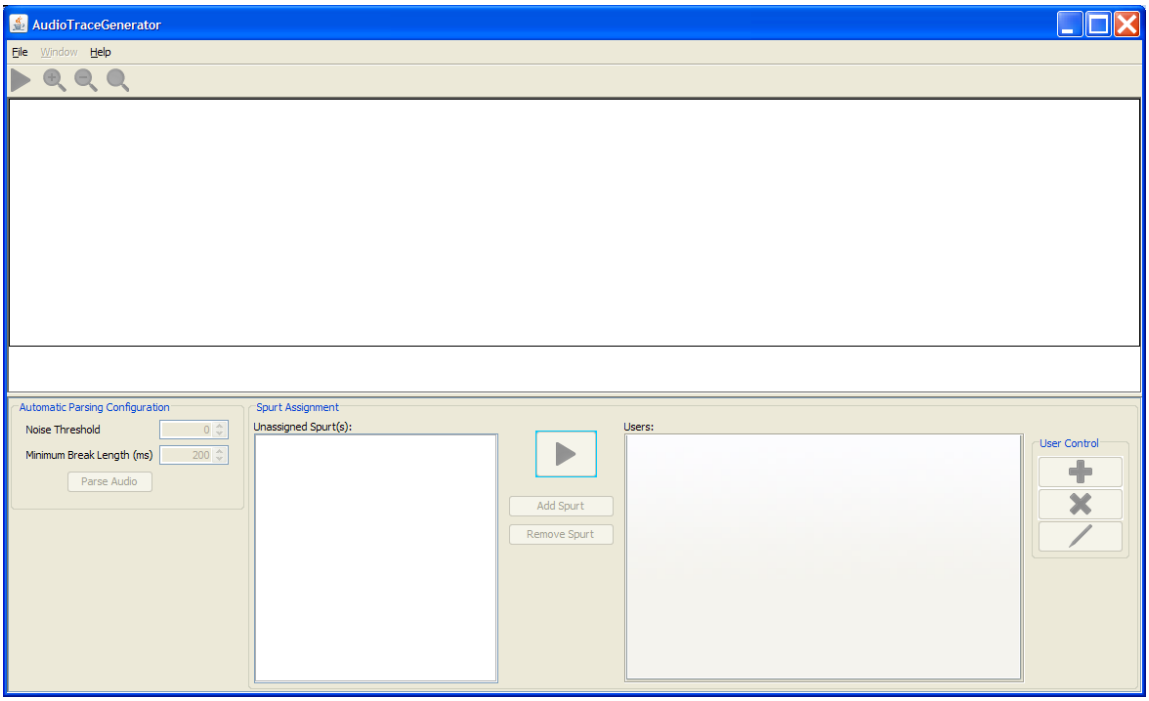



**Figure 25 - Audio Trace Generator: Initial Panel**

### *3.2.5.1.1 File Pull-down Menu*

The “File” pull-down menu contains the following items:

- New: Opens a window for creating a new audio project (Ctrl+N). See Figure 26.

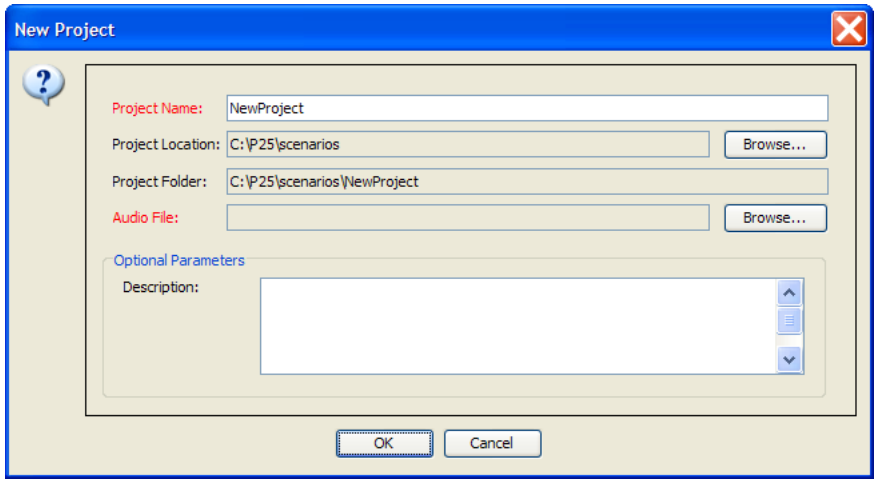



**Figure 26 - Audio Trace Generator: New Project Configuration Window**

- Open: Opens a browser window to search for an existing audio project (Ctrl+O). NOTE: Audio projects are indicated by blue diamonds. See Figure 27.

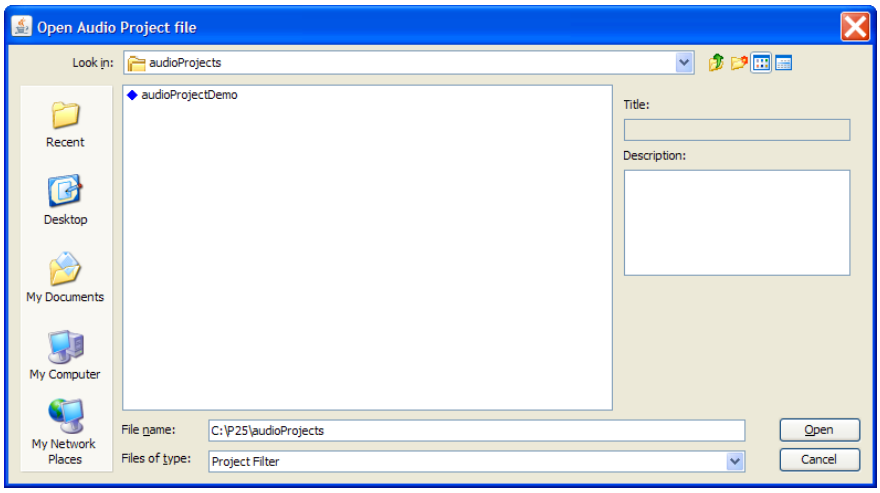



**Figure 27 - Audio Trace Generator: Search for Existing Audio Projects**

- Close: Closes the current project.
- Save: Saves the current project.
- Save As: Saves the current project to another directory, using another name, or both.
- Properties: Opens the current project’s properties window and allows for its modification, see Figure 28.

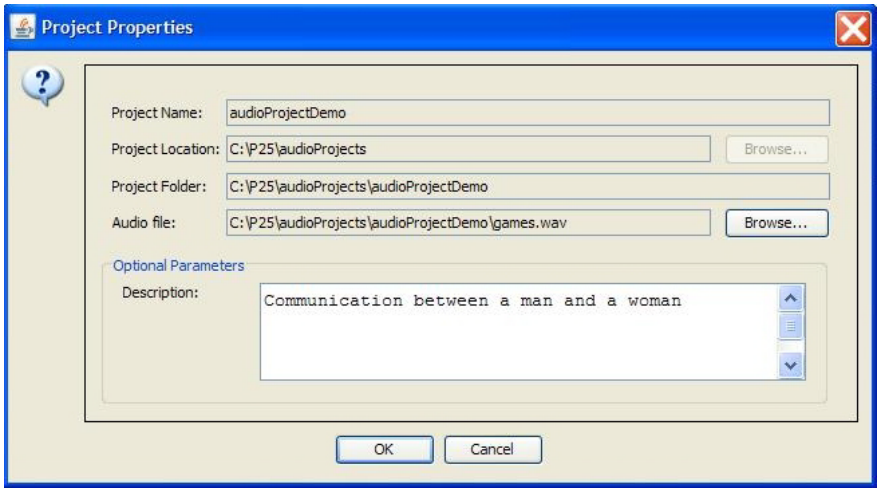



**Figure 28 - Audio Project Properties Window**

- Exit: Exits the tool.

#### *3.2.5.1.2 Window Pull-down Menu*

This menu option lists all opened audio projects and allows for switching between the projects.

#### *3.2.5.1.3 Help Pull-down Menu*

The "Help" pull-down menu contains the following options:

- Log Information: Displays a window with status and processing information
- Help Contents: Displays a window with instructions for using the tool
- User Documentation: Displays this document
- About: Displays the software disclaimer, modules, and contact information

#### *3.2.5.1.4 Audio File Buttons*

Located under the menu are the "Audio File Control" buttons. Click the "Play Audio File" button to play the audio file. Once playback has started, the button will change to the stop icon and it can be used to stop the playback. The zoom buttons are used to expand and contract the length of the graph in the "Sound Graph" panel.

#### *3.2.5.1.5 Automatic Parsing Configuration Panel*

The "Automatic Parsing Configuration" panel contains the "Noise Threshold" parameter, the "Minimum Break Length" parameter and the "Parse Audio" button.

Noise Threshold: Enter an appropriate value or accept the fixed increment sizes. This value represents the threshold in the signal's amplitude to determine if the signal is active or idle.

Minimum Break length: Enter an appropriate value or accept the fixed increment sizes. This value represents the minimum length of idle (silence) that must occur between audio activities to determine the separation between the audio spurts.

Parse Audio button: Use this button to analyze and separate the audio stream into idle and active periods. The results are indicated with red and green vertical lines for the spurts' boundaries. Left click on a spurt will highlight it yellow. Right-click on a spurt to display a pop-up menu; the menu options are "Delete Spurt" and "Split Spurt". See Figure 29.

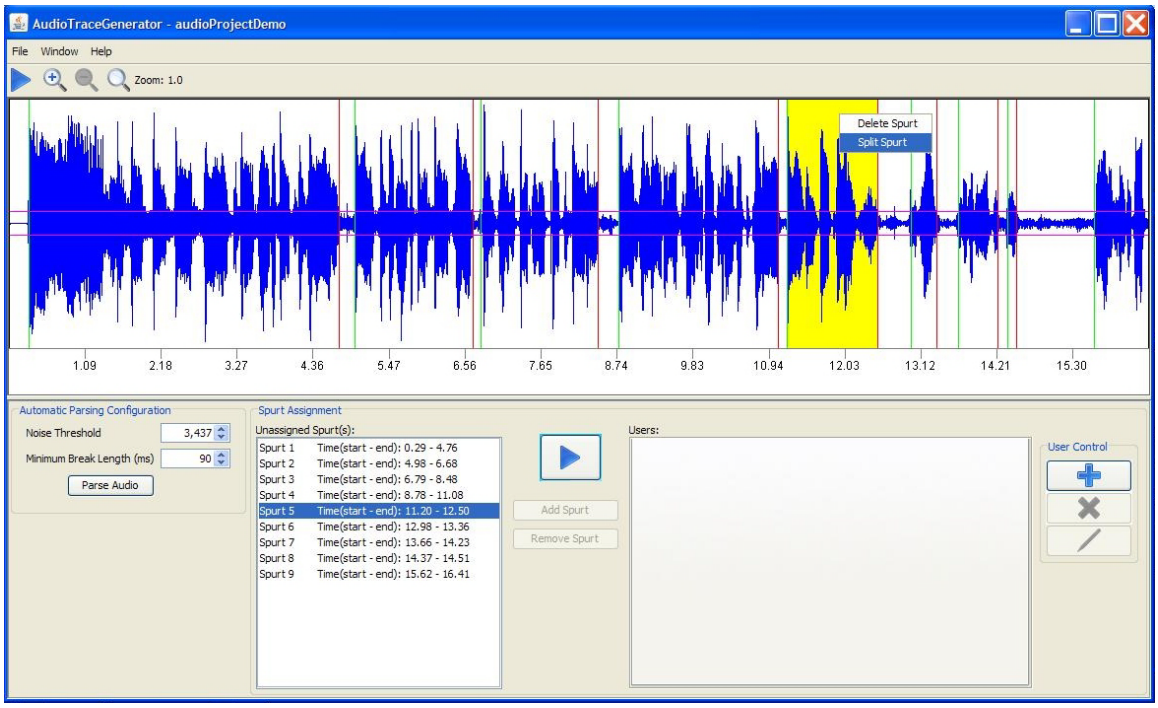



**Figure 29 - Audio Spurts**

- Delete Spurt: Allows for deleting the selected spurt
- Split Spurt: Allows for splitting the selected spurt into halves

NOTE: Grab and drag on a spurt's boundary to resize the spurt

### *3.2.5.1.6 Spurt Assignment Panel*

The "Spurt Assignment" panel contains the "Unassigned Spurt(s)" subpanel, the "Users" subpanel and various control buttons.

After loading an audio file, set the appropriate values in the "Automatic Parsing Configuration" panel then click the "Parse Audio" button to analyze and separate the audio stream into idle and active periods. Each spurt will be numbered and its start and end time will be indicated.

- Unassigned Spurts(s) subpanel: This subpanel contains all the spurts that were created from using the "Parse Audio" button. These spurts can later be assigned to appropriate users.
- Users subpanel: This subpanel contains all users created for spurt assignments.

#### 3.2.5.1.6.1 Spurt Assignment Panel Buttons

Select a spurt from the "Unassigned Spurts(s)" subpanel then use the "Play Selected Spurt" button to play back that spurt. While playing back a spurt, this button will change to the stop icon and can be used to stop the playback of the spurt. Playing back spurts is useful for assigning spurts to the appropriate user(s).

- The "Add New User" button allows for creating new users in the "Users" subpanel.
- The "Remove the Selected User" button allows for deleting users from the "Users" subpanel.
- The "Rename the Selected User" button allows for renaming users in the "Users" subpanel.

Select a spurt from the "Unassigned Spurts(s)" subpanel and use the "Add Spurt" button to associate and move that spurt to the currently selected user in the "Users" subpanel. See Figure 30.

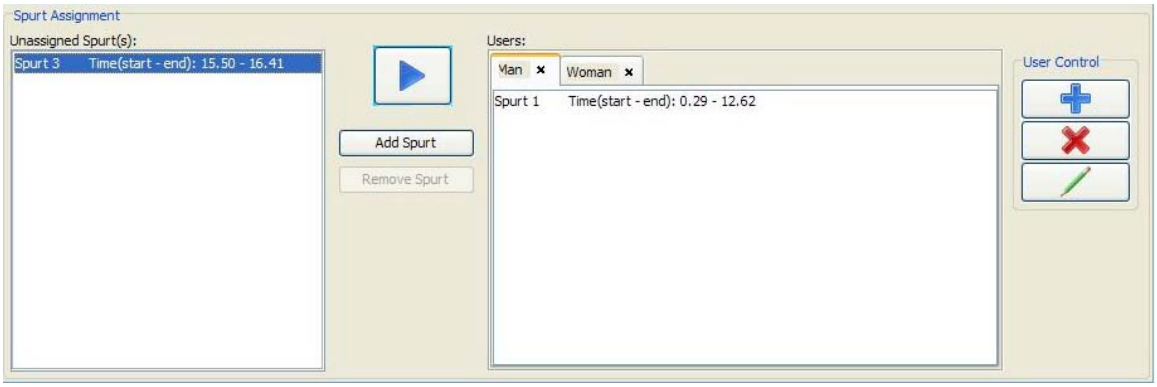



**Figure 30 - Spurt Association with User**

Select a spurt from the "Users" subpanel (associated with the selected user) and use the "Remove Spurt" button to disassociate that spurt from the selected user and move it to the "Unassigned Spurt(s)" subpanel. See Figure 31.

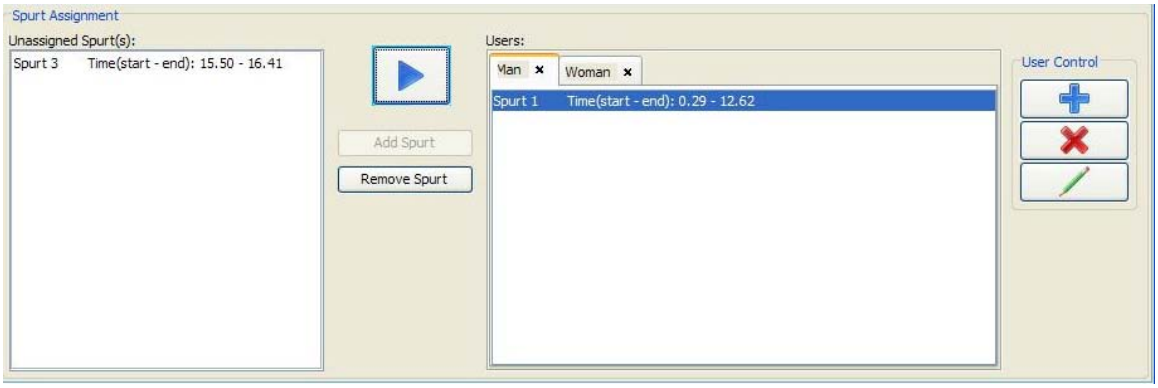



**Figure 31 - Spurt Disassociation with User**

### 3.2.6 Windows Pull-down Menu

The “Windows” pull-down menu contains the following options:

- Topology (see section 4)
- Topology Configuration (see section 5)
- Statistics (see section 6)
- Media (see section 7)
- Status (see section 8)
- FileViewer (see section 9)
- A list of open projects (see section 10), if any, a green check mark indicates the current project

### 3.2.7 Help Pull-down Menu

The “Help” pull-down menu contains the following options:

- GUI documentation (F1): Displays this document
- Simulation model documentation: Displays the simulation model documentation
- About: Displays the software disclaimer, modules, and contact information

## *3.3 Icons*

- Open Project (Ctrl+O)

Opens a browser window to locate and load simulation projects

- Launch simulation in the server (Ctrl+R)

Authenticates the user to the simulation server (if not already authenticated), uploads the current project’s pertinent files to the server, runs the simulation on the server, and downloads simulation result files from the server to the GUI for analytical and display purposes.

IMPORTANT: The current project and its files containing the latest topology and configuration will be saved to the hard drive when any simulation run is done. If the user wishes to keep the original configuration of the project, it is recommended that a copy of the original project be saved using the “File->Save As…” function before making major modifications then running simulations. However, the user may use the “Edit->Undo” function to revert back to the project’s original configuration.

- Simulation running

Indicates the current project’s simulation was launched in the server and is still running.

- Simulation not running

Indicates the current project's simulation was not launched in the server.

- Project is currently in design mode (toggles with read-only mode icon)
Clicking on this icon puts the project into read-only mode (Ctrl+M)

- Project is currently in read-only mode (toggles with design mode icon)
Clicking on this icon puts the project into design mode (Ctrl+M)

## 3.4 Windows and Panels

The "Windows" pull-down menu options allow for displaying all available panels that the GUI has to offer using a layout consisting of tabs. Selecting a particular panel under the "Windows" menu will display that panel in the foreground within the GUI's encapsulating main window (see Figure 34).

Each panel has 3 buttons to the right of its name: Undock, minimize and close.
Each panel has 4 buttons on the far right side: Undock, minimize, maximize and close.

**Undock** – allows the panel to be separated into its own window
**Dock** – returns the panel to be part of the GUI's main window
**Minimize** – turns the panel into an icon at the bottom of the GUI's main window
**Maximize** – returns the panel to its full size within the GUI's main window
**Close** – removes the panel entirely from the GUI's main window. Note that all closed panels can be reopened using the "Windows" pull-down menu options.

## 3.5 New Project Window

Use menu option "File->New Project…" to create new projects. Use the "New Project" window (see Figure 32) to define the project's name, the project's directory/location on the hard drive, the project's title, a short description of the project, select the type of topology for the project's layout/background, and to define the image directories for the project.

### 3.5.1 Properties Panel

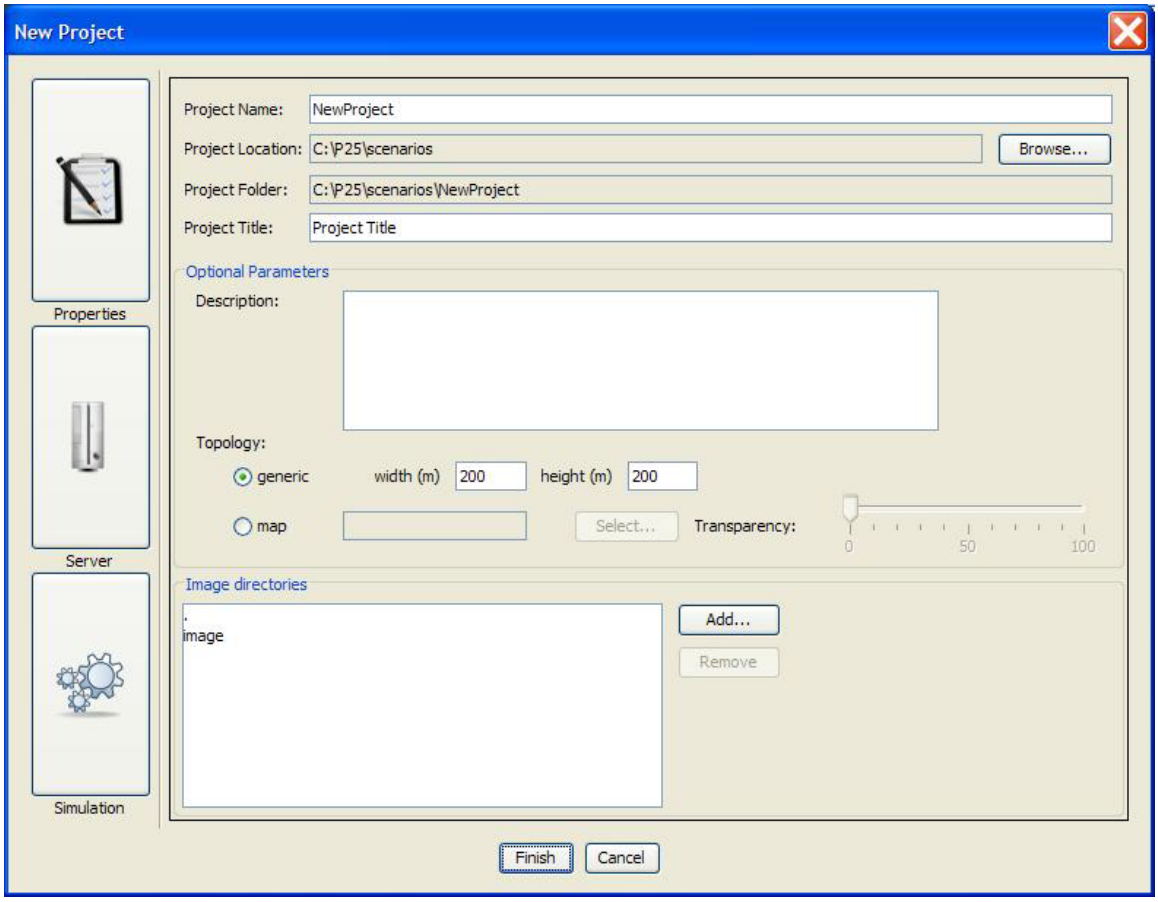



**Figure 32 - New Project Window**

Project Name: The name for the project, this will also be used as the directory/folder name for the project; alphanumeric characters and any other valid characters that are supported by the platform in use (e.g., Windows, Linux, Mac, etc.).

Project Location: The directory/folder path; the "Browse…" button is used to navigate to or to create the parent directory/folder for the project.

Project Folder: The folder containing the project's files; this will be automatically created based on the previous two entries.

Project Title: The title used to identify the project.

Optional Parameters (note that these parameters have built-in default values):

Description: A brief description of the project that will be displayed in the "Open Project file" window.

Topology: Type of background and coordinate system for the project.

- generic: No background is used, the width and height for the background will be used.

- map: A background map is used, use the “Select…” button to select a map from the set of available background maps. See section 3.4.1.1 for more details.

Image directories: Allows for defining additional directories where background image files and icon image files are stored. The GUI will search those directories to look for image files if they are not found in the default “image” directory.

### 3.5.1.1 Selecting a Map for the Project’s Background

The map “Select…” button, from the Topology section of the “New Project” screen or from the “Project Properties” screen is used to select a map from the GUI’s maps database. Select the desired map from the drop down list then click on the “OK” button to use the selected map for the project’s background (see Figure 33).

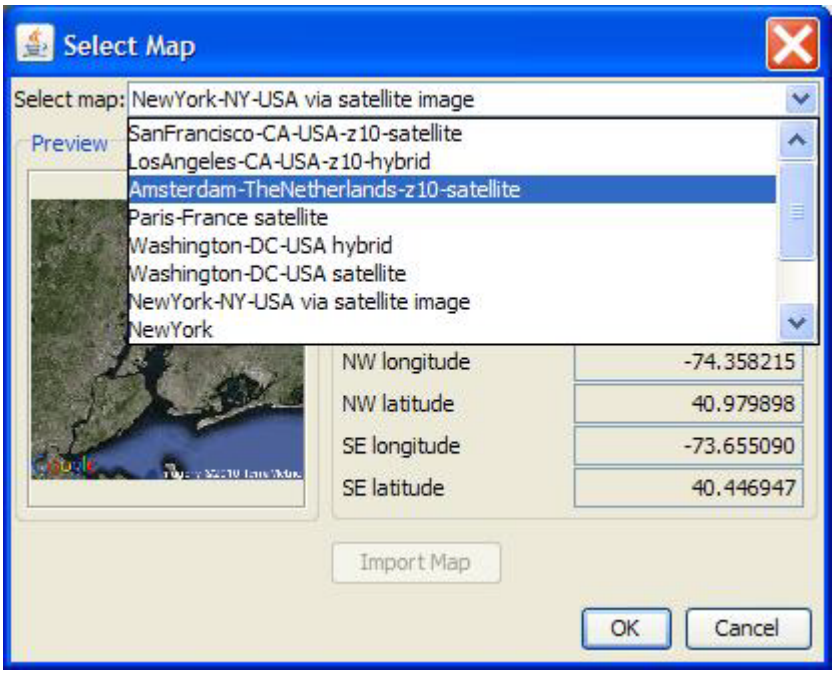



**Figure 33 - Select map Window**

### 3.5.2 Server and Simulation Panels

See section 3.2.3.5.2 for details on the “Server” panel. See section 3.2.3.5.3 for details on the “Simulation” panel.

### 3.5.3 Completion of Project Information

After entering the new project information, a blank project window will be displayed (see Figure 34). If a map was selected as the background, it will be displayed accordingly. The network and its topology are created here; configure the parameters by selecting from the topology icons located in the “Topology Configuration” panel (on the right) and dropping the icons into the “Topology” panel (on the left).

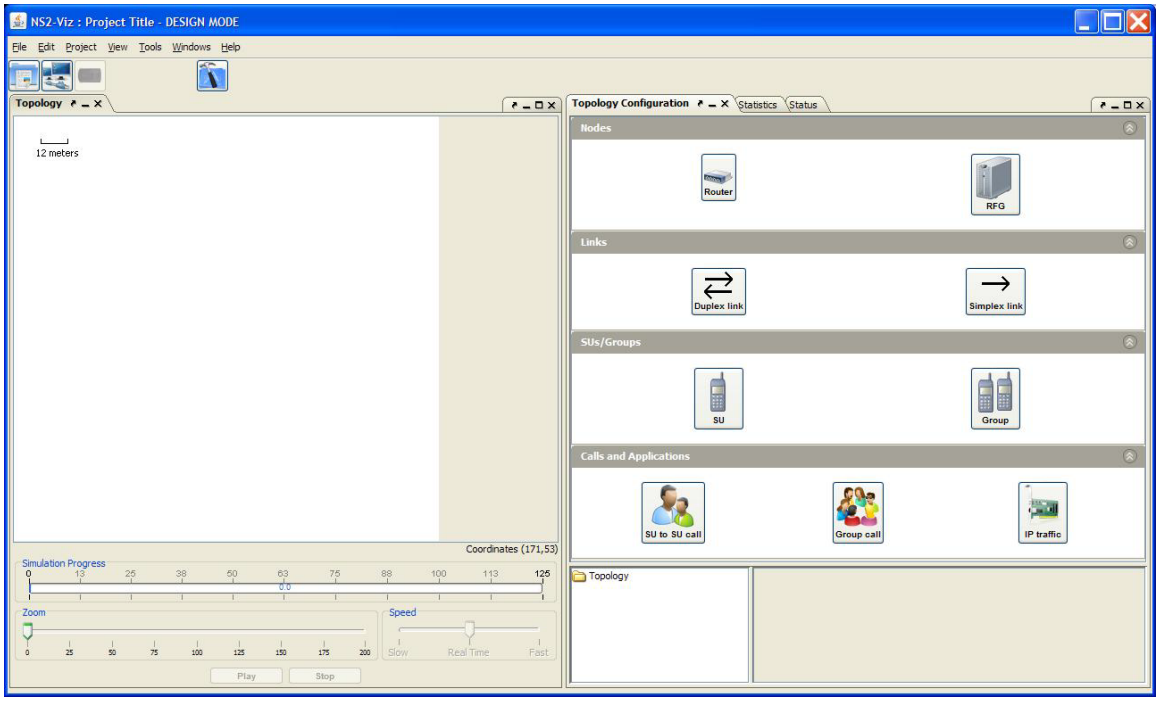



**Figure 34 - New/Blank Project (Design) Window**

NOTE: These panels can be displayed by selecting them from the “Windows” pull-down menu options if they are not already visible.

## *3.6 Open Project Window*

Use the “Open Project” icon or the menu option “File->Open Project…” to bring up a browser window for locating existing projects (projects are marked by red diamonds).

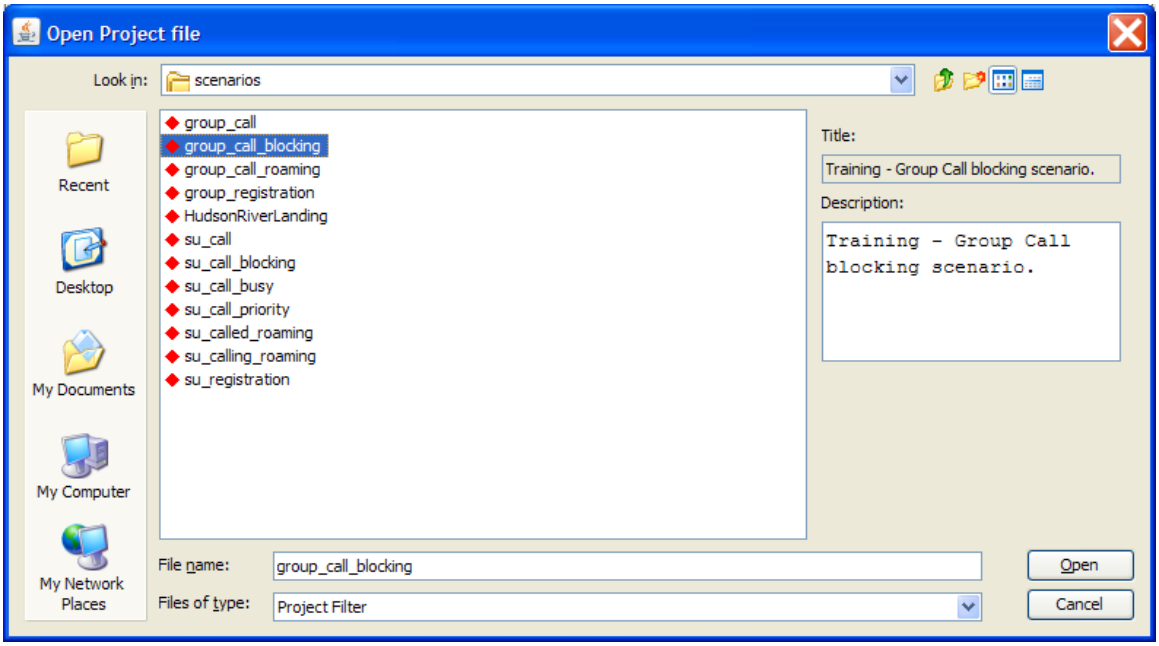



**Figure 35 - Browser Window Showing Simulation Projects**

# 4 Topology Panel

The Topology panel contains four subpanels: The “Topology” subpanel contains a graphical representation of the current project’s topology; the “Simulation Progress” subpanel displays the time line during playback of the simulation via the master control bar; the “Zoom” subpanel controls the size of the “Topology” subpanel; and the “Speed” subpanel controls the playback speed for the “Simulation Progress” subpanel. The Play (a.k.a. the “action” button) and Stop buttons control the simulation playback function. See Figure 36.

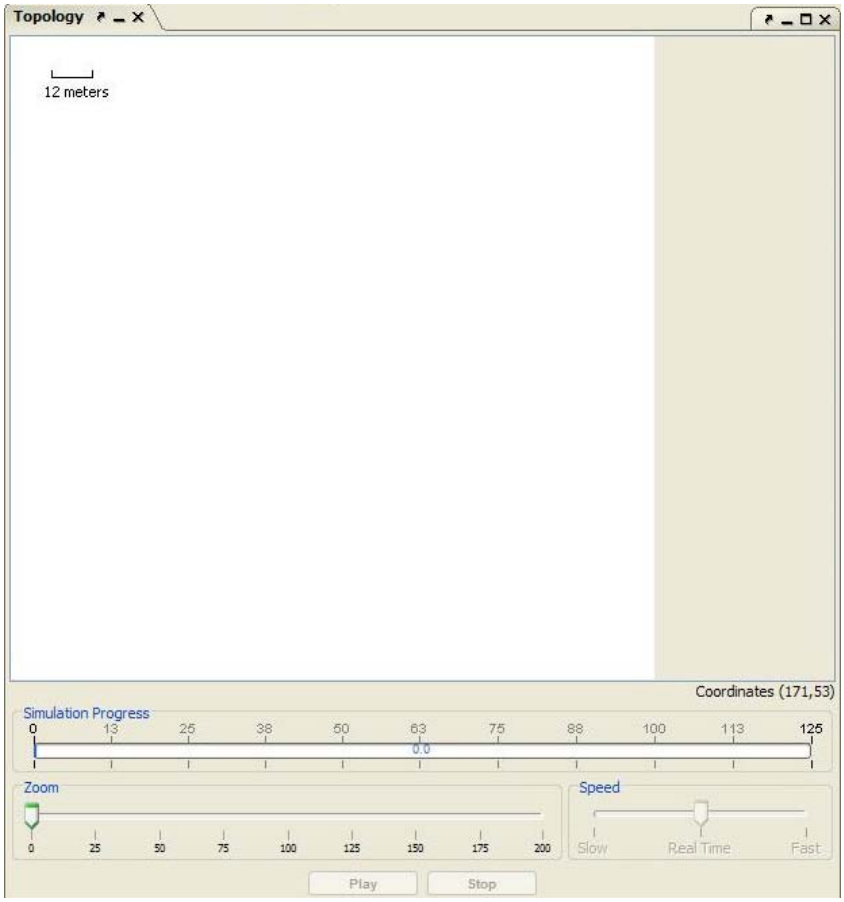



**Figure 36 - Topology Panel**

## *4.1 Topology Subpanel*

For new projects, the “Topology” subpanel is initially blank (or may contain a background image depending on the project’s configuration). For active projects, the actions available are dependent on their topologies and on user defined activities for those projects. The exact actions available depend on the contents of the projects.

To create a network topology, click on the template icons from the “Topology Configuration” panel and drop them into the “Topology” subpanel (see Figure 37). Refer

to the “Network Primer” appendix for more information about creating a network topology.

For a project that uses a map for its background, placing the pointer in the “Topology” subpanel will display the (X,Y) coordinates of the pointer with (0,0) being the upper left corner of the subpanel and (maximum value of X, maximum value of Y) being the lower right corner of the subpanel. The Global Positioning System (GPS) coordinates will be displayed in the lower left corner of the subpanel.

> NOTE: The range and maximum values for either of the coordinate systems were set when the new project was created (see Figure 32, the “Topology” section of the panel).

For a project that does not use a map for its background, placing the pointer in the “Topology” subpanel will display the (X,Y) coordinates of the pointer with (0,0) being the upper left corner of the subpanel and (maximum value of X, maximum value of Y) being the lower right corner of the subpanel.

> NOTE: The maximum values for X and Y were set when the new project was created (see Figure 32, the “Topology” section of the panel).

For an active project, the “Topology” subpanel will display the layout of the topology.

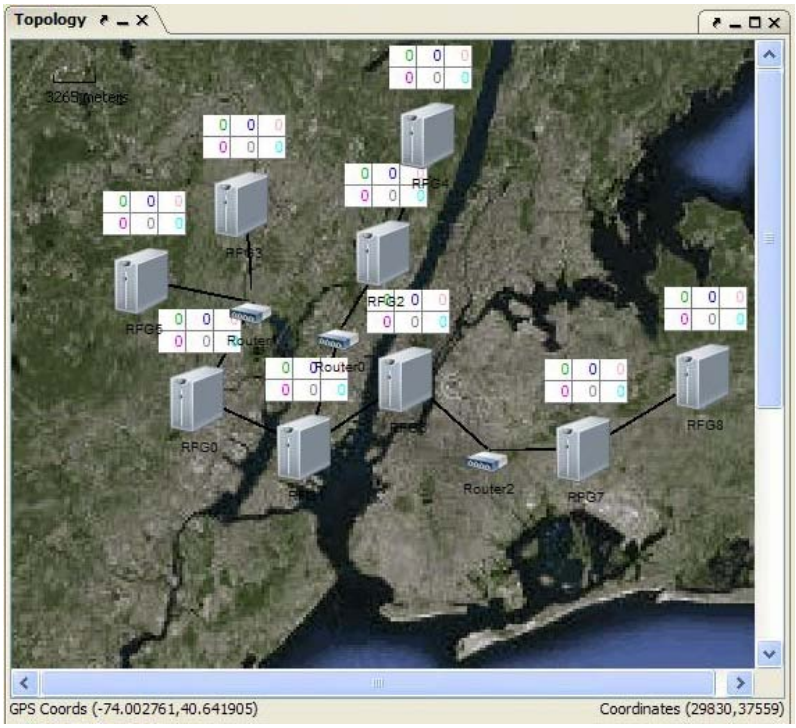



**Figure 37 - Topology Subpanel with an Active Project**

ACTIONS:

- Single clicking on any of the nodes or links will open its entry under the “Topology Configuration” panel.

- Right-clicking on a node icon in the “Topology” subpanel will display a pop-up menu with the following options: Properties, Delete, Hide Icon, Hide Description and Hide Range.
  - Select the “Properties” option to display the properties window that can be used to modify the associated parameters.
  - Select the “Delete” option to delete the object from the topology.
  - Select the “Hide Icon” option to prevent the icon from showing in the “Topology” subpanel.
  - Select the “Hide Description” option to prevent the icon’s description from showing in the “Topology” subpanel.
- Pointing then hovering over any node will display its name.
- Pointing then hovering over any link will display some of the link’s configuration parameters.
- Pointing then hovering over the statistical icon of any RFG will display some statistics for that particular RFG. Also see section 3.2.4.1.
- Right-clicking in a blank (non-iconic) part of the “Topology” subpanel will display a pop-up menu with the following options: Take Snapshot, Save As and Print.
  - Select the “Take Snapshot” option to capture the current view of the “Topology” subpanel to be included in the snapshot list of the PDF report (see Section 3.2.3.2).
  - Select the “Save As” option to save the “Topology” subpanel to an image file.
  - Select the “Print” option to print the image of the “Topology” subpanel.

If the “View->View RFG statistics” option is selected from the main menu bar, then an icon will be displayed above each node with six numbers in a two rows by three columns matrix. The first number (shown in green) represents the number of SUs registered with that node as their home RFSS. The second number (shown in blue) represents the number of SUs registered with that node as their serving RFSS. The third number (shown in orange) represents the number of active SUs in SU-to-SU calls located at that node. The fourth number (shown in pink) represents the number of registered groups with that node as their home. The fifth number (shown in gray) represents the number of registered groups that node serves. The sixth number (shown in light blue) represents the number of active group calls at that node. Also see section 3.2.4.1.

## *4.2 Simulation Progress Subpanel*

This subpanel contains the master control bar that shows the length of the entire simulation, as well as the current time position during the playback of the simulation.

## *4.3 Zoom Subpanel*

This subpanel controls the graphic size of the “Topology” subpanel (i.e., the background).

## *4.4 Speed Subpanel*

This subpanel controls the speed at which the simulation events are played back or displayed.

NOTE: The speed control is not functional for projects containing media file(s).

## *4.5 Buttons*

The “action” and “stop” buttons are inactive until a project is loaded and the simulation results from the server for that project is available for playback.

### 4.5.1 Action Button (Play/Pause/Resume)

The “Action” button has the following modes:

- When “Play” is displayed, select this button to begin the playback of the simulation; once in playback mode, the button will display “Pause”.
- When “Pause” is displayed, select this button to pause the playback of the simulation; once in pause mode, the button will display “Resume”.
- When “Resume” is displayed, select this button to resume playback of the simulation; once in resume mode, the button will display “Pause”.

### 4.5.2 Stop Button

The “Stop” button is used to stop the playback of the simulation; once the simulation is stopped, the “Action” button will display “Play”.

# 5 Topology Configuration Panel

The Topology Configuration panel contains three subpanels: Templates, Topology Folder and Information.

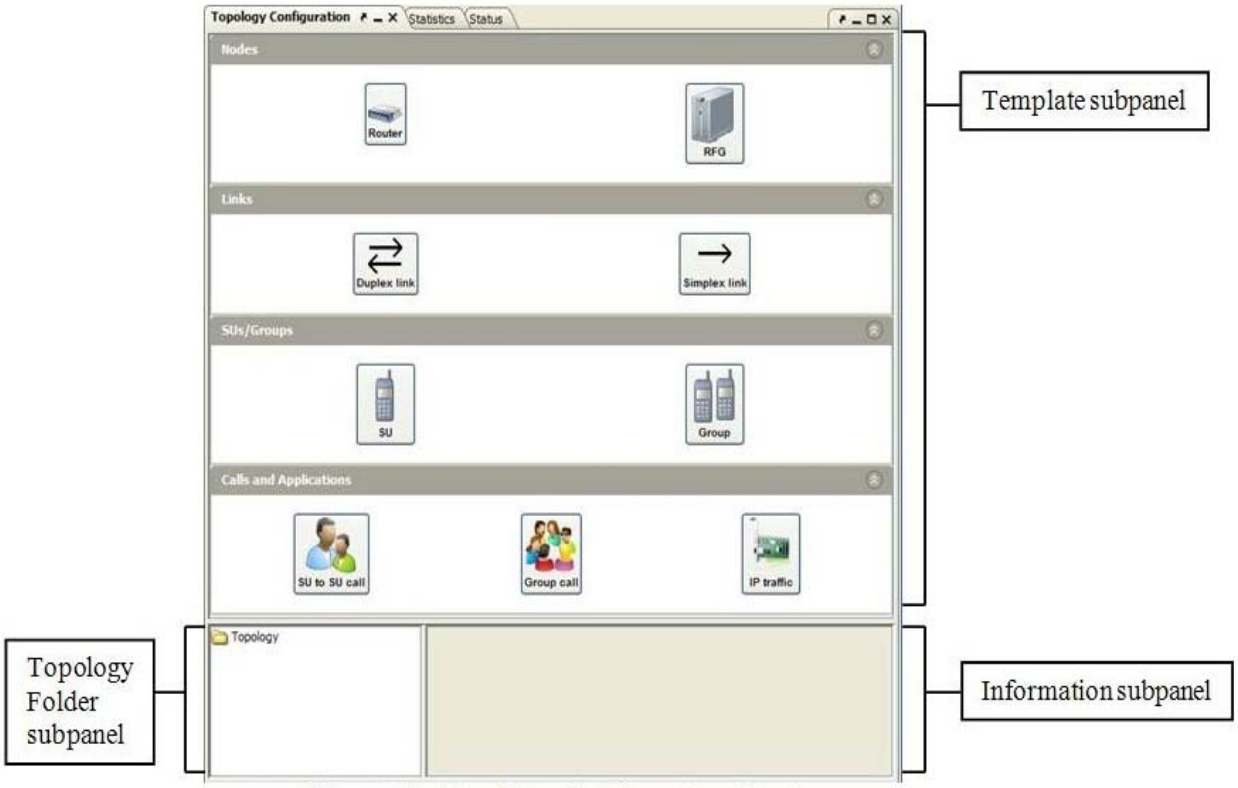



**Figure 38 - Topology Configuration Panel**

## *5.1 Template Subpanel:*

The template subpanel contains four categories of templates: Nodes, Links, SUs/Groups, and Calls and Applications.

### 5.1.1 Nodes

Provided templates are Router and RFG.

### 5.1.2 Links

Supported templates are Duplex link and Simplex link.

### 5.1.3 SUs/Groups

Supported templates are SU and Group.

### 5.1.4 Calls and Applications

Supported templates are SU to SU call, Group call and IP traffic.

ACTIONS:
Each category of template can be expanded or collapsed by clicking on the icon indicated below:

- Expand category
- Collapse category

In design mode, right-clicking on a template icon will display a pop-up menu with the following options:

- Edit template
- Duplicate template
- Delete template

## *5.2 Topology Folder Subpanel*

This subpanel represents the project's topology in a folder structure and allows the user to navigate the topology by expanding and contracting the folders. The root of the folder structure is named "Topology".

The "Topology" folder contains three folders:

- Nodes (see section 5.2.1)
- Links (see section 5.2.2)
- Applications (see section 5.2.3)

ACTIONS:

- Single clicking on the plus symbol will expand the folder's structure.
- Single clicking on the minus symbol will collapse the folder's structure.
- Double clicking on the folder icon or the folder name will toggle between expanding and collapsing the folder's structure.

### 5.2.1 Nodes

The "Nodes" folder contains all nodes in the topology. Currently, the node types supported are routers or radio frequency gateways (RFG). All nodes have a common set of configuration parameters. Depending on the function of the node, additional configuration parameters may be available.

ACTIONS:

- Single click on a node's name to display a common set of configuration parameters, and if applicable additional configuration parameters.
- In design mode, right-click on a node's name to display a pop-up menu with five options: Properties, Delete, Hide Icon, Hide Description and Hide Range.
  - Select "Properties" to display the node's properties window for modifying its parameters.
  - Select "Delete" to delete the node from the topology.
  - Select/unselect "Hide Icon" to hide/show the icon in the "Topology" panel.

- Select/unselect “Hide Description” to hide/show the name of the icon in the “Topology” panel.
- “Hide Range” is grayed out and is currently not applicable.

### 5.2.1.1 Routers

Routers are the basic building blocks upon which P25 networks are built.

ACTIONS:

- Single click on a router’s name to display the “Router information”. See Figure 39.

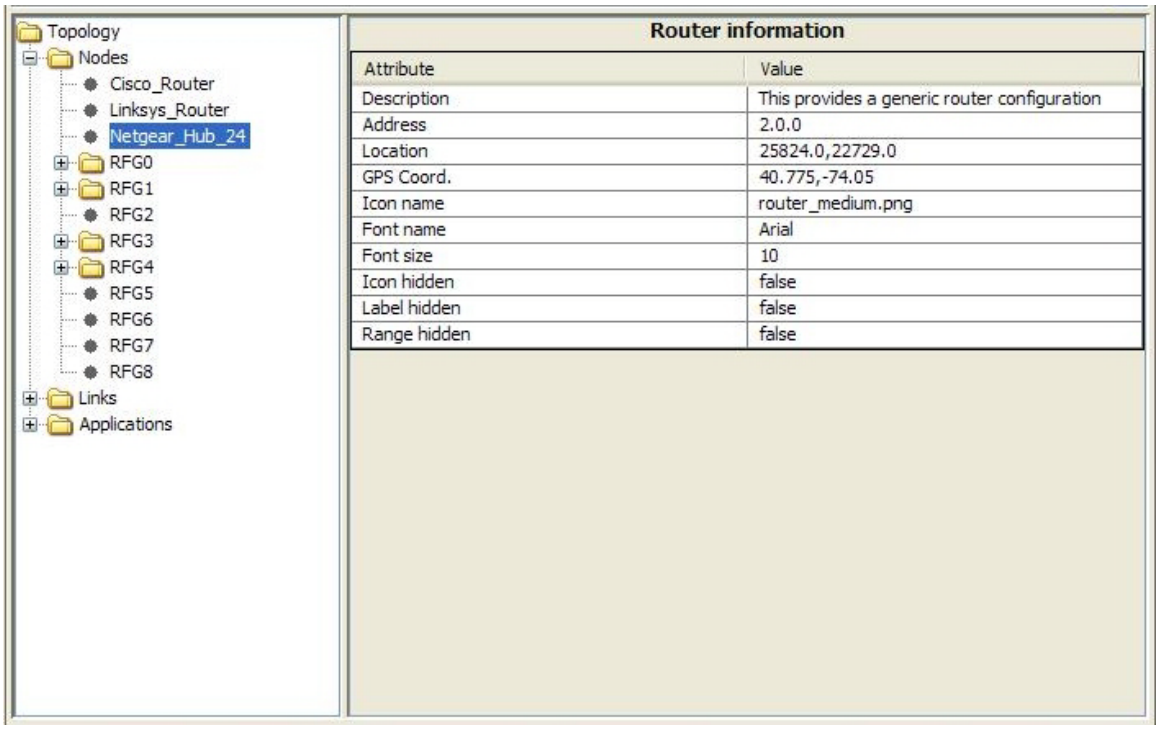



**Figure 39 - Topology: Router Information**

### 5.2.1.2 RFGs

Radio Frequency Gateways provide P25 ISSI functionality. The RFG is a router with additional ISSI functions enabled. If the RFG has been configured to be “home” for at least one SU, then the RFG will have an associated SU folder (see section 5.2.1.2.1). If the RFG has been configured to host at least one group, then it will have an associated Group folder (see section 5.2.1.2.2).

ACTIONS:

- Single click on a RFG’s name to display the “Router information” and “P25/ISSI information”. See Figure 40.

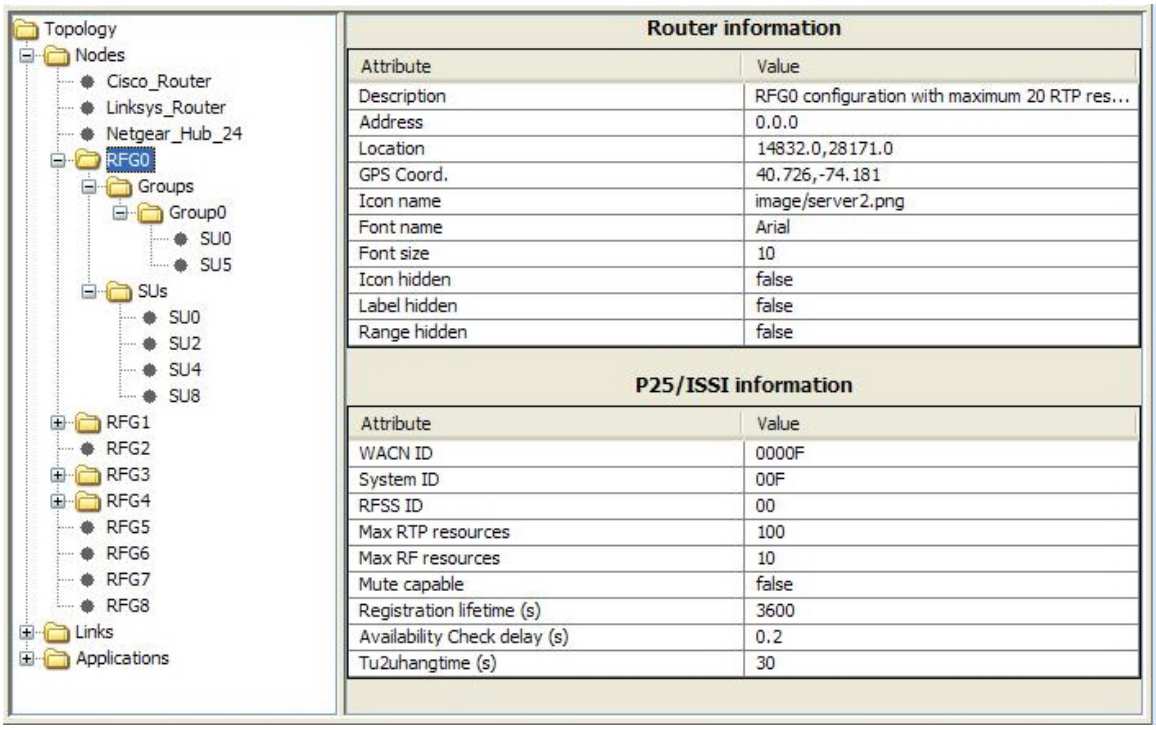



**Figure 40 - Topology: RFG Information**

#### *5.2.1.2.1 SUs folder*

Expand the "SUs" folder to show the individual subscriber units (if any).

ACTIONS:

- Single click on an SU name to display the "SU configuration", "Service Profile", "Mobility information" and "Calls" information. See Figure 41.
- Right-click on an SU name to display a pop-up menu with two options: Properties and Delete.
  - Select "Properties" to display the SU's properties window for modifying its parameters.
  - Select "Delete" to delete the SU from the topology.

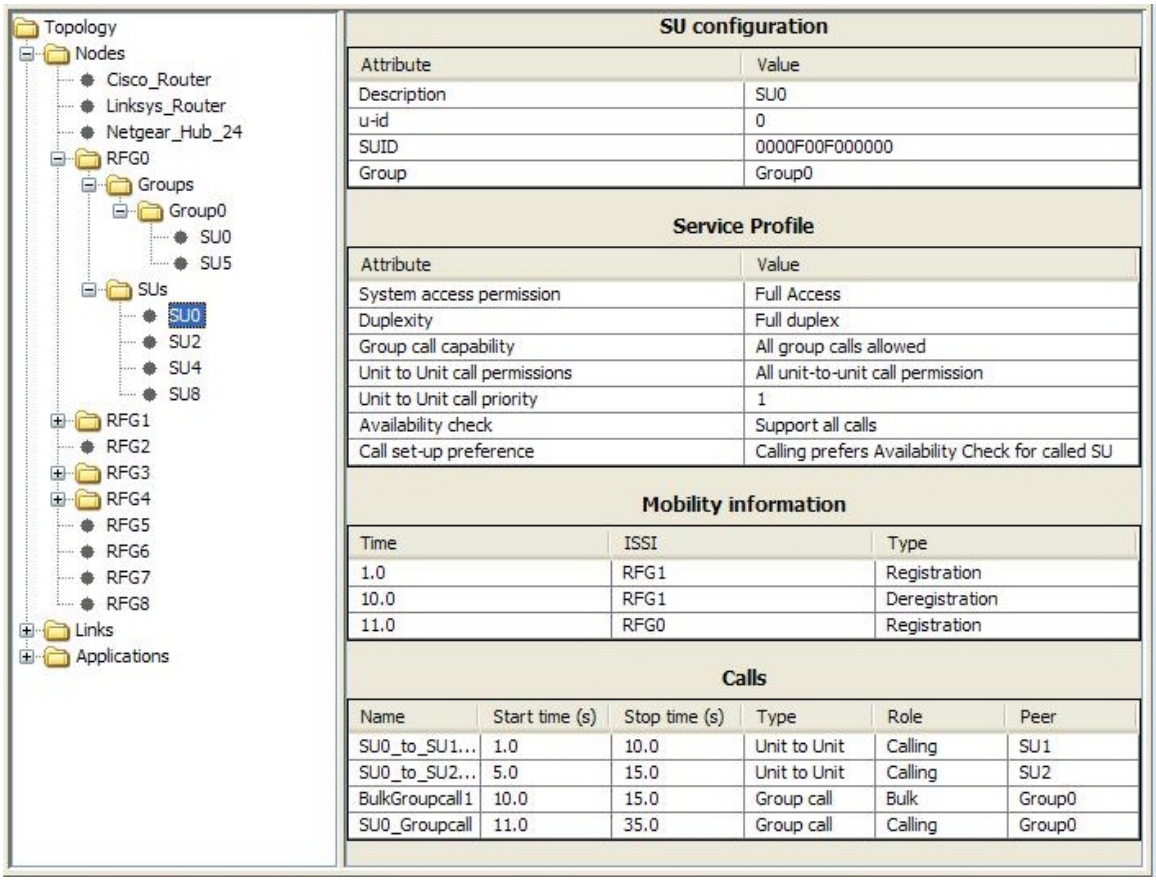



**Figure 41 - Topology: SU Information**

### *5.2.1.2.2 Groups folder*

Expand the "Groups" folder to show the individual groups (if any).

ACTIONS:

- Single click on a group's name to display the "Group configuration", "Service Profile", "SUs" (if any SUs are configured) and "Calls" information. See Figure 42.
- Right-click on a group's name to display a pop-up menu with two options: Properties and Delete.
  - Select "Properties" to display the group's properties window for modifying its parameters.
  - Select "Delete" to delete the group from the topology.

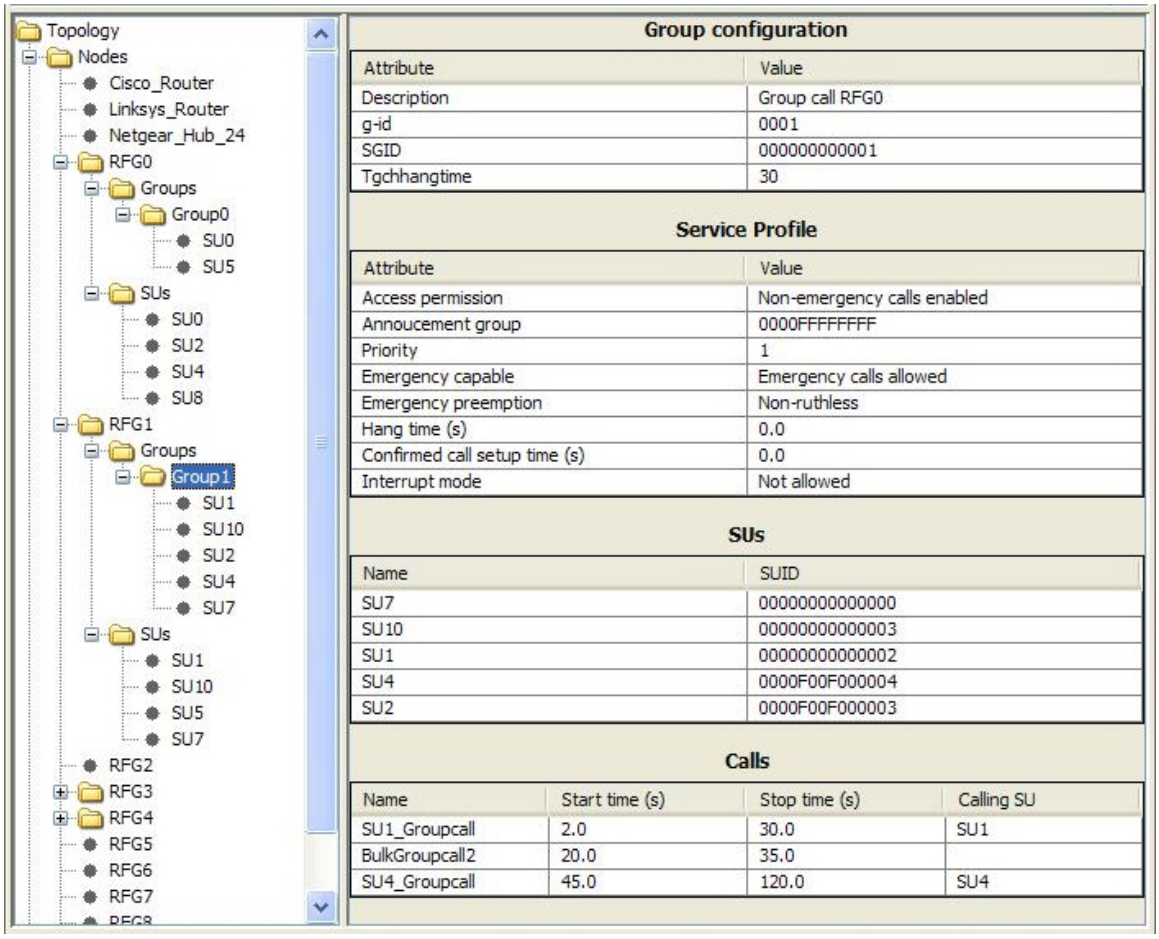



**Figure 42 - Topology: Group Information**

Double click on the group's name or expand its folder to list the SUs that are configured for that group. Single click on an SU's name listed under that group to display that SU's information (the SU's information would be similar to that shown in Figure 41). If a group name cannot be expanded, then it means that group was defined but has no SUs assigned to it.

### 5.2.2 Links

The "Links" folder contains all links in the topology. Link names are presented as pairs of nodes (end points).

ACTIONS:

- Single click on a link's name to display the "Link information". See Figure 43.
- Right-click on a link's name to display a pop-up menu with two options: Properties and Delete.
  - Select "Properties" to display the link's properties window for modifying its parameters.
  - Select "Delete" to delete the link from the topology.

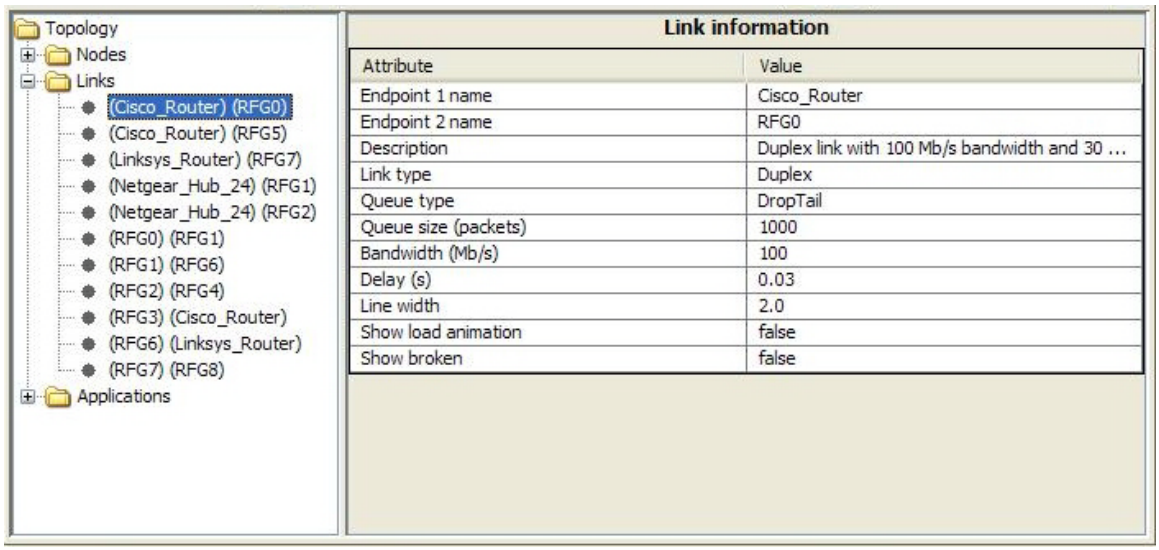



**Figure 43 - Topology: Link Information**

### 5.2.3 Applications

The "Applications" folder contains all applications in the topology sorted by their start time. Supported applications are: CBR Traffic, Exponential Traffic, FTP Traffic, Group Call, Bulk Group Call, SU-to-SU Call and Bulk SU Call.

ACTIONS:

- Right-click on an application's name to display a pop-up menu with two options: Properties and Delete.
  - Select "Properties" to display the application's configuration window for modifying its parameters.
  - Select "Delete" to delete the application.
- Single click on a CBR, an Exponential or an FTP application name to display the "Traffic configuration", "(Application) configuration", "UDP agent configuration" (if UDP is used) or "TCP agent configuration" and "TCP sink agent configuration" (if TCP is used). See Figure 44, Figure 45 and Figure 46 as examples for the various parameters of the traffic applications.

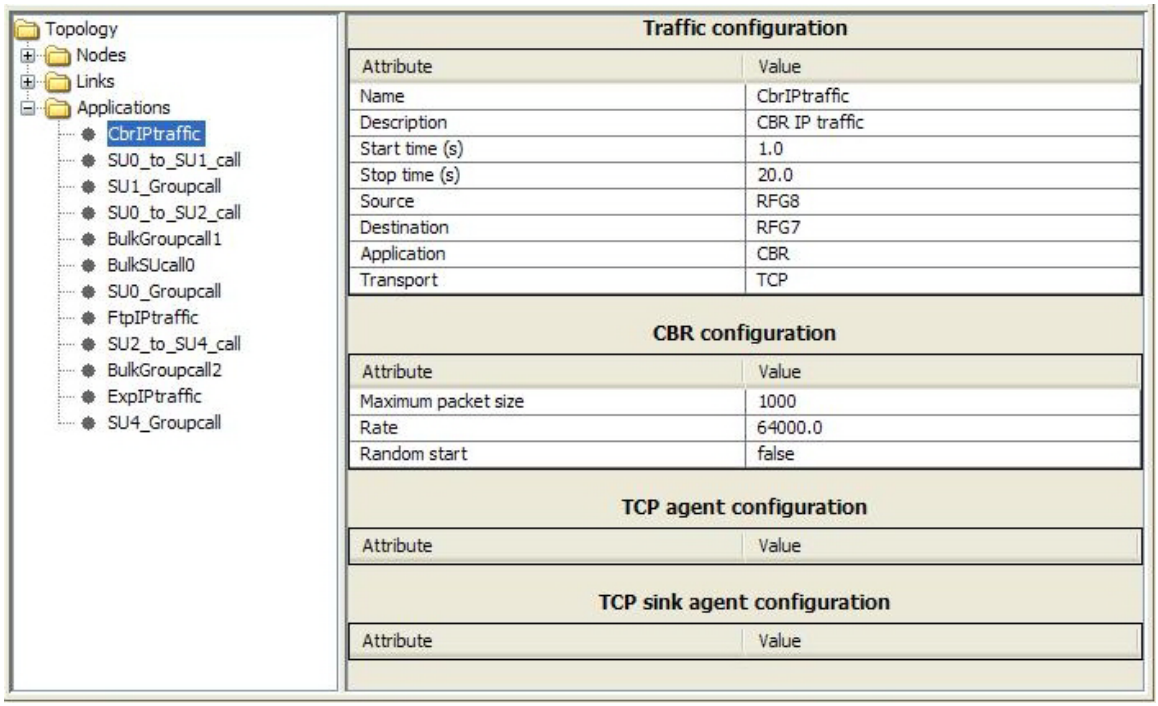



**Figure 44 - Topology: CBR Application Information**

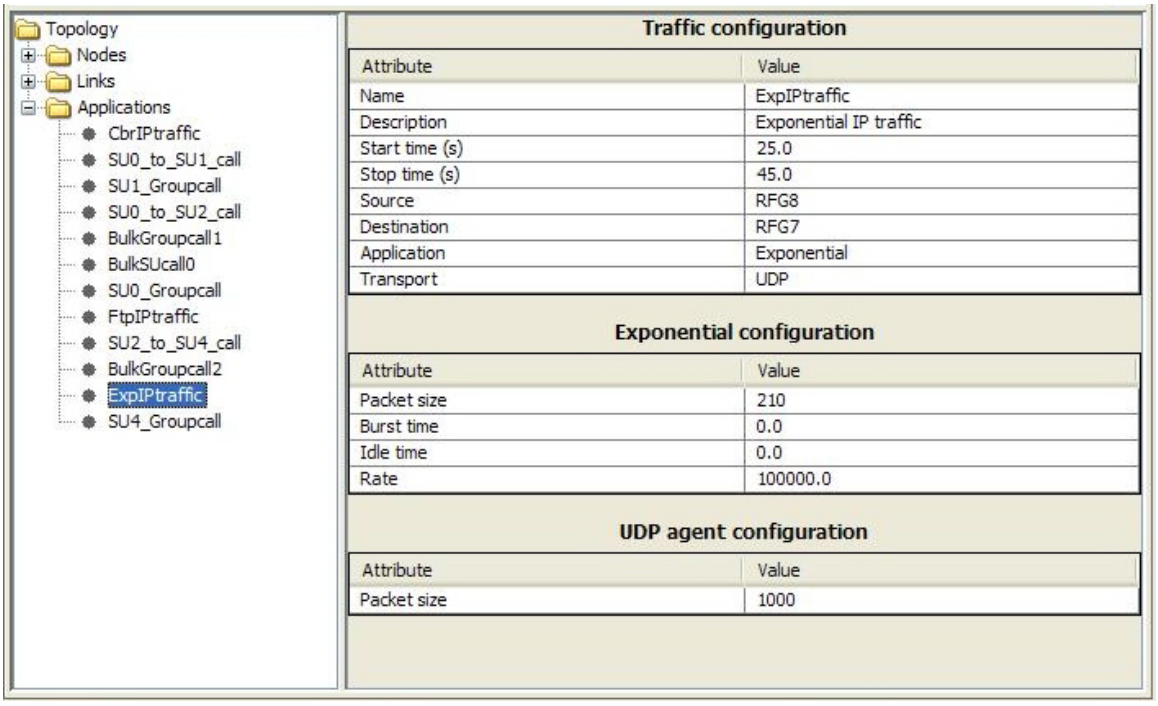



**Figure 45 - Topology: Exponential Application Information**

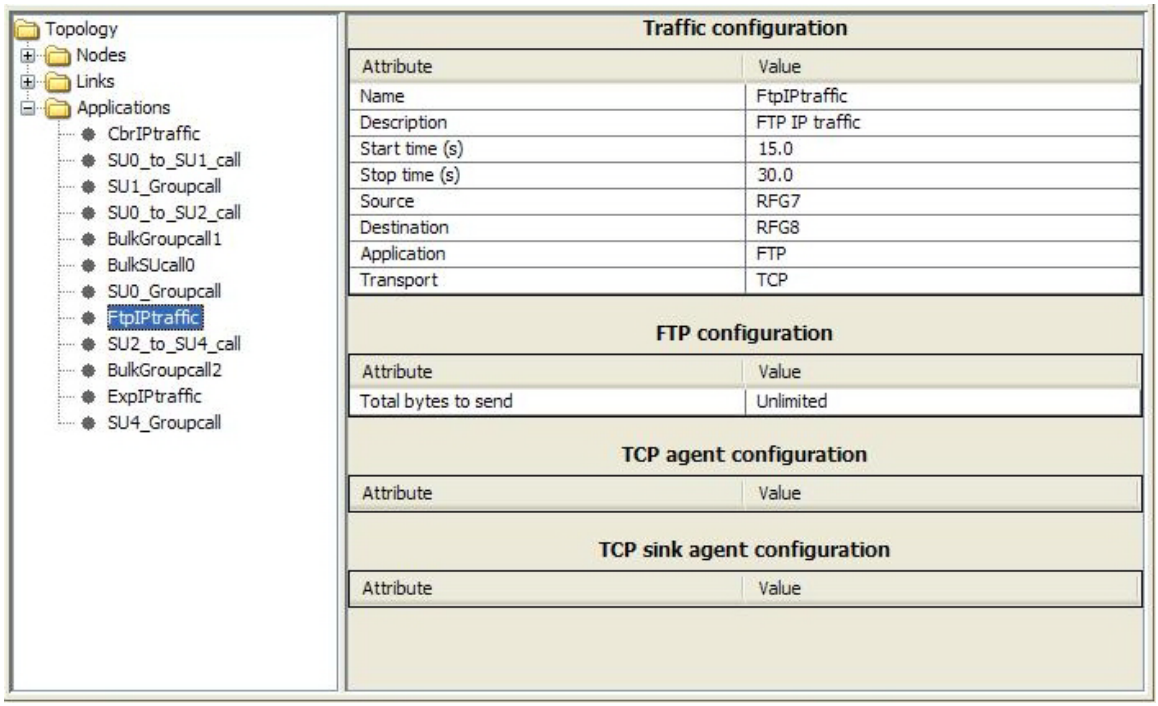



**Figure 46 - Topology: FTP Application Information**

- Single click on a group call name to display the “Group call configuration”. See Figure 47.

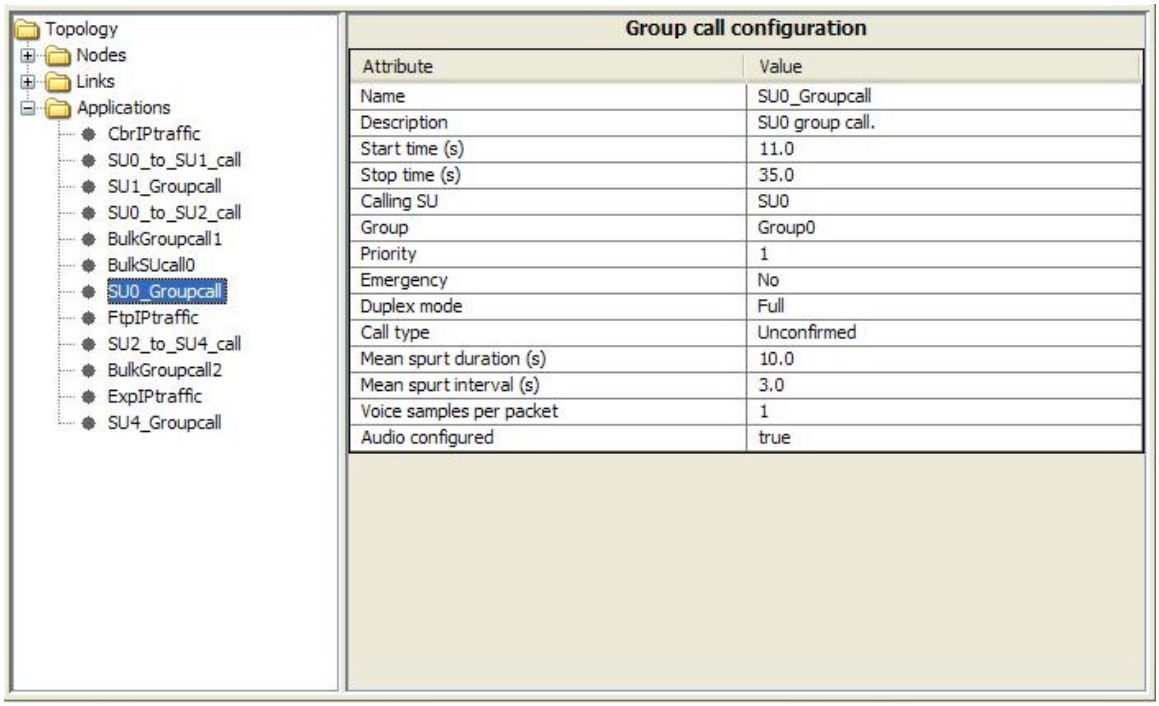



**Figure 47 - Topology: Group Call Application Information**

- Single click on a bulk group call name to display the “Bulk group call configuration”. See Figure 48.

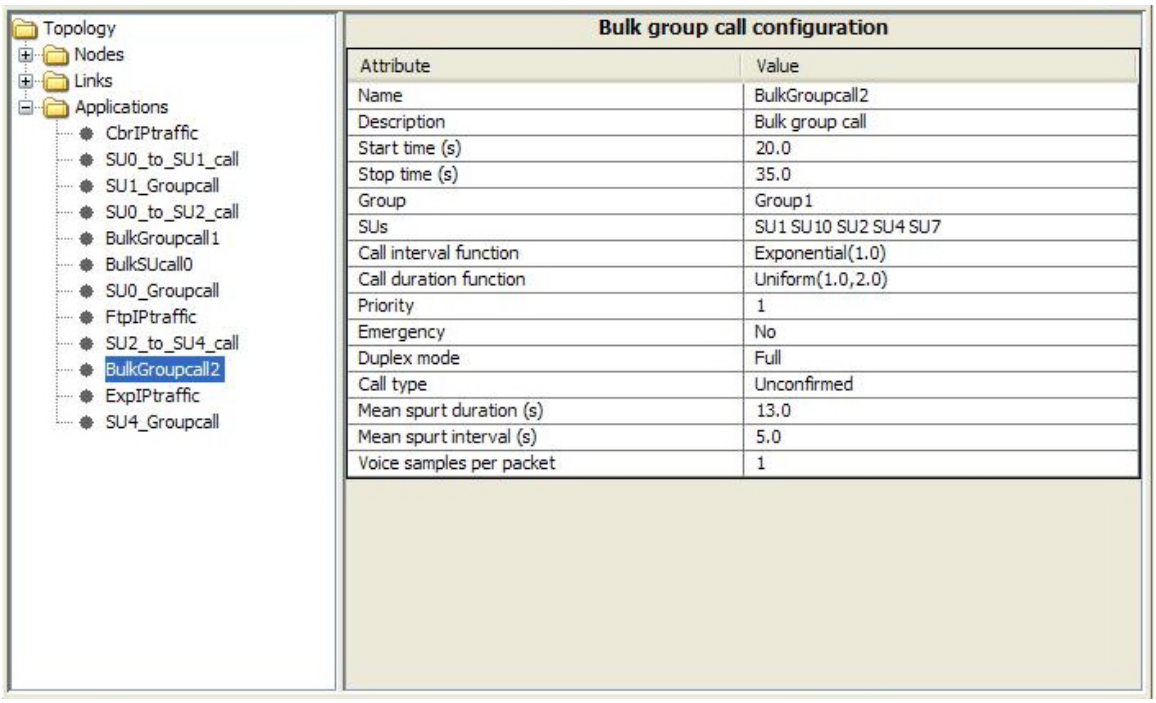



**Figure 48 - Topology: Bulk Group Call Application Information**

- Single click on an SU-to-SU call name to display the "Unit to Unit call configuration". See Figure 49.

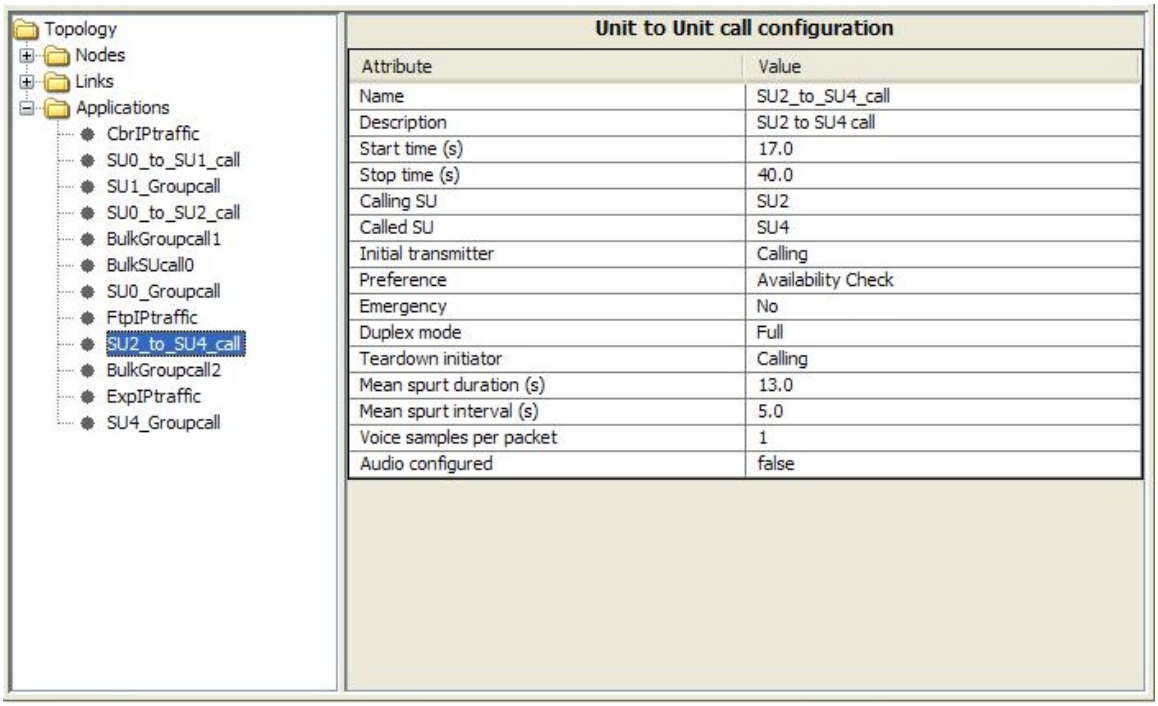
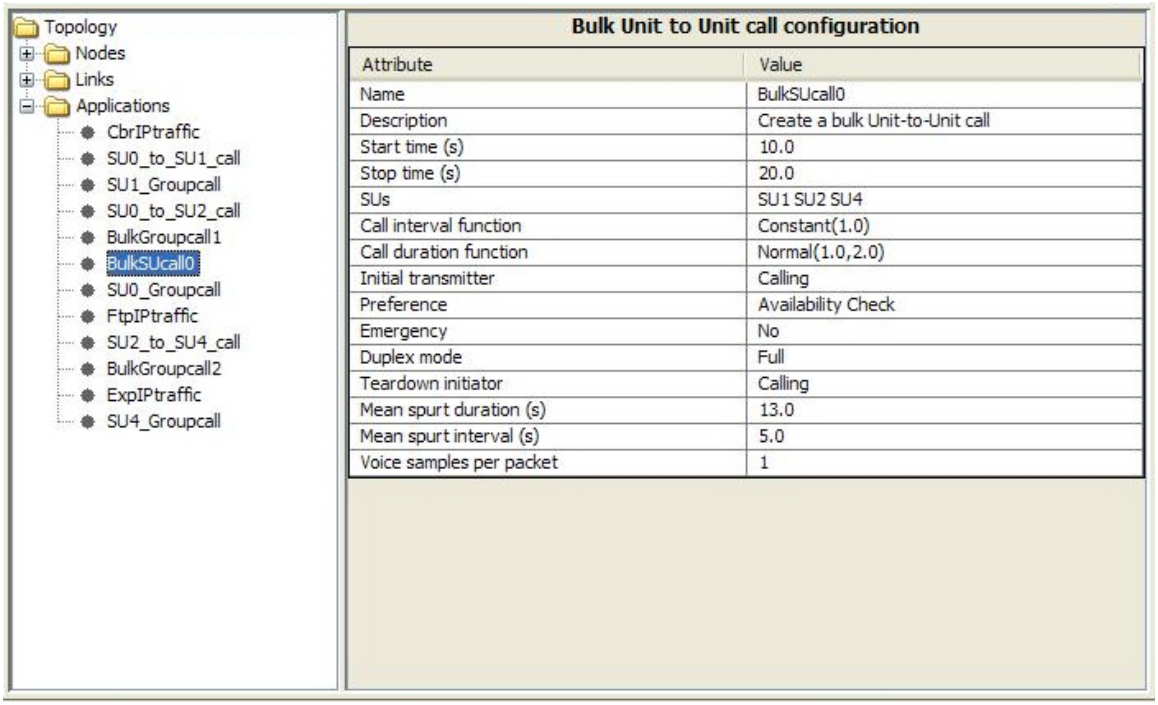



**Figure 49 - SU-to-SU Call Application Information**

- Single click on a bulk SU call name to display the “Bulk Unit to Unit call configuration”. See Figure 50.




**Bulk Unit to Unit call configuration**

| Attribute | Value |
|---|---|
| Name | BulkSUcall0 |
| Description | Create a bulk Unit-to-Unit call |
| Start time (s) | 10.0 |
| Stop time (s) | 20.0 |
| SUs | SU1 SU2 SU4 |
| Call interval function | Constant(1.0) |
| Call duration function | Normal(1.0,2.0) |
| Initial transmitter | Calling |
| Preference | Availability Check |
| Emergency | No |
| Duplex mode | Full |
| Teardown initiator | Calling |
| Mean spurt duration (s) | 13.0 |
| Mean spurt interval (s) | 5.0 |
| Voice samples per packet | 1 |

**Figure 50 - Bulk SU Call Application Information**

# 6 Statistics Panel

The Statistics panel contains two subpanels: Statistics Folder and Graph/Information. See Figure 51. Note that statistics are only available for applications and actions that generated traffic in the network.

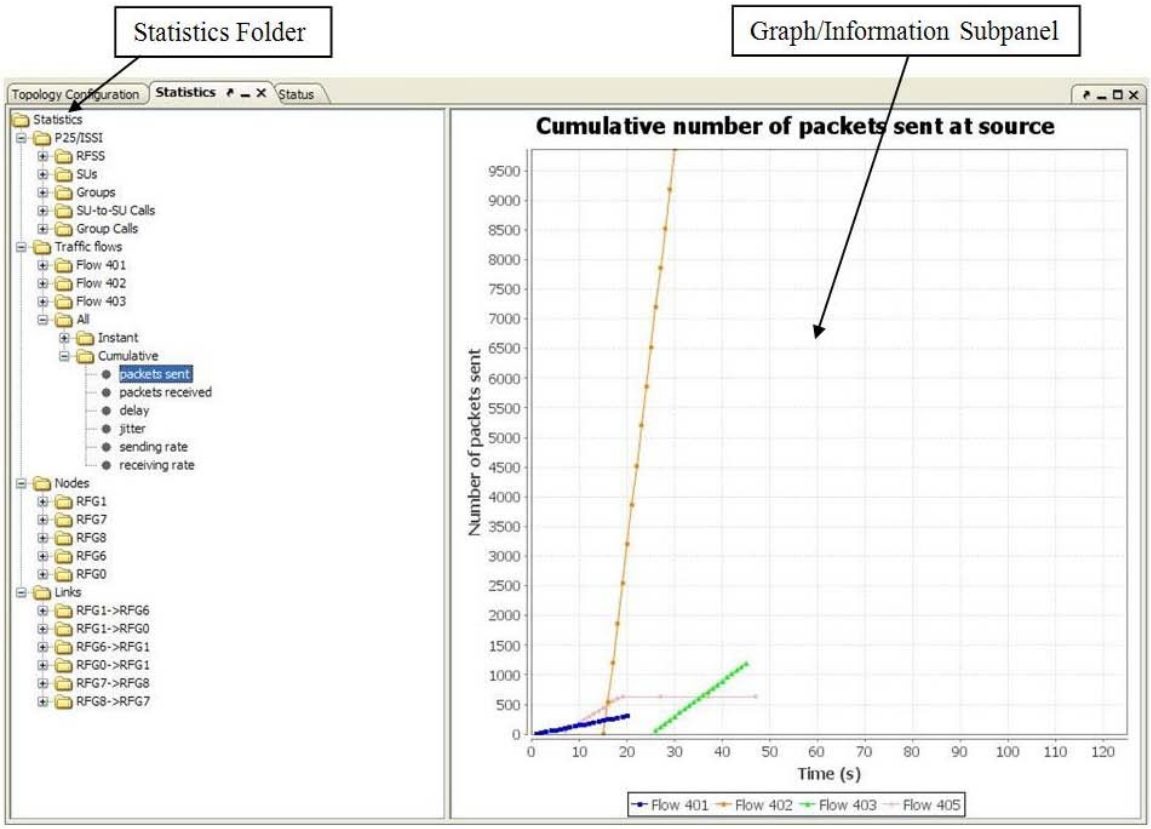



**Figure 51 - Statistics Panel**

The root "Statistics" folder contains performance statistics from the simulation server's results. The layout allows the user to navigate by expanding and collapsing the folders.

The statistics folder contains four folders:

- P25/ISSI
- Traffic flows
- Nodes
- Links

ACTIONS:

- Single click on the Plus symbol to expand the folder.
- Single click on the Minus symbol to collapse the folder.
- Double click on the folder's icon or the folder's name to toggle between expanding and collapsing the structure under that folder.

NOTE: All graphs show statistics up to the time indicated by the master control bar in the "Simulation Progress" subpanel. If the master control bar is at the beginning of the simulation, it is possible that the graphs will be empty since there are no activities yet.

## *6.1 P25/ISSI Folder*

The "P25/ISSI" folder contains statistics specifically related to "Project 25: Inter-RF Subsystem Interface (ISSI)". The five folders under the P25/ISSI folder are RFSS, SUs, Groups, SU-to-SU Calls and Group Calls. If a folder has additional folders under it then it will have a folder icon next to its name. If a folder has no additional folders under it then it will be shown with just its name.

### 6.1.1 RFSS Folder

The "RFSS" folder contains individual RFSS nodes as folders.

ACTIONS:

- Single click on the individual RFSS name to display information related to its SU and group activities.
  - The SU activity table contains the following items and their values:
    - SU registrations initiated by this node
    - SU registrations completed by this node
    - SU registrations received by this node
    - SU registrations accepted by this node
    - SU-to-SU calls initiated
    - SU-to-SU calls completed
  - The group activity table contains the following items and their values:
    - Group registrations initiated by this node
    - Group registrations completed by this node
    - Group registrations received by this node
    - Group registrations accepted by this node
    - Group calls initiated
    - Group calls completed
- Double click on the individual RFSS name to expand and reveal its "instant" folder.

#### 6.1.1.1 Instant folder

ACTIONS:

- Double click on the "instant" folder to expand and reveal the following items:
  - Number of SUs currently registered as home
  - Number of SUs currently registered as serving
  - Number of SUs with active calls
  - Number of groups currently registered as home
  - Number of groups currently registered as serving
  - Number of groups with active calls

- Single click on any of these items will display a graph of its statistic.

- Pointing then hovering over any of the graph's data point will display its values (see Figure 52).

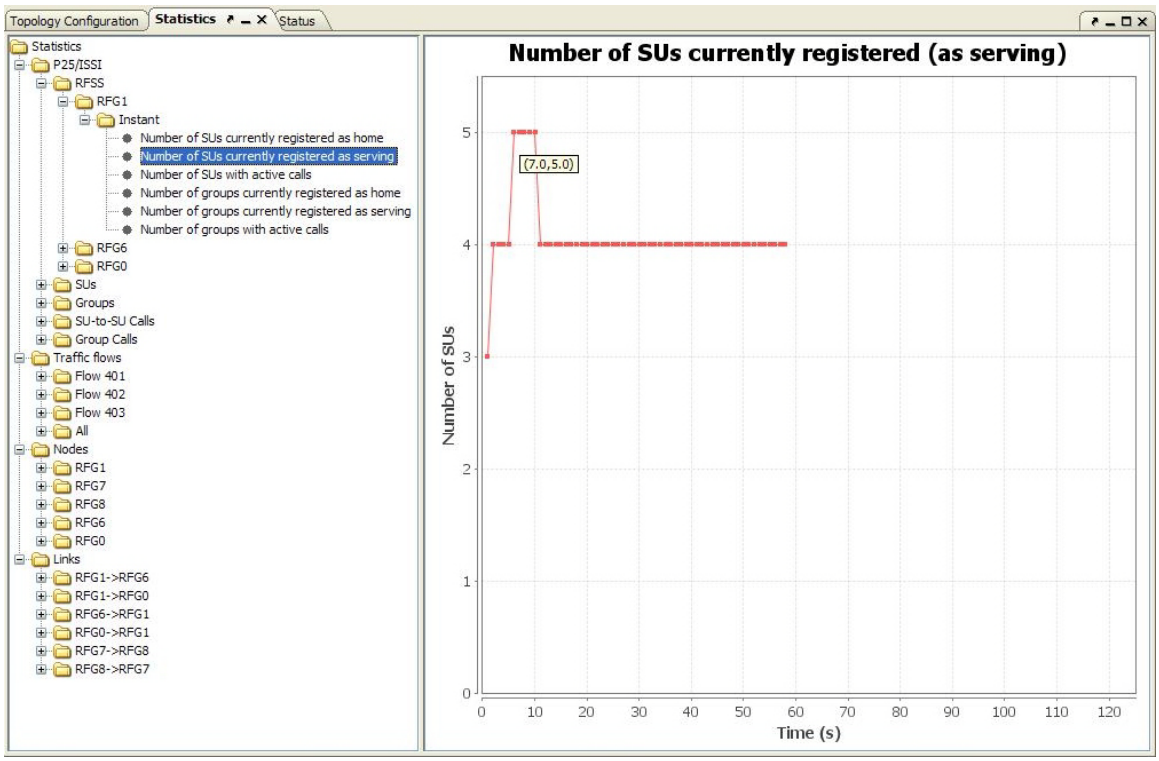



**Figure 52 - Statistics: RFSS Graph**

## 6.1.2 SUs folder

The "SUs" folder contains individual subscriber units (SU) as folders.

ACTIONS:

- Single click on an SU name to display information (servings and calls) about the SU's activities from the simulation. See Figure 53.

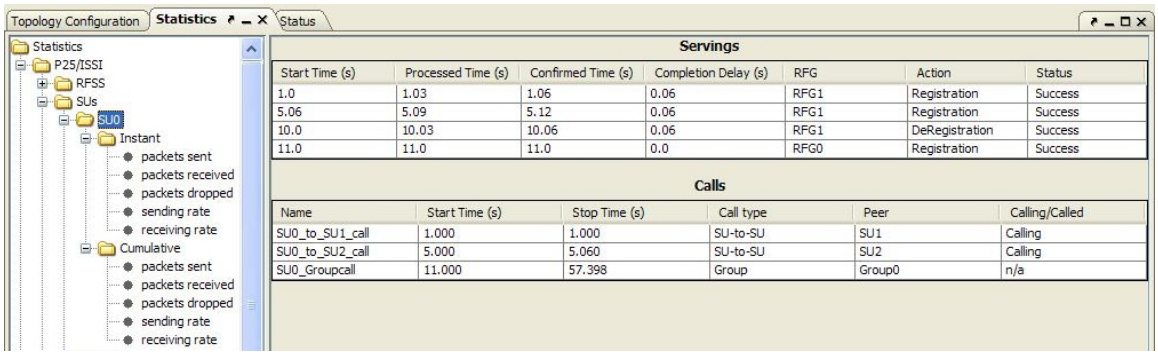



**Figure 53 - Statistics: SU**

- The servings table contains the following information:
  - Start Time: Time the request (action) was initiated
  - Processed Time: Time the "home" received the request

- Confirmed Time: Time the response was received by the “serving”
- Completion Delay: Time it took to complete the request (start to finish)
- RFG: Node that initiated the request
- Action: Type of request (Registration or Deregistration)
- Status: The status of the request (Success or Failure)

- The calls table contains the following information:
  - Name: The name used to identify this call (application)
  - Start Time: Time the call was initiated
  - Stop Time: Time the call ended
  - Call type: SU-to-SU or Group
  - Peer: Indicates the peer that this SU is communicating with for SU-to-SU calls. Indicates the group name that is involved for group calls.
  - Calling/Called: Indicates the role for this SU in the call.

### 6.1.3 Groups Folder

The “Groups” folder contains individual groups as folders if any are defined.

#### 6.1.3.1 Individual Group Folder

ACTIONS:

- Single click on a group name to display the serving RFSSs for the group and any related group calls statistics. See Figure 54.

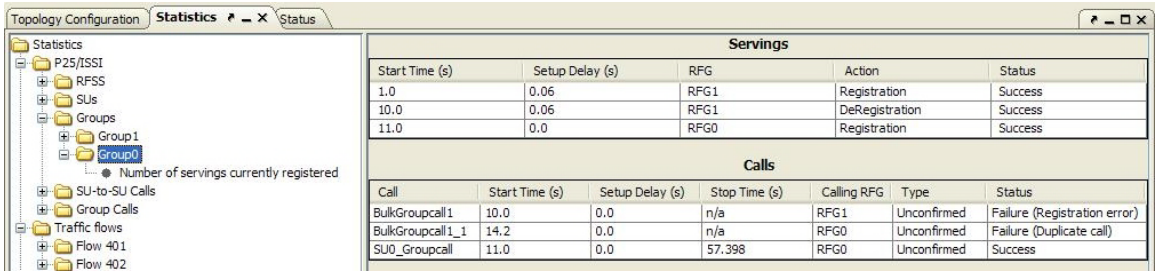



**Figure 54 - Statistics: Group**

- Double click on a group name to show the “Number of servings currently registered” item.
- Single click on the “Number of servings currently registered” item to show the graph for its statistics.
- Pointing then hovering over any of the graph’s data point will display its values.

### 6.1.4 SU-to-SU Calls Folder

The “SU-to-SU Calls” folder contains SU-to-SU calls and bulk SU calls as folders (if any) as well as the “All” folder that summarizes all calls in the project. Bulk SU calls are calls containing multiple SU-to-SU calls under the “bulk”; they are used to simplify the generation of multiple SU-to-SU calls. See Figure 55.

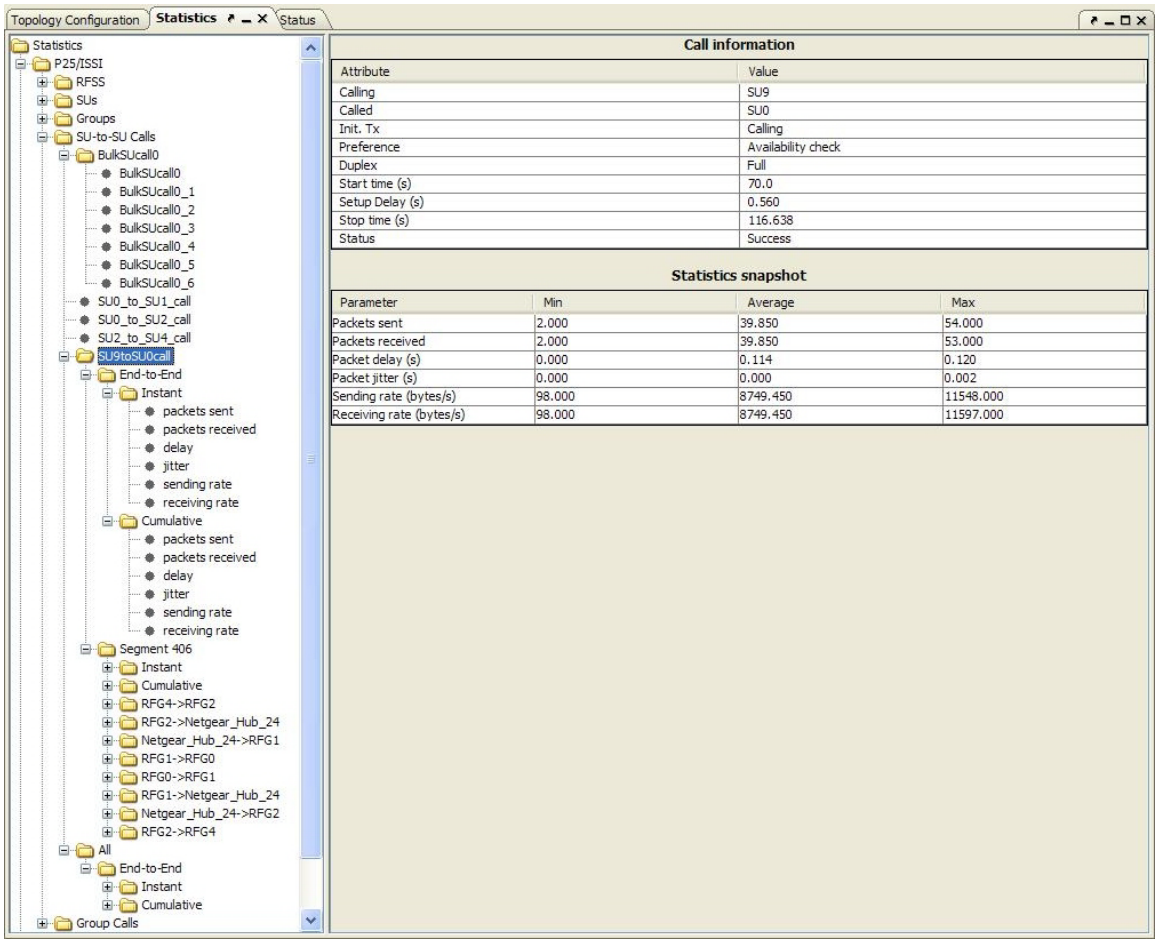



**Figure 55 - Statistics: Expansion of the SU-to-SU Calls Folder**

NOTE: All failed calls do not have a folder icon next to their names hence they are not expandable.

ACTIONS:

- Single click on a failed call name to show its “Call information” which contains the “Status” field with the error message. See Figure 56 and Figure 57.

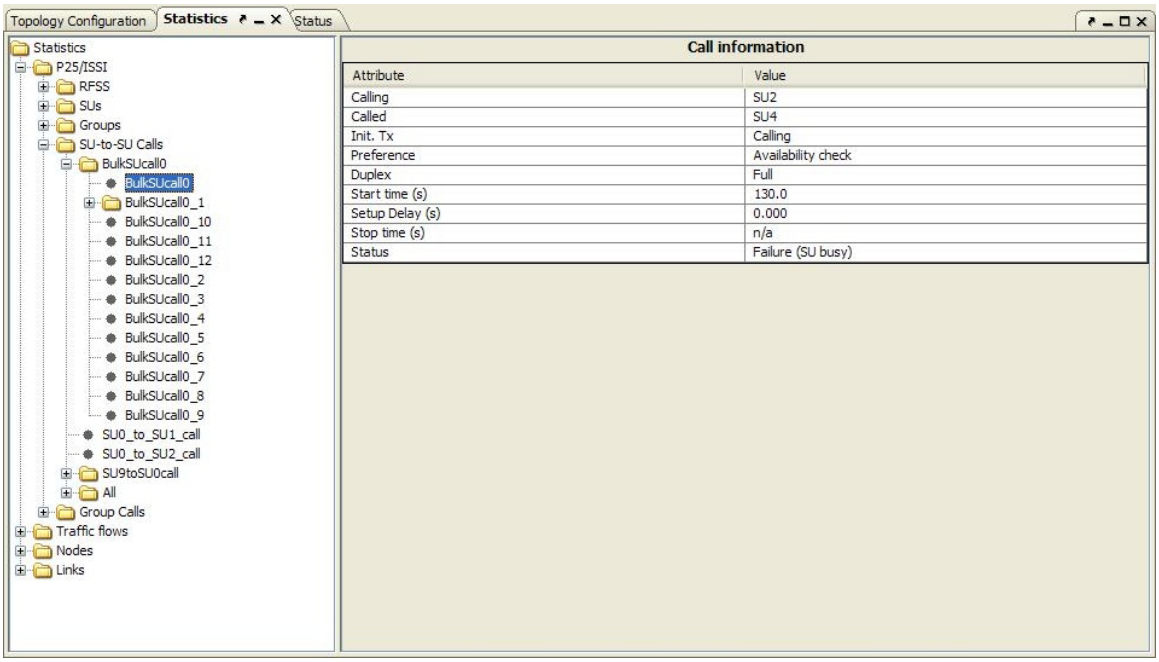



**Figure 56 - Statistics: SU-to-SU Call Failure under a Bulk SU Call**

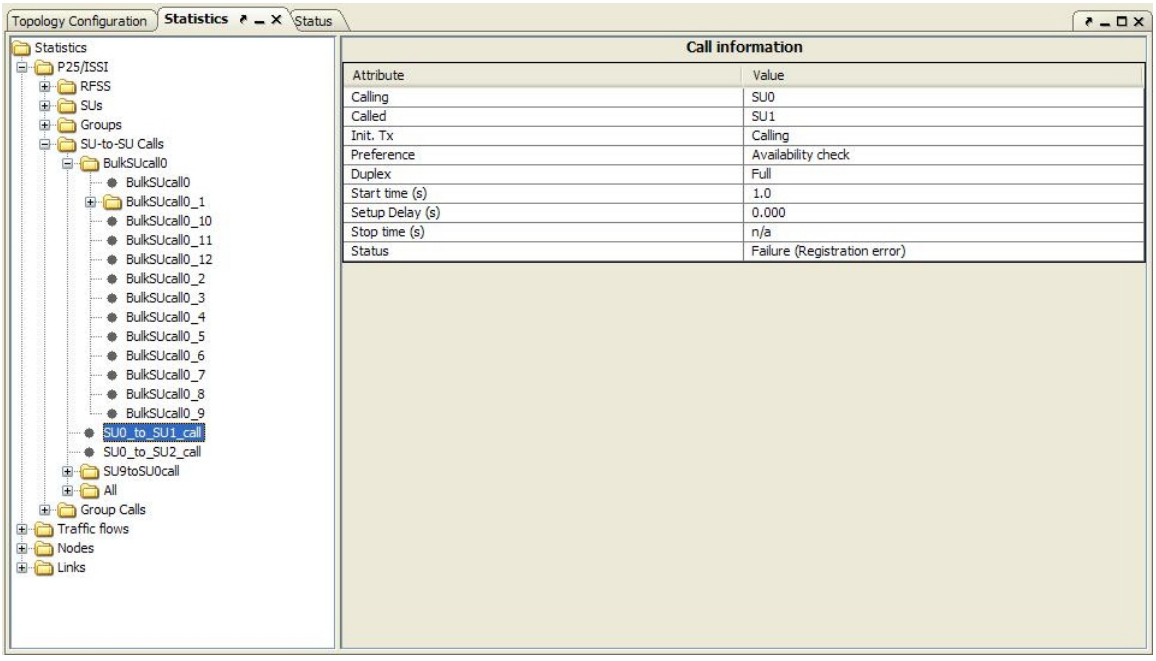



**Figure 57 - SU-to-SU Call Failure**

### 6.1.4.1 Bulk SU Call Folder

ACTIONS:

- Double click on an individual bulk SU call name to display all of the SU-to-SU calls in that bulk. All successful SU-to-SU calls in that bulk will have a folder icon next to their names while all unsuccessful calls will not have the folder icon next to their names and therefore cannot be expanded. See Figure 58.

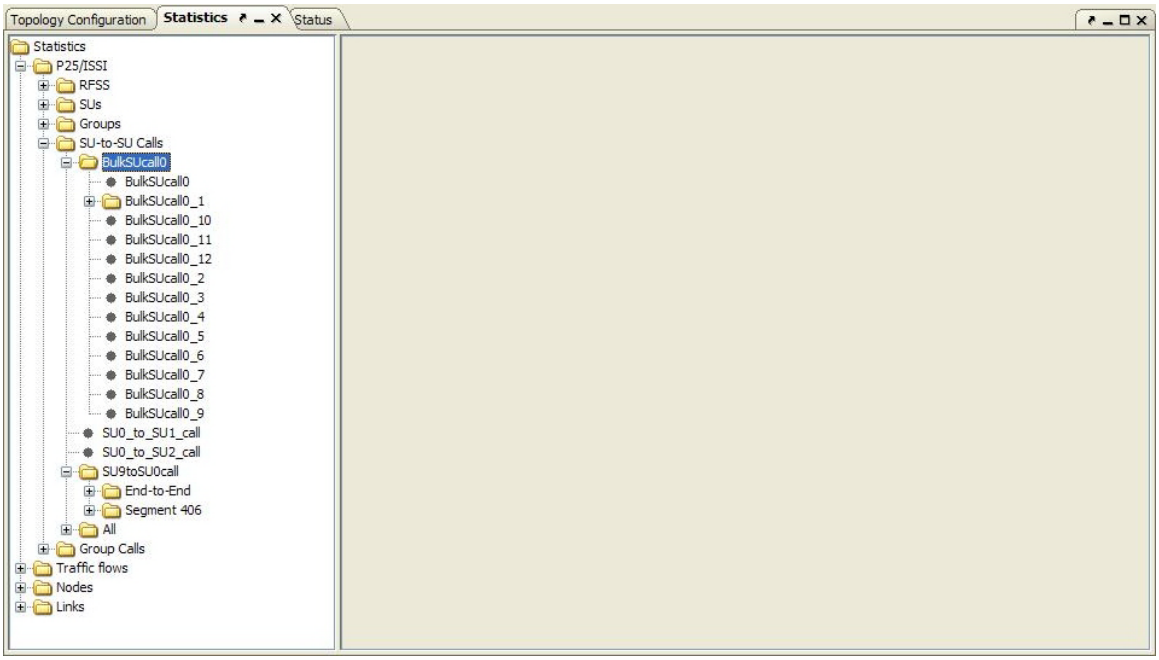



**Figure 58 - Statistics: Bulk SU Call Members**

- Single click on any successful SU-to-SU call in the bulk to display its "Call information" and "Statistics snapshot". In this example, the SU-to-SU call "BulkSUcall0_1" was the only successful call in the bulk SU call "BulkSUcall0" shown in Figure 58. The following section gives more details about the "SU-to-SU Call Folder".

### 6.1.4.2 Individual SU-to-SU Call Folder

ACTIONS:

- Single click on an individual SU-to-SU call to display its "Call Information" and a "Statistics snapshot", see Figure 55.

    - The "Call Information" consists of:
        - Calling: This identifies the SU initiating the call.
        - Called: This identifies the SU receiving the call.
        - Initial Transmission: This indicates which SU began the voice transmission.
        - Preference: This indicates whether availability check was requested or not.
        - Duplex: This indicates whether the communication was half or full duplex.
        - Start time: This indicates the time when this call was initiated.
        - Setup Delay: This indicates the time that it took to establish the call from end to end.
        - Stop time: This indicates the time when this call was stopped.
        - Status: This indicates "Success" if the call succeeded; it indicates "Failure" if the call failed to complete.

The "Statistics snapshot" consists of packets sent, packets received, packet delay, packet jitter, sending rate and receiving rate.

- Double click on an individual call folder to expand and reveal the segment(s) that compose the call, as well as the “End-to-End” folder. A segment is the communication path between two RFGs.

#### *6.1.4.2.1 End-to-End Folder*

The “End-to-End” folder contains instant and cumulative statistical information.

ACTIONS:

- Double click on the “End-to-End” folder to expand and reveal its “Instant” and “Cumulative” folders. See Figure 59.

##### 6.1.4.2.1.1 Instant Folder

ACTIONS:

- Double click on the “Instant” folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate. See Figure 59.
- Single click on the individual item to display a graph of its statistic (if values are available). See Figure 59.
- Pointing then hovering over any of the graph’s data point will display its values. See the graph in Figure 59.

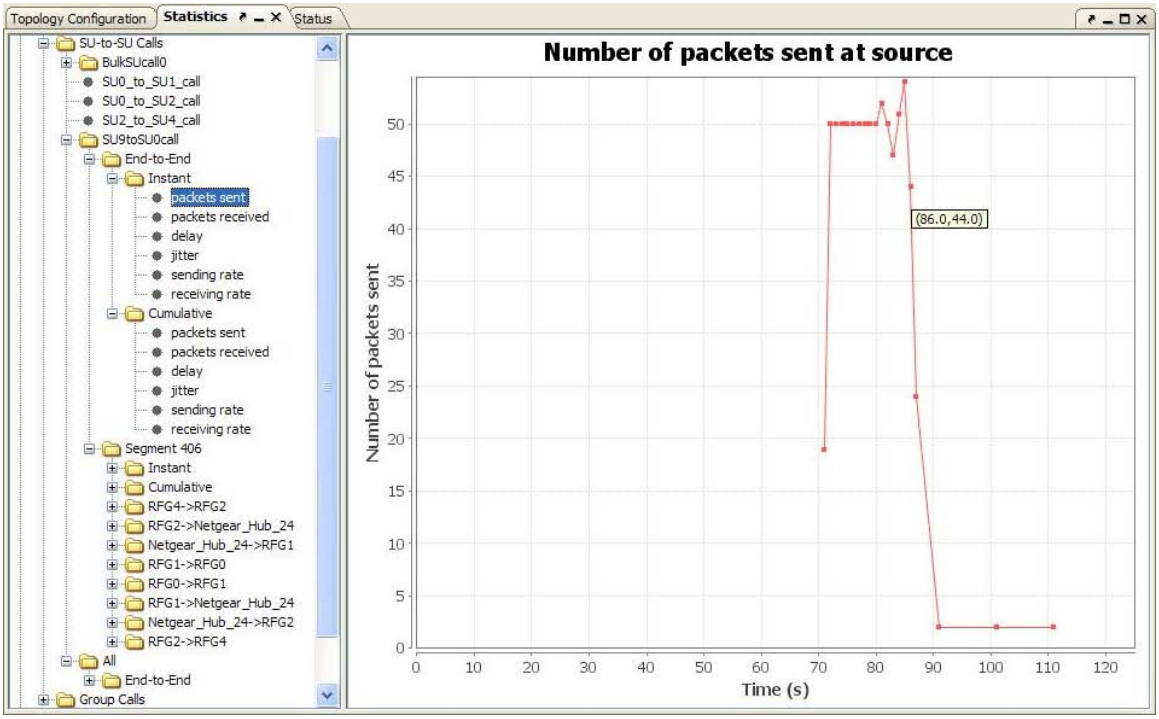



**Figure 59 - Statistics: SU-to-SU Call, Packets Sent Graph**

##### 6.1.4.2.1.2 Cumulative Folder

ACTIONS:

- Double click on the "Cumulative" folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate. See Figure 59.
- Single click on the individual item to display a graph of its statistic (if values are available). See Figure 59.
- Pointing then hovering over any of the graph's data point will display its values. See the graph in Figure 59.

#### *6.1.4.2.2 Segment folder*

The "Segment" folder contains the segments along the transmission path of the call. The number of segments for the call is based on the number of communication paths between two RFGs of the topology (e.g., calling serving to calling home; calling home to called home; called home to called serving).

ACTIONS:

- Single click on a segment name to display its "Call segment information" and its "Statistics snapshot", see Figure 60.

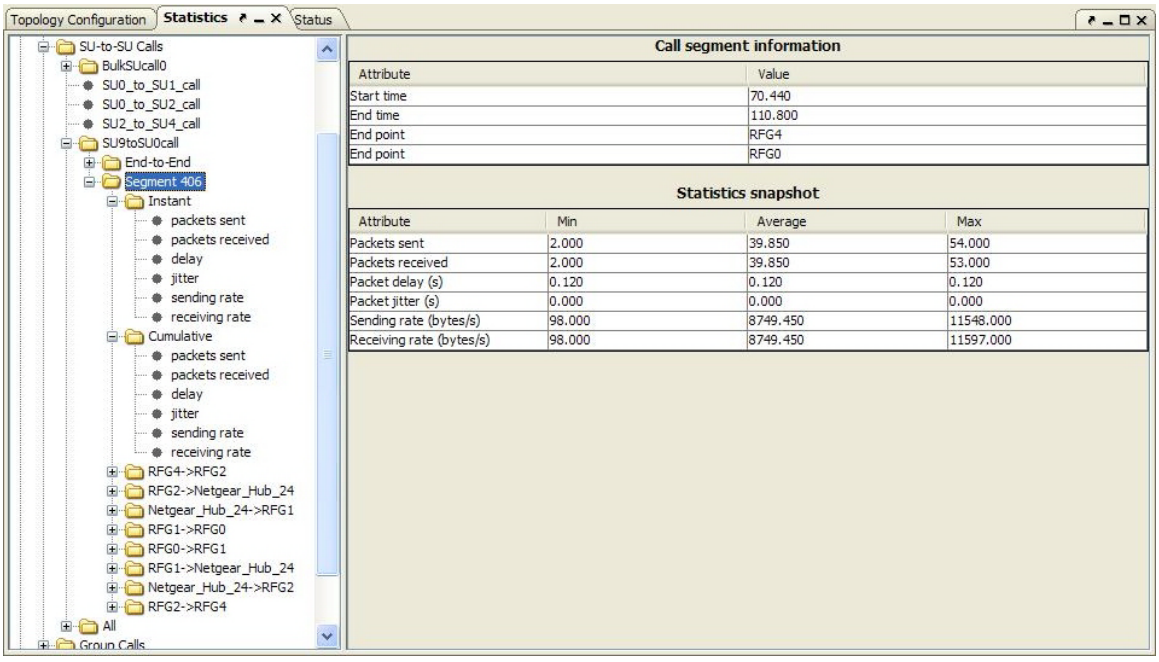



**Figure 60 - Statistics: SU-to-SU Call Segment Information**

- The "Call segment information" consists of:
  - Start time: This indicates the start time for this segment.
  - End time: This indicates the end time for this segment.
  - End point: The "End point" shows the serving's name (one per end point).

The "Statistics snapshot" consists of packets sent, packets received, packet delay, packet jitter, sending rate and receiving rate.

- Double click on an individual segment folder to expand and reveal its “Instant” and “Cumulative” folders.

#### 6.1.4.2.2.1 Instant Folder

ACTIONS:

- Double click on the “Instant” folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

#### 6.1.4.2.2.2 Cumulative Folder

ACTIONS:

- Double click on the “Cumulative” folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

#### 6.1.4.2.2.3 Directional Segment Folder

ACTIONS:

- Single click on a directional segment folder to display its “Statistics snapshot” consisting of packets sent, packets received, packets dropped, queuing delay, transmit delay, sending rate and receiving rate. See Figure 61.

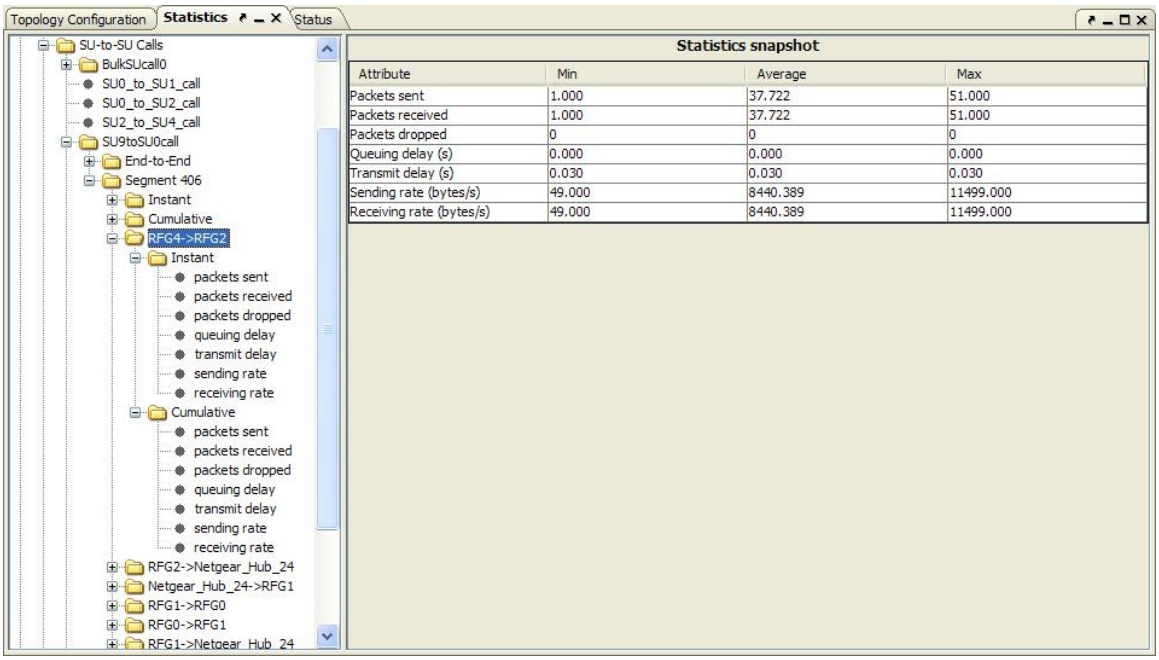



**Figure 61 - Statistics: SU-to-SU Call Directional Segment Information**

- Double click on a directional segment folder to expand and reveal its “Instant” and “Cumulative” folders.

6.1.4.2.2.3.1 Instant Folder

ACTIONS:

- Double click on the “Instant” folder to expand and reveal the following items: Packets sent, packets received, packets dropped, queuing delay, transmit delay, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

6.1.4.2.2.3.2 Cumulative Folder

ACTIONS:

- Double click on the “Cumulative” folder to expand and reveal the following items: Packets sent, packets received, packets dropped, queuing delay, transmit delay, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

## 6.1.4.3 All Folder

The “All” folder contains the “End-to-End” folder. This folder represents the summarization of the statistics for all calls. See Figure 62.

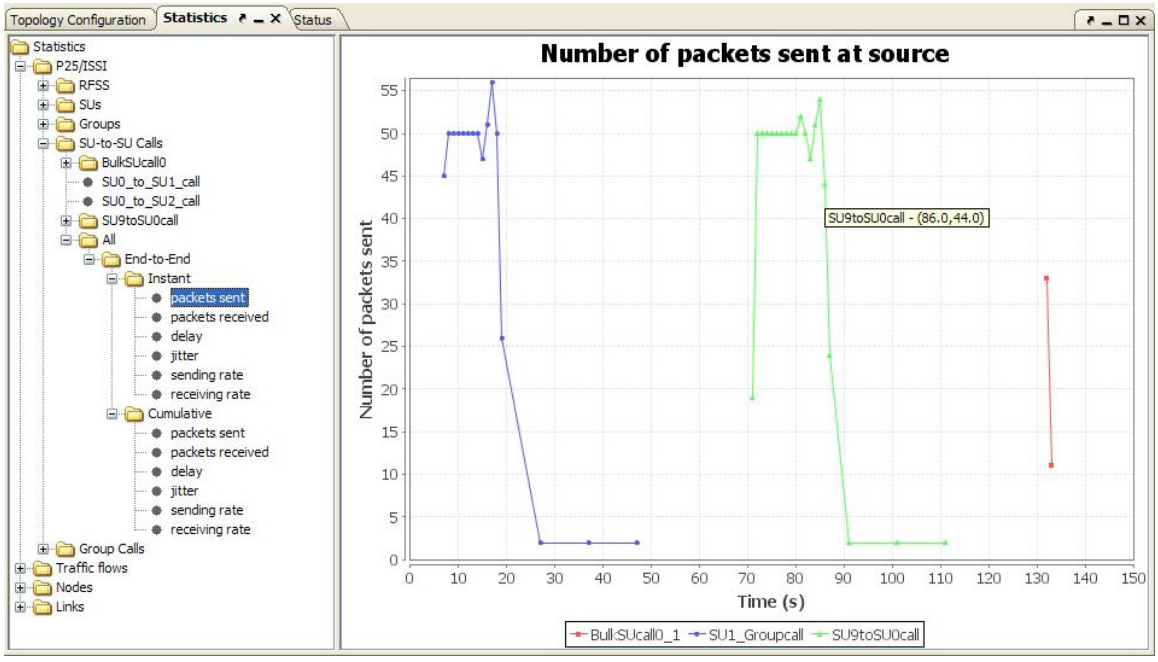



**Figure 62 - Statistics: SU-to-SU Calls “All” Summarization Graph Example**

### *6.1.4.3.1 End-to-End Folder*

The “End-to-End” folder contains the “Instant” and “Cumulative” statistical folders.

ACTIONS:

- Double click on the End-to-End folder to expand and reveal the “Instant” and “Cumulative” folders. See Figure 62.

#### 6.1.4.3.1.1 Instant Folder

ACTIONS:

- Double click on the “Instant” folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

#### 6.1.4.3.1.2 Cumulative Folder

ACTIONS:

- Double click on the “Cumulative” folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

### 6.1.5 Group Calls Folder

The “Group Calls” folder contains group calls and bulk group calls as folders (if any) for the simulation project. Bulk group calls are calls containing multiple group calls under the “bulk”; they are used to simplify the generation of multiple group calls. See Figure 63.

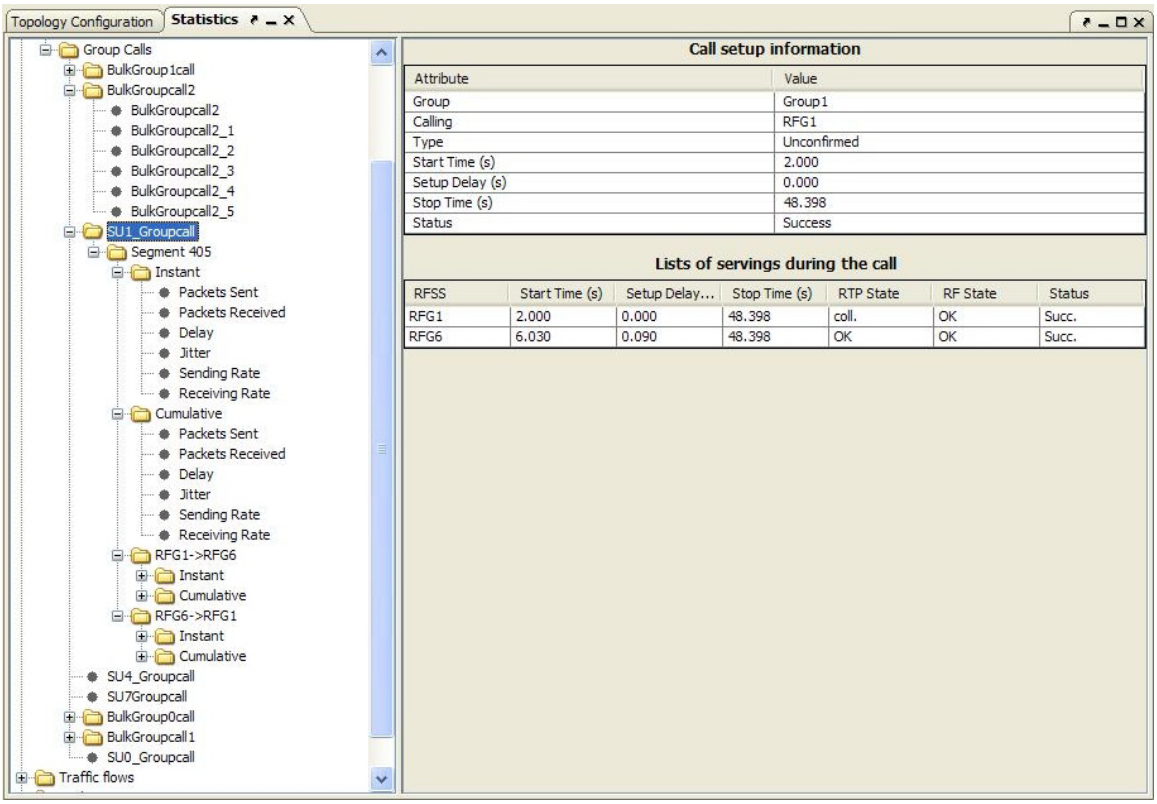



**Figure 63 - Statistics: Expansion of the Group Calls Folder**

NOTE: All failed calls do not have a folder icon next to their names hence they are not expandable. Non-collocated successful calls that have a folder icon next to their names can be expanded to show their segment information if applicable (see "SU1_Groupcall" in Figure 63).

ACTIONS:

- Single click on a call name to show its "Call setup information" and "Lists of servings during the call". The "Status" field in the "Call setup information" shows if the call was successful or not. See Figure 64 and Figure 65.

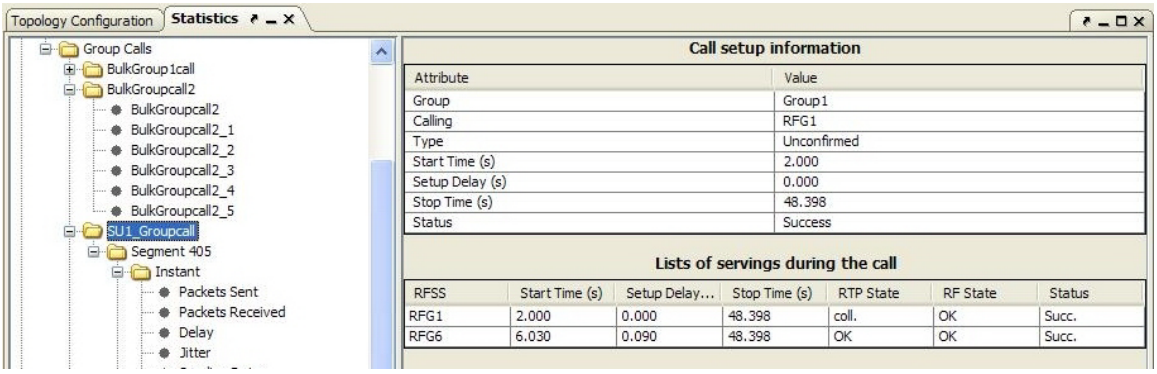



**Figure 64 - Statistics: Successful Group Call Information**

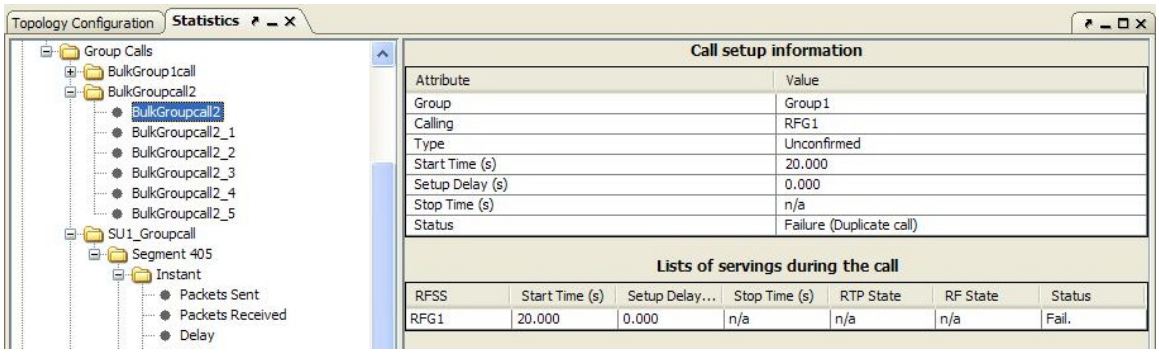



**Figure 65 - Statistics: Failed Group Call Information**

- Double click on an individual group call name to display its segments if applicable. A group call will only have a folder icon next to its name if it contains one or more segment. See Figure 64.

### 6.1.5.1 Segment Folder

The “Segment” folder contains the segments along the transmission path of the group call. The number of segments for the call is based on the number of communication paths between two RFGs of the topology.

ACTIONS:

- Single click on a segment name to display its “Call segment information” and its “Statistics snapshot”, see Figure 66.

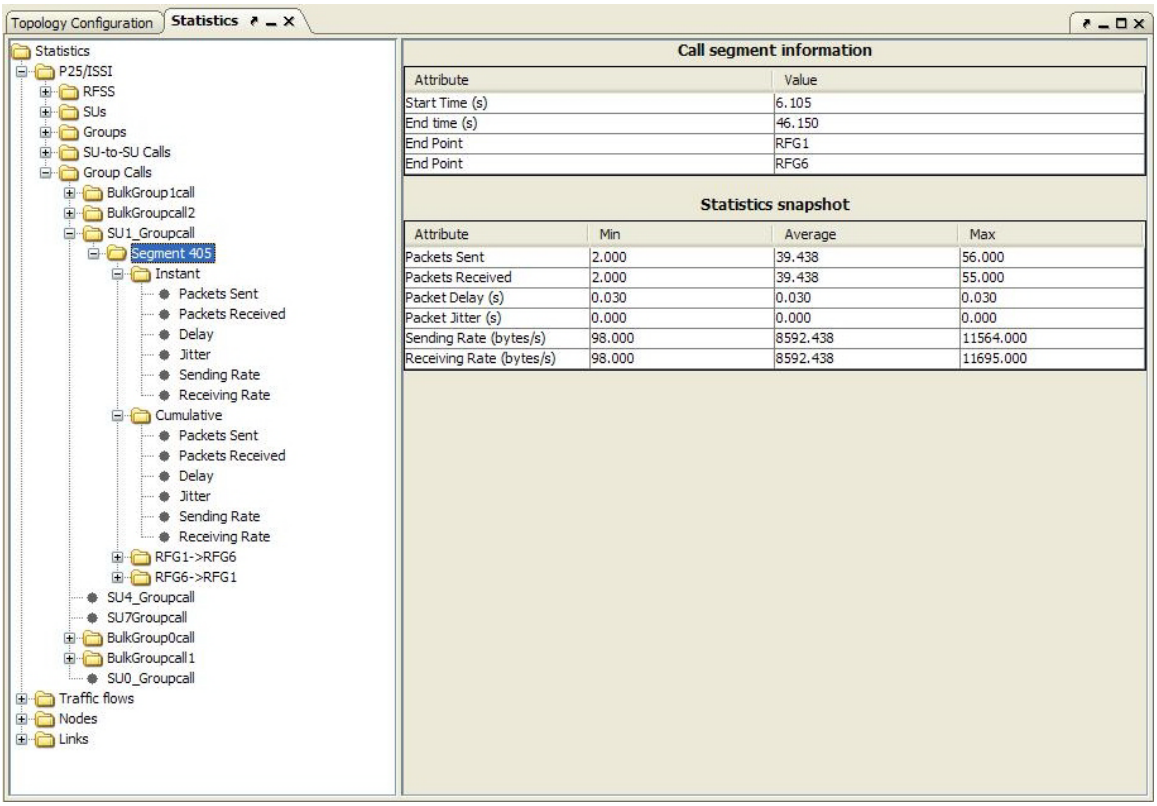



**Figure 66 - Statistics: Group Call Segment Information**

- The "Call segment information" consists of:
  - Start time: This indicates the start time for this segment.
  - End time: This indicates the end time for this segment.
  - End point: The "End point" shows the serving's name (one per end point).

The "Statistics snapshot" consists of packets sent, packets received, packet delay, packet jitter, sending rate and receiving rate.

- Double click on an individual segment folder to expand and reveal its "Instant" and "Cumulative" folders.

#### *6.1.5.1.1 Instant Folder*

ACTIONS:

- Double click on the "Instant" folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph's data point will display its values.

#### *6.1.5.1.2 Cumulative Folder*

ACTIONS:

- Double click on the “Cumulative” folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

#### *6.1.5.1.3 Directional Segment Folder*

ACTIONS:

- Single click on a directional segment folder to display its “Statistics snapshot” consisting of packets sent, packets received, packets dropped, queuing delay, transmit delay, sending rate and receiving rate. See Figure 67.

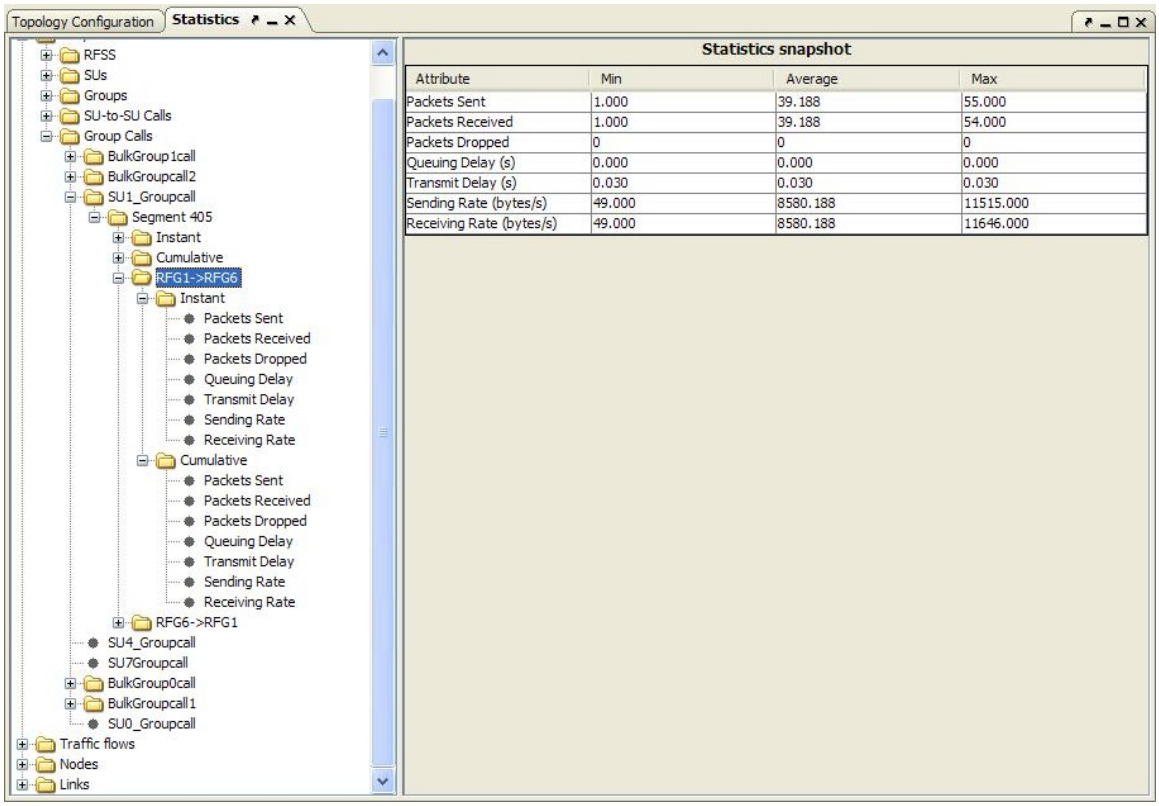



**Figure 67 - Statistics: Group Call Directional Segment Information**

- Double click on a directional segment folder to expand and reveal its “Instant” and “Cumulative” folders. See Figure 67.

##### 6.1.5.1.3.1 Instant Folder

ACTIONS:

- Double click on the “Instant” folder to expand and reveal the following items: Packets sent, packets received, packets dropped, queuing delay, transmit delay, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).

- Pointing then hovering over any of the graph's data point will display its values.

#### 6.1.5.1.3.2 Cumulative Folder

ACTIONS:

- Double click on the "Cumulative" folder to expand and reveal the following items: Packets sent, packets received, packets dropped, queuing delay, transmit delay, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph's data point will display its values.

## *6.2 Traffic Flows Folder*

The "Traffic Flows" folder contains individual flow's statistics by its names (if any) and the "All" folder. Folders can be expanded to show additional information.

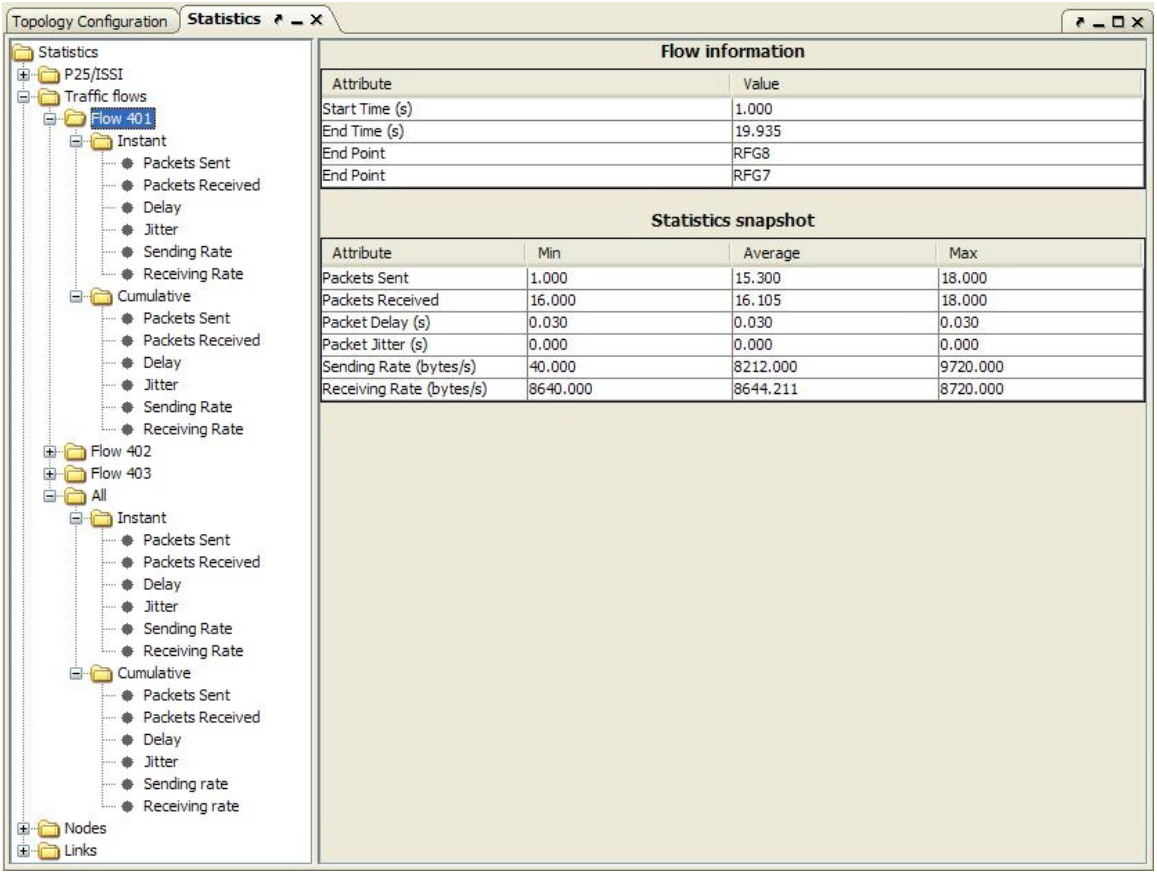



**Figure 68 - Statistics: Expansion of the Traffic Flows Folder**

ACTIONS:

- Single click on a traffic flow folder name to show its "Flow information" and its "Statistics snapshot", see Figure 68.

    - The "Flow information" consists of:

- Start Time (s): This indicates the start time(s) for this flow.
- End Time (s): This indicates the end time(s) for this flow.
- End Point: The “End Point” shows the serving’s name (one per end point).

The “Statistics snapshot” consists of packets sent, packets received, packet delay, packet jitter, sending rate and receiving rate.

- Double click on an individual flow folder to expand and reveal its “Instant” and “Cumulative” folders. See Figure 68.

### 6.2.1 Instant Folder

ACTIONS:

- Double click on the “Instant” folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

### 6.2.2 Cumulative Folder

ACTIONS:

- Double click on the “Cumulative” folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

### 6.2.3 All Folder

The “All” folder represents the summarization of the statistics for all flows and segments.

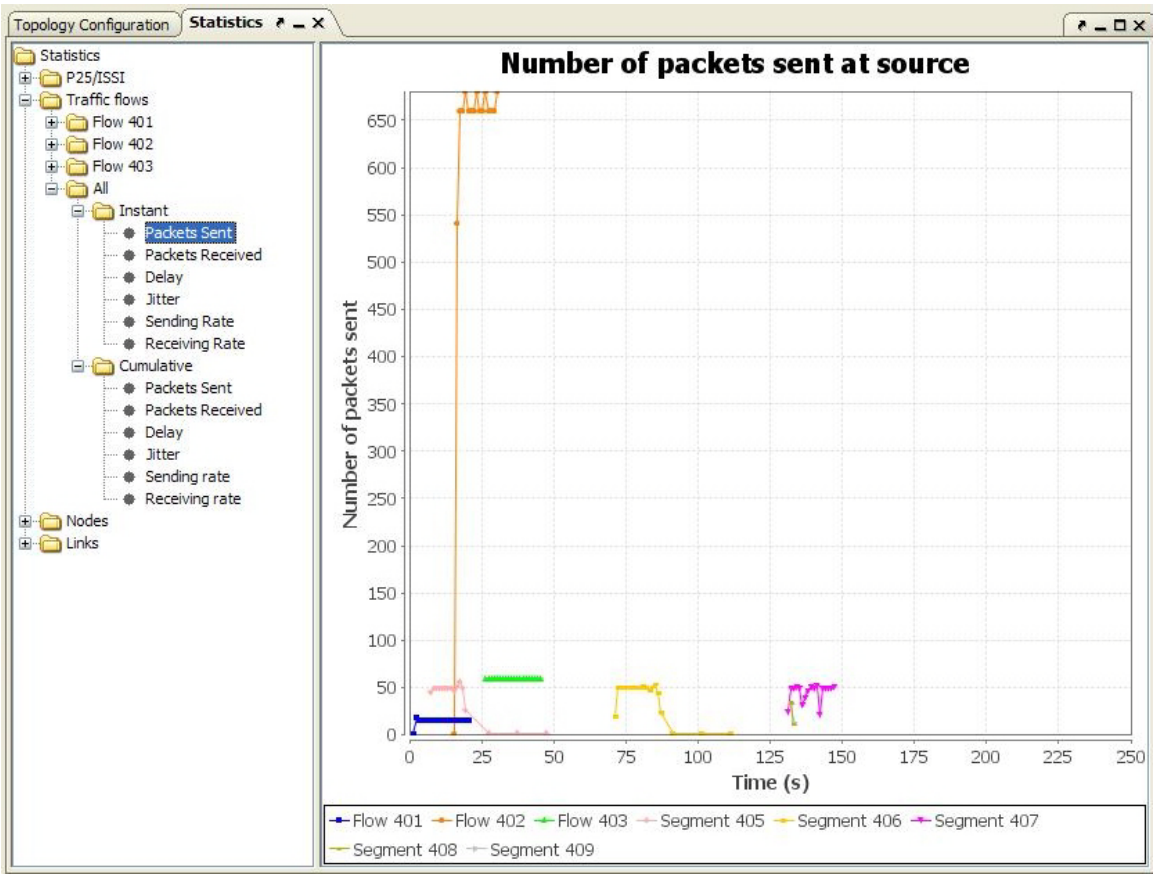



**Figure 69 - Statistics: Traffic Flows "All" Summarization Graph Example**

ACTIONS:

- Double click on the "All" folder to expand and reveal the "Instant" and "Cumulative" folders. See Figure 69.

### 6.2.3.1 Instant Folder

ACTIONS:

- Double click on the "Instant" folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph's data point will display its values.

### 6.2.3.2 Cumulative Folder

ACTIONS:

- Double click on the "Cumulative" folder to expand and reveal the following items: Packets sent, packets received, delay, jitter, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph's data point will display its values.

## 6.3 Nodes Folder

The "Node" folder contains node names as folders; each folder contains statistical information about that node.

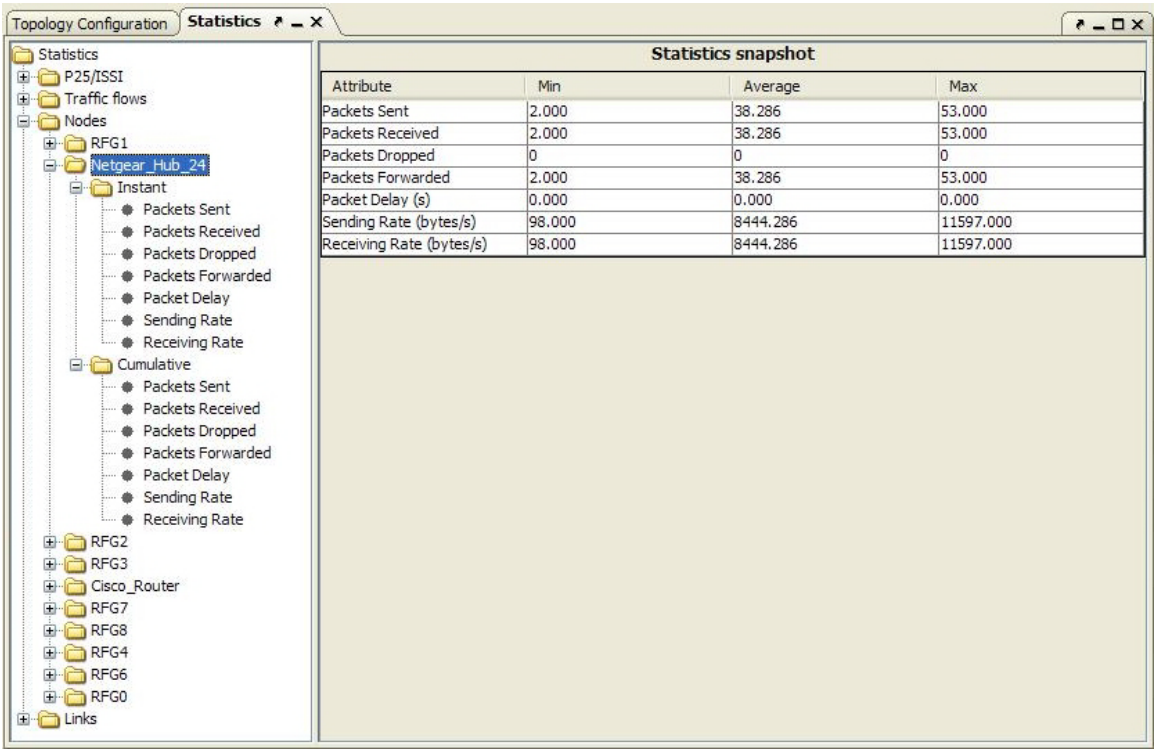



**Figure 70 - Statistics: Expansion of the Nodes Folder**

ACTIONS:

- Single click on a node folder name to show its "Statistics snapshot", see Figure 70.

The "Statistics snapshot" consists of packets sent, packets received, packets dropped, packets forwarded, packet delay, sending rate and receiving rate.

- Double click on an individual flow folder to expand and reveal its "Instant" and "Cumulative" folders.

### 6.3.1 Instant Folder

ACTIONS:

- Double click on the "Instant" folder to expand and reveal the following items: Packets sent, packets received, packets dropped, packets forwarded, packet delay, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph's data point will display its values.

### 6.3.2 Cumulative Folder

ACTIONS:

- Double click on the "Cumulative" folder to expand and reveal the following items: Packets sent, packets received, packets dropped, packets forwarded, packet delay, sending rate and receiving rate.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph's data point will display its values.

## *6.4 Links Folder*

The "Links" folder contains folders representing unidirectional links between two nodes; each folder contains statistical information about that link.

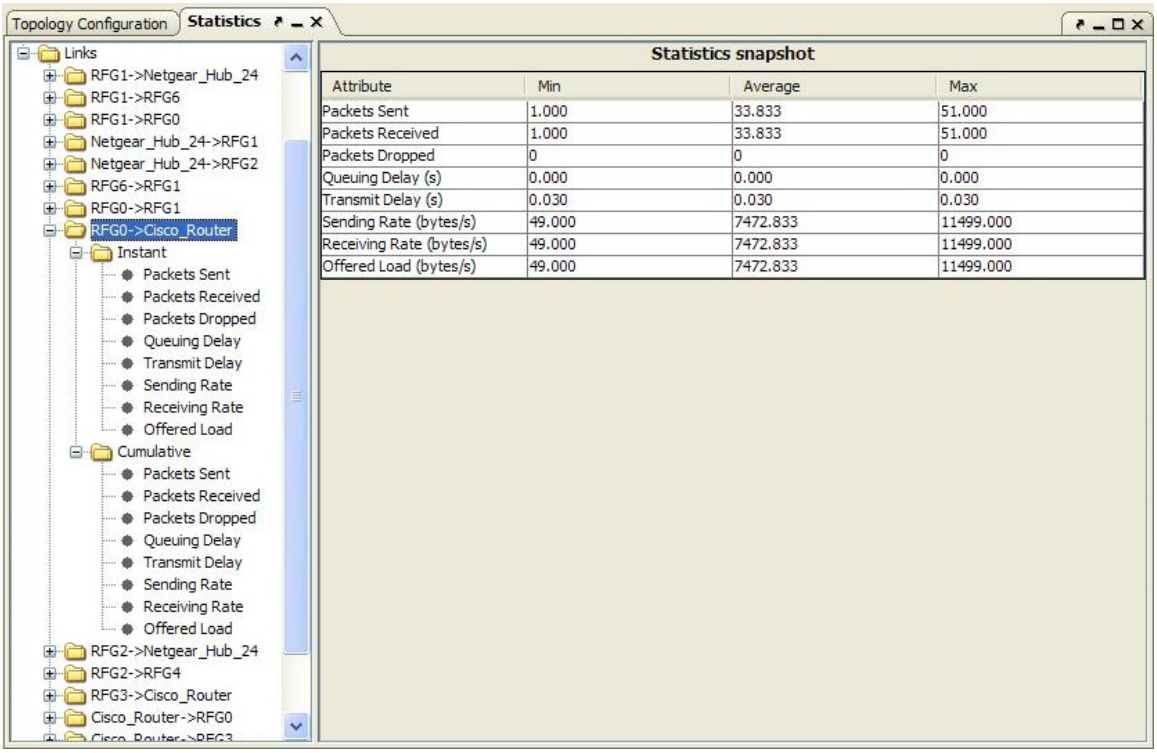



**Figure 71 - Statistics: Expansion of the Links Folder**

### 6.4.1 Unidirectional Link Folder

ACTIONS:

- Single click on a unidirectional link folder name to show its "Statistics snapshot", see Figure 71.

The "Statistics snapshot" consists of packets sent, packets received, packets dropped, queuing delay, transmit delay, sending rate, receiving rate and offered load.

- Double click on an individual unidirectional link folder to expand and reveal its "Instant" and "Cumulative" folders.

#### 6.4.1.1 Instant Folder

ACTIONS:

- Double click on the “Instant” folder to expand and reveal the following items: Packets sent, packets received, packets dropped, queuing delay, transmit delay, sending rate, receiving rate and offered load.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

#### 6.4.1.2 Cumulative Folder

ACTIONS:

- Double click on the “Cumulative” folder to expand and reveal the following items: Packets sent, packets received, packets dropped, queuing delay, transmit delay, sending rate, receiving rate and offered load.
- Single click on the individual item to display a graph of its statistic (if values are available).
- Pointing then hovering over any of the graph’s data point will display its values.

# 7 Media Window

The “Media” window contains a “Call List” a “User List”, a “Confirm Selection” button and a “Status/Information” subpanel. See Figure 72.

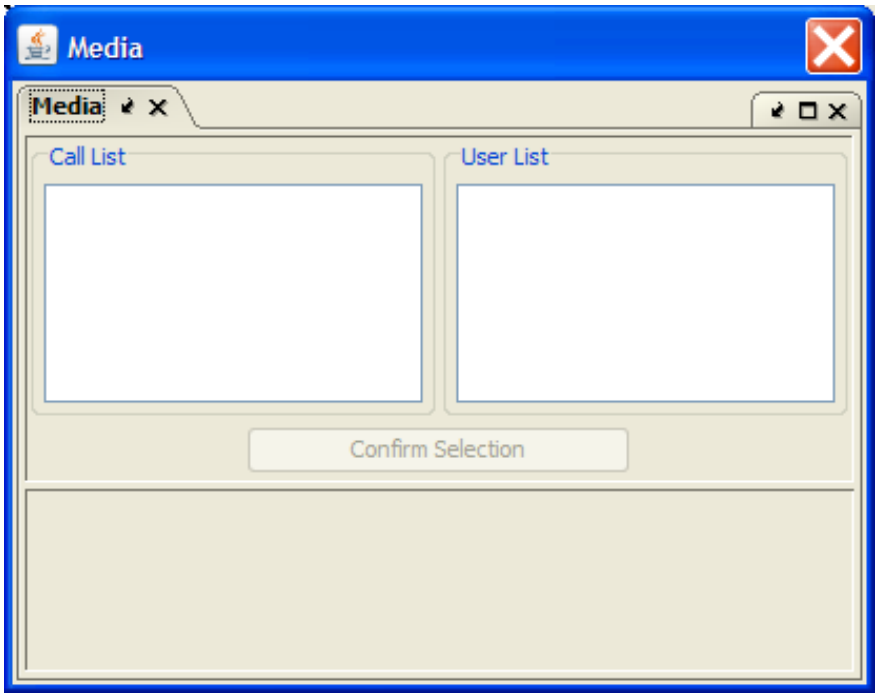



**Figure 72 - Media Window**

- Call List: Contains names of call applications that use audio trace files.
- User List: Lists SUs (users) involved in the selected call applications that are associated with audio trace files.
- Confirm Selection button: Used to confirm the “Call List” and “User List” selection.
- Status/Information subpanel: Used to relay information to the user.

ACTIONS:

- Click on a name in the Call List to display the associated users in the User List.
- Click on a user in the User List to associate the user with the call.
- Click on the “Confirm Selection” button to confirm the selection of the call and its associated user. The call and user selected will be highlighted in green; the associated audio trace file will be played during the appropriate time line of the simulation. Figure 73 shows the Media window undocked and playing a media file.

NOTE: If an audio file cannot be found, a pop-up window with the appropriate error message will be presented.

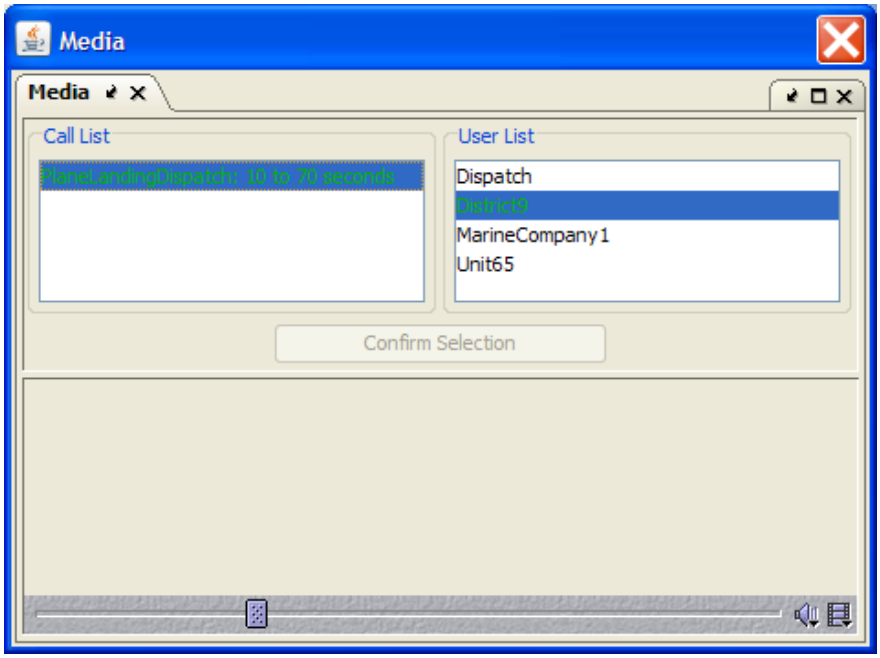



**Figure 73- Media Window: Playing Media File**

# 8 Status Window

The “Status” window displays operational messages.

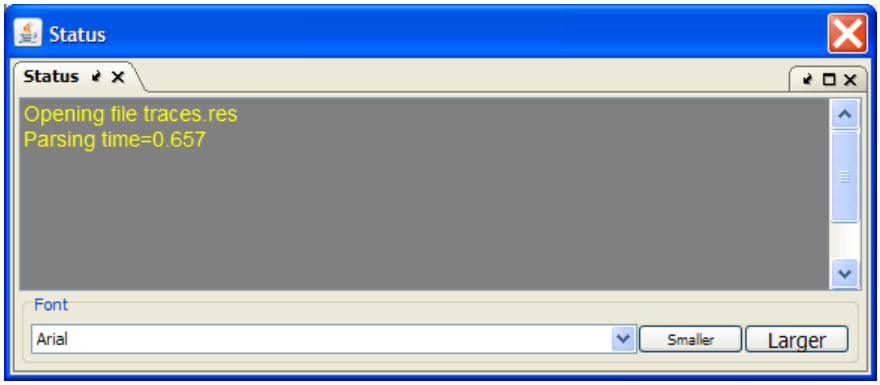



**Figure 74 - Status Window**

ACTIONS:

- Use the “Font” drop-down list to select the desired font type; use the “Smaller” and “Larger” buttons to adjust the font size used in the “Status” area. See Figure 74.

# 9 FileViewer Window

The “FileViewer” window contains three tabs: Project File, Scenario File, and Log File. Each tab displays information for viewing purposes only. See Figure 75.

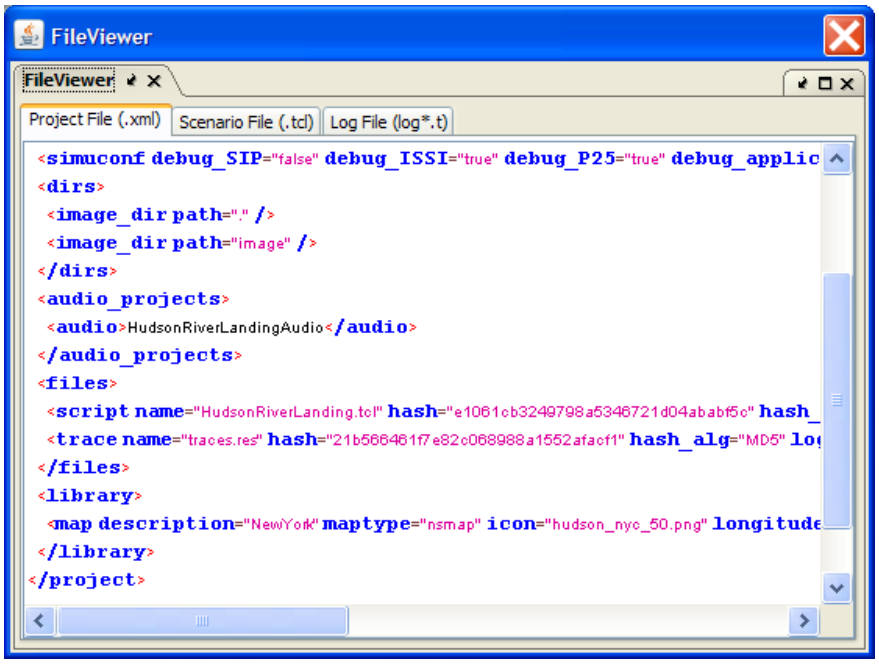



**Figure 75 - FileViewer Window**

- Project File: Displays the content of the project’s xml file.
- Scenario File: Displays the content of the project’s tcl file; the tcl file contains the “tools command language” (TCL) describing the project’s configuration and topology.
- Log File: The log file contains the output from the simulation run.

ACTIONS:

- Select the desired tab to display the content of its associated file.

# 10 List of Opened Projects

The bottom of the “Windows” menu item contains the list of opened projects once one or more projects are loaded. This list allows for swapping between those opened projects; the active project is indicated by a green check mark. Selecting a project from this list makes that project the active project and loads its information accordingly. See Figure 76.

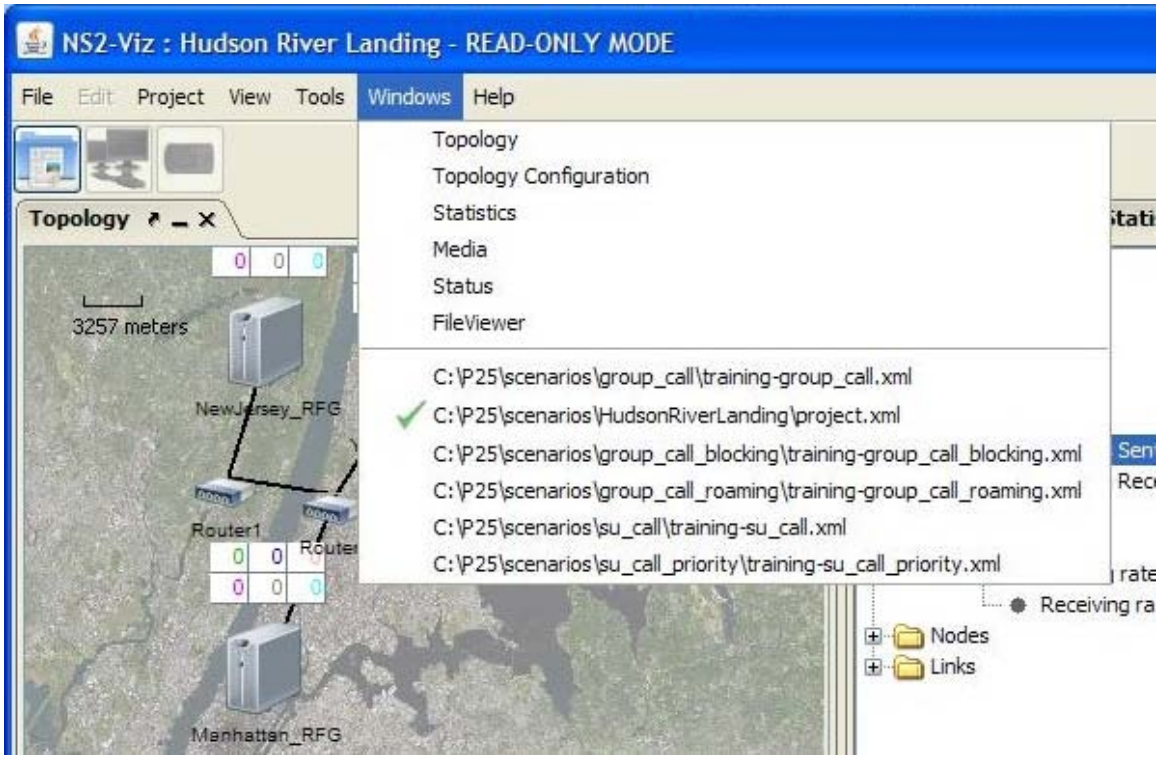



**Figure 76 - List of Opened Projects**

# 11 Running a Simulation

To run the simulation for the active project, select the “Launch simulation in the server” button (Ctrl+R). If authentication with the server has not been performed, the “Authentication Credentials” window is displayed. See Figure 77.

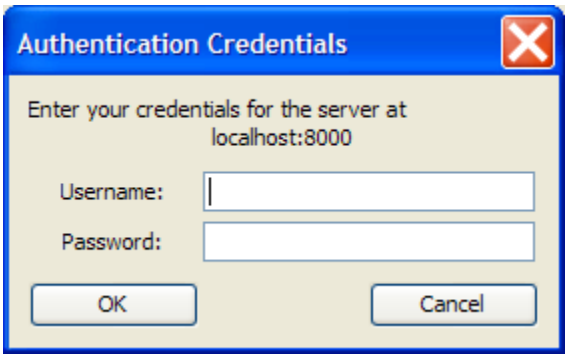



**Figure 77 - Authentication Credentials Window**

Enter the appropriate user identification and password then select the “OK” button; the “Simulation Progress” window is displayed. The length of time that the Simulation Progress window is displayed depends on the time it takes the server to process the project’s information. Select the “Cancel Simulation” button to cancel the simulation run while it is still in progress on the server. See Figure 78.

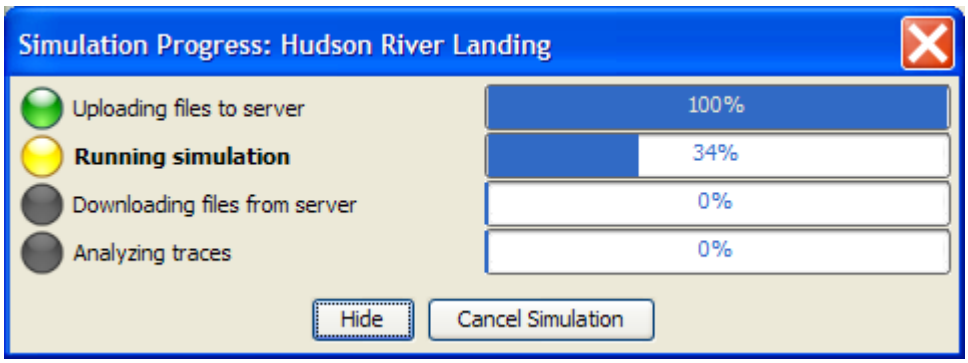



**Figure 78 - Simulation Progress Window**

Once the simulation run is successfully completed and the Simulation Progress window disappears, the “Statistics” panel may be used to display the results.

In the event that the simulation run did not complete successfully, use the “FileViewer” window and select the “Log File” tab to display diagnostic information.

NOTE: The diagnostic information is helpful for solving various simulation problems such as the problem described above. It can also be helpful with other problems such as premature closing of the project while the simulation with the server is incomplete.

# 12 Statistics Computation Methods

This section describes the methods used to compute the statistics.

## *12.1 RFSS statistics*

| **Statistic** | | **Description** |
|---|---|---|
| Overview for SU-to-SU | SU Reg initiated (serving) | Number of SU registrations initiated as serving during the whole simulation |
| | SU Reg completed (serving) | Number of SU registrations successfully completed as serving during the whole simulation |
| | SU Reg received (home) | Number of SU registrations received as home during the whole simulation |
| | SU Reg accepted (home) | Number of SU registrations accepted as home during the whole simulation |
| | SU-to-SU calls initiated | Number of SU calls initiated during the simulation |
| | SU-to-SU calls completed | Number of SU calls successfully setup during the simulation |
| Overview for Group | Group Reg initiated (serving) | Number of group registrations initiated as serving during the whole simulation |
| | Group Reg completed (serving) | Number of group registrations successfully completed as serving during the whole simulation |
| | Group Reg received (home) | Number of group registrations received as home during the whole simulation |
| | Group Reg accepted (home) | Number of group registrations accepted as home during the whole simulation |
| | Group calls initiated | Number of group calls initiated during the simulation |
| | Group calls completed | Number of group calls successfully setup during the simulation |
| Instant<br>These statistics represent the value for a given window of time during the simulation. The default interval time | Number of SUs currently registered as home | Number of SUs registered to this RFSS as home at a given point in time |
| | Number of SUs currently registered as serving | Number of SUs registered to this RFSS as serving at a given point in time |

| Statistic | | Description |
|---|---|---|
| between two measurements is 1 second. | Number of SUs with active calls | Number of SUs participating to an SU call at a given point in time |
| | Number of groups currently registered as home | Number of groups registered to this RFSS as home at a given point in time |
| | Number of groups currently registered as serving | Number of groups registered to this RFSS as serving at a given point in time |
| | Number of groups with active calls | Number of groups participating in an active group call at a given point in time |

## 12.2 SU statistics

| Statistic | | Description |
|---|---|---|
| Serving information | Start Time (s) | Time the serving RFG sent the first SIP Registration message |
| | Processed Time (s) | Time the home RFG received the registration request from the serving RFG |
| | Confirmed Time (s) | Time the serving RFG received the response from the home RFG. |
| | Completion Delay (s) | Time elapsed between the Start time and Confirmed time |
| | RFG | The name of the serving RFG |
| | Action | Indicates if it is a registration/deregistration |
| | Status | The status of the operation (success/fail) |
| Call information | Name | The name of the call |
| | Start Time (s) | Time the first INVITE message was sent to setup the call |
| | Stop Time (s) | Time the call ended (N/A indicates the call was still active at the end of the simulation) |
| | Call type | Type of call (Group or SU-to-SU call) |
| | Peer | Name of the Peer SU or Group |
| | Calling/Called | Indicates the role of this SU in the call (N/A is displayed for Group call) |
| Instant<br>These statistics represent the value for a given window of time during the simulation. The default interval time between two measurements is 1 second. | Packets Sent | Number of packets sent by this SU |
| | Packets Received | Number of packets received by this SU |
| | Packets Dropped | Number of packets dropped by this SU |
| | Sending Rate | Transmission rate in bytes/s |
| | Receiving Rate | Receiving rate in bytes/s |

## 12.3 Group statistics

| Statistic | | Description |
|---|---|---|
| Serving | Start Time (s) | Time the serving RFG sent the first SIP Registration message |
| | Setup Delay (s) | Time needed to receive the confirmation message |
| | RFG | The name of the serving RFG |
| | Action | Indicates if it is a registration/deregistration |
| | Status | The status of the operation (success/fail) |
| Call | Start Time (s) | Time the first INVITE message was sent to setup the call |
| | Setup Delay (s) | Time required to setup the call |
| | Stop Time (s) | Time the call ended (N/A indicates the call was still active at the end of the simulation) |
| | Calling RFG | The RFG that initiated the call |
| | Type | Confirmed/Not confirmed |
| | Status | The status of the operation (success/fail) |
| Instant<br>These statistics represent the value for a given window of time during the simulation. The default interval time between two measurements is 1 second. | Number of servings currently registered | Number of servings registered for this group at a given point in time |

## 12.4 SU-to-SU call statistics

| Statistic | | Description |
|---|---|---|
| Call information | Calling | The name of the calling SU |
| | Called | The name of the called SU |
| | Init. Tx | Indicates which SU has the right to transmit first |
| | Preference | Indicates if the availability check needs to be performed by the called serving |
| | Duplex | Indicates if the call Half/Full duplex |
| | Start time (s) | Time the first INVITE message was sent to setup the call |
| | Setup delay (s) | Time required to setup the call |
| | Stop time (s) | Time the call ended (N/A indicates the call was still active at the end of the simulation) |
| | Status | The status of the operation (success/fail) |
| Statistics snapshot | Minimal/Average/Maximum values of the statistics collected for this call (See 12.8) | |
| End-to-End | Provides instant and cumulative statistics for the communication between the two SUs (see 12.8) | |
| Segment | Provide instant and cumulative statistics for the communication between two RFSSs that were part of the call (for example between a serving and a home or between two homes). This is defined as a call segment. | |
| Link | Provide instant and cumulative statistics for the communication between two nodes that composed the call segment. | |

## 12.5 Group call statistics

| Statistic | | Description |
|---|---|---|
| Call | Group | The group associated with this call |
| | Calling | The RFG that initiated the call |
| | Type | Call type (Confirmed/Unconfirmed) |
| | Start Time (s) | Time the first INVITE message was sent to setup the call |
| | Setup Delay (s) | Time required to setup the call |
| | Stop Time (s) | Time the call ended (N/A indicates the call was still active at the end of the simulation) |
| | Status | The status of the operation (success/fail) |
| Serving | RFSS | The serving RFSS that joined the group call or modify the call segment |
| | Start Time (s) | Time the RFSS joined the group call |
| | Setup Delay (s) | Time required to join the group call |
| | Stop Time (s) | Time the RFSS left the group call |
| | RTP state | State of the RTP resources during the call setup |
| | RF state | State of the RF resources during the call setup |
| | Status | The status of the operation (success/fail) |
| Segment | Provide instant and cumulative statistics for the communication between the group home RFSS and a serving RFSS that is part of the call. | |
| Link | Provide instant and cumulative statistics for the communication between two nodes that composed the call segment. | |

## 12.6 Node statistics

| Statistic | | Description |
|---|---|---|
| Snapshot | Minimal/Average/Maximum values of the statistics collected as defined in this table. | |
| Instant<br>These statistics represent the value for a given window of time during the simulation. The default interval time between two measurements is 1 second. | Packets Sent | Number of packets sent from any of the node's interfaces |
| | Packets Received | Number of packets received from any of node's interfaces |
| | Packets Dropped | Number of packets dropped by this node |
| | Packets Forwarded | Number of packets forwarded by this node when acting as a router. |
| | Packet Delay | Delay between the time a packet is received and the time it is forwarded. |
| | Sending Rate | Transmission rate in bytes/s |
| | Receiving Rate | Receiving rate in bytes/s |
| Cumulative<br>These statistics represent the measurement collected from the beginning of the simulation. | Packets Sent | Number of packets sent from any of the node's interfaces |
| | Packets Received | Number of packets received from any of node's interfaces |
| | Packets Dropped | Number of packets dropped by this node |
| | Packets Forwarded | Number of packets forwarded by this node when acting as a router. |
| | Packet Delay | Delay between the time a packet is received and the time it is forwarded. |
| | Sending rate | Transmission rate in bytes/s |
| | Receiving rate | Receiving rate in bytes/s |

## 12.7 Link statistics

| Statistic | | Description |
|---|---|---|
| Snapshot | Minimal/Average/Maximum values of the statistics collected as defined in this table. | |
| Instant<br>These statistics represent the value for a given window of time during the simulation. The default interval time between two measurements is 1 second. | Packets Sent | Number of packets sent across this link |
| | Packets Received | Number of packets received across this link |
| | Packets Dropped | Number of packets dropped over this link |
| | Queuing Delay | Delay to transmit the packet |
| | Transmission Delay | Delay between the time a packet is put in the transmission queue and the time it is received by the peer node. |
| | Sending Rate | Transmission rate in bytes/s |
| | Receiving Rate | Receiving rate in bytes/s |
| | Offered Load | Data rate entering the transmission queue in bytes/s |
| Cumulative<br>These statistics represent the measurement collected from the beginning of the simulation. | Packets Sent | Number of packets sent across this link |
| | Packets Received | Number of packets received across this link |
| | Packets Dropped | Number of packets dropped over this link |
| | Queuing Delay | Delay to transmit the packet |
| | Transmission Delay | Delay between the time a packet is put in the transmission queue and the time it is received by the peer node. |
| | Sending Rate | Transmission rate in bytes/s |
| | Receiving Rate | Receiving rate in bytes/s |
| | Offered Load | Data rate entering the transmission queue in bytes/s |

## 12.8 Application statistics

| Statistic | | Description |
|---|---|---|
| Instant<br>These statistics represent the value for a given window of time during the simulation. The default interval time between two measurements is 1 second. | Packets Sent | Number of packets sent from any of the end points |
| | Packet Received | Number of packets received from any of the end points |
| | Delay | Delay between the time it is generated by the application on the transmitter side and the time it is received successfully on the received side. |
| | Jitter | Packet jitter for the packets received. |
| | Sending Rate | Transmission rate in bytes/s |
| | Receiving Rate | Receiving rate in bytes/s |
| Cumulative<br>These statistics represent the measurement collected from the beginning of the simulation. | Packets Sent | Number of packets sent from any of the end points |
| | Packet Received | Number of packets received from any of the end points |
| | Delay | Delay between the time it is generated by the application on the transmitter side and the time it is received successfully on the received side. |
| | Jitter | Packet jitter for the packets received. |
| | Sending Rate | Transmission rate in bytes/s |
| | Receiving Rate | Receiving rate in bytes/s |

## 12.9 Traffic flows statistics

See section 12.8.

# 13 Versions and Compatibility

The GUI is only compatible with the appropriate version of the simulation server and its associated model. Attempting to use the GUI with a server running a different version of code will cause an error and their communications will be aborted.

If the client attempts to interact with a server that is running an incompatible version, a pop-up error message will be shown and the operation will be aborted. See example in Figure 79.

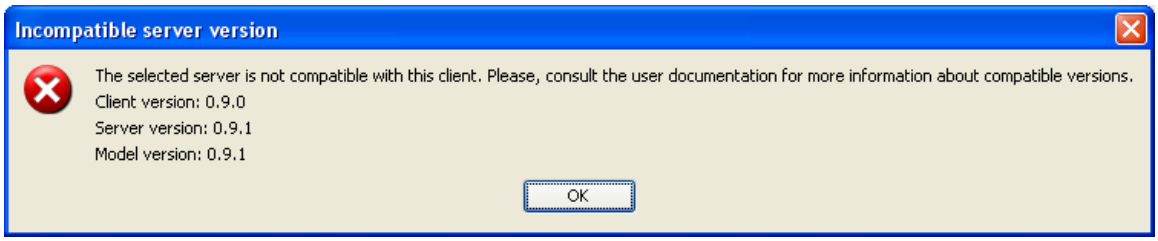



**Figure 79 - An Example of an Incompatible Server Version Message**

# 14 Shortcut Keys/Combinations

The following list shows the shortcut keys or key-combinations that are mapped to specific functions in the GUI application:

- **Ctrl+F:** Open the “Search” window.
- **Ctrl+G:** Launch the “Audio Trace Generator” tool.
- **Ctrl+L:** Open the “VizNet Properties” window.
- **Ctrl+M:** Switch between design mode and read-only mode.
- **Ctrl+N:** Open the “New Project” window to create a new project.
- **Ctrl+O:** Open an existing project by bringing up a browser window.
- **Ctrl+P:** In design mode, open the “Project Properties” window.
- **Ctrl+R:** In design mode, execute the simulation run with the server.
- **Ctrl+S:** Save the current project.
- **Ctrl+W:** Close the current project.
- **Ctrl+Y:** Redo the last edit action.
- **Ctrl+Z:** Undo the last edit action.
- **F1:** Open the documentation for the GUI.
- **F12:** Save the current project to a different directory, to a different name or both.

The following list shows the shortcut keys or key-combinations that are mapped to specific functions in the Audio Trace Generator tool:

- **Ctrl+N:** Open the “New Project” window to create a new project.
- **Ctrl+O:** Open an existing project by bringing up a browser window.
- **Ctrl+S:** Save the current project.
- **F1:** Open the documentation for the Audio Trace Generator tool.

# 15 Acronyms

**CBR** Constant Bit Rate
**DNS** Domain Name System (IETF RFC 1035)
**FTP** File Transfer Protocol
**GPS** Global Positioning System
**GUI** Graphical User Interface
**IETF** Internet Engineering Task Force
**IP** Internet Protocol
**ISSI** Inter-RF Subsystem Interface (P25)
**JRE** Java Runtime Environment
**P25** Project 25
**PDF** Portable Document Format
**RF** Radio Frequency
**RFC** Request for Comments
**RFG** Radio Frequency Gateway (P25)
**RFSS** Radio Frequency Subsystem (P25)
**RTP** Real-time Transport Protocol (IETF RFC 3550)
**SIP** Session Initiation Protocol (IETF RFC 3261)
**SU** Subscriber Unit (P25)
**TCL** Tool Command Language
**TCP** Transmission Control Protocol
**UDP** User Datagram Protocol
**URL** Uniform Resource Locator
**XML** Extensible Markup Language

# 16 References

[1] TIA-102.BACA-A “Project 25 Inter-RF Subsystem Interface Messages and Procedures for Voice and Mobility Management Services”, January 2009.

# A Network Primer

## *A.1 Networks and Their Compositions*

Networks physically consist of nodes connected by links; the nodes run applications that may generate traffic that is transmitted over the links or they may relay traffic from incoming links to outgoing links. The “Topology Configuration” panel contains the icons necessary to create the various objects for the network topology.

**NODES**

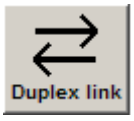
Nodes are either configured as routers or RFGs.

Use the “Router” icon to create IP routers for the network topology. The address parameter is required to configure a router for the topology.

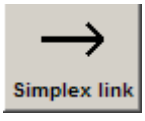
Use the “RFG” icon to create RFGs for the network topology. A RFG is an IP router that has its ISSI parameters configured (e.g., maximum RTP resources, maximum RF resources and registration lifetime).

**LINKS**

The connections between nodes are called links. Duplex and Simplex links are supported.



Use the “Duplex link” icon to create duplex links between nodes for the network topology. Duplex links permit transmission of data in both directions between the nodes involved.



Use the “Simplex link” icon to create simplex links between nodes for the network topology. Simplex links permit transmission of data in only one direction between the nodes involved.

**P25 ISSI CONFIGURATION FUNCTIONS**

P25 ISSI configuration functions related to the RFG nodes are SU and the “talk” Group.

Use the “SU” icon to create and configure individual subscriber units for the network topology. An SU can only be configured to have its “home” on one RFG.

Use the “Group” icon to create and configure “talk” groups for the network topology. A “talk” group can only be configured to have its “home” on one RFG.

**APPLICATIONS**

A network carries calls or applications. P25 defines two types of calls: SU-to-SU call and Group call. The GUI also supports a set of applications designed to simulate specific IP traffic. Calls need to be properly configured in order to generate network traffic. If calls are not properly defined, then their activities and traffic statistics will not be generated for the network.

Use the “SU-to-SU call” icon to create SU to SU calls. These applications define which SU originates the call; which SU receives the call; the start time and stop time; and some P25 specific parameters (e.g., which device transmits the data first, whether availability check is requested or not). Some voice application parameters may be configured as well (e.g., mean spurt duration, mean spurt interval and number of IMBE blocks per P25 ISSI RTP packet). Audio files may also be configured and used as the traffic generators for the call.

Use the “Group call” icon to create “talk” group calls. These applications define which SU originates the call; the talk group of the call; the start time and stop time; and some P25 specific parameters (e.g., whether it is a confirmed or unconfirmed call). Some voice application parameters may be configured as well (e.g., mean spurt duration, mean interval and number of IMBE blocks per P25 ISSI RTP packet). Audio files may also be configured and used as the traffic generators for the call.

Use the "IP traffic" icon to create Internet Protocol traffic applications. IP traffic applications simulated by the GUI include the constant bit rate (CBR) traffic model, the file transfer protocol (FTP) traffic model and the exponential traffic model. These applications allow for simulating traffic flow between two nodes using their respective IP traffic models; they define the source node, the destination node, the start and stop times, the transport protocol to use (UDP or TCP) and the related parameters for the transport protocol.

## *A.2 Creating a Network*

Use the icons in the "Topology Configuration" panel to create a network topology.

**Step 1)** Create a node

Click on one of the "Nodes" icon (e.g., RFG) in the "Topology Configuration" panel (the icon will turn to a slightly darker gray); move the pointer to the "Topology" panel (the pointer will become the selected icon as it passes within the "Topology" panel's canvas area), click again in the "Topology" panel's canvas area to place the node at the desired location. The node's configuration window will appear for configuration purposes. See Figure 80.

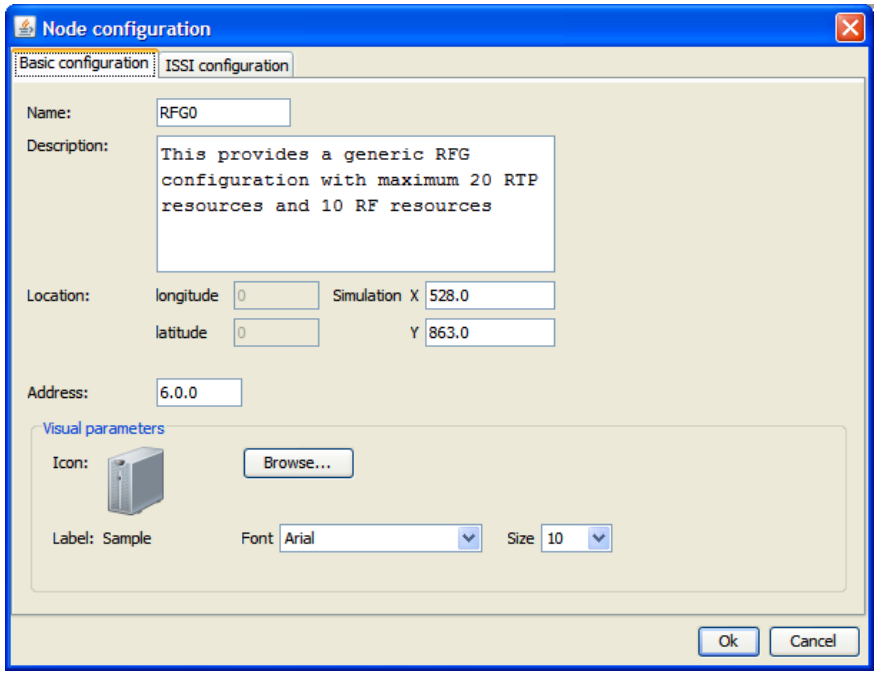



**Figure 80 - Node Configuration Window (Basic Configuration Tab)**

ACTIONS:

- Enter a unique name for the node; it must be unique for the whole network topology.

The acceptable values are alphanumeric (i.e., a..z, A..Z, 0..9) and the '_' character is also allowed. The name must begin with a letter and be at least two characters in length.

- Enter a description to describe this node.
- To change the location of the node using the configuration window, enter the appropriate values for the longitude or latitude parameters.

  The acceptable values are zero through the maximum X coordinate and zero through the maximum Y coordinate.

  The alternative way to relocate a node is to click on the node within the canvas area and drag the node to its new location on the canvas; its coordinates will change accordingly.
- Enter an appropriate address for the node if the system generated address is not acceptable. Note that addresses must be unique for the whole network topology.
- To change the "Visual parameters":
  1) Use the "Browse…" button to select an icon from the available list.
  2) Select the "Font" from the list.
  3) Select the font "Size" from the list.
- Select the "ISSI configuration" tab to configure ISSI parameters. See Figure 81.

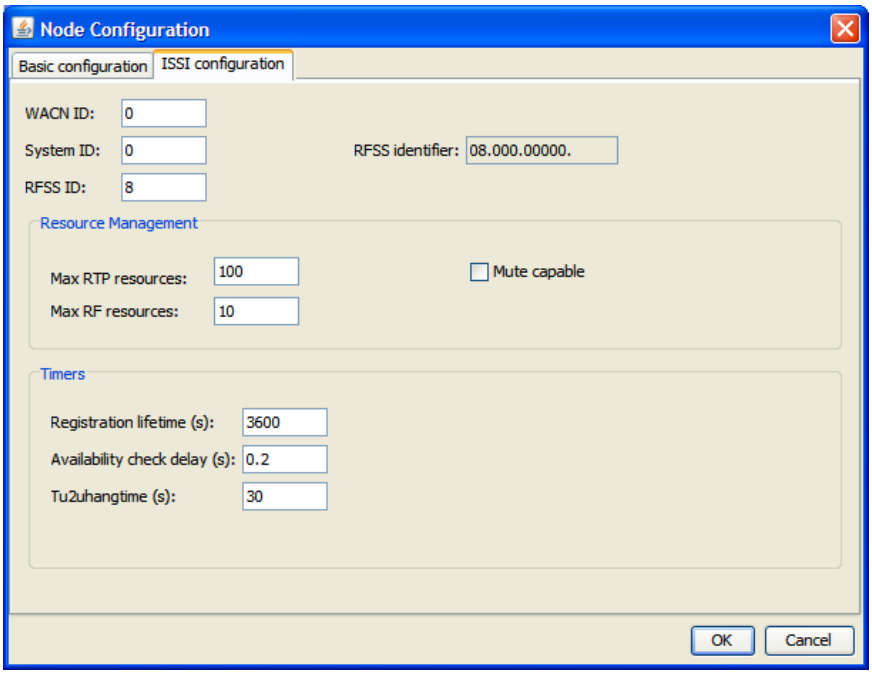



**Figure 81 - Node Configuration Window (ISSI Configuration Tab)**

ACTIONS:

- Enter the Wide Area Communications Network (WACN) identification (ID) for the node. This is a 5HEX-DIGIT value.

  The acceptable range of values is 0 to 1048575 (i.e., 0x00000 to 0xFFFFF). For hexadecimal values, precede the digits with the string "0x" (i.e., zero and the lower case 'x' character). The number used for the hexadecimal value must be five digits long.

- Enter the System identification (ID) for this node. This is a 3HEX-DIGIT value.
  The acceptable range of values is 0 to 4095 (i.e., 0x000 to 0xFFF). For hexadecimal values, precede the digits with the string "0x" (i.e., zero and the lower case 'x' character). The number used for the hexadecimal value number must be three digits long.
- Enter the Radio Frequency Subsystem (RFSS) identification (ID) for this node. This is a 2HEX-DIGIT value.
  The acceptable range of values is 0 to 255 (i.e., 0x00 to 0xFF). For hexadecimal values, precede the digits with the string "0x" (i.e., zero and the lower case 'x' character). The number used for the hexadecimal value number must be two digits long.
- The "RFSS identifier" is automatically generated using the format: "RFSS ID"."System ID"."WACN ID" as specified in TIA-102.BACA-A, section 3.4.1.1.
- Enter the maximum Real-time Transport Protocol (RTP) resources available.
  The acceptable range of values is 0 to 2,147,483,647 ($2^{31}$-1).
- Enter the maximum Radio Frequency (RF) resources available. Radio Frequency resources are equivalent to radio frequency channels. It requires one Radio Frequency resource to support one call.
  The acceptable range of values is 0 to 2,147,483,647 ($2^{31}$-1).
- Check the "Mute capable" checkbox if the RFG is required to mute when losing transmissions.
- Enter the appropriate "Registration lifetime" value.
  The acceptable range of values is 0 to 2,147,483,647 ($2^{31}$-1).
- Enter the appropriate "Availability check delay" value; this is the time the allotted time that the RFSS has to carry out an availability check.
  The acceptable range of values is 0 to 2,147,483,647 ($2^{31}$-1).
- Enter the appropriate "Tu2uhangtime" value; this is the maximum time interval during which there is no voice activity among RFSSs participating in an SU-to-SU call, before the call is released.
  The acceptable range of values is 0 to 2,147,483,647 ($2^{31}$-1).

**Step 2)** Repeat step 1 to create at least one other node for the network topology.

**Step 3)** Connect at least two of the nodes with a link. Click on a link icon (e.g., simplex or duplex) from the "Topology Configuration" panel; in the canvas area, single click on the first node then move to the second node and single click again to link them. Once the link is completed, the "Link Configuration" window will be displayed for configuration purposes; enter the appropriate values for the link's properties. See Figure 82.

NOTE: If there are no links between the nodes or if there are other issues such as the simplex links not allowing for packet delivery then a simulation error will occur.

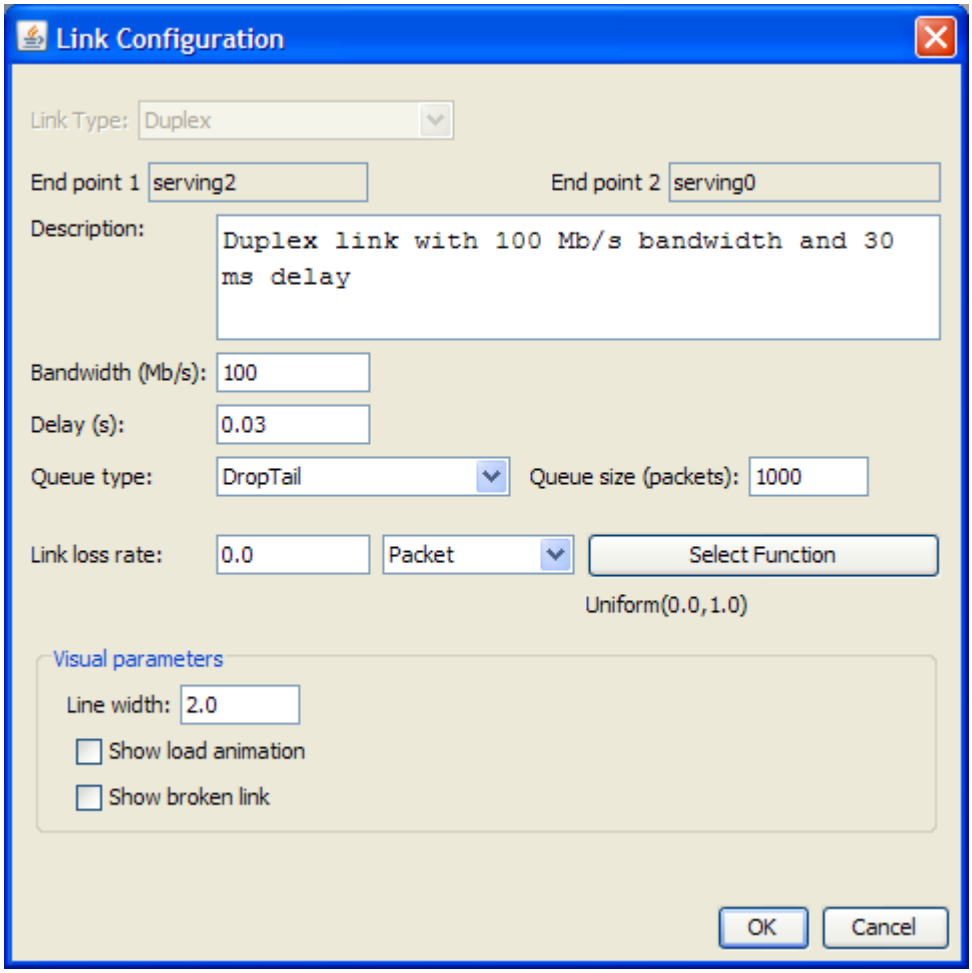



**Figure 82 - Link Configuration Window**

ACTIONS:

- Enter an appropriate description for the link.
- Enter a bandwidth.
  The acceptable range of values is zero (0) to 9,999,999.
- Enter a delay time.
  The acceptable range of values is zero (0) to 9,999,999.
- Select a queue type or accept the default (Drop tail).
- Enter a queue size or accept the default.
  The acceptable range of values is 0 to 2,147,483,647 ($2^{31}$-1).
- Enter the link loss rate, the loss unit (Packet or Byte), and select a random function and its parameters using the "Select Function" button.
- To change the "Visual parameters":
  1) Enter an appropriate value for the line width (a value between 0 and 9,999,999).
  2) Check/Uncheck the option to show load animation.
  3) Check/Uncheck the option to indicate when the link is broken.

**Step 4)** In order to create user activities on the network, either groups or subscriber units must be added to the network.

NOTE: If the network is to support groups, it is best to create the groups first then the subscriber units so that the subscriber units can be configured to be associated with a group upon its creation. If the subscriber unit is created first, then its configuration window will have to be revisited in order to associate that SU with a group.

**Step 4a)** Configure groups (if necessary) by using the "Group Configuration" window. See Figure 83.

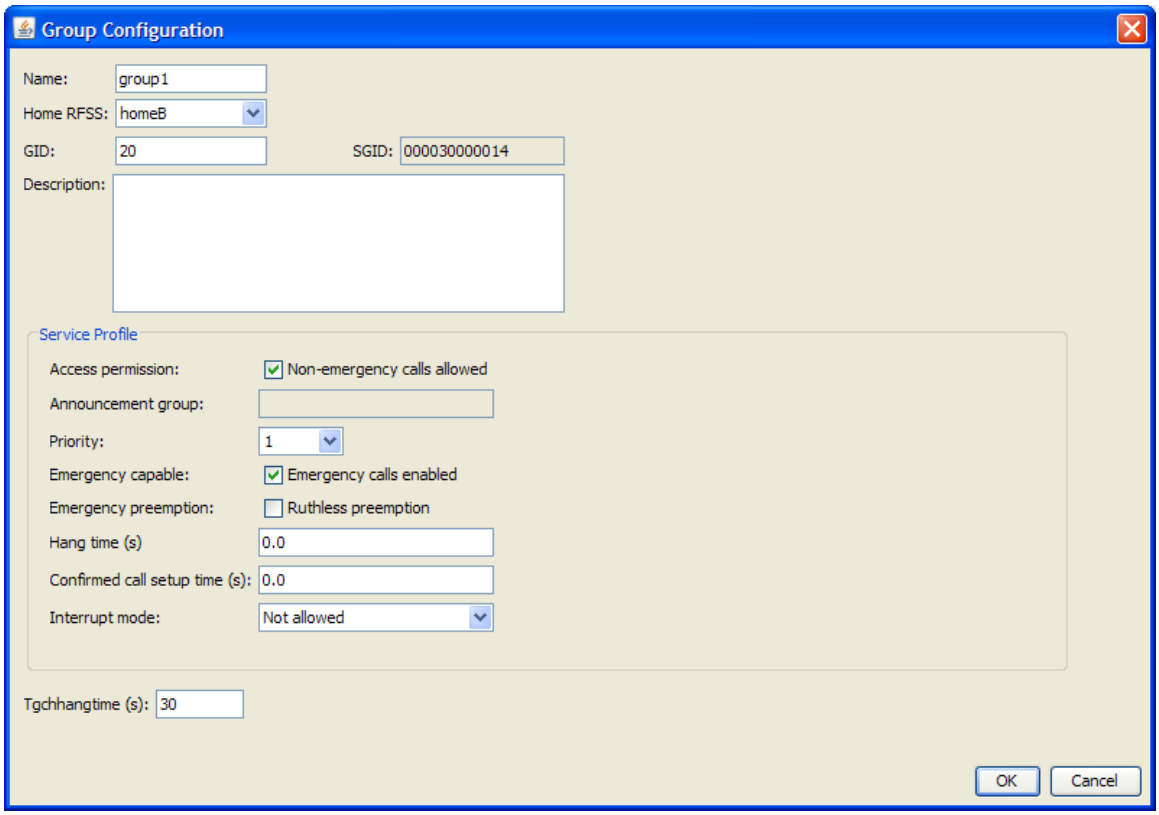



**Figure 83 - Group Configuration Window**

ACTIONS:

- Enter a unique name for the group; it must be unique for the whole network topology. The acceptable values are alphanumeric (i.e., a..z, A..Z, 0..9) and the '_' character is also allowed. The name must begin with a letter and be at least two characters in length.
- Select an RFSS from the available list for this group's home.
- Enter a Group ID. This is a 4HEX-DIGIT value.
  The acceptable range of values is 0 to 65535 (i.e., 0x0000 to 0xFFFF). For hexadecimal values, precede the digits with the string "0x" (i.e., zero and the lower case 'x' character). The number used for the hexadecimal value must be four digits long.

- The subscriber group identification (SGID) is automatically generated using the WACN and system ID from the “Home RFSS” and this group’s ID.
- Enter an appropriate description for this group if applicable.
- Select the “Access permission” to allow/disallow non-emergency calls.
- Select an appropriate priority from this group; this is used when this group competes against other groups on calls.
- Select if emergency calls will be supported.
- Select if resource preemption will be supported for emergency calls.
- Enter the “Hang time” for the RF resources (a value of 0 indicates a transmission trunked call, values greater than 0 indicate a message trunked call).
- Enter the “Confirmed call setup time” to define the maximum time that the RFG will hold the first PTT spurt if not all required resources are available to set up the call.
- Select the appropriate “Interrupt mode” to define how calls are interrupted for this group (if applicable).
- Enter the appropriate “Tgchhangtime” or accept the default. (See TIA-102.BACA-A, Annex A, Table 38 on page 328: “Maximum time interval (i.e., ISSI hang time) during which there is no voice activity over the ISSI among the RFSSs participating in a group call, which when exceeded will entail group call release.”)
  The acceptable range of values is 0 to 2,147,483,647 ($2^{31}$-1).

NOTE: The “Announcement group” parameter shown is currently not implemented.

**Step 4b)** Use the “SU Configuration” window to configure SUs. See Figure 84.

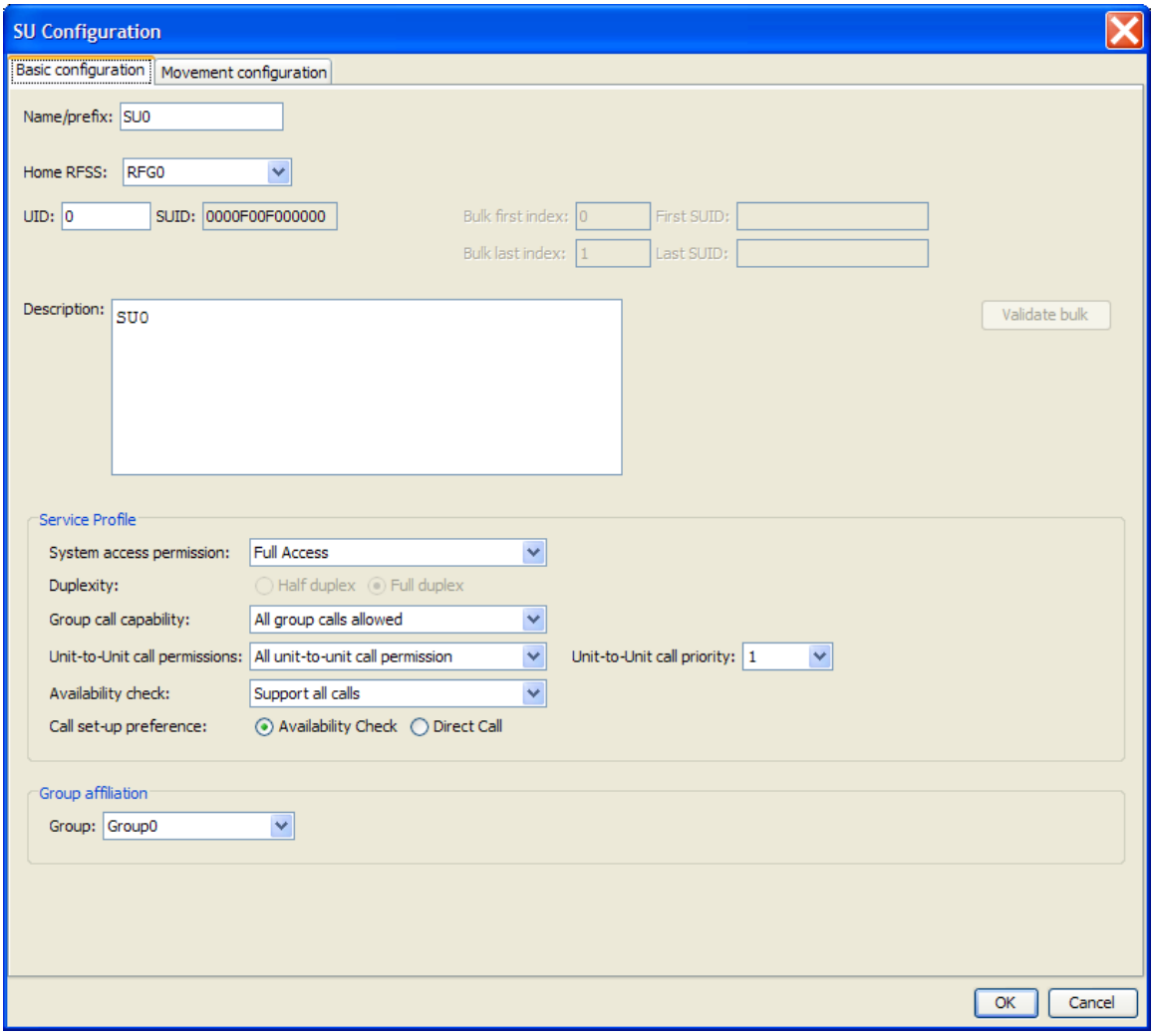



**Figure 84 - SU Configuration Window (Basic Configuration Tab)**

ACTIONS:

- Enter a unique name for the subscriber unit; it must be unique for the whole network topology.
  The acceptable values are alphanumeric (i.e., a..z, A..Z, 0..9) and the '_' character is also allowed. The name must begin with a letter and be at least two characters in length.
- Select an RFSS from the available list for this SU's home RFSS.
- Enter a user identifier (UID) to uniquely indentify this SU.
  The acceptable range of values is 0 to 16777215 ($2^{24}$-1) (i.e., 0x000000 to 0xFFFFFF). For hexadecimal values, precede the digits with the string "0x" (i.e., zero and the lower case 'x' character). The number used for the hexadecimal value must be six digits long.
- The subscriber unit identification (SUID) is automatically generated using the WACN and system ID from the "Home RFSS" and this SU's ID.
- Enter an appropriate description for this SU if applicable.
- Select an appropriate "System access permission".

- Select an appropriate “Group call capability”.
- Select an appropriate “Unit-to-Unit call permission” and its associate priority.
- Select an appropriate “Availability check”.
- Select an appropriate “Call set-up preference”.
- Select a “Group affiliation” if applicable.

    NOTE: The SU can only be associated with one of the previously defined groups. The SU’s configuration window can be recalled to associate the SU to another group if necessary.

Click the “Movement configuration” tab to continue with the SU’s configuration. The “Movement configuration” panel allows for the configuration of RFSS registration and deregistration. These “movements” allow the SU to attach and move among the RFSSs. See Figure 85.

NOTE: The SU can only be registered with one RFSS at a time.

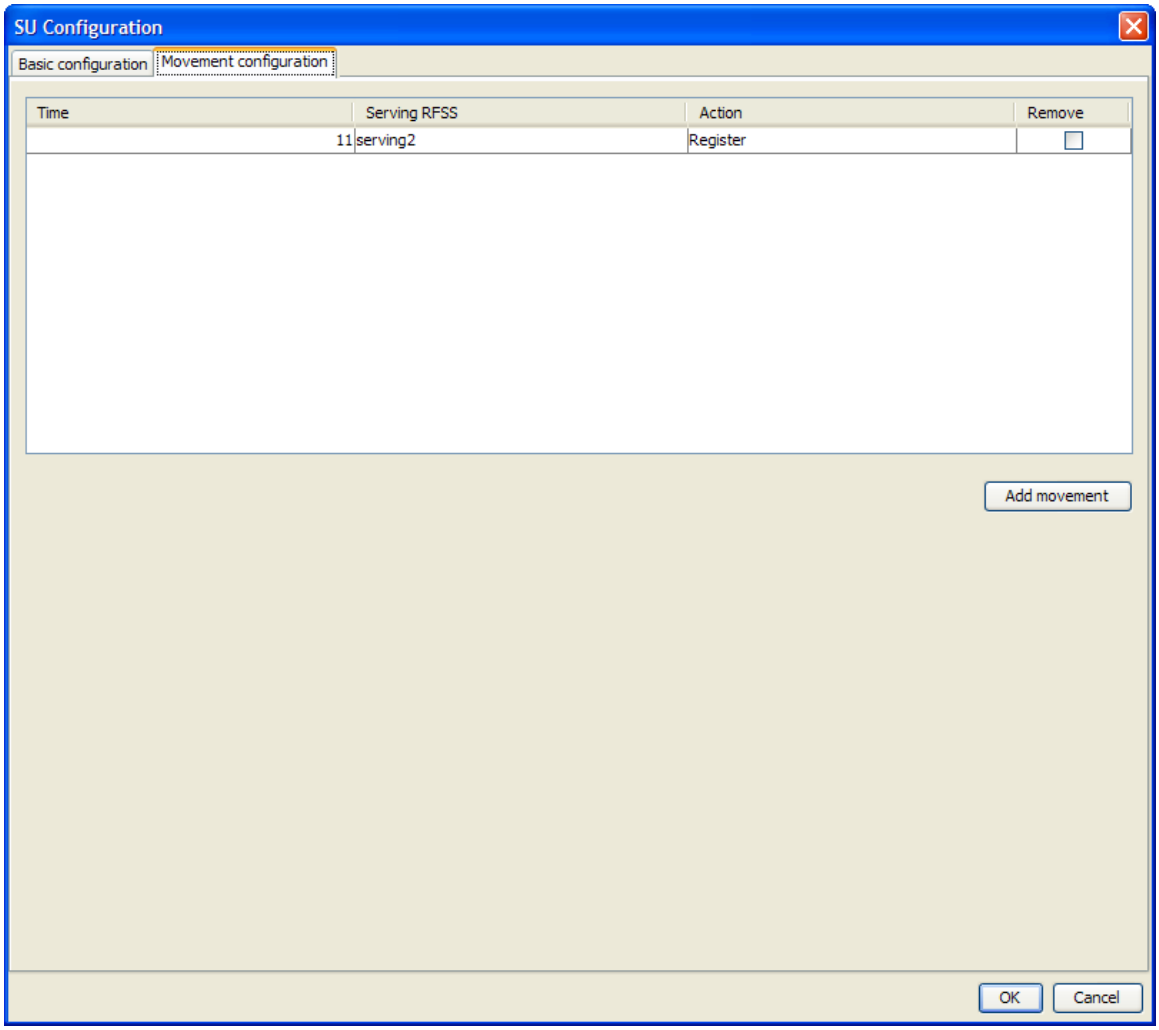



**Figure 85 - SU Configuration Window (Movement Configuration Tab)**

ACTIONS:

- Use the “Add movement” button to create and add entries to the movement table.
- For each entry, enter an appropriate time (in seconds) greater than zero for when this action is to occur in the simulation.
  The acceptable range of values is 1 to 2,147,483,648.
- For each entry, select an appropriate serving RFSS from the pull-down list.
- For each entry, select the appropriate action (register or deregister).

NOTE: The SU must be registered with a serving RFSS in order to make or receive calls.

To simulate a movement, create another entry and register the SU to a different RFSS; be sure to make the time for the new entry greater than the time of the old entry.

NOTE: Since the SU cannot be registered with more than one RFSS, it will be automatically deregistered from its previous RFSS in order to register with the new RFSS.

**Step 5)** Once SUs and groups have been created for the network topology; the following applications can be created: Group calls, bulk group call, unit-to-unit calls (SU-to-SU) and bulk unit-to-unit calls.

**Step 5a)** Configuring group calls

Select the “Group call” icon

from the “Topology Configuration” panel to bring up the “Group Call Configuration” window. See Figure 86.

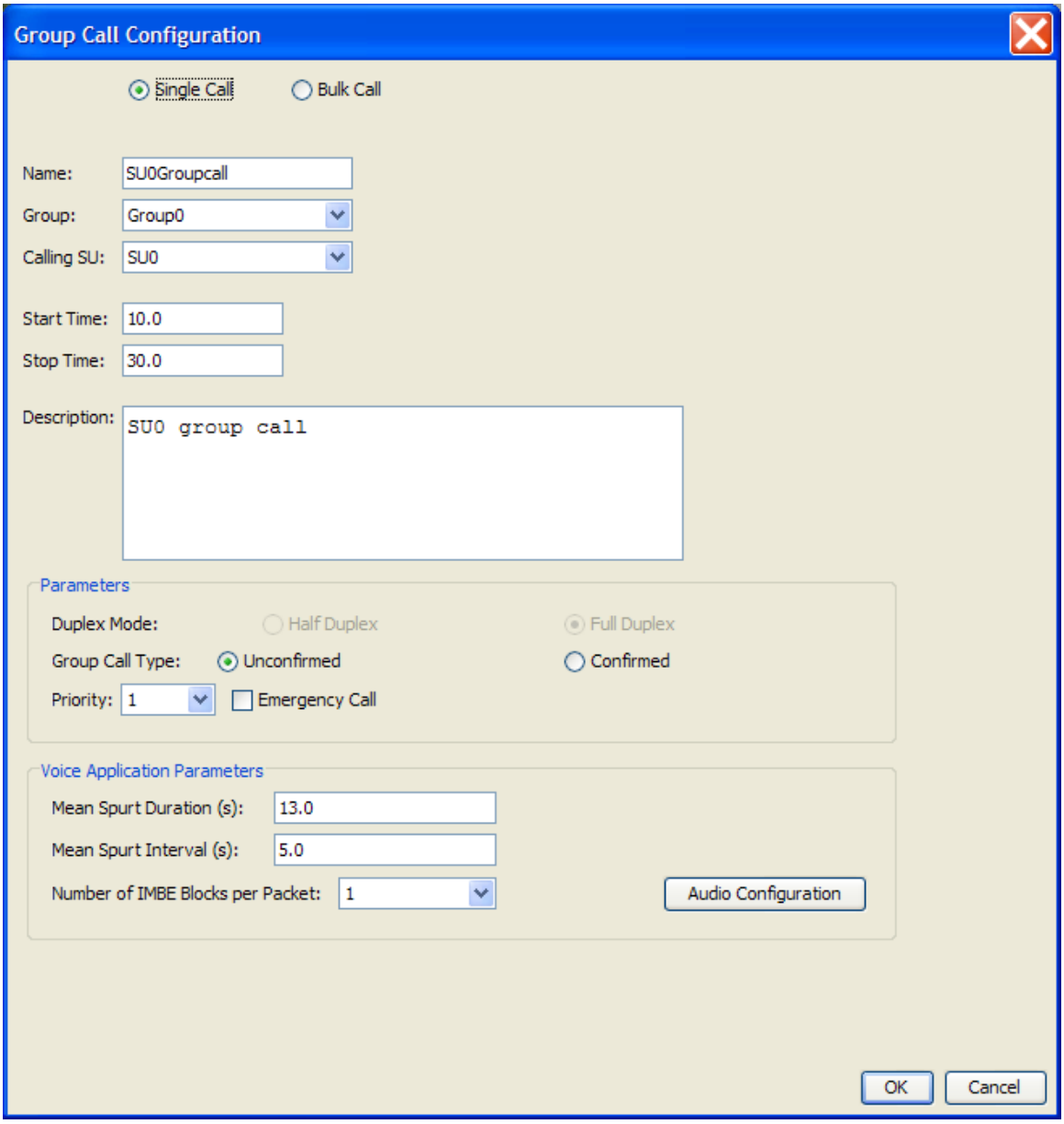



**Figure 86 - Group Call Configuration Window (Single Group Call)**

ACTIONS:

- Select the "Single Call" radio button to specify a single group call application.
- Enter a unique name for the group call; it must be unique for the whole network topology.

  The acceptable values are alphanumeric (i.e., a..z, A..Z, 0..9) and the '_' character is also allowed. The name must begin with a letter and be at least two characters in length. The name cannot end with "_XX" where "XX" is an arbitrary length number.
- Select a group from those previously defined via the pull-down options.
- Select the SU that will initiate the call from those previously defined via the pull-down options.

- Enter an appropriate start time.
  The acceptable range of values is zero (0) or larger and must be smaller than the stop time.
- Enter an appropriate stop time.
  The acceptable range of values is greater than zero (0) to 9,999,999 and must be larger than the start time.
- Enter an appropriate description for this call if applicable.
- Choose an appropriate “Group Call Type” (Unconfirmed or Confirmed).
- Select an appropriate priority for the call via the pull-down options.
- Use the checkbox to indicate if the call is an emergency or non-emergency group call.
- Enter the appropriate values for “Mean Spurt Duration” and “Mean Spurt Interval”.
  Acceptable values are zero to 9,999,999.
- Select the appropriate “Number of IMBE Blocks per Packet” via the pull-down options (1, 2, or 3).
- The “Audio Configuration” button can be used to incorporate audio trace files from previously created audio projects. The use of audio trace files will preempt the “Mean Spurt Duration” and “Mean Spurt Interval” values. See section B for more details.

**Step 5b)** Configuring bulk group calls

Select the “Group call” icon

from the “Topology Configuration” panel to bring up the “Group Call Configuration” window. See Figure 87.

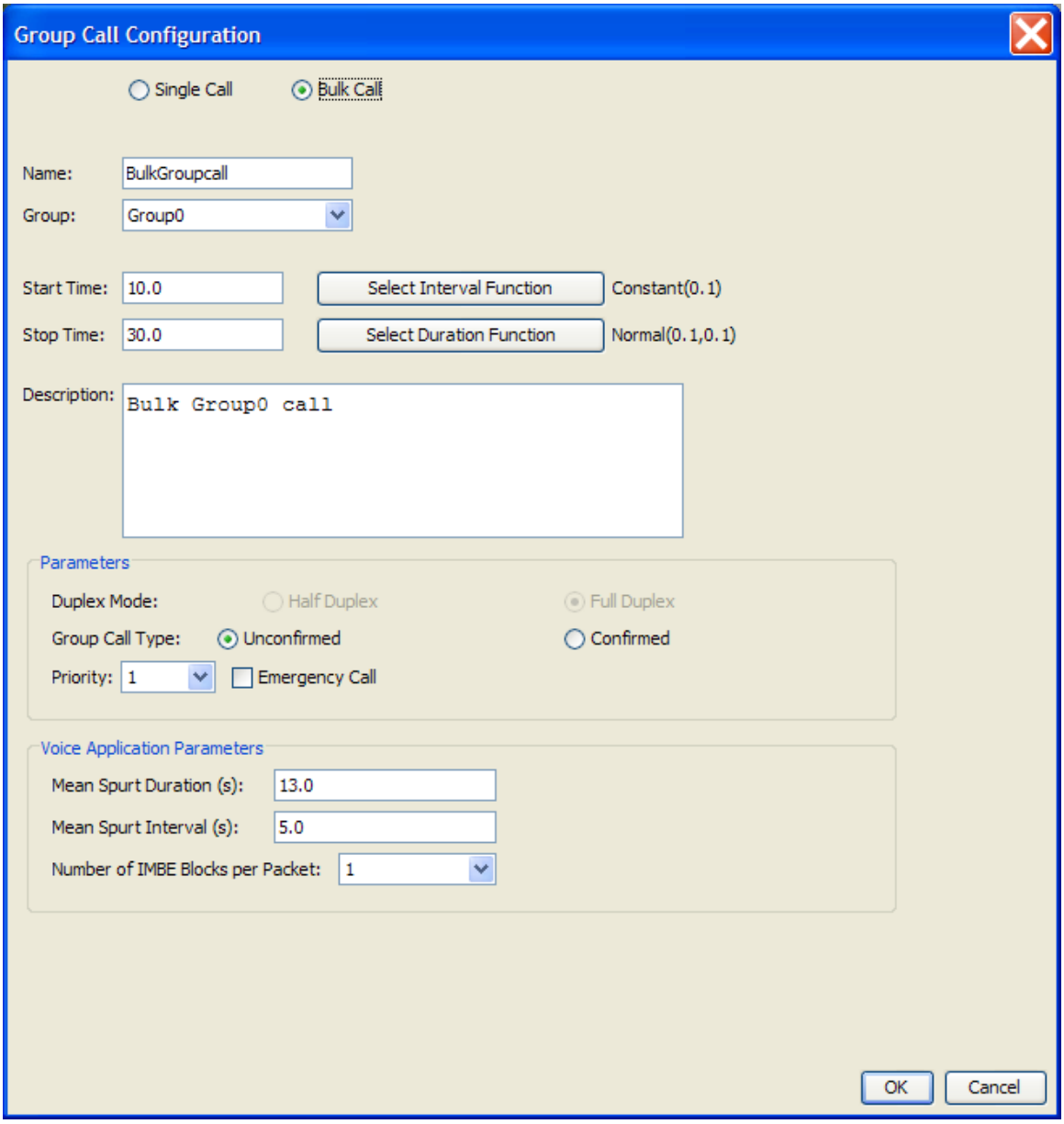



**Figure 87 - Group Call Configuration Window (Bulk Group Call)**

ACTIONS:

- Select the "Bulk Call" radio button to specify a bulk group call application. See Figure 87.
- Enter a unique name for the bulk group call; it must be unique for the whole network topology.

  The acceptable values are alphanumeric (i.e., a..z, A..Z, 0..9) and the '_' character is also allowed. The name must begin with a letter and be at least two characters in length.
- Select a group from those previously defined via the pull-down options.
- Enter an appropriate start time.

The acceptable range of values is zero (0) or larger and must be smaller than the stop time.

- Enter an appropriate stop time.
  The acceptable range of values is greater than zero (0) to 9,999,999 and must be larger than the start time.
- Use the “Select Interval Function” button to select an appropriate interval function and its parameters.
- Use the “Select Duration Function” button to select an appropriate duration function and its parameters.
- Enter an appropriate description for this call if applicable.
- Choose an appropriate “Group Call Type” (Unconfirmed or Confirmed).
- Select an appropriate priority for the call via the pull-down options.
- Use the checkbox to indicate if the call is an emergency or non-emergency group call.
- Enter the appropriate values for “Mean Spurt Duration” and “Mean Spurt Interval”.
  Acceptable values are zero to 9,999,999.
- Select the appropriate “Number of IMBE Blocks per Packet” via the pull-down options (1, 2, or 3).

**Step 5c)** Use the “SU to SU Call Configuration” window to configure SU-to-SU calls. See Figure 88.

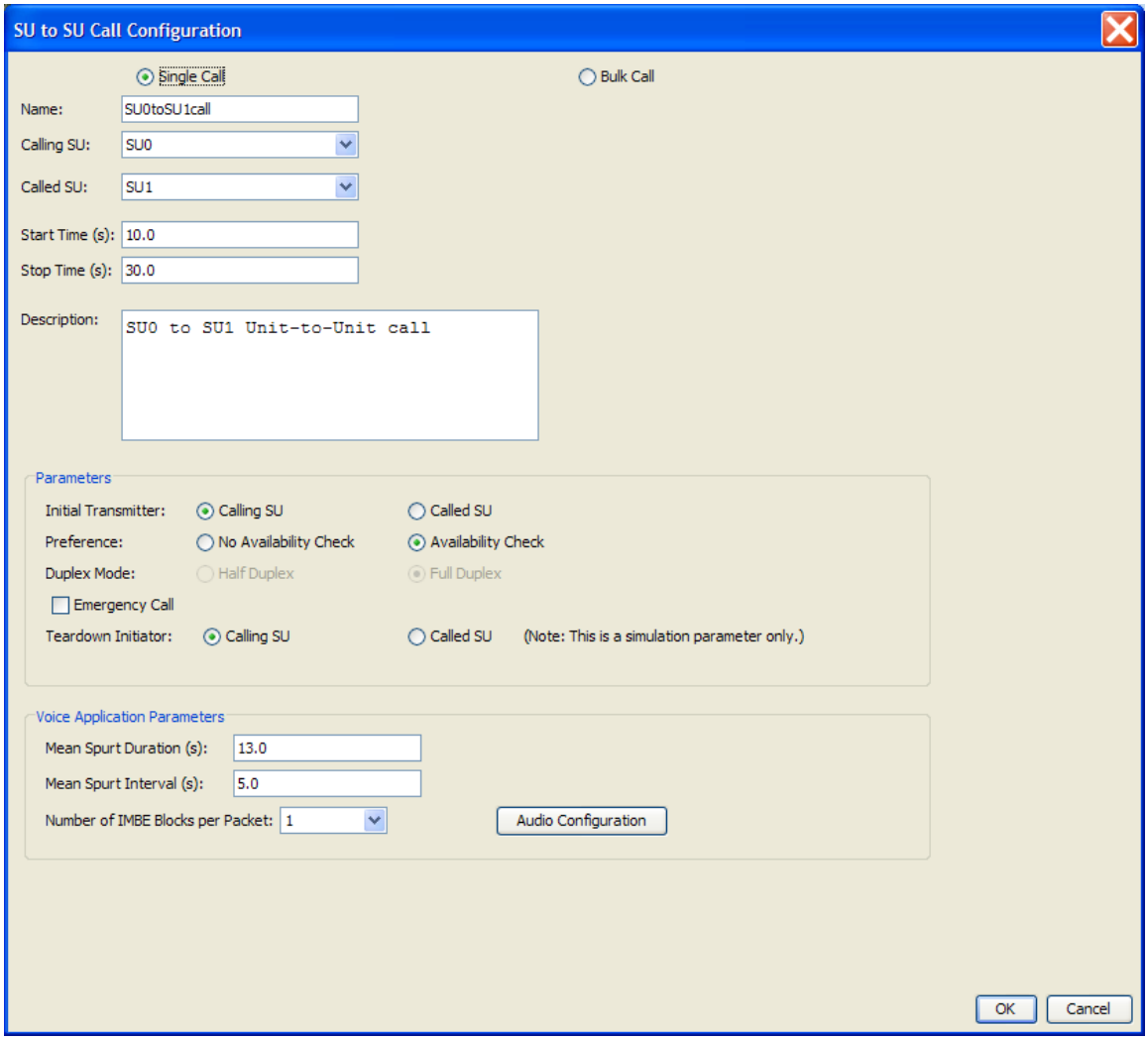



**Figure 88 - SU to SU Call Configuration Window (Single Call)**

ACTIONS:

- Select the "Single Call" radio button to specify a single SU-to-SU call application.
- Enter a unique name for the SU-to-SU call; it must be unique for the whole network topology.

  The acceptable values are alphanumeric (i.e., a..z, A..Z, 0..9) and the '_' character is also allowed. The name must begin with a letter and be at least two characters in length. The name cannot end with "_XX" where "XX" is an arbitrary length number.
- Select the SU that will initiate this call from those previously defined via the pull-down options.
- Select the SU that will receive this call from those previously defined via the pull-down options.
- Enter an appropriate start time.

  The acceptable range of values is zero (0) or larger and must be smaller than the stop time.
- Enter an appropriate stop time.

The acceptable range of values is greater than zero (0) to 9,999,999 and must be larger than the start time.

- Enter an appropriate description for this call if applicable.
- Select the appropriate “Initial Transmitter” (Calling SU or Called SU), this SU will be transmitting the initial data for the call.
- Select the appropriate “Preference” of either no availability check or availability check.
- Use the checkbox to indicate if the call is an emergency or non-emergency call.
- Select the appropriate “Teardown Initiator” (Calling SU or Called SU), this SU will initiate the teardown of the call.
- Enter the appropriate values for “Mean Spurt Duration” and “Mean Spurt Interval”. Acceptable values are zero to 9,999,999.
- Select the appropriate “Number of IMBE Blocks per Packet” via the pull-down options (1, 2, or 3).
- The “Audio Configuration” button can be used to incorporate audio trace files from previously created audio projects. The use of audio trace files will preempt the “Mean Spurt Duration” and “Mean Spurt Interval” values. See section B for more details.

**Step 5d)** Use the “SU to SU Call Configuration” window and enabling the “Bulk Call” option to configure bulk SU-to-SU calls. See Figure 89.

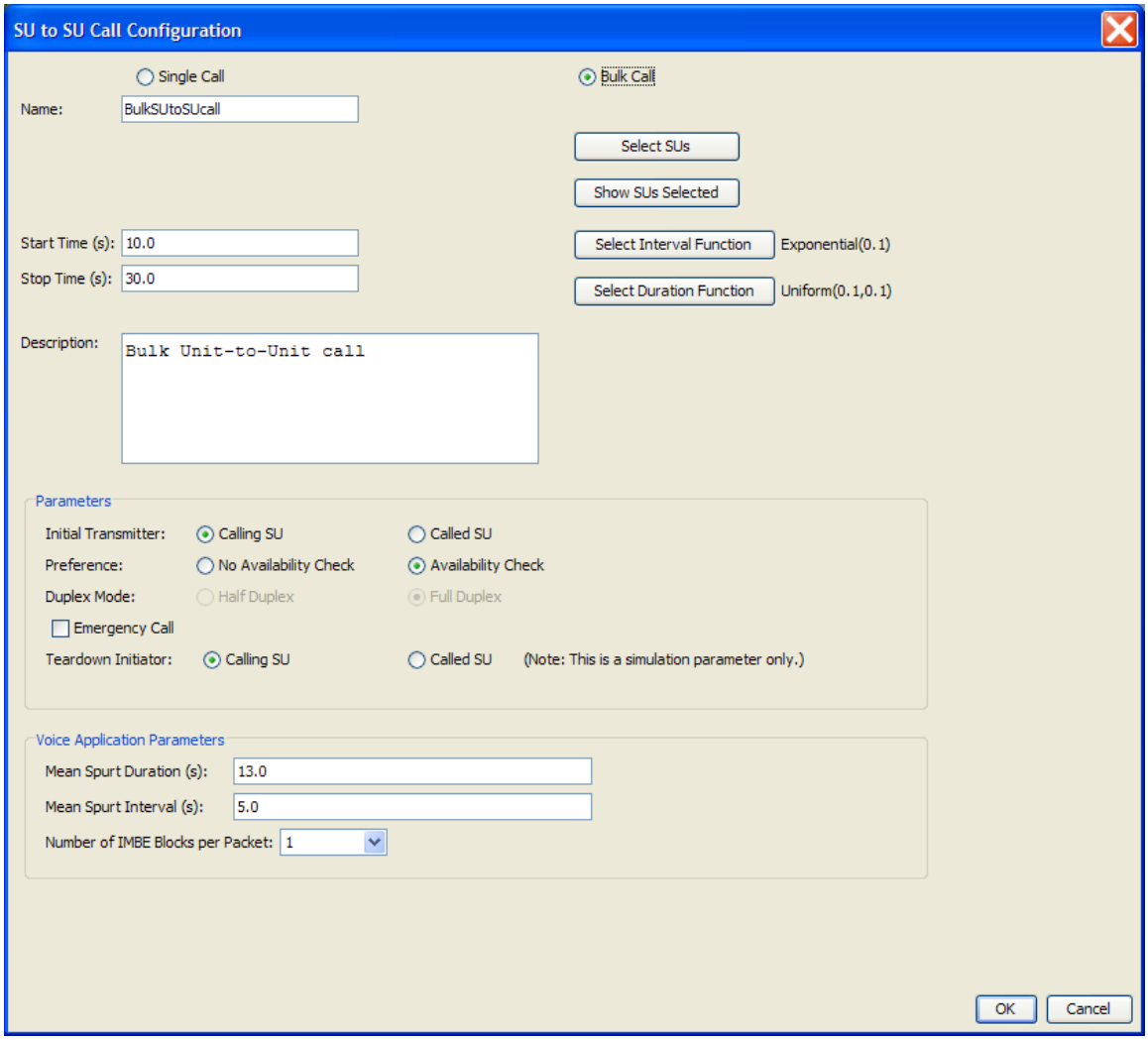



**Figure 89 - SU to SU Call Configuration Window (Bulk Call)**

ACTIONS:

- Select the “Bulk Call” radio button to specify a bulk SU-to-SU call application.
- Enter a unique name for the bulk SU-to-SU call; it must be unique for the whole network topology.

  The acceptable values are alphanumeric (i.e., a..z, A..Z, 0..9) and the ‘_’ character is also allowed. The name must begin with a letter and be at least two characters in length.
- Use the “Select SUs” button to select the SUs to be included in the bulk call.
- Enter an appropriate start time.

  The acceptable range of values is zero (0) or larger and must be smaller than the stop time.
- Enter an appropriate stop time.

  The acceptable range of values is greater than zero (0) to 9,999,999 and must be larger than the start time.
- Use the “Select Interval Function” button to select an appropriate interval function and its parameters.

- Use the “Select Duration Function” button to select an appropriate duration function and its parameters.
- Enter an appropriate description for this call if applicable.
- Select the appropriate “Initial Transmitter” (Calling SU or Called SU), this SU will be transmitting the initial data for the call.
- Select the appropriate “Preference” of either no availability check or availability check.
- Use the checkbox to indicate if the call is an emergency or non-emergency call.
- Select the appropriate “Teardown Initiator” (Calling SU or Called SU), this SU will initiate the teardown of the call.
- Enter the appropriate values for “Mean Spurt Duration” and “Mean Spurt Interval”. Acceptable values are zero to 9,999,999.
- Select the appropriate “Number of IMBE Blocks per Packet” via the pull-down options (1, 2, or 3).

**Step 6)** Save the newly defined network

From the main menu bar, select “File->Save” (Ctrl+S).

**Step 7)** Run the simulation

From the main menu bar, select “Project->Launch Simulation” or click on the icon

**Step 8)** If the simulation run is successful, the results and statistics can be viewed in the “Statistics” Panel.

**Step 8a)** If the simulation run is not successful, open the “FileViewer” window and select the “Log File” tab to view information about the failure. This information may be helpful for diagnosing the problem.

# B Audio Traces

If the simulation project does not contain any media file and the user elects to display the media window from the menu bar (Windows->Media), then the media window is presented with no media files to play, see Figure 90.

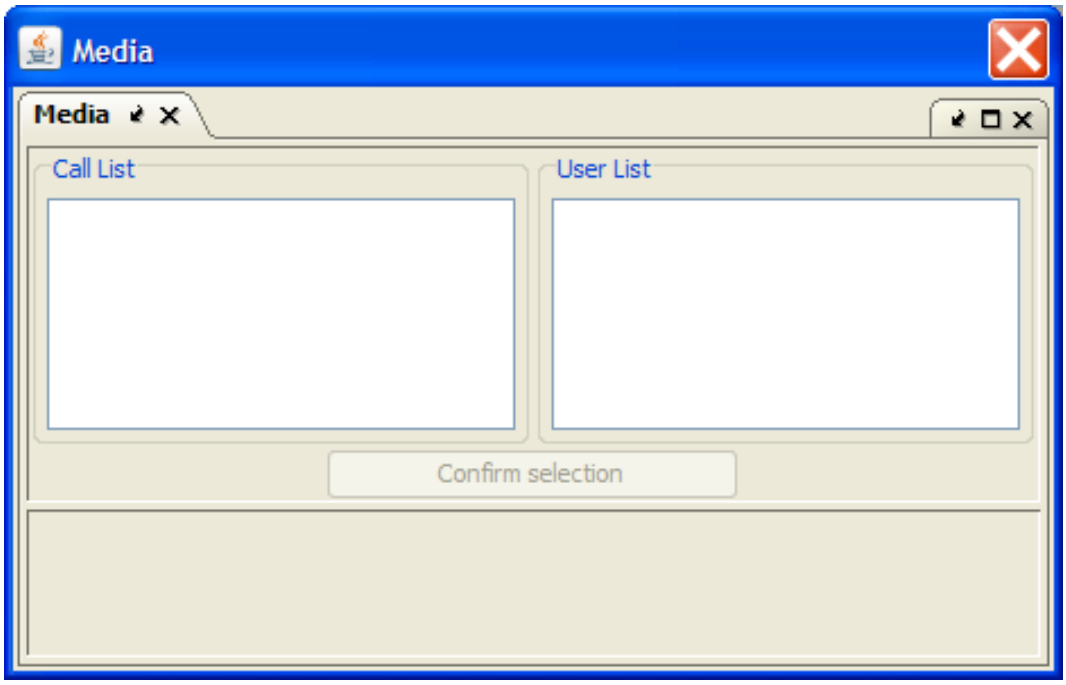



**Figure 90 - Media Window with no Media Files Available**

If the simulation project contains one or more audio media files, then the media window contains the “Call List” and its related “User List”, see Figure 91.

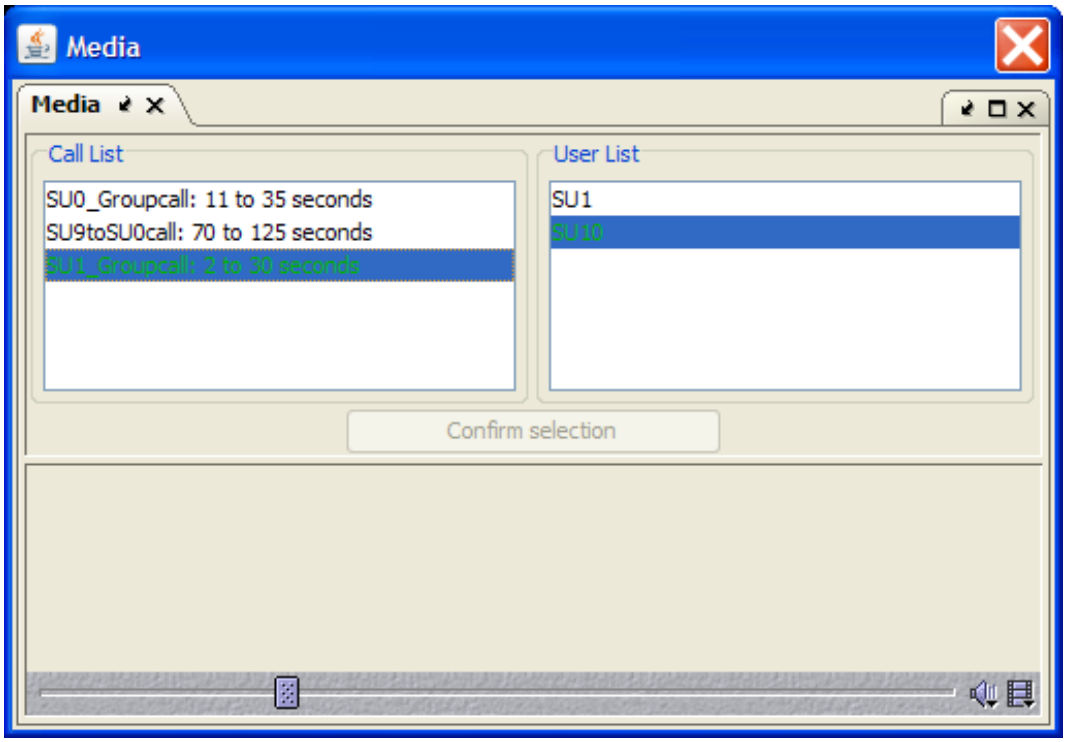



**Figure 91 - Media Window with Media Files Available for Playback**

The following sections describe how media projects are created, how media files can be included to simulation projects and how to control the playback of the media files using the available control bars.

## B.1 Creating Audio Projects

From the main GUI window, select “Tools->Audio Trace Generator” to bring up the Audio Trace Generator (ATG) window as shown in Figure 92. The ATG contains a menu bar at the top; located under the menu bar are the “Audio File Control” buttons followed by the “Sound Graph” panel, the “Automatic Parsing Configuration” panel and the “Spurt Assignment” panel. Also see section 3.2.5.2.

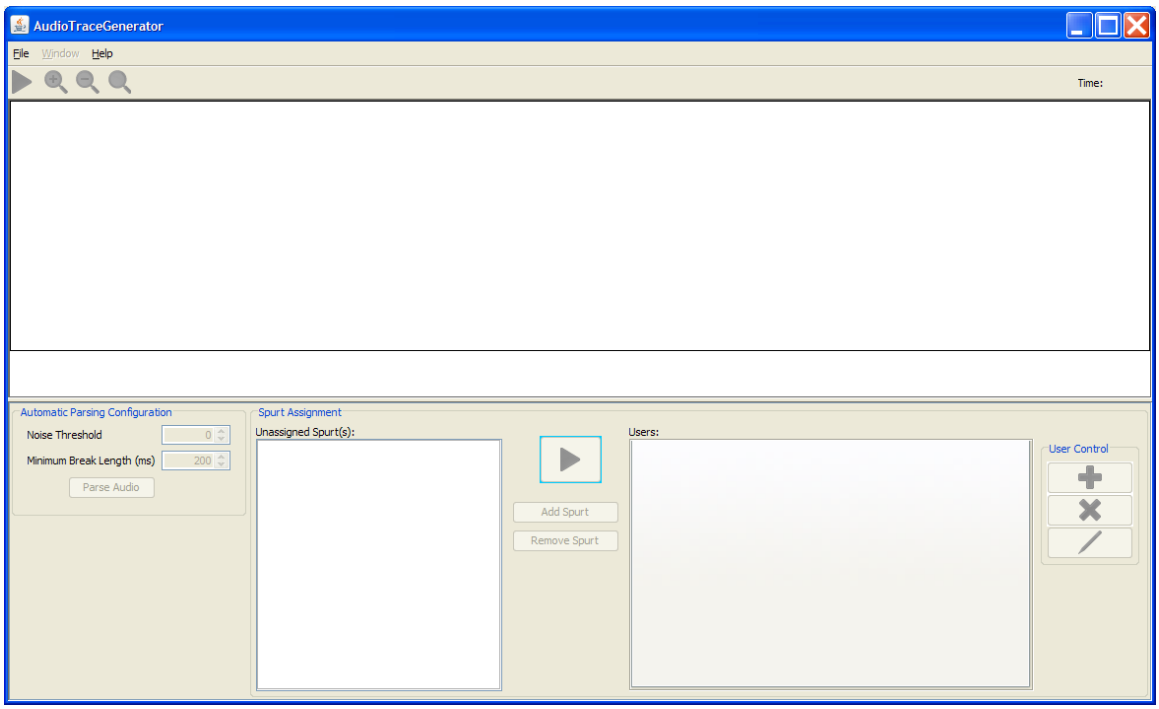



**Figure 92 - Initial Screen of the Audio Trace Generator**

Select “File->New…” to bring up the “New Project” configuration window, see Figure 93. For “Project Location”, use the “Browse” button to navigate to an appropriate folder for creating the new project; for “Audio File”, use the “Browse” button to select an audio file for the project; enter an appropriate description for the project then click the “OK” button to create the project.

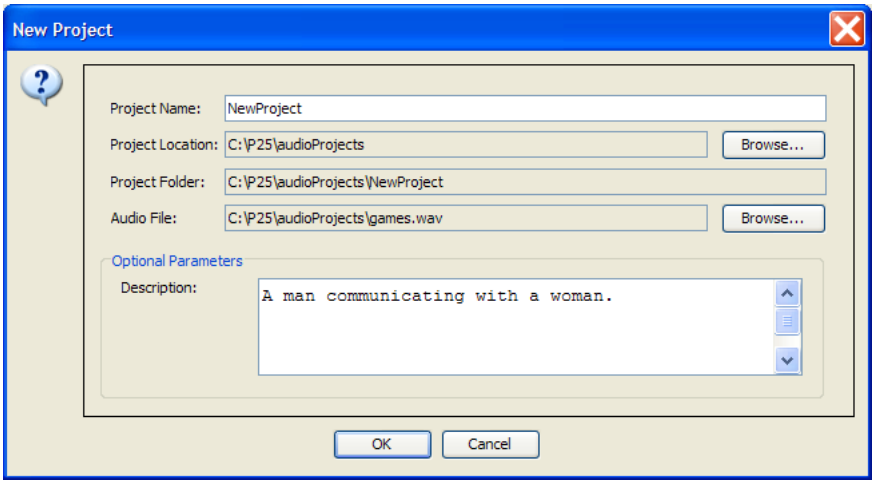



**Figure 93 - New Audio Project Configuration Window**

The Sound Graph panel will display the audio file's signals accordingly, see Figure 94. Enter appropriate "Noise Threshold" and "Minimum Break Length" values then click the "Parse Audio" button to analyze and separate the audio signals into spurts (at least one spurt will be detected).

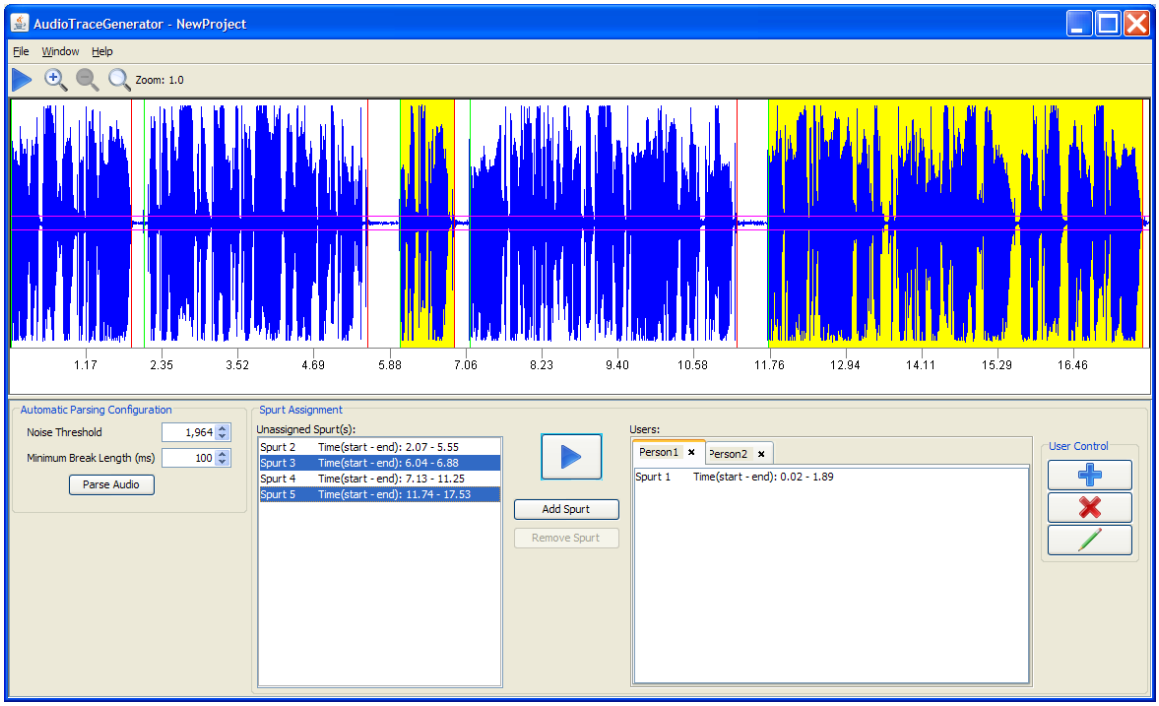



**Figure 94 - Audio Trace Generator with an Analyzed Audio File**

Select the spurt(s) in the "Unassigned Spurt(s)" subpanel and use the "Play Selected Spurt" button to listen to the spurt(s). If necessary, readjust the "Noise Threshold" and "Minimum Break Length" values and reanalyze the audio file until the spurts are correctly separated.

Use the “Add New User” button to create one or more users in order to assign the spurt(s) to the appropriate number of people in the audio file. Select the appropriate user tab in the “Users” subpanel; select the spurt(s) from the “Unassigned Spurt(s)” subpanel, then use the “Add Spurt” button to associate the spurt(s) with the appropriate user(s). See Figure 94.

If a spurt is incorrectly associated with a user tab, then select the invalid spurt from that user’s tab and use the “Remove Spurt” button to disassociate that spurt with the user and move the spurt back to the “Unassigned Spurt(s)” subpanel. See Figure 95.

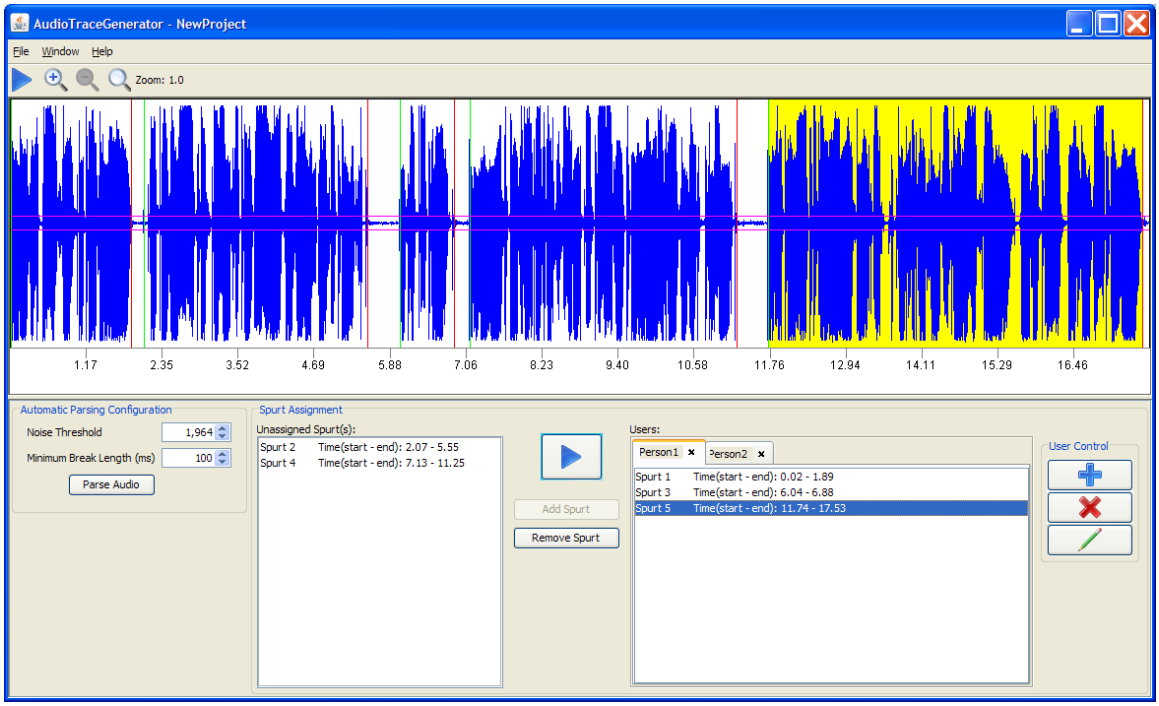



**Figure 95 - User Tab Containing an Invalid Spurt**

Use the “Remove the Selected User” button along with the “Rename the Selected User” button to delete or rename the user accordingly.

Once all spurts are correctly associated with their users, use the “File->Save” menu option to save the audio project then use “File->Exit” to exit the ATG. The newly created audio project, i.e., its folder’s content, can now be used with simulation projects.

## *B.2 Associating Audio Files with Simulation Projects*

The example described below is for a “Group” call; however the general procedure for associating audio projects with applications/calls from simulation projects is similar.

From the main GUI window, select “File->Open Project…” to load a simulation project that requires the addition of audio media. Go into “edit” mode for the project and select the “Topology Configuration” tab, see Figure 96.

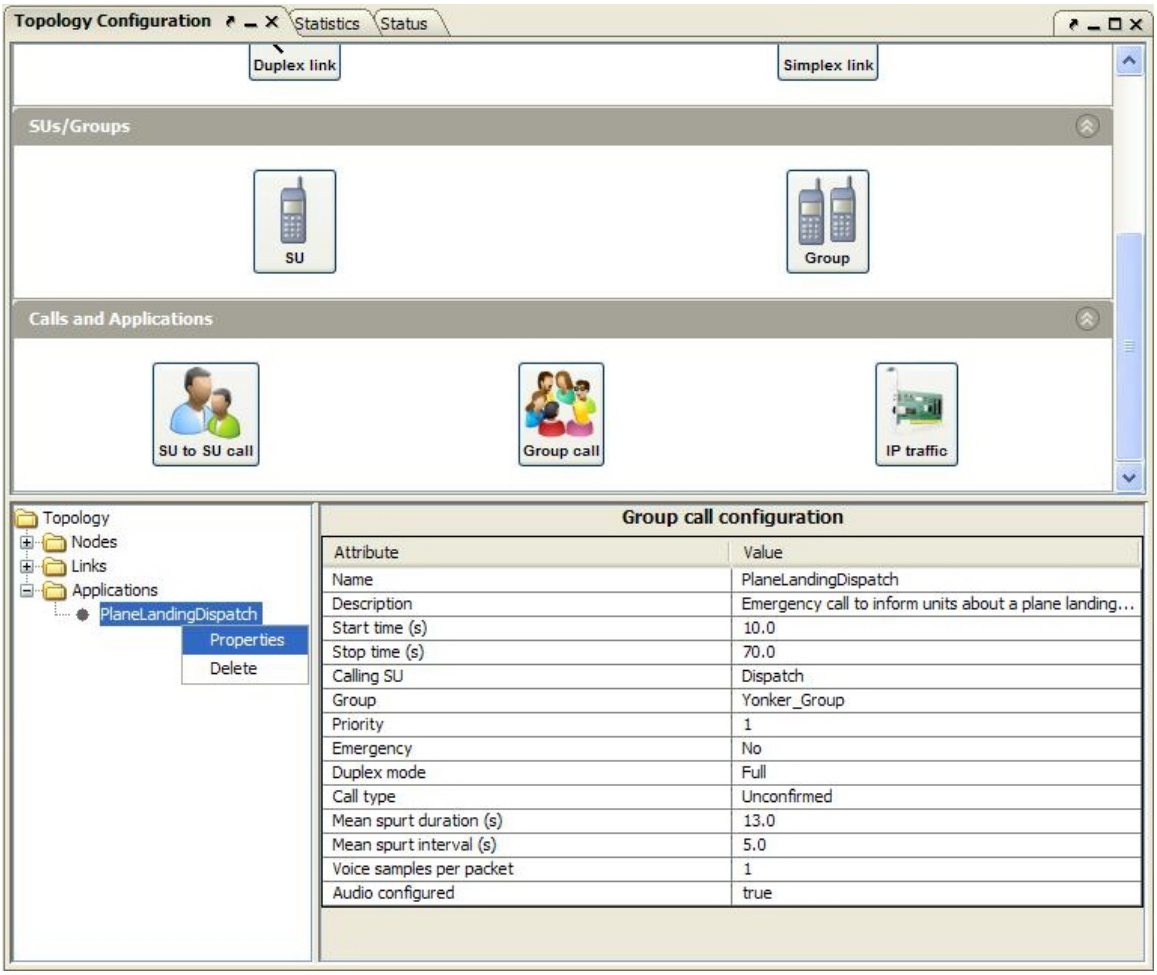



**Figure 96 - Topology Configuration Tab Showing Applications**

Expand the “Topology->Applications” folder then right-click on an application/call that requires audio media; select the “Properties” option to configure that call and bring up its configuration window. In this example, a “Group” call is used, see Figure 97.

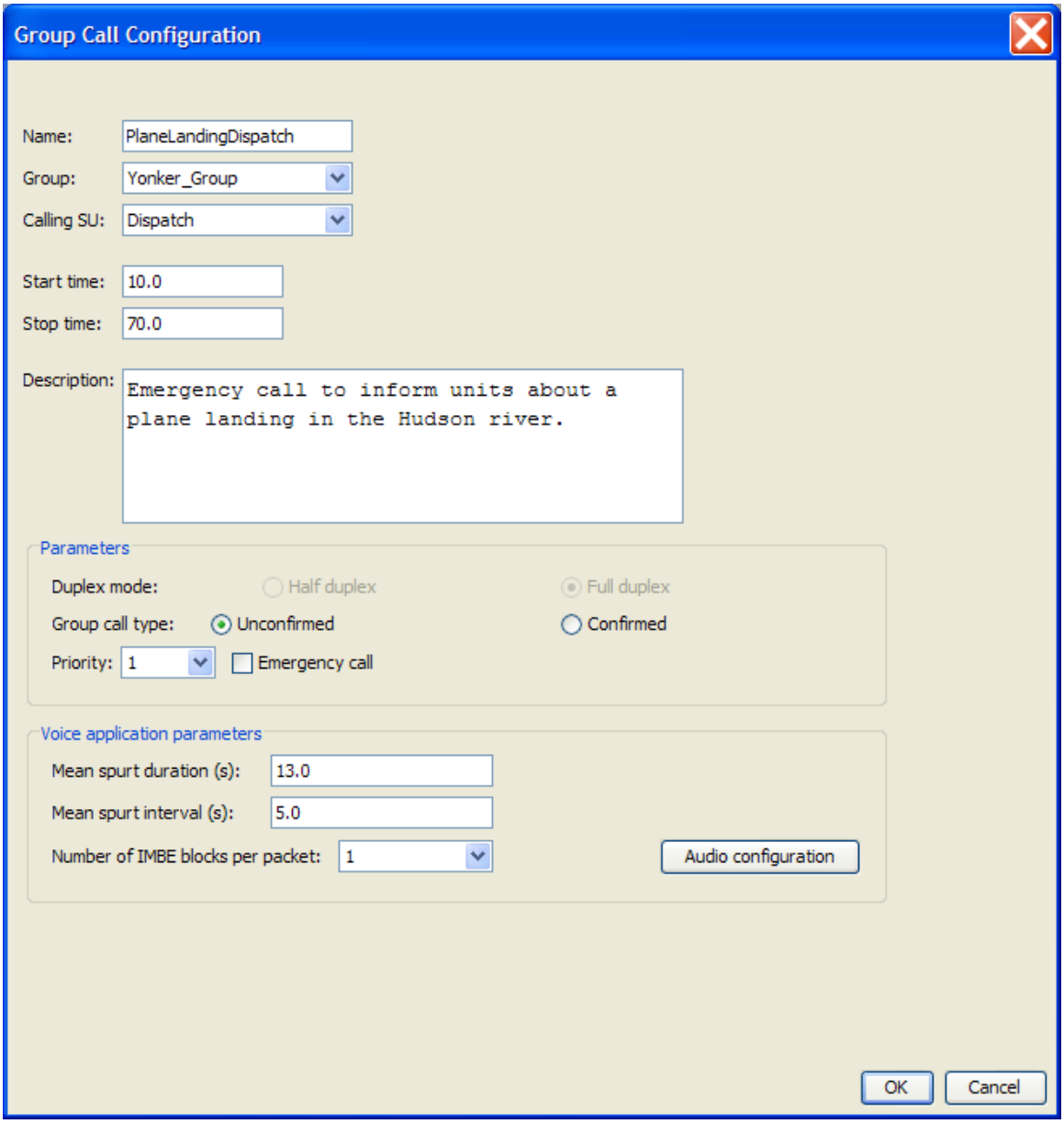



**Figure 97 - SU to SU Call Configuration Window**

Select the "Audio configuration" button to bring up the "Audio Call Configuration" window, see Figure 98.

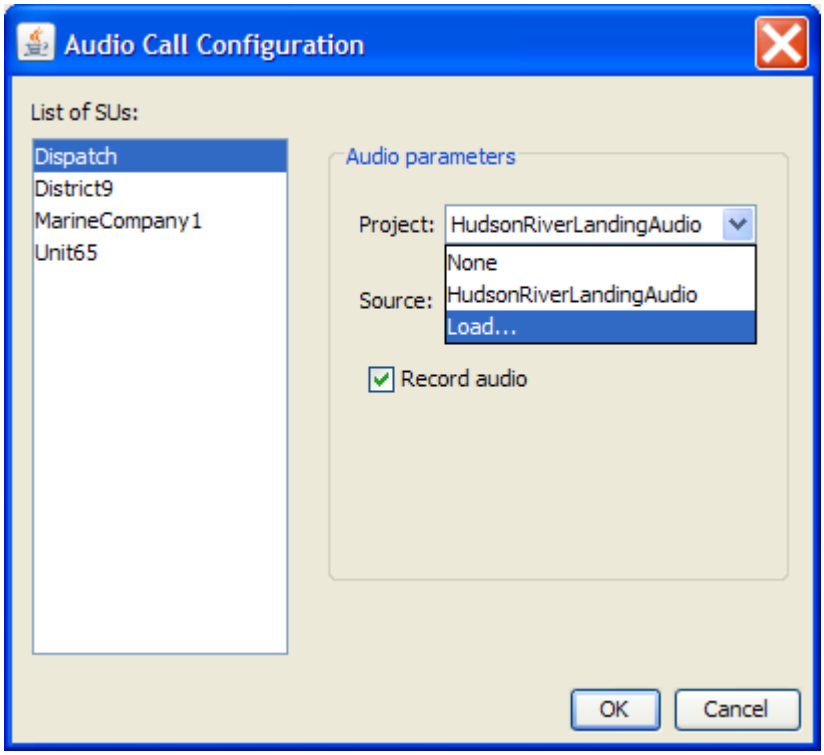



**Figure 98 - Audio Call Configuration Window**

For each SU that is associated to an audio project such as the project described in section B.1; from the "Audio Parameters" drop-down options, select Project->Load (see Figure 98) and navigate to the appropriate audio project and load it by selecting "Open" (see Figure 99). Notice that each audio project can only be loaded once but can be used multiple times for various subscriber units.

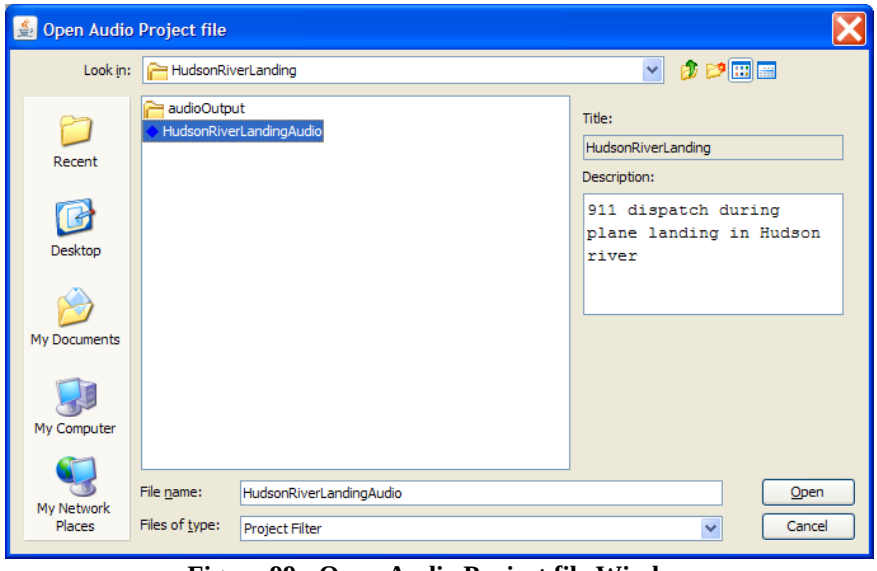



**Figure 99 - Open Audio Project file Window**

Map each of the appropriate SUs (from the "List of SUs") to their related user (from the audio project) by using the "Project" and "Source" drop-down options; the audio spurts were previously mapped to the users from the steps described in section B.1. Check the "Record Audio" checkbox if the audio that the selected SU hears is to be recorded (see Figure 100).

> NOTE: The recording of the audio that an SU hears is independent of the assignment of audio spurt(s) to that SU, i.e., an SU can record audio that it hears without having audio spurt(s) assigned to it, and vice versa. Also note that the recorded audio that the SU hears does NOT include the audio generated by that SU (i.e., the SU does not hear its own voice).

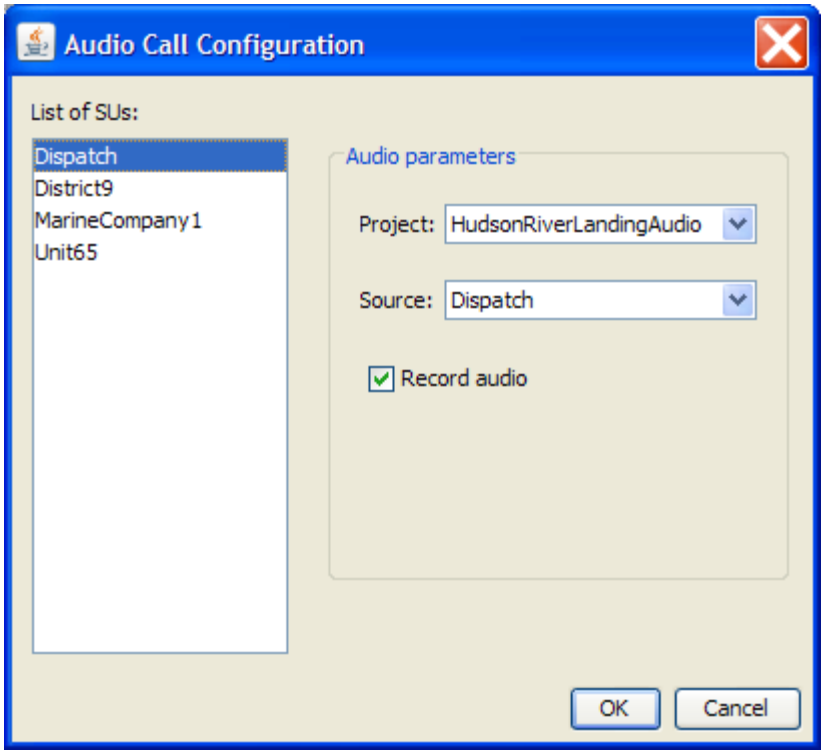



**Figure 100 - Mapping SUs to Users from Audio Projects**

Select OK in the "Audio Call Configuration" window to save the SU mappings, then select OK in the "Group Call Configuration" window to save its configuration. From the main window, select "File->Save" to save the simulation project. Select the "Launch simulation in the server" button to run the simulation project in the server. The server will then generate appropriate output files, and the GUI (client) will generate the resulting audio files based on the server's output files.

## *B.3 Playing Back Audio Files from Simulation Projects*

After loading a simulation project that contains media files for playback (see section B.1 above for creating such a project), the media panel will load the list of available calls.

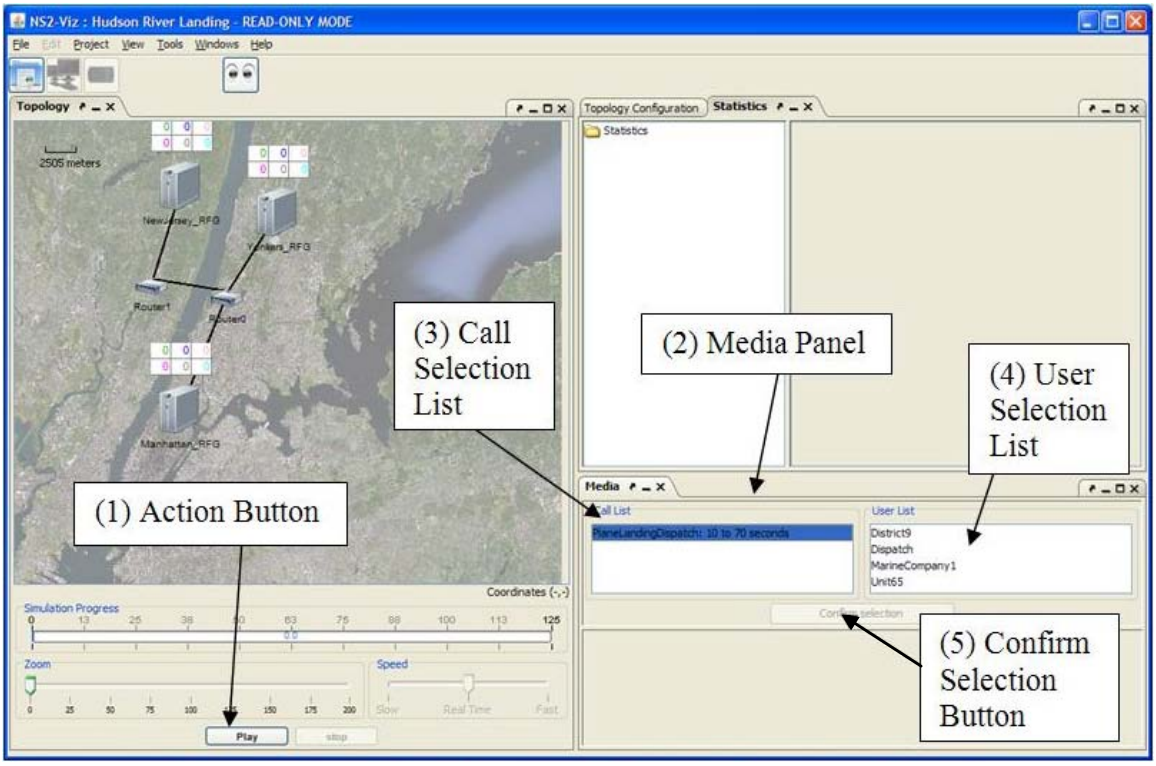



**Figure 101 - Main Screen with a Simulation Project Containing Audio Files**

The "Action" button (1) has three modes, play/pause/resume (see section 4.5.1), to initiate playback of the simulation, select the play mode (see Figure 101). The media panel (2) contains the call selection list (3) that contains all calls related to the simulation project; the user selection list (4) contains all users mapped to each call; the confirm selection button (5) is used to select the media file to play.

Once in play mode, the action button assumes the pause mode and the master control bar (1) shows the playback time line of the simulation project (see Figure 102); select the action button while it displays "Pause" to suspend playback. The media control bar (2) will be displayed only when the playback time line is in the time range of the media file, e.g., if the media file's start time is 15 seconds into playback, then the media control bar will be displayed at 15 seconds and beyond during playback.

Figure 102 shows the master time slider (3), it is used to control the project's playback time position; the media time slider (4) can be used to select the media playback time position while the project's time line is within the time range of the media file; the volume button (5) and the media properties button (6) are also shown.

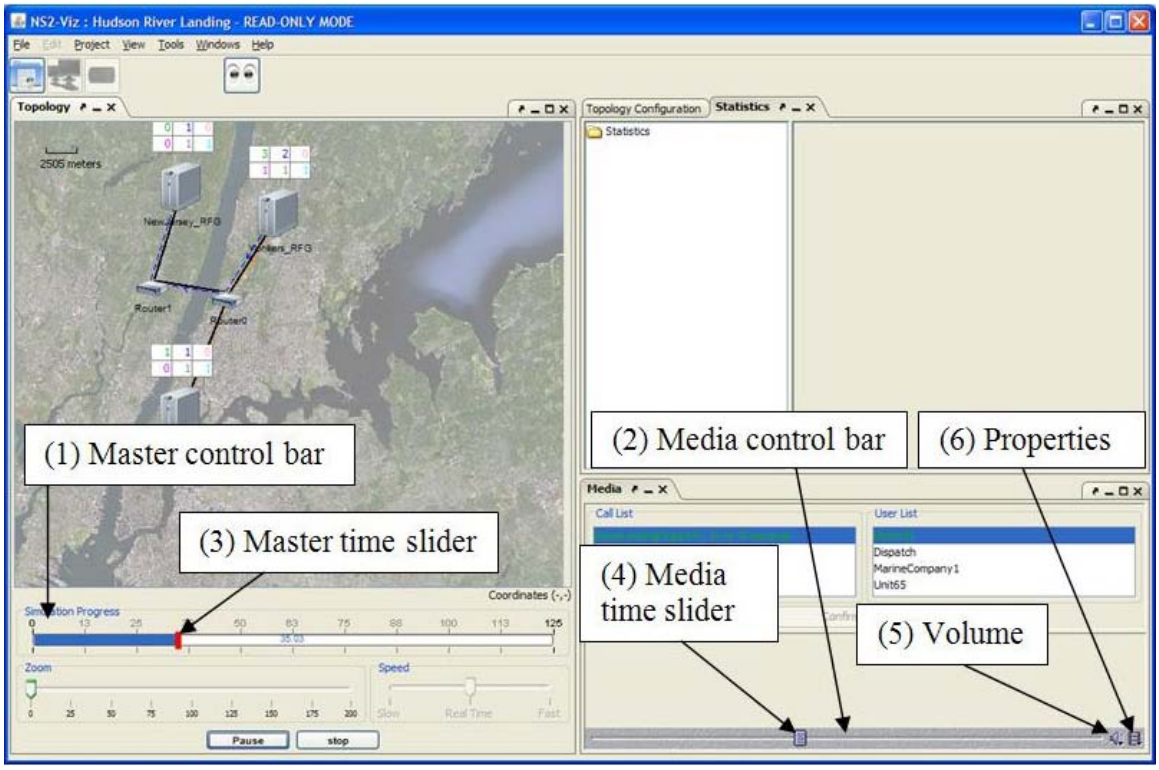



**Figure 102 - Main Screen during Playback of a Media File**

The media properties button is used to bring up the "Media Properties" window to show characteristics of the media file; see Figure 103.

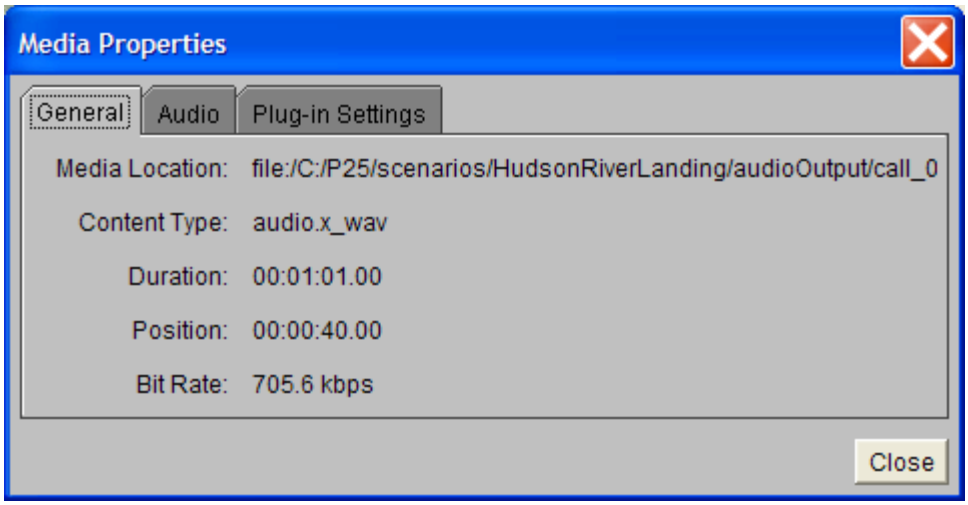



**Figure 103 - Media Properties Window**

During playback, the user may click on the master time slider or the media time slider to select specific playback time. From the pause mode, select the action button to resume playback. Select the stop button at any time to stop playback of the simulation project.

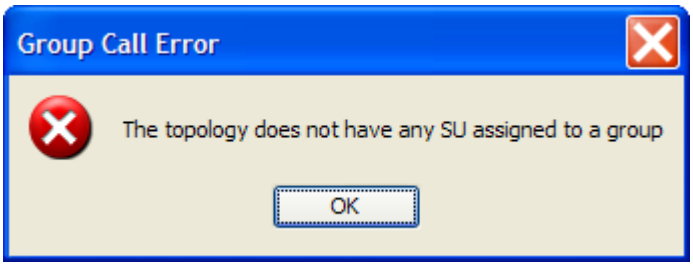
Selecting a specific call from the “Call List” then selecting a specific user from the “User List” then selecting the “Confirm Selection” button will result in playing back what that particular user heard during the prerecorded transmission (media file). Notice that the transmission of the user selected will not be heard but the other people’s transmissions will be heard, i.e., media file playback is heard in first person singular mode.

Selecting a different media file can be done at any time during playback; after the “Confirm Selection” button is selected, the specified media file will begin playback immediately at the time indicated by the master control bar, but only if the media file’s time range is within the time range of the master time slider. The selection of a media file that is not within the time range of the master time slider is also allowed; once the master time slider is playing within the time range of that particular media file then that media file will begin to play automatically.

# C Common Error/Warning Messages

This appendix contains some common error messages along with their possible causes.

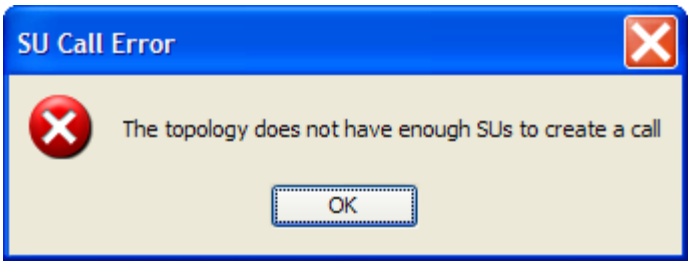
**1)**




Group Call Error: The topology does not have any SU assigned to a group

Cause: There are no SUs that have been configured to use a talk group or there are no SUs created in the topology.

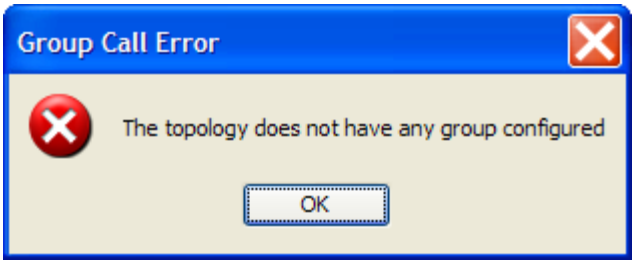
**2)**




SU Call Error: The topology does not have enough SUs to create a call

Cause: There are no SUs defined or there is only one SU defined in the topology.

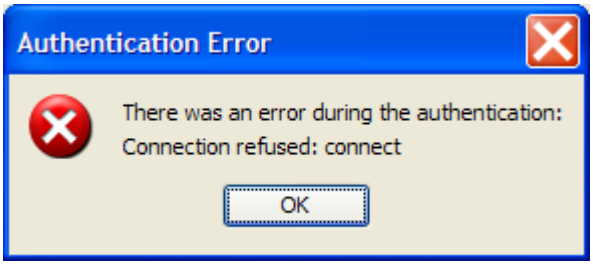
**3)**




Group Call Error: The topology does not have any group configured

Cause: No group has been configured for a node in the topology.

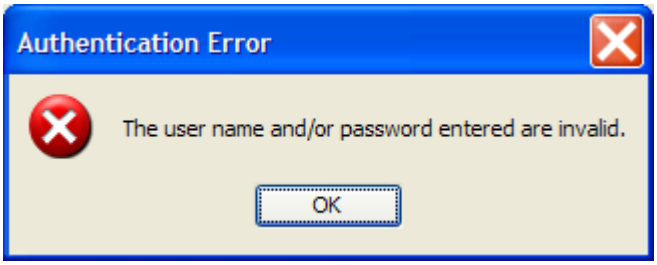
**4)**




Authentication error: Connection refused

Cause: Unable to connect to the server to authenticate.

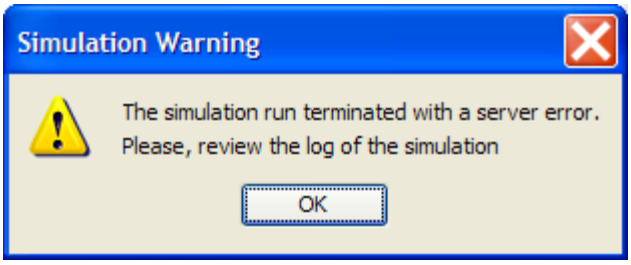
**5)**




Authentication error: Invalid user name or password

Cause: An invalid user name and/or password were entered resulting in an authentication failure.

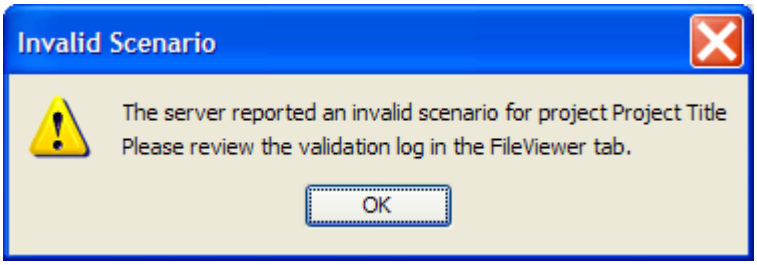
**6)**




Simulation Warning

Cause: The simulation run terminated with an error on the server. Review the log of the simulation for more details.

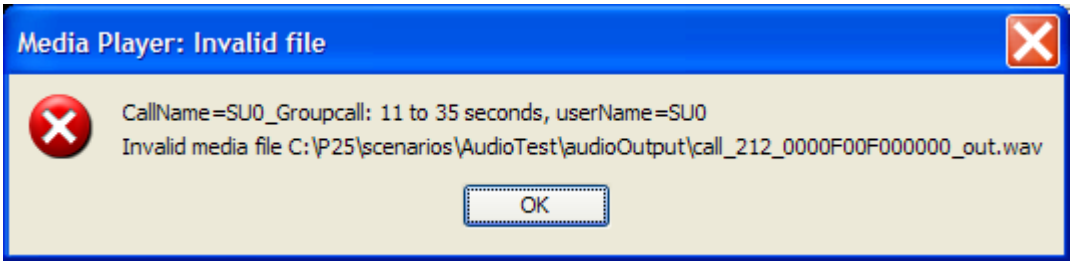
**7)**




Invalid Scenario

Cause: The server reported an invalid scenario for the project (i.e., the project's configuration is malformed). Review the validation log in the "FileViewer" tab for more details.

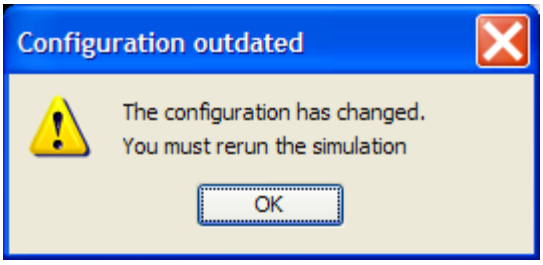
**8)**




Invalid Media File

Cause: The Media Player cannot find or open the specified media file. The project's media file or files are missing.

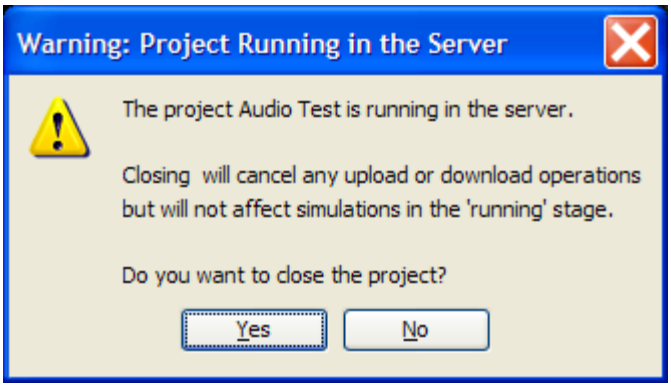
**9)**




Configuration Outdated

Cause: The project's configuration has changed since the last simulation was run with the server. If the user tries to view the results from the simulation (such as statistics) and changes have been made to the project then this message will be displayed. Rerun the simulation to resolve this pop-up message.

**10)**

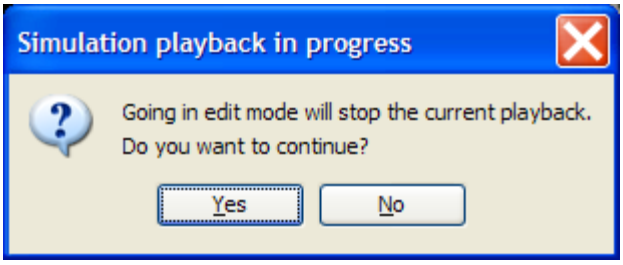



Pending Simulation

Cause: If the user tries to close a project after it has been submitted to the server for processing, and the server has not concluded its processing of the project then this message will be displayed.

Note: If the simulation is running, closing the project will not stop the simulation on the server. When the project is reopened, the user will have the opportunity to check the status of the simulation; once the simulation is completed, the results can be accessed. This feature is useful for running large/long simulations.

**11)**




Simulation Playback Notice

Cause: During the playback of a simulation (i.e., in read-only mode), the user chooses to switch to design mode causing this notice to be displayed.

# D List of Software Tools

Various Java technologies were used in developing the Graphical User Interface for Project 25, this section acknowledges what software products/packages were used in developing the GUI. Software packages that were involved with developing and supporting the GUI included but not limited to the following:

- Cryptographic Provider: The Legion of the Bouncy Castle (http://www.bouncycastle.org)
- Docking Windows: InfoNode (http://www.infonode.net)
- Java (version 6): www.java.com
- Java Audio Implementation: Tritonus (http://www.tritonus.org)
- Java Chart Library: JFreeChart (http://www.jfree.org/jfreechart)
- JavaAPIforKML: (http://labs.micromata.de/display/jak/Home)
- JAXB: (http://java.sun.com/developer/technicalArticles/WebServices/jaxb)
- Media Player: JMF (http://java.sun.com/javase/technologies/desktop/media/jmf)
- NetBeans OpenIDE Libraries: (http://netbeans.org/features/platform)
- Numerical Methods: (http://www-sfb288.math.tu-berlin.de/~jtem/numericalMethods)
- Other Swing Extensions: (https://jxlayer.dev.java.net, http://fifesoft.com/rsyntaxtextarea)
- PDF Generation: iText Java PDF library (http://www.lowagie.com/iText)
- RSyntaxTextArea: (http://fifesoft.com/rsyntaxtextarea)
- Swing Component Extensions: (https://swingx.dev.java.net)
- TCL: www.tcl.tk
- XML Parser: JDOM (http://www.jdom.org)
- Xuggle Library: (http://www.xuggle.com)

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