NS3 – GUI HELPER

Manual for Release v1.1.0

Abstract

The NS3-GUI Helper project presents a comprehensive manual designed to assist users in harnessing the power of NS3 (Network Simulator 3) through an intuitive graphical user interface (GUI).

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1 CONTENTS

2 CHAPTER 1 - GETTING STARTED

The "Getting Started" section serves as an introduction for new users to quickly familiarize themselves with the software and begin using it effectively. It provides a concise roadmap to navigate through the initial steps of installation, launching the software, and performing basic tasks. The primary goal is to empower users to start using the software with minimal friction and to build confidence in their ability to explore its features further.

2.1 OVERVIEW

NS-3 GUI Helper is an innovative software tool designed to streamline the process of network simulation using NS-3 (Network Simulator 3) by providing an intuitive graphical user interface (GUI). NS-3 is renowned for its accuracy and flexibility in modelling complex network scenarios, but its command-line interface can present challenges for novice users. NS-3 GUI Helper addresses this issue by offering a user-friendly interface that simplifies simulation setup, configuration, and visualization in early stage of learning process for NS-3.

Whether you are a student, professor or a master of a NS-3 this software might help you to write efficient code, minimal error and it can save your time for writing code for basic scenarios.

2.1.1 Key features

1. Graphical Interface
2. Simulations Design Tool
3. Visualization Capabilities

2.1.2 benefits

1. Accessibility
2. Efficiency
3. Ease of use

2.1.3 Target Audience

NS-3 GUI Helper is ideal for students, researchers, network engineers, and professionals who need to design, simulate, and analyse network scenarios using NS-3. It caters to users who may be unfamiliar with the intricacies of NS-3's command-line interface and provides an accessible entry point to network simulation.

2.1.4 Capability

NS-3 GUI Helper is compatible with NS-3, a widely-used discrete-event network simulator, and supports various operating systems, including Windows, macOS, and Linux distributions.

3 CHAPTER 2 - BASIC NAVIGATION

The Basic Navigation section of the NS-3 GUI Helper manual offers users a fundamental understanding of how to navigate the software's interface efficiently. By familiarizing users with the layout and functionality of the graphical user interface (GUI), this section empowers them to access key features and perform tasks with ease.

3.1 EXPLORING MAIN MENU

You will be shown a step-by-step guide for accessing the Main Menu, also known as the menu bar, of this application.

3.1.1 File Menu

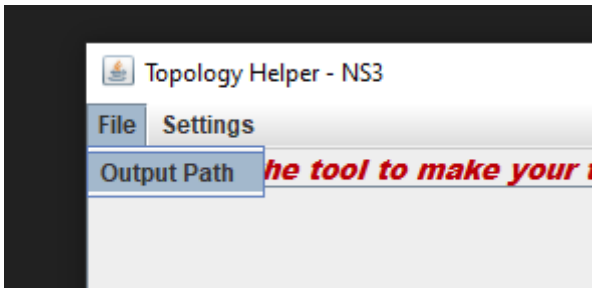

Figure 1 - Main Menu

In the menu bar, there are primarily two menus. We are currently exploring the "File" menu. This menu allows you to specify the file path where the code for the topology will be generated, as it serves as the main function of this application. Furthermore, you have the option to modify the name of the generated file.

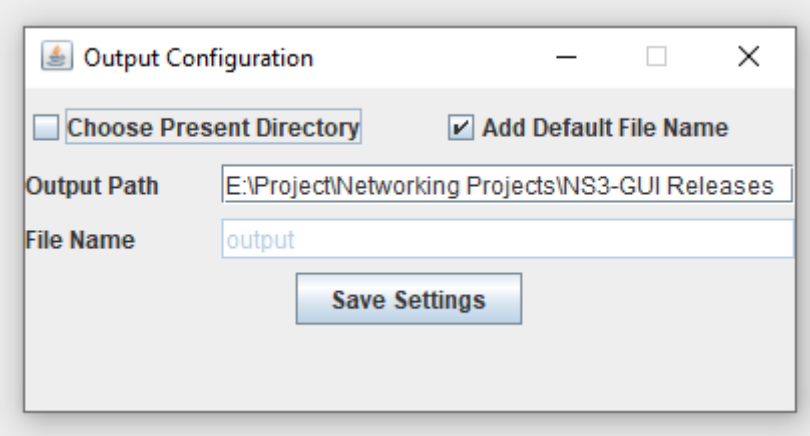

Figure 2 - Output configuration Dialog Box

After selecting "Output Path" from the "File" Menu, a dialog box (refer to Figure 2) will appear. Here, you can specify the output path and file name as discussed earlier. Additionally, if you prefer the default settings, you can check the checkbox provided. Finally, click the "Save Settings" button to save your chosen settings.

3.1.2 Settings Menu

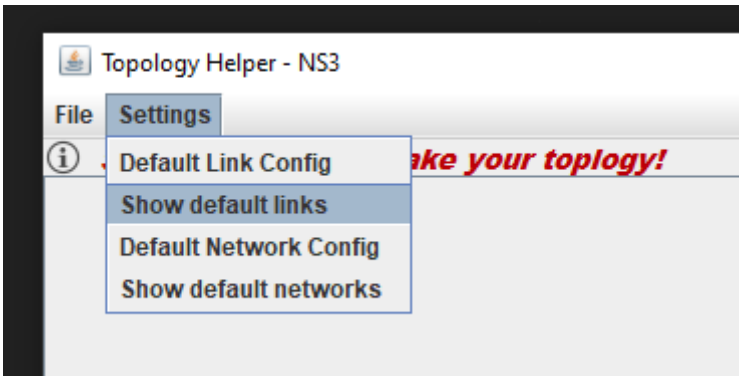

Figure 3 - Settings Menu

The "Settings" menu provides convenient interaction with the application, primarily enabling you to save frequently used configurations. This functionality minimizes the number of clicks and time required to set up the application repeatedly.

3.1.2.1 Managing Default Links

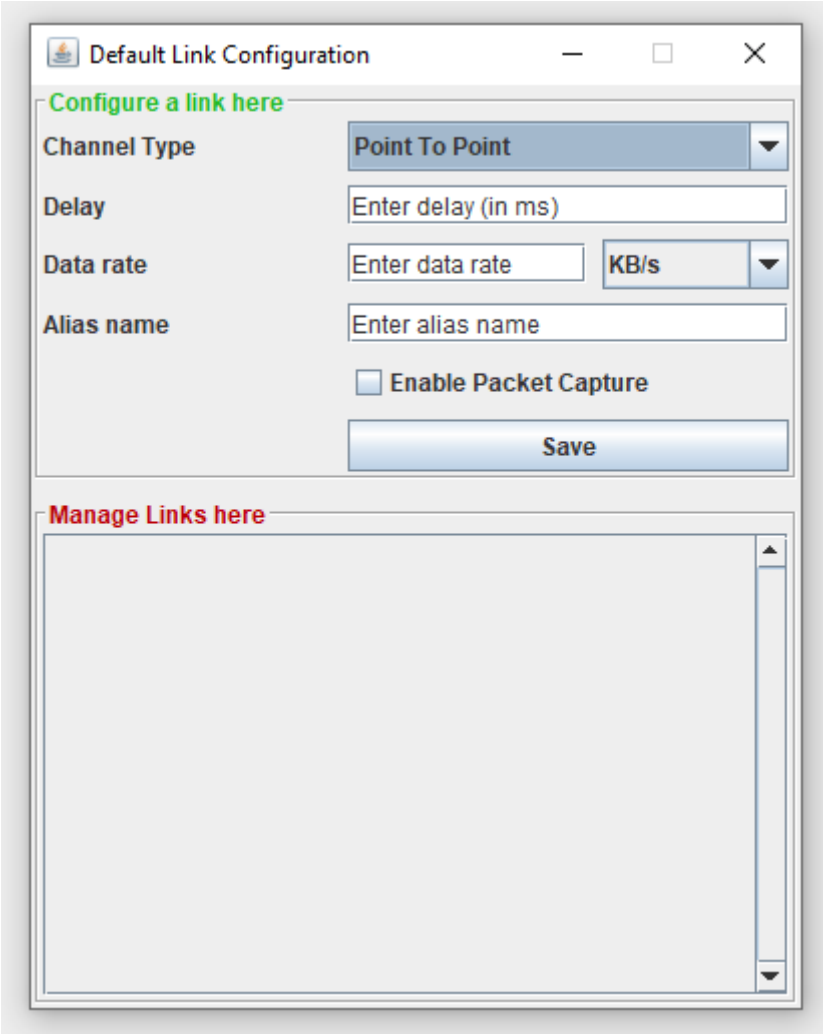

Figure 4 - Default Link Configuration Dialog Box

This dialog box (refer to Figure 4) facilitates the addition, editing, and deletion of default network links (channel) along with their configurations. It allows you to add links that you use frequently, thereby saving time on repetitive configuration tasks.

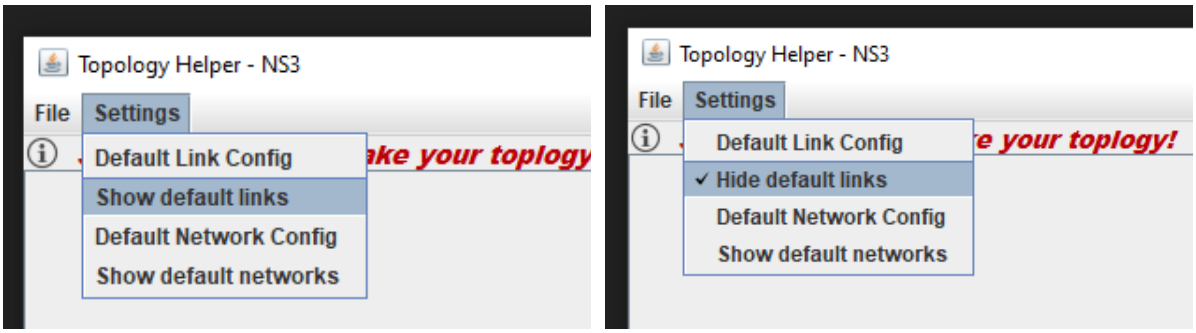

Figure 5 - Before and After clicking on "show default links"

You can then click on “show default links” (refer to Figure 5) to use the configured default links into your current topology. Once clicked it will be visible in your main panel as shown below. (refer to Figure 6)

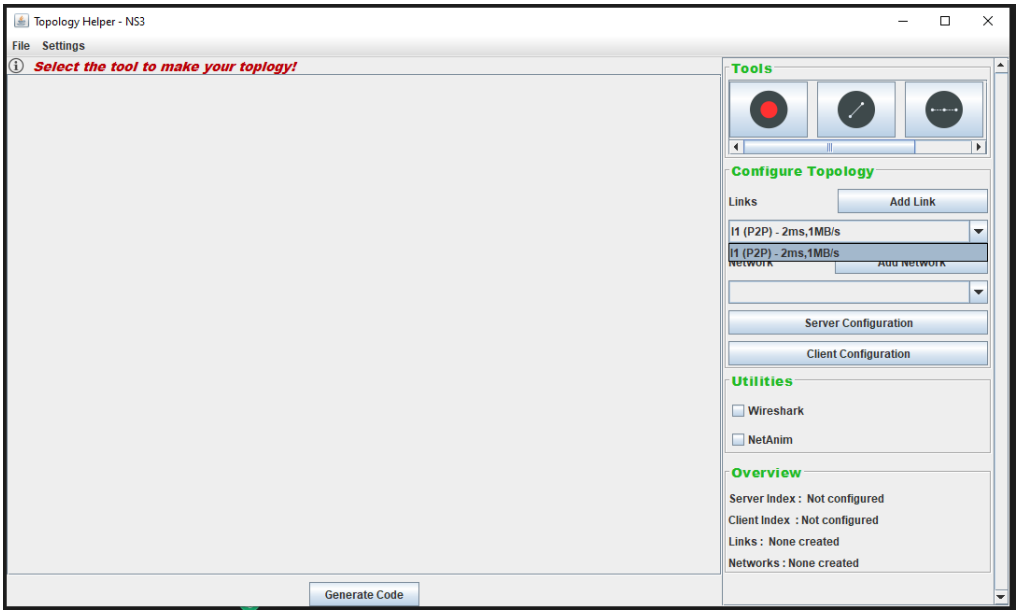

Figure 6 - Showing Default Links to Main panel

3.1.2.2 Managing Default Networks

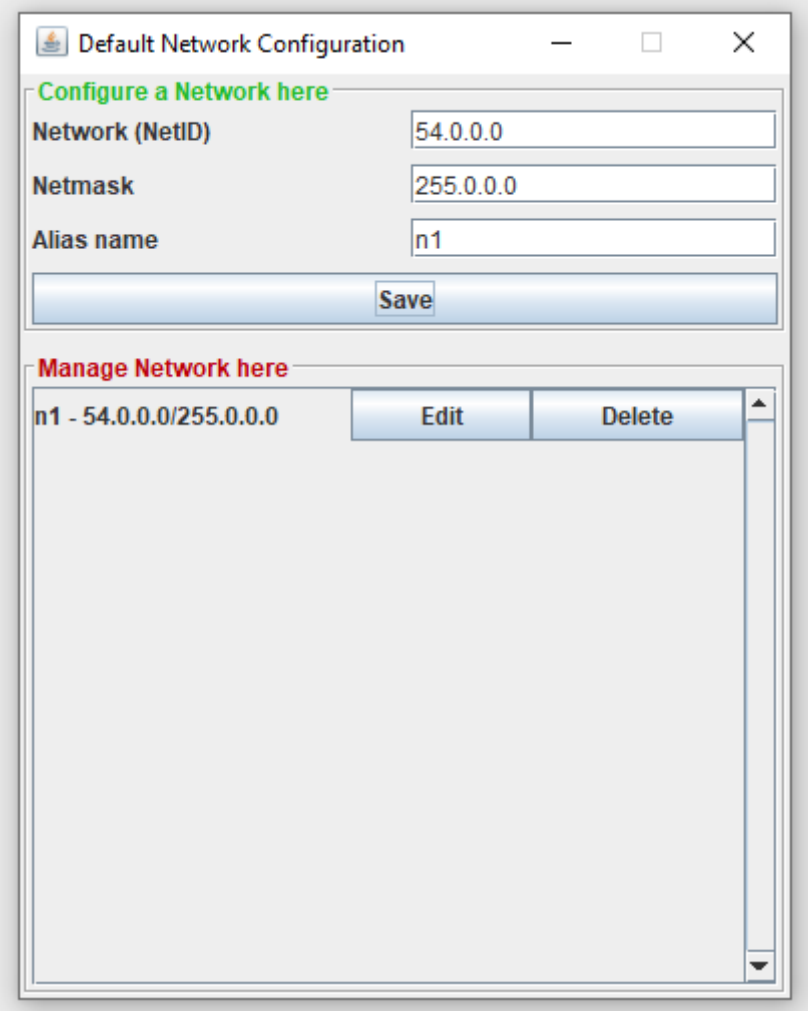

Figure 7 - Default Network Dialog Box

This dialog box (refer to Figure 7) facilitates the addition, editing, and deletion of default network along with their configurations. It allows you to add network settings that you use frequently, thereby saving time on repetitive configuration tasks. Other than that the functionalities are same as above Dialog for Default Links (refer to section 2.1.2.1).

3.2 EXPLORING THE LAYOUT

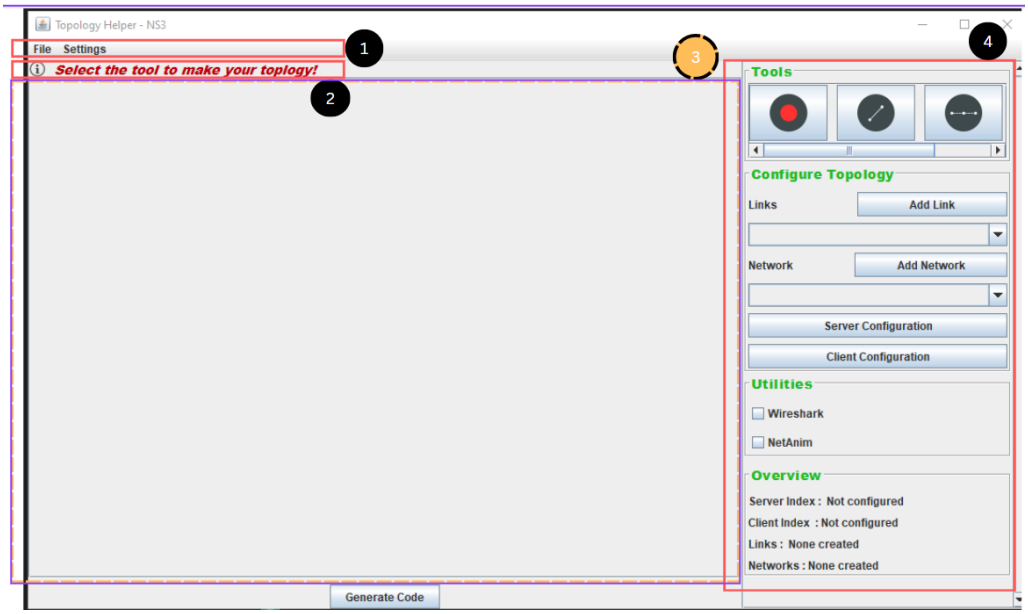

Figure 8 - Layout of the Application

The application is structured into four main components: the "menu bar" (see section 2.1), marked as label 1 in figure 8, the "information label" displaying details about the selected tool/utility (label 2 in figure 8), the "canvas area" where you create your topology (label 3 in figure 8), and the "main panel" (label 4 in figure 8), which houses various utilities and tools for topology creation.

3.3 EXPLORING THE MAIN PANEL

3.3.1 Exploring Tools Section

In this interface, you'll find a variety of tools available for selection. Choosing a tool triggers updates in the "information label," displaying relevant details about the selected tool. Feel free to select any tool; usage instructions are provided for each one. Hovering on each tool, pops up the name of the tool as a tool tip text.

3.3.1.1 Node Tool

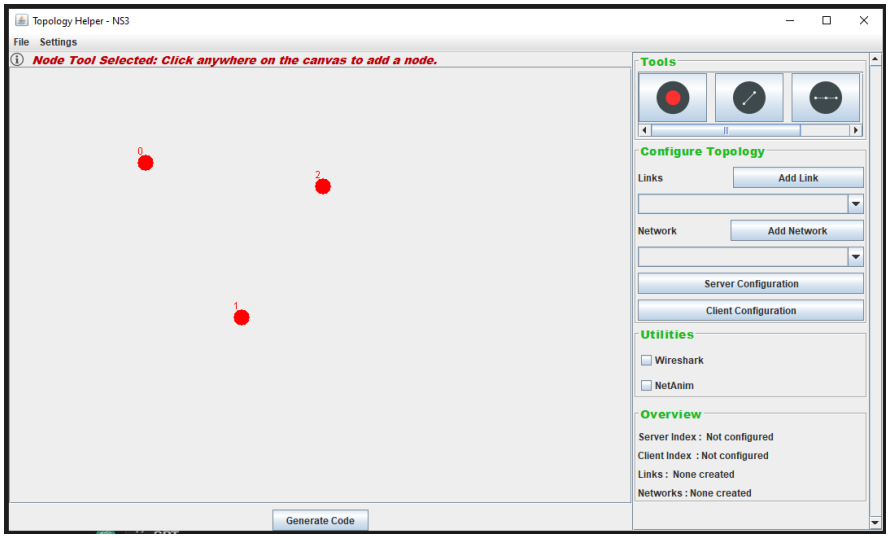

Figure 9 - Selection of node tool

Figure 10 - Icon of node tool

The node tool icon is visible (see figure 10). When you select this tool, you can add nodes to the canvas. These nodes represent the "NodeContainer" class from NS-3. Simply click anywhere on the canvas to add a node, which becomes part of your topology. Each node is assigned an index, displayed on top of the node in the GUI.

3.3.1.2 P2P Link Tool

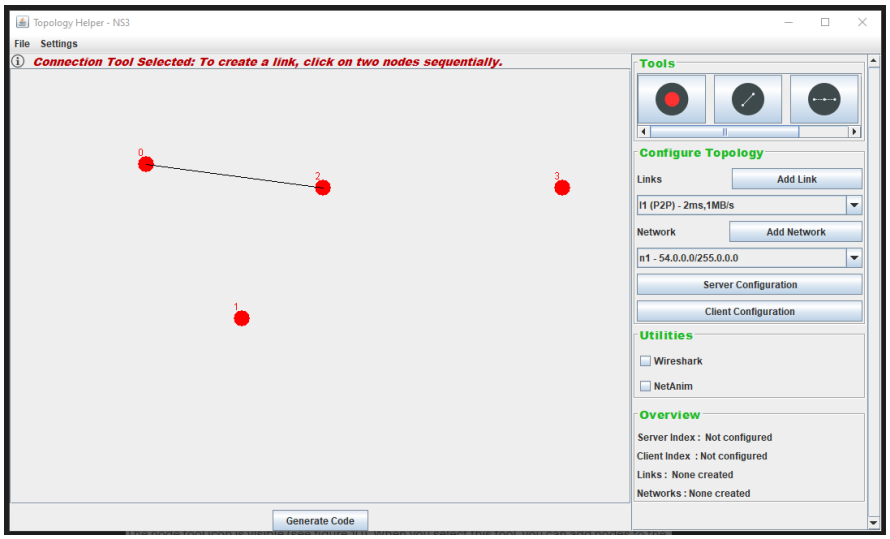

Figure 11 - selection of P2P Link Tool

The icon for the P2P Link Tool is displayed (see figure 12). Clicking on this tool will provide instructions on how to use it within the "information label." Essentially, you'll need to click on any two nodes sequentially to establish a P2P wired link between them. This action mirrors the creation of "NodeDevices" using "PointToPointHelper" in NS-3. After selecting the second node, a "Configure Connection" dialog box will prompt you (refer to figure 13), where you can specify the desired P2P Link and Network settings for configuring the devices.

Figure 12 - icon for P2P Link Tool

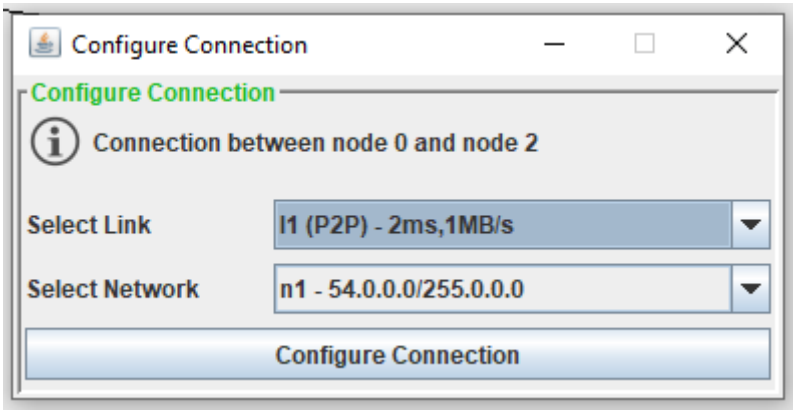

Figure 13 - Configure Connection Dialog Box

3.3.1.3 CSMA Link Tool

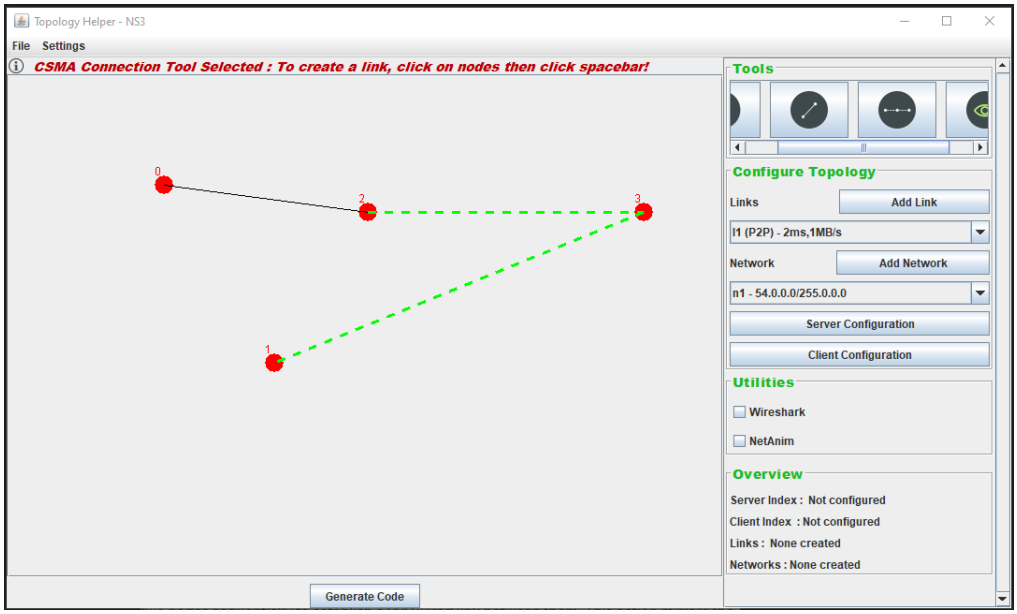

Figure 14 - Selection of CSMA Link Tool

Figure 15 - Icon for CSMA Link Tool

The procedure for adding a CSMA Link is quite similar to what we've seen for the "P2P Link" (refer to section 2.3.1.2). Similar to the CSMA Channel, which is a replication of the "CsmaHelper" from NS-3, it can accommodate more than two networking nodes in the same channel. You can click on the nodes you wish to include in the CSMA Channel and then press the "Space Bar"

key on the keyboard to configure the connection. Upon pressing the "Space Bar" key, you'll encounter the same "Configure Connection" dialog box (refer to figure 14), allowing you to select the desired CSMA Link and Network Configuration. This configures “NodeDevices” using “CsmaHelper” from NS-3.

3.3.1.4 View Tool

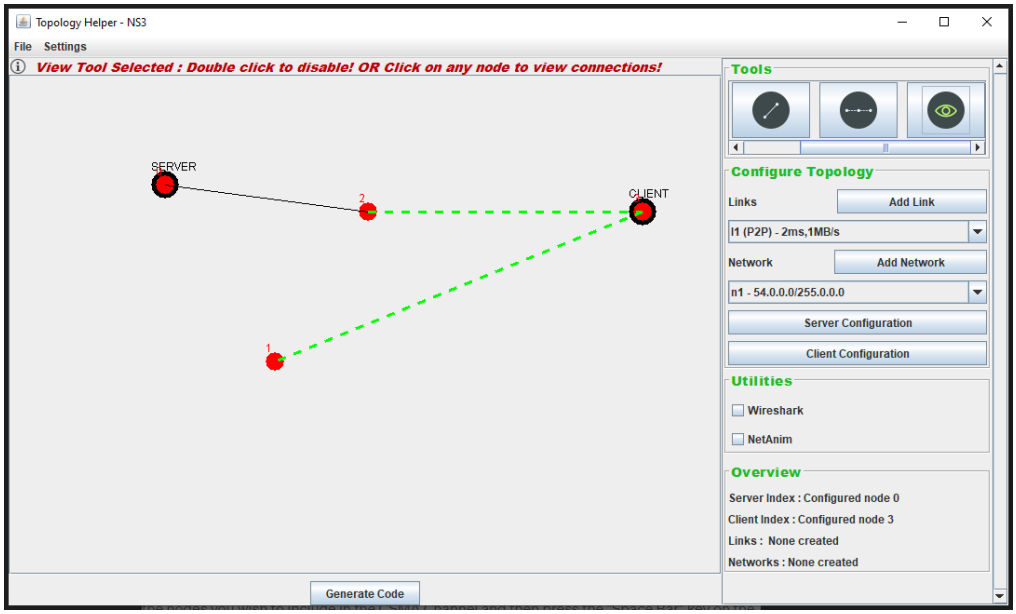

Figure 16 - Selection of View Tool

Once you've configured the Client and Server Nodes (refer to section 2.3.2.3 and 2.3.2.4), you can utilize the View Tool, which highlights these nodes (refer to figure 16). Double-clicking will deactivate the highlighting. Essentially, this tool serves as a utility for visualizing the topology. Although you can also view the client and server node indexes from the Overview tab, located within the main panel's last tab.

Figure 17 - Icon of view tool

3.3.2 Exploring Configure Topology Section

This section or tab within the main panel provides options for adding links, network settings, configuring server, and configuring client. Currently, the feature set includes configuring one "UdpEchoClient" and one "UdpEchoServer."

However, we are planning to introduce an update soon that will allow the addition of multiple client servers and multiple applications.

3.3.2.1 Adding a network link

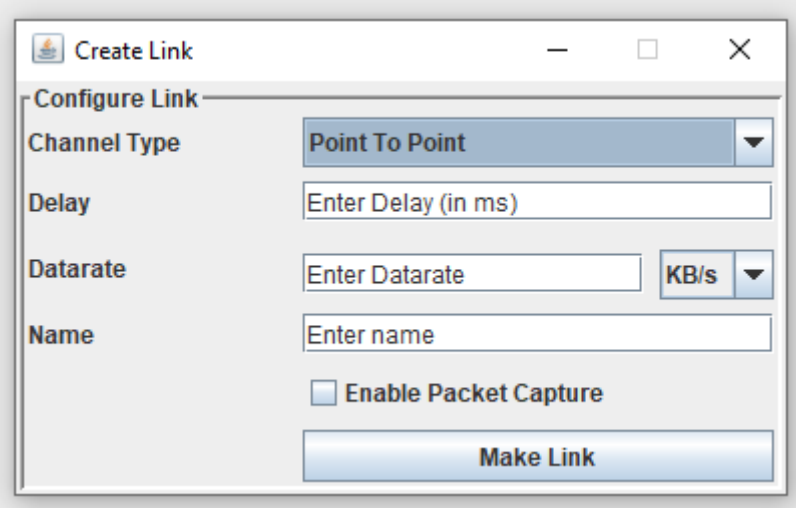

Figure 18 - Create Link Dialog Box

Clicking on the "Add Link" button in the Configure Topology tab of the main panel will open the "Create Link" dialog box (see figure 18). This dialog box allows you to establish a network link, which can be associated with the "PointToPointHelper" or "CsmaHelper" classes from NS-3. These helpers can be added using the tools discussed in section 2.3.1. Created links will be shown in the dropdown that is below the button which says “Add Link”.

The channel type is bound to be changed in upcoming releases.

3.3.2.2 Adding a network

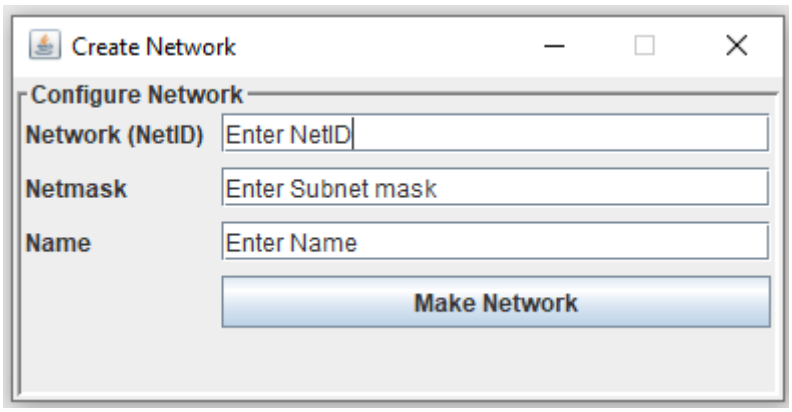

Figure 19 - Create a network dialog box

Clicking on the "Add Network" button allows you to add a network configuration that can be applied when configuring network devices using the tools discussed in section 2.3.1.

3.3.2.3 Server Configuration

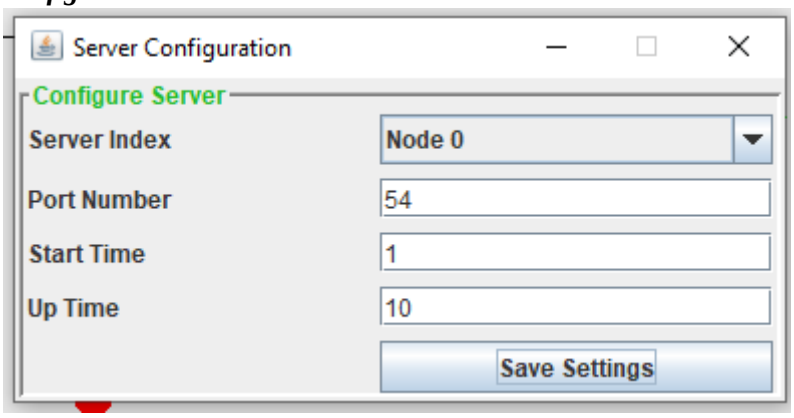

Figure 20 - Server Configuration Dialog Box

Clicking on the "Server Configuration" button will open the Server Configuration Dialog Box, enabling you to create a single UdpEchoServer with minimal configuration settings.

This section is bound to change in next releases, allowing you to add multiple servers with the particular type of server that you want.

3.3.2.4 Client Configuration

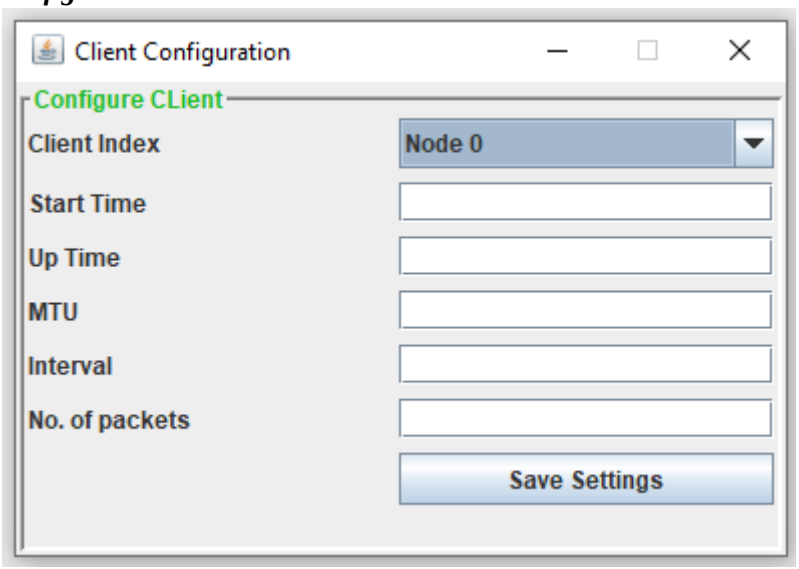

Figure 21 - Client Configuration Dialog Box

By clicking on the "Client Configuration" button, you will be presented with the Client Configuration Dialog Box. From there, you can create a single UdpEchoClient with ease.

This section is bound to change in next releases, allowing you to add multiple servers with the particular type of client that you want.

3.3.3 Exploring the Utilities

The term "utilities" in NS-3 encompasses various tools designed to extract useful insights from simulations, such as visualization tools or data collection mechanisms like NetAnim, WireShark, and Trace Sources. Presently, our focus lies on NetAnim and Wireshark, both of which are elaborated upon below.

This section is bound to change in upcoming releases, allowing you to configure more utilities with various configuration settings.

Figure 22 - Utility Section from the Main Panel

3.3.3.1 NetAnim Utility

In the Utility tab of the Main Panel, you will find a checkbox (see figure 22) that facilitates the generation of ".xml" files. Although there are additional server configurations possible, such as node positioning and attaching mobility modules for NetAnim visualization, these options are not currently available via the GUI. Our focus for this release is limited to specific features, with plans to expand in future updates.

This section is bound to change in later releases, allowing you to set several configurations for the visualization in NetAnim.

3.3.3.2 WireShark Utility

Within the WireShark Utility section, you'll find a checkbox (see figure 22) that, when enabled, initiates packet capture. While there are various configuration possibilities, including selective node capture and time periods, our current focus is streamlined. Packet capture is currently enabled for the entire link, akin to the ".EnablePcapAll()" function, as we've confined our scope for this release.

This section is bound to change in later releases, allowing you to set several configurations for the Data collection in Wireshark.

3.3.4 Exploring Overview Tab

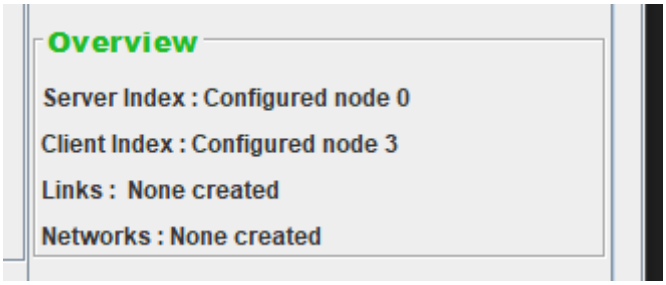

Figure 23 - Overview tab from the Main Panel

You can access an overview of the current topology from the Overview tab. This section displays essential information such as server index, client index, the number of created links, the number of networks created, and more.