NETKROM Technologies

ISPAIR Base Station

NETKROM OS & NETKROM NMS

User Manual

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Table of Contents

Hardware Installation 7
Warnings 7
Package contents 8
Setup Requirements 9
ISPAIR Base Station Installations 10
Mounting the ISPAIR Base Station in the pole or tower 14

1. Product Overview 15
1.1 Compatibility and Requirements 15
1.2 NETKROM NMS Features 15
1.3 NETKROM Features 15
1.4 NETKROM NMS Installation Guide 16

2. NETKROM NMS 17
2.1 Overview of NNMS Interface 17
2.1.1 NETKROM NMS Main Menu 19
2.1.2 Network Topology Tab Information Panes 21
2.1.3 Node Shortcut Menu 22
2.2 Getting Started with NNMS 23
2.2.1 Auto-Discovering Nodes 23
2.2.2 Configuring a New Node 25
2.2.3 Moving and Resizing Icons 27
2.2.4 Adding Background Map Images 27
2.2.5 Saving and Loading Profiles 29
2.2.6 Using the Node Shortcut Menu 29

3. IP Networking 36
3.1 Using the Network Interfaces Tree 37
3.2 Configuring Basic IP Settings 37
3.2.1 IP Address 38
3.2.2 Subnet 38
3.2.3 Enable/Disable Selected Interface 38
3.2.4 PTP IP Address 38
3.2.5 MAC Address 38
3.2.6 MAC Spoofing 38
3.2.7 STP Enable 38
3.3 Configuring Global Settings 38
3.3.1 Default Gateway 39
3.3.2 IP Forwarding 39
3.3.3 DNS1 and DNS2 39
3.4 Using Special Interface Commands 39
3.4.1 Network Bridge Commands 39
3.4.2 Virtual Interface Commands 41
3.5 Using Table View 42
3.6 Configuring VLANs 43
3.6.1 Adding VLAN Interfaces 44
3.6.2 Removing VLAN Interfaces 45
3.6.3 Modifying VLAN Interfaces 45
3.6.4 Uploading VLAN Interfaces 45

4. Static IP Routing 46
4.1 Configuring Routing Tables and Entries 47
4.1.1 Adding a New Routing Table 47
4.1.2 Remove an Existing Routing Table 48
4.1.3 Adding Static Routing Entries 48
4.1.4 Removing Static Routing Entries 49
4.1.5 Modifying Static Routing Entries 49
4.1.6 Repositioning Static Routing Entries 49
4.2 Configuring Static Rules 49
4.2.1 Adding Rule Entries 50
4.2.2 Removing Rule Entries 51
4.2.3 Modifying Rule Entries 51
4.2.4 Repositioning Rule Entries 51

5. Wireless 52
5.1 Setting Operational Modes 54
5.1.1 Selected Operational Mode 54
5.1.2 Configuring an Access Point 54
5.1.3 Configuring WDS Mode 58
5.1.4 Configuring Repeater Mode 59
5.1.5 Configuring AP Client and Station Modes 61
5.1.6 Using Site Survey Operation 62
5.2 Configuring Radio Settings 64
5.2.1 Selecting Physical Layer Options 65
5.2.2 Setting Channels and Frequencies 65
5.2.3 Setting Transmission Rates 65
5.2.4 Setting the MAC Address 65
5.2.5 Setting Frag 66
5.2.6 Setting RTS 66
5.2.7 Selecting Diversity Options 66
5.2.8 Selecting Antenna Options 66
5.2.9 Setting Transmitted Power 66
5.3 Configuring Security Settings 67
5.3.1 Setting Wired Equivalent Privacy (WEP) 67
5.3.2 Setting Wi-Fi Protected Access (WPA) 68
5.3.3 Configuring Access Control Lists (ACL) 70
5.4 Configuring Atheros Advanced Capabilities 71
5.5 Wireless Topology Scenarios 74
5.5.1 Point-to-Point Links 74
5.5.2 BSSID Extended Repetition 76

6. Dynamic Routing - RIP 77
6.1 RIP General Parameters 78
6.2 RIP Protocol Parameters 79
6.3 RIP Redistribute Parameters 80

7. Firewall and NAT 81
7.1 Firewall and NAT Chains 81
7.1.1 Firewall Chains 81
7.1.2 NAT Chains 82
7.2 Configuring Firewall Rules 82
7.2.1 Configuring Firewall Matching Fields 83
7.3 Configuring NAT Rules 88
7.3.1 Configuring NAT Matching fields 88
7.3.2 Examples 92

8. DHCP 95
8.1 Configuring a DHCP SERVER 95
8.1.1 Setting DHCP Server Fields 96
8.1.2 Lease Time Strategies 99
8.2 Configuring a DHCP CLIENT 99
8.3 Configuring a DHCP Relay 100
9. WAN 102
9.1 Configuring a PPPoE CLIENT 102
9.1.1 Setting PPPoE Client Fields 103
9.2 Configuring a PPTP Client 104
9.2.1 Setting PPTP Client Fields 105
10. Quality of Service 107
10.1 The QoS window tab 107
10.1.1 Traffic Classes 108
10.1.2 Traffic Policies 109
10.1.3 Network Interfaces 109
10.2 Differentiating network traffic 110
10.3 Guarantees and Limitations 111
10.3.1 Committed Information Rate (CIR) 112
10.3.2 Peak Information Rate (PIR) 112
10.3.3 Excess Burst Size (EBS) 112
10.3.4 Committed Burst Size (CBS) 113
10.3.5 Priority 113
10.4 Example: Bandwidth reservation for FTP Servers 114
10.4.1 Single Class per Policy 115
10.4.2 Parallel Classes 117
10.4.3 Class Hierarchy 119
10.5 Example: Elimination of P2P Traffic 121
10.5.1 Shared Policies 123
10.6 Example: Access Point Bandwidth Sharing 123
10.6.1 New QoS Entry 123
10.6.2 QoS Statistics 125
10.7 Design Guidelines and Limitations 126
10.7.1 Destination/Source MAC match type 126
10.7.2 Application match type 127
10.7.3 Child to Parent class relation 127
10.7.4 PIR on parallel classes 127
10.7.5 Efficiency considerations 128
10.8 Frequently Asked Questions 128
10.8.1 Submit, Apply Changes: I'm confused! 128
11. HotSpot Wizard 129
11.1 HotSpot Main Tab 129
11.2 Using the HotSpot Wizard 131
11.2.1 WAN 132
11.2.2 LAN 134
11.2.3 DHCP 134
11.2.4 NAT & Protection 135
11.2.5 Wireless 139
11.2.6 Radius 140
11.2.7 Authentication Type 141
11.2.8 Walled Garden 142
11.2.9 Advertisement 142

11.2.10 Web Customization....143
11.2.11 Summary....144
11.2.12 Enabling the HotSpot....145
11.3 Backend Radius Configuration Example....146
11.3.1 MAC Authentication....146
11.3.2 UAM Authentication....147
11.4 HotSpot Configuration Example....147
11.5 Troubleshooting....158
11.5.1 Cannot set wireless interface configuration....158
11.5.2 DNS Error....158
11.5.3 Cannot obtain an IP address....158
11.5.4 Obtained an IP address but cannot Ping HotSpot....158
11.5.5 HotSpot running, but no activeDHCP Server....159
11.5.6 A user not authenticated, but can access the Internet....159
11.5.7 NETKROM NMS lost connectivity with Hotspot....159
12. System Services....160
12.1 Configuring SNMP Settings....160
12.2 Configuring HTTP Settings....162
12.3 Configuring SSH Settings....163
12.4 Configuring NTP Settings....164
12.5 Setting the Administrator Password....165
13. Monitoring and Statistics....167
13.1 Using the Status Info Dialog Box....167
13.2 Using the Current Throughput Graph....167
13.3 Viewing Packet Statistics....168
13.4 Viewing the ARP Table....169
13.5 Viewing the Open Connections List....170
13.6 Using Monitor Utilities....170
13.6.1 Pinging (ICMP Utility)....170
13.6.2 Using Traceroute....172
13.7 Viewing System Properties....173
14. System Tuning....175
15. MRTG Support....178
15.1 Using MRTG....178
16. WISP Easy Wizard....180
17. APPENDIX - I....182
17.1 Restore to Factory Defaults Settings....182
18. Index....185

Hardware Installation

Warnings

- Do not work on the system or connect or disconnect cables during periods of lightning activity.

- Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, as they may cause serious injury or death.

- Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

- To meet regulatory restrictions, the radio and the external antenna must be professionally installed. The network administrator or other IT professional responsible for installing and configuring the unit must be a suitable professional installer. Following installation, access to the unit should be password protected by the network administrator to maintain regulatory compliance.

- The ISPAIR Base Station and PoE injector can be damaged by incorrect power application. Read and carefully follow the installation instructions before connecting the system to its power source.

Package contents

Take a moment to ensure you have all of the following parts in your Outdoor Waterproof Unit installation kit before you begin installing the product. If any parts are missing, please contact your local vendor or contact us at 305-4182232.

KIT CONTAINS

1. ISPAIR Base Station
2. Mounting bracket (include: 2 stainless steel U-Bolt, 1 Bracket and 4 screw nuts)
3. 100-240VAC – 48VDC, 350 mA PoE Injector
4. Power Cable
5. RJ45 Waterproof Connector System
6. CD ROM

Setup Requirements

Before starting, please verify that the following is available:

- CAT5/5e or FTP Outdoor Ethernet cable (from the ISPAIR Base Station to PoE Injector)
- At least one computer is installed with the NNMS and a wired or wireless network interface adapter
- TCP/IP protocol is installed and IP address parameters are properly configured on all your network's nodes

Important!

- Configure and verify the ISPAIR Base Station operations first before you mount the unit in a remote location.

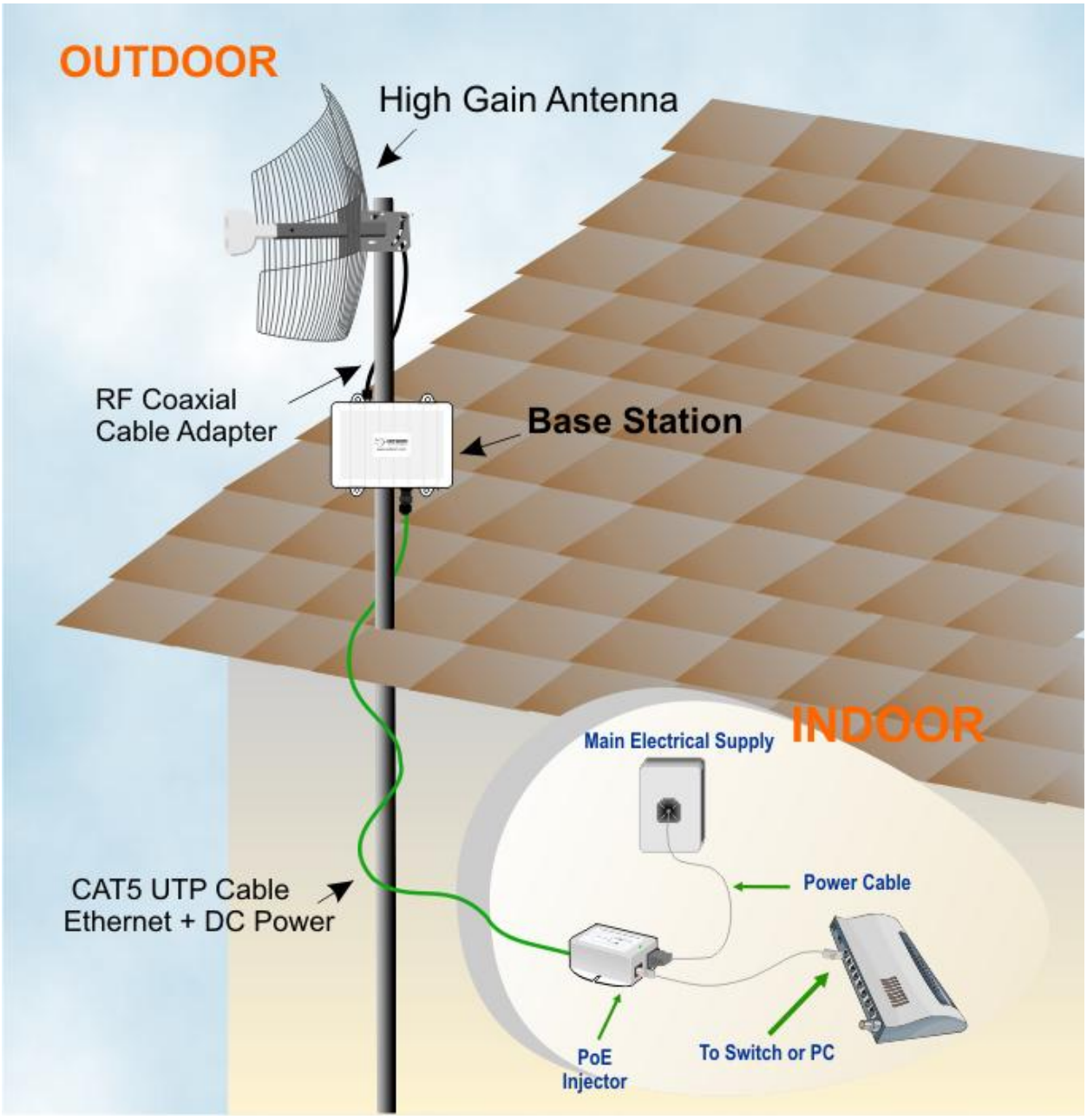
- You may need to install a lightning arrestor to protect your ISPAIR Base Station from the lightning.

- For choosing the best location for your ISPAIR Base Station choose an elevated location where trees, buildings and large steel structures will not obstruct the antenna signals and which offers maximum line-of-sight propagation with the users.

- Select an appropriate antenna to improve range and/or coverage and the ISPAIR Base Station also lets you fine-tune parameters such as the transmit power to achieve the best results.

ISPAIR Base Station Installations

The diagram below shows the overall setup of the ISPAIR Base Station.



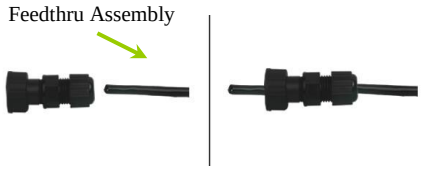
Step 1:

Connect your UTP or FTP Outdoor cat.5 Ethernet cable with waterproof connector to the RJ-45 connector on the ISPAIR Base Station. Then connect the other end of the cable to the PoE injector.

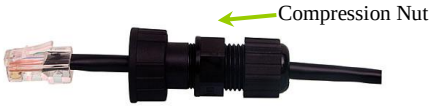
For the Netkrom PoE, the recommended length of the RJ45 Category 5 cable is up to 260 feet or 80 meters.

1.- Remove the thin enclosure nut from the feedthru assembly. This can be discarded. Loosen the compression nut completely

2.- Insert the RJ45 connector thru the feedthru assembly



3.- Tighten the compression nut loosely feedthru assembly



4.- Screw the entire feedthru assembly into the RJ45-ECS housing which is already mounted in the enclosure. There should be a rubber gasket between the two assemblies. Tighten the feedthru assembly to create a seal.

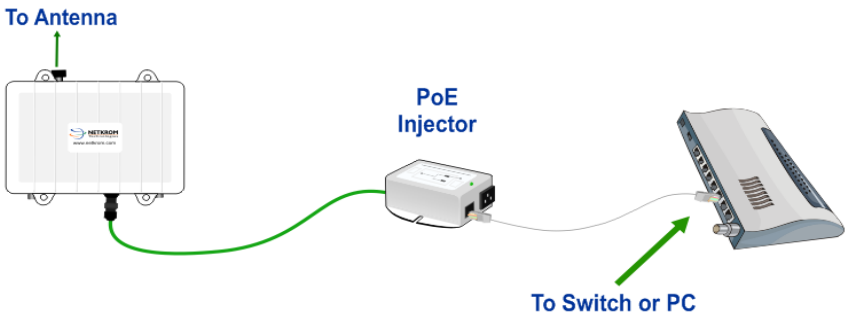
5.- The final step is to tighten the compression nut until the gaskets are tight around the Cat5 cable. Always push the cable toward the connector while tightening to ensure good strain relief of cable to connector.

Step 2:

Connect the external antenna to the N Female connector of the ISPAIR Base Station.

Step 3

Connect the RJ45 Ethernet cable from the Netkrom PoE Injector to a switch or PC you will use to configure the access point.



Note:

The Cat.5 cable used between the Ethernet port of the PoE injector labeled with a WARNING message and the ISPAIR Base Station must be straight-through.

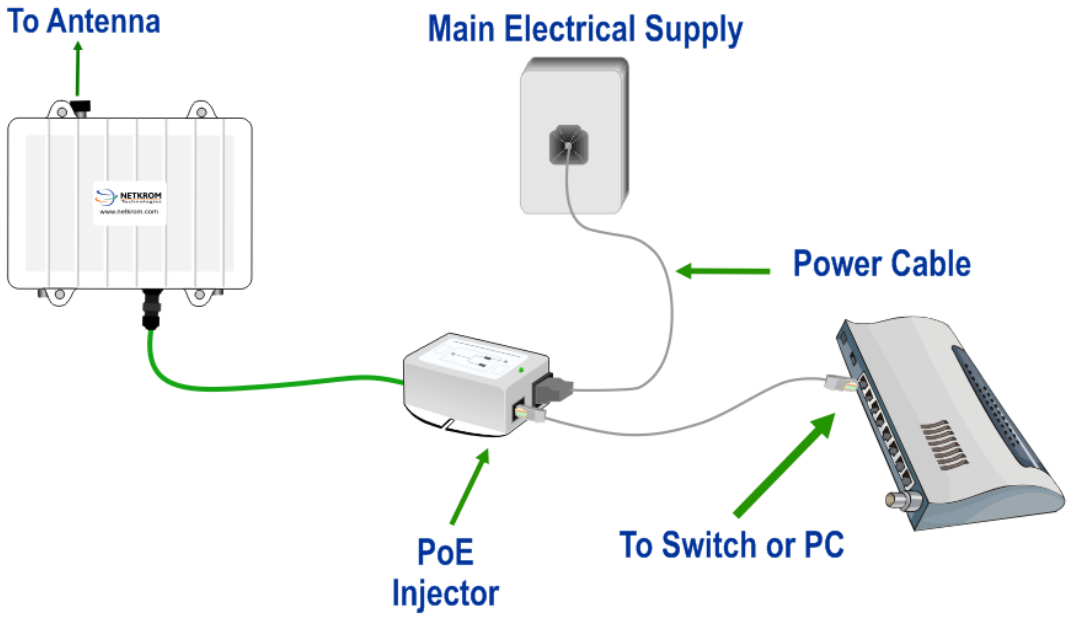
The Cat.5 cable used between the Ethernet port of the PoE injector labeled “Switch Hub” and the switch can be straight-through or crossover.

The Cat.5 cable used between the Ethernet port of the PoE injector labeled “Switch Hub” and a PC must be crossover.

Connect the power cable supplied in the Netkrom PoE kit to the main electrical supply and the power plug into the socket of the injector.
Now, turn on your power supply. Notice that the POWER LED has lighted up.
This indicates that the access point is receiving power through the Netkrom PoE Injector and that connection between your access point and your network has been established.

Note:

Please use the power adapter provided in the package. Using a power adapter with a different voltage rating will damage this product.



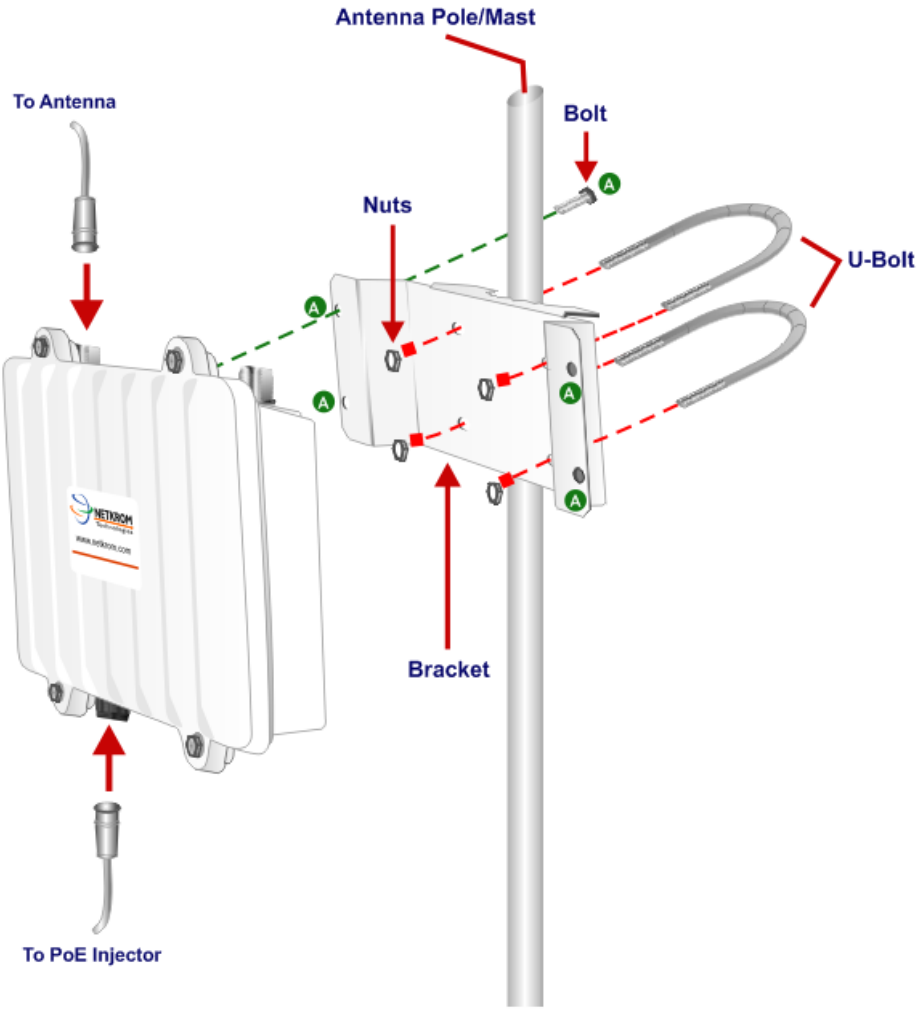
Mounting the ISPAIR Base Station in the pole or tower

The ISPAIR Base Station device can be mounted on the pole or tower as shown in following:

1. - Mount the bracket to the pole with the U-bolts.

2. - Attach the radio to the bracket which was mounted on the pole with the supplied nuts and U-bolts.

3. - Tighten the U-bolts and nuts with hand tools.



1. Product Overview

The **NETKROM Network Management System (NNMS)** is used to configure and manage wireless networks of **NETKROM** nodes. NETKROM NMS has been designed to provide network administrators with a comprehensive and simple way to control and configure their network nodes.

1.1 Compatibility and Requirements

The NETKROM NMS software operates on any PC or Mac supported by Java. That is any version of Microsoft Windows (98/ME/2000/NT/XP/VISTA) or GNU/Linux.

1.2 NETKROM NMS Features

- Optimized communication protocol between NETKROM's software and NETKROM NMS featuring high levels of interactivity. Additionally an advanced encryption scheme can guarantee secure configuration and monitoring of NETKROM nodes.
- Easy wizard-based configuration of NETKROM Hot-Spot.
- Easy WISP Configuration Wizard
- New graph-based statistics providing real time bandwidth utilization per network interface.
- New robust network topology display.
- Built-in Multi Router Traffic Grapher (MRTG) support

1.3 NETKROM Features

- Advanced fault tolerant mechanisms guaranteeing node stability.
- Advanced Hotspot functionality
  - Web Redirect (Universal Access Method)
  - MAC Authentication
  - Bandwidth Management
  - User Information and Radius Statistics
  - Walled Garden
  - Advertisement URLs
  - Configurable redirection page

- Multiple bridged high speed interfaces
- Administration MAC
- Radius Attributes Support
- WAN Interface configuration (PPPoE, PPTP)
- DHCP leases information added.
- Wireless Functionality
- Advanced Wireless Security (WPA, 802.1x)
- Best Channel Selection Algorithm
- Country Code Selection (+ out of band modes)
- Wireless to wireless traffic filtering
- Mac Address Spoofing
- Advanced Firewall functionality
- NTP (Network Time Protocol) service

1.4 NETKROM NMS Installation Guide

For a Windows installation, double-click the NETKROM_vX_setup.exe installer and follow the prompts. The installer comes bundled with jre 1.4, so you do not have to pre-install it.

For a Linux or Macintosh installation, unzip the *NNMSvX_jars.zip* file and launch the application as java –jar NNMSvX.jar from the current directory. JRE (v1.4) must be preinstalled.

2. NETKROM NMS

2. NETKROM NMS

If your goal is to deploy several wireless access points in one system, central management is recommended. Even if you plan to begin with a smaller network, but expect to expand in the future, a centrally managed system should be considered. The NETKROM Network Management System (NNMS) provides an effective, turnkey management solution that covers the needs of most users.

Using **NNMS** you can:

Manage access points and devices on the wireless network

Configure network nodes, polling settings, and other parameters

- Load and save network configurations
- Configure and view network topology
- Auto-discover available nodes
- Analyze network traffic using the Multi Router Traffic Grapher (MRTG)

2.1 Overview of NNMS Interface

The user interface utilizes typical drop down menus, short cut menus (right click) and tabbed/sub-tabbed panes inside the main window.

NNMS Main Window

The NETKROM NMS window is a graphical user interface that facilitates viewing, configuring and monitoring your wireless network. The interface includes a typical main menu, tabbed panes containing graphical and textual information and shortcut menus that allow you to navigate to other windows, tabs and dialog boxes.

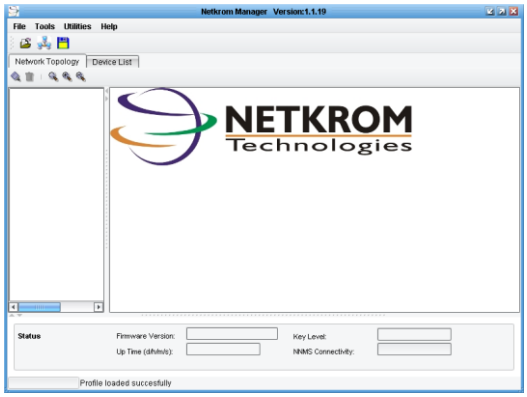


Figure 1. NNMS Main Window

Main Menu

The **NETKROM NMS** window features a menu system with four main menu headings: **File**, **Tools**, **Utilities** and **Help**.

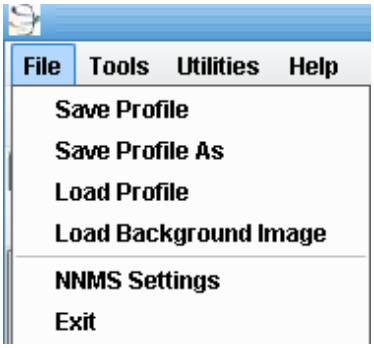


Figure 2. NNMS Main Menu System

Tabbed Panes

The main body of the NNMS window displays information in tabbed panes. When NNMS starts the **Network Topology** tab is available. This tab contains three information panes: the **Topology Map**, the **Registered Node List** and the **Node Status** pane.

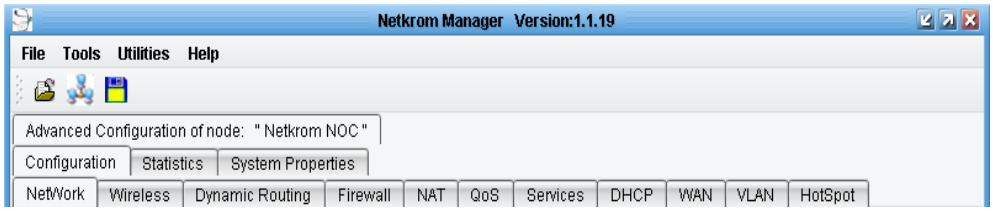


Figure 3. NNMS Tabbed Panes

Node Shortcut Menu

Many other functions are accessible via the **Node Shortcut Menu**, which includes the following items: **GUI-Node Connectivity Settings, Open Status Window, Advanced Node Configuration, Save Configuration, Unlock, Back Up, FW Upgrade, Reboots, Current Throughput, Wisp Easy Wizard (WEW)** and **Remove.** From the Node Shortcut Menu you can access additional tabbed windows used in configuring and monitoring the network.

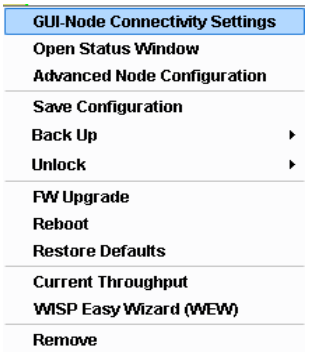


Figure 4. Node Shortcut Menu

2.1.1 NETKROM NMS Main Menu

Using NNMS menus you can manage system profiles, implement tools to discover, add and view nodes, launch utilities and access help information. RW menus include:

File

Save Profile – Save the current NNMS profile

- **Load Profile** – Load a previously saved NNMS profile
- **Load Background Image** – Load a background image (typically a map) to be displayed in the Topology Map
- **NNMS Settings** – Set polling interval and polling port values
- **Exit** – Exit NNMS

Tools

- **View Topology** – Display the Topology Map tab
- **Add New Node** – Open the Insert New Node dialog box
- **License Manager** – Display the License Manager tab
- **Discovery Manager** – Open the Auto Discovery dialog box

Utilities

MRTG – Open the MRTG window

Help

- **Home Page** – Access the NETKROM website
- **About** – Display the NETKROM introductory window

2.1.2 Network Topology Tab Information Panes

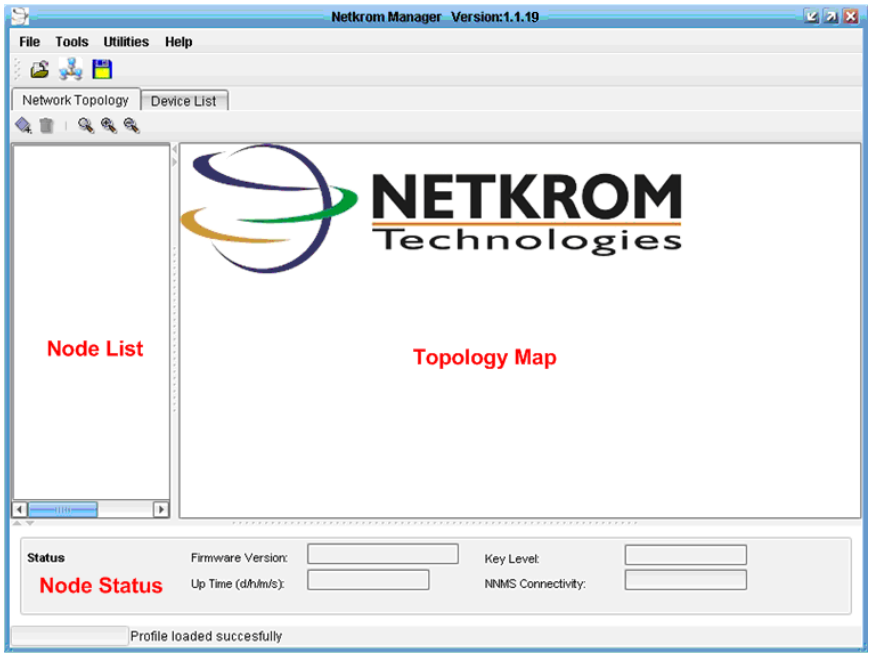


Figure 5. The NETKROM NMS Window

Topology Map

Located in the center pane, the **Topology Map** displays icons representing network nodes and connection information describing the layout of the network. It also can display a map graphic in the background.

Registered Node List

Located in the left pane, the **Registered Node List** displays all registered nodes on the network

Node Status

Located in the bottom pane, the **Node Status** area displays the following information on the currently selected node

Firmware Version – The number representing the firmware version residing in the node

- **Up Time** – The length of time the node has been operating
- **Key Level**
- **NNMS Connectivity** – The ratio of successfully received probe responses

All panes are resizable and can be adjusted according to user preferences.

2.1.3 Node Shortcut Menu

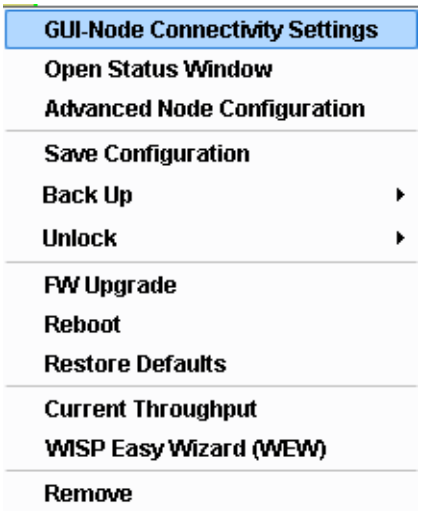


Figure 6. Node Shortcut Menu

GUI-Node Connectivity Settings

The **GUI-Node Connectivity Settings** menu option allows you to access the **Node Connectivity Settings** dialog box (for the currently selected node).

Open Status Window

The **Open Status Window** menu option allows you to access the **Status** dialog box, which contains the **FW Version, Key Level, Up Time** and **Host Name** fields. (The FW Version, Key Level and Up Time fields also are displayed in the **Node Status** pane of the **Topology Map** tab.)

Advanced Node Configuration

The **Advanced Node Configuration** menu option allows you to retrieve information from the selected node. A new pane is displayed containing a main tab (**Advanced Configuration of node: [node name].** Under this tab three sub-tabs are displayed: **Configuration, Statistics** and **System Properties.** Each of these tabs contains several additional sub-tabs used in the configuration process.

Save Configuration

The **Save Configuration** menu option allows you to permanently save the configuration for the current node.

Note: *After the base station is configured, the configuration parameters are stored in RAM (volatile memory). If the base station is powered down the configuration will be lost unless you Save Configuration to the base station's permanent memory.*

Back Up

The **Back Up** menu option allows you to back up and restore the configuration settings for the selected node.

FW Upgrade

The **FW Upgrade** menu option allows you to access the **Select** dialog box, from which you can select the firmware image file to be loaded into the node.

Reboot

The **Reboot** menu option allows you to reboot the node.

Current Throughput

The **Current Throughput** menu option allows you to display a real-time graphical display of transmit and receive traffic of the network interface.

WISP Easy Wizard (WEW)

The **WISP Easy Wizard (WEW)** menu option allows you to start a wizard that provides an easy and convenient way to install and configure wireless nodes. (See Chapter 16 for details)

Remove

The **Remove** menu option allows you to remove the currently selected node from the **Topology Map** and **Registered Node List**.

2.2 Getting Started with NNMS

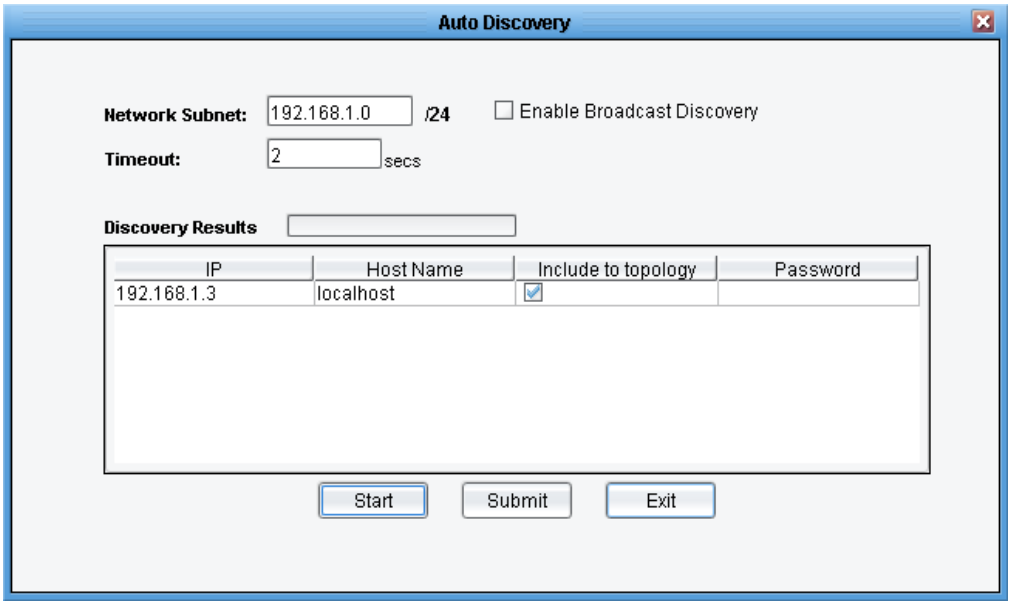
Starting from the menus and windows mentioned above, you can auto-discover and insert new nodes, display maps and graphics of your wireless network, save and load profiles and access multi-tabbed windows used for advanced configuration of nodes.

2.2.1 Auto-Discovering Nodes

Discovery Manager allows you to discover nodes and insert them into the **Topology Map.** A custom polling protocol is used to detect NETKROM nodes in the specified subnet. Discovered nodes are displayed in a tabular format.

To use **Discovery Manager**:

In the **Tools** menu, select **Discovery Manager**. The **Auto Discovery** dialog box appears.



Auto Discovery Dialog Box

Network Subnet

In the **Network Subnet** field, type the subnet address. (NNMS will detect nodes in which the first three segments, or 24 bits, of their IP address match the first three segments of the subnet address.)

Enable Broadcast Discovery

Select the **Enable Broadcast Discovery** checkbox. (NNMS uses a UDP broadcast message to detect any nodes on the network.)

Timeout

In the **Timeout** field, type a timeout value in seconds (default: 10 seconds)

Discovery Results

Click **Start** to initiate a discovery poll. The **Discovery Results** bar graph displays the progress of the poll. When complete, the table displays the **IP Address**, **Host Name** and **Password** (if used) of discovered node. The checkbox under **Include to Topology** is automatically selected.

Include to Topology

To display a node in the **Topology Map**, leave the **Include to Topology** checkbox selected.

Submit

Click the **Submit** button to insert the nodes into the **Topology Map.**

Cancel

Click the **Cancel** button to exit the **Auto Discovery** dialog box.

Icons for each node should be visible in the **Topology Map**, labeled with the hostname. If two nodes have the same default hostname, NNMS will label one with the hostname and the other with its IP address. (The label can be changed to an Alias using the **GUI-Node Connectivity Settings** dialog box, accessible from the **Node Shortcut Menu.)**

2.2.2 Configuring a New Node

Network nodes can be configured manually using the **Insert New Node** dialog box.

1. Use any one of the following three methods to configure a new node:

- Right click anywhere in the topology pane, then click the **Insert new node** button that appears

or

- Click the icon

or

On the **Tools** menu, click **Add New Node**. The **Insert New Node** dialog box appears.

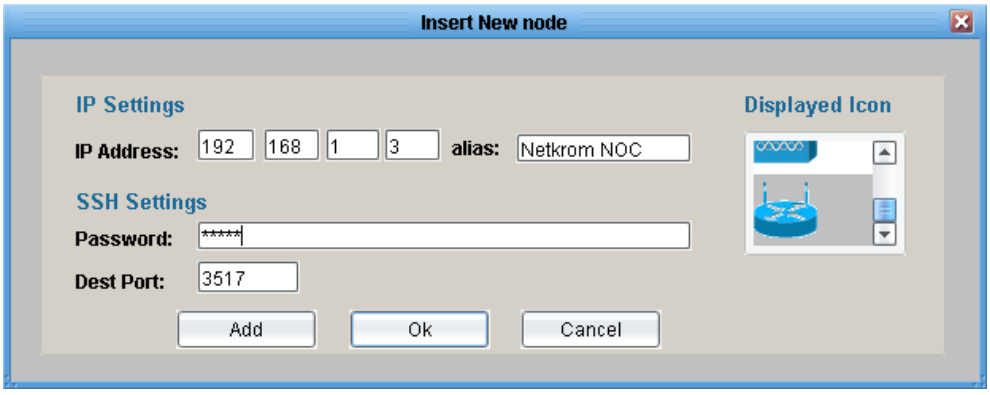


Figure 7. Insert New Node Dialog Box

2. Type the **IP address**, **Alias** (optional) and **SSH Settings Password**. (Typically a new node is given the default password *admin)*

3. Select a **Displayed Icon** (optional) to represent the node.

	Access Point		Router
	Dual Access Point		Firewall Router
	Firewall		Voice Gateway
	IP Telephony Router		Wireless Bridge
	Mobile Access Router		NAT
	Wireless Router (default icon)		

Figure 8. List of Available Icons

Note: *Though optional, adding* ***Alias*** *and/or* ***Displayed Icon*** *provides an enhanced visual representation of the nodes. This becomes especially useful when working with middle to large scale networks.*

4. Click the **Add** button. The icon will appear in the topology pane. All topology panes are updated with the new insertion information.

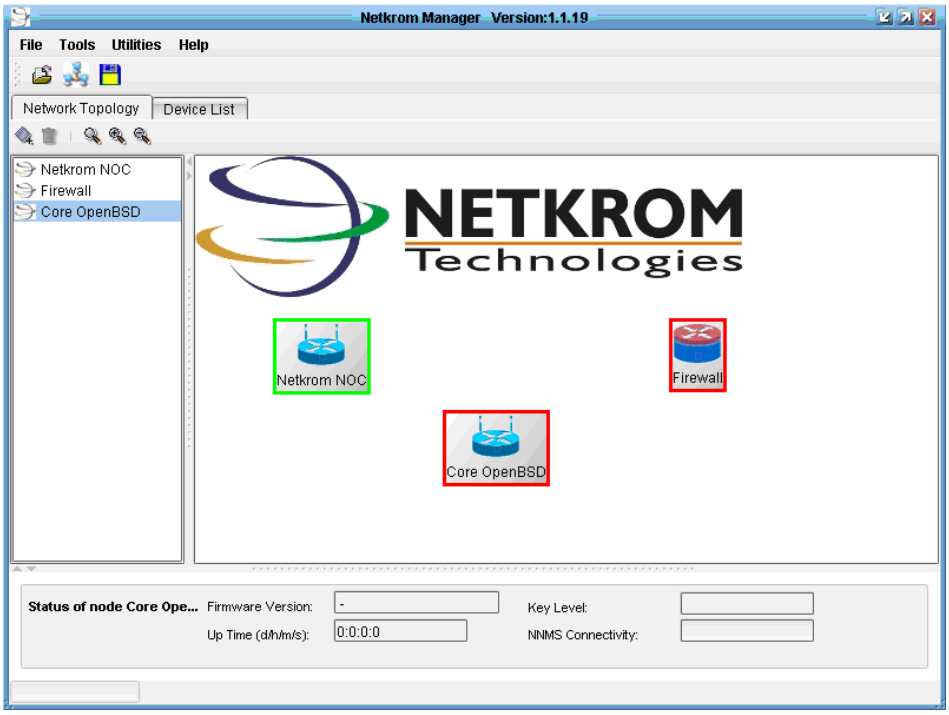


Figure 9. Node Insertion

If the newly inserted node has successfully responded to a network probe, a green outline appears around the icon. A red outline

indicates the node is not responding.

2.2.3 Moving and Resizing Icons

- To move a node icon, drag it to the desired location in the pane.

To resize a node icon, select the icon, then drag one of its handles.

2.2.4 Adding Background Map Images

Topology Map can be further enhanced by loading a background image to indicate the geographical location of the nodes. To add a background image:

- On the **File** menu, click **Load Background Image**. The **Load Background Image** dialog appears.
- Browse to the image file you wish to load, select it and click the **Load Background Image** button.

Note: *.gif or .jpg formats may be used for background images*

Figure 10. Customized Topology Map

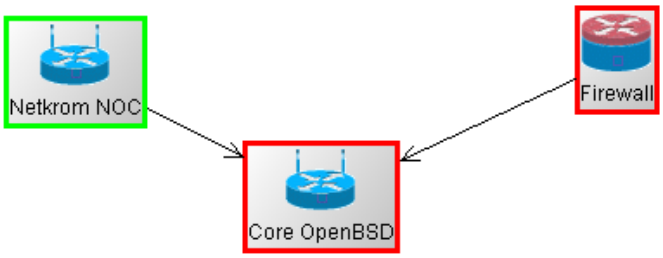
- Adjust the magnification level of the background image using the following zoom buttons located above the **Registered Node List**:

Zoom In

Zoom Out

Restore to default.

- Create arrows indicating a connection between nodes by clicking in the center of the *source* node (a hand cursor will appear), and dragging to the center of the *destination* node. A line with arrowhead will appear between the nodes.



Network Nodes Showing Connection

2.2.5 Saving and Loading Profiles

1. To save a **Topology Profile**, on the **File** menu, click **Save Profile**.
2. To load a **Topology Profile,** on the **File** menu, click **Load Profile**.

2.2.6 Using the Node Shortcut Menu

You can manage and configure a variety of operating parameters of network nodes from the **Node Shortcut Menu,** which can be accessed using either of the following methods:

Double click any node name shown in the **Node List**

or

- Right click any node in the **Topology Map**

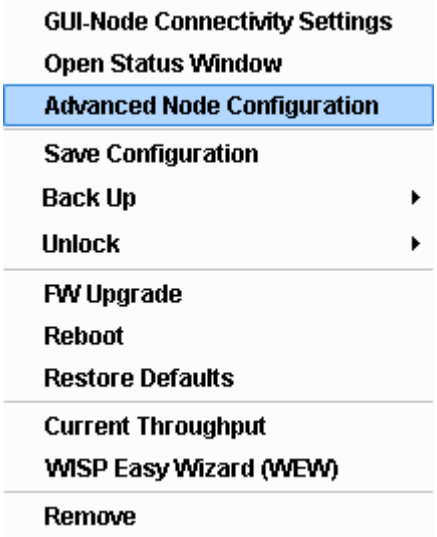


Figure 11. Node Shortcut Menu

GUI-Node Connectivity Settings

Click this option to display the **Node Connectivity Settings** dialog box. This box contains the **IP Address** and **Alias** assigned to the selected icon. If an Alias has not been assigned, the Alias field will contain the Hostname of the node.

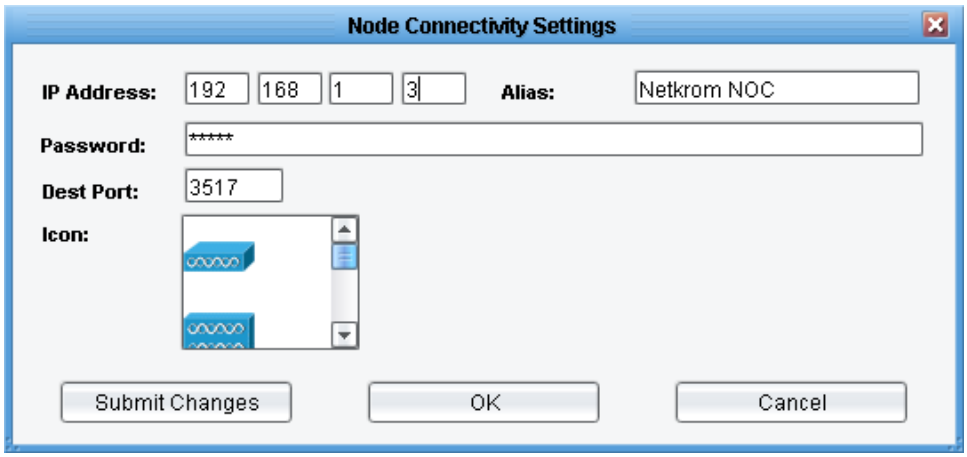


Figure 12. GUI-Node Connectivity Settings Dialog Box

IP Address

When NETKROM NMS scans the network it looks for the **IP Address** listed in this dialog. If it makes a connection, the border around the icon turns green. If not, the border is red.

Default IP address: 192.168.1.3

Alias

To change the **Alias**, type the new name into the Alias text box.

Password

Type the password (default: *admin)* into the **Password** field. (This step is required to allow access to **Advanced Node Configuration** described later in this section.)

Node Icon

To change the node icon, select a icon from the drop down menu.

Submit Changes

Click the **Submit Changes** button to add the node to the Topology Map and keep the dialog box open

OK

Click **OK** to add the node and exit the dialog box.

***NOTE**: Changing the IP Address, Alias or Password, specifies the parameters assigned to the currently selected node icon. The IP address and password will be used when NNMS scans the network. Changing the IP address of the icon does not change the IP address of the node. If the IP address of the icon is changed to an address not present on the network, the border of the associated icon will turn red indicating no connection has been made.*

Open Status Window

Click this option to access the **Status** dialog box, which contains the **FW (Firmware) Version, Key Level, Up Time** and **Host Name** fields. (The FW Version, Key Level and Up Time fields also are displayed in the **Node Status** pane of the **Topology Map** tab.)

- The **FW Version** field contains the version number of the firmware residing in the currently selected node.
- The **Key Level** field should display Level 2.
- **Up Time** – The length of time the node has been operating
- **Host Name** – The name of the currently selected node

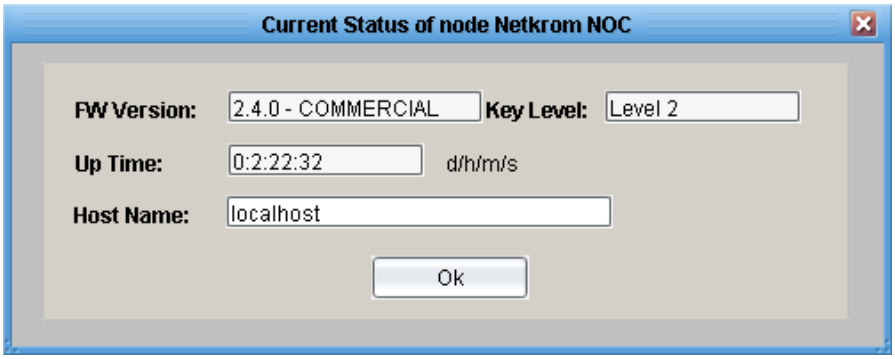


Figure 13. Current Status Dialog Box

Advanced Node Configuration

Click this option to retrieve information from the selected node and open the **Advanced Configuration of Node** tab**.**

***NOTE:** To access the Advanced Node Configuration you must first access the GUI-Node Connectivity Settings via the Node Shortcut Menu and enter the password, then click OK or Submit.*

The **Advanced Configuration of Node** tab contains three sub-tabs: **Configuration, Statistics** and **System Properties.**

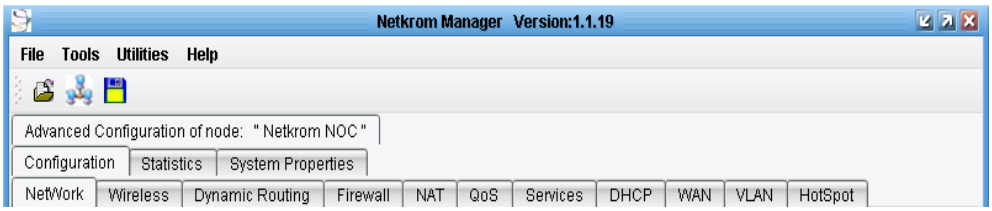


Figure 14. Advanced Node Configuration Tab with Sub-Tabs

Each tab contains several additional tabs. The mind map below shows the hierarchy of advanced configuration tabs and sub-tabs used. The table indicates the chapter where descriptions and configuration procedures for each tab are located.

Tab	Chapter
Network	3, 4
VLAN	3
Wireless	5
Firewall	6
NAT	6
DHCP	7
WAN	8
Bandwidth Manager	9
HotSpot	10
Services	11
Statistics	12

Figure 15. Tab/Chapter List

The table above indicates the chapters where descriptions and configuration procedures for each tab are located.

Advanced Configuration Tab Hierarchy

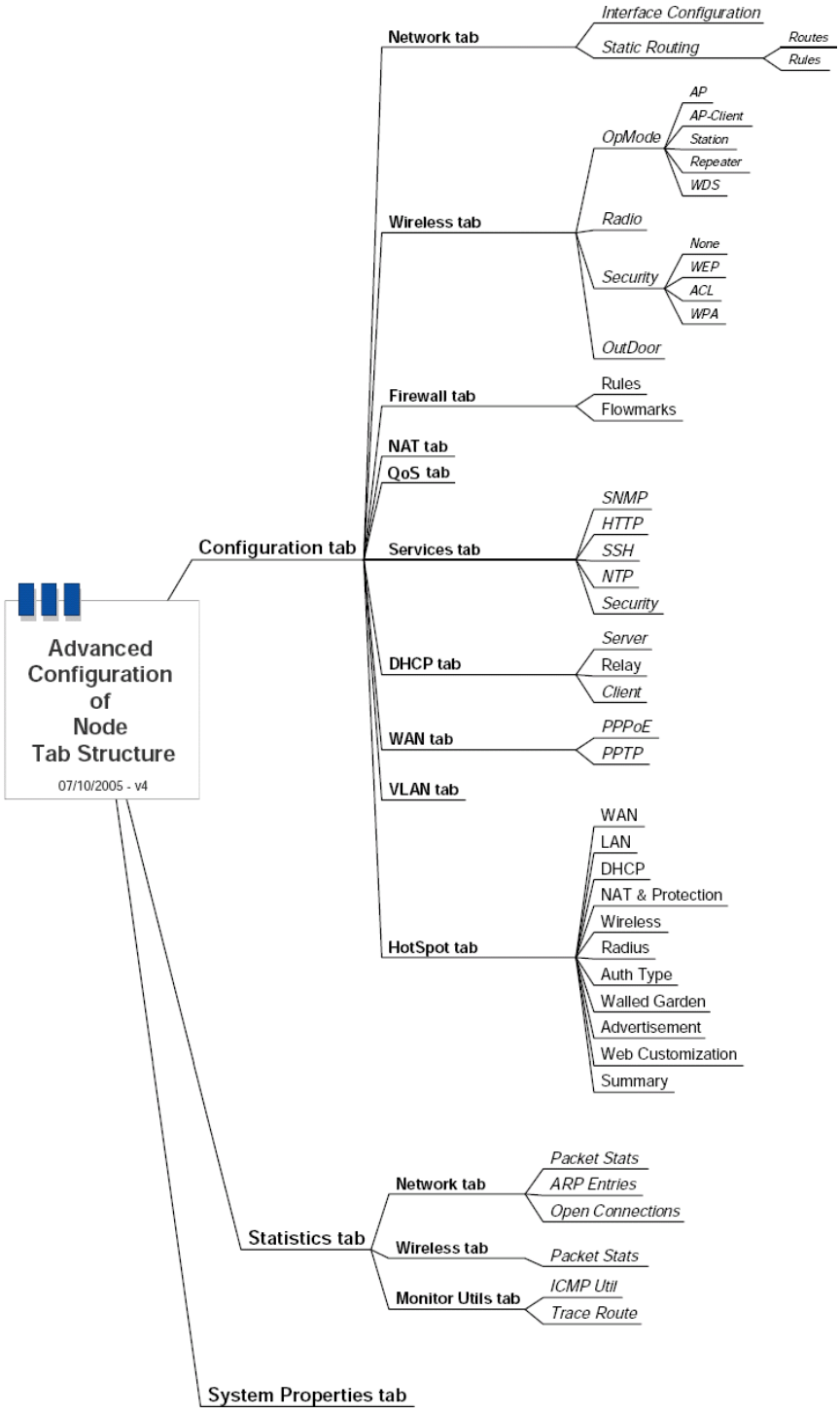


Figure 16. Mind Map of Advanced Configuration Tabs and Sub-tabs

Save Configuration

Click this option to permanently save the configuration for the current node.

Note: *After the base station is configured, the configuration parameters are stored in RAM (volatile memory). If the base station is powered down the configuration will be lost unless you Save Configuration to the base station's permanent memory.*

Back Up

Click this option and select:

- **Retrieve Configuration** to Retrieve the last saved node configuration

or

Restore Configuration to Restore the node configuration from a file

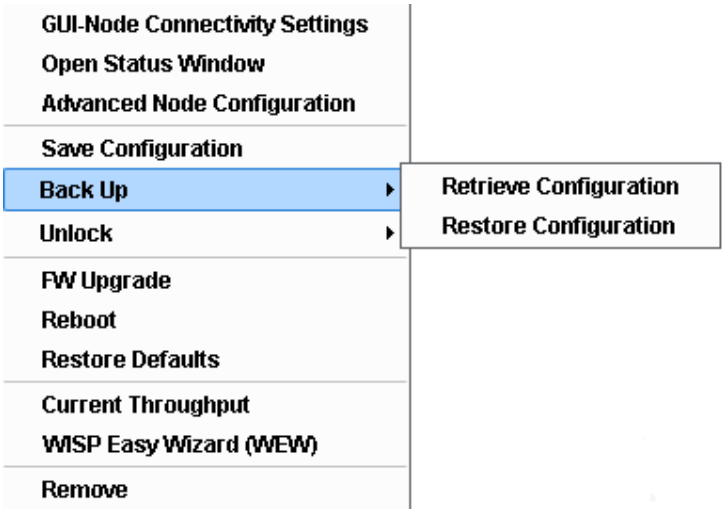


Figure 17. Back Up Menu Options

FW Upgrade

Click this option to access the **Select** dialog box, from which you can select the firmware image file to be loaded into the node.

Reboot

Click this option to reboot the node. An **Alert** dialog box appears with the question: **Should system save its configuration before reboot.** Click **Yes** if you want to save the configuration.

Current Throughput

Click this option to display a real-time graphical display of transmit and receive traffic of the network interface.

WISP Easy Wizard (WEW)

Click this option to start a wizard that provides an easy and convenient way to install new nodes. (See Chapter 16 for details)

Remove

Click this option to remove the currently selected node from the **Topology Map** and **Registered Node List**.

3. IP Networking

3. IP Networking

This section describes **IP Networking** settings and configuration procedures for your NETKROM node.

To configure **IP Networking**, select the **Interface Configuration** tab, located under the **Advanced Configuration of Node, Configuration, Network** tabs.

See Page 33 for a diagram showing Advanced Configuration tabs and sub-tabs.

The **Interface Configuration** tab features four panes:

- **Network Interfaces Tree** (left pane)
- **Basic IP Configuration** (top pane)
- **Global Settings** (center pane)
- **Special Action Interface Commands** (bottom pane)

Two buttons are located at the top of the IP Configuration tab:

- **Refresh** – Click Refresh to retrieve setting from the selected node.
- **Submit** – Click Submit to upload the configuration to the node.

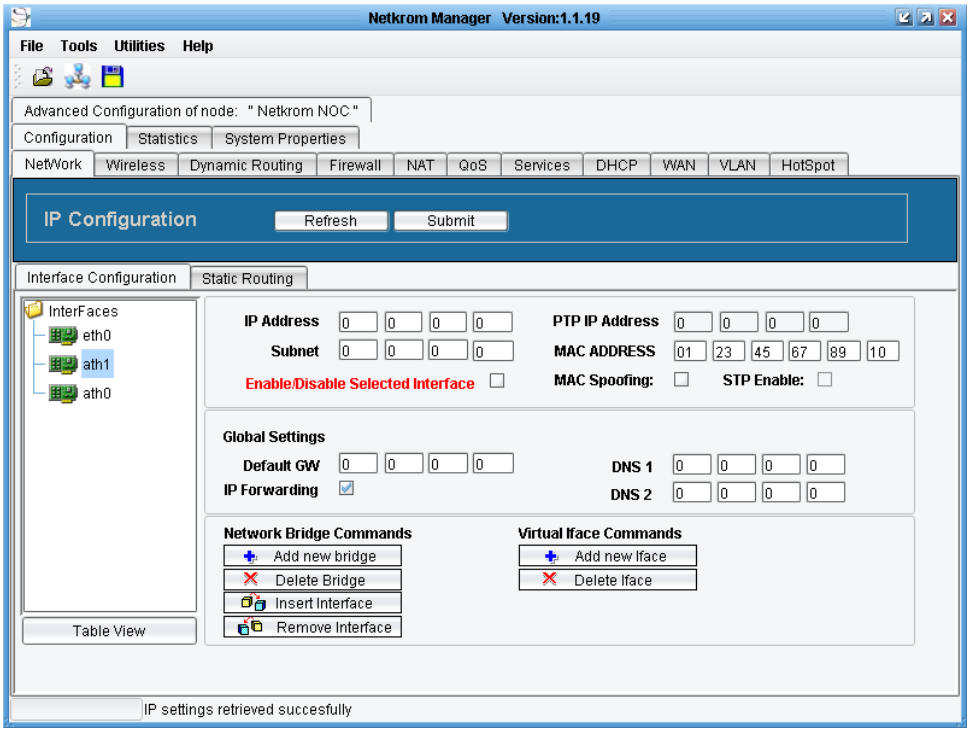


Figure 18. Network Configuration Tab

3.1 Using the Network Interfaces Tree

The left pane of the **IP Configuration** tab contains the **Network Interfaces Tree**, a representation of all available network interfaces of the selected node. The tree view can be expanded or collapsed by left clicking on any master interface. When an interface is selected, data fields in the other panes display the parameters associated with the selected interface and changes can be made.

3.2 Configuring Basic IP Settings

The top pane of the **IP Configuration** tab contains all **Basic IP Configuration** fields for the interface selected in the Network Interfaces Tree.

Figure 19. IP Interface Settings

The following section describes the fields used to configure IP settings.

3.2.1 IP Address

The **IP Address** field contains the IP address of the selected interface. To change the IP address of the interface, type the new address into this field and click the **Submit** button.

3.2.2 Subnet

The Subnet field contains the subnet mask address of the selected interface. To change the subnet address, type the new address into this field and click the **Submit** button.

3.2.3 Enable/Disable Selected Interface

%he **Enable/Disable Selected Interface** box indicates whether the interface is enabled. If this box is not checked the interface will maintain the desired configuration but it will remain disabled. If the selected interface is a *virtual interface*, this box has no effect. Virtual interfaces can only be in the enabled state.

3.2.4 PTP IP Address

If there is a PPP connection (from a PPPoE client or a PPTP client), the remote peer IP address is displayed in the **PTP IP Address** field. Otherwise this field is blank. This is a read-only field.

3.2.5 MAC Address

The **MAC Address** field displays the interface's Media Access Control (MAC) address in hex format. This field is readable for any kind of interface and writeable only for physical interfaces. To change the MAC address of a physical interface the **MAC Spoofing** check box must be selected.

3.2.6 MAC Spoofing

When the **MAC Spoofing** check box is selected an alternate MAC address (for physical interfaces only) can be typed into the **MAC Address** field.

3.2.7 STP Enable

The **STP Enable** check box enables the use of Spanning Tree Protocol,

> ***Note:*** *Spanning Tree Protocol (STP) eliminates Layer 2 loops in networks, by selectively blocking some ports and allowing other ports to forward traffic, based on global (bridge) and local (port) parameters you can configure*

3.3 Configuring Global Settings

The center pane of the IP Configuration tab contains **Global Settings.** These fields apply to all network interfaces.

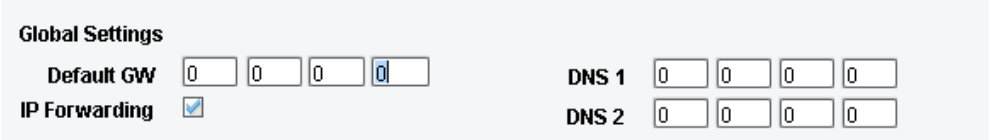


Figure 20. IP Global Settings

3.3.1 Default Gateway

Every IP packet with an unknown destination will be forwarded through the default gateway IP address. Set this address statically by typing it into the **Default GW** field. It also can be set dynamically from another application such as a DHCP client, a PPPoE client, or a PPTP client.

3.3.2 IP Forwarding

IP Forwarding all traffic to flow between interfaces even if they are set on different subnets. Select the IP Forwarding check box to allow the system to forward packets from one subnet to another.

3.3.3 DNS1 and DNS2

You can set DNS1 and DNS2 addresses statically by typing them in or they can be set dynamically from another application such as a DHCP client, a PPPoE client, or a PPTP client.

3.4 Using Special Interface Commands

The bottom pane of the **IP Configuration** tab contains **Special Action Interface Commands** used to create and manage network bridges and virtual interface commands.

Figure 21. Special Interface Commands

3.4.1 Network Bridge Commands

A bridge is a LAN interconnection device that operates at the data link layer (layer 2) of the OSI reference model. It may be used to join two

LAN segments (A, B), constructing a larger LAN. A bridge is able to filter traffic passing between the two LANs and may enforce a security policy separating different work groups located on each of the LANs. Bridges were first specified in IEEE 802.1D (1990) and later by ISO (in 1993).

Add New Bridge

To create a new network bridge interface

1. Click the **Add new bridge** button. The **Insert New Bridge** dialog box appears.

2. Type the bridge name in the box, then click the **Submit** button. The bridge name appears in the **Network Interfaces Tree**.

Note: *The bridge name must begin with the string "br". There is no limitation to the rest of the name.*

Delete Bridge

To delete a bridge

1. Select the bridge in the **Network Interfaces Tree**

2. Click the **Delete Bridge** button in the **Network Bridge Commands** pane

Insert Interface

To insert an interface as a 'slave' under a bridge

1. In the **Network Interfaces Tree,** select an interface to become the slave.

2. Click the **Insert Interface** button. The **Insert Iface to Bridge** dialog bx appears.

3. In the **Select Bridge** list box, select the desired bridge.

4. Click **Submit**. The tree is rearranged to show the interface as a slave to the bridge.

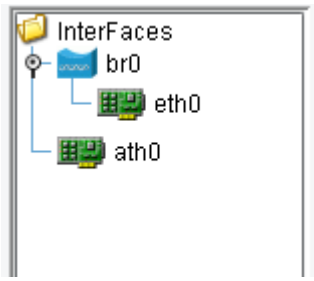


Figure 22. Inserting an Interface Under a Bridge

Remove Interface

1. Select the interface in the Network Interfaces Tree.

2. Click the **Remove Interface** button.

3.4.2 Virtual Interface Commands

From the **Special Interface Commands** pane you also can create **virtual** network interfaces—ones that are not associated with hardware. Virtual interfaces allow you to associate more than one IP address with a system. A typical use of this technique would be to support multiple Web sites. For example, if http://www.examplesite.com were assigned the address 222.33.44.55, virtual interfaces 222.33.44.56 and 222.33.44.57 might be assigned to www.examplesite.net and www.examplesite.org. All three sites could exist on the same system without conflict.

Virtual interfaces also allow a system to communicate on more than one network address space. For example, virtual interfaces allow you to temporarily renumber a network from a masqueraded network address space to a private (10.0.0.0) subnet. During the transition, all servers can be assigned a virtual address enabling them to communicate with clients on both the old and new network address spaces. Externally, virtual interfaces appear as if they are actual interfaces.

Add New Interface

To insert a new virtual interface in association with a physical interface

1. dlect the physical interface in the **Network Interfaces Tree.**

2. Click the **Add new Iface** button. The virtual interface appears in the tree and is automatically named with a prefix that matches the physical interface name and a suffix which is includes the virtual interface index inside brackets.

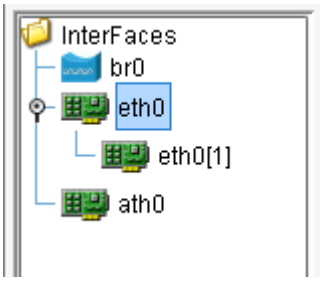


Figure 23. Insertion of Virtual Interfaces

Delete Interface

To permanently remove a virtual interface

1. Select the virtual interface in the **Network Interfaces Tree**
2. Click the **Delete Iface** button

3.5 Using Table View

The **Table View** option is a feature that further enhances the controllability of interface IP settings. This feature allows you to browse and edit the basic settings of all available interfaces. To access this option, click the **Table View** button located below Network Interface Tree pane. The **Interface Configuration** dialog appears.

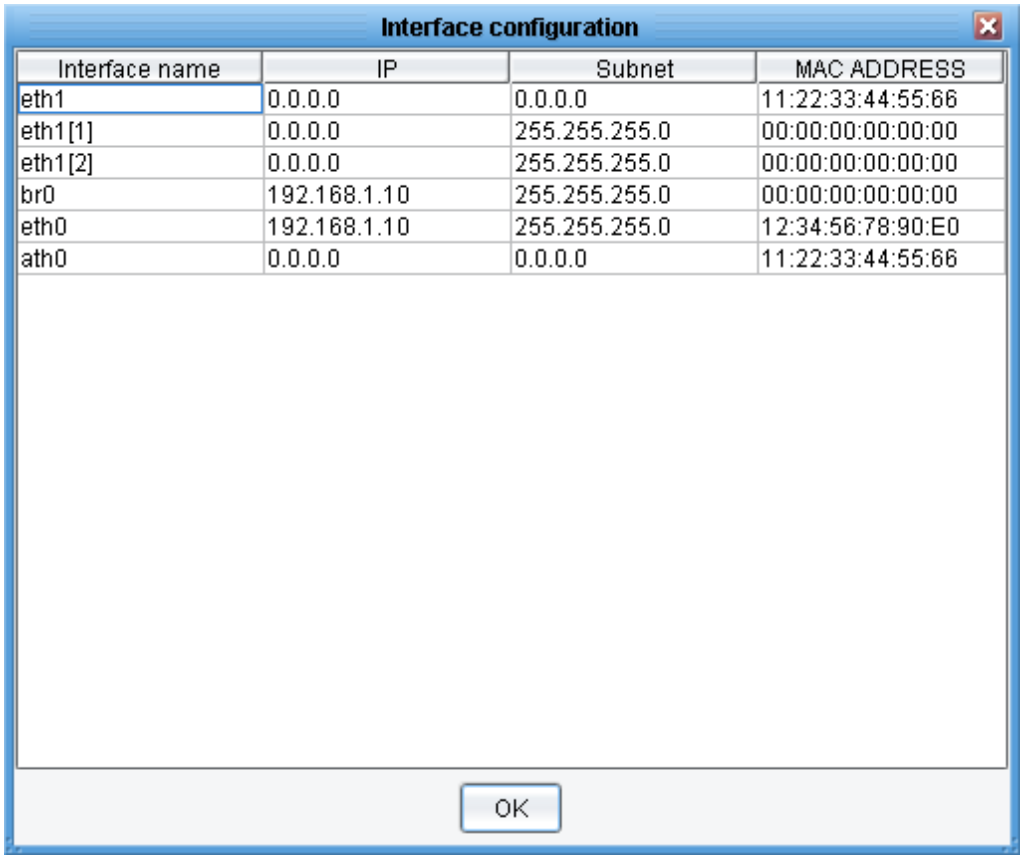


Figure 24. Interface Table View

3.6 Configuring VLANs

A Virtual LAN (VLAN) is a group of devices on one or more LANs that are configured so that they can communicate as if they were attached to the same network, when in fact they are located on a number of different LAN segments. Because VLANs are based on logical instead of physical connections, they are very flexible for user/host management, bandwidth allocation and resource optimization. The IEEE 802.1Q specification establishes a standard method for tagging Ethernet frames with VLAN membership information.

The IEEE 802.1Q standard defines the operation of VLAN bridges that permit the definition, operation and administration of Virtual LAN topologies within a Bridged LAN infrastructure. The 802.1Q standard is intended to address the problem of how to break large networks into smaller parts so broadcast and multicast traffic does not require more bandwidth than necessary. The standard also helps provide a higher level of security between segments of internal networks.

To make a router an 802.1Q compliant device, one or more VLAN interfaces must be created with the proper tags. This can be accomplished

in the VLAN tab of the NETKROM NMS window. VLAN interfaces can be added, removed and managed from this tab.

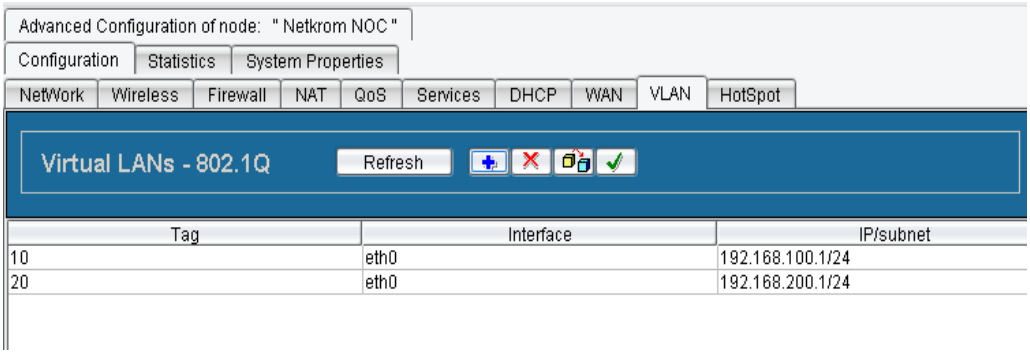


Figure 25. VLAN Tab

3.6.1 Adding VLAN Interfaces

1. In the **VLAN** tab, click the button. The **Create a new VLAN** dialog appears. This dialog contains the main fields for configuring a VLAN interface. The **VLAN TagID** field automatically generates a unique VLAN identifier according to 802.1Q.

2. Click the arrow on the **Interface** dropdown list and select any enabled physical interface or bridge.

3. Type IP/subnet address in the **IP Address/Subnet Mask** fields. These are required to properly route tagged packets. If there is a need to drop un-tagged panes (not 802.1Q compliant), configure the specific physical interface and any virtual interface with zero IP address.

4. Click **Submit** to complete the process. The virtual interface **Tag** number, **Interface** name and **IP/subnet** address will appear in the **Virtual LAN** list.

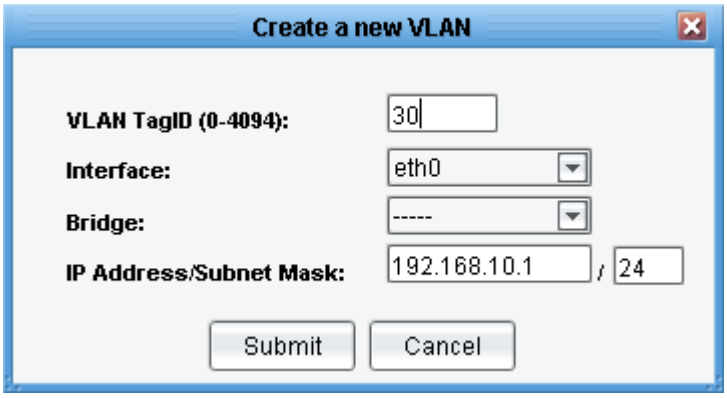


Figure 26. Create a New VLAN Dialog Box

3.6.2 Removing VLAN Interfaces

To remove a VLAN Interface, in the VLAN list, select the interface to be deleted. Click the button. The VLAN information will disappear from the list.

3.6.3 Modifying VLAN Interfaces

To modify the settings for a VLAN interface, select the interface and click the button. The **Create a new VLAN** dialog box appears. The settings for the interface are shown in the fields.

Change these settings as required, then click the **Submit** button. The new settings appear in the VLAN Interface list.

3.6.4 Uploading VLAN Interfaces

To send the configuration settings to the node, click the button.

4. Static IP Routing

4. Static IP Routing

Static routing is the manual method used to set up routing. An administrator enters routes into the router using configuration commands. This method has the advantage of being predictable and simple to set up. It is useful in managing small networks but becomes somewhat unwieldy on larger networks. NETKROM NMS provides management tools for manipulating any of the routing tables and configuring rules.

To configure **Static IP Routing**, select the **Static Routing** tab, located under the **Advanced Configuration of Node, Configuration, Network** tabs. In the **Static Routing** tab you can select the **Routes** tab or the **Rules** tab.

See Page 33 for a diagram showing Advanced Configuration tabs and sub-tabs.

In the **Routes** tab you can:

- Add, delete and select routing tables
- Add, delete, modify and prioritize routes

In the **Rules** tab you can:

- Add, delete and select rules

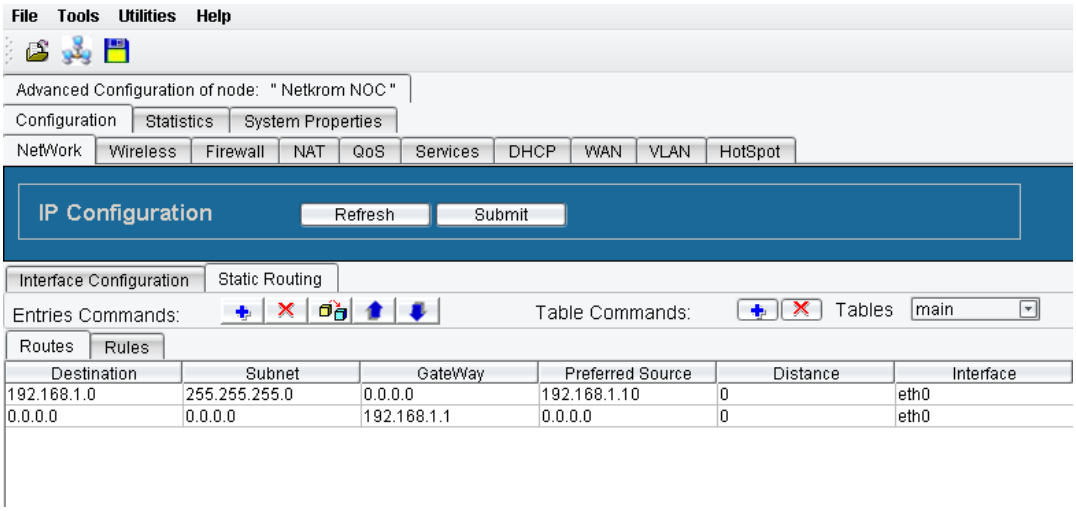


Figure 27. Routing Table Handling

The bar across the top of the **Static Routing** tab contains the following options:

- **Entries Commands** buttons

Button	Command
	Insert New Route
	Delete Route
	Modify Route
	Move Up
	Move Down

Figure 28. Route Entries Commands

- **Table Commands** buttons

Button	Command
	Insert New Route
	Delete Route

Figure 29. Route Table Commands

- **Tables** drop down list

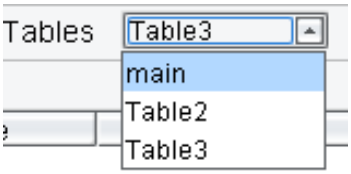


Figure 30. Routing Tables Drop Down List

4.1 Configuring Routing Tables and Entries

NETKROM provides a multiple routing table system with a flexible infrastructure and the ability to implement policy routing. In addition to the local and main routing tables, NETKROM supports up to 252 additional routing tables.

4.1.1 Adding a New Routing Table

To create a new routing table that will be integrated in the multiple routing table system

1. Click the **Table Commands** button. The **Insert New Routing Table** dialog appears.

2. Type the name into the **Routing Table** box, then click **Submit**. The table name is stored in the drop down list for future use.

4.1.2 Remove an Existing Routing Table

To delete an existing routing table

1. Select the table name from the Main drop down list.

2. Click the Table Commands button.

CAUTION: The user has to be careful not to delete the main routing table, as this action can lead to connectivity problems.

4.1.3 Adding Static Routing Entries

To add a new static route

1. Select the **Routes** tab

2. Click the **Entries Commands** button. The **Insert New Route** dialog box appears.

3.

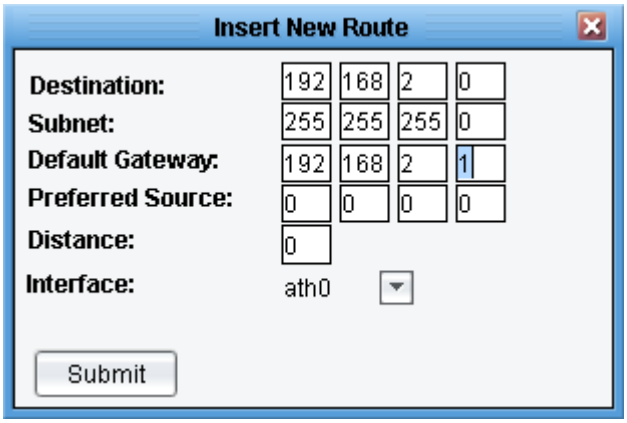


Figure 31. Insert New Route

In the above example all the traffic with destination addresses that belong to subnet 192.168.2.0/24 will be forwarded via interface ath0.

•

4. In the **Destination** boxes, type the destination network or destination host address.

5. In the **Subnet** boxes, type the netmask for the destination net. (255.255.255.255 for a host destination and 0.0.0.0 for the default route)

6. In the **Default Gateway** boxes, type the gateway address (if required).

7. In the **Preferred Source** boxes, type the preferred source address for communicating to that destination.

8. In the **Distance** box, type the distance to the target, usually counted in hops. (This field is not used by recent kernels, but may be needed by routing daemons.)

9. In the **Interface** drop down list, select the interface to which packets for this route will be sent.

10. To accept your settings, click the **Insert New Route** dialog **Submit** button, then click the **IP Configuration** pane **Submit** button to complete the process.

4.1.4 Removing Static Routing Entries

To remove a specific routing entry, select the table row of that entry, then click the **Entries Commands** button.

4.1.5 Modifying Static Routing Entries

To edit a specific routing entry, select the table row of that entry, then click the **Entries Commands** button.

4.1.6 Repositioning Static Routing Entries

Routing entries allocated in each routing table are parsed by the OS kernel in a serial manner. To modify the series (priority) of allocated entries, select the table row of the entry to be moved, then click the **Entries Commands** button to move the entry upward or the button to move it downward in the list.

4.2 Configuring Static Rules

A rule is a method for implementing Access Control Lists (ACL) for routes. Rules allow you to specify the filters that match packets to select a route structure when the filter does match.

Using a rule you can perform the most common Policy Routing function: route by source address. The rule can specify the selection of a packet if the source address of the packet falls within a designated address range, and which route structure to use or other destination to choose if there is no match. However, on a system with only one routing table, a rule set is usable only under limited conditions.

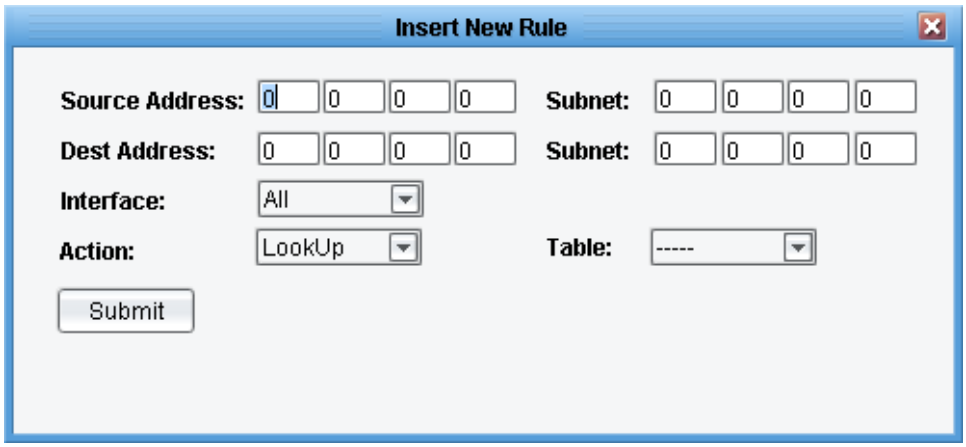


Figure 32. New Routing Rule Insertion

4.2.1 Adding Rule Entries

To add a new rule entry

1. Select the **Rules** tab
2. Click the **Entries Commands** button. The **Insert New Rule** dialog appears.
3. In the **Source Address** boxes, type the address of the source network or source host.
4. In the Source Address **Subnet** boxes, type the netmask for the source net. Type 255.255.255.255 for a host source.
5. In the **Destination Address** boxes, type the destination network or destination host.
6. In the Destination Address **Subnet** boxes, type the netmask for the destination net. Type 255.255.255.255 for a host destination.
7. In the **Interface** drop down list, select the interface that packets are received from. The interface can be one of the available physical interfaces or can be set to **All**.

8. In the **Action** drop down list, select one of the following:

    a) **LookUp** to cause the routing subsystem to look up the routing table selected in the **Table** drop down list. (Default: Main table)

    b) **Unreachable** to drop the received packet and send an ICMP packet to the source indicating the destination was unreachable.

    c) **Drop** to silently drop packets with matching frames.

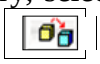
9. In the **Table** drop down list, select the routing table you wish to use with the **LookUp** option described above.

In the example screenshot above the rule specifies that the system will silently drop packets originated from network space 10.10.10.0/24 arriving in any interface.

4.2.2 Removing Rule Entries

To remove a specific rule entry, select the table row of that entry, then click the **Entries Commands** button.

4.2.3 Modifying Rule Entries

To edit a specific rule entry, select the table row of that entry, then click the **Entries Commands**  button. The **Insert New Rule** dialog appears with the fields for the selected rule filled in. Modify as required, then click **Submit.**

4.2.4 Repositioning Rule Entries

Rules entries allocated in each routing table are parsed by the OS kernel in a serial manner. To modify the series (priority) of allocated entries, select the table row of the entry to be moved, then click the **Entries Commands** button to move the entry upward or the button to move it downward in the list.

5. Wireless

5. Wireless

NETKROM NMS allows you to configure all wireless settings for nodes on your wireless network, including:

- **Link Distance**
- **Transmit Power**
- **Operational Modes**
- **Radio Settings**
- **Security Settings**
- **Outdoor Settings**
- **Country Code Settings**
- **Site Survey Operation**

To configure **Wireless** settings, select the **Wireless** tab, located under the **Advanced Configuration of Node, Configuration** tabs. In the **Wireless** tab you can select the **OpMode, Radio, Security** or **Outdoor** sub-tabs.

See 33 for a diagram showing Advanced Configuration tabs and sub-tabs.

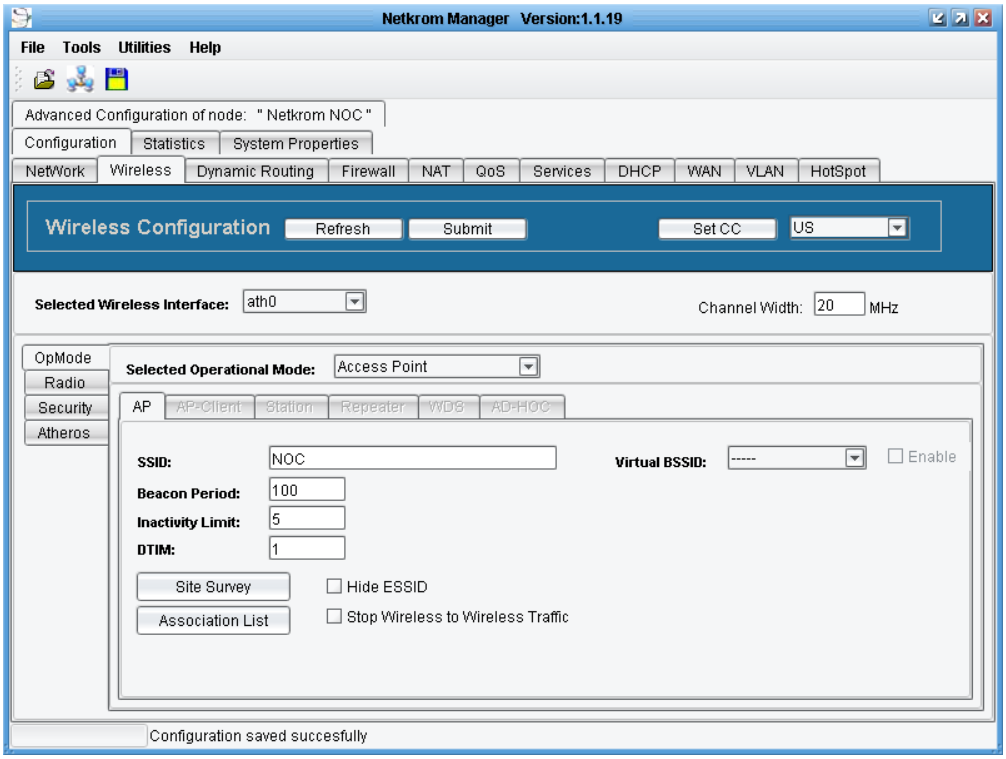


Figure 33. Wireless Configuration Panel

Three buttons and two drop down lists are located at the top of the **Wireless** tab:

- **Refresh** – Click **Refresh** to retrieve setting from the selected node.
- **Submit** – Click **Submit** to upload the configuration to the node.
- **Set CC –** Click **Set CC** to accept the country code specified in the CC drop down list
- **CC List** – Select the required country code from the list, then click Set CC. The software will perform all the appropriate checks of the available radio chipsets in the system in the background. If any of them does not support the specified country code a possible violation could occur. If that occurs, NETKROM NMS warns you with a popup alert. This protects you from choosing an unsupported country code which might cause a loss of connection with the wireless interface after setting the specific country code.
- **Selected Wireless Interface list** – Select the wireless interface to be configured. If there are multiple wireless interfaces available, this drop down a list is populated. If the selected interface is not active a red warning message is shown next to the interface.

5.1 Setting Operational Modes

A NETKROM node has the ability to operate in the following modes:

- **Access Point**
- **WDS** (Wireless Distribution System)
- **Repeater**
- **AP Client**
- **Station**

Site Survey

The **Site Survey** button is accessible in all **OpMode** tabs. **Site Survey** scans all available frequencies associated with the IEEE 802.11a, b and g physical layer. When the scan is complete the **Site Survey** dialog box appears, indicating any possible sources of interference by other nearby access points. **For more information on Site Survey settings, see Section 5.1.6.**

5.1.1 Selected Operational Mode

The **Selected Operational Mode** drop down list is populated with all available operational modes a NETKROM node can adopt. Selecting an operational mode from the drop down list makes the corresponding pane available in the **OpMode** tab.

5.1.2 Configuring an Access Point

To configure the node as an access point (AP), select **Access Point** in the **Selected Operation Mode** drop down list. The **AP** tab becomes available. Several parameters must be configured as follows:

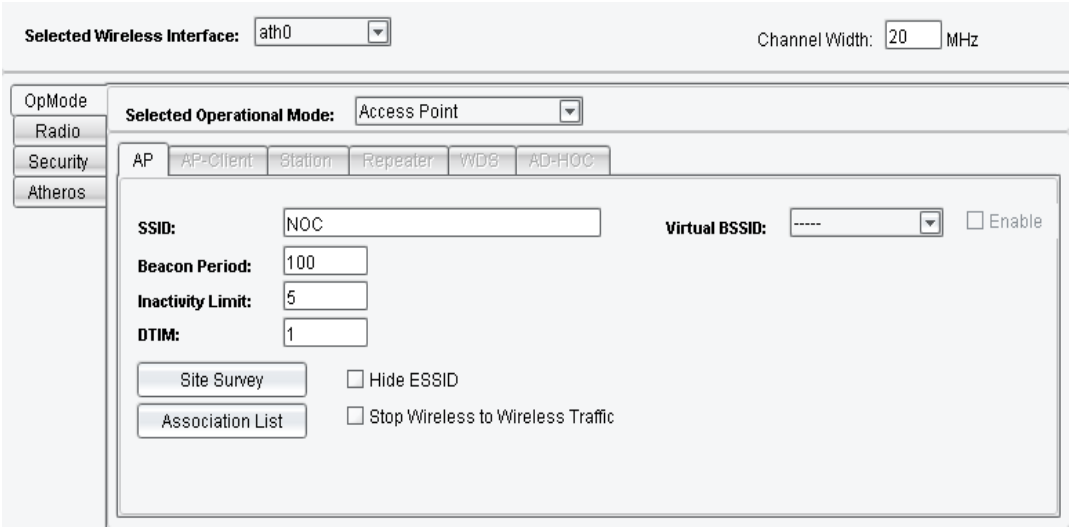


Figure 34. Wireless Operational Mode Settings

SSID (Service Set Identifier)

This field contains the string which is published as ESSID by the access point. To create a name for the service set identifier (SSID), type the name in the **SSID** box.

Inactivity Limit

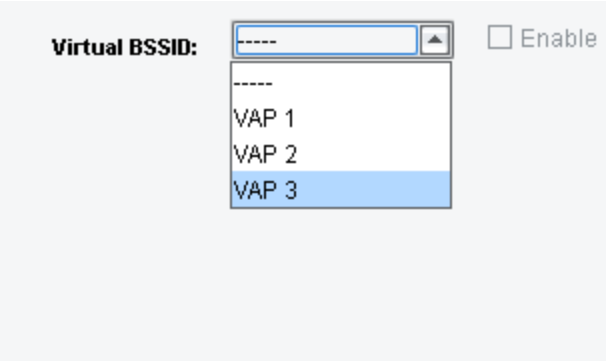
If a station associated with the NETKROM access point is idle for a period of time defined by the **Inactivity Limit** field, the NETKROM access point sends a disassociation frame to the station to inform it that it had been disassociated due to inactivity timeout. To configure the **Inactivity Limit**, type the inactivity threshold, in minutes, in this box.

Beacon Period

This field represents the desirable time interval between two consecutive beacons. To configure the **Beacon Period**, type the number of seconds in this box. (Default: 100)

Virtual BSSID

As from the last INMS versions you can create three extra virtual AP's (VAP) from one physical interface. First you have to set the native" (the actual physical) AP and it's properties (Beacon period, Inactivity, DTIM). These properties will follow any created VAP.



To create a VAP click the Virtual BSSID scroll bar, choose VAP 1 and click enable to enable it. After clicking submit a new interface will be created with preconfigured name.

Association List

To access a list of information for all nodes associated with the AP, click the **Association List** button. The **Associated stations for wireless interface** dialog box appears.

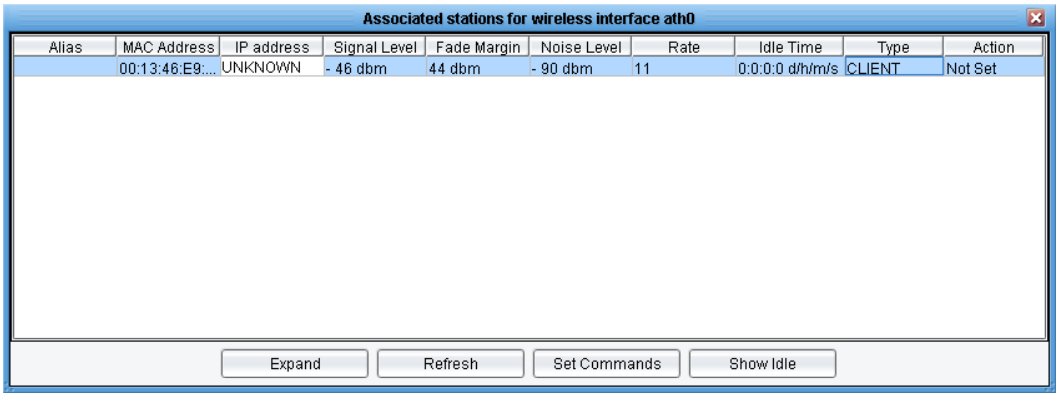


Figure 35. Association List

A description for each field in the Association List follows:

Alias

An **Alias** is a special name you can create to identify a client on the AP. When the configuration is saved, all aliases are saved on the device.

MAC Address

The **MAC Address** field contains the MAC address of each client associated with the AP.

IP Address

The **IP Address** field contains the IP address of each client that exchanges network traffic with the AP

Note: A client can be seen with multiple IP addresses if transparent bridging is being used. To see a list of the IP addresses, click Expand with the desired client selected.

Signal Level

The **Signal Level** field displays the signal level for each associated client based on Received Signal Strength Indication (RSSI).

Fade Margin

The **Fade Margin** field displays the actual difference between Signal Level and Noise Level.

Noise Level

The **Noise Level** field displays the noise level of the chip according to transmit rate and physical layer standard

Rate

The **Rate** field displays the transmission rate the AP uses to exchange data with each client.

Idle Time

The **Idle Time** field displays the time that has passed since a formerly associated client was disassociated.

Type

The **Type** field indicates the type of the node listed. It can contain the following values:

- Adapter (Station Mode)
- AP_Client (AP Client Mode)
- WDS_Type
- Client

*NOTE: Every client that has ever been associated to the AP is included to this list, which is automatically saved when you click **Save Configuration**.*

Action

- The **Action** field is a drop down list that allows you to perform several different actions on the selected node. You can:
- Select **Set Alias** to set an Alias for a specific node.
- Select **Remove** to remove an idle node from the list.
- Select **Disassociate** to disassociate a client which is associated with the AP.
- Select **Permanent Disassociation** to disassociate a client which is associated to the AP and simultaneously add its MAC to an Access Control List to deny access.

Stealth Mode

Stealth Mode is another enhancement of Access Point mode. When Stealth Mode is enabled the AP does not transmit beacons and hides its

SSID in transmitted probe responses, which makes the AP essentially invisible. No other node can discover it unless that node already has the AP's settings. In addition, a custom polling protocol is implemented, which is compatible with links between NETKROM APs and NETKROM clients. When using this protocol NETKROM clients are able to detect NETKROM Stealth APs.

To implement this feature, select the **Stealth Mode** checkbox.

Hide Essid

Hiding the AP's ESSID prevents outside users from joining the network because they cannot detect the network identifier. To stop the AP from publishing its ESSID in it beacon transmissions, select the **Hide ESSID** check box.

Stop Wireless To Wireless Traffic

To prevent traffic between two wireless stations that are both associated with a NETKROM AP, select the **Stop Wireless to Wireless Traffic** check box.

NOTE: *NETKROM has the ability to support Address 4 traffic. However it is necessary to put the wireless interface (the one that operates as an access point) under a Network Bridge (check IP Network configuration) if you intend to enable Address 4 support.*

5.1.3 Configuring WDS Mode

A NETKROM node can operate as an access point WDS node. This gives you the opportunity to configure a Wireless Distribution System Network by setting up a number of NETKROM WDS nodes, each one taking part in the network. All the features and settings described in the access point section are supported for WDS mode. In addition, WDS Mode features a WDS List which contains the MAC addresses of all WDS nodes included in the network.

To configure the currently selected node for Wireless Distribution System (WDS) mode, select **WDS** in the **Selected Operation Mode** drop down list. The **WDS** tab becomes available. **SSID, Inactivity Limit, Beacon Period, Site Survey, Stealth Mode, Hide ESSID and Stop Wireless to Wireless Traffic** fields are configured the same as for Access Point Mode. The WDS tab also features an **Association List** button and a list of **Registered WDS Nodes.**

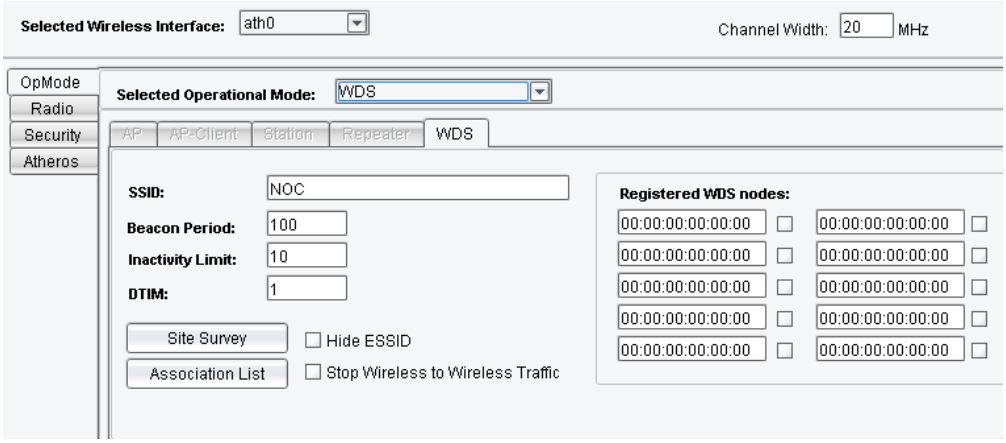


Figure 36. Wireless WDS Mode Settings

In the **Registered WDS nodes** list**,** type the MAC addresses of the nodes to be configured. Select the check box next to the MAC address field to enable it as part of the WDS network topology. (The enable feature can be helpful when WDS nodes change behavior. You can maintain the nodes' MAC addresses in the list and enable or disable as necessary.

5.1.4 Configuring Repeater Mode

Repeater Mode is an advanced NETKROM mode. When a NETKROM node is configured to perform as a repeater it operates as a client. It associates with an AP that matches the desired BSSID (Basic Service Set Identifier) and adopts the settings of the BSS (Basic Service Set). After the association is complete, NETKROM repeats the BSS creating a brand new BSS range. Repeaters implement a combination of both Client mode and Access Point mode functionality and features such as Stealth Mode and Wireless to Wireless Traffic control.

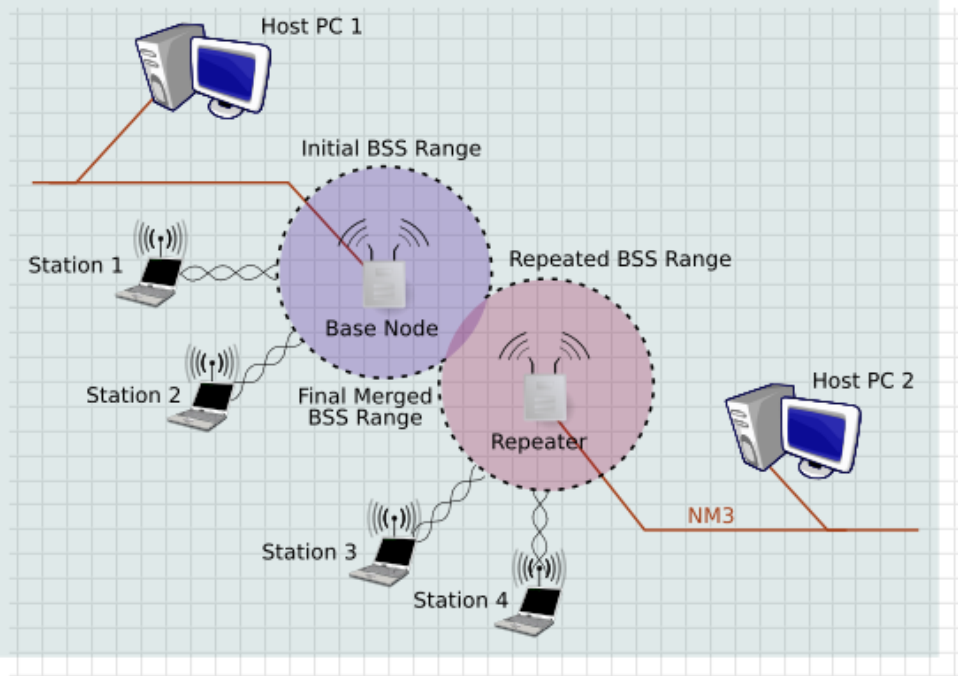


Figure 37. Repeater Topology

As the diagram above illustrates, the NETKROM Repeater is associated with the NETKROM Base Node. After being associated, the NETKROM Repeater extends the NETKROM Base Node's BSS. The result is that the Initial BSS range is expanded to the footprint shown by the Final Merged BSS range with the Repeater acting as an access point with the Base Node settings. The three stations in the example topology can have access to both Host-PC-1 and Host-PC-2 (or can exchange data between them) regardless of whether they are associated with the Base Node or the Repeater.

Preferred SSID/Preferred BSSID

To configure a NETKROM node as a **Repeater**, type the **Preferred SSID** name or the **Preferred BSSID** MAC address into the appropriate fields. Click the **Submit** button and wait for the Repeater to associate itself with the specified Base node. The Repeater is then ready to accept associations with wireless stations.

State and Link Quality/Signal Level

The **State** field and **Link Quality/Signal Level** fields mirror Client Node's state as far as it has to do with the potential link with an access point. A continuous polling protocol operates between the NETKROM NMS and all nodes which have been added in the Network Topology pane. For Client configured nodes, NETKROM NMS is continuously

informed of the State (Idle, Authenticated or Associated) of the node, the quality of the link (if associated) and the dynamic signal strength.

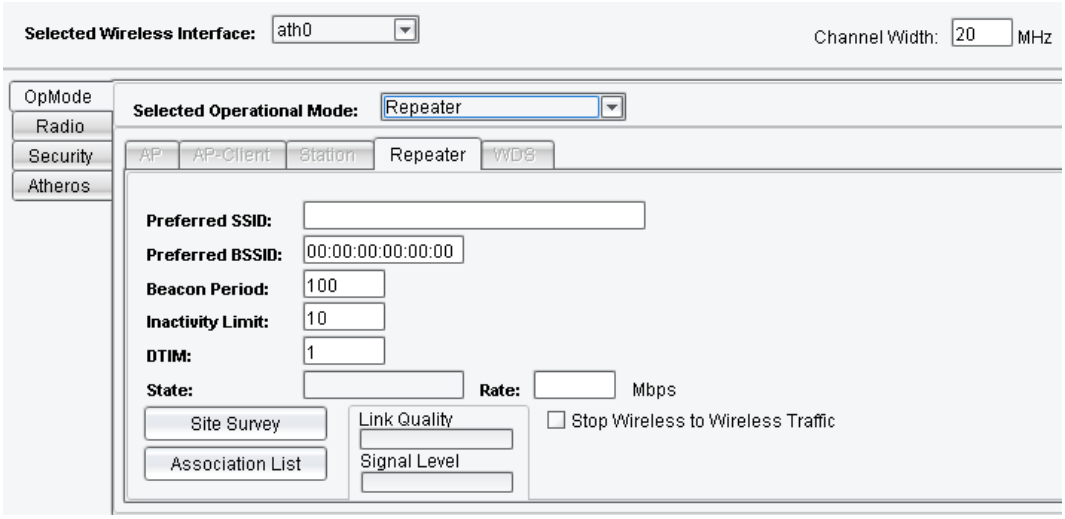


Figure 38. Repeater Mode Settings

5.1.5 Configuring AP Client and Station Modes

The functionality of **AP Client** and **Station** modes is similar. Both modes configure the node as a client. The main difference is that **AP Client** supports address 4 traffic. **Station** has an embedded proxy-ARP functionality to support only address 3 traffic for all possible entities which maybe adjacent to its Ethernet interface. You can select either mode based on your network needs.

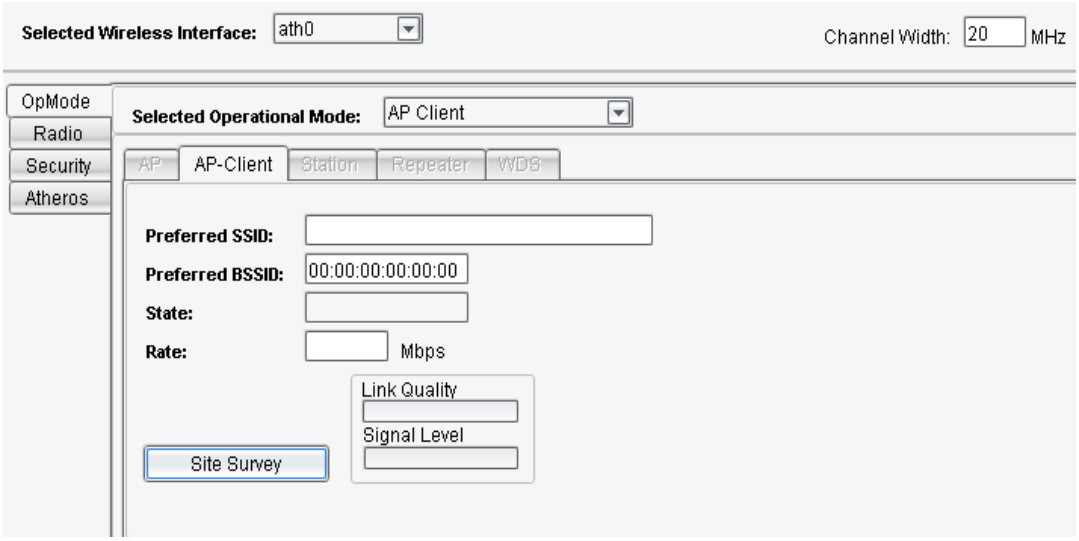


Figure 39. AP Client Mode Settings

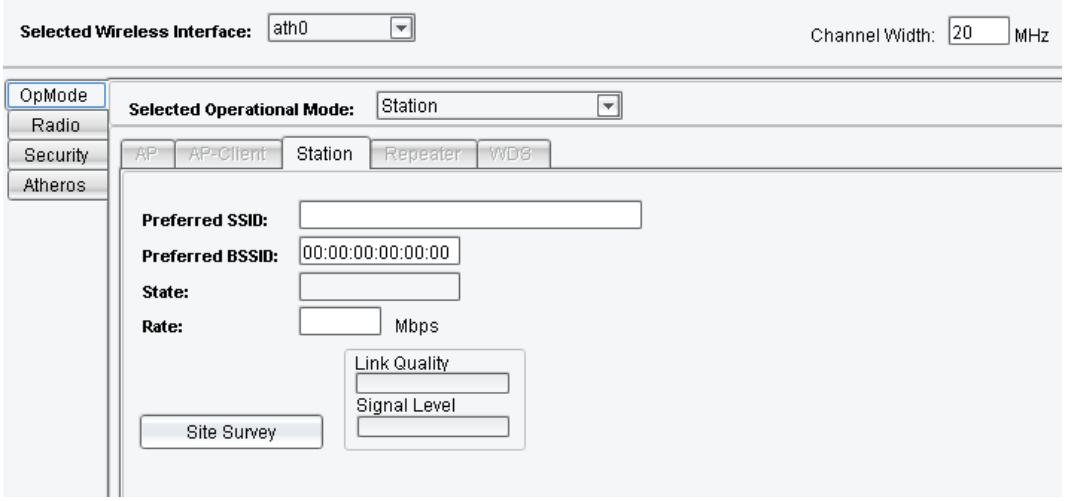


Figure 40. Station Mode Settings

Preferred SSID

This field contains the string which is published as ESSID by the AP Client/Station node. To create a name for the service set identifier (SSID), type the name in the **Preferred SSID** box.

Preferred BSSID

This field contains the MAC address which is published as BSSID by the AP Client/Station node. To create a name for the basic service set identifier (BSSID), type the MAC address in the **Preferred BSSID** box.

State and Link Quality/Signal Level

The **State** field and **Link Quality/Signal Level** fields mirror Client Node's state as far as it has to do with the potential link with an access point. A continuous polling protocol operates between the NETKROM NMS and all nodes which have been added in the Network Topology pane. For Client configured nodes, NETKROM NMS is continuously informed of the State (Idle, Authenticated or Associated) of the node, the quality of the link (if associated) and the dynamic signal strength.

5.1.6 Using Site Survey Operation

The **Site Survey** button is available on all **OpMode** tabs. If a NETKROM node operates as AP Client, Repeater or Station, Site Survey will scan all available channels to find an appropriate BSSID to join (based on user credentials SSID, BSSID, Security etc). When a NETKROM node acts as an access point or WDS, Site Survey can be used to scan and monitor adjacent frequencies to detect interference from other access points.

When you click the Site Survey button, the Site Survey dialog box appears. Rows in the dialog box display all the available information for every node scanned.

After the scan is complete and the dialog box list is populated, the status bar at the bottom of NETKROM NMS window displays the message **Site survey list retrieved successfully**.

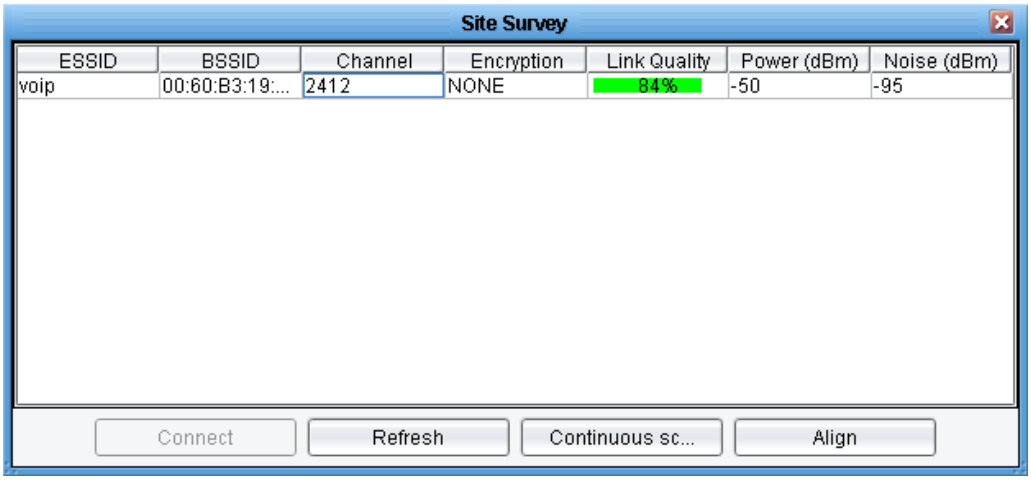


Figure 41. Site Survey Operation

At the bottom of the Site Survey dialog box four buttons are available:

Connect:

Select a node in the list and click **Connect** to connect to that node.

Refresh

Click the Refresh button to re-scan and update the Site Survey list.

Continuous Scan

Click **Continuous Scan** to enable consecutive scanning. The button remains depressed until clicked a second time. While in Continuous Scan mode, the Site Survey list is updated dynamically, merging all the possible unique entries.

Align

The **Align** option allows you to achieve the best possible alignment for a distant point-to-point link. Click the **Align** button. The **Site Survey Align** dialog box appears. This dialog box displays **BSSID**, **SSID**, **Channel Number**, **Link Quality** and **Signal Level** fields. Using this dialog you can monitor signal strength and quality value statistics through consecutive polling. Polling occurs at a high frequency to provide an up-to-date representation of the link. While monitoring these statistics you can adjust

your antenna to achieve maximum performance. When optimal antenna position and polarity are achieved, click the **Quit** button to return to the Site Survey panel.

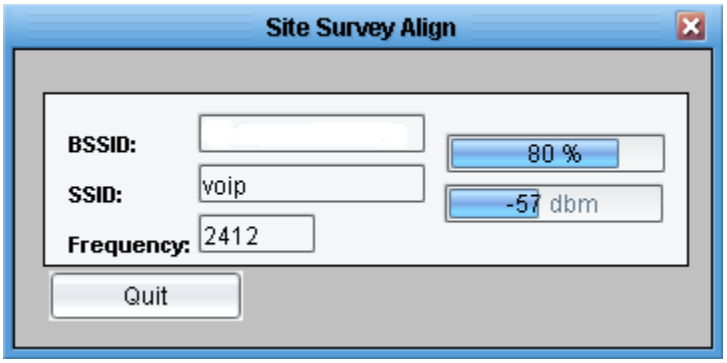


Figure 42. Site Survey Align

5.2 Configuring Radio Settings

To configure the radio settings of the selected wireless interface, select the **Radio** tab on the left side of the **Wireless** pane. From the Radio tab you can:

- select the **Physical** layer options (IEEE 802.11a,b and g)
- select the **Channel** number
- select whether the Channel is expressed as a number or **Frequency**
- select the **TxRate** (data transmission rate)
- set and enable the **Frag** value
- set and enable the **RTS** parameter
- enable **Spoofing**
- configure the **MAC Address**
- enable **Diversity** operation
- select the **Antenna** connector

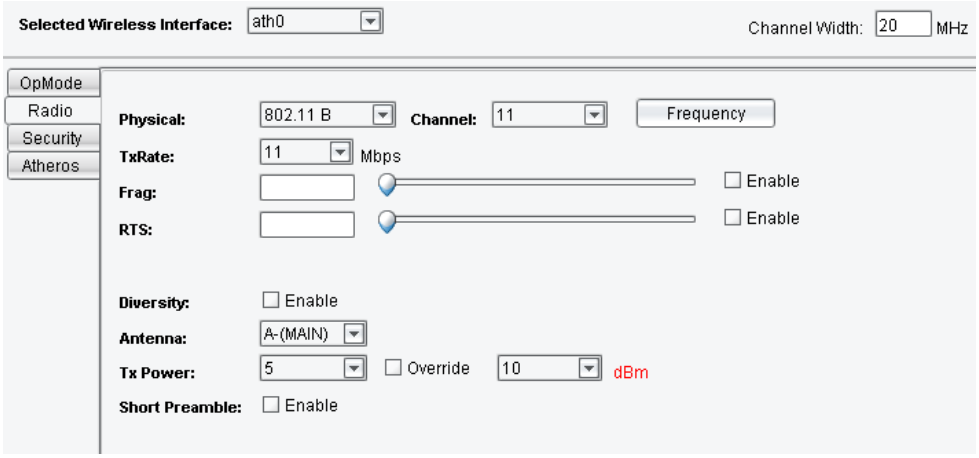


Figure 43. Wireless Radio Settings

5.2.1 Selecting Physical Layer Options

The **Physical** drop down list contains all physical layer options that are available for the specific hardware you are using. If your hardware supports IEEE 802.11 a, b and g standards the **Physical** drop down list will contain **AUTO, 802.11A, 802.11B, 802.11B-G, Turbo A and Turbo G** options**.** (If the hardware does not support a physical layer standard NETKROM NMS returns a warning dialog indicating the NIC cannot be configured in the selected physical layer standard.)

5.2.2 Setting Channels and Frequencies

The **Channel** drop down list displays the currently selected radio channel using the standard IEEE channel numbering convention. To convert the Channel field to display the actual frequency, click the **Frequency** button.

5.2.3 Setting Transmission Rates

The **TxRate** drop down list allows you to select a standard transmission rate based on the available rates associated with the selected physical layer standard. You also can select **Auto** mode. In Auto mode NETKROM will be auto-configured to support the optimal TxRate for each related node. This can be very useful in environments sensitive to retries. In Auto mode an auto-rate fallback algorithm, which runs on the background, tries to maximize the data transfer rate.

Note: *Management and Control frames are always transmitted at the lowest available rate of the selected physical layer standard.*

5.2.4 Setting the MAC Address

The **MAC Address** field contains the MAC address of the configured radio card/hardware that has been selected in the **Selected Wireless Interface** field. However, you can enable spoofing functionality by

selecting the **Enable Spoofing** checkbox and typing a new MAC address into the MAC Address field.

5.2.5 Setting Frag

The **Frag** field allows you to implement fragmentation of packets, a technique that improves network performance in the presence of RF interference. You can set the fragment size by typing in the frame size threshold (in bytes). If a frame exceeds this value it will be fragmented. The fragmentation range is 256 to 2048 bytes. Setting the fragmentation threshold to 2048 effectively disables fragmentation.

To implement fragmentation, type the threshold value into the **Frag** box and select the Enable check box.

5.2.6 Setting RTS

The RTS field allows you to implement RTS/CTS handshaking between a NETKROM node and another station on the wireless network. RTS/CTS handshaking helps minimize collisions among hidden stations on a wireless network. An RTS/CTS handshake involves the originating node sending a Ready To Send frame to its destination, then waiting for the destination to return a Clear To Send frame. The originating node will then send its data. RTS/CTS operation adds to overhead but can help avoid collisions. When implementing RTS on a NETKROM access point RTS operation is initiated if a packet exceeds the threshold configured in the **RTS** field. The valid range is 0 to 2347 bytes. (If RTS is enabled a starting value of 500 is recommended.)

To implement **RTS**, type the threshold value into the **RTS** box and select the Enable check box.

5.2.7 Selecting Diversity Options

The **Diversity** field allows you to enable the use of two antennas for diversity operation, if two are used for the same radio.

5.2.8 Selecting Antenna Options

The **Antenna** drop down list allows you to select the **Right** or **Left** antenna, if two are used.

5.2.9 Setting Transmitted Power

The transmitted power of the node can be set by selecting preset values between 5 and 30. This is a custom scale (with no defined units) which simply represents minimum and maximum Transmitted Power of the currently selected wireless interface. To set transmitted power, select a value in the **Tx Power** drop down list.

5.3 Configuring Security Settings

From the **Security** tab you can configure the security settings of the Selected Wireless Interface. From this tab you can set up

- **None** (no security)
- **WEP** (Wired Equivalent Privacy)
- **WPA** (Wi-Fi Protected Access)
- **ACL** (Access Control List)

5.3.1 Setting Wired Equivalent Privacy (WEP)

Through the **WEP** tab you can configure a NETKROM node to encrypt/decrypt data with keys based on the WEP protocol. To implement WEP, select **WEP** in the **Selected Encryption Mode** drop down list.

To implement 64-bit encryption, select **WEP-64** in the **WEP Type** drop down list.

To implement 128-bit encryption, select **WEP-128** in the **WEP Type** drop down list.

Four text boxes (**WEP Key #1, #2, #3** and **#4)** with adjacent option buttons allow you to maintain four different encryption keys, while using one of them. Type one or more encryption key into the text boxes, then select the option button of the one to be used.

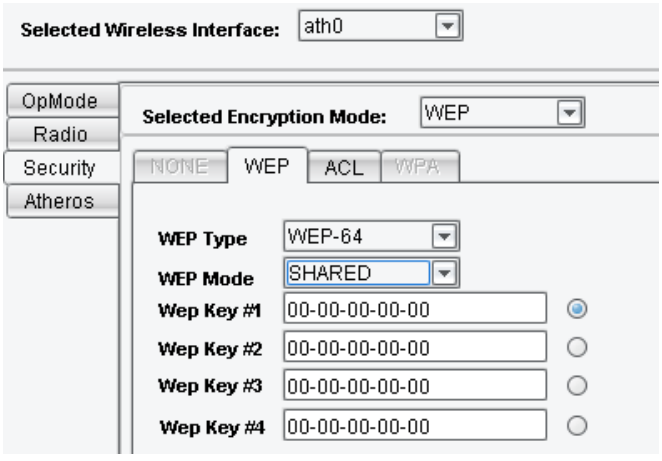


Figure 44. Wireless WEP Settings

5.3.2 Setting Wi-Fi Protected Access (WPA)

In the **WPA** tab you can configure a NETKROM node to encrypt/decrypt data with keys based on WPA protocol. To implement WPA, select **WPA** in the **Selected Encryption Mode** drop down list.

Setting WPA Mode

To set the **WPA Mode**, select either the **WPA** or **RSN(WPA 2)** option button.

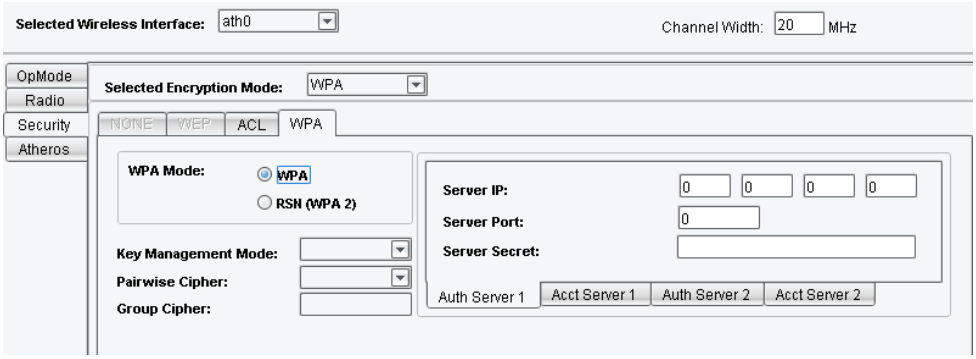


Figure 45. Wireless WPA Settings

Setting Key Management Mode

To configure the **Key Management** field, select **PSK** (Pre-Shared Key) or **EAP** (Extensible Authentication Protocol) in the **Key Management Mode** drop down list. This selection determines the type of fields that appear in the area in the right side of the pane.

EAP

When EAP is selected, several text boxes appear on the right side of the panel. These fields are required in order to force a NETKROM access point to authenticate clients on a Back-End Authentication Server. They include

- the **Server IP** address
- the **Server Port** number, used for EAP-TLS packet transactions (usually 1812)
- a **Server Secret** phrase which is used for the NETKROM node authenticator to be accepted by the Back-End Authentication Server.

*EAP-TLS is by default the supported protocol for EAP. The NETKROM node uses 802-1X authentication to authenticate its clients. If the NETKROM node is configured as a client, in the case of EAP-TLS usage, you should upload the appropriate certificates on NETKROM station. This can be done by clicking the **Upload Server** and **Client Certificate** buttons on the right pane.*

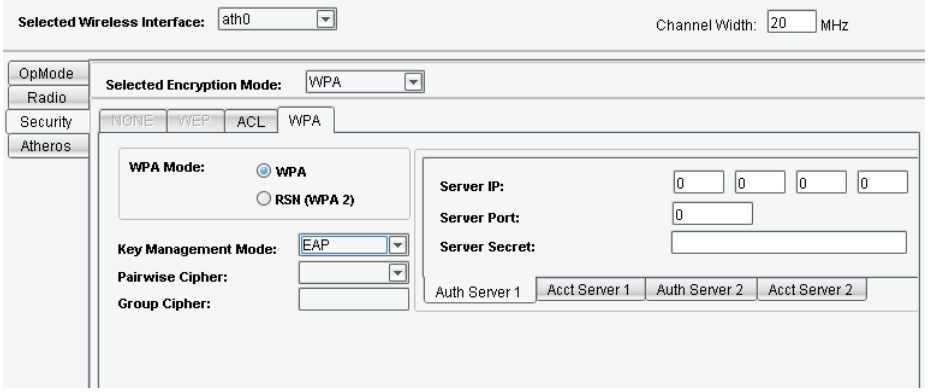


Figure 46. EAP Settings

PSK

When **PSK** is selected in the **Key Management Mode**, drop down list, the **Pass Phrase** text box appears on the right side of the pane. This is the initial value on which negotiated WPA keys are created. To configure the **Pass Phrase** field, type the pass phrase.

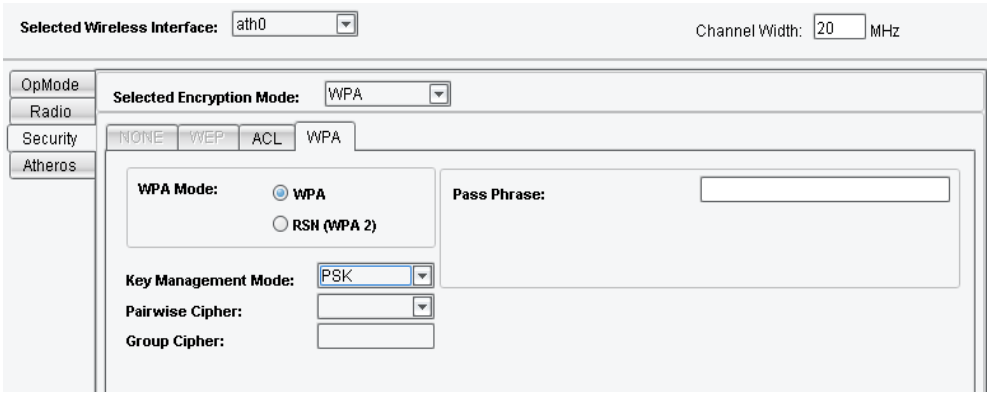


Figure 47. PSK Settings

Pairwise Cipher

The **Pairwise Cipher** field provides three options for the encryption mechanism of a NETKROM node.

- **TKIP** (Temporal Key Integrity Protocol)
- **AES(CCMP)** (Advanced Encryption Standard-Counter Mode CBC-MAC Protocol)
- **BOTH** (selected if a NETKROM node is configured as an access point)

Group Cipher

(Group Cipher is not functional in NETKROM NMS version 1.1.3)

5.3.3 Configuring Access Control Lists (ACL)

When the **Selected Operational Mode** has been set to **Access Point** or **WDS,** the **ACL** sub-tab in the **Security** tab is available for selection. You have the option of setting an **Access Control List** to manage clients trying to connect to the access point. To configure Access Control List functions, click the **ACL** tab, then select the **Enable** checkbox.

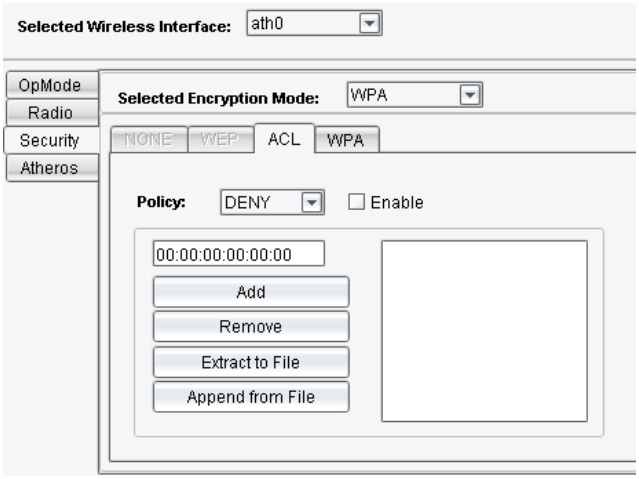


Figure 48. Access Control List Settings

Denying Access

To deny specified clients access to the node, select **DENY** in the **Policy** drop down list**.** Clients with MAC addresses matching MAC addresses registered in the ACL will be denied access. All other addresses will be allowed

Allowing Access

To allow specified clients access to the node, select **ALLOW** in the **Policy** drop down list. Clients with MAC addresses matching MAC addresses registered in the ACL will be allowed access. All other addresses will be denied.

Setting up Access Control Lists

There are two methods to set up an Access Control List.

- Type in the MAC addresses manually, using the **Add** button, and remove selected MAC addresses using the **Remove** button.

- Load a text file containing the MAC addresses using the **Append from File** button.

Extracting Access Control Lists

To save an existing ACL, click **Extract to File** and name/save the file. This can be a useful feature if you need to submit the same MAC list to another access point.

5.4 Configuring Atheros Advanced Capabilities

The Atheros tab is useful in optimizing the operation of distant NETKROM nodes.

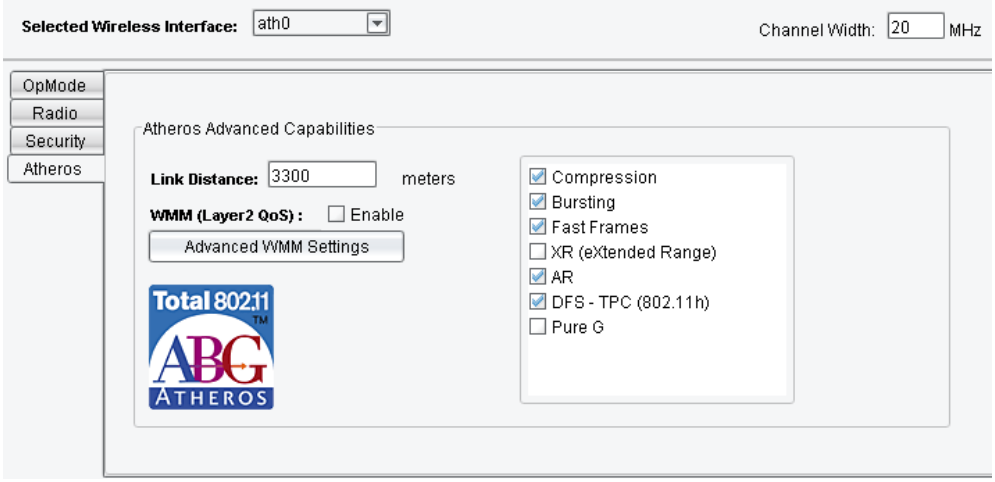


Figure 49. Atheros Settings

Link Distance

Setting the Link Distance can be effective in optimizing operation of a node. When Link Distance is defined, the acknowledge timeout is configured according to the distance. In lossy environments, where many retries occur, acknowledge timeout should be configured accordingly to the distance between the nodes. To set this parameter, type the distance (in meters) into the **Link Distance** text box.

Fast Frames

Fast Frames is a feature of Atheros-based technologies that utilizes *frame aggregation* and timing modifications to increase the data throughput rate of the system. It increases throughput by transmitting more data per frame and removing inter-frame pauses. To implement fast frames, select the **Fast Frames** check box.

Packet Bursting

Packet Bursting is another technique used by Atheros-based technologies to increase throughput by decreasing overhead and sending more data frames per given period of time. To implement packet bursting, select the **Packet Bursting** check box.

WMM (Layer 2 QoS) / Advanced WMM Settings

WMM (Wi-Fi Multimedia) is a priority-based Quality of Service method used in implementing Voice over WLANs. To implement WMM, select he **WMM (Layer QoS)** check box, then click the **Advanced WMM Settings** checkbox to access the **Advanced WMM Parameters** dialog Box.

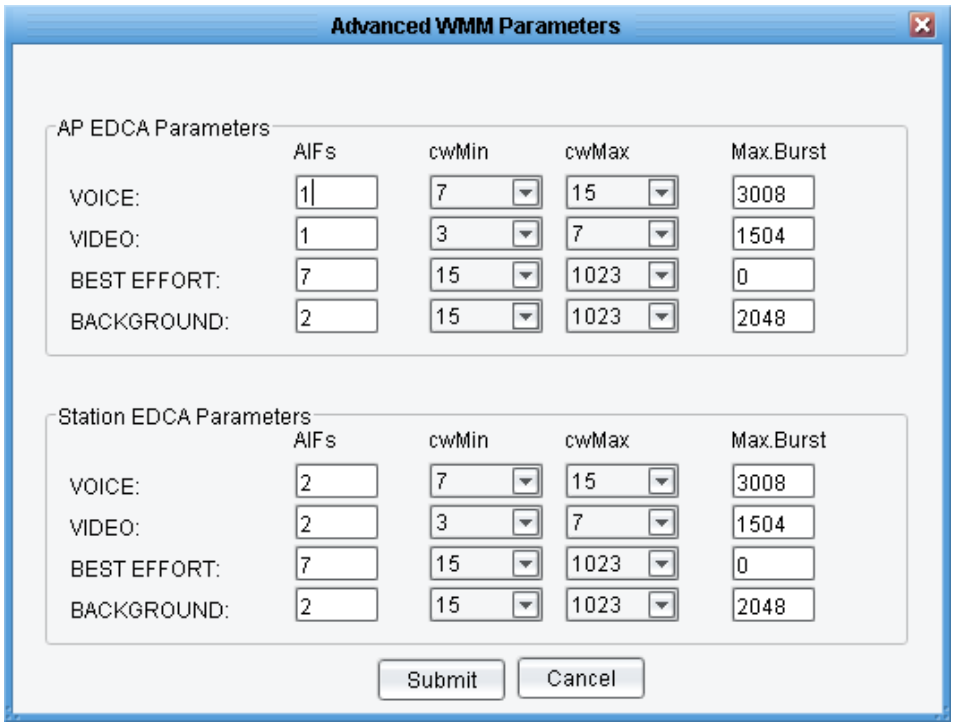


Figure 50. Advanced WMM Parameters

WMM QUEUES (TRAFFIC PRIORITIES)

There are the four queues that h/w uses to organize and prioritized the packets

AC_BK= Background Access Category

(Lowest Priority for bulk data that require maximum throughput and there is not any time sensitivity related such as FTP for example)

AC_BE= Best Effort Access Category

(medium priority , traditional IP data via this queue)

AC_VI= Video Access Category

(High Priority lower than VOICE ,video data sent to this)

AC_VO= Voice Access Category

(High priority , VOIP data and streaming media)

NOTE1 :: On behalf of the AP these fields are advertised in the Beacon and the CLIENT or STATION on the other side are informed via this in order to be aware of the policy of the AP.On the other hand AP knows the policy of each Client.

NOTE2 ::AP EDCA parameters affect traffic flowing from AP to the client or station(On the other hand STA EDCA control the upstream form client or Station to AP)

CONFIGURABLE FIELDS (per queue)

.

a.**CWmin** = Minimum Value of Contention Window

b.**CWmax** = Maximum Value of Contention Window

b.**AIFsn** = Arbritary Interframe Space

d.**TXOP** = Length of TXOP

CWmin
Input to the algorithm that specifies the initial random backoff wait time (window as known) for retry transmission.This valuw is the upper limit in msecs of a range from which initial random backoff wait time is determined.

CWmax
This value is the upper limit in msecs for the doubling random backoff value.This doubling continues until either the data frames is sent or the Max Contention Window is reached

AIFs

The Arbitration Inter-Frame Spacing specifies a wait time for data frames

TXOP
This is an interval of time when an **WMM** station or client has the right to initiate transmisions onto the wireless medium.

5.5 Wireless Topology Scenarios

In this section two possible specific wireless topologies are described, based on NETKROM's operational modes. In the first section two ways of setting a point-to-point link are described. In the second section a specific topology concerning NETKROM Repeater functionality is described.

5.5.1 Point-to-Point Links

There are two basic topology scenarios. You can create a point to point link using either scenario.

WDS to WDS Scenario

A point-to-point link can be created by configuring two NETKROM nodes as WDS access points.

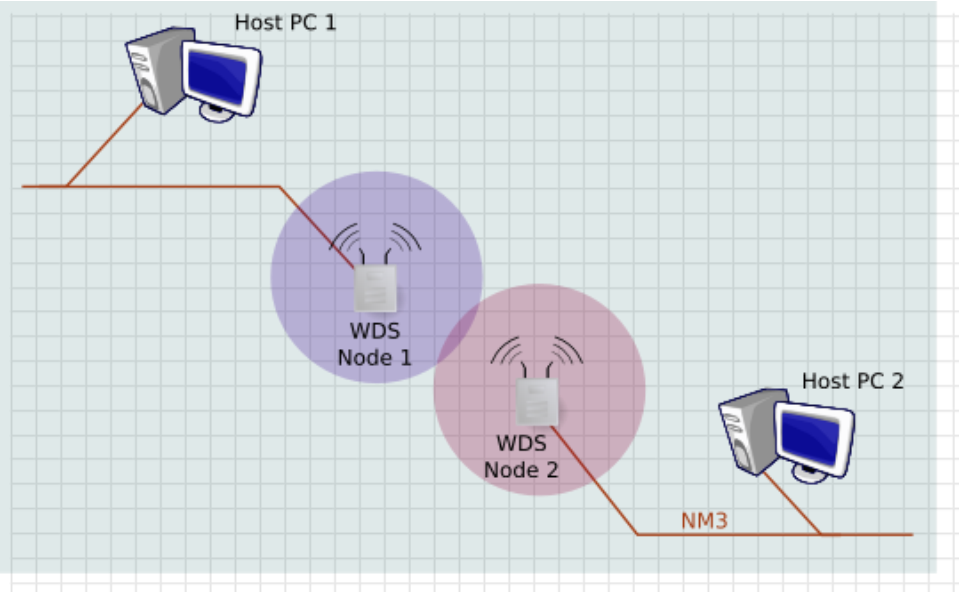


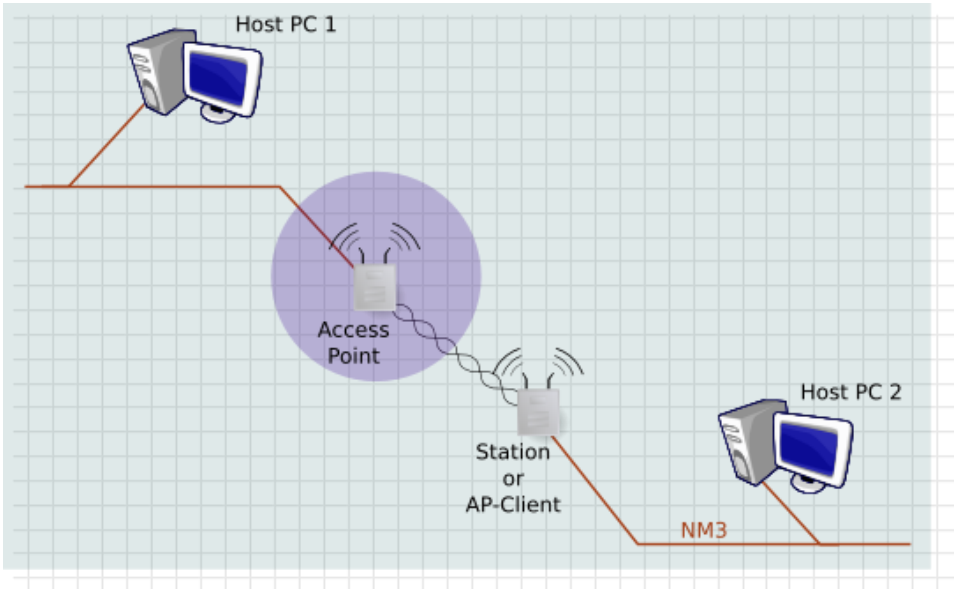
Figure 51. WDS Topology

WDS Node-1 configuration should include the following :

- WDS-Node-2's MAC address should be set in Node-1's WDS list.
- Both nodes should transmit on the same frequency.
- NETKROM Stealth Mode should be used (if you want to avoid beacon transmitting) or Hide ESSID (if you want beacons to be transmitted but not to publish the NETKROM node's ESSID.)
- Additionally, you can enable an ACL with Policy set up to Deny and no node's MAC address in the list to prevent stations from connecting to the node.

The same configuration should be set in WDS Node-2, with corresponding values.

AP to AP-Client Scenario



You can set up a point-to-point link using AP and AP Client Modes.

Figure 52. Point-to-point Topology

The access point should be configured as follows:

1. Set up the ESSID of the AP.
2. Enable Stealth Mode in the AP.
3. Enable ACL with Policy set up to ALLOW and put the AP-Client's MAC address in the MAC list.

The AP-Client should be configured as follows:

1. Type the AP's MAC address into the SSID field.
2. Type the MAC address of the AP into the Preferred BSSID field.
3. Perform a Site Survey.
4. Select the AP from list and perform an Align.
5. Make all the adjustments to achieve optimal alignment results

5.5.2 BSSID Extended Repetition

Repeater is a custom mode of NETKROM. Repeater functionality is described in the Operational Modes section of this document.

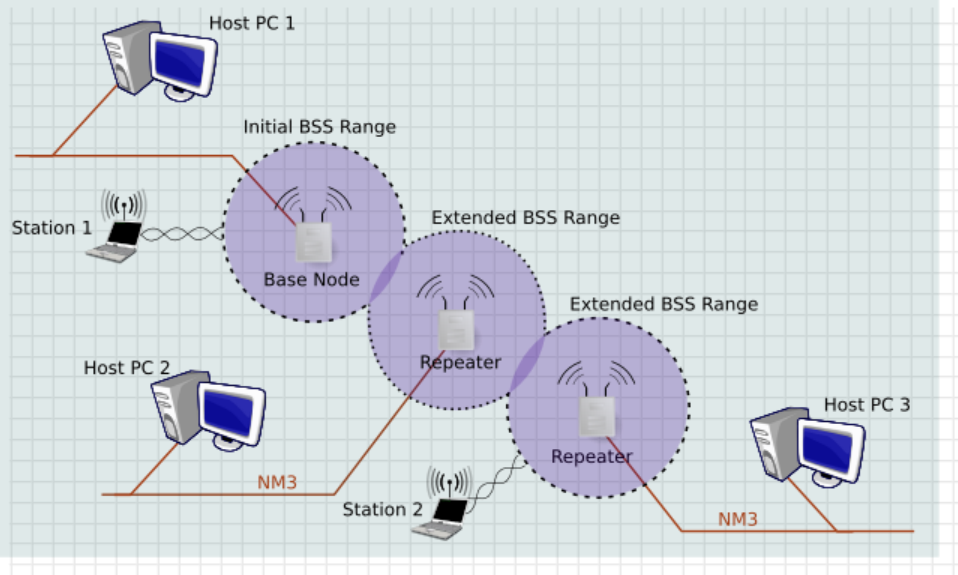


Figure 53. Extended Repetition Topology Example

In this scenario the NETKROM Base Node's BSS is repeated through a Repeater chain. Each NETKROM Repeater node repeats the BSS of the previous node. Each station is connected to a different Repeater Node, but they all belong to the same BSS as if they were on the same access point. This topology can be useful in creating a long distance extension of a Base Node AP's BSS, or even to reduce the load of an AP in a large area with many clients. Also, by configuring a NETKROM Repeater in an optimal position within the target area, you can achieve load-balancing. In addition, Repeater offers bridging of all wireless Clients with all Ethernet Host PCs adjacent to its Ethernet interface.

6. Dynamic Routing - RIP

The **Routing Information Protocol** (RIP) is one of the most commonly used interior gateway protocol (IGP) routing protocols on internal networks (and to a lesser extent, networks connected to the Internet), which helps routers dynamically adapt to changes of network connections by communicating information about which networks each router can reach and how far away those networks are.

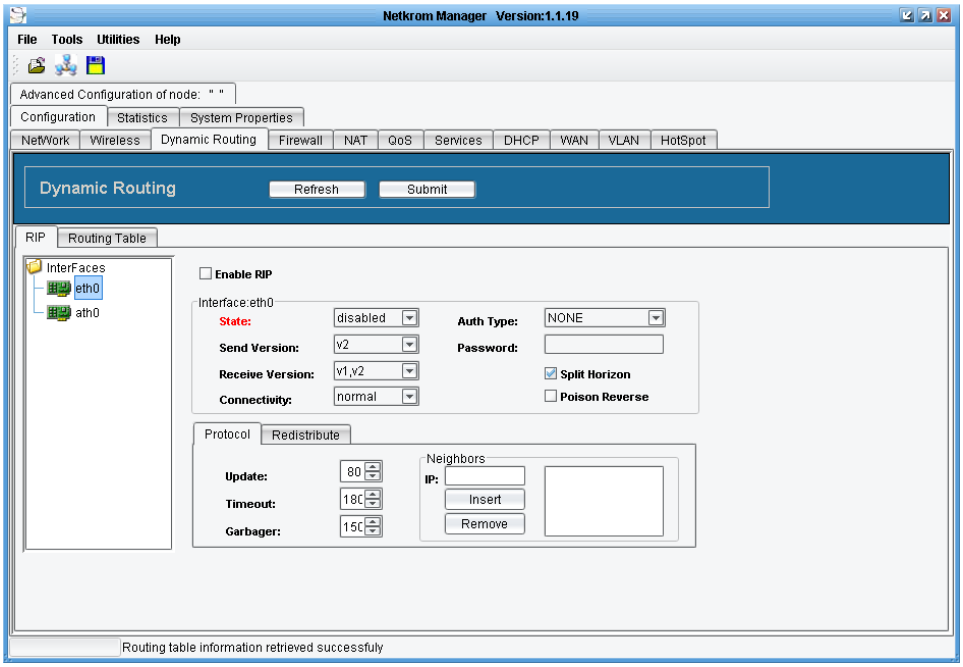
Architecturally, RIP is a layer management protocol for what is called the Internetwork Layer in the Internet protocol suite or the Network Layer in the OSI Reference Model. While it is carried in end-to-end (IPS) or transport layer (OSI) packets, using port number 520 in the User Datagram Protocol, as a routing protocol, it belongs to the network layer, not the layer that moves its packets.

RIPv1

RIPv1, defined in RFC 1058, uses classful routing. The routing updates do not carry subnet information, lacking support for variable length subnet masks (VLSM). This limitation makes it impossible to have different-sized subnets inside of the same network class. In other words, all subnets in a network class must be the same size. There is also no support for router authentication, making RIPv1 slightly vulnerable to various attacks.

RIPv2

Due to the above deficiencies of RIPv1, RIPv2 was developed in 1994 and included the ability to carry subnet information, thus supporting Classless Inter-Domain Routing (CIDR). However to maintain backwards compatibility the 15 hop count limit remained. Rudimentary plain text authentication was added to secure routing updates; later, MD5 authentication was defined in RFC 2082. Also, in an effort to avoid waking up hosts that do not participate in the routing protocol, RIPv2 multicasts routing updates to 224.0.0.9, as opposed to RIPv1 which uses broadcast.



6.1 RIP General Parameters

- **Enable:** Enables the overall RIPd process.
- **State:** Assigns the RIPd deamon onto the selected interface.
- **Send Version:** Selects the version of RIP to send RIP requests.
- **Receive Version:** Selects the version of RIP to reply to RIP requests.
- **Connectivity:** Selects the operation mode of RIPd deamon, RIP classifies routers as active and passive (silent). Active routers advertise their routes (reachability information) to others. Passive routers listen and update their routes based on advertisements but do not advertise. Typically, routers run RIP in active mode, while hosts use passive mode.
- **Auth Type:** Usage RIPv2 only, Allows packets to be authenticated via either an insecure plain text password, included with the packet, or via a more secure MD5 based HMAC (keyed-Hashing for Message AuthentiCation). Enabling authentication prevents routes being updated by unauthenticated remote routers, but still can allow routes (I.e. the entire RIP routing table) to be queried remotely, potentially by anyone on the internet, via RIPv1.
- **Password:** Password *input text* field.
- **Split Horizon:** Enables the *Split Horizon option*. This is simply data suppression. It works by not sending updates about networks

it learned out the interface through which it learned those networks.

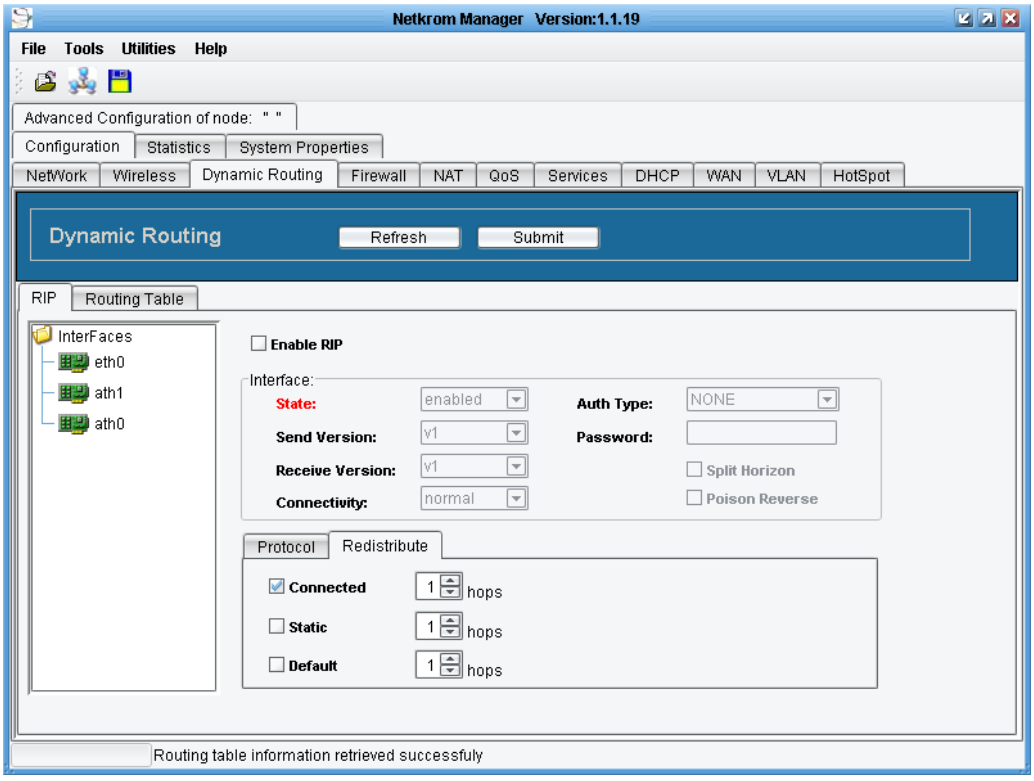
- **Poison Reverse:** Configures the *Split Horizon option* to operate with *Poison Reverse* option as well. When sending updates out an interface, designate any networks you learned from that interface unreachable. In particular, it is never useful to claim reachability for a destination network to the neighbor(s) from which the route was learned. *Split horizon* is a scheme for avoiding problems caused by including routes in updates sent to the router from which they were learned. The *simple split horizon* scheme omits routes learned from one neighbor in updates sent to that neighbor while *Split horizon with poisoned reverse* includes such routes in updates, but sets their metrics to infinity.

6.2 RIP Protocol Parameters

- **Update:** Sets the auto update timer, The router will send its entire route table to every neighbor it has.
- **Timeout:** Sets the expiration timer. If a route gets to a certain configurable age, the router will think the device from which it learned that route has gone away, thus we flush it. Note, when a route expires, it is NOT removed from the table. It has its metric set to 16 or unreachable.
- **Garbager:** Sets the garbage collection timer. When a route hits this timer, it is indeed removed from the table.
- **IP Neighbors:** Inserts/removes neighbors' IP addresses. When a neighbor doesn't understand multicast, this command is used to specify neighbors. In some cases, not all routers will be able to understand multicasting, where packets are sent to a network or a group of addresses. In a situation where a neighbor cannot process multicast packets, it is necessary to establish a direct link between routers. The neighbor command allows the network administrator to specify a router as a RIP neighbor.

6.3 RIP Redistribute Parameters

- **Connected:** Redistributes connected routes into the RIP tables. This command redistributes connected of the interface which RIP is disabled. The connected route on RIP enabled interface is announced by default.
- **Static:** Redistributes routing information from static route entries into the RIP tables.
- **Default:** Redistributes routing information from kernel route entries into the RIP tables.



7. Firewall and NAT

7. Firewall and NAT

A firewall protects networked computers from intentional hostile intrusion that could compromise confidentiality or result in data corruption or denial of service. A network system in order to support firewall functionality must have at least two network interfaces, one for the network it is intended to protect, and one for the network it is exposed to. A firewall sits at the junction point or gateway between the two networks, usually a private network and a public network such as the Internet.

To configure **Firewall** settings, select the **Firewall** tab, located under the **Advanced Configuration of Node, Configuration** tabs.

To configure **NAT** settings, select the **NAT** tab, located under the **Advanced Configuration of Node, Configuration** tabs.

See Page 33 for a diagram showing Advanced Configuration tabs and sub-tabs.

7.1 Firewall and NAT Chains

NETKROM OS supports advanced firewall and NAT (Network Address Translation) functionality and features an easy management and monitoring interface, providing a turnkey solution for advanced and novice network administrators. However, a firewall mis-configuration may result in denial of service even for the administrator, outlining a high risk configuration.

NETKROM OS Firewall and NAT subsystems consist of four firewall and two NAT queue chains.

7.1.1 Firewall Chains

- **Input firewall** - All incoming traffic is tested against the input firewall rules prior to being accepted.
- **Output firewall** - All outgoing traffic is tested against the output firewall rules prior to being sent.
- **Forwarding firewall** - All traffic that is being forwarded through the operating system is tested against the forwarding firewall rules prior to being forwarded.
- **Flowmark** - All incoming traffic that matches the corresponding criterions is marked.

7.1.2 NAT Chains

- **DNAT** - Used to alter destination attributes of a packet (to redirect them).
- **SNAT** - Used to alter source attributes of a packet (to hide sender's address and properties).

The following image displays the way data packets flow through Firewall and NAT chains:

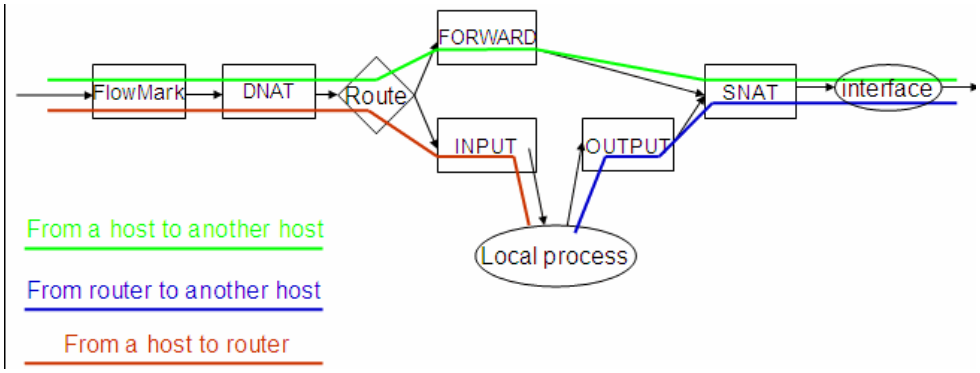


Figure 54. Packet flow diagram

7.2 Configuring Firewall Rules

Rules are entries in a chain consisting of several fields (criteria) that can be used to match a data packet. If all criteria are met, the rule is matched and the packet leaves the chain, launching the action of the matching rule.

From the Firewall tab you can

- **Select Chain**s
- Set up **Policy**
- Add, delete and manage Firewall **Rules** and **Flowmarks**
- **Write** rules to the active list
- **Refresh** the displayed information

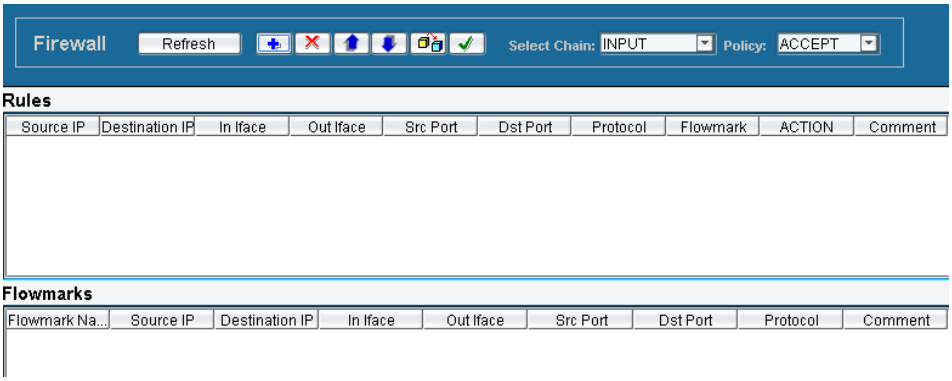


Figure 55. Firewall Chains

Before configuring a rule, you must **Select Chain** and set the **Policy.**

Select Chain

In the **Select Chain** drop down list, select **Input**, **Output** or **Forward**.

Policy

In the **Policy** drop down list, select **Accept** or **Drop.**

ACCEPT - The packet will flow to the next chain, leaving the current chain at this rule (no further rules in this chain are further examined),

DROP - The packet stops flowing, is discarded, without notifying the sender.

7.2.1 Configuring Firewall Matching Fields

Click the button. The **Firewall Rule Configuration for [chain type] Chain** dialog box appears. This dialog box contains two tabs: **Basic** and **Advanced.**

Not Check Boxes

In both tabs, several fields have a **Not** check box beside them. The Not field inverts the matching operation, causing a match to occur if the opposite of the rule is matched. For example, **Source IP**: is configured with the specific IP address. When the adjacent check box is selected the rule will match all packets **except** the ones that have the specified Source IP address.

Basic Rule Settings

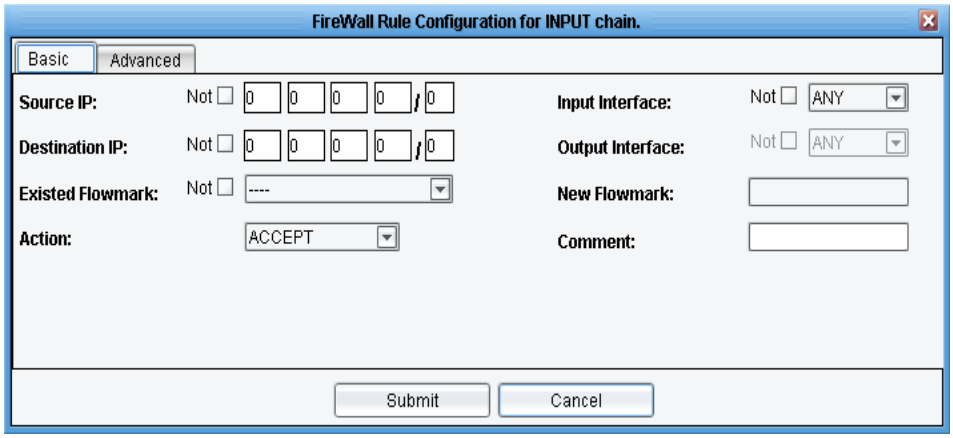


Figure 56. Firewall Rule Configuration Dialog Box, Basic Tab

Source IP

The **Source IP** field displays the Source IP address of the packet. The address can be expressed as a single IP address (e.g. 192.168.1.1/32), or as a whole IP subnet (e.g. 192.168.1.0/24). A match occurs if the source IP of the packet is exactly the same or belongs to the subnet configured.

Type the source IP address and number of subnet mask bits into the **Source IP** field.

Destination IP

The **Destination IP** field displays the Destination IP address of the packet. The address can be expressed as a single IP address (e.g. 192.168.1.1/32), or as a whole IP subnet (e.g. 192.168.1.0/24). A match occurs if the destination IP of the packet is exactly the same or belongs to the subnet configured.

Type the destination IP address and number of subnet mask bits into the **Destination IP** field.

Input Interface

The **Input Interface** field displays the interface from which the packet was delivered. A match occurs if the interface that the packet arrived from is the same as the configured interface (if the configured interface is a bridge, this also matches with interfaces under the bridge).

In the **Input Interface** drop down list, select a specific input interface, or select **ANY**.

Output Interface

The **Output Interface** field displays the interface from which the packet is to be transmitted. A match occurs if the interface that the packet will be transmitted from is the same with the configured interface (in case the

configured interface is a bridge, this also matches with interfaces under the bridge).

In the **Output Interface** drop down list, select a specific input interface, or select **ANY**.

Existing Flowmark

The **Existing Flowmark** drop down list contains Flowmarks that already have been configured. Select a Flowmark from the list to configure a Flowmark as a firewall matching rule. A match occurs if the packet was marked by this mark when it flowed through the Flowmark chain.

New Flowmark

The **New Flowmark** field is available if **Mark** is selected in the **Action** field. Type the name of the new flowmark in the **New Flowmark** box.

Action

When a rule is matched, its action is performed. Firewall actions can be:

ACCEPT - The packet will flow to the next chain, leaving the current chain at this rule (no further rules in this chain are further examined),

REJECT - The packet stops flowing, is discarded, and a return ICMP packet (reason code UNREACHABLE) is sent back to the sender.

DROP - The packet stops flowing, is discarded, without notifying the sender.

FORWARD - (currently not in use)

MARK - The packet will flow to the next chain, leaving the current chain at this rule (no further rules in this chain are further examined). It will be marked as **New Flowmark**.

Comment

The **Comment** field is used to enter a string consisting of at most 30 characters to describe the rule. This field is not used for matching.

Advanced Rule Settings

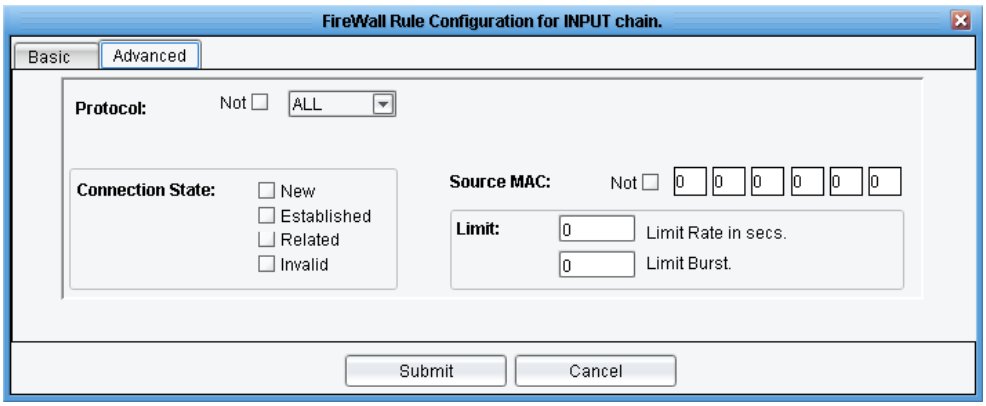


Figure 57. Firewall Rule Configuration Dialog Box, Advanced Tab

Protocol

The **Protocol** drop down list contains a list of protocols that can be selected for matching. The contents of the dialog box changes depending on the protocol selected. The following selections may be configured in this field:

- **ALL –** A match always occurs.
- **TCP** – A match occurs if

  1. the packet's protocol type is **TCP**

  AND

  2. the **SYN flag** of the packet matches based on which of the following is selected in the SYN flag drop down list:
     - **ALL** - matches always.
     - **SET** - A match occurs if the packet starts a new connection.
     - **NOT SET** - A match occurs if the packet is a member of a previously started connection.

  AND

  3. **Source Port** - Source port is entered as number (0-65535) where 0 indicates that all ports are matched.
  4. **Destination Port** - Destination port is entered as number (0-65535) where 0 indicates that all ports are matched.

Figure 58. Advanced Firewall Rule, TCP

- **UDP** – A match occurs if

  5. the packet's protocol type is **UDP**

  AND

  6. **Source Port** - Source port is entered as number (0-65535) where 0 indicates that all ports are matched.

  AND

  7. **Destination Port** - Destination port is entered as number (0-65535) where 0 indicates that all ports are matched.

- **ICMP** – A match occurs if

  8. the packet's protocol type is **ICMP**

  AND

  9. the **ICMP Type** matches based on which of the following is selected in the **ICMP Type** drop down list:

     1. **ANY**: A match occurs always
     2. **REQUEST**: A match occurs if the packet is an ICMP request.
     3. **RESPONSE**: A match occurs if the packet is an ICMP response.

- **GRE** – A match occurs if the packet's protocol type is **GRE** (Generic Routing Encapsulation)
- **ESP** - A match occurs if the packet's protocol type is **ESP**
- **AH** – A match occurs if the packet's protocol type is **AH**

Connection State

NETKROM can perform firewall functions based on the connection state. The following selections may be configured in this field:

New - A match occurs if the packet starts a new connection (router has seen packets in one direction).

Established - A match occurs if the packet is a member of an existing connection (router has seen packets in both directions).

Related - A match occurs if the packet starts a new connection, but is also a member of an existing connection (router has seen packets in both directions).

Invalid - A match occurs if the packet is not a member of an existing connection, but also it does not start a connection (ambiguous packet).

Source MAC

A match occurs if the packet's **Source MAC** address (in the Ethernet header) is the same as the address in this field. Type the **Source MAC** address in the **Source MAC** field

Limit

The **Limit** fields contain settings related to the rate at which the packet is arriving.

Limit Rate - A match occurs if the configured rate has not been reached yet.

Limit Burst - A match occurs if the configured burst rate has not been reached yet.

Important: *To enable a Firewall rule (write it to the active list) you must click the* *button.*

7.3 Configuring NAT Rules

Rules are entries in a chain consisting of several fields (criteria) that can be used to match a data packet. If all criteria are met, then the rule is matched and the packet leaves the chain, launching the action of the matching rule.

From the NAT tab you can

- Select the **NAT Kind**
- Add, delete, edit and manage NAT rules
- Write NAT rules to the active list

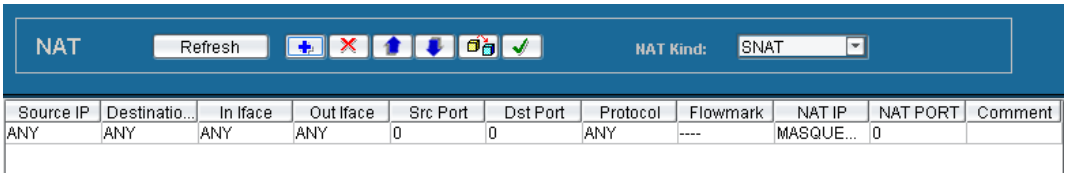


Figure 59. NAT Chains

Before configuring rules you must select the **NAT Kind** drop down list.

NAT Kind

In the **NAT Kind** drop down list, select **SNAT** or **DNAT.**

7.3.1 Configuring NAT Matching fields

To add a rule, click the button. The **NAT Rule Configuration for [NAT Kind] Chain** dialog box appears.

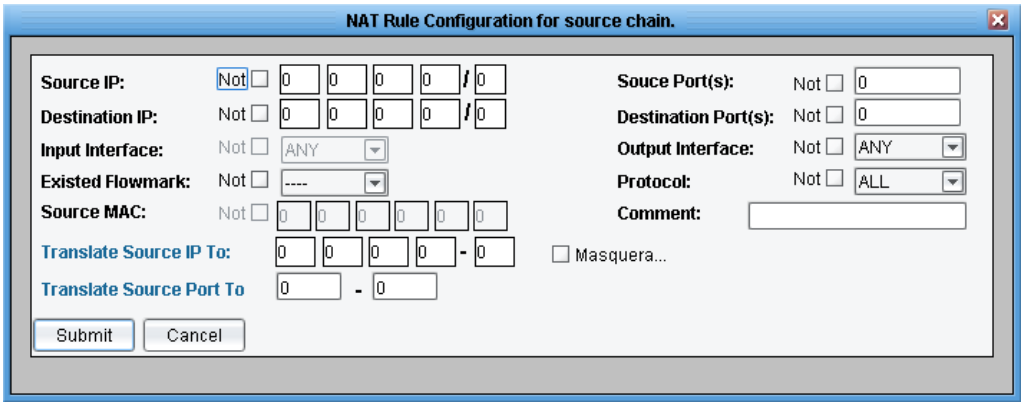


Figure 60. NAT Rule for Configuration for Source Chain Dialog Box

SNAT/DNAT Common Fields

The following fields are common to SNAT and DNAT configuration dialog boxes.

Not Check Boxes

Several fields have a **Not** check box beside them. The NOT field inverts the matching operation, causing a match to occur if the opposite of the rule is matched. For example, **Source MAC**: is configured with the specific MAC address. When the adjacent check box is selected the rule will match all packets **except** the ones that have the specified Source MAC address.

Source IP

The **Source IP** field displays the Source IP address of the packet. The address can be expressed as a single IP address (e.g. 192.168.1.1/32), or as a whole IP subnet (e.g. 192.168.1.0/24). A match occurs if the source IP of the packet is exactly the same or belongs to the subnet configured.

Type the source IP address and number of subnet mask bits into the **Source IP** field.

Destination IP

The **Destination IP** field displays the Destination IP address of the packet. The address can be expressed as a single IP address (e.g. 192.168.1.1/32), or as a whole IP subnet (e.g. 192.168.1.0/24). A match occurs if the destination IP of the packet is exactly the same or belongs to the subnet configured.

Type the destination IP address and number of subnet mask bits into the **Destination IP** field.

Source Port(s)

The **Source Port(s)** field displays the port number of the source node. A match occurs if the source port number is the same as the number in this field.

Type the source port number into the **Source Port** field.

Destination Port(s)

The **Destination Port(s)** field displays the port number of the destination node. A match occurs if the destination port number is the same as the number in this field.

Type the destination port number into the **Destination Port** field.

Input Interface

The **Input Interface** field displays the interface from which the packet was delivered. A match occurs if the interface that the packet arrived from is the same as the configured interface (if the configured interface is a bridge, this also matches with interfaces under the bridge).

In the **Input Interface** drop down list, select a specific input interface, or select **ANY**.

Output Interface

The **Output Interface** field displays the interface from which the packet is to be transmitted. A match occurs if the interface that the packet will be transmitted from is the same with the configured interface (in case the configured interface is a bridge, this also matches with interfaces under the bridge).

In the **Output Interface** drop down list, select a specific input interface, or select **ANY**.

Existing Flowmark

The **Existing Flowmark** drop down list contains Flowmarks that already have been configured. Select a Flowmark from the list to configure a Flowmark as a firewall matching rule. A match occurs if the packet was marked by this mark when it flowed through the Flowmark chain.

Protocol

The **Protocol** drop down list contains a list of protocols that can be selected for matching. The following selections may be configured in this field:

- **ALL –** A match always occurs.
- **TCP** – A match occurs if

    10. The **Source port** is entered as a number from 0 to 65535, where 0 indicates that all ports are matched.

11. The **Destination port** is entered as a number from 0 to 65535, where 0 indicates that all ports are matched.

- **UDP** - A match occurs if packet's protocol type is UDP and,
  12. The **Source port** is entered as a number from 0 to 65535, where 0 indicates that all ports are matched.
  13. The **Destination port** is entered as a number from 0 to 65535, where 0 indicates that all ports are matched.
- **ICMP -** A match occurs if packet's protocol type is ICMP
- **GRE -** A match occurs if packet's protocol type is GRE
- ***AH* -** A match occurs if packet's protocol type is AH
- ***ESP* -** A match occurs if packet's protocol type is ESP

Source MAC

Sender's MAC address. A match occurs if the packet's Source MAC address (in the Ethernet header) is the same.

Comment

The **Comment** field is used to enter a string consisting of at most 30 characters to describe the rule. This field is not used for matching.

SNAT Chain Specific Fields

The following fields are available in the SNAT configuration dialog box.

Masquerade: The IP address to be assigned to outgoing packets is dynamically retrieved by the current outgoing interface's IP address (does not need to explicitly configure the outgoing source IP address).

Translate Source IP to: The IP address (or range of IP addresses) that the source IP of the packet will change to. In case there is a range of IP addresses, a round robin algorithm is used to assign addresses.

Translate Source Port to: The range of the router's ports used to send NATed packets and track for responses.

DNAT Chain Specific Fields

The following fields are available in the DNAT configuration dialog box.

Redirect – When a match occurs, the packet will be redirected to another port of the router.

Translate Dest IP to – The IP address (or range of IP addresses) that the destination IP of the packet will change to. In case there is a range of IP addresses, a round robin algorithm is used to assign addresses. This is used to **forward the packet to another host**.

Translate Dest Port to – The port that the packet will be sent to (in case there is a range of ports, a round robin algorithm is used).

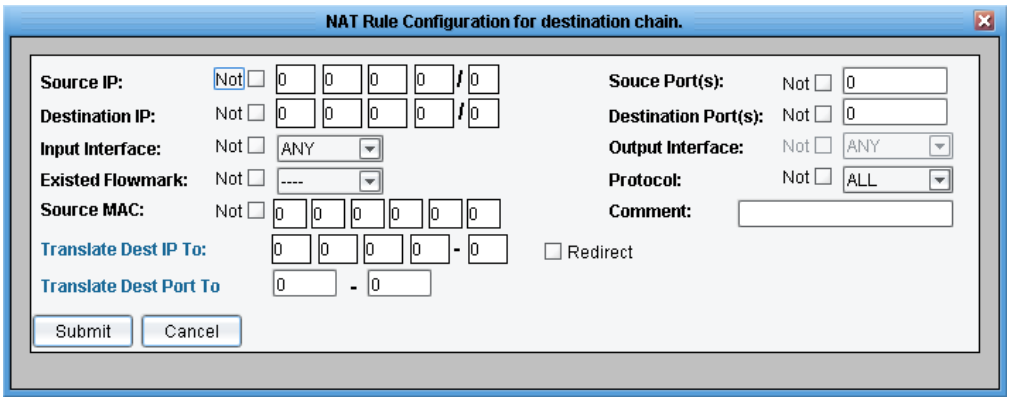


Figure 61. NAT Rule for Configuration for Destination Chain Dialog Box

Important: *To enable a NAT rule (write it to the active list) you must click the* *button.*

7.3.2 Examples

The following examples may be helpful in understanding how to configure Firewall and NAT rules.

Deny incoming SSH connections to your router from the internet.

SSH service by default runs on port 22. Assume that the router is connected to the internet through interface eth0. To disallow incoming SSH connections from the internet, you can insert a rule in the Input chain of the Firewall system that will drop this kind of connection (because they are TCP connections, SYN flag will be set).

To accomplish this, configure the Firewall rules as follows:

In the Basic tab:

Source IP:	0.0.0.0/0 (any)
Destination IP:	0.0.0.0/0 (any)
Input interface:	eth0 (the connection to internet)
Comment:	no_SSH_connect
ACTION:	DROP

In the Advanced tab:

Protocol:	TCP
SYN Flag:	SET
Source Port:	0(any)
Destination Port:	22(SSH)

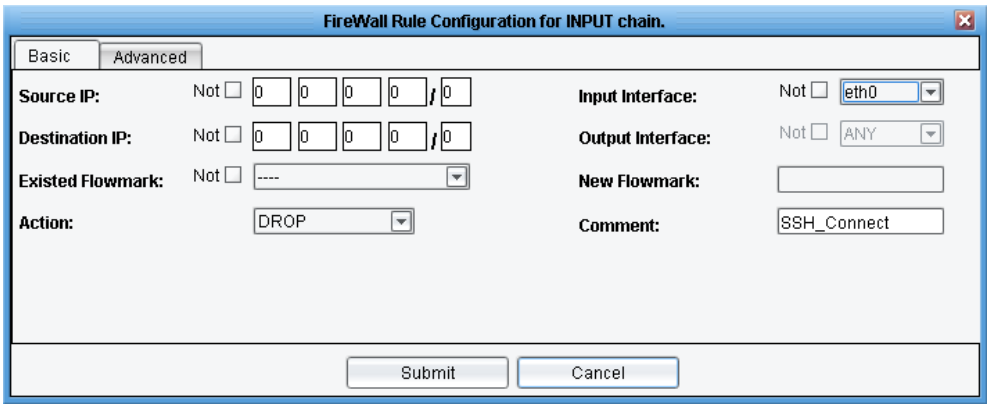


Figure 62. Basic Rule Example Configuration

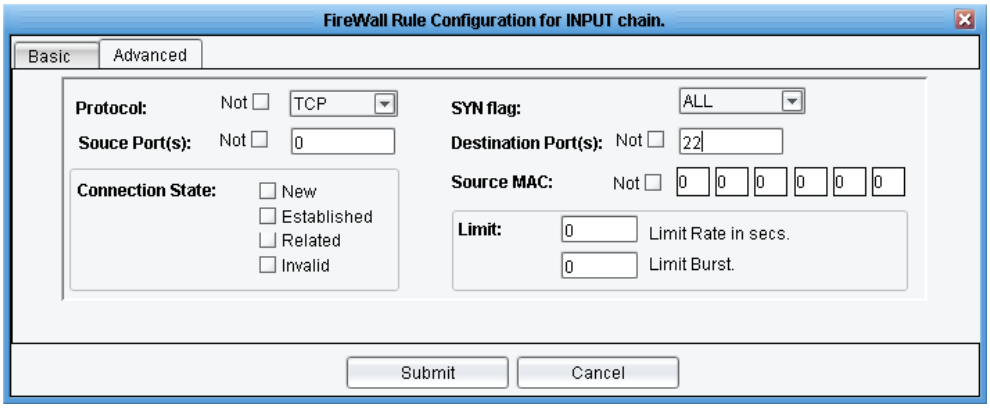


Figure 63. Advanced Rule Example Configuration

Click **Submit** to add the rule to the list and apply it to the router.

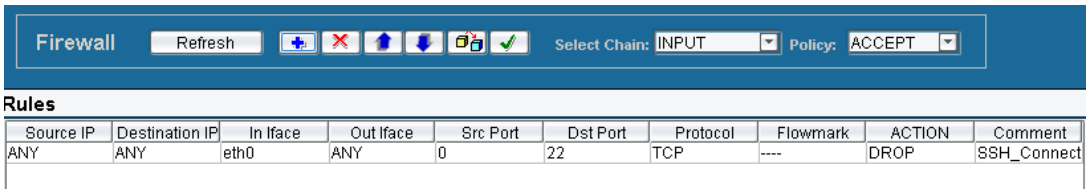


Figure 64. Example Firewall Tab

NAT: Having a single public IP address, allow whole local network to access the internet.

Assume that the router is connected to the internet through interface eth0 and IP address 173.55.1.2/24. Your local network is connected to router's eth1 interface with IP address 192.168.1.1/24. You should masquerade all outgoing traffic to the internet (interface eth0) originated from your local network (interface eth1).

Insert a rule to the SNAT chain as follows:

Details

Source IP: 192.168.1.0/24 (local network)

Output Interface: eth0

Translate Source IP to: 0.0.0.0-0 MASQUERADE (eth0's IP address)

Comment: NAT_on_WAN

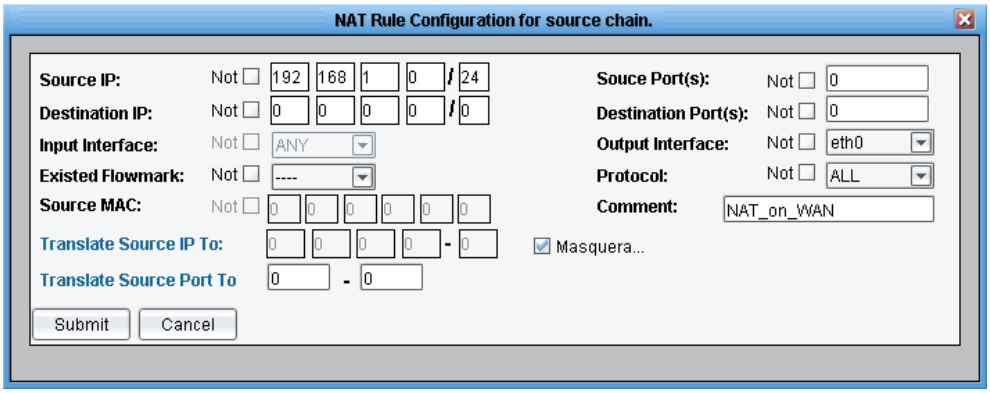


Figure 65. NAT Configuration - Masquerade Example

Click **Submit** to add the rule to the list and apply it to the router.

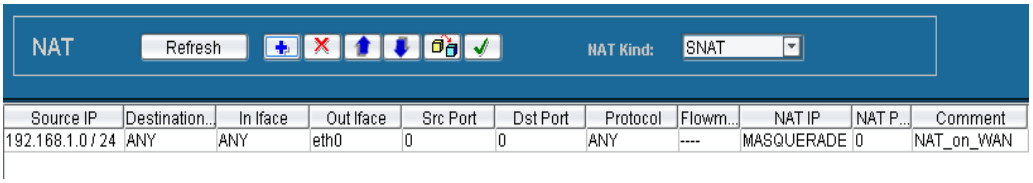


Figure 66. NAT Tab - Masquerade Example

HINT: make sure IP Forwarding is enabled on the router (Interface settings Panel).

Important: To enable a NAT rule (write it to the active list) you must click the button.

8. DHCP

8. DHCP

The **Dynamic Host Configuration Protocol (DHCP)** provides configuration parameters to Internet hosts in a client-server model. DHCP server hosts allocate network addresses and deliver configuration parameters to other (client) hosts.

DHCP consists of two components: a protocol for delivering host-specific configuration parameters from a server to a host and a mechanism for allocation of network addresses to hosts.

To configure **DHCP** settings, select the **DHCP** tab, located under the **Advanced Configuration of Node, Configuration** tabs. The DHCP tab contains two sub-tabs: **Server** and **Client**, selected by clicking the corresponding option button.

See Page 33 for a diagram showing Advanced Configuration tabs and sub-tabs.

8.1 Configuring a DHCP SERVER

The NETKROM DHCP server provides an extended set of configuration parameters while at the same time being effective and low resource consuming.

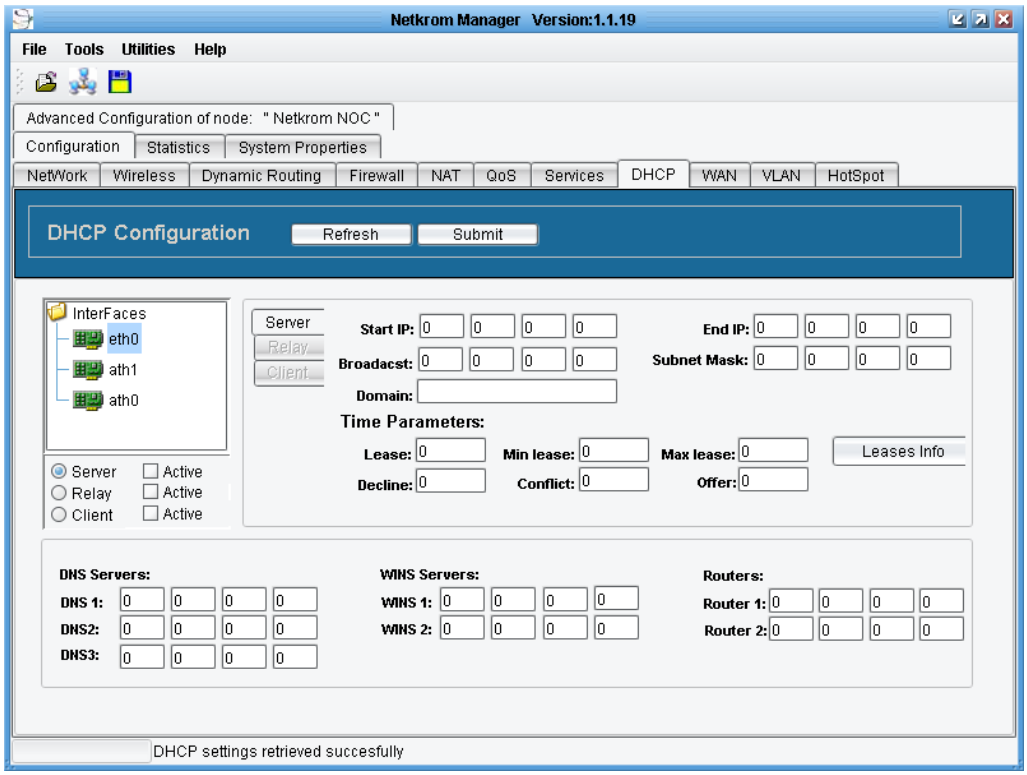


Figure 67. DHCP Server Configuration Dialog Box

To configure a **DHCP Server**, select the interface from the interface tree. Its background turns blue. Only clients in the same physical interface will be able to acquire IP addresses from this DHCP server. If clients from other physical interfaces must acquire their IP addresses from the same server a bridge should be created, and those interfaces should be added under that bridge. Then, select that bridge as the DHCP server interface.

NOTE: *You cannot select an interface which is under a bridge as the DHCP server interface. Additionally the DHCP server interface should have already been configured with a valid IP address and subnet mask. Multiple DHCP servers on different interfaces are allowed.*

8.1.1 Setting DHCP Server Fields

To configure DHCP server settings, select the **Server** option button and select the **Active** check box. The **Server** tab becomes available.

After completing the required fields, click the **Submit** button**.** This uploads the configuration to the node without starting the server.

Start IP and End IP

Type the appropriate IP addresses into the **Start IP** and **End IP** fields. These are the upper and lower limits for the DHCP server address pool.

Broadcast

Type the appropriate IP address into the **Broadcast** field. This field contains the IP address clients will use. Broadcast IP should be one of the addresses the Subnet Mask permits.

Subnet Mask

Type the appropriate IP address into the **Subnet** Mask field. This is the subnet mask clients will use.

Domain

Type the **Domain** name (if any) that will be allocated to clients into this text box.

Time Parameters

For each of the following fields, type the appropriate value into the box.

Lease

The **Lease** field contains the number of seconds an allocated IP is valid. After expiration the client has to renegotiate for getting a new IP (which is usually the same). The expiration time that the client adopts depends on the operating system running on the client and the DHCP client configuration.

Decline

The **Decline** field contains the number of seconds that an IP will be reserved (leased) for if a DHCP decline message is received.

Min Lease

The **Min Lease** field contains the minimum number of seconds. If a lease to be given is below this value (sec), the full lease time is used instead.

Conflict

The **Conflict** field contains the amount of time (sec) that an IP address will be reserved (leased) if an ARP conflict (two clients with the same IP address) occurs.

Max Lease

The **Max** Lease field contains the maximum number of current leases (allocated IP addresses). After this limit is reached the server stops assigning IP addresses to new clients.

Offer

The **Offer** field contains the number of seconds an offered address is reserved (leased). This field specifies the number of seconds the DHCP

server should cache the offers it has extended to discovering DHCP clients. The default value is 60 seconds. On fast network media this value can be decreased.

DNS Servers

In the three **DNS Servers** fields (DNS 1, DNS 2 and DNS 3), type the IP addresses of the DNS servers that DHCP clients will use for DNS requests.

WINS Servers

If there are WINS servers that client should use, type the addresses in the **WINS Servers** fields (WINS 1 and WINS 2).

Routers

In the **Routers** fields (Router 1 and Router 2), type the IP addresses of the routers (default gateways) the client can use.

Leases Info

Click the **Leases Info** button to access the **DHCP Leases** dialog box that displays all the allocated leases.

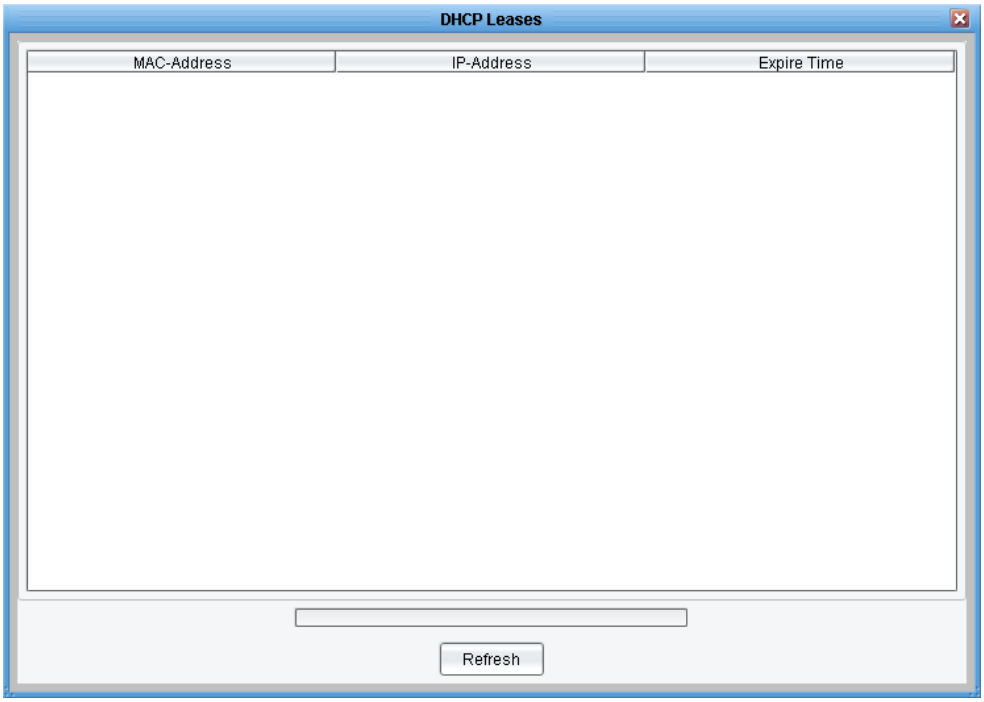


Figure 68. DHCP Leases Dialog Box

In the current version DHCP server configuration does not support dynamic changing of the DHCP leases file. After an IP allocation you are

able to see the new record in the DHCP Leases dialog after approximately a 60 second delay.

8.1.2 Lease Time Strategies

One of the most common DHCP administration questions is, "What setting should I give my lease times?" As with many networking questions, the answer is, "It depends." The primary decision criterion is the desired frequency at which your clients update their configuration data.

If you are using DHCP only for randomized address assignments, having longer lease times will result in greater levels of stability. For example, if you use lease duration times of one month or longer, a temporary server outage is not likely to affect your normal operations much. However, if you are using DHCP for a variety of system-configuration options (such as default DNS servers and static routes), you will want to have shorter lease times so that changes to the network are recognized quickly by the DHCP clients. In this case, having lease times that are longer than a day or two can be problematic because clients that obtain a new lease just before a critical infrastructure change is made will not recognize this change until the lease expires or gets renewed.

For dynamic environments, there are two common lease-duration strategies. The first calls for leases to be renewed halfway through a working day (such as having them expire every eight hours, which will cause them to be renewed after four hours). Another strategy is to set the lease duration to a multiple of two and a half times the working day (that is, 20 hours for an eight-hour working day), causing the leases to completely expire overnight and thus be renegotiated every morning. The former strategy works well on networks that keep their machines running all of the time, while the latter strategy works well on networks where systems are powered down or otherwise removed from the network at night.

Be forewarned, however, that both strategies expose the network to problems if the DHCP server goes down or is on a remote network that is subject to outages. If the DHCP clients are getting their lease data from a remote DHCP server that is on the other side of a WAN link that is even minimally prone to failure, chances are good that short lease times will result in at least a few failed lease renewals.

8.2 Configuring a DHCP CLIENT

Configuration of the **DHCP Client** application is simple. The only requirement is selection of the interface where the DHCP client will search for DHCP servers.

Similar to DHCP server configuration, multiple instances of DHCP client on different interfaces are allowed.

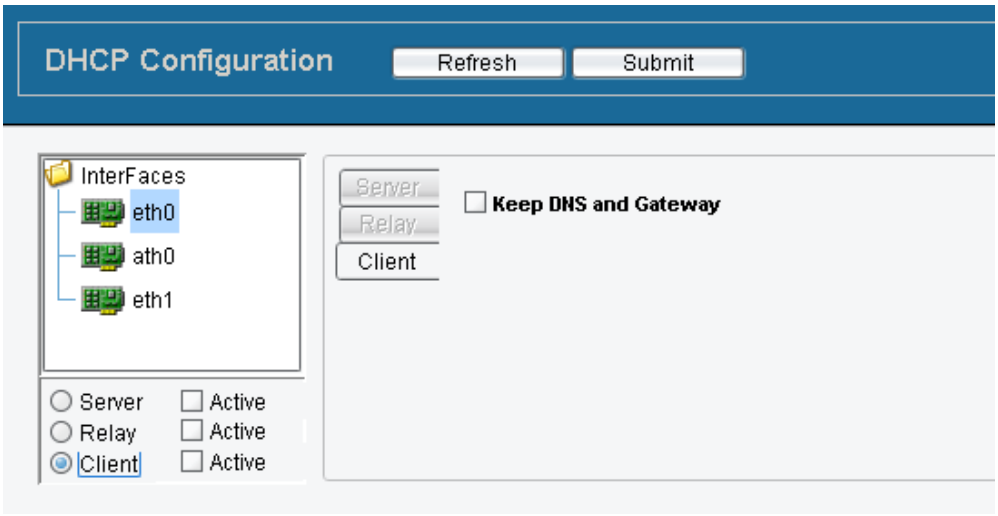


Figure 69. DHCP Client

To configure a **DHCP Client**, select the interface from the interface tree. Its background turns blue.

To configure DHCP client settings, select the **Client** option button and select the **Active** check box. The **Client** tab becomes available.

To prevent the changing of a client's default system gateway and DNS addresses when the client receives an IP address from the server, select the **Keep DNS and Gateway** check box. This is useful when you already have set a static default gateway and DNS and want them to remain unchanged, or if they are to be configured from another application (e.g. PPPoE client). In most other cases this field should be remain unselected.

To complete the configuration, click the **Submit** button**.**

8.3 Configuring a DHCP Relay

DHCP does not require a server on each subnet. To allow for scale and economy, a relay agent can be installed listening to DHCP messages and forwarding them on (and onto other network segments). This eliminates the necessity of having a DHCP server on each physical network.

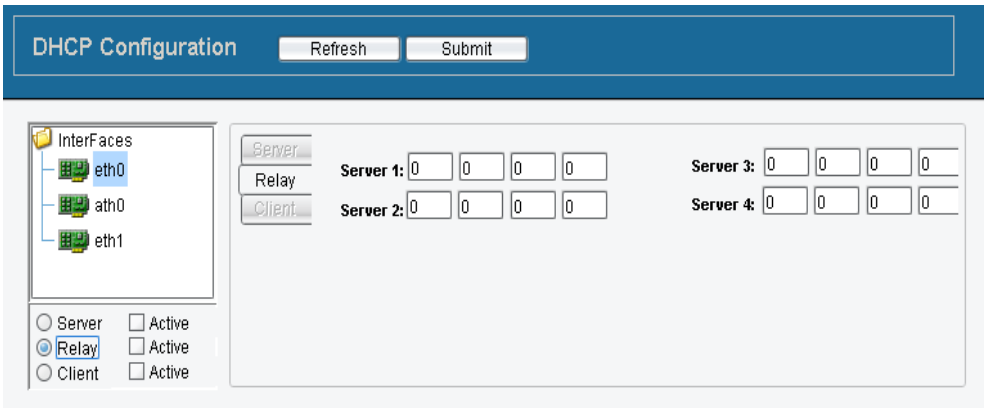


Figure 70. DHCP Relay

To configure a **DHCP Relay**, select the interface from the interface tree. Its background turns blue.

To view the full **DHCP Relay** pane, select the **Relay** option button, then select the **Active** check box. The **Relay Configuration** pane appears.

The **Relay Configuration** pane represents the subnet (LAN) where a relay listens for client DHCP requests in order to forward them to DHCP servers **Server 1**, **Server 2**, **Server 3** or **Server 4**. Type the appropriate IP addresses in these fields.

Interface where application relays on should has a valid ip and subnet mask and like the other DHCP apis, DHCP relay can have multiple instances on different interfaces.

To complete the configuration, click **Submit.**

9. WAN

9. WAN

To configure **WAN** settings, select the **WAN** tab, located under the **Advanced Configuration of Node, Configuration** tabs. The WAN tab contains two sub-tabs: **PPPoE** and **PPTP**, selected by clicking the corresponding option button.

See Page 33 for a diagram showing Advanced Configuration tabs and sub-tabs.

9.1 Configuring a PPPoE CLIENT

The PPPoE client application is used to create PPPoE connections with PPPoE servers mainly used by Internet Service Providers.

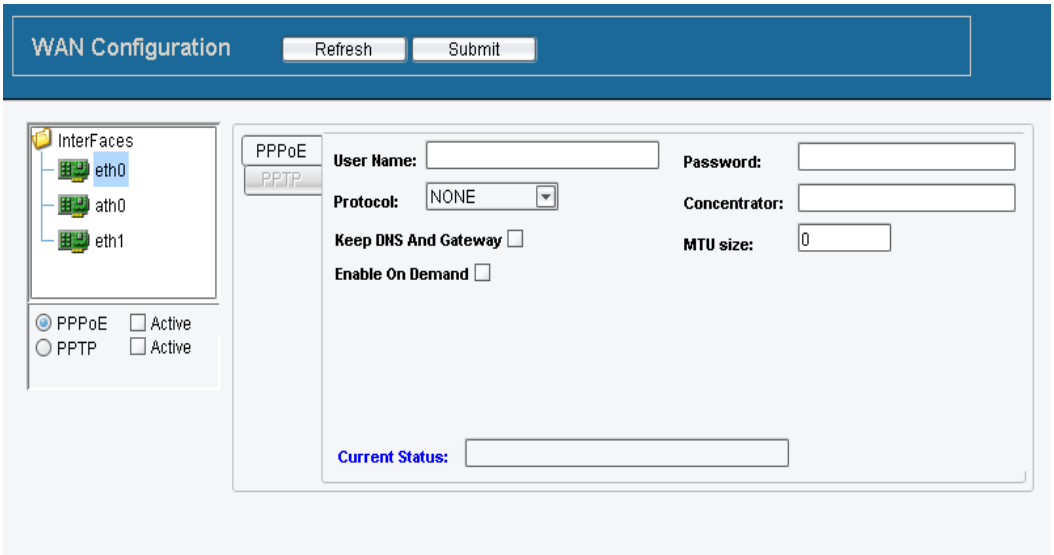


Figure 71. PPPoE Configuration

To configure a **PPPoE Client**, select the interface from the interface tree. Its background turns blue. This interface usually shares the same medium with an ADSL modem (in bridge mode). There is no need for a pre-configured valid IP address and subnet mask on this interface.

To view the full PPPoE tab, select the **PPPoE** option button and select the **Active** check box. The **PPPoE tab** appears.

After completing the required fields, click **Submit.**

9.1.1 Setting PPPoE Client Fields

User Name

Type the **User Name** for the client that will be used to authenticate with the PPPoE server (usually supplied by the ISP).

Password

Type a **Password** (more than three characters) for the client. This is used to authenticate with the PPPoE server and is usually supplied by the ISP.

Protocol

In the **Protocol** drop down list, select the **Protocol** to be used for authentication with the PPPoE server. Protocol options are: **None, PAP** and **CHAP**.

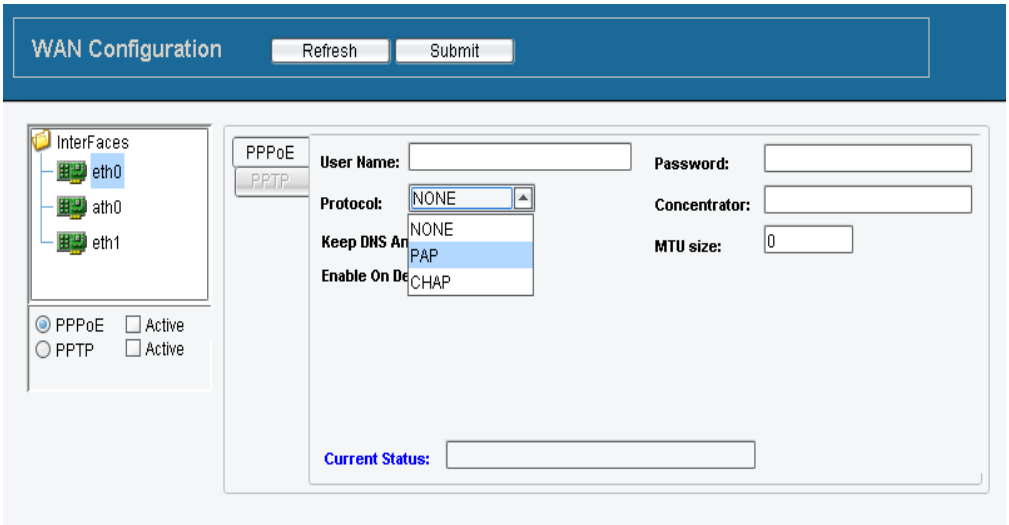


Figure 72. PPPoE Protocol Selection

Concentrator

The **Concentrator** contains the name of a server and relates to the case where there are multiple PPPoE servers available. If those servers have a valuable name (called a Concentrator name) you can choose the proper one by type the correct name into this field.

Keep DNS and Gateway

In most cases PPPoE authentication supplies the client with some valid DNS addresses and makes the PPPoE interface the default system gateway. To set a static DNS address and/or a default gateway, or leave another application to configure them, (e.g. DHCP client), select the **Keep DNS and Gateway** check box.

MTU size

The normal Ethernet MTU is 1500 bytes in length, but the PPPoE overhead, plus two bytes of overhead for the encapsulated PPP frame, mean that the MTU of the PPP interface is at most 1492 bytes. This causes all kinds of problems if you are using a Linux machine as a firewall and interfaces behind the firewall have an MTU greater than 1492. For safety MTU size must be an integer between 536 and 1412.

Enable on Demand

Enable on Demand is a feature which enables the functionality of creating a PPPoE connection only when there is IP traffic on a PPPoE interface. Some ISPs offer connection agreements where charging depends on time. In these cases this feature could be valuable. When the **Enable on Demand** check box is selected, the following fields appear: **Remote Domain, Remote IP** and **Demand Time**

To configure this field identify the PPPoE server by its IP address and type the address into the **Remote IP** field, **OR** determine its domain name and type it into the **Remote Domain** field. Then type a time period (seconds) into the **Demand Time** field. If a PPPoE connection remains idle for this period, the connection closes until you try to use it again (probably from a PC behind the router).

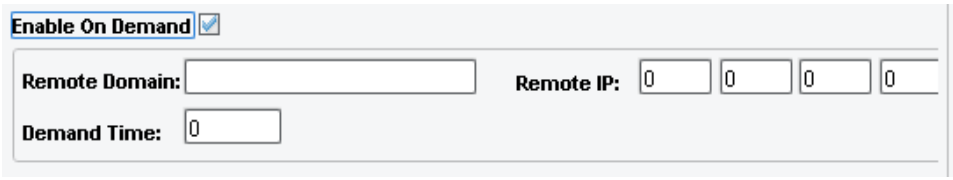


Figure 73. PPPoE - Enable on Demand Settings

Current Status

When you click the Refresh button the **Current Status** field displays information on the current connection (whether there is a connection or the reason for an unsuccessful attempt to connect).

9.2 Configuring a PPTP Client

The PPTP client application is used to create PPTP connections with PPTP servers mainly used by Internet Service Providers.

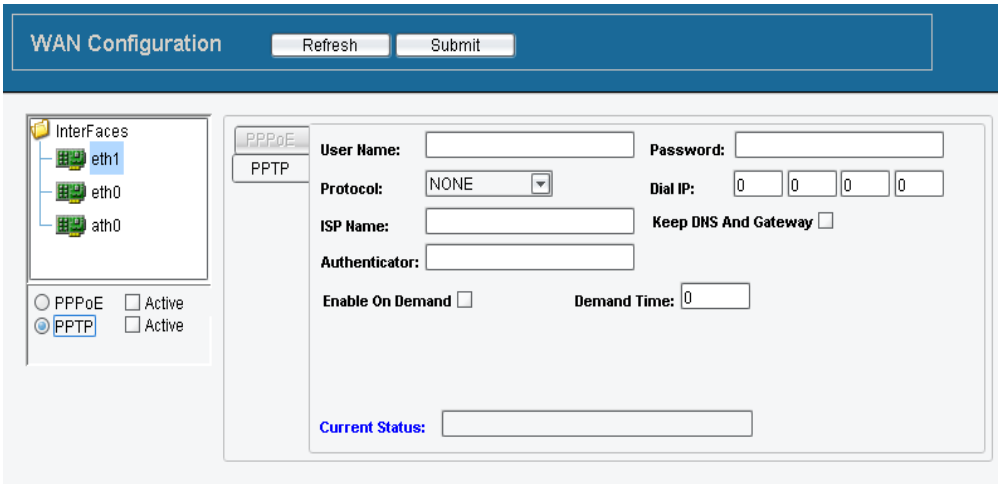


Figure 74. WAN - PPTP Settings

To configure a **PPTP Client**, select the interface from the interface tree. Its background turns blue. This interface must be pre-configured with a valid IP address and subnet mask from the PPTP server subnet or it should be able to "see" PPTP server in some way (e.g. through default gateway).

To view the full PPTP tab, select the **PPTP** option button and select the **Active** check box. The **PPTP tab** appears.

After completing the required fields, click **Submit.**

9.2.1 Setting PPTP Client Fields

User Name

Type the **User Name** for the client that will be used to authenticate with the PPTP server (usually supplied by the ISP).

Password

Type a **Password** (more than three characters) for the client. This is used to authenticate with the PPTP server and is usually supplied by the ISP.

Protocol

In the **Protocol** drop down list, select the **Protocol** to be used for authentication with the PPTP server. Protocol options are: **None, PAP** and **CHAP**.

Dial IP or ISP Name

To identify the PPTP server, type the IP address in the **Dial IP** field, OR type the DNS name of the PPTP service in the **ISP Name** field.

Keep DNS and Gateway

In most cases PPTP authentication supplies the client with some valid DNS addresses and makes the PPPoE interface the default system gateway. To set a static DNS address and/or a default gateway, or leave another application to configure them, (e.g. DHCP client), select the **Keep DNS and Gateway** check box.

Authenticator

Some PPTP servers require an **Authenticator** field called to establish a PPTP connection. This name usually is provided by ISPs.

Enable on Demand

Enable on demand is a feature which enables the functionality of creating a PPTP connection only when there is IP traffic on a PPTP interface. Some ISPs offer connection agreements where charging depends on time. In these cases this feature could be valuable.

Select the **Enable on Demand** check box, then type a time period (seconds) into the **Demand Time** field. If a PPTP connection remains idle for this period, the connection closes until you try to use it again (probably from a PC behind the router).

Current Status

When you click the Refresh button the **Current Status** field displays information on the current connection (whether there is a connection or the reason for an unsuccessful attempt to connect).

10. Quality of Service

10. Quality of Service

Quality of service (also know as Traffic Shaping) refers to the general concept of prioritizing network traffic, according to some of its properties. By default, each packet is treated equally and in a first-come, first-served basis. However, by utilizing QoS, certain traffic patterns, can be given higher priority or can be guaranteed specific network resources. From now on, we will refer to a traffic pattern as class.

Some of the policies that can be enforced with QoS are:

- Restrict or eliminate the bandwidth consumed by P2P applications.
- Distribute the available bandwidth equally among a group of HOTSPOT users.
- Make sure that certain services (eg. the web portal of a hotspot) will always be accessible, no matter how overloaded the network is.
- Reserve a portion of the available bandwidth for latency-sensitive applications, like VoIP.
- Mitigate DoS attacks by restricting the network usage available for specific kinds of traffic (eg. ICMP traffic).

10.1 The QoS window tab

Let's have a look first, at the overall GUI interface (Picture 77).

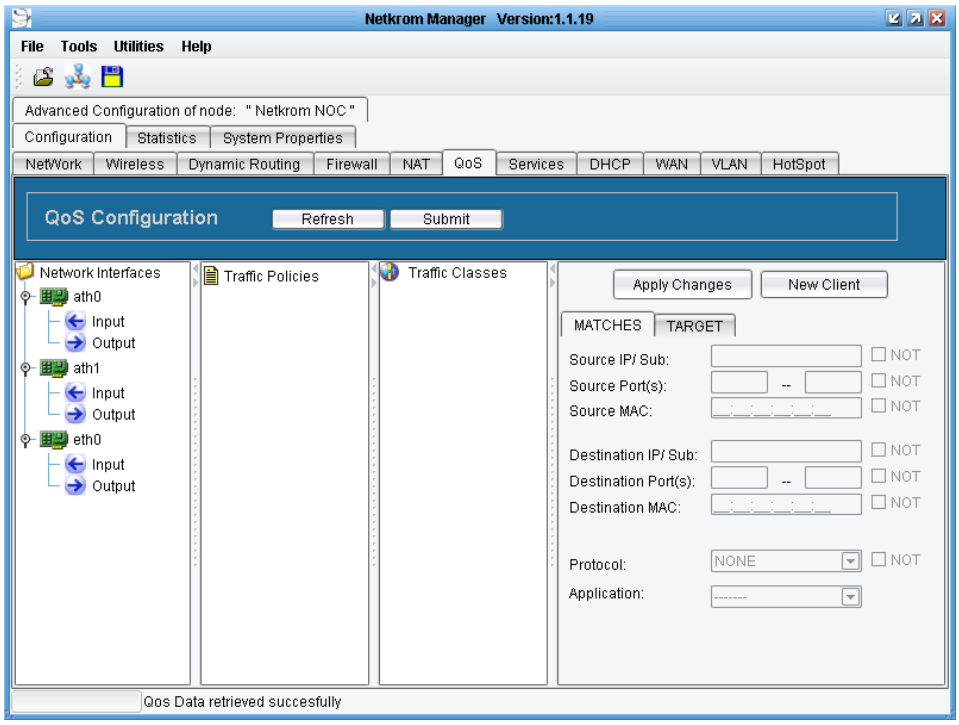


Figure 75. The QoS window

There are three main columns:

10.1.1 Traffic Classes

Traffic classes are entities to which we associate specific traffic patterns, and specific network resources. The traffic patterns constitute the *Matches* associated to a Traffic Class, and the network resources reserved, comprises the *Target* of the Traffic Class. These properties can be configured via the rightmost panel of the QoS window.

To add a new Traffic Class, you have to right-click on the "Traffic Classes" label in the respective Panel. You can define as many Traffic Classes as you wish. A Traffic Class can also form a tree-like hierarchy of Subclasses. The tree may have at most two layers of subclasses (Picture 78).

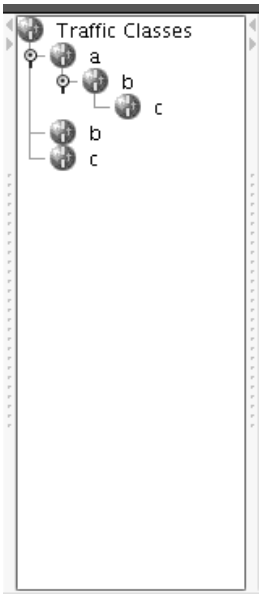


Figure 76. Three layer class hierarchy

10.1.2 Traffic Policies

A Traffic policy is an object to which we associate one or more classes and one or more interfaces. The set of classes assigned to a Traffic Policy, defines the policy for the associated interfaces. The way you assign classes to policies is unlimited. Traffic policies can be shared by many interfaces, in which case the interfaces are unified from the QoS standpoint. Shared polices will be discussed in more depth later in this chapter.

10.1.3 Network Interfaces

This panel lists all physical interfaces of the system. For each interface, we distinguish two flows: An incoming one, which corresponds to traffic coming to the interface, from the underlying physical layer, and an outgoing one, which corresponds to traffic going out of the interface, to the physical layer.

***Note**: Bridges and virtual interfaces will not be present here. If you want to set a policy to a bridge, set the same traffic policy to every physical interface that makes up the bridge. Virtual interfaces can only be distinguished, in the basis of their ip address.*

Bear in mind, that you can't assign **more than one policy per interface flow**; as well as, **the same policy to both flows of the same interface**.

The way that Classes, Policies and Interfaces are interrelated is depicted in picture 79.

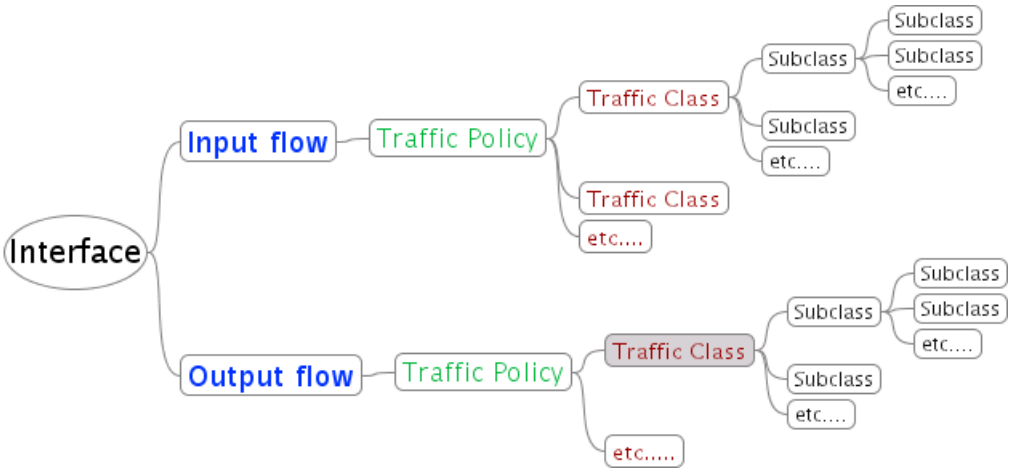


Figure 77. Classes, Policies and Interfaces

Associations are carried out by drag&dropping one to item on another.

10.2 Differentiating network traffic

The network traffic can be categorized by almost any combination of the following properties

Inbound/Outbound Interface	eg. Eth0 in, ath0 out
Source/Destination IP/subnet	eg. 192.168.2.0/24, 172.16.1.1/32
Source/Destination IP port range	eg. 0-1024, 520
Source/Destination Mac	eg. 01:02:03:04:05:06
Protocol	eg. IP, TCP, UDP, ICMP, ...
Application	eg. P2P traffic, etc
Negations of most of the aforementioned	eg. ! 192.168.1.1/32

These parameters constitute the MATCH part of a class. The GUI panel responsible for these options is depicted at picture 80.

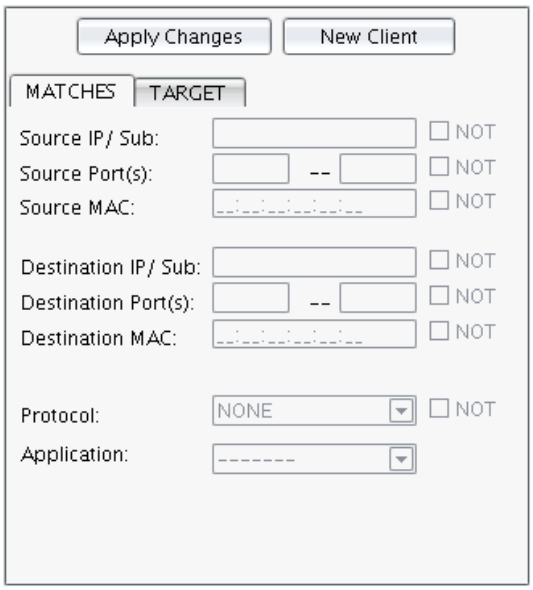


Figure 78. Network Traffic Matches

10.3 Guarantees and Limitations

On the other hand, the network resources that can be guaranteed or limited are:

- Committed Information Rate
- Peak Information Rate
- Committed Burst Size
- Excess Burst Size
- Priority

These parameters constitute the TARGET part of a class. The GUI interface responsible for these options are depicted in Picture 81.

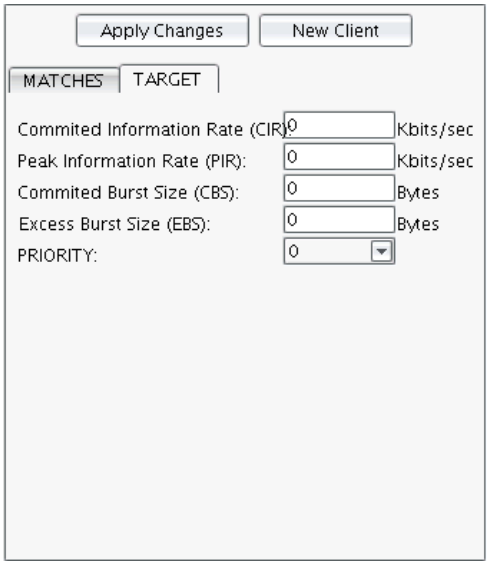


Figure 79. Policy parameters

10.3.1 Committed Information Rate (CIR)

This is the rate (expressed in kbits/s) which is guaranteed that will always be available to the respective traffic class. Apparently, the CIF dedicated for a specific class, can not exceed the network bandwidth available. When multiple competing classes exist for the same interface and for the same direction (output/input), the sum of all of them should also not overrun the available bandwidth.

Note that, regardless of the CIR the traffic is always transmitted at the maximum speed supported by the physical interface. Literally, the CIR expresses the average rate in which the traffic is sent, in due time.

10.3.2 Peak Information Rate (PIR)

This is the maximum rate (in kbits/s) in which, the traffic of a class, can be sent or received (in average). Even if no other traffic competes for the bandwidth, this barrier can not be exceeded. This value can be as large as the capacity of the link and as small as the CIR.

The bandwidth between CIR and PIR is not guaranteed for a class. The possibility for a class to exploit this range, depends on its priority as we will see later.

10.3.3 Excess Burst Size (EBS)

Some applications are characterized by short periods of intensive network usage and long periods with no network usage at all. For instance, when we browse the Internet, our web browser requests a web page and then remains idle for a long period of time, until another page is requested.

Such applications are not served well by the CIR/PIR mechanism alone. The EBS mechanism remedies this problem by allowing an application to send a number of bytes continuously, for some time, without being interrupted. As soon as EBC bytes have been sent, the application is forced back to normal behavior (average rate ranging between CIR and PIR).

10.3.4 Committed Burst Size (CBS)

The CBS corresponds to the minimum number of bytes that have to be available in order for a transmission to start. By the time that the transmission starts, it is not possible to be interrupted, until there are no other data to send. By default this value is the smallest possible (a single packet size ideally) and scarcely will you have to set a different value.

In order to better understand the concept of rate and burst, consider the analogy: Each class (or subclass as we will see later) is like a bucket with size EBS. The bucket is filled up at a rate which ranges between CIR and PIR. In accordance with this analogy, transmission starts when we throw water out of the bucket. The minimum quantity of water (traffic) that we can be thrown out is CBS. Therefore, when a class is idle for a while, it's possible for an application later on, to send a large burst of data, until the "bucket" is empty. Similarly, for a class that sends traffic at a steady rate, lower than CIR, its "bucket" will always be filled up.

10.3.5 Priority

The Priority value dictates which class, among those at the same layer, will get the unused bandwidth. This bandwidth comes from those classes that are not fully utilizing their CIR. This extra bandwidth is delivered first to the class with the highest priority and as soon as the PIR (or EBS) of this class is reached, the distribution continues to the next class in order of priority. Priority value can vary between 0 (higher priority) and 7 (lower priority).

Consider the scenario: We have a standard 11mbps wireless link, and we want to guarantee half of it, to outgoing TCP traffic. Then we further divide it to TCP traffic destined for host x, and that destined to host y. This scenario is depicted in the following table.

Classes in the table denoted as "auto", are classes that are automatically (and transparently) created by the system to handle unclassified traffic. These automatically generated classes, get the rest of the bandwidth (as its CIR), which is not reserved for any of the user-defined ones. System generated classes are always of priority 7.

<table>
<tr><th colspan="4">11 mbps Link Bandwidth</th></tr>
<tr><td colspan="3">USER CLASS</td><td>AUTO CLASS</td></tr>
<tr><td colspan="3">CIR 5,5 mbps: Outgoing TCP</td><td>CIR 5,5 mbps: Anything but TCP</td></tr>
<tr><td colspan="3">Priority 0</td><td>Priority 7</td></tr>
<tr><td>USER SUBCLASS 1</td><td>USER SUBCLASS 2</td><td>AUTO SUBCLASS</td><td rowspan="3">No subclasses available</td></tr>
<tr><td>1,8 mbps
host x</td><td>1,8 mbps
host y</td><td>Rest traffic
(1,8 mbps)</td></tr>
<tr><td>Priority 0</td><td>Priority 1</td><td>Priority 7</td></tr>
</table>

Back in our scenario:

Let's assume now that 7 mbps traffic (out of the 11 mbps) qualifies for the USER CLASS. This means that we have 7 mbps TCP traffic, which has to be distributed among the three subclasses. Let's also assume that 1/3 of this traffic is destined for host x and another 1/3 for host y. Although, it might be tempting to say that, its of the subclasses will get 1/3 of the 7 mbps, in actual, SUBCLASS 2 and AUTO SUBCLASS will get exactly 1,8 mbps (the CIR) and SUBCLASS 1 will get 3,4 mbps. This is because SUBCLASS 1 has a higher priority. If there is no traffic at all for SUBCLASS 1, then SUBCLASS 2 will get 5,2 out of the 7 mbps available. By now, the role of priority should be clear.

10.4 Example: Bandwidth reservation for FTP Servers

Let's have a look now at one example, in order to better comprehend the QoS mechanism. Let's say that we have a NETKROM OS powered Hotspot, equipped with an standard 11mbps wireless interface. The **real available** bandwidth on such an interface is approximately 5.5mbps or 5500kbps. On the ethernet side, there are two ftp servers and a bunch of other insignificant hosts. The ftp servers are meant to serve the hotspot clients. Hence, we would like to guarantee some bandwidth for them. The network layout is illustrated in picture 82.

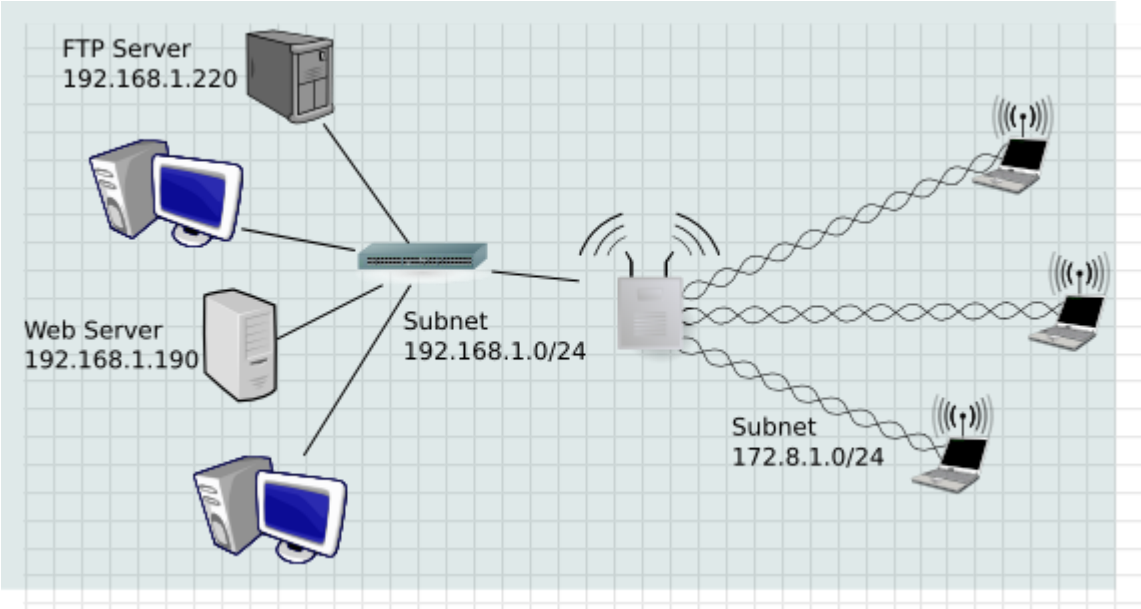


Figure 80. Hotspot with two back-end FTP servers

10.4.1 Single Class per Policy

We will start by defining a QoS policy to guarantee 3 mbps for FTP traffic. Since we want to guarantee both uploads and downloads from the ftp servers, we will create two different classes, one for each flow direction. On each of them, we will set a PIR limit (3.5 mbps), in order to prevent the FTP server from monopolizing the bandwidth.

Steps to follow:

1. We click on “Traffic Classes” and right-click on it.
2. We add a new class, named let's say “ftp_traffic_out”, to handle outgoing traffic from interface ath0.
3. We click on “ftp_traffic_out” class and configure the MATCHES and TARGET as depicted on picture 83.

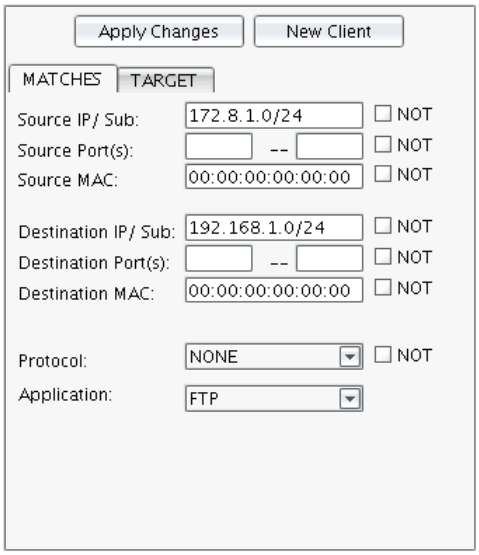


Figure 81.

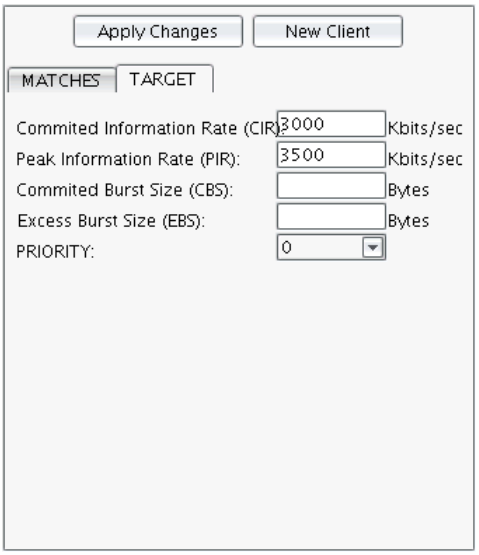


Figure 82. 'ftp_traffic_out' configuration

4. Similarly, we set up an 'ftp_traffic_in' class for the incoming flow direction. (Picture 84).

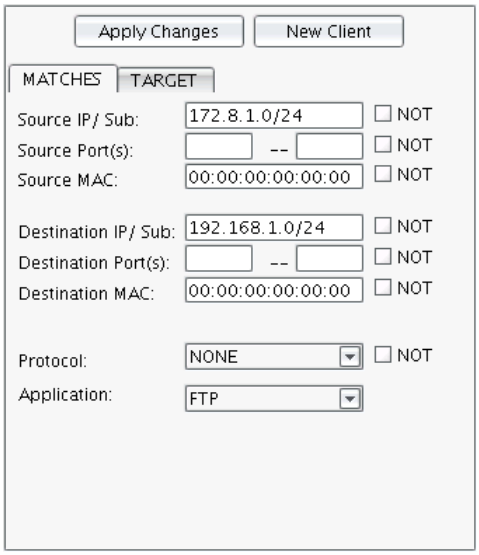


Figure 83.

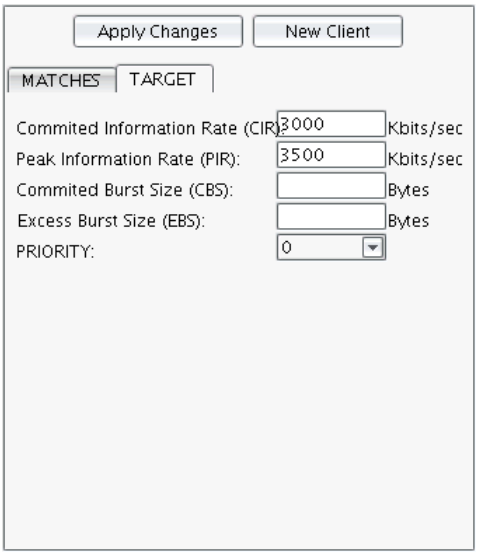


Figure 84. 'ftp_traffic_in' configuration

5. Now we will create two policies, one for each flow direction, named 'ftp_in' and 'ftp_out'. We accomplish this by right-clicking on 'Traffic Policies' label.

6. Then we associate each class to each respective policy (Picture 85). This is done by dragging-dropping classes to policies and policies to interface flows.

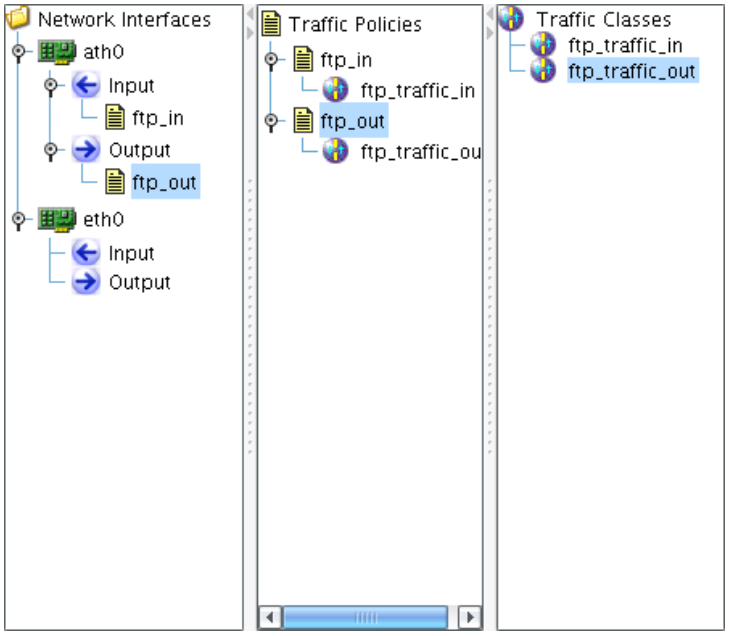


Figure 85. Single class per policy

10.4.2 Parallel Classes

Up to now, we guarantee 3mbps for FTP traffic coming from any of the directly connected subnets, and destined to the other one. However, we make no provisions for users (of either subnet), who might set up an FTP server on their own initiative. Such ftp servers can consume part of the 3mbps quota, which is reserved for the two original FTP server. If we want to prevent this, we will have to be more specific when defining our classes. In particular:

1. We rename 'ftp_traffic_out' to 'ftp_traffic_out_ftp1' to handle traffic destined for FTP server 192.168.1.220. We change the destination address to 192.168.1.220/32. We leave the ftp application type to FTP.
2. Similarly, we rename 'ftp_traffic_in' to 'ftp_traffic_in_ftp1' to handle traffic originating for FTP server 192.168.1.220. Therefore, we change the source address to 192.168.1.220/32. The ftp application type of TARGET remains as it is.
3. In a similar manner, we create two new classes, named 'ftp_traffic_out_ftp2' and 'ftp_traffic_in_ftp2' to handle traffic originated from/destined to 192.168.1.190/32 (Picture 86). We also set the TARGET application type to FTP.

4. Since we dived the total CIR/PIR of the initial classes (one for each direction) in two classes, we have also to redefine the CIR/PIR on each subclass to 1500/1750. This way, for each direction the policy guarantees an aggregated CIR of 3000 and an aggregated PIR of 3500.

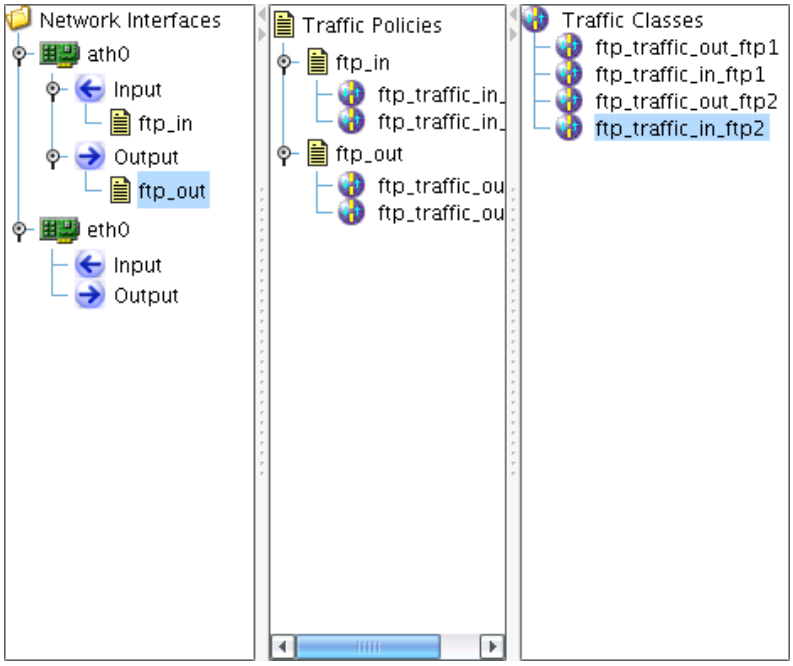


Figure 86. Parallel classes

Classes 'ftp_traffic_in_ftp1' and 'ftp_traffic_in_ftp2' are considered *Parallel Classes*, as far as the incoming interface flow of ath0 is concerned. This is because they don't form a hierarchy and hence, for every arriving packet, both of them are evaluated against it. Classes 'ftp_traffic_out_ftp1' and 'ftp_traffic_out_ftp2' are also parallel classes, as far as the outgoing interface flow of ath0 is concerned.

Parallel classes, although very convenient feature should be used with caution. By all means, you should **avoid setting parallel classes that overlap** each other. In other words, it should be clear which class will be activated for every arriving packet. For instance, the two classes depicted at picture 87 are overlapping, cause is ambiguous which one will handle traffic originating within subnet 172.8.1.0/24 and destined to host 192.168.1.1/32 with destination port number 200.

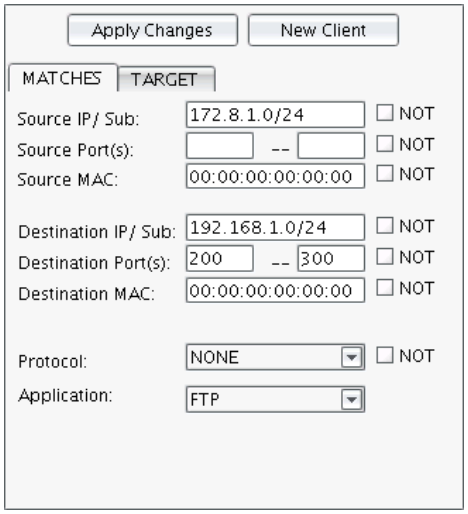


Figure 87.

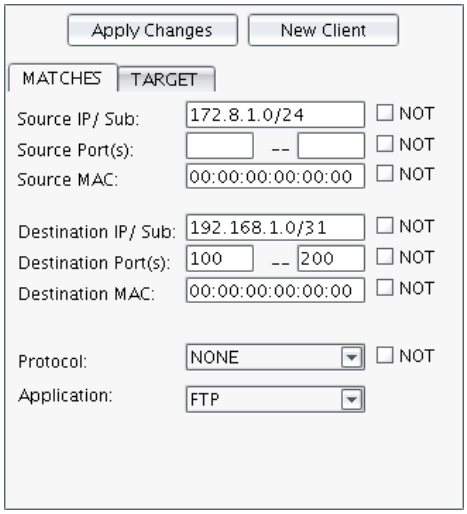
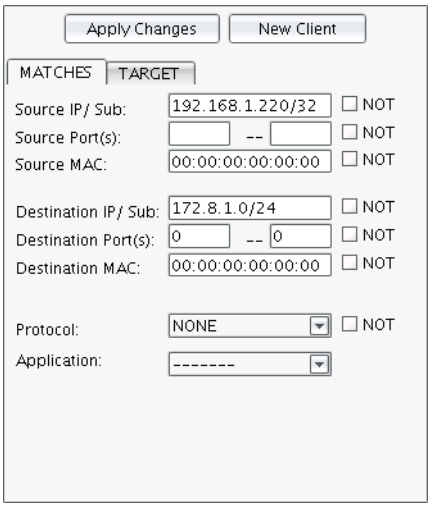


Figure 88. Overlapping parallel classes

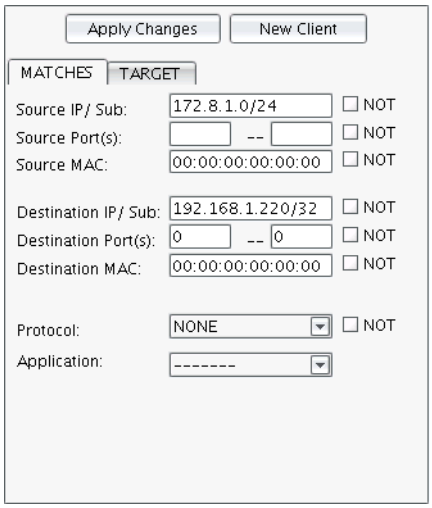
10.4.3 Class Hierarchy

Although the aggregated ftp traffic falls within limits (3000/3500), the maximum allowed bandwidth for each FTP server is restricted to 1750 kbps. An intuitive workaround would be to set the PIR of each class to 3500. However, in that case, if there is a lot of ftp traffic for both FTP servers, then the aggregated ftp traffic might exceed the desired restriction: 3500 (since 3500+3500=7000). In order to alleviate this problem, we will have to create a class hierarchy.

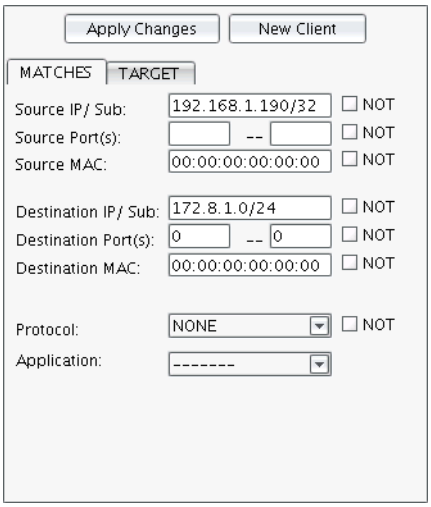
1. We set the CIR/PIR of every class created up to now to 1499/3500 and we remove the application type of FTP.
2. We create two new classes, named 'ftp_traffic_in' and 'ftp_traffic_out'. We set the CIR/PIR on each of them to 3000/3500. Source IP/Sub of 'ftp_traffic_in' should be set to 192.168.1.0/24 and destination IP/Sub of 'ftp_traffic_out' to 192.168.1.0/24. This is to allow for other ftp sessions to take place. Next, on the MATCHES part, we set the port range to 20 – 21 (ftp-data, ftp-control), and the protocol type to FTP.



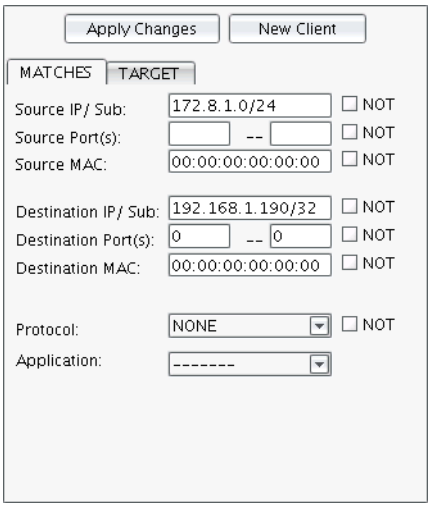
ftp_traffic_in_ftp1



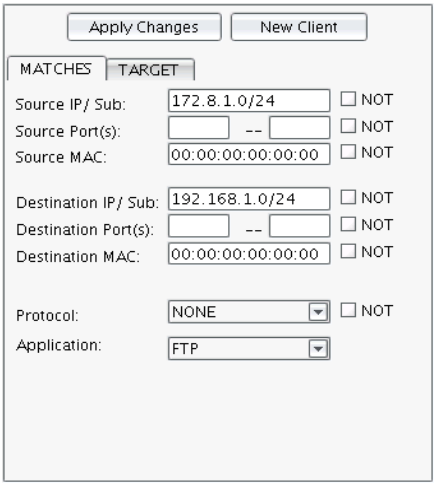
ftp_traffic_out_ftp1



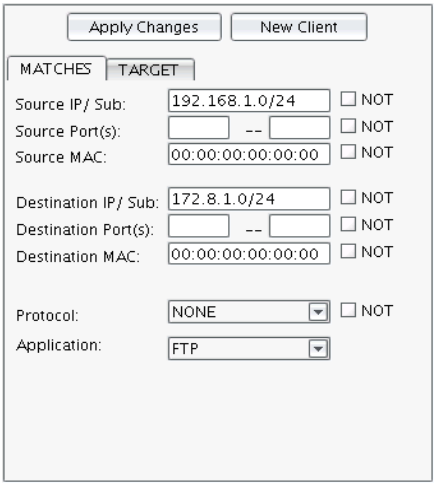
ftp_traffic_in_ftp2



ftp_traffic_out_ftp2



ftp_traffic_in



ftp_traffic_out

3. We drag&drop the previous classes to these new ones to create a class hierarchy as depicted at picture 88. We also alter the structure of our policies, so that only the newly created classes are assigned to them.

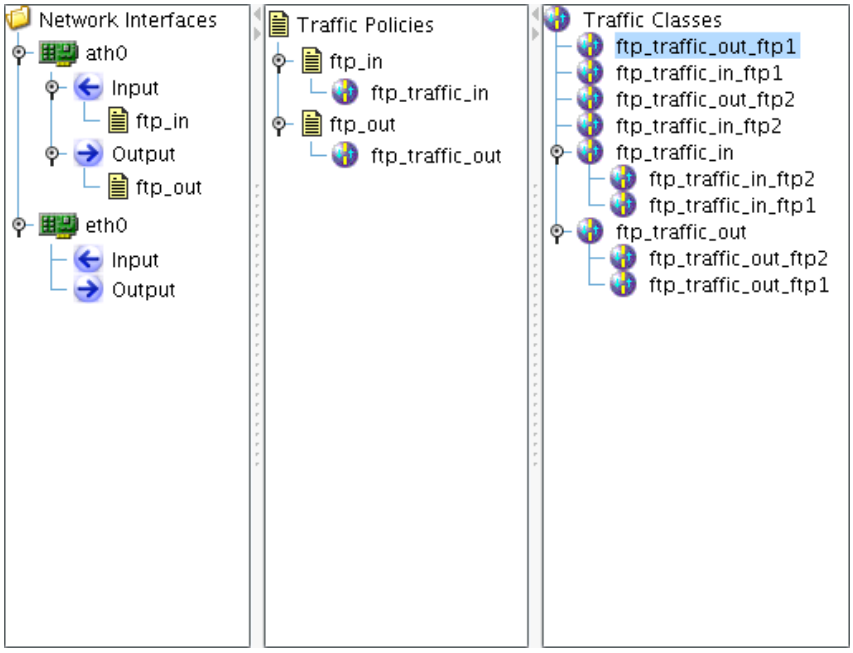


Figure 89. Class hierarchy

This way we limit the PIR at parent classes (3000/3500) and then we further distribute the bandwidth among the child classes (1499/3500 each). So, we enforce an upper limit on the amount of bandwidth used for FTP traffic, and at the same time, we enable both FTP Server to use the full potential of the reserved bandwidth.

***Note**: We couldn't have set a CIR of 1500 on each subclass, because when we subdivide a class to subclasses, there should always be some bandwidth available to accommodate for the rest of the traffic (traffic not covered by any of the subclasses).*

10.5 Example: Elimination of P2P Traffic

Currently, NETKROM OS does not support filtering of ip traffic based on its Layer 7 properties. For example, you can't set up a firewall rule to block incoming/outgoing P2P traffic. Nonetheless, you can virtual eliminate it, by restricting the bandwidth available to it.

In this example we will set up two Traffic Policies, one for each direction, and two Traffic Classes, that will reduce the bandwidth available to P2P traffic to as low as Kbits/sec. P2P users will soon get frustrated and drop

their P2P applications altogether. The following pictures demonstrate the QoS configuration needed.

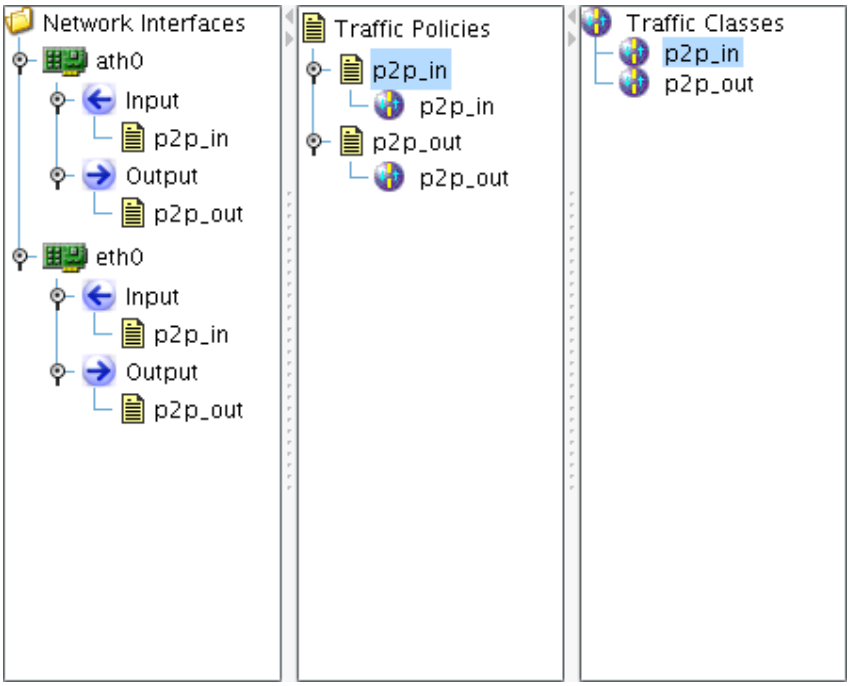
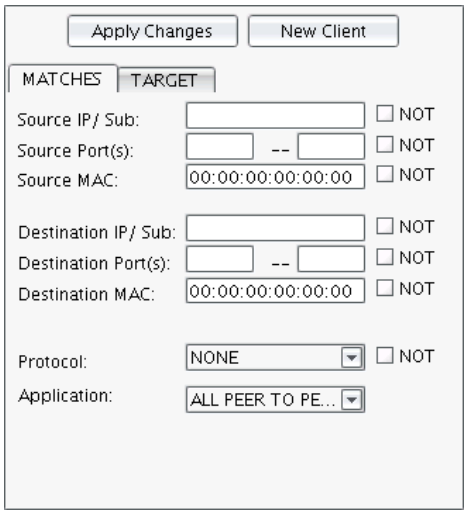
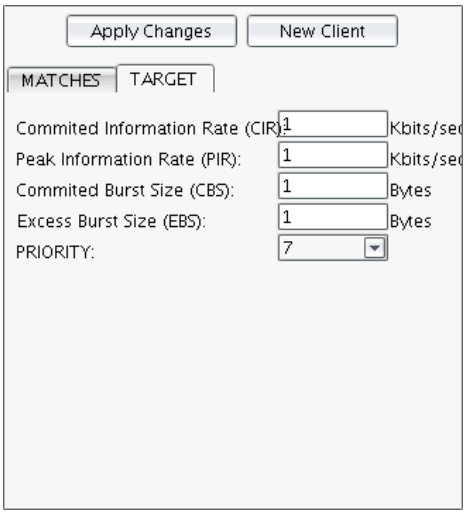


Figure 90. Class hierarchy for restricting P2P traffic on both interfaces



p2p_in, p2p_out MATCHES



p2p_in, p2p_out TARGET

Figure 91. Overlapping parallel classes

10.5.1 Shared Policies

In our example, traffic policies p2p_in and p2p_out are shared between interfaces eth0 and ath0. That makes them (both interfaces) to be regarded as a single interface, from the standpoint of QoS. In practice, this means that 1 Kbits/sec can be occupied by P2P traffic coming from either eth0 or ath0, and an other 1 Kbits/sec for P2P traffic leaving from either eth0 or ath0 (not 1 Kbits/sec each).

10.6 Example: Access Point Bandwidth Sharing

10.6.1 New QoS Entry

NETKROM OS NNMS has a convenient way to set bandwidth policies for individual clients of an Access Point. This feature works only for clients that have a statically assigned IP and not via DHCP. If you want to set bandwidth policies for individual AP Clients which get their IP via DHCP, you'll have to set up your classes manually based on client's MAC address.

You define a bandwidth policy for an AP client by clicking on the “New Client” button (picture 91).

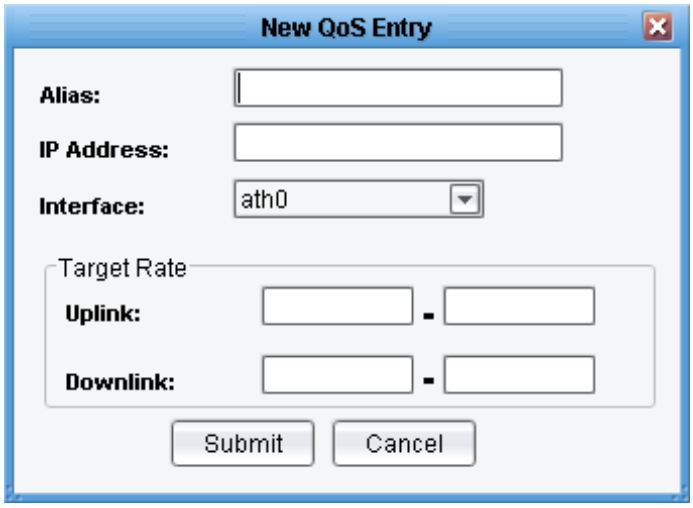
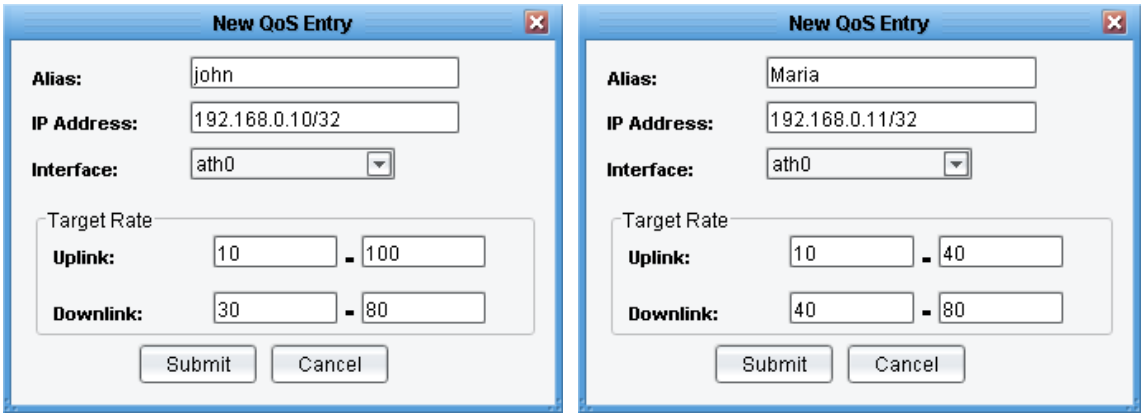


Figure 92. The 'New QoS Entry' window

We will now create two bandwidth policies for two AP clients (John and Maria).



John's settings ***Marias's settings***

Figure 93. John's and Maria's settings

> ***Note**: If it's about a single IP, use a subnet mask of /32. However, if you want the policy to cover multiple IPs, then use the appropriate subnet mask.*

After submitting both windows the resulting class hierarchy will be:

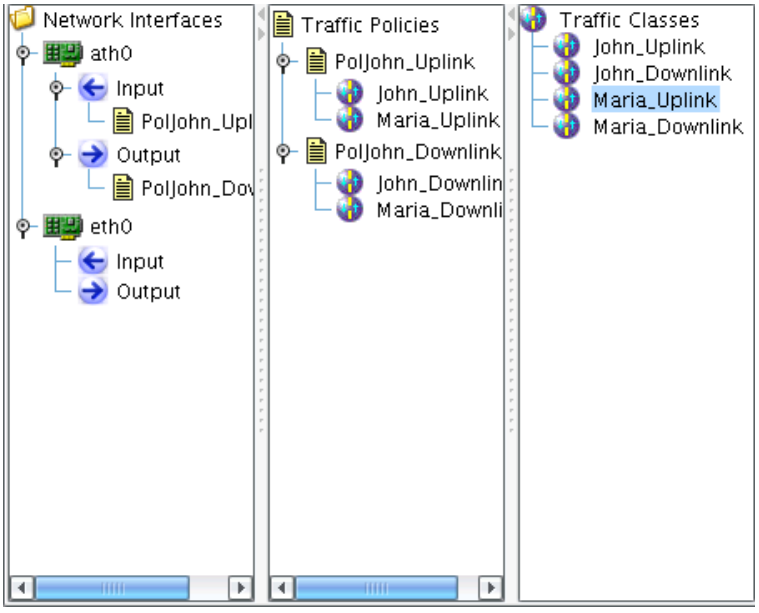


Figure 94. Resultant QoS layout for Maria and John

10.6.2 QoS Statistics

By right-clicking on the traffic policy below the associated interface flow, you can get statistics regarding packets handled by this policy.

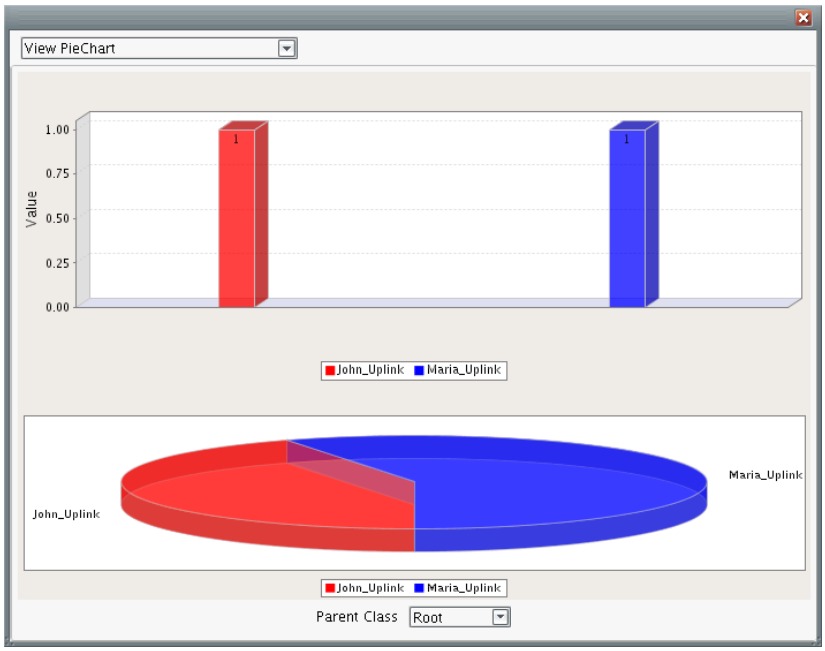


Figure 95. Current rate and packet analogy

The bar chart on the top illustrates the current average rate for each class. The pie chart corresponds to the number of packets services by the class up to now. By choosing the table view you get some more detailed statistics, including dropped packets due to rate/burst limitations.

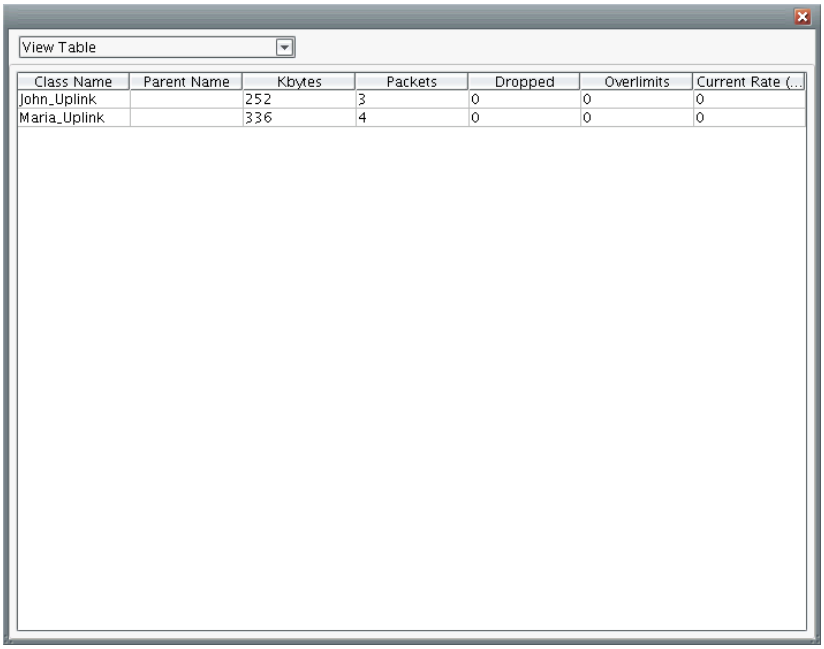


Figure 96. More detailed statistics

10.7 Design Guidelines and Limitations

10.7.1 Destination/Source MAC match type

To use the destination MAC match type, you have to create a bridge interface and assign to it the desired physical interface (a single interface is ok). Then, you can use the destination MAC match type of the interface assigned to the bridge.

Also bear in mind that, on a regular ip network, all receiving packets on the gateway, have as destination mac the gateway's mac address. Similarly, all packets forwarded by the gateway, have as source mac the gateway's mac address. Hence, it's pointless to use these fields on a NETKROM OS powered AP, which acts as a gateway.

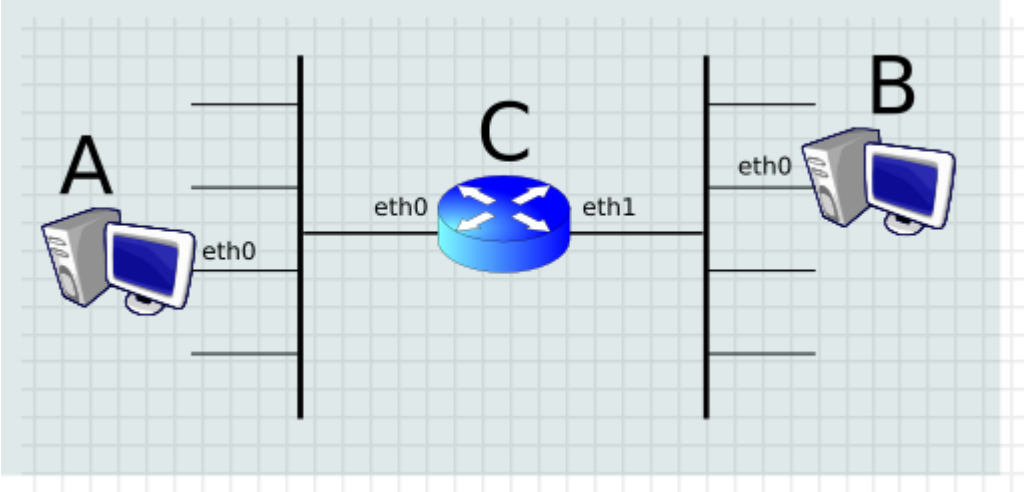


Figure 97. *A Packet sent by A for B has C.Eth0's mac address as destination mac, and when it is resent by C, it has a source mac of C.Eth1.*

When A sends a packet for B, the packet initially has destination mac: C.Eth0. Thereafter, when gateway C forwards it to its destination (host B) it has source mac: C.eth1.

10.7.2 Application match type

You may set the application match type only on leaf subclasses, on a class hierarchy. The reason behind this is that application type is very specific and should only exist on subclasses that reside on the last level (leaf) of a class hierarchy.

Moreover, when application type is used on a leaf class, it's not possible to set the protocol match type on any of its parent classes. This is because, when you set an application type match, you implicitly define the protocol type which corresponds to the that application type.

10.7.3 Child to Parent class relation

In a class hierarchy, a child's MATCH and TARGET part should be subset of that of each parent class. Therefore, you can't have a parent class to match a destination port range of 1-1024, when one of its child classes matches destination port range 500-2000. Port range 1025-2000 is not a subset of the parent class.

10.7.4 PIR on parallel classes

Currently, the QoS subsystem requires that all parallel classes (or subclasses) will either have a PIR defined or not. Therefore, it's not possible to set the PIR on a subclass and not set it on one of its sibling classes. All of them should either have or not have a PIR defined.

10.7.5 Efficiency considerations

Whenever possible, prefer the port or protocol match type instead of the application one. Application match type is slower and more CPU intensive.

10.8 Frequently Asked Questions

10.8.1 Submit, Apply Changes: I'm confused!

'Apply Changes' button is to save changes made to the rightmost panel of the QoS interface. This is the panel responsible for setting MATCHES and TARGET properties of a class. On the other hand 'Submit' is used to save the overall QoS configuration. Finally, don't forget to save configuration on the device via the 'Save Configuration' option on the 'View Topology' window.

11. HotSpot Wizard

11. HotSpot Wizard

The NETKROM OS HotSpot Access Gateway enables telcos, operators, wireless ISPs, enterprises, government institutions, or school campuses to deploy WLANs with secured user authentication support. Based on both RADIUS (Remote Authentication User Dial-In Service) and Web Redirection technology, when an unauthenticated wireless user is trying to access a Web page, a logon page is shown instead of the requested page, so that the user can type his/her user name and password for authentication. Then, the user credential information is sent to a back-end RADIUS server to see if the user is allowed to access the Internet. This web-redirection also supports Web page customization, allowing operators or HotSpots to easily designate a Web page / Advertisement URL before / after user login, not to mention Web-redirection bypass for paid users and/or those frequently using HotSpot services, where authentication can be performed using their MAC address.

To configure the **HotSpot Wizard** settings, select the **HotSpot** tab, located under the **Advanced Configuration of Node, Configuration** tabs.

See Page 33 for a diagram showing Advanced Configuration tabs and sub-tabs.

11.1 HotSpot Main Tab

When the HotSpot tab is selected a simple user interface is displayed as a starting point for the HotSpot configuration process. From the HotSpot Main tab you can:

- enable the HotSpot
- view the status of the Hotspot
- view the administrator's MAC address
- start the HotSpot Wizard
- open a window to view a file containing configuration information
- open a window to view user information
- open a window to view Radius statistics

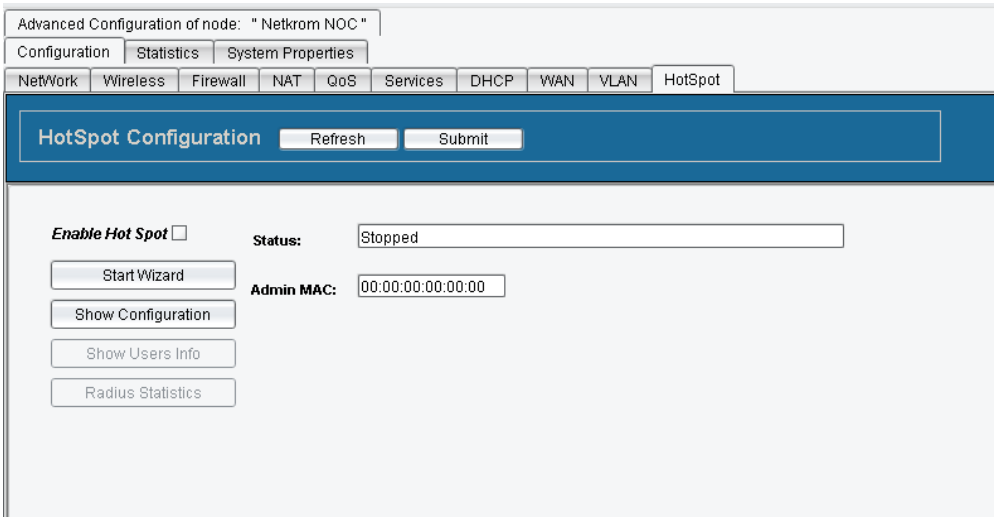


Figure 98. Main HotSpot Tab

Enable HotSpot

Click the **Enable HotSpot** button to stop or start Hotspot functionality.

Status

Status displays current HotSpot status (**Stopped**, **Running** or **Initializing**). In case there is a problem with HotSpot initialization procedure, an error message is displayed.

Example: DNS error

The HotSpot needs to connect to a DNS server, but cannot find one. This may be a possible incorrect configuration of the HotSpot's WAN interface settings, or a possible temporary unreachable state of the DNS server (WAN is not initialized yet, PPP connection is not established yet). The HotSpot will keep retrying to initialize at certain intervals.

Admin MAC

Admin MAC is the administrators MAC Address. This MAC address (if not zeros), is always considered authenticated and assigned the first HotSpot Dynamic IP address (x.x.x.2). Setting it is recommended, to avoid losing connectivity with the HotSpot, if connected to one of its HotSpot interfaces.

Users Info

Users Info is a list of users that have obtained an IP address, their authentication status (TRUE or FALSE), and users' statistics. To access

this list, click the **Users Info** button. The **HotSpot Users** dialog box appears.

The **Users Info** button is available when the HotSpot configuration is complete and the HotSpot is running.

Figure 99. Users Info Window

Radius Statistics

The **Radius Statistics** window allows you to view information about the operation of the Radius server. To access the **Radius Statistics** window, click the **Radius Statistics** button.

The **Radius Statistics** button is available when the HotSpot configuration is complete and the HotSpot is running.

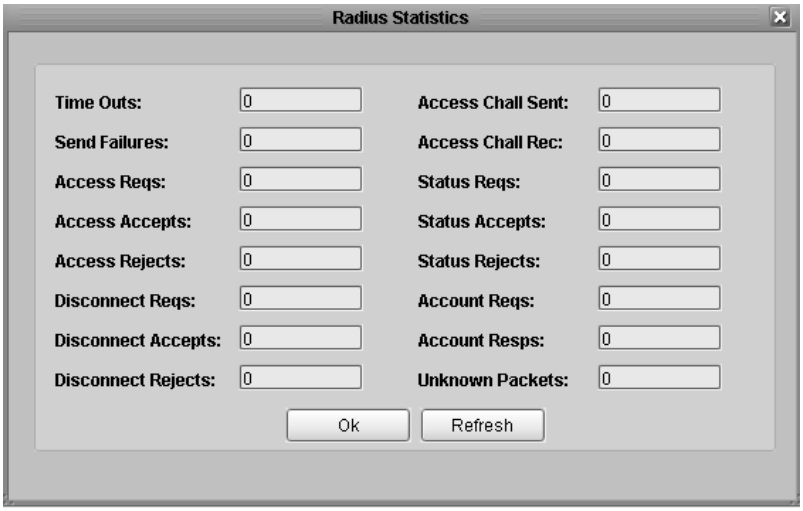


Figure 100. Radius Statistics Window

11.2 Using the HotSpot Wizard

To begin the wizard configuration, click the **Start Wizard** button in the configuration panel. A multi-tabbed pane opens with the **WAN** tab on top. To navigate between tabs, click the **Next** or **Previous** buttons at the bottom of the pane.

The following sections describe the configuration settings for each tab.

11.2.1 WAN

WAN is the interface that the HotSpot should use to connect to the Internet.

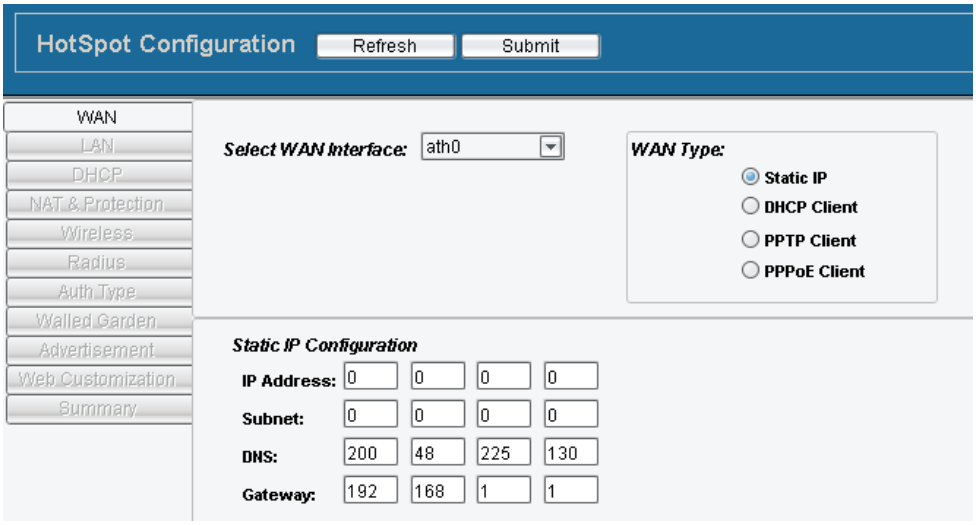


Figure 101. HotSpot Wizard WAN Tab

Configure the WAN tab as follows:

Select WAN Interface

Select the interface to be used as the WAN Interface from the **Select WAN Interface** drop down list.

WAN Type

Select one of the following WAN Types by clicking the option button. Different configuration fields will become available in the lower section of the tab depending on the select made in this field.

- **Static IP**
- **DHCP Client**
- **PPTP Client**
- **PPPoE Client**

Static IP

The WAN interface will be assigned with a static **IP address**, **Subnet** mask, **DNS** IP and **Gateway** IP.

DHCP client

The WAN interface will retrieve dynamically the corresponding IP Settings via DHCP protocol.

PPTP Client

The WAN interface will try to connect via the PPTP protocol based on its configuration parameters.

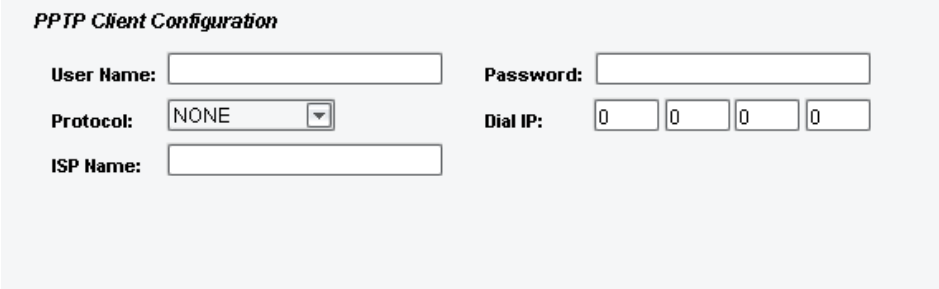


Figure 102. HotSpot WAN PPTP Client Settings

- Type the user name in the **User Name** field
- Type the password in the **Password** field.
- Select **None, PAP** or **CHAP** in the **Protocol** field.
- Type the ISP name in the **ISP Name** field.
- Type the dial IP address in the **Dial IP** field.

PPPoE Client

The WAN interface will try to connect via the PPPoE protocol based on its configuration parameters.

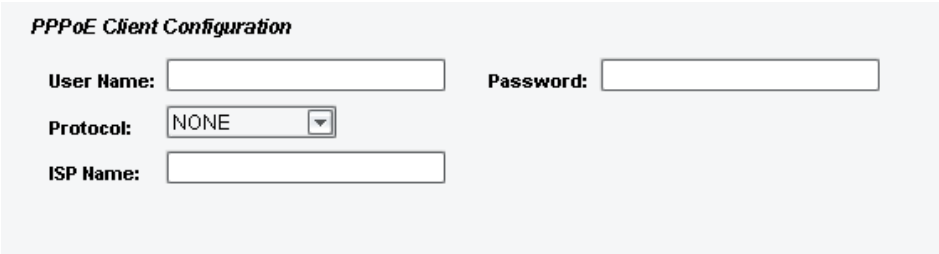


Figure 103. HotSpot WAN PPTPoE Client Settings

- Type the user name in the **User Name** field
- Type the password in the **Password** field.
- Select None, PAP or CHAP in the Protocol field.
- Type the ISP name in the **ISP Name** field.

11.2.2 LAN

Select the physical interfaces to be used as HotSpot interfaces, then click the to transfer it to the **HotSpot Interfaces** box. You have the flexibility to select multiple interfaces, either Ethernet or wireless. When the HotSpot is initialized, these interfaces will be bridged under a network bridge called br_HotSpot.

Figure 104. HotSpot Wizard LAN Tab

11.2.3 DHCP

Hotspot will assign HotSpot users with an IP address in the range of the configured dynamic IP addresses. Configure the HotSpot DHCP tab as follows:

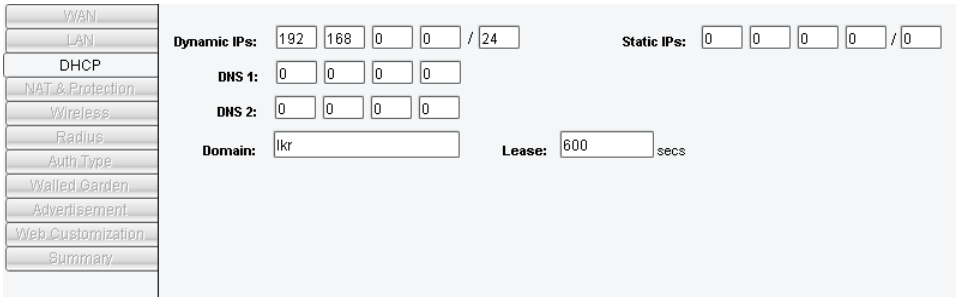


Figure 105. HotSpot Wizard DHCP Tab

Warning: Hotspot uses its build-in DHCP server, which is not displayed in the DHCP panel of the router.

Dynamic IPs

Type the base IP address and subnet into the **Dynamic IPs** field.

Example: If the dynamic IP addresses are 192.168.1.0/24, the Hotspot will assign IP addresses in the range of 192.168.1.2 to 192.168.1.254. IP address 192.168.1.0 is the Network IP, which cannot be assigned. IP address 192.168.1.1 will be assigned to the HotSpot itself (br_HotSpot

interface). IP address 192.168.1.255 is the Broadcast IP, which cannot be assigned.

DNS 1 and DNS 2

If DNS values are set to 0.0.0.0, the Hotspot will assign the router's DNS IP addresses.

Domain

Domain is the domain name assigned to HotSpot users.

Lease

Is the number in seconds users' DHCP client services will have to renew their assigned IP.

Static IP

Static IP is an advanced option left to the administrator. Using it, Hotspot will never assigned this range of IP addresses, unless MAC authentication is used and the Radius server's response forces an IP address of this range to be assigned (Framed-IP-Address).

Example: If dynamic IP addresses are configured as above and static IP addresses are 192.168.1.0/30, the Hotspot will assign IP addresses in the range 192.168.1.4 to 192.168.1.254, leaving IP addresses 192.168.1.2 to 192.168.1.3 to be assigned from the Radius server.

Warning: *The Static IPs subnet should be a sub-subnet of the Dynamic IPs subnet.*

11.2.4 NAT & Protection

NAT Enable

If the **NAT Enable** option is selected, HotSpot users' IP addresses will be translated to the WAN's IP address (Network Address Translation, Masquerade). This should be used if the dynamic IP addresses assigned are not public IP addresses, but private ones. If NAT Enable is not selected, HotSpot users' IP addresses will be forwarded to the Internet unmodified.

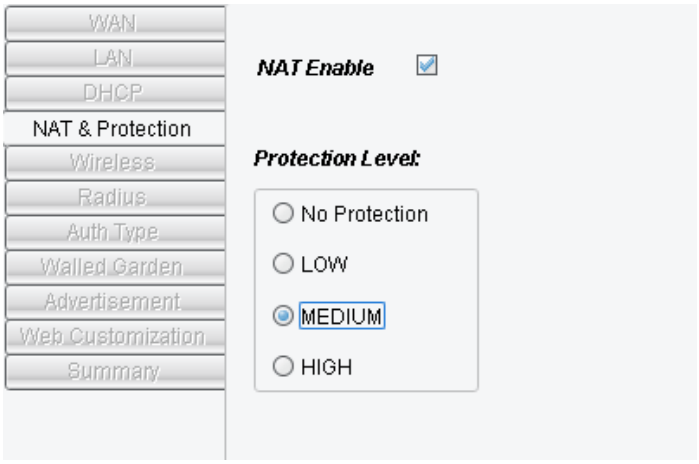


Figure 106. HotSpot Wizard NAT & Protection Tab

Protection Level

Protection is performed through firewall rules. According to the protection level used, appropriate firewall rules will be generated. (The comment "Added_By_Hotspot" will be automatically generated.)

Warning: *All preconfigured firewall rules will be dropped.*

There are four levels of protection:

No Protection

There is no protection. All traffic is accepted both from WAN and HotSpot interfaces.

Low Protection

Policy of the **Input** firewall chain will be set to **Drop**. The following configuration will be applied to the firewall subsystem.

Traffic Coming from the WAN Interface

Type	Action	Comments
Connections Related or Established	Accepted	Traffic initiated from router or HotSpot users
SSH connection	Accepted	New SSH connection
SNMP	Accepted	SNMP request
NNMS connection	accepted	New NNMS connection
ICMP traffic	Limited to 5/sec	All ICMP types
UDP port 500 and Protocols AH, ESP (IPsec)	Accepted	IPsec traffic
Everything else	Dropped	

Traffic Coming from Hotspot Interfaces

Type	Action	Comments
Connections To Internet	Accepted	Traffic from HotSpot users
SSH connection	Accepted	New SSH connection
SNMP	Accepted	SNMP request
NNMS connection	accepted	New NNMS connection
ICMP traffic	Limited to 5/sec	All ICMP types
Protocols AH, ESP (IPsec)	Accepted	IPsec traffic
Everything else	Dropped	

Medium Protection

Policy of the **Input** firewall chain will be set to **Drop**. The following configuration will be applied to firewall subsystem.

Traffic coming from WAN interface

Type	Action	Comments
Connections Related or Established	Accepted	Traffic initiated from router or HotSpot users
NNMS connection	accepted	New NNMS connection
ICMP traffic	Limited to 5/sec	All ICMP types
UDP port 500 and Protocols AH, ESP (IPsec)	Accepted	IPsec traffic
Everything else	Dropped	

Traffic coming from Hotspot Interfaces

Type	Action	Comments
Connections To Internet	Accepted	Traffic from HotSpot users
NNMS connection	accepted	New NNMS connection
ICMP traffic	Limited to 5/sec	All ICMP types
Protocols AH, ESP (IPsec)	Accepted	IPsec traffic
Everything else	Dropped	

High Protection

Policy of the **Input** firewall chain will be set to **Drop**. The following configuration will be applied to firewall subsystem.

Warning: NNMS *Connectivity from WAN or Hotspot interfaces will be lost!*

Traffic coming from WAN interface

Type	Action	Comments
Connections Related or Established	Accepted	Traffic initiated from router or HotSpot users
ICMP traffic	Limited to 5/sec	All ICMP types
UDP port 500 and Protocols AH, ESP (IPsec)	Accepted	IPsec traffic
Everything else	Dropped	

Traffic coming from Hotspot Interfaces

Type	Action	Comments
Connections To Internet	Accepted	Traffic from HotSpot users
ICMP traffic	Limited to 5/sec	All ICMP types
Protocols AH, ESP (IPsec)	Accepted	IPsec traffic
Everything else	Dropped	

11.2.5 Wireless

If there are wireless interfaces used as HotSpot interfaces, the **Wireless** tab is used to configure the wireless settings of these interfaces.

By default, Wireless to Wireless traffic is dropped.

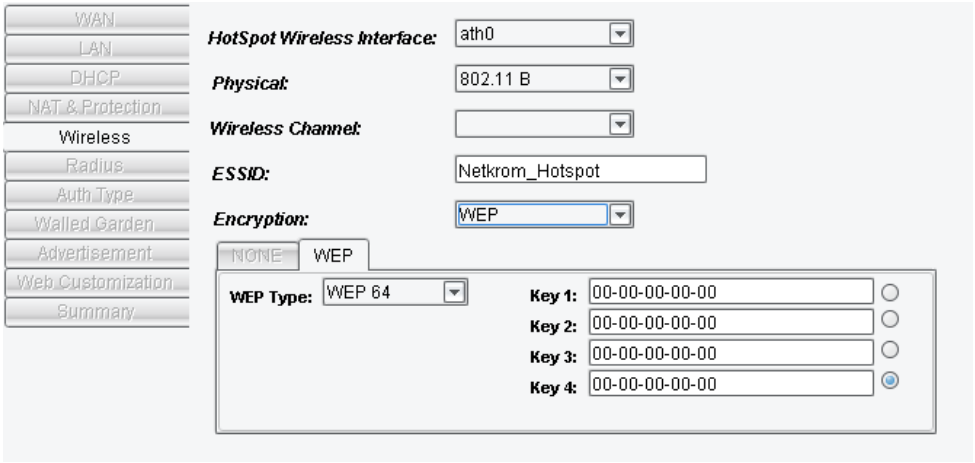


Figure 107. HotSpot Wizard Wireless Tab

HotSpot Wireless Interface

Select the **HotSpot Wireless Interface** from the drop down list.

Physical

Select the **Physical** layer standard of your interface, or select **Auto**.

Wireless Channel

If any selection except **Auto** is selected in the **Physical** list, this list is available. Select a **Wireless Channel** number.

ESSID

Type the **ESSID** name in this text box.

Encryption

In the **Encryption** drop down list, select **None** or **WEP**. If **WEP** is selected, the additional fields appear.

WEP Type

Select **WEP 64** or **WEP 128** in the **WEP Type** drop down list

Key 1, Key 2, Key 3 and Key 4

Type up to four different Key codes in these fields and select the one to be used by clicking the option button beside it.

11.2.6 Radius

The radius server used to authenticate HotSpot users.

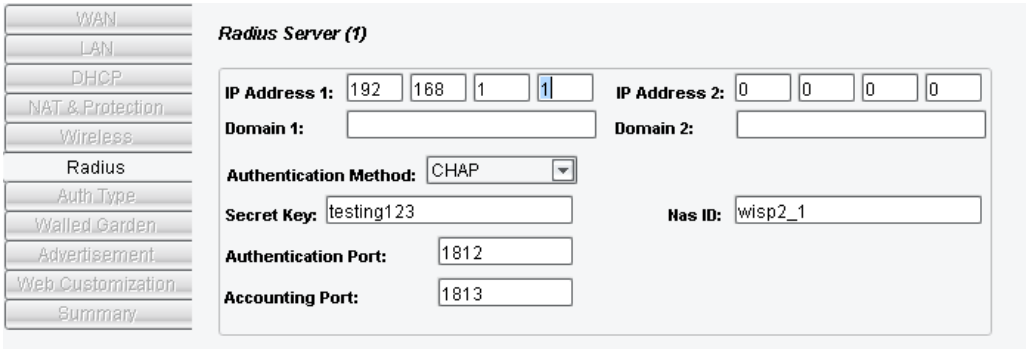


Figure 108. HotSpot Wizard Radius Tab

IP Address 1 and 2 / Domain 1 and 2

Either the **IP address** or **Domain** name of at least one Radius Server must be configured. The second Radius server is used as a backup server (if present).

Authentication Method

Authorization to Radius server will be performed using the **Authentication Method** (**CHAP** or **PAP**) selected in the **Authentication Method** drop down list.

Secret Key

Type the **Secret Key** of the Radius Server in this field.

NAS ID

Type the HotSpot's NAS identifier in the **NAS ID** box.

Authentication Port

The **Authentication Port** is the port used to send Access Requests to Radius Server (1812 by default).

Accounting Port

The **Accounting Port** is the port used to send Accounting Requests to the Radius Server (1813 by default).

11.2.7 Authentication Type

Authentication Type is the method used to authenticate HotSpot users. At least one must be enabled.

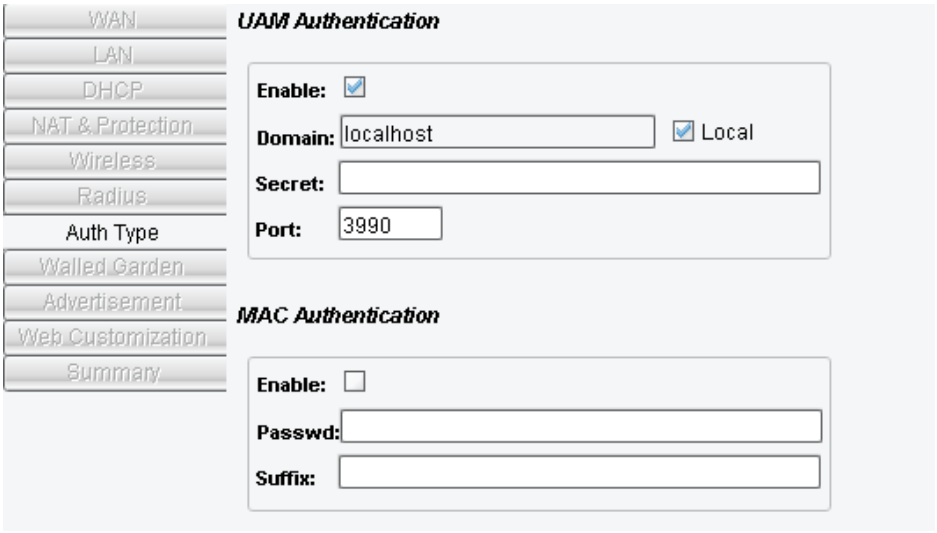


Figure 109. HotSpot Wizard Authentication Tab

UAM Authentication

UAM is the common Web-redirection authentication type. Hotspot users, after they have obtained an IP address, and opened a Web browser, will be redirected to the HotSpot's Web page to provide their Username and Password.

Enable

Select the **Enable** check box to enable **UAM Authentication.**

Domain

Type the URL of the authentication webpage into the **Domain** text box.

Secret

The **Secret** field is currently unused.

Port

Port is the local port the HotSpot will use for redirection (default 3990).

MAC Authentication

Hotspot users can be authenticated to the Radius Server using their MAC address (the MAC address of their media used to obtain an IP address).

Hotspot will send an access request to the Radius Server, using as Username the MAC address of the user (followed by the suffix string if present). It also sends password configured in the **Password** field. If authentication is successfully completed, the user obtains the Framed-IP-

Address of the Radius Access Response (if present), or the next available IP address in the range of Dynamic IP addresses. If authentication fails and UAM Authentication is enabled, user obtains an IP address in the range of Dynamic IP addresses and UAM authentication is performed (WEB-redirect page).

Enable

Select the **Enable** check box to enable **MAC Authentication.**

Password

Password is the password used to authenticate HotSpot users to Radius Server.

Suffix

Suffix is the string attached to the HotSpot users' MAC address used as Radius Username.

Warning: If MAC authentication is enabled, HotSpot users will obtain an IP address ONLY if the Radius Server is reachable.

11.2.8 Walled Garden

Walled Garden is a set of at most five domains or IP addresses or subnets that a user can access without having performed authentication (The user must have previously obtained an IP address from the HotSpot).

Type the URLs for these domains or IP addresses into the **Walled Garden URLs** text boxes.

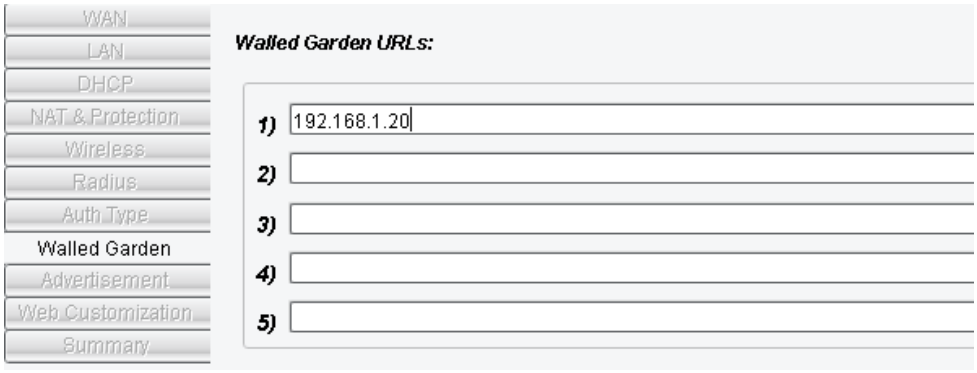


Figure 110. HotSpot Wizard Walled Garden Tab

11.2.9 Advertisement

Advertisement is a set of at most five URLs that a HotSpot user will be redirected to, after having authenticated successfully using UAM authentication.

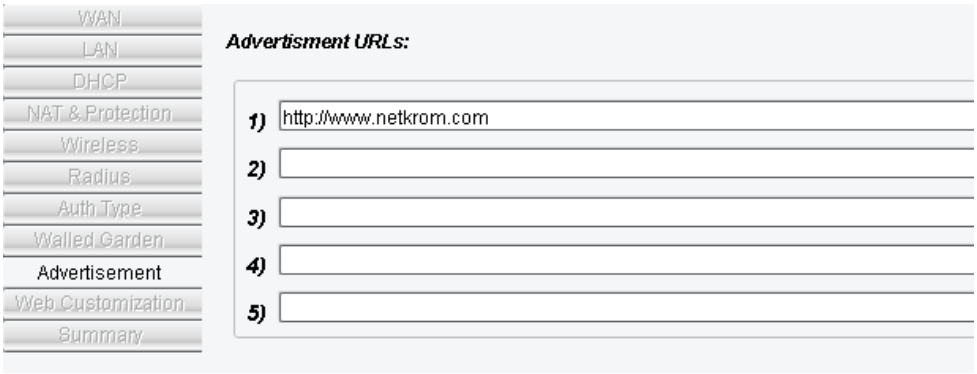


Figure 111. HotSpot Wizard Advertisement Tab

11.2.10 Web Customization

From the **Web Customization** tab, the login Web page to which a HotSpot user is redirected can be customized according to administrator's needs.

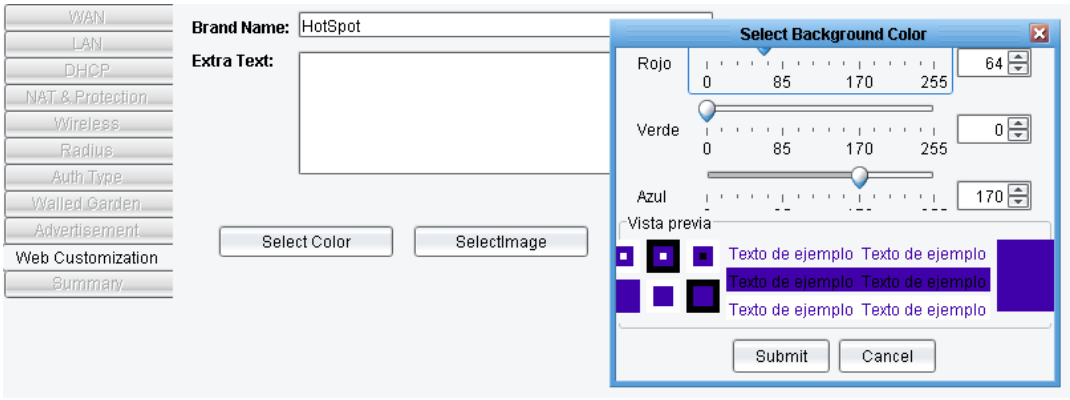


Figure 112. HotSpot Wizard Web Customization Tab

The following text fields that the administrator can fill with info describing his needs.

Brand Name

Type the Brand name of the company providing the HotSpot. E.g. *Downtown Bistro's Hotspot*

Extra Text

Type additional text for promotional purposes. E.g. *Featured by Tony's HotSpot Operators.*

Select Color

Click **Select Color** to access the **Select Background Color** dialog box. Select the background color of the redirection Web page.

Select Image

Click **Select** Image to access the **Select** dialog box and import a .jpg, .bmp or .jpeg graphics file that is superimposed on the Web redirection page.

11.2.11 Summary

All configuration data is stored in the **Summary** field. When the **Summary** tab is on top the configuration data is shown in this tab.

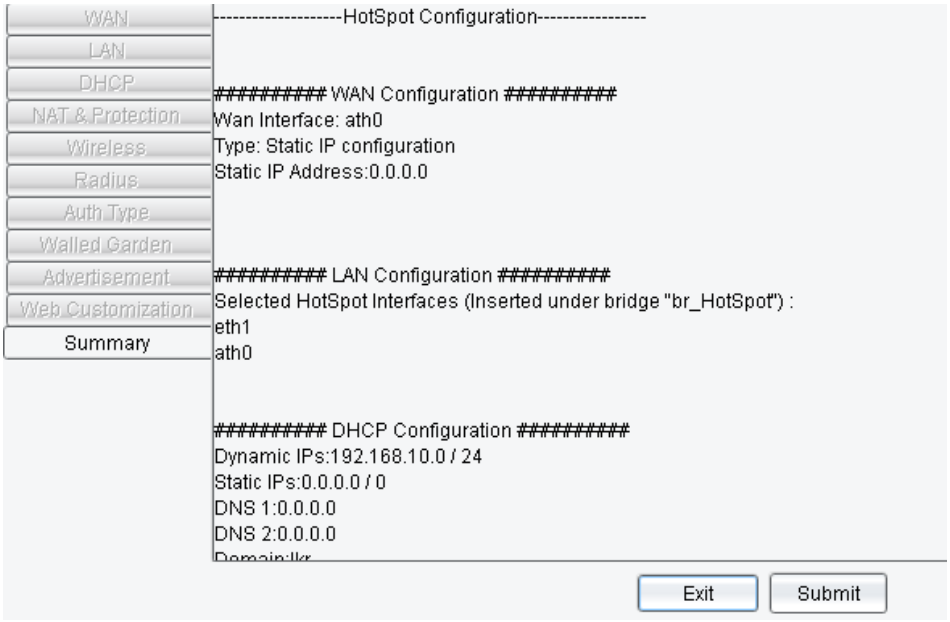


Figure 113. HotSpot Wizard Summary Tab

Submit

To apply the configuration to the router, click the **Submit** button at the bottom of the **Summary** tab.

Exit

Click **Exit** to return to the main HotSpot configuration tab

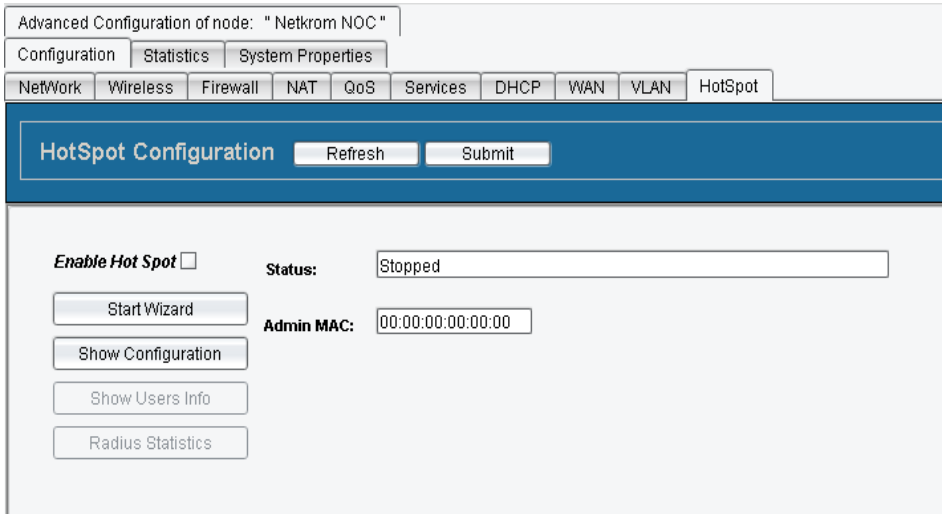


Figure 114. Hain HotSpot Tab

11.2.12 Enabling the HotSpot

In the main HotSpot tab, click **Submit.**

If Hotspot is already running, it will try to set the new configuration and start again. If an error occurs, the previous configuration will be restored.

If Hotspot is not running, the configuration is applied but Hotspot will remain stopped.

To start the router operating as a HotSpot, select the **Enable HotSpot** check box in the main HotSpot tab and click the **Submit** button again.

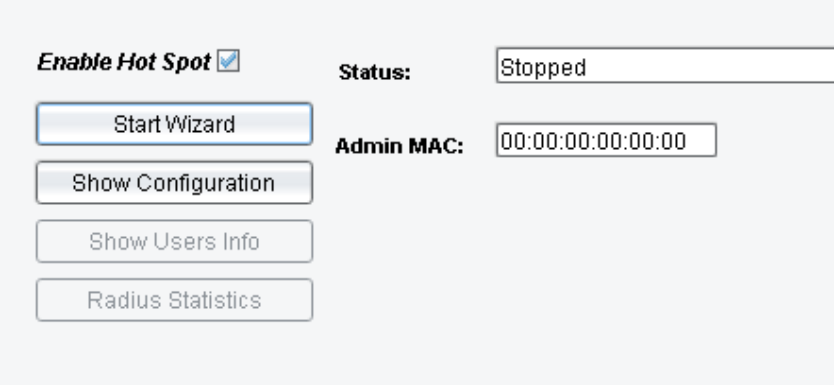


Figure 115. Start HotSpot

To poll the HotSpot's status, click the **Refresh** button. If the **Status** box displays **Initializing**, retry a few minutes later. The **Status** box will display **Running** when initialization is complete.

When the HotSpot is running the **Show Users Info** and **Radius Statistics** buttons will be available.

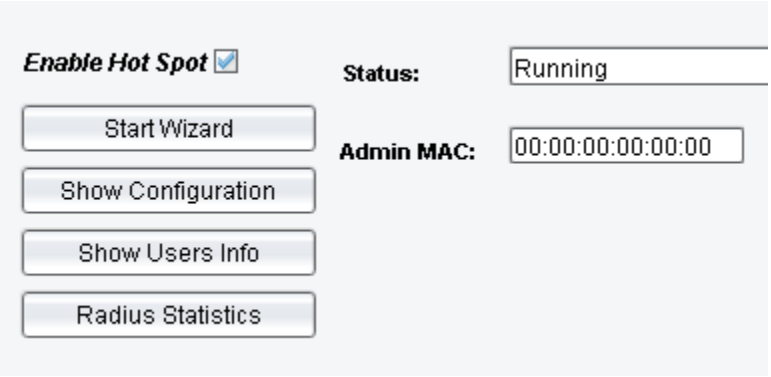


Figure 116. HotSpot Running

11.3 Backend Radius Configuration Example

The following is an example for the Linux free radius package:

Assume

- Dynamic IPs subnet is 192.168.1.0/24
- Static IPs subnet is 192.168.1.0/30.
- Radius password configured for MAC authentication is "password".

11.3.1 MAC Authentication

To authenticate a user using MAC authentication with MAC 000102030405, configure the radius server as follows:

- 00-01-02-03-04-05* Auth-Type := Local, User-Password == "password"
- Class = 0702345678,
- Session-Timeout = 7200,
- Idle-Timeout = 600,
- Acct-Interim-Interval = 60,
- Paned-IP-Address = 192.168.1.3,
- WISPr-Bandwidth-Max-Up = 256000,

- WISPr-Bandwidth-Max-Down = 512000

***NOTE:** FORMAT HAS BEEN CHANGED FROM VERSION 1.1.0 (XX-XX-XX-XX-XX-XX INSTEAD OF XXXXXXXXXXXX). CAPITAL LETTERS MUST BE USED (0A-0B-0C-0D-0E-0F).*

Upon successful authentication,

- User will be authenticated for 7200 seconds (2 hours), will obtain IP address 192.168.1.3, upload bandwidth 256 kbps and download bandwidth 512 kbps.
- HotSpot will send Accounting requests to radius every 60 seconds.

11.3.2 UAM Authentication

To authenticate a user using UAM authentication with username “user1” and password “his_password”, configure the radius server as follows:

- user1 Auth-Type := Local, User-Password == "his_password"
- Class = 0702345678,
- Session-Timeout = 7200,
- Idle-Timeout = 600,
- Acct-Interim-Interval = 60,
- WISPr-Bandwidth-Max-Up = 256000,
- WISPr-Bandwidth-Max-Down = 512000

Upon successful authentication,

- User will be authenticated for 7200 seconds (2 hours), , upload bandwidth 256 kbps and download bandwidth 512 kbps.
- HotSpot will send Accounting requests to radius every 60 seconds.

11.4 HotSpot Configuration Example

Assume that the user’s system is equipped with two Ethernet interfaces and one wireless interface.

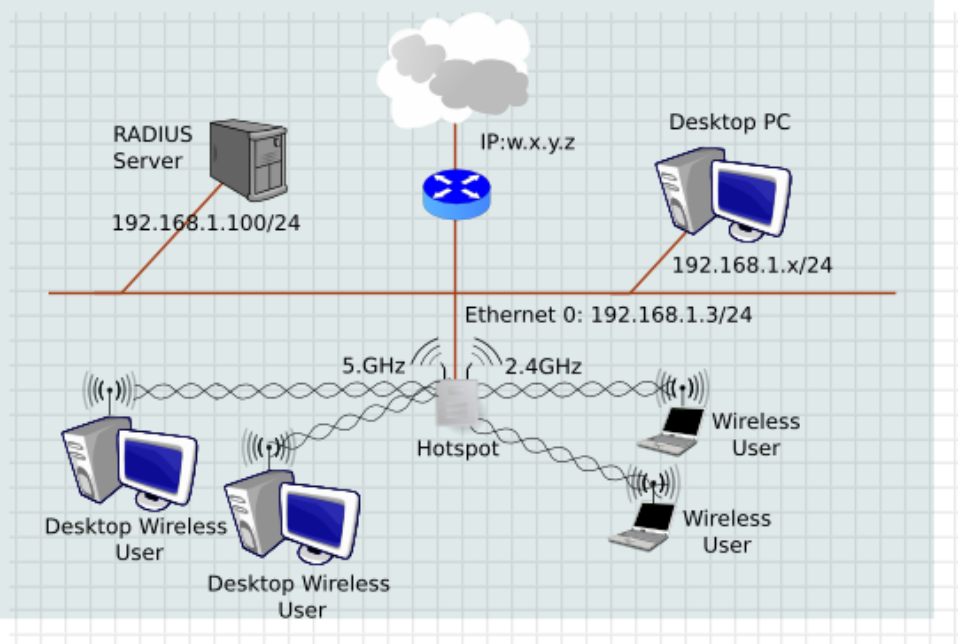


Figure 117. Network Topology – Example

The user is connected to the internet via a router with public IP w.x.y.z. His/her private IP subnet is 192.168.1.0/24. The router masquerades private IPs to its public IP.

The user must authorize users connected to both HotSpots' Ethernet interface eth1 and wireless interfaces ath0. This is accomplished by configuring NETKROM to act as a HotSpot and authenticate users connected to those interfaces (HotSpot LAN Interfaces).

The authentication is assumed to be handled by the user's local Radius Server (IP 192.168.1.00).

NETKROM HotSpot's WAN Interface in that case is eth0, the one connected to the router (and Internet).

Hotspot users will be assigned with IPs in the subnet 192.168.0.0/24

To sum up, NETKROM HotSpot should be configured with:

- WAN interface: eth0, with static IP 192.168.1.3/24
- LAN Interfaces: eth1 and ath0
- Gateway: 192.168.1.1 (router's private IP)
- DNS: say 65.173.1.1 (obtained from your internet connection)
- Radius Server: 192.168.1.100 (let radius secret be "radius_secret")
- Dynamic IPs assigned to users: 192.168.0.0/24

Applying this example, network topology will change to:

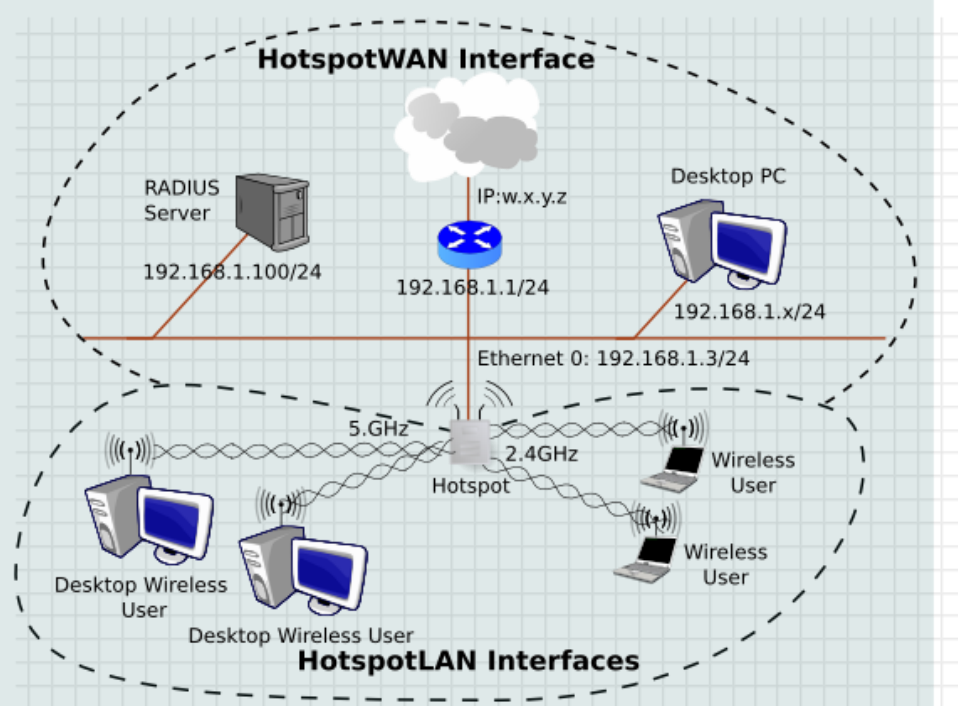


Figure 118. Network Topology after Hotspot – Example

Red lines show the user's LAN (WAN for HotSpot), where there is no authentication performed.

Green lines show the user's public LAN (LAN for HotSpot), where authentication is required.

HotSpot Configuration Procedure

Select **Advanced Node Configuration** from the **Node Shortcut Menu** in NETKROM NMS.

Click the **HotSpot** tab to begin the HotSpot configuration. The **HotSpot** tab appears.

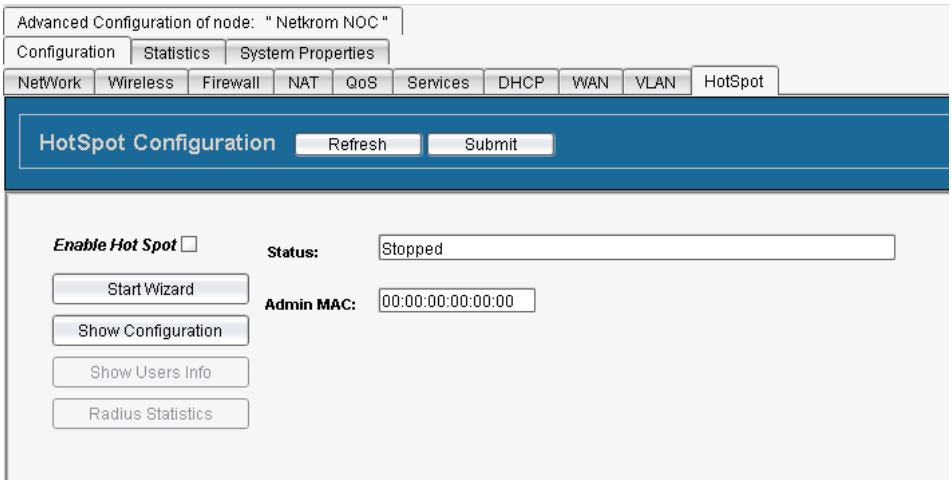


Figure 119. HotSpot Main Panel – Example

Click the **Start Wizard** button. The **HotSpot Configuration** pane appears containing several tabs. The **WAN** tab is on top.

1. In the **Select WAN Interface** drop down list, select: **eth0** as the WAN interface
2. In the **IP Address** field, type: **192.168.1.3**
3. In the **Subnet** field type: **255.255.255.0**
4. In the **DNS** field type: **65.173.1.1**
5. In the **Gateway** field type: **192.168.1.1**

Click the **Next** button. The **LAN** tab will appear.

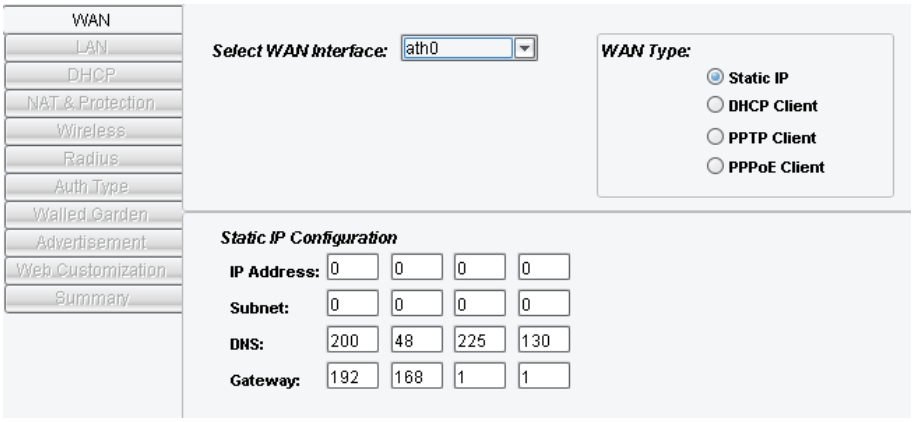


Figure 120. WAN Configuration – Example

The **LAN** tab contains two lists: **Physical Interfaces** and **HotSpot Interfaces**

In the Physical Interface list, Select **eth1** and **ath0** and copy them to the HotSpot Interface list by clicking the button.

Click the **Next** button. The **DHCP** tab will appear.

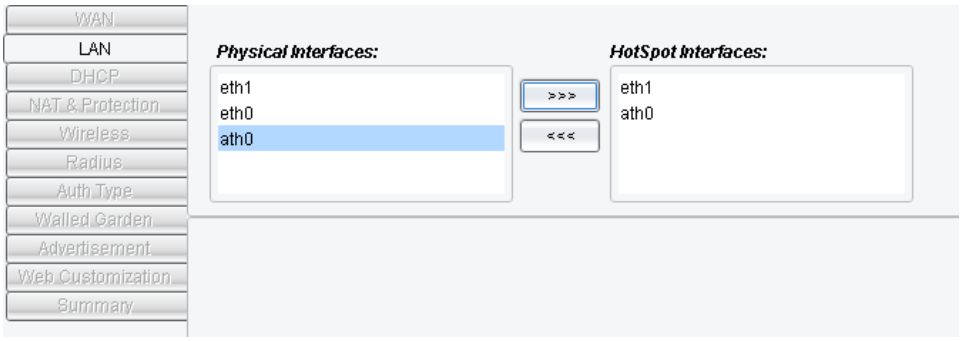


Figure 121. LAN Configuration – Example

Configure **DHCP** server settings (IP addresses to be assigned from HotSpot to Users) as follows:

1. In the **Dynamic IPs** field, type: 192.168.0.0 / 24 (24 is the Subnet Mask portion representing 255.255.255.0)
2. In the **DNS 1** field, type: 0.0.0.0 (This will tell it to get NETKROM WAN DNS IP)
3. In the **Domain** field type: **domain_of_your_choice**
4. In the **Lease** field, type 600, the lease time for DHCP (in seconds)

Click the **Next** button. The **NAT & Protection** tab will appear.

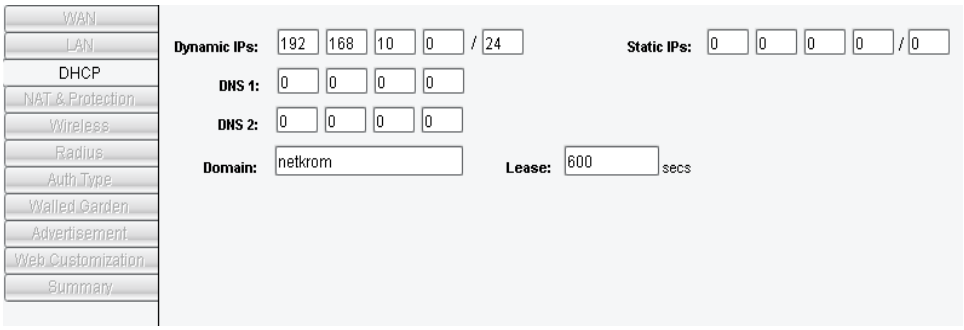


Figure 122. HotSpot's DHCP Server Configuration – Example

Configure **NAT & Protection** settings as follows:

1. Select the **NAT Enable** check box. Due to HotSpot's Private Dynamic IPs subnet, Hotspot should masquerade users' IP addresses to its WAN IP (eth0).
2. In the **Protection Level** box, select: **Medium**.

Click the **Next** button. The **Wireless** tab will appear.

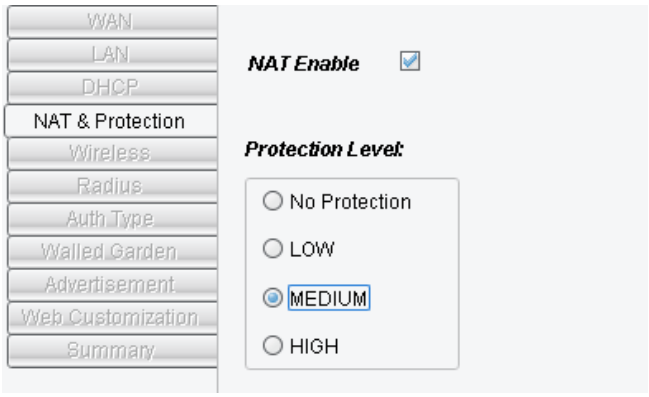


Figure 123. NAT & Protection Level Configuration – Example

Configure **Wireless** settings as follows:

1. In the **Physical** drop down list, select: **802.11B**
2. In the **Wireless Channel** drop down list, select: **1**
3. In the **ESSID** field, type: **My_HotSpot**
4. In the **Encryption** drop down list, select: **NONE**

Click the **Next** button. The **Radius** tab will appear.

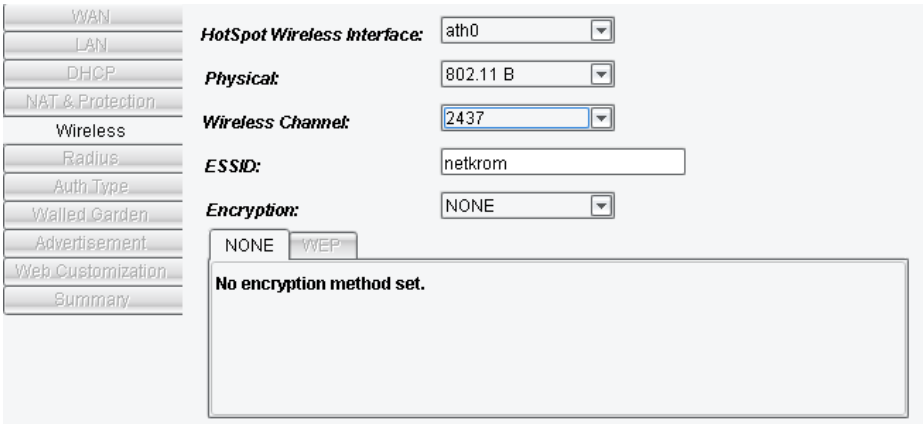


Figure 124. Wireless Configuration – Example

Configure **Wireless** settings as follows:

1. In the IP Address 1 field, type: 192.168.1.100
2. In the IP Address 2 field, type: 0.0.0.0 (no backup radius server)
3. In the Authentication Method drop down list, select: CHAP
4. In the Secret Key field, type: radius_secret
5. In the Authentication Port field, type: 1812
6. In the Accounting Port field, type: 1813
7. In the Nas ID field, type : some_nas (if needed by radius server)

Click the **Next** button. The Auth Type tab will appear.

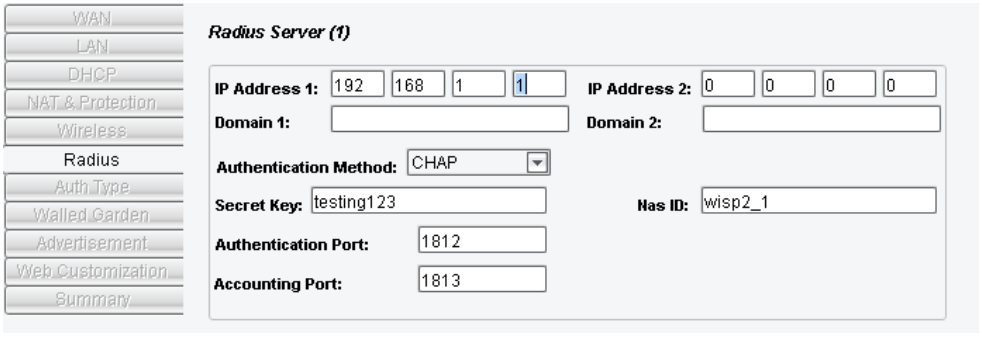


Figure 125. Radius Configuration – Example

Configure **Authentication Type** settings as follows:

In the **UAM Authentication** section, select the **Enable** check box to authenticate users via Web redirection

Click the **Next** button. The **Walled Garden** tab will appear.

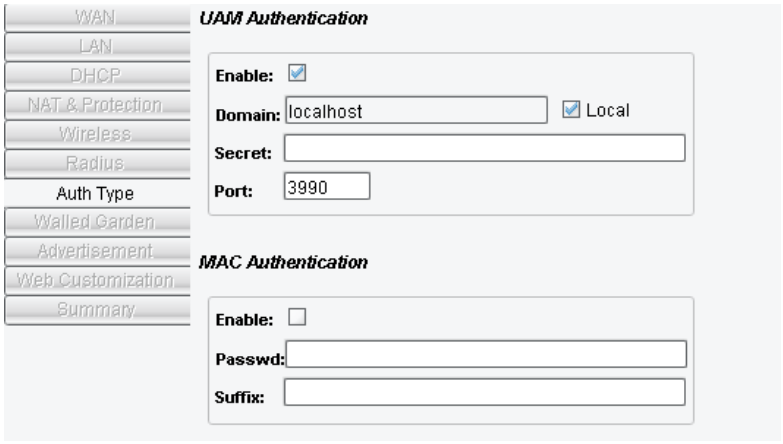


Figure 126. Authentication Methods – Example

In the **Walled Garden** tab you can configure domains that a user can access without being authenticated. Configure **Walled Garden** settings as follows:

In the **Walled Garden URLs** box, type 192.168.1.20 into field 1. (For this example, this address is assumed to operate a public web server. A user connected to a HotSpot LAN Interface can then access that address without authentication.)

Click the **Next** button. The **Advertisement** tab will appear.

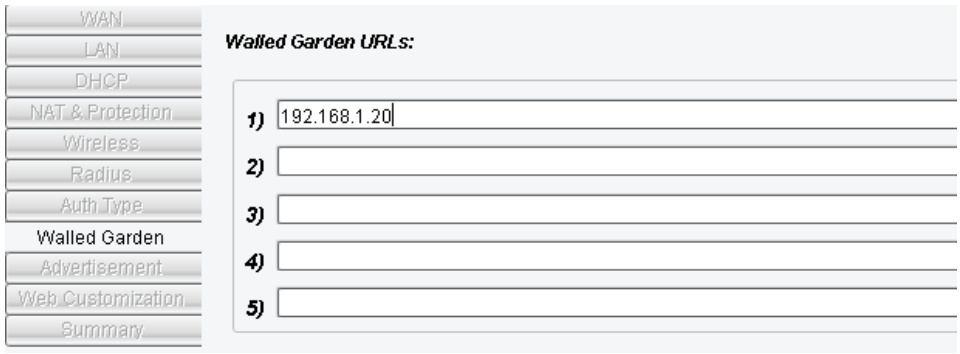


Figure 127. Walled Garden Configuration – Example

In the **Advertisement** tab you can configure domains that a user will be directed to after being authenticated. Configure **Advertisement** settings as follows:

In the **Advertisement URLs** box, type the URL of any Web site.

Click the **Next** button. The **Web Customization** tab will appear.

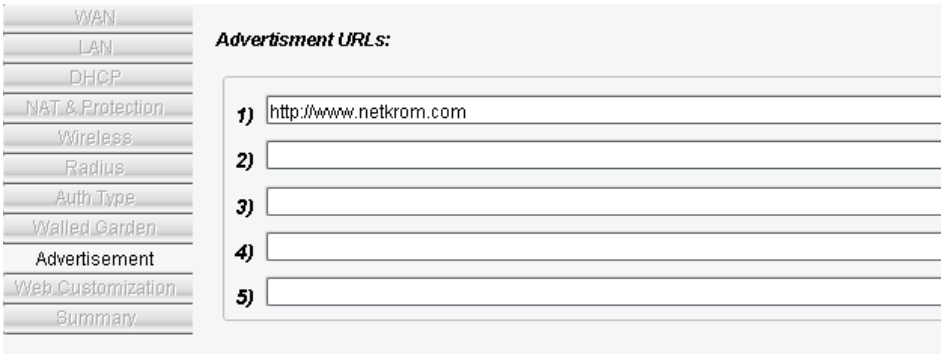


Figure 128. Redirection URLs Configuration – Example

In the **Web Customization** tab you can customize the redirection Web page. Configure **Web Customization** settings as follows:

1. In the **Select Background Color** box, set the Red, Green and Blue fields by dragging the controls or changing values in the corresponding spin boxes.
2. In the **Brand Name** and **Extra Text** boxes, type a text message.
3. Click the **Select Image** button to browse for image files to insert into the Web page.

Click the **Next** button. The **Summary** tab will appear.

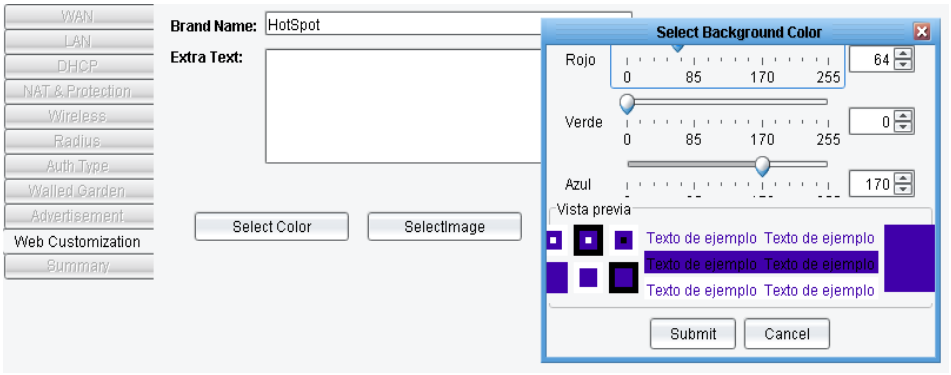


Figure 129. Web Page Customization – Example

The **Summary** tab displays a summary of configuration options.

Click the **Submit** button in the Summary tab.

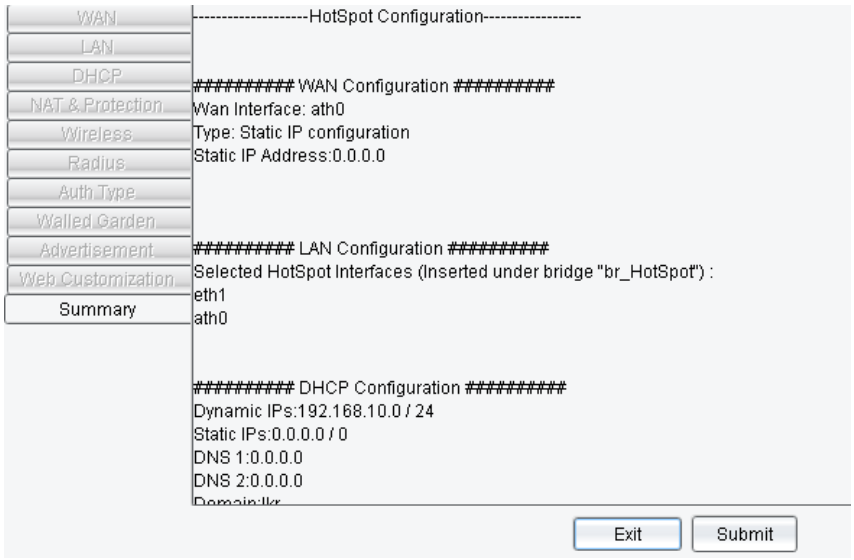


Figure 130. Summarize Configuration – Example

Click the **Exit** button. The main **HotSpot** pane appears.

Although the configuration has been loaded, Hotspot is not running. (Status field displays: **Stopped).** To complete the procedure:

1. In the **Admin MAC** box, type the administrator's MAC address. This is recommended to ensure connectivity is not lost with HotSpot in the event of a Radius mis-configuration.
2. Click the **Submit** button to apply the configuration to HotSpot. The original **HotSpot** tab appears.
3. To complete the process, select the **Enable HotSpot** check box.

Click the **Submit** button to start HotSpot.

Note: *HotSpot will assign to its HotSpot interfaces the IP address: 192.168.0.1 Administrator's IP address will be 192.168.0.2*

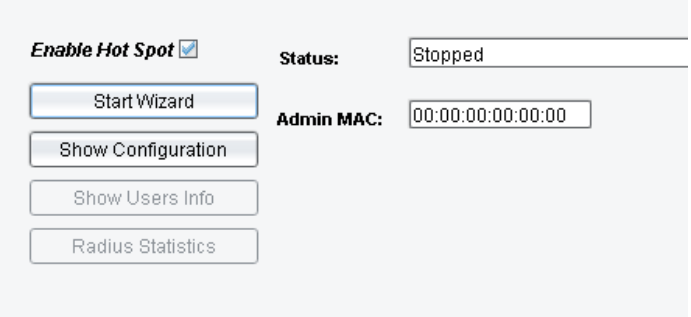


Figure 131. Start HotSpot – Example

To poll HotSpot's status, click the **Refresh** button. If the **Status** box displays **Initializing**, retry a few minutes later. The **Status** box will display **Running** when initialization is complete. With HotSpot running all changes have been applied to the router.

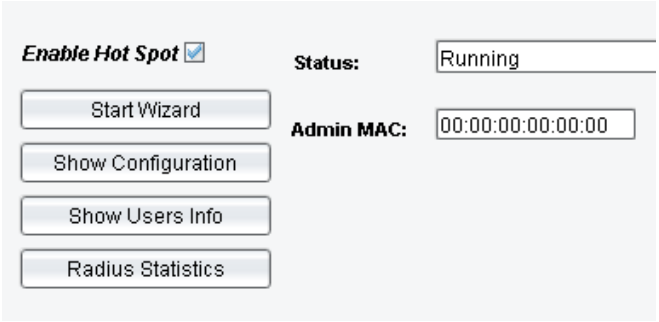


Figure 132. HotSpot is Running – Example

Return to the Network tab and note the **Interface List** contains a bridge **br_HotSpot** with **eth1** and **ath0** under it.

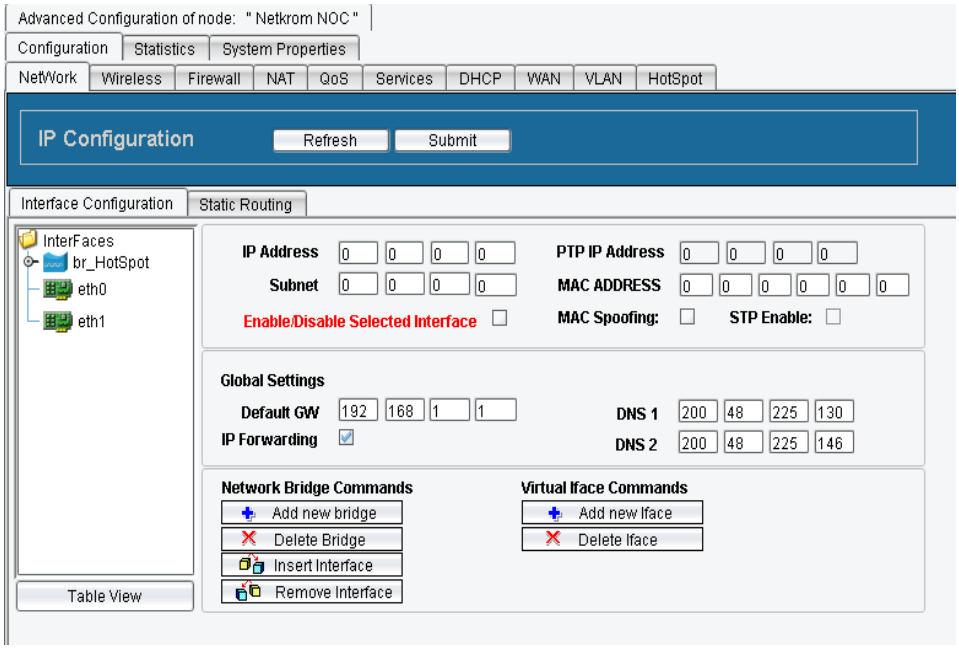


Figure 133. Interface Panel after HotSpot's Initiation – Example

Select the **Firewall** and **NAT** tabs and note that they also are initialized.

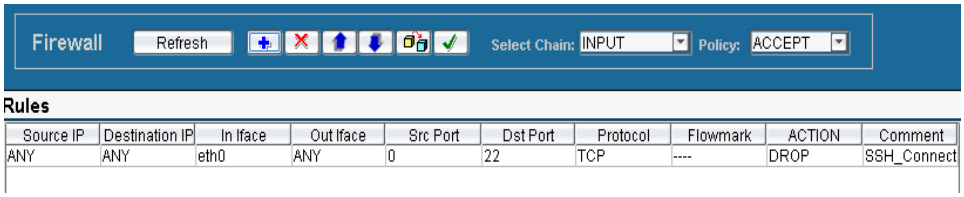


Figure 134. New Firewall Settings – Example

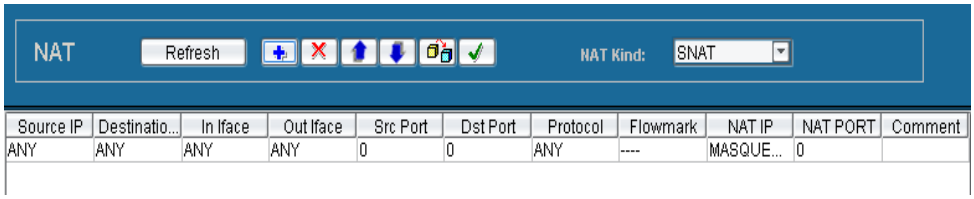


Figure 135. NAT Settings – Example

If a user connects to the HotSpot, it will assign the next free Dynamic IP address.

Figure 136. HotSpot has Assigned an IP address – Example

If this user now tries to access the Internet, a Redirection Web-page is displayed:

11.5 Troubleshooting

11.5.1 Cannot set wireless interface configuration

- Check if you have selected channel and ESSID.
- If you are running NETKROM OS with a CPE license, wireless interfaces cannot be used as access points, and Hotspot cannot have wireless HotSpot interfaces.

11.5.2 DNS Error

- If you use static IP address for the WAN, make sure you have entered the right settings.
- If you use dynamic IP allocation (DHCP, PPPoE and PPTP clients), wait for the WAN interface to establish a connection.

11.5.3 Cannot obtain an IP address

- Check if the Dynamic IP addresses are all allocated by selecting **Show User Info**. If more IP addresses are required, reconsider configuring an extended IP pool for Dynamic IP addresses.
- If MAC authentication is enabled, check if your RADIUS server is operating and has connectivity with the HotSpot, or Radius Settings are right (Secret Key, Ports) .
- Check if Hotspot Status in the Main HotSpot tab is running.

11.5.4 Obtained an IP address but cannot Ping HotSpot

Check if the user is authenticated.

11.5.5 HotSpot running, but no activeDHCP Server

Hotspot uses its built in DHCP server; there is no mis-configuration.

11.5.6 A user not authenticated, but can access the Internet

Check if the domain the user has accessed is in the Walled Garden domains.

11.5.7 NETKROM NMS lost connectivity with Hotspot

- If you access Hotspot through the WAN interface, make sure WAN interface has established its connectivity, or you have not selected HIGH Protection Level in Hotspot configuration (in this situation the NNMS connection from WAN is dropped).
- If you access Hotspot through the HotSpot LAN interfaces, and you have selected HIGH Protection Level in HotSpot configuration, NNMS connection cannot be established.
- If you access HotSpot through the HotSpot LAN interfaces, and you have configured your MAC address as the administrator's MAC, then enable DHCP client on your computer. If you cannot obtain an IP address, configure your computer with a static IP address, the first in Dynamic IP addresses (x.x.x.2) and try again (Maybe Hotspot is initializing).
- If there is another interface, neither WAN nor LAN, try to connect through it.

12. System Services

12. System Services

NETKROM can be configured to run the following services:

- **SNMP** (Simple Network Management Protocol) Service
- **HTTP** (Hyper-Text Transfer Protocol) Service
- **SSH** (Secure Shell Protocol) Service
- **NTP** (Network Time Protocol) Service

To configure **System Services** settings, select the **Services** tab, located under the **Advanced Configuration of Node, Configuration** tabs.

See Page 33 for a diagram showing Advanced Configuration tabs and sub-tabs.

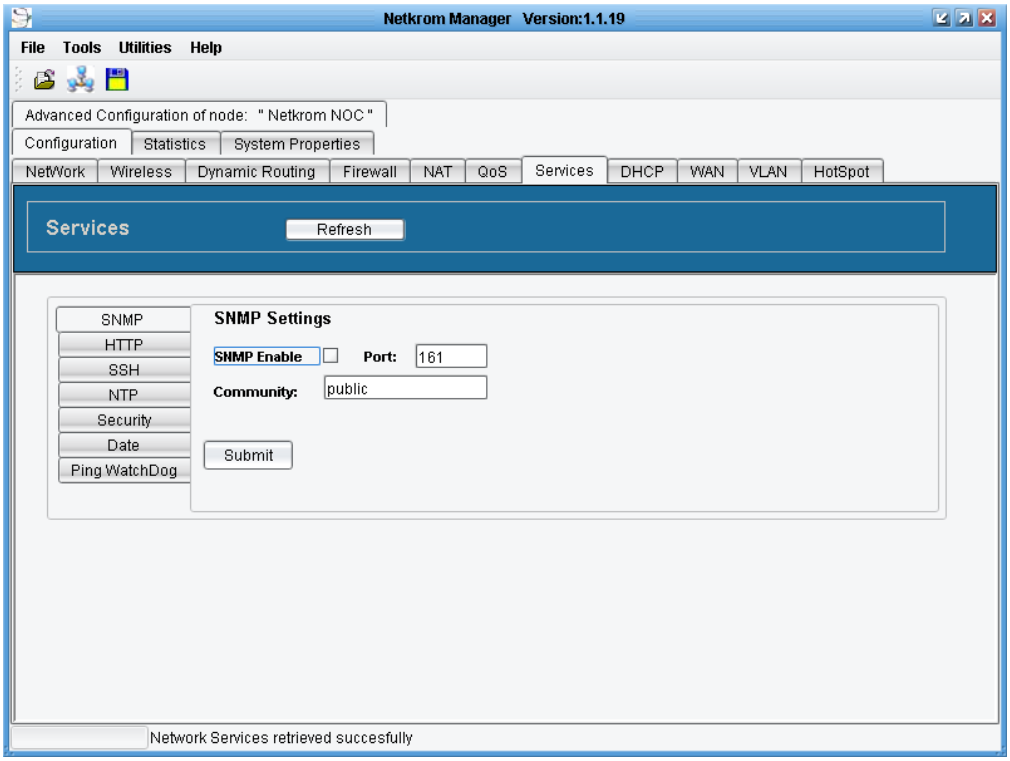


Figure 137. Services Tab

12.1 Configuring SNMP Settings

SNMP (Simple Network Management Protocol) is the most widely used protocol for managing TCP/IP Internets. A network management station

(NMS) uses SNMP query (poll) SNMP processes (agents) on network devices such as routers and end stations. These agents maintain a list of variables and their values that describe the state of the network device. The variables can describe routing table entries, interface addresses, and byte counts transmitted on various interfaces. The collection of variables is described by a Management Information Base (MIB).

When SNMP is enabled, NETKROM will respond to SNMP requests (SNMP get, getnext, getbulk, walk).

A community name can be configured, as a read-only community. SNMP set requests are not supported.

To configure **SNMP**, select the **SNMP** tab under the **Services** tab. Configure the SNMP tab fields as follows:

SNMP Enable

Select the **SNMP Enable** checkbox to enable SNMP

Port

The **Port** field contains the router port that the SNMP module listens to for SNMP requests (default 161). Typically you will not have to change this value.

Community

The **Community** field contains the read-only community name of SNMP service (default: public). SNMP service will respond to requests if and only if the community name is set appropriately.

Submit

Click **Submit** to apply the configuration.

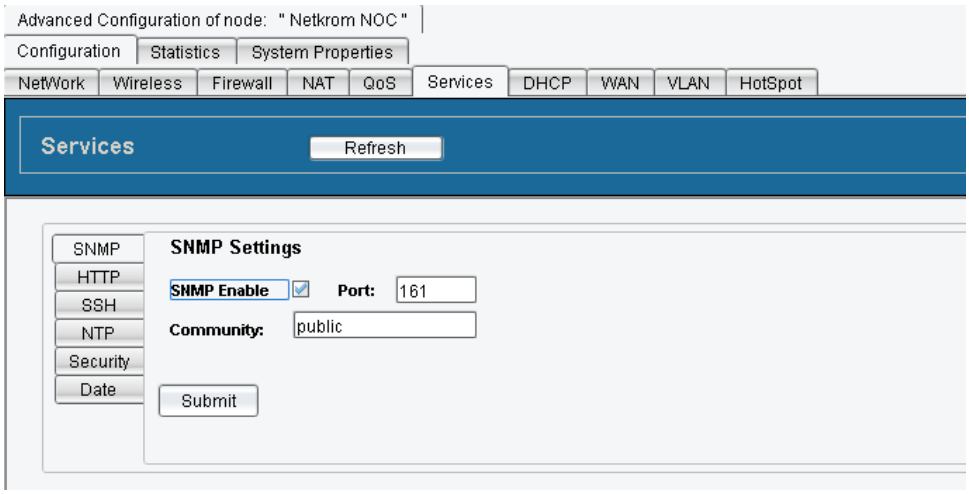


Figure 138. SNMP Service Configuration

12.2 Configuring HTTP Settings

Web servers are the computers that run Web sites, accepting HTTP (Hyper-Text Transfer Protocol) connections from web browsers and delivering Web pages and other files to them, as well as processing form submissions. When HTTP is enabled, NETKROM will respond to HTTP/HTTPS requests.

To configure **HTTP**, select the **HTTP** tab under the **Services** tab. Configure the HTTP tab fields as follows:

HTTP Enable

Select the **HTTP Enable** checkbox to enable HTTP

Port

The **Port** field contains the router port that the HTTP module listens to for HTTP requests (default 80). Typically you will not have to change this value.

Upload SSL Certificate

Click **Upload SSL Certificate** to open a **Select** dialog box and upload your own SSL certificate for Secure HTTP requests (HTTPS). A default certificate is included in every newly installed NETKROM.

Upload Key File

Click **Upload Key File** to open a **Select** dialog box and upload your own keys file for Secure HTTP requests (HTTPS). A default file is included in every newly installed NETKROM.

Submit

Click **Submit** to apply the configuration.

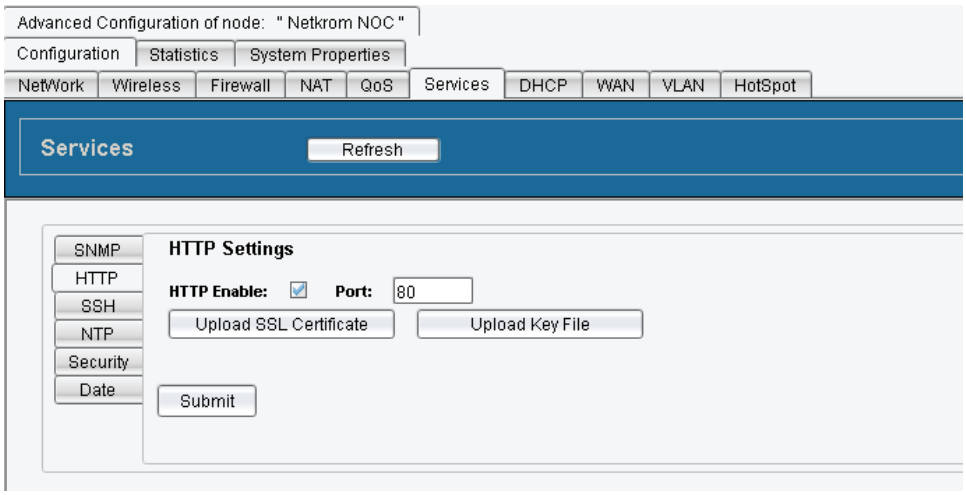


Figure 139. HTTP Service Configuration

12.3 Configuring SSH Settings

Developed by SSH Communications Security Ltd., Secure Shell is a program to log into another computer over a network, to execute commands in a remote machine, and to move files from one machine to another. It provides strong authentication and secure communications over insecure channels.

SSH protects a network from attacks such as IP spoofing, IP source routing, and DNS spoofing. An attacker who has managed to take over a network can only force SSH to disconnect. He or she cannot play back the traffic or hijack the connection when encryption is enabled.

When using SSH's slogin (instead of rlogin) the entire login session, including transmission of password, is encrypted; therefore it is almost impossible for an outsider to collect passwords. When SSH is enabled, NETKROM will respond to SSH connection requests.

To configure **SSH**, select the **SSH** tab the **Services** tab. Configure the SSH tab fields as follows:

SSH Enable

Select the **SSH Enable** checkbox to enable SSH

Port

The **Port** field contains the router port that the SSH module listens to for SSH connection requests (default 22). Typically you will not have to change this value.

Submit

Click **Submit** to apply the configuration.

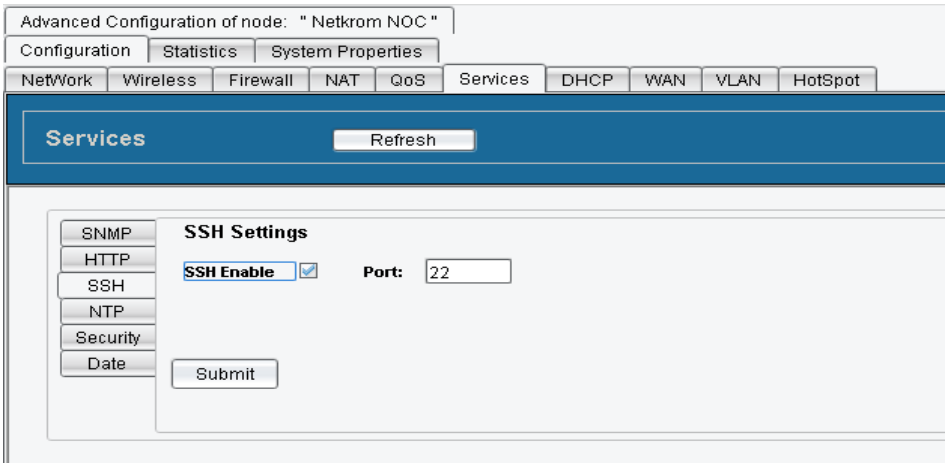


Figure 140. SSH Service Configuration

12.4 Configuring NTP Settings

The **Network Time Protocol (NTP)** is a time synchronization system for computer clocks through the Internet. The main characteristics of NTP are the following.

- Fully automatic, continuous synchronization
- Suitable for synchronizing one computer, or a whole computer network
- Fault tolerant and dynamically auto configuring
- Based on UTC time, independent of time zones and day-light saving time.
- Synchronization accuracy can reach 1 millisecond.

When NTP is enabled, NETKROM will periodically send a request to a configured NTP server (based Interval time) and adjust NETKROM's local system time.

To configure **NTP**, select the **NTP** tab under the **Services** tab. Configure the NTP tab fields as follows:

NTP Enable

Select the **NTP Enable** checkbox to enable NTP

Port

The **Port** field contains the router port that the NTP module listens to for NTP server responses (default 123). Typically you will not have to change this value.

Domain

The **Domain** field contains the domain name or IP address of the NTP server.

Interval

The **Interval** field contains the interval, in minutes, between two consecutive requests (default 60 minutes).

Submit

Click **Submit** to apply the configuration.

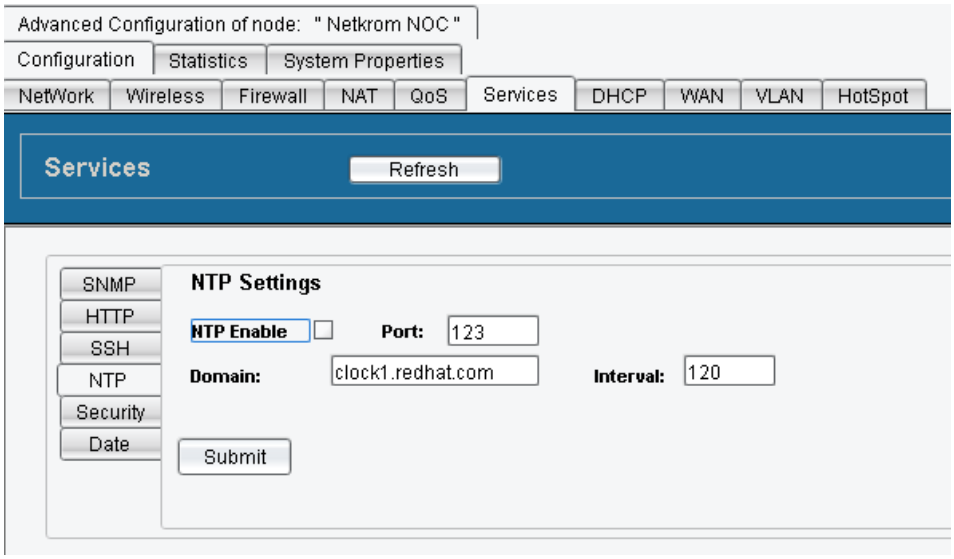


Figure 141. NTP Service Configuration

12.5 Setting the Administrator Password

To configure the administrator password, select the **Security** tab under the **Services** tab. Configure the Security tab fields as follows:

Old Password

Type the current password in the **Old Password** text box. The default password is: *admin*

New Password

Type the new password in the **New Password** text box. The new password must be at least 8 characters and no more than 63 characters

Re-type

Re-type the new password in the **Retype** text box

Submit

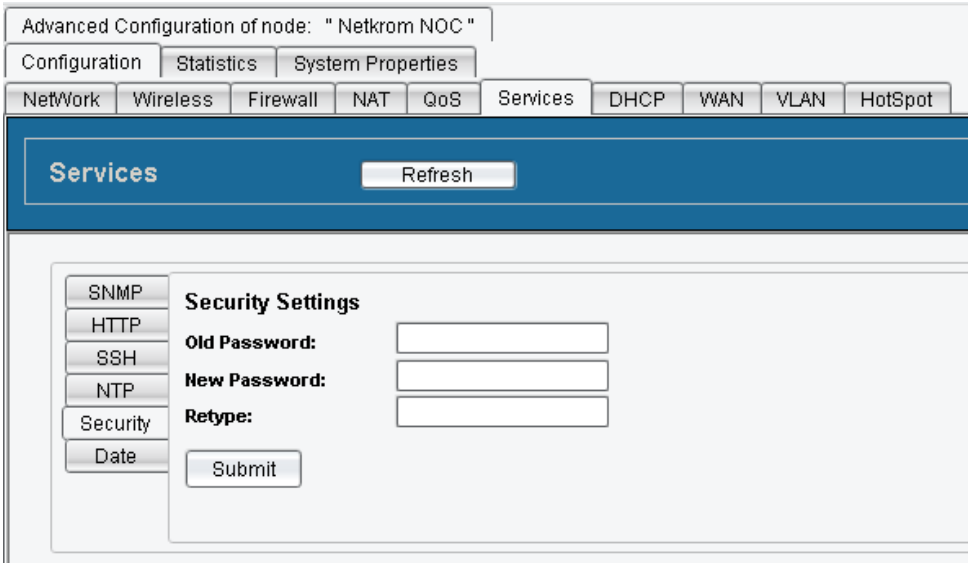


Figure 142. Change Administrator's Password

Click **Submit** to apply the configuration.

13. Monitoring and Statistics

13. Monitoring and Statistics

The advanced statistics engine of NETKROM OS, in combination with the graphing facilities of NETKROM NMS, lets the administrator delve into the results real-time, identifying high bandwidth nodes and possible bottlenecks.

Some **Monitoring and Statistics** features are available from the **Node Shortcut Menu.** Others are located under the **Advanced Configuration of Node, Configuration** tabs.

See Page 33 for a diagram showing Advanced Configuration tabs and sub-tabs.

13.1 Using the Status Info Dialog Box

The **Status Info** dialog box provides all the information displayed in the bottom pane of the **Network Topology** tab, with the addition of an extra editable field which is used to set the **Host Name** of the node. The displayed information is useful in cases where the administration unit is "hidden" behind NAT and connectionless communication (such as NETKROM Polling Protocol and SNMP) can not be initiated.

To view the Status Info dialog box, click **Open Status Window** in the **Node Shortcut Menu.**

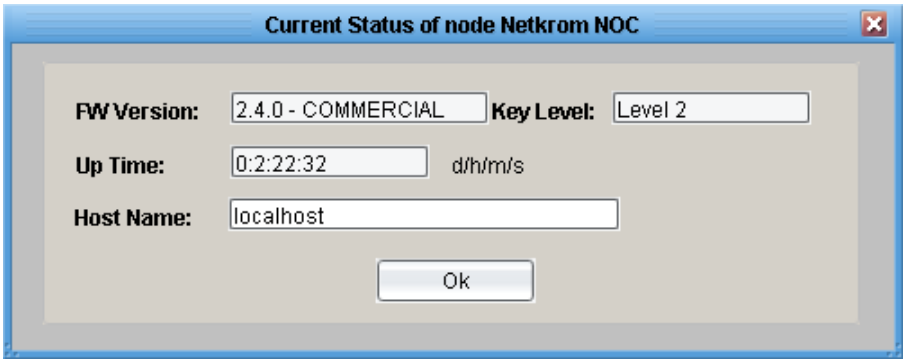


Figure 143. Current Status of Node Dialog Box

13.2 Using the Current Throughput Graph

The **Current Throughput** graph provides a real-time graphical display of transmit and receive traffic of each network interface. By monitoring performance and analyzing performance data, you can begin to see patterns in the data that will help you locate bottlenecks. After you have

located a bottleneck, you can make changes to the component to improve performance. Bottlenecks can occur anywhere in your server environment at any time, so it is important to capture baseline performance information about your system and monitor performance regularly. NETKROM NMS provides the option of real time traffic monitoring.

To view the **Current Throughput Graph**, click **Current Throughput** in the **Node Shortcut Menu.**

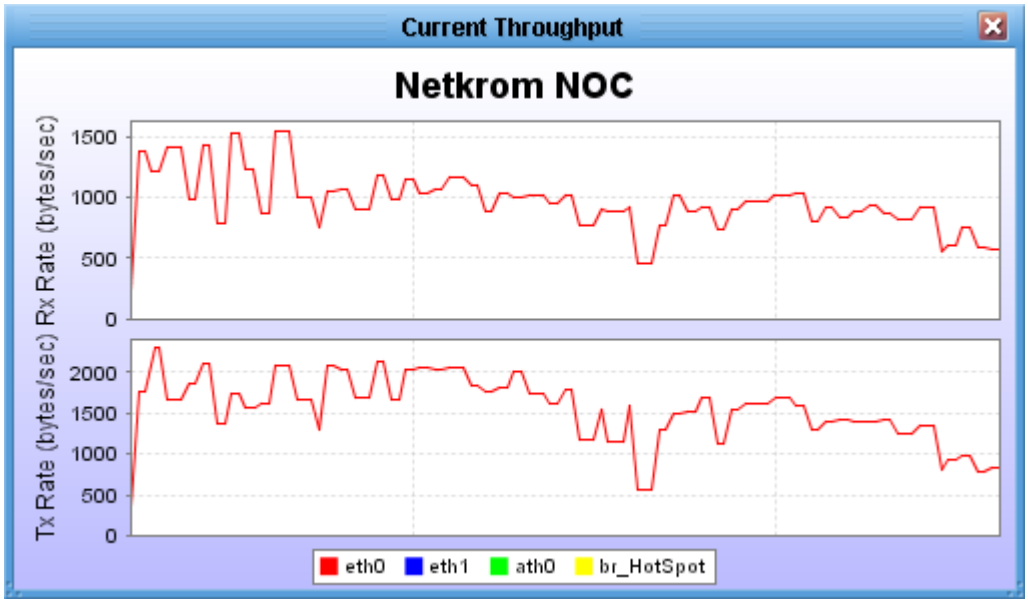


Figure 144. Current Throughput Window

13.3 Viewing Packet Statistics

The **Packet Stats** tab contains information concerning the total packet statistics per interface.

To view packet statistics, select the **Packet Stats** tab under the **Advanced Configuration, Statistics, Network** tabs.

Interface

Select the interface for which you want to view statistics in the drop down list.

Refresh

Click **Refresh** to update the graph.

Reset

Click **Reset** to…

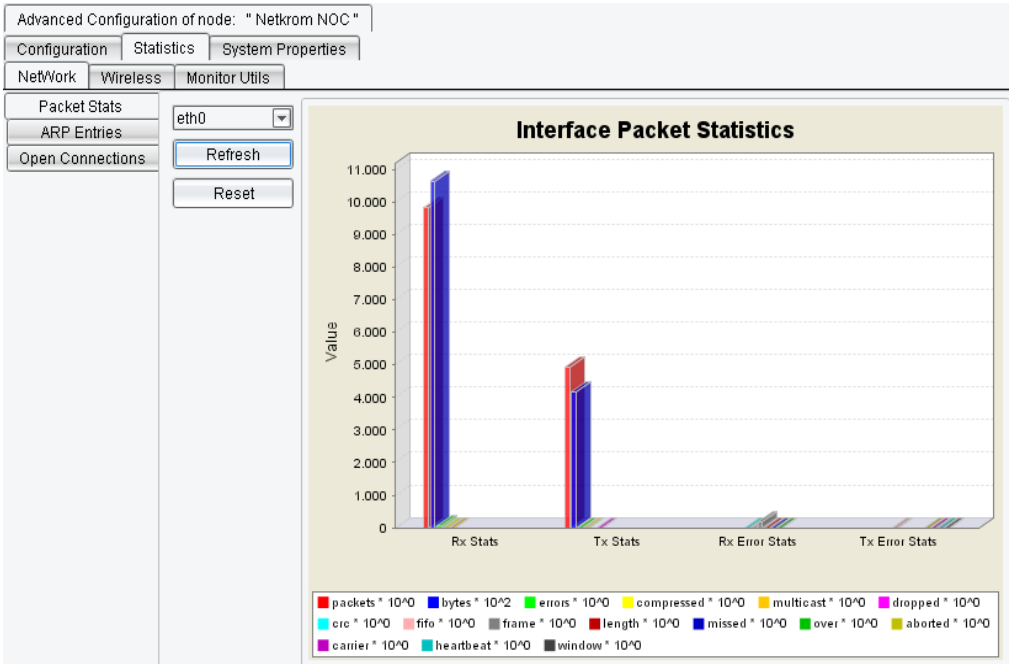


Figure 145. Interface Packet Statistics

13.4 Viewing the ARP Table

The **ARP Entries** tab contains the ARP (Address Resolution Protocol) table of the currently selected NETKROM node.

On a single physical network, individual hosts are known on the network by their physical hardware address. Higher-level protocols address destination hosts in the form of a symbolic address (IP address in this case). When such a protocol wants to send a datagram to destination IP address w.x.y.z, the device driver does not understand this address.

Therefore, a module (ARP) is provided that will translate the IP address to the physical address of the destination host. It uses a lookup table (sometimes referred to as the *ARP cache*) to perform this translation.

When the address is not found in the ARP cache, a broadcast is sent out on the network, with a special format called the *ARP request.* If one of the machines on the network recognizes its own IP address in the request, it will send an *ARP reply* back to the requesting host. The reply will contain the physical hardware address of the host and source route information (if the packet has crossed bridges on its path). Both this address and the source route information are stored in the ARP cache of the requesting host. All subsequent datagrams to this destination IP address can now be translated to a physical address, which is used by the device driver to send out the datagram on the network.

To view the ARP table, select the **ARP Entries** tab under the **Network** tab.

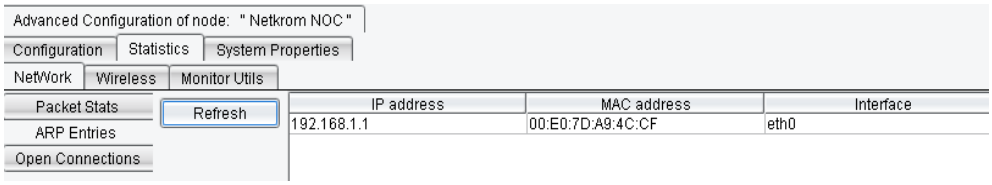


Figure 146. ARP Entries Table

13.5 Viewing the Open Connections List

The **Open Connections** tab displays all your computer's inbound and outbound connections and lists all open ports, helping the administrator to detect host's activity. Open connections can be sorted in ascending or descending order per column by clicking on the corresponding table header.

To the Open Connections list, select the **Open Connections** tab under the **Advanced Configuration, Statistics, Network** tabs.

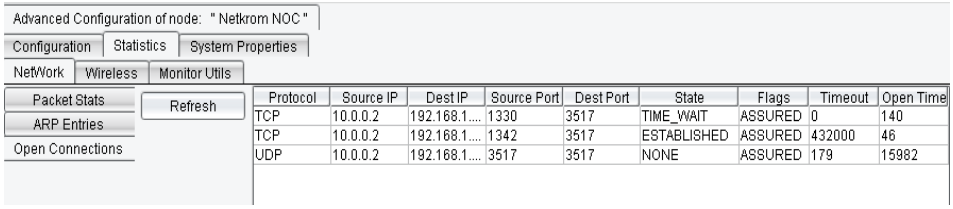


Figure 147. Open Connections Tab

Refresh

Click **Refresh** to update the open connections information.

13.6 Using Monitor Utilities

The **Monitor Utilities** tab provides a user interface for implementing two useful network utilities: **Ping (ICMP)** and **Traceroute**. To access these utilities, select the **Monitor Utilities** tab under the **Advanced Configuration, Statistics** tabs. The **Monitor Utils** tab has two sub-tabs: the **ICMP Util** tab and **Trace Route** tab.

13.6.1 Pinging (ICMP Utility)

The **ICMP Util** tab provides a convenient tool for initiating Ping commands. Ping sends ICMP requests to the address you specify and lists the responses received and their round trip time. When the utility is

terminated it summarizes the results in a graphic display, giving the average round trip time and the percent packet loss. This utility can be used to determine whether there is a problem with the network connection between two hosts.

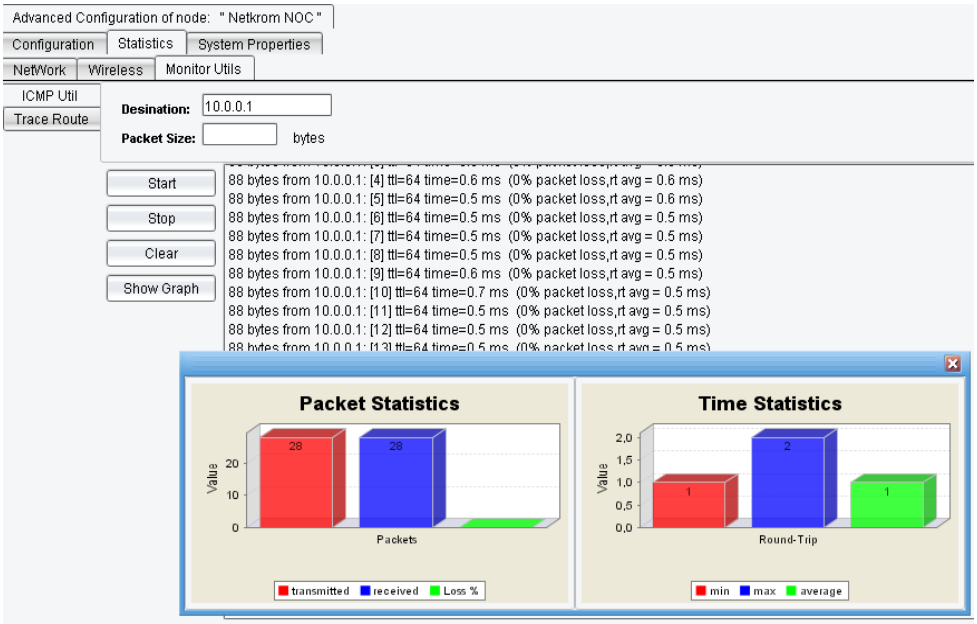


Figure 148. ICMP Utility Tab

To configure and use the ICMP Utility, select the **ICMP Util** tab, configure the **Destination** and **Packet Size** fields, then use **Start, Stop and Clear** buttons as follows:

Destination

Type the IP address of the node you wish to ping in the **Destination** text box.

Packet Size

Type the number of bytes to be sent in each packet in the **Packet Size** box.

Start

Click **Start** to initiate the Ping command. The software will repeatedly ping the destination address. The window will display the number of bytes, source address, time to live (ttl), the round trip time, % packet loss, and average time.

Stop

Click the **Stop** button to terminate the pinging process. The pinging session will end and a window will appear displaying the **Packet**

Statistics (Transmitted Packets, Received Packets and Loss %) and **Time Statistics** (Min, Max and Average) in bar graph format.

Clear

Click **Clear** to clear the data from the window. Data can be cleared while a pinging session is underway.

13.6.2 Using Traceroute

The **Traceroute** tab provides a convenient tool for initiating Trace Route commands.

Traceroute is a utility that records the route (the specific gateway computers at each hop) through the Internet between your NETKROM node and a specified destination. It also calculates and displays the amount of time each hop took. Traceroute is a handy tool for understanding where problems are in the Internet network.

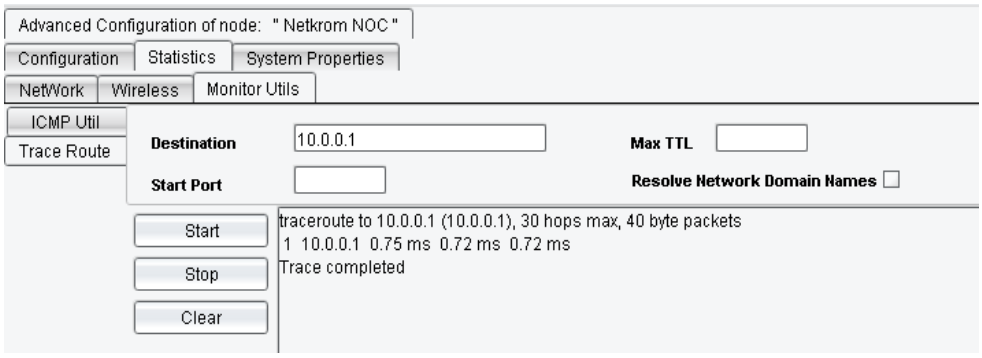


Figure 149. Traceroute Tab

To configure and use the ICMP Utility, select the **ICMP Util** tab, configure the required fields, then use the buttons as follows:

Destination

Type the IP address of the node to which you wish to Traceroute in the **Destination** text box.

Start Port

Type the port number in **Start Port** box.

Max TTL

Type the maximum time to live value in the **Max TTL** box.

Resolve Network Domain Names

Select **Resolve Network Names** to cause the utility to include the domain names of each IP address listed.

Start

Click **Start** to initiate the TraceRoute command. The software will trace the route to the destination address. The window will display the number of hops max, size of the packets and elapsed time.

Stop

Click the **Stop** button to terminate the TraceRoute process. The Traceroute session will end and a dialog box will appear displaying the **Traceroute utility terminated.**

Clear

Click **Clear** to clear the data from the window.

13.7 Viewing System Properties

The **System Properties** tab provides information about the currently selected nodes CPU and Memory. To access the **System Properties,** select the **System Properties** tab under the **Advanced Configuration** tab,

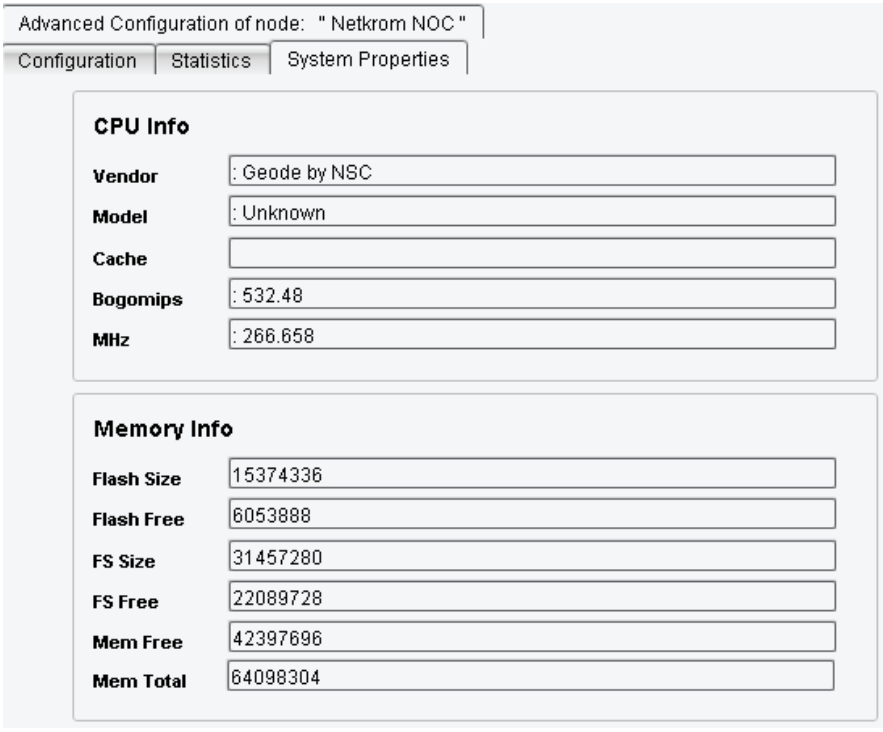
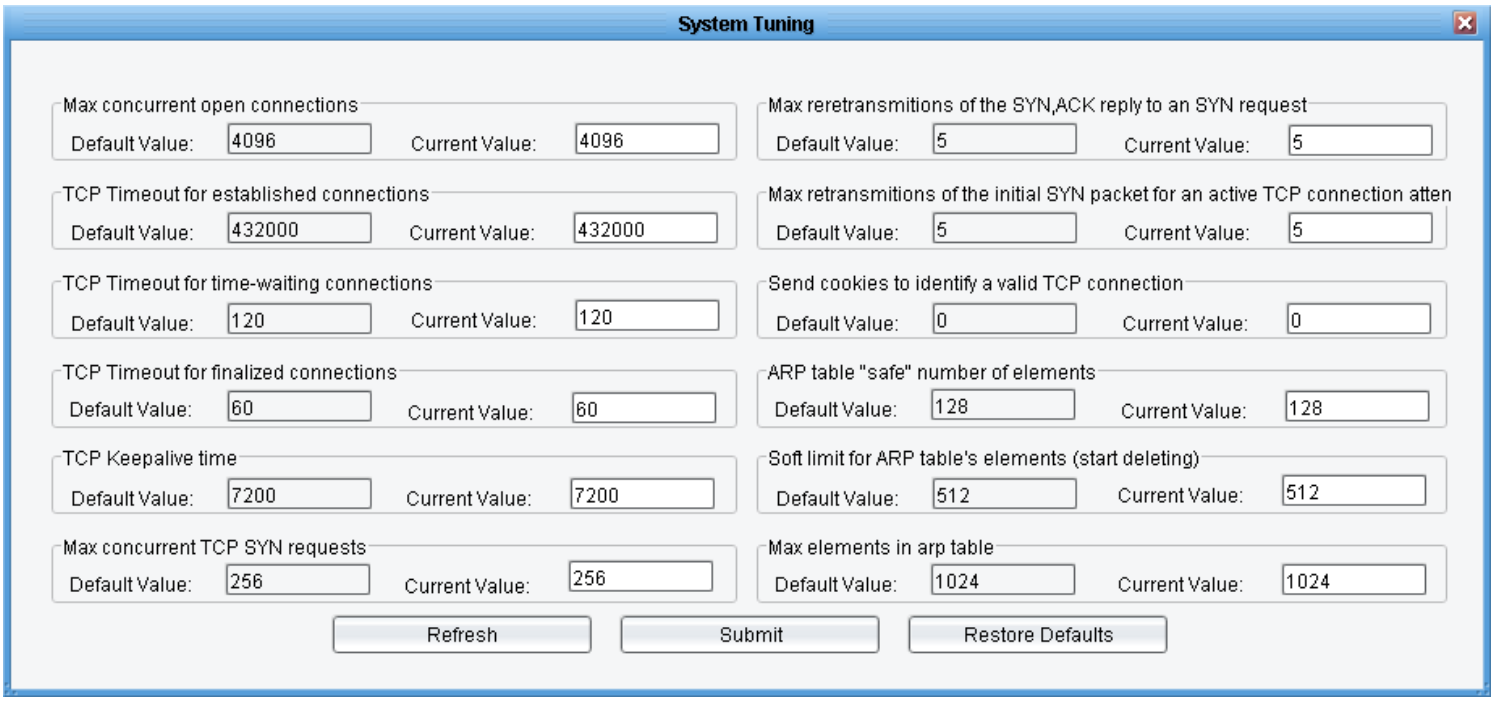


Figure 150. System Properties Dialog

To refresh the data in the **System Properties** fields, click the **Refresh** button.

14. System Tuning

System Tune allows one to maximize performance for specific applications. Using this parameters you will be able to configure advanced parameters in the TCP stack, make advanced adjustments to have a better control over your links, restrict and limit communication requests with your wireless equipment.



Max Concurrent Open Connections

The Max concurrent open connections field contains the number of concurrent connection attempts at one time.

TCP Timeout for Established Connections

The TCP Timeout for established connections field contains the maximum value permitted by a TCP implementation for the established timeout, measured in milliseconds.

TCP Timeout for time-waiting connections

The TCP Timeout for time-waiting connections field contains the maximum value permitted by a TCP implementation for the time-waiting timeout, measured in milliseconds.

TCP Timeout for finalized connections

The TCP Timeout for finalized connections field contains the maximum value permitted by a TCP implementation for the finalized timeout, measured in milliseconds.

TCP Keepalive time

TCP Keepalive time field contains the time a tcp connection going to be keep. The keepalive concept is very simple: when you set up a TCP connection, you associate a set of timers. Some of these timers deal with the keepalive procedure. When the keepalive timer reaches zero, you send your peer a keepalive probe packet with no data in it and the ACK flag turned on. You can do this because of the TCP/IP specifications, as a sort of duplicate ACK, and the remote endpoint will have no arguments, as TCP is a stream-oriented protocol. On the other hand, you will receive a reply from the remote host (which doesn't need to support keepalive at all, just TCP/IP), with no data and the ACK set.

If you receive a reply to your keepalive probe, you can assert that the connection is still up and running without worrying about the user-level implementation. In fact, TCP permits you to handle a stream, not packets, and so a zero-length data packet is not dangerous for the user program.

This procedure is useful because if the other peers lose their connection (for example by rebooting) you will notice that the connection is broken, even if you don't have traffic on it. If the keepalive probes are not replied to by your peer, you can assert that the connection cannot be considered valid and then take the correct action.

Max concurrent TCP SYN requests

Max concurrent TCP SYN requests field contains the number of concurrent connection request attempts at one time.

Max reretransmitions of the SYN/ACK reply to an SYN request

This parameter defines the maximum re-retransmitions a remote host will reply (SYN/ACK) if it does not receive any response from the transmitter host (syn request). This This process is used to protect the link from ddos.

Send cookies to identify a valid TCP connection

Blah blah blah . . .

ARP table "safe" number of elements

ARP table "safe" number of elements field contains the maximun number of entries that can be considerer as safe. An ARP table is a mapping of IP addresses to physical addresses.

Soft limit for ARP table's elements (start deleting)

Soft limit for ARP table's elements (start deleting) field contains the number from the system starts deleting entries in arp table slowly until reach the safe number of elements.

Max elements in arp table

Max elements in arp table field contains the maximun number of entries in arp table, the maximum number of entries and cannot be passed.

15. MRTG Support

15. MRTG Support

Multi Router Traffic Grapher, or **MRTG**, is a tool to monitor the traffic load on network links. MRTG generates HTML pages containing GIF images which provide a live visual representation of this traffic.

MRTG client support of NETKROM NMS uses the package provided by JRobin (http://www.jrobin.org/utilities/MRTGdemo.html).

To use the **MRTG**, select **MRTG** under the **Utilities** menu.

15.1 Using MRTG

To implement MRTG, extract the required files in a network server with java support and initialize it by executing the following command: "java –jar MRTG-server-1.4.0.jar".

Using MRTG

- After the successful MRTG server initialization, in the **Utilities** menu select **MRTG**. The built in MRTG client will be invoked and a prompt appears requesting the MRTG server IP address.
- Type the MRTG server IP address. Upon successful connection nodes can be inserted in the monitoring list.
- On each node insertion the user will be presented with a list of all available interfaces. The user may select one or more interfaces to monitor.

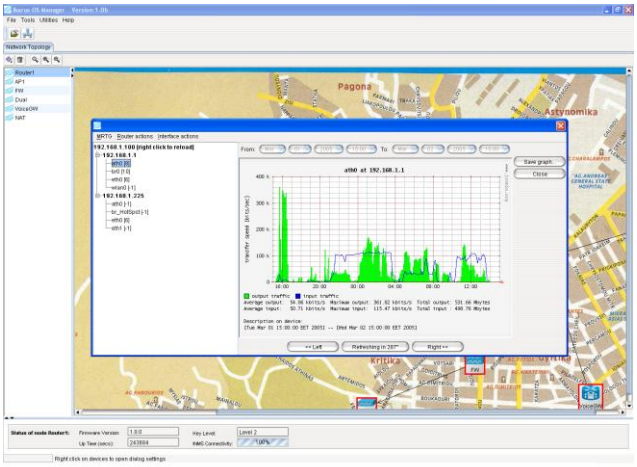


Figure 151. MRTG Display Statistics

NOTE: *The JRobin MRTG server uses SNMP polls to retrieve information which means that the SNMP agent has to enable in the monitored node.*

16. WISP Easy Wizard

16. WISP Easy Wizard

The **WISP Easy Wizard** is an extension to NETKROM NMS providing a convenient and easy way to install NETKROM nodes.

To start the WISP Easy Wizard, in the **Node Shortcut Menu**, select **WISP Easy Wizard (WEW).** The **WISP Easy Wizard (WEW)** dialog box appears which displays some typical WISP installations.

Select from the available operational modes. An Info Tip is displayed in the upper-left corner of the window when the cursor is hovered over an image.

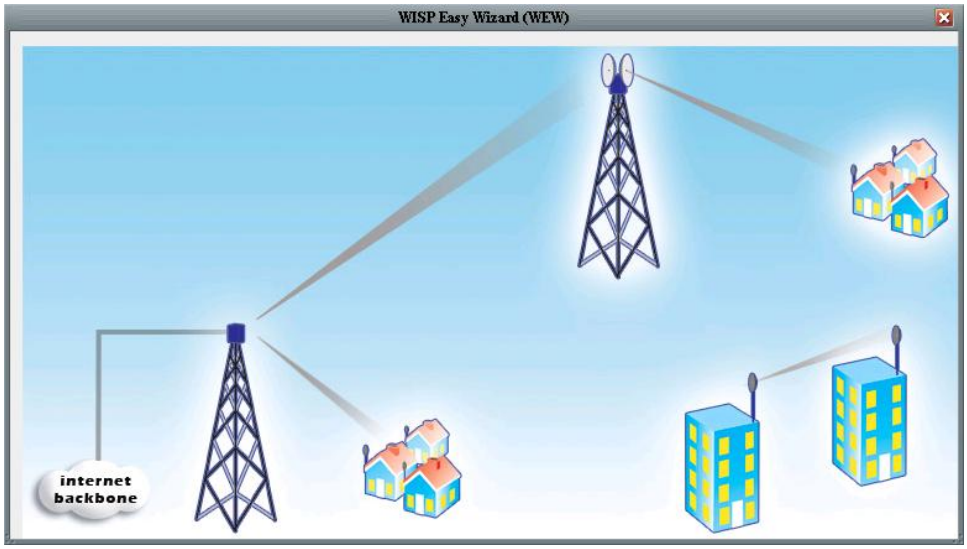


Figure 152. WISP Easy Wizard

Available configuration scenarios:

- **Backhaul AP**
- **Repeater AP**
- **Point-to-point link**
- **CPE installation**

Selecting the mode that is closest to your target configuration allows you to access a step by step simplified configuration procedure, which guides you through the whole configuration process.

After completion of the wizard, you can tweak the applied configuration manually as described in the previous chapters.

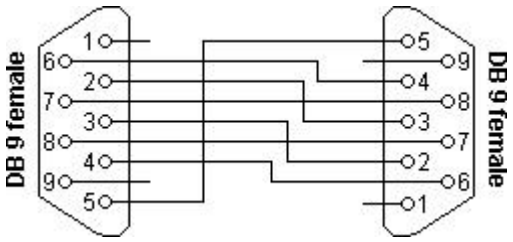
NOTE: After the successful application of the configuration via WEW the current IP is maintained to avoid losing connectivity with the device. If the user does not require that IP address any more, it is recommended to remove it by deleting the corresponding Virtual Interface.

17. APPENDIX - I

17.1 Restore to Factory Defaults Settings

Required tools:

Null Modem Cable with Full Handshaking:



Note: It will be necessary a Null Modem Adapter (DB9 male/ DB9 male), since the Serial Port built in the board is DB9 female.

A Terminal Emulator (e.g. Hyperterminal)

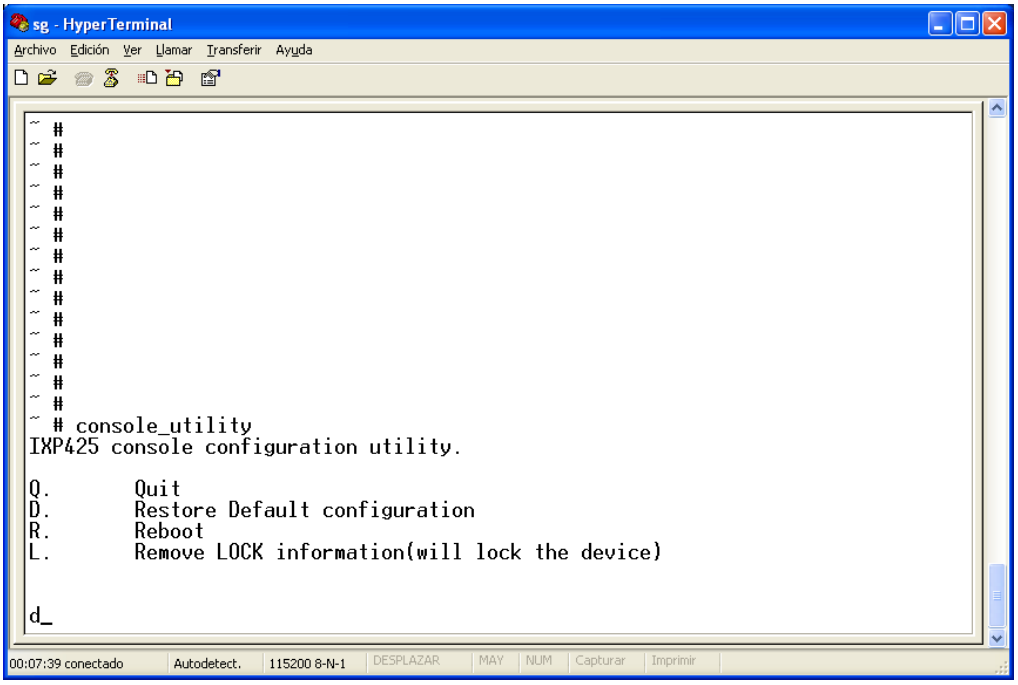
Parameters:

Bits per second:	115200
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	None

Procedure:

- Use the Null Modem cable to connect your PC and the built-in Serial Port of the radio (Previously you have to open the outdoor enclosure)
- Open the Terminal Emulator and use the parameters mentioned above.
- Power Up the Radio (Use the same PoE system provided by Netkrom Technologies)
- Press Enter continuously.
- Use the following commands to Restore Default Configuration:

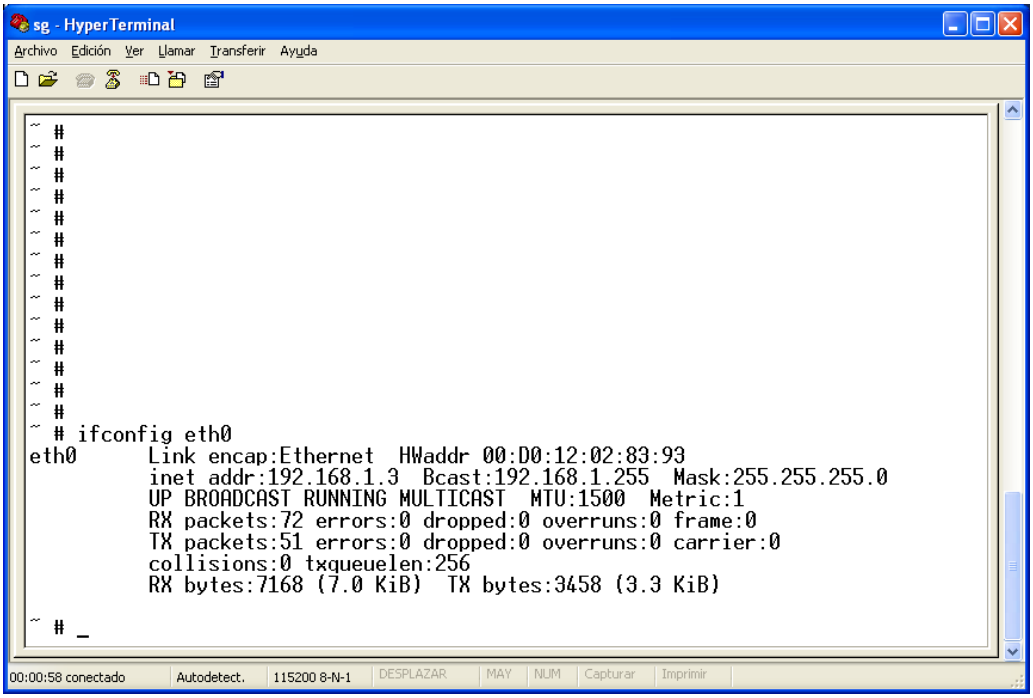
a) Run the command ***console_utility*** and then select the option **D (**Restore Default Configuration)



b) Then you will be able to ping 192.168.1.3 (ISP-BS500's default IP address) and use the default password which is admin

Note:

If you only lost the IP address of the radio (eth0), then only use the following command to show the IP Address, ***ifconfig eth0***



18. Index

Access Point **52**

ACL

Allowing Access 67

Denying Access 67

Extracting lists 68

Setting up lists 67

Action **55**

Add

Background Image 26

Firewall 80

New Bridge 38

New Interface 40

Rule Entries 48

Static Route 46

AES(CCMP) **66**

Alias **54**

Antenna Options **63**

AP Client **58**

ARP Table **166**

Association List **53**

Authentication

MAC 143

UAM 144

Backend Radius

Configuration 143

Backup **33**

Bandwidth Manager **104**

Beacon Period **52**

BSSID

Preferred 59

Current Throughput **34, 164**

Default Gateway **37**
DHCP
Client 96
Configuration 92
Conflict 94
Decline 94
Fields 93
HotSpot DHCP Server 131
Lease 94
Lease Time Strategies 96
Leases 95
Max Lease 94
Min Lease 94
Offer 94
Relay 97
Time Parameters 94
Diversity Options **63**
DNAT **88**
DNS
Error 127, 155
Keep DNS and Gateway 97
Keep DNS and Gateway 100
Keep DNS and Gateway 103
PPTP service name 102
Spoofing 160
DNS Address
DHCP Servers 95
Global Settings 38
Fade Margin **54**
Firewall **74, 78**
Chains 78
Examples 88
Matching Fields 80
Global Settings **37**
Hide ESSID **55**
HotSpot

Advertisement 139
Authentication Type 137
Configuration 126, 146
DHCP Example 131
LAN Settings 130
NAT Enable 132
Protection Level 133
Radius Server 137
Troubleshooting 155
WAN Settings 105, 106, 109, 110, 112, 114, 116, 120, 122, 123, 124, 125, 128
Web Customization 140
Wizard Configuration 128
HTTP 159
ICMP 167
Idle Time 54
Inactivity Limit 52
Interface
Select/Disable 36
IP Address 36, 54
Remote Peer 36
IP Forwarding 37
IP Networking
Configuration 35
IP settings 36
MAC 138
Address 37, 54
Spoofing 37
MRTG 171, 174
NAT
Chains 78
Matching Fields 85
Rules 84
Network Bridge 38
Network Interfaces Tree
Using 36
Node
Add 24

Advanced 30
Moving/Resizing Icons 26
Save 33
Shortcut Menu 21, 28
Status Window 30
Noise Level **54**
NTP **161**
Open Connections List **167**
Outdoor Settings
Configuration 68
Link Distance 68
Packet Statistics **165**
Pairwise Cipher **66**
Password **162**
Pinging **167**
PPTP Client **101**
Profiles
Saving and Loading 28
PSK **66**
Radio
Channels and Frequencies 62
Configuration 61
MAC Address 62
Phycial Layer 62
Transmission Rates 62
Reboot **33**
Repeater Mode
Configuration 56
Routers **95**
Routing
Modifying 49
Removing 49
Repositioning 49
Static 47
Tables 45
Security

Access Control Lists 67
Configuration 64
WEP 64
WPA 65
Signal Level **54**
Site Survey **51**
Align 60
Continuous Scan 60
Operation 59
SNAT **87**
SNMP **157**
SSH **160**
SSID **52**
Preferred 57, 59
State and Link Quality **57, 59**
Status
Info Dialog Box 164
Stealth Mode **55**
Stop Traffic **55**
Subnet **36**
Backend Radius Fields 143
DHCP Server Fields 94
Discovery Manager Fields 22
Firewall Matching Fields 81
HotSpot Fields 147
NAT Matching Fields 86
PPTP Fields 102
Walled Garden Fields 139
System Properties **170**
System Services
Configuration 157
Table View **40**
Throughput **164**
TKIP **66**
Trace Route **169**
Transmission Rate **54**

Transmitted Power **63**
Type
Node 54
UAM **138**
Upgrade
Firewall 33
Utilities **167**
Virtual Interface **39**
VLAN **41**
Interfaces 42
Walled Garden **139**
WAN **99**
PPPoE Client 99
WDS **55**
WEP **136**
WINS
Servers 95
Wireless **50**
Extended Repetition 73
Point to Point Links 71
Scenarios 71
Setting Modes 51
WISP Easy Wizard **34**

1. Operation Manual

1.1 Operation

Equipment Under Test is a high power miniPCI card to be used in outdoor wireless systems. Please follow the following instruction while using this card. This card is meant to be operated (and used) by system integrators who are aware of the regulatory requirements in the area it is being used. The following instructions need to be followed while using the card

- Before inserting the card in a host PC board, please power down the host PC board first
- The antenna port (MMCX connector) should be connected to the appropriate load or antenna before powering up the host board. Lack of Antenna (or load) while the Equipment Under Test is powered up will cause severe damage to the card
- Please make sure any person handling the card with bare hands follows proper ESD precautions. Improper handling could cause ESD damage.
- The card should not be tampered or modified in any way. Tampering or modification could cause the card to fail standard tests

1.2 FCC Information

1.2.1 Electronic Emission Notices

This device complies with CFR 47 Part 15 of the FCC rules.

Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

1.2.2 FCC Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to CFR47 Part 15. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment, not withstanding use in commercial, business and industrial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from where the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1.2.3FCC Radiation Exposure Statement

To comply with FCC RF exposure requirements in section 1.1307, a minimum separation distance of 2.1 feet is required between the antenna and all occupational persons, and a minimum separation distance of 4.6 feet is required between the antenna and all general population persons.

1.2.4Antenna Installation

WARNING: It is installer's responsibility to ensure that when using the authorized antennas in the United States (or where FCC rules apply); only those antennas certified with the product are used. The use of any antenna other than those certified with the product is expressly forbidden in accordance to FCC rules CFR47 part 15.204. The installer should configure the output power level of antennas, according to country regulations and per antenna type. Professional installation is required of equipment with connectors to ensure compliance with health and safety issues.

1.2.5Antenna Compliance

The Equipment Under Test radio module has been tested and certified with the following antennas:

Figure 153. Grid (24 dBi) – W24-24G
Figure 154. Dipole (2 dBi)

Any antenna of same make and lower gain than those listed above may be used in compliance with certification.