Raylink

WISP AP Controller

User Guide

Ver. 1

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Chapter 1

Introduction

The Raylink WISP AP Controller is a unique global solution, solving the last-mile broadband access problem. It is the best way to build your last-mile network. This chapter provides an overview of how the AP Controller works.

The AP Controller offers an alternative to expensive leased lines or fiber networks. It provides the high-performance, cost effective LAN-to-LAN and LAN-to-WAN connectivity that is ideally suited for a wireless ISP (WISP).

The medium access control (MAC) address table can handle a maximum 2048 learned network nodes. Two 512-Kilobit (Kb) internal buffers allow full speed on each Ethernet segment. Standard transparent bridging features can be configured, for example:

- Packets can be filtered (dropped) by MAC and IP address
- Packets can be forwarded based on specific Bridge Groups and traffic queues
- Packet forwarding can be fully disabled over a chosen queue, port or entire bridge.

Raylink Network Management Software (NMS) is a fully graphical Windows 32-bit program that is capable of managing your AP Controller from any networked personal computer (PC) over the Internet. Raylink NMS performs all remote control functions for management, forwarding, filtering, and monitoring of network services, traffic analysis and billing. Additional Raylink NMS features include:

- Built-in triggers and event logging
- Configurable forwarding, filtering, and monitoring policies.

Product Features

This section describes the product features of the AP Controller.

Bridging Features

- Layer 2 store and forward
- Up to 8 logical groups per port (VLAN)
- Packet filtering on MAC address level.

Traffic Throttling / Shaping / Forwarding

- Traffic throttling from 32 Kilobits per second (Kbps) to 2048 Kbps
- Traffic shaping with up to 128 queues
- Forwarding at up to the maximum Ethernet/Fast Ethernet speed

Packet Buffering

- Two 512 Kb shared software data buffer

Standards Compliance

- IEEE 802.3 Ethernet
- IEEE 802.3u Fast Ethernet
- IEEE 802.1d Transparent learning bridge
- IEEE 802.11 WLAN – Frequency-hopping spread spectrum (FHSS).

Wireless Features

- Infrastructure Access Point, Infrastructure Client, and Ad-Hoc (point-to-point)
- 2.4 GHz Industrial Scientific Medical (ISM) band
- Speeds up to 2 Mbps
- Distances up to 15 miles.

Port Statistics

- Complete port traffic statistics
- Collection polling rate - 10 seconds.

Address Table Features

- 2048 learned nodes
- Flushing time - 10 minutes.

Security Features

- Password-protected management
- 64 bit software encryption
- Encrypted proprietary management protocol.

Configuring the AP Controller

This section describes the initial configuration of the AP Controller including setting the basic operating parameters.

Preparing Your Configuration Tools

Before you start the basic configuration of your AP Controller please prepare the following items:

- The Raylink Installation CD that contains all the installation files.
- A PC or notebook computer equipped with a functional COM port, a CD-ROM, and a 32-bit Windows operating system. This computer will be used as the Raylink Management Station.
- A standard crossed (null-modem) serial cable.

Configuration Overview

The AP Controller is designed to be configured initially by using a PC or notebook computer. Configuration of the AP Controller includes:

- Installing the Raylink Network Management System (NMS) on a PC or notebook computer running the Win95/98/NT/2000/XP operating system. This installation will turn this computer into a Raylink Management Station.
- Connecting the Raylink Management Station to the AP Controller.
- Setting up the interface parameters and other operating conditions within the AP Controller.
- Disconnecting the Raylink Management Station from the AP Controller.

Installing Network Management

Follow these steps to install the Raylink Network Management System (NMS) as your configuration utility:

1. Insert the Raylink Installation CD into the CD-ROM drive.

2. Click the **Start** button on the Windows Taskbar, then click **Run** and continue by clicking the **Browse** button.

3. In the Browse window, select the drive containing the Installation CD. Browse to the file SETUP.EXE and click the **Open** button.

4. In the Run window, click the **OK** button to start the selected SETUP program.

5. Follow the instructions displayed in the Setup window; click the **Next** button.

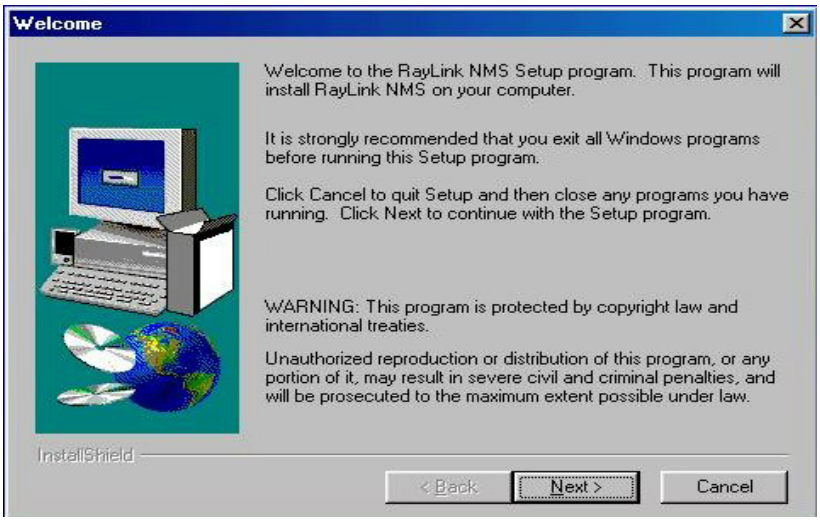


Figure 1 - Welcome

6. To create the directory in C:\Program Files for your Raylink NMS, accept the default settings by clicking the **Next** button in the Choose destination Location window or click the **Browse** button to enter a new location.

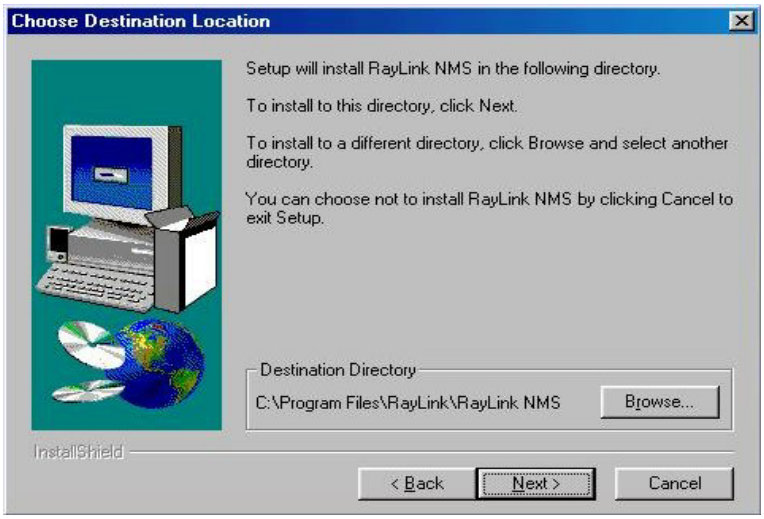


Figure 2 - Destination Location

7. To create a new directory or to change the default location, select drive in the **Drives** box; type the new directory name in the **Path** box of the Choose Directory window.

8. To create a new program group for your Raylink NMS, accept the default settings in the Select Program Folder window or type a new name in the **Program Folders** box.

9. In the next window, check your setup and click the **Next** button to start copying the files.

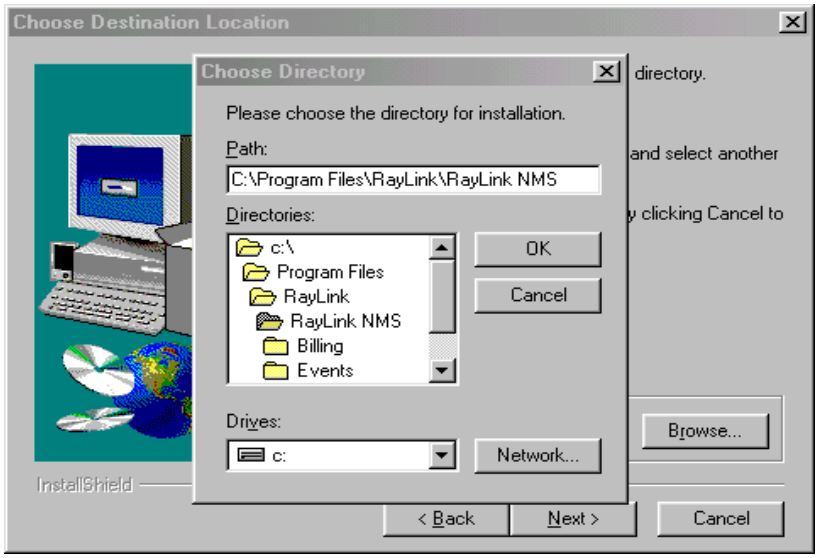


Figure 3 - Custom Installation Path

10. After completing the installation steps, restart the computer.

Your Raylink NMS should now be installed. You may want to create a Raylink NMS shortcut on your Windows Desktop.

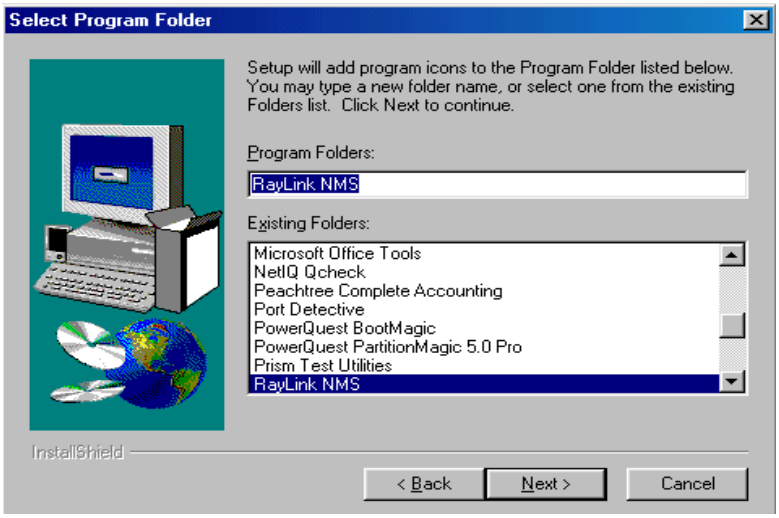


Figure 4 - Program Folder

Configuring a Serial Connection with the AP Controller

The basic setup of the AP Controller requires a temporary serial cable connection between the Raylink Management Station and the AP Controller. Begin configuring this serial connection after the Raylink NMS is installed on your Management Station. Follow these steps to configure the serial connection:

1. Shut down and power Off the AP Controller.
2. Unplug and remove the hardware key from the serial port of the AP Controller.
3. Connect a standard crossed (null modem) serial cable between the serial ports on the Management Station and the AP Controller.

Note: Because the COM1 port is usually connected to the mouse-pointing device on your Raylink Management Station, we suggest using another available serial port. If the port is busy with anything other than your AP Controller, you will get the message: "Can't open port COMx! "

4. Power up the Management Station and start the Raylink NMS.
5. In the main menu, select **File** and then select **Serial Line Console.** The Serial Port Settings window appears.
6. Select the appropriate serial port of your Management Station in the Serial Port Settings drop-down box. Configure this port as shown.

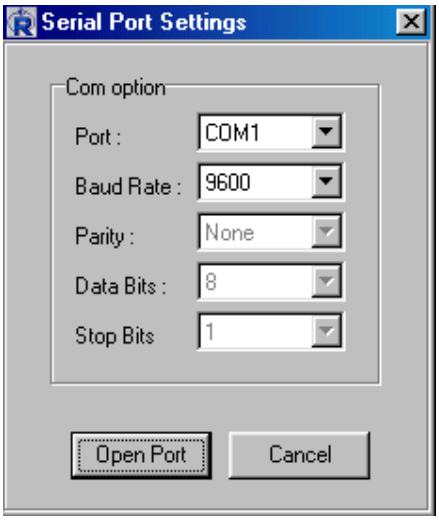


Figure 5 - Serial Port Settings

7. Click the **Open Port** button. The "Not connected" status message will be displayed next to the title in the Serial Line Console window.

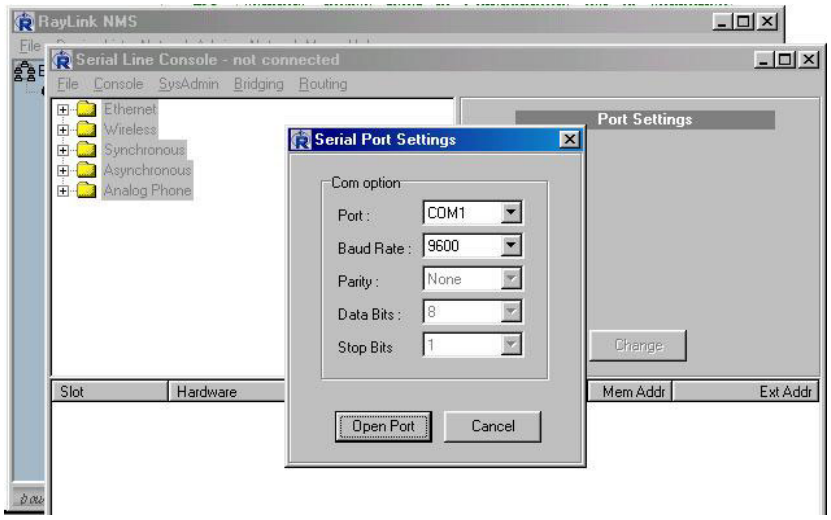


Figure 6 - Serial Line Console Not Connected

8. In the Serial Line Console window, select **Console** and then select **Connect to Device**.

9. Power On the AP Controller.

10. Click the **Connect** button in the Device Connecting dialog box.

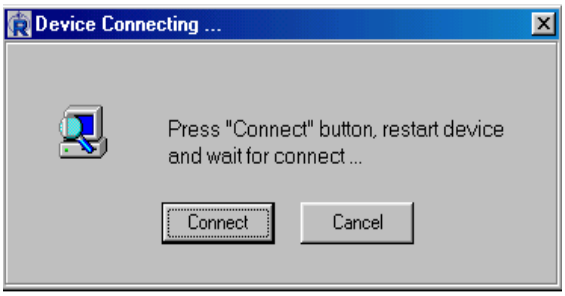


Figure 7 - Device Connecting

11. A “Connecting device” message is displayed. Wait for the connection to be established.

Figure 8 - Waiting for Device Response

12. When the Serial Line Console window says “connected to” your network and the wireless and Ethernet hardware is shown, the AP Controller is ready to accept your configuration commands.

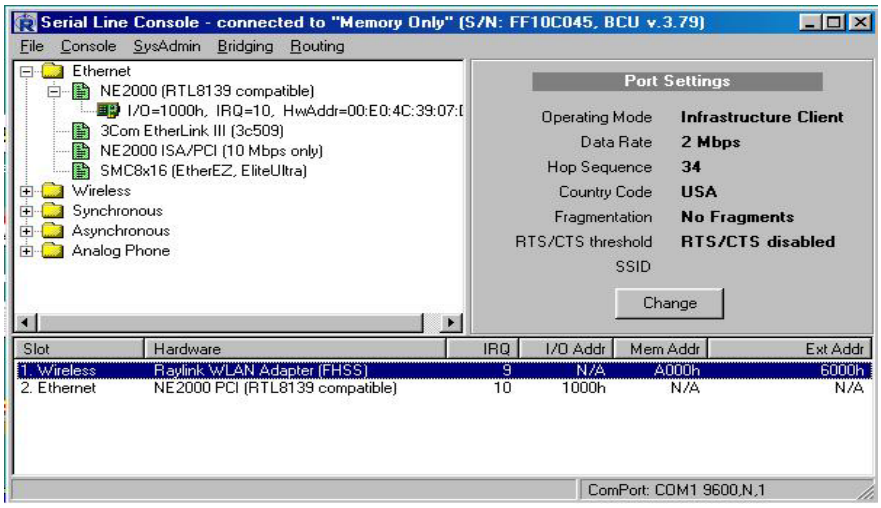


Figure 9 - Connected

Note: If your AP Controller is unreachable through the network, then a direct serial cable connection is the only way to modify the operating parameters.

Configuring Initial Operating Parameters

Configuring the initial operating parameters includes the following:

- Setting the interface configuration parameters
- Reordering interfaces in the slot list
- Changing the IP networking properties
- Changing the Administration password
- Writing the operating parameters to permanent memory.

Selecting Ethernet Interfaces

The Ethernet ports are preconfigured and may not need to be changed. Follow these steps to reconfigure the Ethernet ports:

1. To change the media type, select the hardware interface in the bottom part of the Serial Line Console window and click the **Change** button.

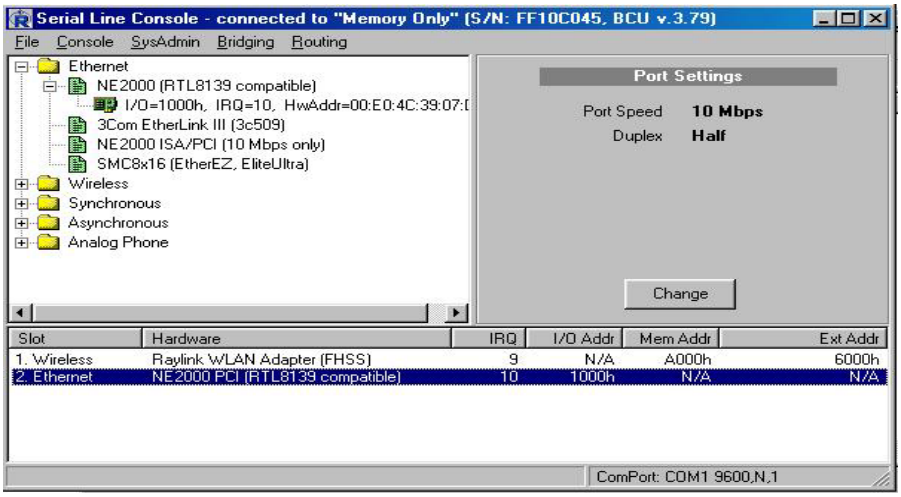


Figure 10 - Selecting Ethernet Interfaces

2. In the New Values box of the Port Settings window, select the new value.
3. Click the **Save** button to accept the changes.
4. Repeat the above steps until all Ethernet Interfaces are configured, then write the settings to permanent memory.

Setting Wireless Interface Parameters

Set your Wireless Interface card operating parameters by doing the following:

1. Click the Wireless Interface in the bottom part of the Serial Line Console window and then click the **Change** button. The Port Settings window for the Wireless Interface appears.

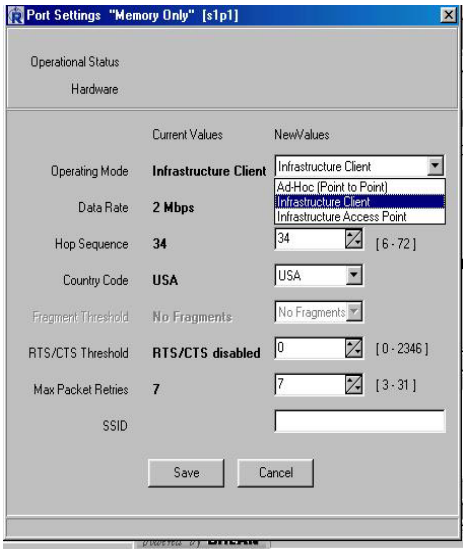


Figure 11 - Wireless Port Settings Window

2. Select the desired wireless operating mode in the **Operating Mode** drop-down box. The AP Controller can operate in Infrastructure Access Point, Infrastructure Client, and Ad-Hoc (point-to-point) modes.
3. Set the other Wireless Interface parameters (**Data Rate, Hop Sequence, Country Code, RTS/CTS Threshold Threshold, Max Packet Retries** and **SSID**).
4. Enter your changes, then click the **Save** button.
5. Repeat the above steps until all the Wireless Interfaces are configured.
6. Write the new settings to the permanent memory of the AP Controller.

Reordering Interfaces in the Slot List

Follow these steps to reorder or to remove interfaces in the slot list:

1. To change the availability of the particular Interface within the **Slot** column, select the Interface in the bottom part of the Serial Line Console window.
2. To move the record up by one position in the **Slot** list, right-click the Interface and click **Move record up** in the pop-up menu.
3. To move the record down by one position in the **Slot** list, right-click the Interface and click **Move record down** in the pop-up menu.
4. To remove an unnecessary Interface from the **Slot** list, right-click the Interface and click **Delete record** in the pop-up menu. To confirm removing the Interface, click the **Yes** button.

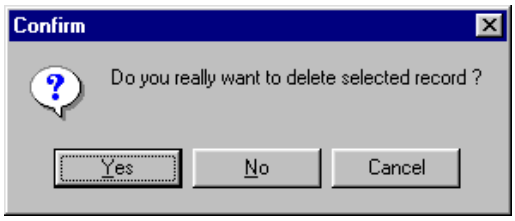


Figure 12 - Confirmation

5. After editing the **Slot** list, write the settings to the permanent memory of the AP Controller.

Changing IP Networking Properties

Your AP Controller communicates in normal operating mode with the Management Station via the standard IP protocol. To make your AP Controller accessible in your network, set your particular IP networking properties. Once you

have done this, you can manage the AP Controller from any PC connected to the Internet.

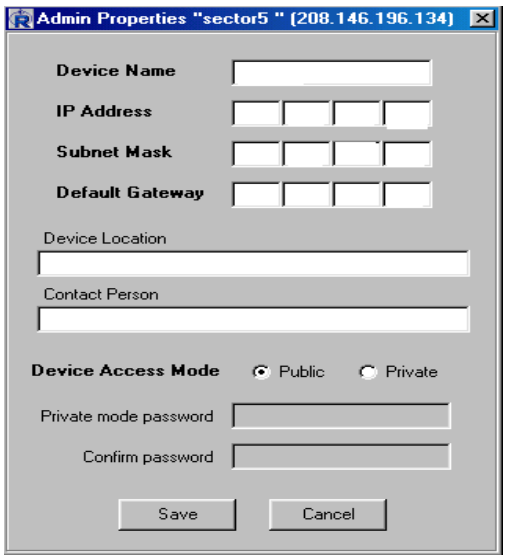


Figure 13 - Empty Admin Properties Window

Follow these steps to set the IP networking properties:

1. Click the **SysAdmin** command in the Serial Line Console window.
2. Click **SysAdmin Device Properties**.
3. Type the device name (used to identify your device) in the **Device Name** box.

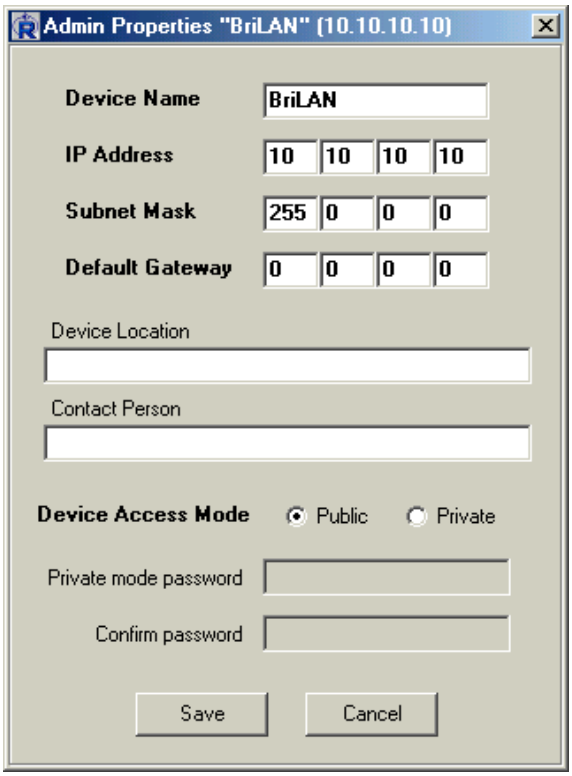


Figure 14 - Admin Properties Before Saving

4. Enter the IP Address for the AP Controller in the **IP Address** box.
5. Enter the subnet mask in the **Subnet Mask** box.
6. Enter the default gateway in the **Default Gateway** box. If your network is not interconnected with other networks, you do not need to make an entry in this box.
7. Save the current settings by clicking the **Save** button.

8. Confirm by clicking the **Yes** button.

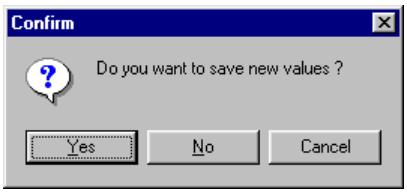


Figure 15 - Admin Properties Confirmation

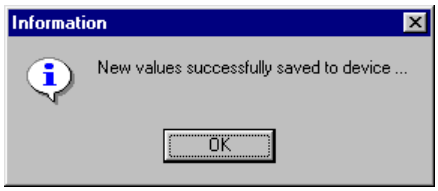


Figure 16 - New Settings were Accepted

9. Write the properties to the permanent memory of the AP Controller.

Changing Administration Password

During normal operation, remote management of your AP Controller with the Management Station is possible using standard IP network connectivity. Traffic and status data are available without specifying a password for the AP Controller. Without the password, all other management functions are disabled.

Note: Configuring parameters via the serial cable does not require using the SysAdmin Password.

To improve management security, you can change the default password (SysAdmin). Follow these steps to change the default password:

1. Click **SysAdmin** in the menu bar of the Serial Line Console window.
2. Click **SysAdmin Password** in the SysAdmin menu.
3. Type the new password in the **SysAdmin Password** dialog box and click the **OK** button. The password is case-sensitive (upper and lower case).

Figure 17 - Password Change

4. Confirm the password by retyping it in the **SysAdmin Password Confirmation** dialog box and then click the **OK** button.

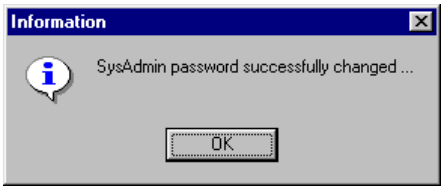


Figure 18 - Password Accepted

5. Write the new password to permanent memory of the AP Controller.

Writing Operation Parameters to Permanent Memory

When performing the initial configuration of your AP Controller, all configuration parameters changes are sent via serial cable to the RAM memory of the AP Controller. Follow these steps to make these changes permanent and to write them to permanent memory:

1. Click the **File** command in the Menu Bar of the Serial Line Console window.
2. Click **Save settings to Device**.
3. Click the **Yes** button in the Confirm dialog box.

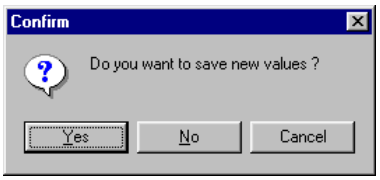


Figure 19 - Confirm

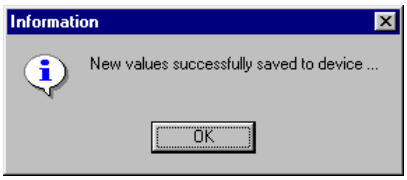


Figure 20 - Values Saved

4. To close the Information box, click the **OK** button.

Note: If you want to return to the default parameters, use the **Reset Device to Defaults** command.

Finishing Initial Setup

You finish the initial setup by writing all operation parameters to the permanent memory of the AP Controller. Follow these steps to write the parameters to memory:

1. Close the Serial Line console window by clicking **Exit** in the **File** menu.
2. Shut down your AP Controller.
3. Disconnect the serial cable from the COM ports of the AP Controller and the Management Station.
4. Connect the hardware key to the serial port of the AP Controller.

Your initial setup of the Raylink WISP AP Controller is now completed. Now you can connect your new AP Controller to the network and continue fine-tuning the other operating parameters.

Chapter 2

Remote Administration

This section provides information about performing routine administration tasks over the network using the Raylink Network Management Software (NMS). Using Raylink NMS, you can perform management tasks remotely for your Raylink WISP AP Controller.

Running Raylink NMS

You can manage your AP Controller from any networked PC having local or remote connectivity to the AP Controller. To manage the AP Controller remotely, you need:

- A personal computer (PC) with the Windows operating system, TCP/IP, and Raylink Network Management Software (NMS)
- At least one AP Controller to manage
- Network connectivity to your AP Controller(s).

Follow these steps to start the Raylink NMS:

1. On the Windows task bar, click the **Start** button and point to **Programs** group.
2. Point to **Raylink NMS** group and click the **Raylink NMS** command.
3. Continue under the Raylink NMS program window.

Tip: You can use the Ping command from your operating system to test connectivity from the Raylink Management Station to the AP Controller. Click **Start**, then click **Run** and enter "Ping -t followed by the IP address of your AP Controller".

Adding an AP Controller to the Network

Your network may contain several AP Controllers, accessable from the Device List and from the **Network Map**. The **Network Map** is accessible from the **Network Map** tab in the right side of your Raylink NMS window. The left portion of your Raylink

NMS window contains basic graphical information about the operational status of your AP Controller. The operational status of a particular AP Controller is indicated by color-coded icons:

- Green – Clear/Working OK
- Yellow – Critical Warning (Example – No Ethernet connection)
- Red– Critical Error (Example – No signal in Ad-Hoc mode)
- Gray – Unreachable (Example – Not visible to network)

Follow these steps to add a new AP Controller to the **Network Map**:

1. Click **Device List** in the Raylink NMS window menu.
2. Point to the **Add Device to Map** command.
3. In the Add Device dialog box, enter the valid IP address and password for the new AP Controller.

Figure 21 - Enter IP Address and Access Password

4. Click OK.

Expanding an AP Controller View

Each AP Controller listed on your Network Map can be simultaneously displayed in detail in its own Expanded View window. There are several ways to open the Expanded View window.

- Double-click the LED icon of the AP Controller, or
- Double-click the icon of the AP Controller on the **Network Map** tab, or
- Double-click on the record of the AP Controller on the **Device List** tab, or
- Right-click on the icon of the AP Controller on the **Network Map** tab and then click the **Expanded View** command, or

- Right-click on the record of the AP Controller on the **Device List** tab and then click the **Expanded View** command.

Switching to SysAdmin Level

The proprietary network management protocol used by the AP Controller is secured with authorization and encryption. When the remote management console communicates with your AP Controller, it checks the password of the System Administrator. When your access is unauthorized or you enter an invalid password, you will not be able to modify any parameter of the AP Controller. Authorized users work in the SysAdmin Level mode.

Note: The default password is set to "SysAdmin".

Follow these steps to switch to the SysAdmin Level mode:

1. Open an **Expanded View** window of the AP Controller.
2. Select **Device**, point to **SysAdmin Level**, and select **Open SysAdmin Level**.
3. Enter your valid SysAdmin password in the dialog box. The password is case-sensitive and must contain from 6 to 20 characters.
4. Click the **OK** button.

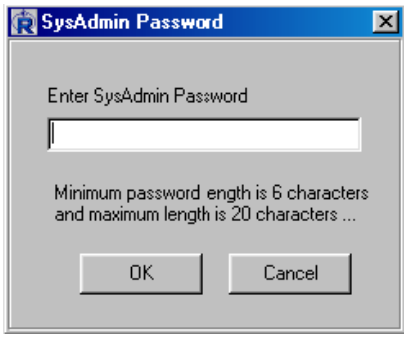


Figure 22 - Enter Password

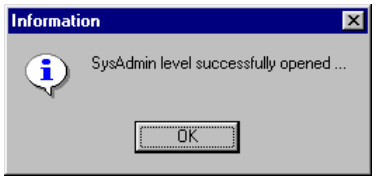


Figure 23 - Password Accepted

5. The yellow-colored key on the left side of the SysAdmin Level command indicates that the SysAdmin commands are enabled.

Changing SysAdmin Password

You can change your current password in the SysAdmin Level mode. Follow these steps to set the administration password:

1. Open Expanded View of the AP Controller and switch to SysAdmin Level mode.
2. Select **Device**, point to **SysAdmin Level**, and select **Change SysAdmin Password**.
3. In the resulting SysAdmin Password dialog box enter your new password. Passwords are case-sensitive and must contain between 6 and 20 characters.

Figure 24 - Enter New Password

4. Confirm the new password by retyping it in the SysAdmin Password Confirmation dialog box, and then click the **OK** button.

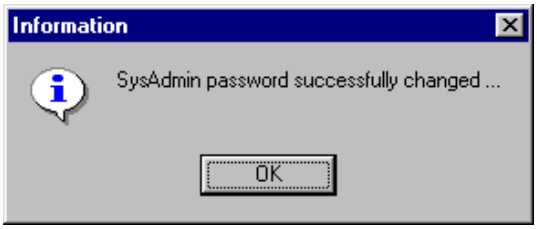


Figure 25 - Password Changed

You can disable the SysAdmin Level commands by closing your SysAdmin Level session. Follow these steps to close your SysAdmin Level session:

1. Open an Expanded View of the AP Controller.
2. Select **Device**, point to **SysAdmin Level**, and select **Close SysAdmin Level**.
3. Click the **Yes** button in the Confirm dialog box.
4. Click the **OK** button in the Information message box.

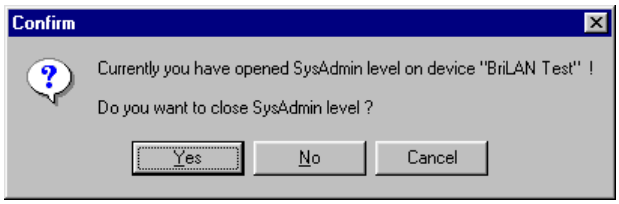


Figure 26 - Confirmation

Figure 27 - SysAdmin Level Closed

Note: If you forget your SysAdmin password, establish a direct serial cable connection (see Chapter 1) and enter a new password.

Upgrading The Raylink WISP AP Controller

A typical wireless network installation may include a number of AP Controllers deployed over a wide physical area. The Raylink NMS allows you to upgrade these remote AP Controllers from the Raylink Management Station.

Replacing Raylink Image File Remotely

The Raylink Image File is contained on your Raylink Installation CD. The Image File is an executable version of the Raylink Network Operating System (NOS).

NOTE: The NOS is the operating system software that controls the operation of the AP Controller.

Follow these steps to remotely upgrade a previous version of the Image File and to transfer the new Image File to each AP Controller through the network:

1. Open Expanded View of the AP Controller and switch to SysAdmin Level mode.
2. In the **Device** menu point to **System Upgrade**.
3. In the **System Upgrade** menu click **Raylink Image File**.
4. In the Raylink System Upgrade window enter the full path and file name of the Raylink Image File that you want to use or click the **Browse** button to select it.

5. After clicking the **Browse** button select or browse the new System Image File (with the BIF suffix) in the Open dialog box. Click the **Open** button to confirm your selection.
6. In Raylink System Upgrade window click the **Upload** button.

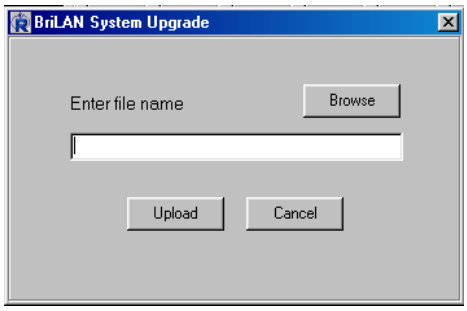


Figure 28 - Upload

7. In the Confirm dialog box, click the **Yes** button to save the currently uploaded file to the AP Controller.

Figure 29 - Confirm Write File to Flash Memory

8. In the Confirm dialog box, click the **Yes** button to restart the AP Controller with the new image file.

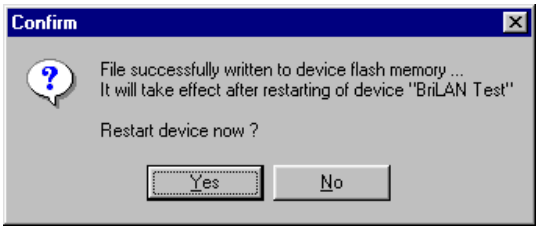


Figure 30 - Confirm Restart Now

Replacing Raylink Configuration Utility Remotely

The Raylink Installation CD contains the Raylink Configuration Utility. The Configuration Utility is normally used when you change Interface options with a

direct cable connection to the AP Controller. Follow these steps to remotely upgrade a previous version of the Configuration Utility and transfer the new file to an AP Controller through the network:

1. Open Expanded View of the AP Controller and switch to SysAdmin Level mode.
2. Select the **Device** menu and point to **System Upgrade**.
3. Click **Raylink Configuration Utility**.
4. In Raylink System Upgrade window enter the full path and file name of the Raylink Image file you want use or click the **Browse** button to select it.

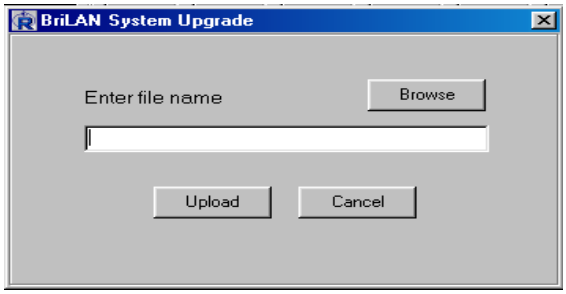


Figure 31 - Specify File

5. After clicking the **Browse** button, select or browse the new configuration utility file (with the BCU suffix). Click the **Open** button to confirm your selection.
6. In the Raylink System Upgrade window, click the **Upload** button.
7. In the Confirm dialog box click the **Yes** button to save the current uploaded file to the AP Controller.

Figure 32 - Write File to Memory

8. To restart the AP Controller immediately, click the **Yes** button in the Confirm dialog box.

Figure 33 - Confirm Restart Now

Restarting the AP Controller Remotely

Occasionally you may want to restart the WISP AP Controller remotely. Follow these steps to restart the AP Controller remotely after upgrading the system files or the configuration utility.

1. Open the Expanded View of the AP Controller and switch to SysAdmin Level.
2. In the Expanded View menu, select **Device**, and then select **Device Restart**.
3. To restart the AP Controller immediately, click the **Yes** button in the Warning dialog box.

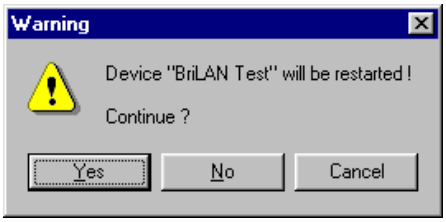


Figure 34 - Confirm Restart

4. To finish the task, click the **OK** button in the Information message box.

Figure 35 - Device Restarted

Getting Information About The System Mainboard

Sometimes you may need hardware-specific information about the AP Controller or about the utilization of the system central processing unit (CPU). This information can give you a picture of the current system load and can also alert

you to the need for upgrades. Using the Raylink NMS you can obtain this information remotely.

Viewing CPU and RAM Information

Follow these steps to view information about the hardware of your system mainboard:

1. Open the Expanded View window of the selected AP Controller.
2. Right-click the **CPU** slot in the Expanded View window.
3. Click **System Information** in the resulting pop-up menu.
4. Click **OK** to close the System Information window.

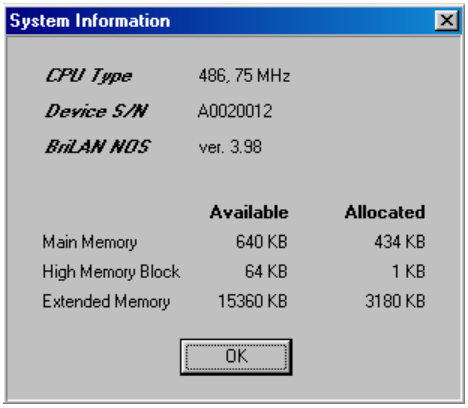


Figure 36 - CPU and Memory Information Summary

Viewing CPU Utilization

Follow these steps to view information about the CPU Utilization of your AP Controller:

1. Open the Expanded View window of the selected AP Controller.
2. Right-click the **CPU** slot in the left pane of the Expanded View window.
3. Point to and click **CPU Utilization in Graph** in the resulting popup menu.
4. To change the time scaling of your diagram, click **Graph** in the menu bar.
5. Point to **Collection Period** and select the requested time interval.
6. To close the System Information window, click **File** in the menu bar and then click **Close**.

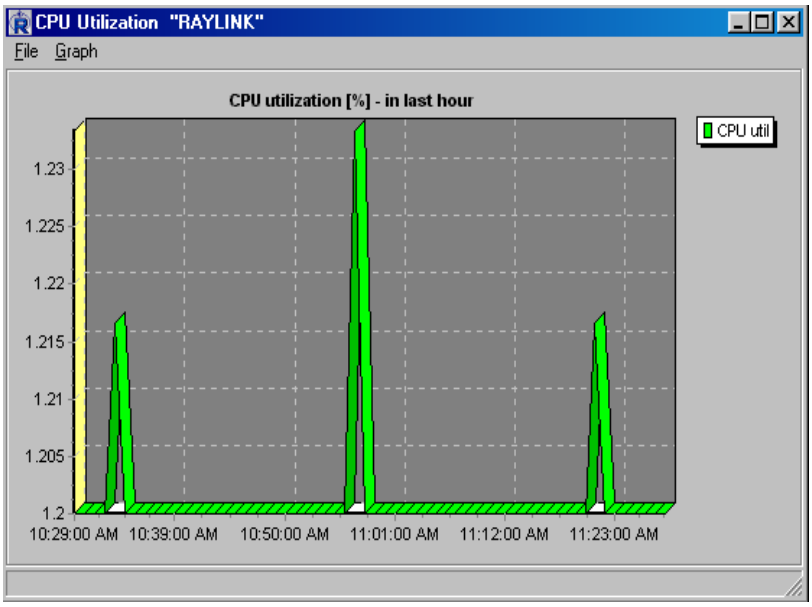


Figure 37 - CPU Utilization Graph

Managing Raylink Network Services

Using the AP Controller you can run the following services on your AP Controller:

- Bridging
- Virtual Channels

Raylink NMS contains all the tools for remote configuration of the listed services, plus filtering, monitoring, traffic analysis, billing and event logging. To manage Raylink Network Services, complete the following tasks:

1. Configure the service
2. Apply your custom Raylink forwarding, filtering, and monitoring Policies
3. Start your new Raylink service

Chapter 3

Configuring Interface Parameters

This section provides information on modifying operating parameters of the Interface Ports on your WISP AP Controller. Sometimes you may need to check or change the operating parameters of the interface(s) installed in your AP Controller. You can also perform these tasks remotely.

The general process used to configure the port operating parameters is to:

1. Switch to the SysAdmin level.
2. Read the Port Configuration.
3. Change the Port Configuration (optional).
4. Check the wireless link quality (optional).

Checking Port Settings

Follow these steps to check the Interface Port settings remotely:

1. Open the Expanded View window for the AP Controller.
2. Right-click the **Port** record in the Expanded View window, or right-click the **Port** in the Slot Panel window.
3. In the popup menu, click **Advanced Port Info**. The Advanced Port Info window displays the Port information.

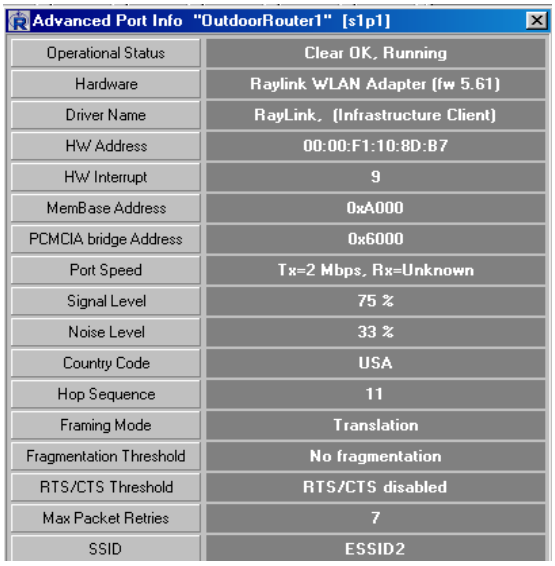


Figure 38 - Advanced Port Info for Wireless Port

4. To close the Advanced Port Info window, click **(x)** in the upper right-hand corner of the window.

Changing Port Settings

You can edit some operating parameters such as **Media Type**, **Data Rate, Hopping Sequence, TX Power Level, Fragment Threshold,** and **SSID** of any selected Port on your AP Controller. Follow these steps to change the Port operating parameters remotely:

1. Open the Expanded View window for the AP Controller.

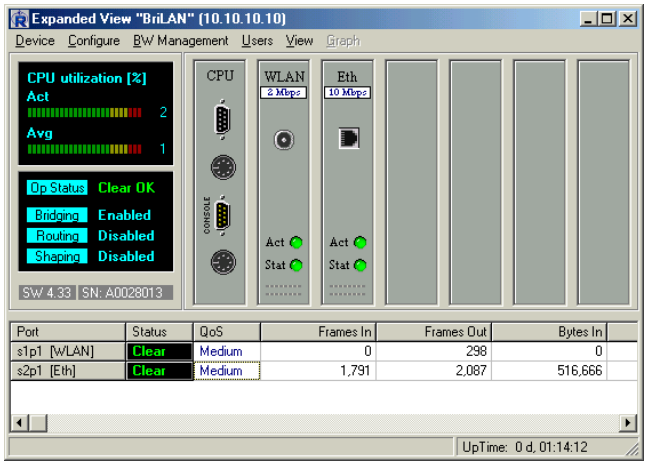


Figure 39 - Expanded View Window

2. Enter SysAdmin Level by clicking **Device**, pointing to **SysAdmin Level**, and clicking **Open SysAdmin Level**. Enter the SysAdmin password.
3. Right-click the Port in the details (bottom) pane of the Expanded View window or right-click the Port in the Slot Panel window.
4. In the popup menu, click **Configure Port**.
5. Set the appropriate operation parameters in the Port Settings window.
6. Click the **Save** button in the Port Settings window.
7. To confirm the settings, click the **Yes** button in the **Confirm** message box.

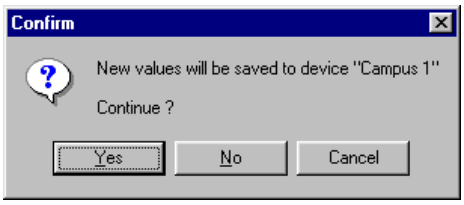


Figure 40 - Confirm

8. To have the new settings take effect, click the **Yes** button in the **Confirm** message box.
9. The Information window confirms that the new Port settings have been accepted.

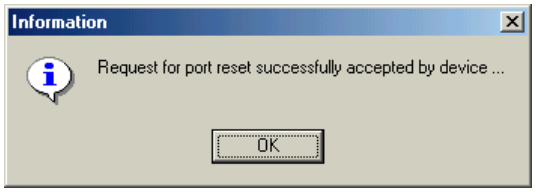


Figure 41 - Port Reset Request Accepted

Checking Packet Length Distribution

Knowing the current packet distribution by size can give you a useful picture of the traffic on your network segments. You can check the distribution diagram of the current packet traffic in six predefined characteristic packet size intervals (in bytes).

Follow these steps to see the Packet Length Distribution diagram:

1. Open the Expanded View window.
2. Right-click the Port Record in the details pane or right-click the Port in the Slot Panel window.

3. In the popup menu, click **Packet Length Distribution** and continue in the Packet Length Distribution window.

4. If you want to change diagram scaling between **Own Maximal Values**, **Common Maximal Values** and **Percentage View,** right-click the diagram then click the requested scaling in the resulting popup menu.

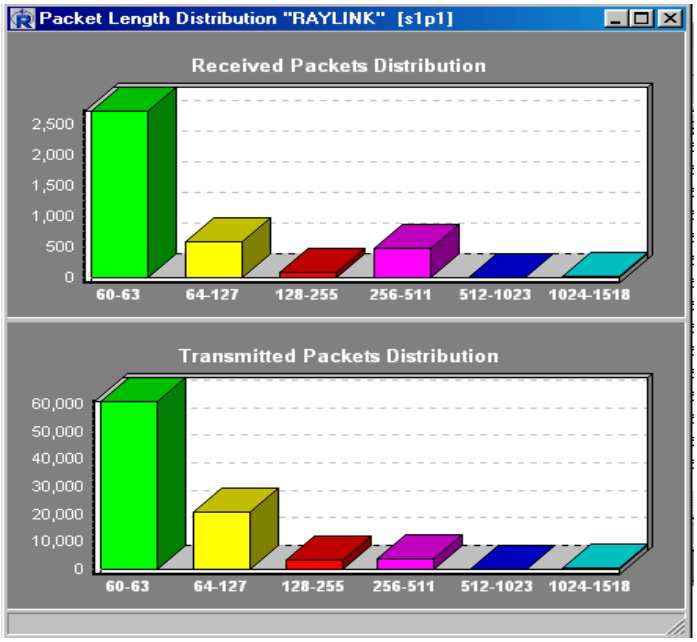


Figure 42 - Packet Length Distribution

Checking Wireless Link Quality

You can check the quality of your point-to-point wireless links in real-time directly from the management station, using the interface parameter options. This helps you to find the best position and direction for your antenna. Follow these steps to see the quality of the selected wireless link:

1. Open the Expanded View window for the desired AP Controller.
2. Right-click the **Wireless Port Record** in the details pane.
3. Click **Wireless Port Quality Details** and continue in the Real Time Wireless Link Statistics window.

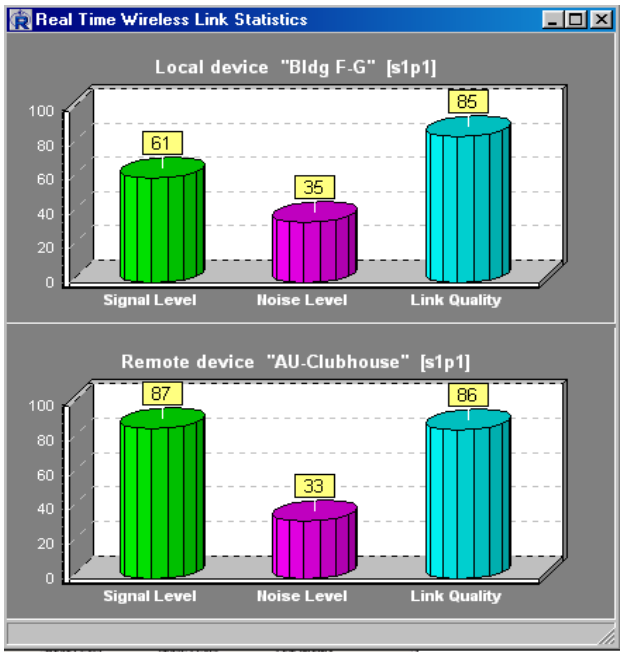


Figure 43 - Wireless Link Statistics

Changing Port Operation Status

All configured Ports are enabled by default, however you can enable or disable a selected Port at any time. If a Port is disabled, all network traffic is completely stopped over the Port. Follow these steps to change the status of a Port:

1. Open the Expanded View window for the AP Controller.
2. Right-click the **Port Record** in Port.

3. Click **Enable/Disable Port**.
4. To change the port operation status, click the **Yes** button in the Confirm window.

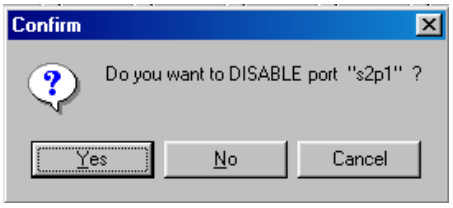


Figure 44 - Confirm Change

5. To complete the task, click the **OK** button in the Information message box.

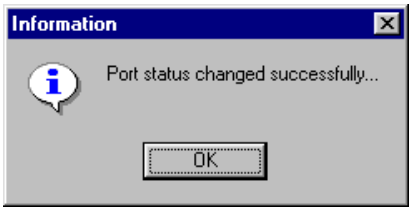


Figure 45 - Port Status Changed

Chapter 4

Configuring Bridging

This section describes the bridging configuration options available on your Raylink WISP AP Controller. Your AP Controller can operate as a medium access control (MAC-layer) multiport learning bridge. When bridging is enabled, the AP Controller works transparently to higher-level protocols and defines the boundary of the collision domain.

The general process used to configure bridging is to:

1. Switch to the SysAdmin Level.
2. Enable bridging on the AP Controller.
3. Disable bridging on some Ports (optional).
4. Configure Raylink Bridging Policies (optional).

Changing Bridging Status

By default, the bridging feature of your AP Controller is enabled, however you can enable or disable bridging at any time. Follow these steps to change the bridging status of the AP Controller:

1. Open the Expanded View window.
2. Click **Configure** on the Expanded View menu bar and point to **Bridging**.
3. To enable bridging, click **Enable Bridging**. When bridging is enabled, a checkmark will appear to the left of the Bridging command, indicating that bridging is enabled.

Note: Do not disable bridging on an AP Controller while you are configuring it. If you want to disable bridging over one selected Port, put that Port into a disabled Bridge Group.

Changing Port Level Bridging Status

By default, the bridging feature on the Port level is enabled. You can disable or enable bridging on a selected Port at any time. Changing the bridging status of a Port does not affect the routing status of the Port. To completely disable (or enable) both bridging and routing, use the Disable/Enable Port command.

Follow these steps to change the bridging status on the Port level:

1. Open Expanded View window.
2. Click **Configure** on the Expanded View menu bar.
3. Point to **Bridging** and click on **Bridge Group Manager**.
4. Click on the appropriate Port in the details pane.
5. Select or de-select the **Enable Bridging** checkbox in the Bridge Groups Manager window.

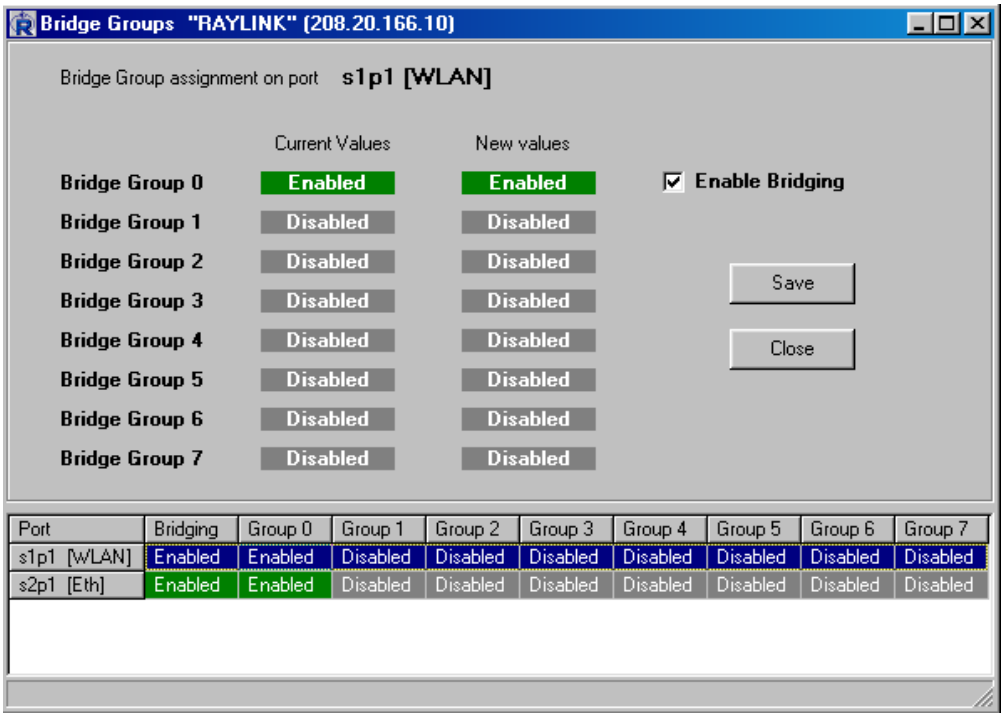


Figure 46 - Changing Bridge Group Status

6. Click the **Save** button in the Bridge Groups Manager window and click the **Yes** button in the Confirm dialog box.

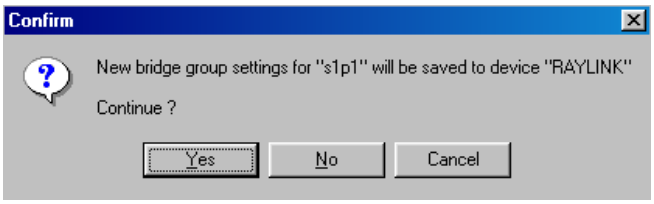


Figure 47 - Confirm Save

7. To finish the task, click the **Yes** button in the **Information** message box.

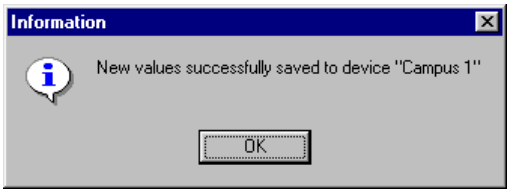


Figure 48 - Settings Saved

Applying Bridging Policies

After the Raylink bridge service has been started, you can apply several rules for packet forwarding and filtering. The following rules define your custom Raylink bridging policy:

- Port grouping for custom packet forwarding
- Network Node assignment with Permitted and Denied Ports for custom filtering
- Port or Network Node assignment with Traffic Shaping Queues for custom filtering.

Grouping the Ports

This section contains information about creating virtual networking groups by introducing filtering rules on the Interface.

You can group Interface ports to create virtual network groups. When bridging is enabled for the AP Controller, you can create up to eight separate Bridge Groups, which aggregate individual Interface ports. This aggregation feature enables the use of the AP Controller as a “port-selective” packet filter, which controls packet traffic between particular network segments. Ports belonging to a selected Bridge Group are treated with a common forwarding policy. Packets are forwarded only between the Interface Ports that belong to the same Bridge Group. End-nodes

that belong to different Bridge Groups can't access each other. Packets can't pass between different Bridge Groups; they are stopped on the AP Controller.

The general process used to create virtual networking groups is to:

1. Switch to the SysAdmin Level.
2. Enable bridging on the AP Controller.
3. Assign Ports to the required Bridging Groups.
4. Disable bridging on appropriate ports (optional).

Configuring Bridge Groups

You can configure up to eight Bridge Groups. Each Bridge Group must contain at least two specific Interface Ports. You can assign each Interface Port to one or more Bridge Group. To create and use Bridge Groups, your AP Controller must have bridging enabled.

This window contains all the Interface Ports available for the AP Controller with the current Bridge Group assignments.

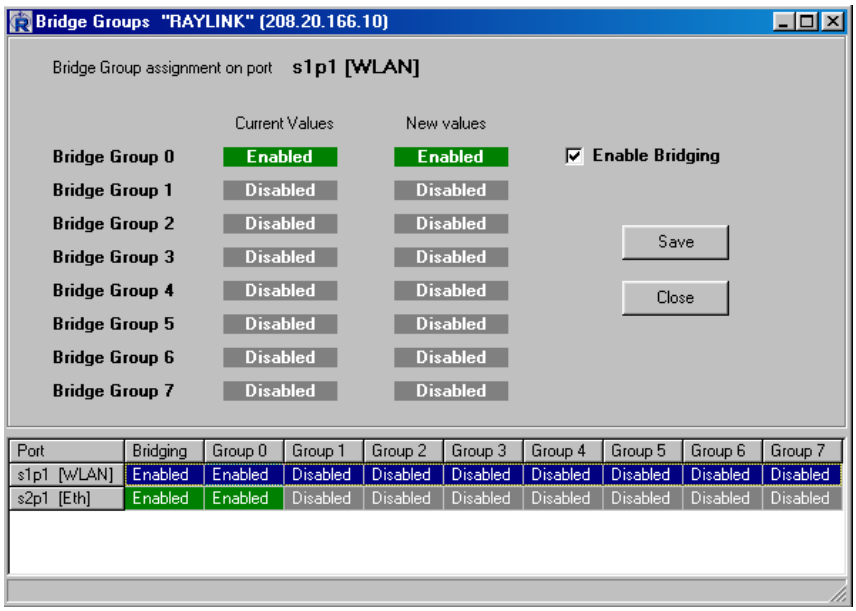


Figure 49 - Bridge Groups Window

If the Interface Port is a member of a given Bridge Group, "Enabled" is displayed under **Current values**. When the Interface Port is not a member of a particular Bridge Group, **Current values** displays "Disabled".

Follow these steps to configure Bridge Groups:

1. Open the Expanded View window.
2. Click the **Configure** command on the Expanded View window menu bar and point to **Bridging.**
3. Click **Configure Bridge Groups**.
4. Click the Interface Port that you want to assign to a Bridge Group.
5. Click the **Disabled** status indicator under **New values**. The status indicator will toggle from Disabled to Enabled.
6. To make your changes permanent, click the **Save** button.

Changing Interface Port Membership in a Bridge Group

Follow these steps to change the Interface Port membership in a Bridge Group:

1. Open the Expanded View window for the AP Controller.
2. Click the **Configure** command on the Expanded View window menu bar and point to **Bridging.**
3. Click **Bridge Group Manager**.
4. To change the membership of a Port, click the Port record.
5. Click the button under **New values** in the row with the requested Bridge Group. The status indicator toggles between Disabled and Enabled.
6. To make the changes permanent, click the **Save** button.
7. To accept the settings, click the **Yes** button in the Confirm message box.

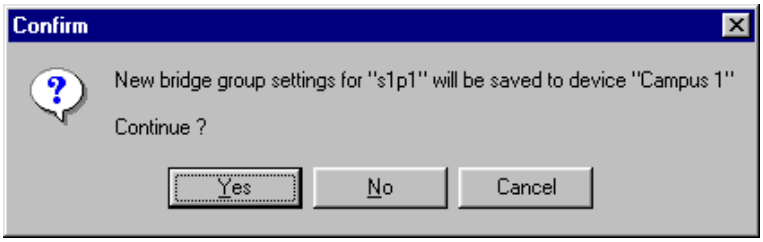


Figure 50 - Confirm

8. Click the **OK** button in the Information message box.

Note: By default, all Interface Ports are enabled and assigned to the 0 Bridge Group.

Chapter 5

Managing Network Nodes

This section describes the use of the network node management feature available in your Raylink WISP AP Controller. You can implement customized Connectivity Policies on individual Network Nodes defined by medium access control (MAC) or Internet protocol (IP) addresses. This feature is implemented with a built-in MAC and IP address database. The database helps you to keep track of your **Network Node Identifiers** for all network nodes. Database fields include **First Name**, **Last Name**, **Custom Info**, **Port Assignment**, **Accessibility Rules on Ports**, and **Traffic Shaping Queue Assignment**.

The general process of configuring customized Connectivity Policies on individual Network Nodes is to:

1. Switch to the SysAdmin Level.
2. Fill in the necessary Network Node Identifiers (optional).
3. Configure the Port for bridging.
4. Set the Port accessibility rules on the Network Node.
5. Save the created Policy.

Entering Network Node Identifiers

To make it easier to work with MAC and IP addresses within the AP Controller, you can provide additional information to the built-in network node database. You can identify your network nodes by First and Last Name (usually of characteristic user) and with additional information (usually address, room or phone number, e-mail) of users. You can use this data if the AP Controller is used to provide billing information for your users. You can browse and sort your database using clickable table headers in the details pane such as **User Name**, **MAC Address**, **IP Address**, **Port**, **Net Mask**, **Status**, **TSQ**, **and Denied Ports**. Because the network node database is stored on each individual AP Controller, you can use both the local AP Controller database and the distributed Raylink NMS.

Configuring MAC-Level Network Nodes

Follow these steps to edit Network Node Identifiers:

1. Open the Expanded View window.
2. Click the **Users** command.
3. Click **MAC Address Level**.

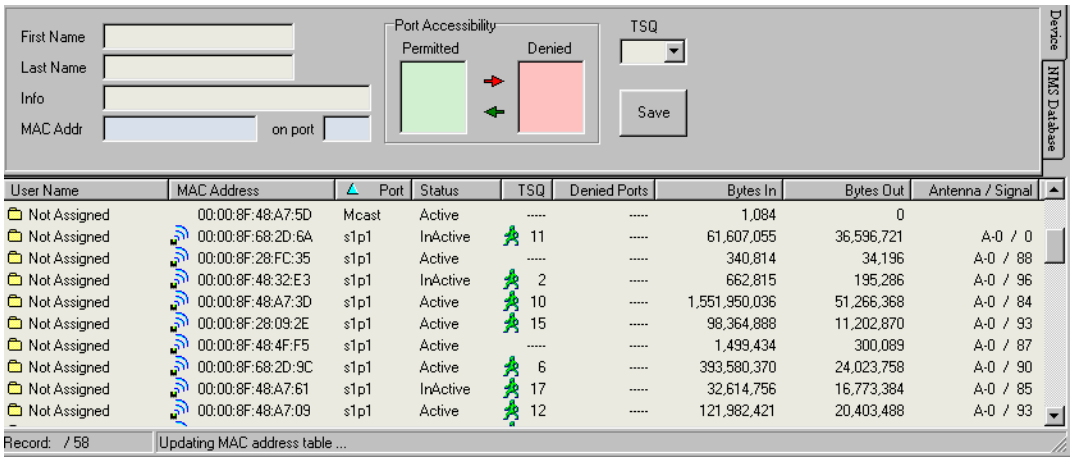


Figure 51 - MAC-Level Node Management

4. Modify the content of **First Name**, **Last Name** or **Info** text boxes.
5. To permanently write the changes to the AP Controller, click the **Save** button.
6. To close the MAC Address Level Users window, click the **Close** icon.

Configuring IP Address-Level Network Nodes

Follow these steps to edit Network Node Identifiers:

1. Open the Expanded View window.
2. Click the **Users** command.
3. Click **IP Address Level**.

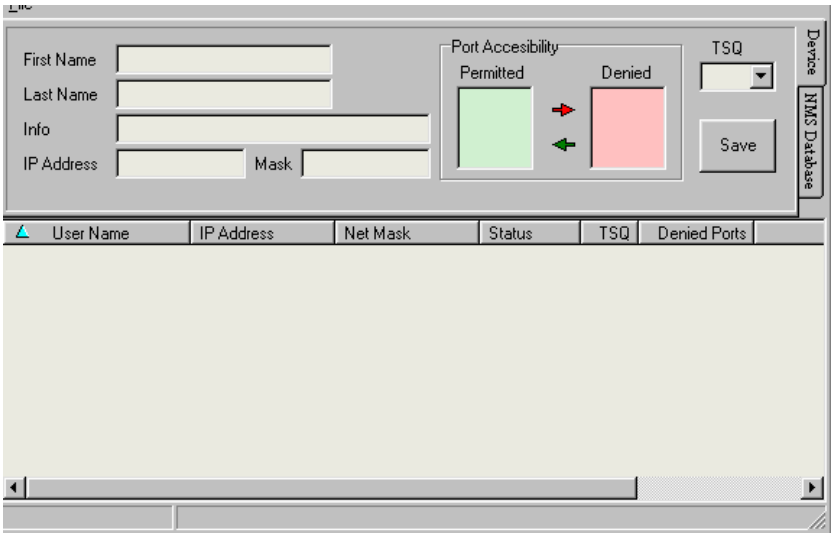


Figure 52 - IP Address-Level Node Management

4. Modify the content of **First Name**, **Last Name** or **Info** text boxes.
5. To permanently write the changes to the AP Controller, click the **Save** button.
6. To close the IP Address Level Users window, click the **Close** icon.

Changing Port Accessibility

If a particular network node is Denied on a selected Port, all network traffic is disabled over that Port, both coming from and going to the network node.

Follow these steps to change the port accessibility for a particular network node:

1. Open the Expanded View window.
2. Click the **Users** command.
3. Click **MAC** or **IP Address Level.**
4. Under the User Name column, click on the network node.
5. In the Port Accessibility field, click the Port that you want to change.
6. Using the red or green arrows, move the Port to **Denied** or **Permitted**.
7. To permanently write the changes to the AP Controller, click the **Save** button.
8. To close the window, click the **Close** icon.

Note: By default, all Network Nodes are Permitted on all Ports. If you need to stop all traffic for all Network Nodes, use the Disable Port command instead of moving all Network Nodes to Denied Port.

Chapter 6

Monitoring the Network

This section describes network monitoring options available on your Raylink WISP AP Controller. Knowing the exact status of your network may help you to better understand the requirements of your network users. Network monitoring also helps you to plan the future development of your network infrastructure.

The AP Controller works as a continuous network traffic monitor. You can easily monitor network load statistics over various time scales and locate your busiest network nodes and error generating sources. These network monitoring tools are available without using the SysAdmin mode. The general process of network monitoring is to:

1. Expand the View of a selected AP Controller.
2. Select the information to display.
3. Configure graph scaling (optional).
4. Zoom in or out of a particular graph area (optional).
5. Select normal or logarithmic scaling (optional).
6. Add more data series (optional).

Selecting Displayed Data

By default, Port traffic data from your AP Controller is available and can be displayed in graphical format. To display a selected type of traffic data, use the drag and drop method that follows:

1. Open the Extended View window and right-click the Interface that you want to display.
2. Click **Advanced Port Statistics**.
3. In the **Counters** column, click the cell containing the information that you want to display in graphical form.
4. While holding down the right mouse button, drag the cell and drop it into the graph area.

Selecting Data Collection Period

You can choose from several different data collection period displays. The collection periods can range from 5 minutes up one week. The default data collection period is 5 minutes. To change the data collection period, do the following:

1. Select and display information in graphical form.
2. Click the **Graph** menu on the menu bar of the current window.
3. Point to **Collection Period** and select the desired time scale.

Selecting Normal or Logarithmic Scaling

You may have traffic data with either very small or very large values. When traffic levels are high, it is easier to understand your graphs using a logarithmic scale. Follow these steps to change from a normal to a logarithmic scale:

1. Click the **Graph** menu on the menu bar of the current window.
2. In the **Graph** menu, click **Logarithmic View**.
3. When the Logarithmic View is activated, a checkmark appears to the left of the **Logarithmic View** menu item.

Working With Multiple Data Series

Sometimes you may need to compare data series measured on different Ports. Follow these steps to combine the same type of data series from different Ports onto one diagram:

1. Select and display information in graphical form (as described in the "Selecting Displayed Data" section, above) for the first Port.
2. While holding down the right mouse button, drag a cell from an additional Port and drop it into the graph area.

Zooming a Specific Graph Area

To display a specific area of your graph you may need to use the zoom feature. You can zoom into or zoom out of a selected graph area.

To change zoom properties, do the following:

1. Select and display information in graphical form.
2. Click in the specific graph the area you want to zoom-in or zoom-out.
3. While holding down the left mouse button, drag the box selection area to the right to zoom in or to the left to zoom out.
4. Click and hold down the right mouse button to reposition the actual graph within the graphing area.

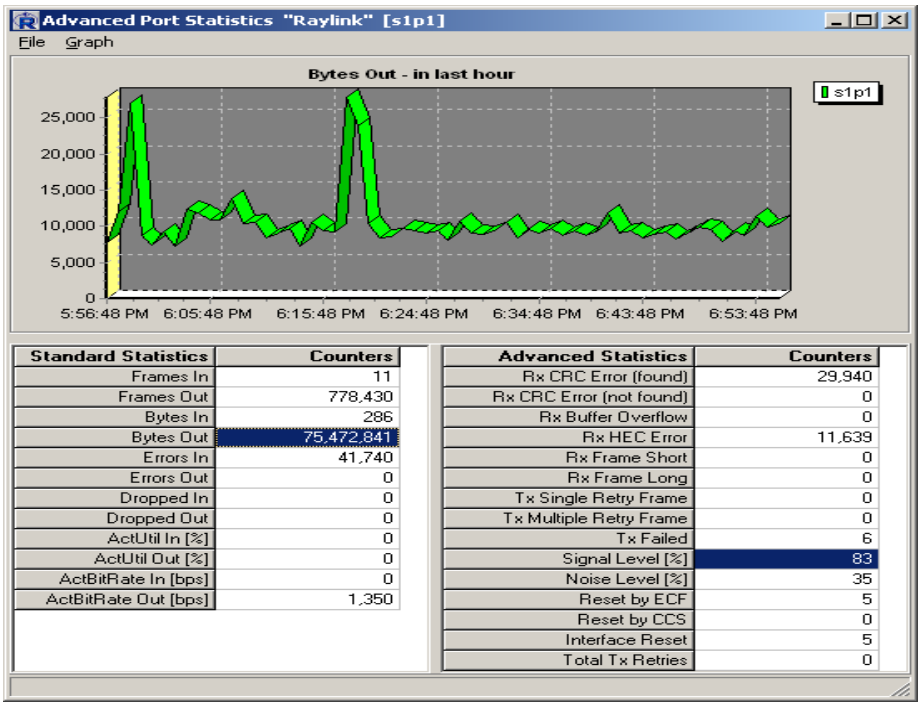
Creating Basic Port Statistics Graphs

Your AP Controller comes with built in traffic counters that permanently monitor all basic network activities. The following traffic counters are available on the Port level:

- Frames in/out
- Bytes in/out
- Errors in/out
- Dropped in/out
- ActUtil in/out
- ActBitRate in/out

You can see the current values of the selected counters or you can display them as time-dependent function values. Do the following to display an evolution of specified information:

1. Open the Expanded View window.
2. Click the cell containing the information that you want to display in graphical form.
3. While holding down the right mouse button, drag the cell and drop it into the graph area.
4. Add more traffic data series and select the appropriate data collection period.
5. To display details of your graph, change from logarithmic to normal view and zoom-in or zoom-out the specific graph area.



Standard Statistics	Counters
Frames In	11
Frames Out	778,430
Bytes In	286
Bytes Out	75,472,841
Errors In	41,740
Errors Out	0
Dropped In	0
Dropped Out	0
ActUtil In [%]	0
ActUtil Out [%]	0
ActBitRate In [bps]	0
ActBitRate Out [bps]	1,350

Advanced Statistics	Counters
Rx CRC Error (found)	29,940
Rx CRC Error (not found)	0
Rx Buffer Overflow	0
Rx HEC Error	11,639
Rx Frame Short	0
Rx Frame Long	0
Tx Single Retry Frame	0
Tx Multiple Retry Frame	0
Tx Failed	6
Signal Level [%]	83
Noise Level [%]	35
Reset by ECF	5
Reset by CCS	0
Interface Reset	5
Total Tx Retries	0

Figure 53 - Advanced Port Statistics Graph

Creating Advanced Port Statistics Graphs

Your AP Controller contains advanced traffic counters that constantly monitor specific network activities. The following advanced traffic counters are available at Port level:

Standard Statistics:

Frames In – Total number of frames **received** by the "Interface"

Frames Out – Total number of Frames **sent** by the "Interface"

Bytes In – Total number of bytes **received** by the "Interface"

Bytes Out – Total number of bytes **sent** by the "Interface"

Errors In – Total number of errored packets on input (packets are discarded)

Errors Out – Total number of errored packets on output (packets are discarded)

Dropped In – Number of received packets discarded

Dropped Out – Number of transmitted packets discarded

ActUtil In% – Incoming (receiving) actual (immediate) utilization of the capacity of the connection (%)

ActUtil Out% – Outgoing (sending) actual (immediate) utilization of the capacity of the connection (%)

ActBitRate In – Actual (immediate) receiving speed of the connection (bps)

ActBitRate Out– Actual (immediate) sending speed of the connection (bps)

Advanced Statistics:

Rx CRC Error [found] – Number of packets received with bad Cyclic Redundancy Code (CRC) check sum. The CRC is unique for every packet transmitted and received and provides verification that the packet has not been corrupted.

Rx Buffer Overflow – Number of packets discarded because of the overrun of the physical data buffer of the "Interface".

Rx HEC Error – Number of packets received with bad header.

Rx Frame short – Number of packets shorter than the minimum packet length (60 bytes for Ethernet).

Rx Frame long – number of packets longer as maximum packet length (1514 for Ethernet).

Tx Single Retry Frame – Number of packets retransmitted just once.

Tx Multiple Retry Frame – Number of packets retransmitted more than one time.

Tx Failed – Number of attempts where transmit failed.

Signal Level (%) – Information about the quality of the wireless connection – signal strength.

Noise Level (%) – Information about the quality of the wireless connection – noise (Interference level) (30 % – is normal level).

Reset by ECF – Number of the Interface resets caused by lost of communication between firmware of the wireless card and host's driver.

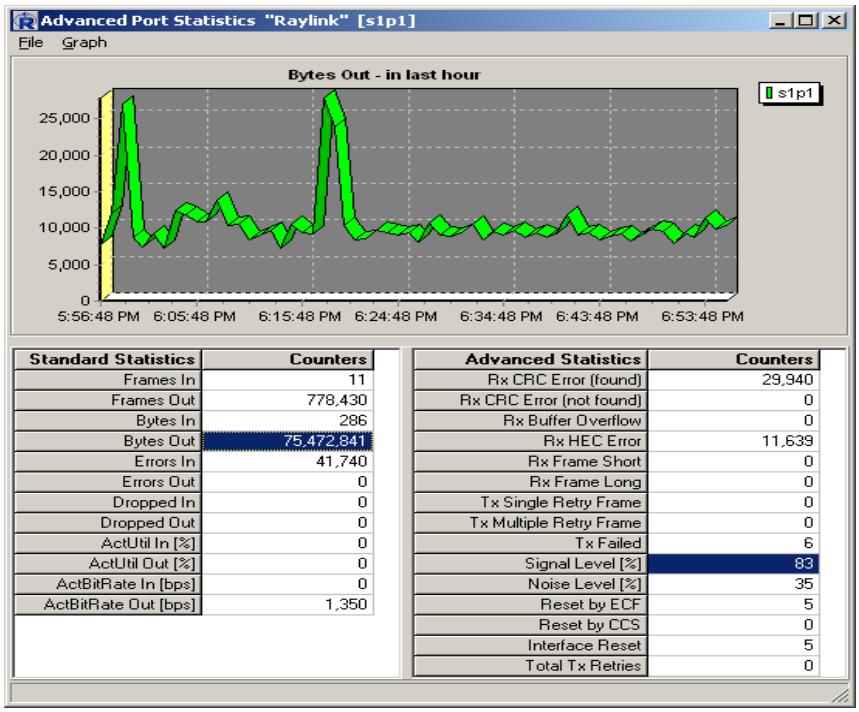
Reset by CCS – Number of Interface resets caused by impossibility to write packet to output buffer in defined time limit (1 sec).

Interface Reset – Total number of the resets of the "Interface".

Total Tx Retries – Total number of packet retries in transmit process.

Such traffic measures can be particularly useful when troubleshooting your network. You can see the current values of the traffic counters or you can display them as time-dependent function values. Follow these steps to display an evolution of specified information:

1. Open Expanded View window.
2. Right-click the Port record that you want to examine. In the resulting popup menu, click on **Advanced Port Statistics**.
3. Click the cell in the **Counters** column containing the information that you want to display in graphical form.
4. While holding down the right mouse button, drag the cell and drop it into the graph area.
5. Add more traffic data series and select the appropriate data collection period.
6. To display details of your graph, change to logarithmic or normal view and zoom in or zoom out the specific graph area.



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Advanced Statistics	Counters
Rx CRC Error (found)	29,940
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Rx Buffer Overflow	0
Rx HEC Error	11,639
Rx Frame Short	0
Rx Frame Long	0
Tx Single Retry Frame	0
Tx Multiple Retry Frame	0
Tx Failed	6
Signal Level [%]	83
Noise Level [%]	35
Reset by ECF	5
Reset by CCS	0
Interface Reset	5
Total Tx Retries	0

Figure 54 - Advanced Traffic View

Configuring Traffic Shaping

Your AP Controller contains advanced traffic shaping capabilities that allow you to limit users symmetrically or asymmetrically. Traffic shaping features include:

- 128 traffic shaping queues
- Traffic shaping by Port or User level

- Multiple users per traffic shaping queue
- Configuring traffic shaping queues for separate uploads and download speeds
- Viewing real-time activity by traffic shaping queue.

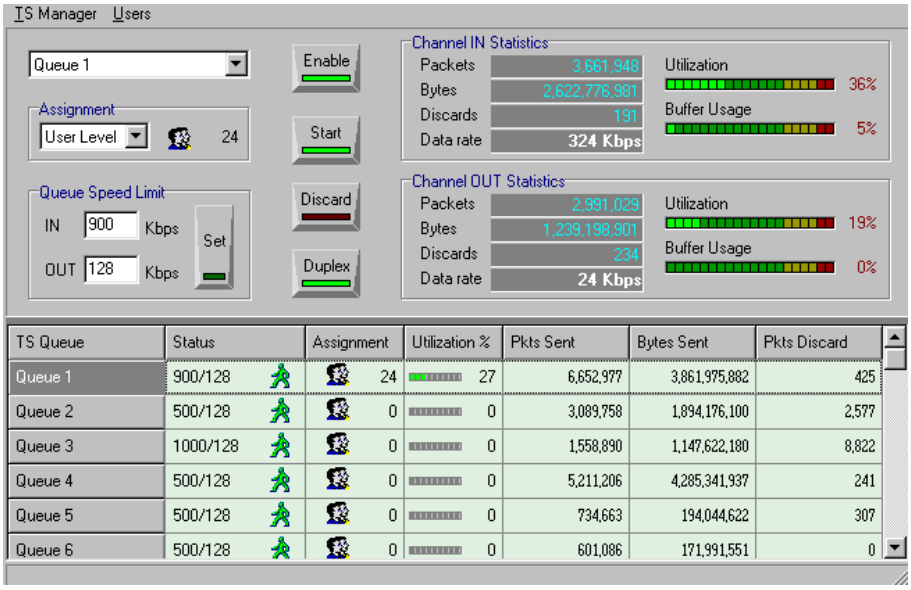

Figure 55 - TS Manager

Enabling Traffic Shaping

Follow these steps to enable traffic shaping:

1. Open the SysAdmin Level.
2. Open the expanded view of the AP Controller.
3. Select the **BW Management** menu.
4. Left click **Traffic Shaping** to open the Traffic Shaping Manager.
5. Select the **TS Manager** menu.
6. Left click **Enable Traffic Shaping**.
7. Left click the **Enable** button. This will enable the Traffic Shaping Queue.
8. Left click the **Start** button to activate the Traffic Shaping Queue.
9. Right click the **Queue Speed Limit** window and change Queue to desired limit.

10. Click the **Set** button to activate the Queue Speed Limit.
11. To set the Queue Speed Limit asymmetrically, click the **Duplex** button.
12. Repeat until desired number of Queues is set.

Assigning Users to Traffic Shaping Queues

You may assign users to queues individually or assign multiple users to a queue. Traffic Shaping Queues may be used to monitor individual usage in real time. Follow these steps to assign users via a MAC address or an IP address:

1. Open the SysAdmin Level.
2. In Expanded View or Traffic Shaping Manager, select the User menu.
3. Select **Mac Address Level** or **IP Address Level** depending upon your needs.
4. Highlight the User by left clicking on the IP or MAC Address.
5. Right click on the highlighted address and select **Change TS Queue Assignment**.
6. Select the desired TS Queue and click **OK**.

Appendix A

Choosing Your Hopping Sequence

In most countries, the AP Controller hops between 79 different 1 MHz-wide channels. In a few countries a smaller number of channels are authorized.

All hopping sequences for access points located in the same geographical area (the area where the access points can hear each other) must be chosen from the same hopping set. Sequences from different hopping sets may cause unacceptable interference to each other. Use the following chart to select your AP Controller hopping sequences.

Note: Other radio manufacturers may number their hopping sequences differently. For example, Alvarion numbers their sequences from 1 to 26 within each hopping set. For example, a Raylink AP Controller with a hopping sequence of 7 is the same as an Alvarion radio with a hopping sequence of 3 in hopping set 2. Another example, an Alvarion radio with a hopping sequence of 26 in hopping set 3 is the same as a Raylink AP Controller with a hopping sequence of 77. To minimize interference, all radios (even different brands) in the same area must use a different hopping sequence chosen from the same hopping set.

26 Hopping Sequence Choices in each Hop Set	Hopping Sequences in Hop Set 1	Hopping Sequences in Hop Set 2	Hopping Sequences in Hop Set 3
1st	0	1	2
2nd	3	4	5
3rd	6	7	8
4th	9	10	11
5th	12	13	14
6th	15	16	17
7th	18	19	20

8th	21	22	23
9th	24	25	26
10th	27	28	29
11th	30	31	32
12th	33	34	35
13th	36	37	38
14th	39	40	41
15th	42	43	44
16th	45	46	47
17th	48	49	50
18th	51	52	53
19th	54	55	56
20th	57	58	59
21st	60	61	62
22nd	63	64	65
23rd	66	67	68
24th	69	70	71
25th	72	73	74
26th	75	76	77

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