USER'S GUIDE

Wireless Arrays

XR and XN Series
February 7, 2013
Release 6.4

XIRRUS
High Performance Wireless Networks

Wireless Array™

XR and XN Series

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(Revision F)

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Xirrus, Inc.
2101 Corporate Center Drive
Thousand Oaks, CA 91320
USA

Tel: 1.805.262.1600
1.800.947.7871 Toll Free in the US
Fax: 1.866.462.3980

www.xirrus.com

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Introduction

These topics introduce the Xirrus Wireless Array, including an overview of its key features and benefits.

The Xirrus Family of Products

Figure 1. Xirrus Arrays: XR Series

The Xirrus family of products includes the following:

- **The XR Series of Xirrus Wireless Arrays**
  The newest Xirrus Wireless Arrays have been completely redesigned to provide distributed intelligence, integrated switching capacity of up to 10 Gbps, increased bandwidth, and smaller size. The radios support IEEE802.11 a, b, g, and n clients, and feature the capacity and performance needed to replace switched Ethernet to the desktop. Modular radios allow you to increase the number of radios, upgrade to more powerful radios, or even upgrade later to future technologies like 802.11ac and 802.11.ad as they are introduced.

- **The XN Series of Xirrus Wireless Arrays**

  The Xirrus Wireless Arrays have the speed and reach of IEEE 802.11n technology. The XN Series of Arrays feature the capacity and performance needed to replace switched Ethernet to the desktop.

  XN Series Arrays integrate multiple Integrated Access Points—radios with high-gain directional antennas for increased range and coverage. The Array also incorporates an onboard multi-gigabit switch, wireless controller, and firewall into a single device, along with a dedicated wireless threat sensor and an embedded spectrum analyzer. The Wireless Array provides more than enough bandwidth, security, and control to replace switched Ethernet to the desktop as the primary network connection.

- **Xirrus Management System (XMS)**

  XMS is used for managing large Array deployments from a centralized Web-based interface. The XMS server is available pre-installed on the Xirrus Management Appliance series, or as a software package to be installed on your own server hardware (optionally under VMware).

  Users start the XMS client simply by entering the URL of the XMS server on a web browser. The XMS server manages a number of Wireless Arrays via SNMP.

  If you need detailed information about this product, refer to the *XMS User's Guide*.

- **Xirrus-supplied Power over Gigabit Ethernet (PoGE)**

  The PoGE modules eliminate the need for running separate power cabling. Additionally, an available eight port module provides distributed power to multiple Arrays, facilitating backup power when connected via a UPS.

Nomenclature

Throughout this User's Guide, the Xirrus Wireless Array is also referred to as simply the **Array**. In some instances, the terms **product** and **unit** are also used. When discussing specific products from the Xirrus family, the product name is used (for example, XR-4830). The Wireless Array's operating system is referred to as the **ArrayOS**. The Web Management Interface for browser-based management of the Array is referred to as **WMI**.

The XR Series Arrays have very flexible radio capabilities—each of the radios may be independently configured to support IEEE802.11a, 11b, 11g, or 11n clients or a combination of client types. One radio is typically assigned as the RF **monitor** radio, supporting intrusion detection and prevention, self-monitoring, and other services. Radios support both 2.4GHz and 5 GHz, and are named **iap1, iap2, ... iap*n***.

The XN series of Arrays have two types of radios—the 5 GHz 802.11a/n radios are named **an1** through **an12** (for 16-port models). The 802.11a/b/g/n radios are named **abgn1** to **abgn4**, and they also support both 2.4GHz and 5 GHz.

The Xirrus Management System is referred to as **XMS**. The Power over Gigabit Ethernet system may be referred to as **PoGE**.

Why Choose the Xirrus Wireless Array?

The deployment of wireless is a necessity as businesses strive for greater flexibility in the workplace and the need for employee mobility rises. The user community is placing spiraling and often unanticipated demands on the wireless network, with the rapid proliferation of devices such as iPads and wireless enabled phones. Xirrus Wireless Arrays have the capability to support the large number of user devices present in today's environments, with superior range and coverage. Wireless is compatible with standard Ethernet protocols, so connectivity with existing wired infrastructure is transparent to users—they can still access and use the same applications and network services that they use when plugged into the company's wired LAN (it's only the plug that no longer exists).

Wireless has come a long way in the past few years and now offers the performance, reliability and security that Enterprise customers have come to expect from their networks. The technology is being driven by four major IEEE standards:

- **802.11a**
  Operates in the 5 GHz range with a maximum speed of 54 Mbps.
- **802.11b**
  Operates in the 2.4 GHz range with a maximum speed of 11 Mbps.
- **802.11g**
  Supports a higher transmission speed of 54 Mbps in the 2.4 GHz range and is backwards compatible with 802.11b.
- **802.11n**
  Uses multiple antennas per radio to boost transmission speed as high as 450Mbps, increasing throughput, range, and maximum number of users. 802.11n is backwards compatible with 802.11a/b/g.

Whether you have just a handful of users or thousands of users, wireless has the scalability and flexibility to serve your needs.

See Also

Key Features and Benefits
Wireless Array Product Overview
The Xirrus Family of Products

Wireless Array Product Overview

Part of the family of Xirrus products, the Wireless Array is a high capacity, multi-mode device designed with up to four times the coverage and eight times the bandwidth and user density compared with legacy thin access point wireless products. Its distributed intelligence eliminates the use of separate controllers and their accompanying bottlenecks. Each radio, with its directional high-gain antennas, can achieve up to 450 Mbps throughput (on XR-1000 and higher Array modesl).

Figure 2. Wireless Array (XR Series)

The Wireless Array (regardless of the product model) is Wi-Fi® compliant and simultaneously supports 802.11a, 802.11b, 802.11g, and 802.11n clients. The multi-state design allows you to assign radios to 2.4 GHz and 5 GHz bands (or both) in any desired arrangement. Integrated switching and active enterprise class features such as VLAN support and multiple SSID capability enable robust network compatibility and a high level of scalability and system control. The optional Xirrus Management System (XMS) allows global management of hundreds of Arrays from a central location.

Multiple versions of the Array with different numbers of Integrated Access Points (IAPs) support a variety of deployment applications.

XR Wireless Array Product Family

XR500 Series Arrays

These Arrays have one Gigabit Ethernet port and two radios—one multi-state radio (2.4GHz or 5GHz) and one 5GHz radio. They support 300Mbps, connecting up to 240 users at one time.

The XR500 provides flexibility for delivering wireless service in low-to-medium user density scenarios, in challenging deployments in areas with high RF attenuation, and in isolated or physically separated locations.

Like other XR Arrays, these models have an integrated controller, firewall, threat sensor and spectrum analyzer. Unlike other XR Arrays, these models have omni-directional antennas rather than directional antennas.

Feature	XR520
No. radios: 802.11 a/b/g/n/monitor	2
Radio type	2x2
# Integrated omni-directional antennas	4
Integrated wireless switch ports	2
Integrated RF spectrum analyzer, threat sensors	Yes
1 Gigabit Uplink Ports	1
Wireless bandwidth	300 Mbps
Users supported	240

XR-1000 and XR-2000 Series Arrays

These Arrays include models with one Gigabit Ethernet port and two or four multi-state radios (2.4GHz or 5GHz) that can support 300Mbps or 450Mbps, connecting upwards of 320 users at one time.

The Xirrus XR-1000 Series Wireless Array is a two slot chassis available in a two multi-state (2.4GHz or 5GHz) radio configuration supporting up to 160 users with up to 900Mbps of bandwidth (up to 450 Mbps per radio). The XR-1000 provides flexibility for delivering wireless service in low user density scenarios, challenging deployments in areas with high RF attenuation, and in isolated or physically separated locations. The elliptical-shaped coverage pattern produced by its directional antennas is ideal for covering facilities with central hallways and adjacent rooms commonly found in office buildings, hotels, and dormitories.

The Xirrus XR-2000 Series Wireless Array is a four slot chassis available in a four multi-state (2.4GHz or 5GHz) radio configuration supporting up to 320 users with up to 1.8Gbps of bandwidth. These models support a range of low to high-performance applications, including offices, hospitals, campuses and classrooms, and hotels.

Like all XR Arrays except the XR500 Series, these models integrate multi-state radios with high gain directional antennas, an onboard multi-gigabit switch, controller, firewall, threat sensor and spectrum analyzer all built on a modular chassis designed for future extensibility.

Feature	XR-1220	XR-1230	XR-2220	XR-2230	XR-2420	XR-2430
No. radios: 802.11 a/b/g/n/monitor	2	2	2	2	4	4
Radio type	2x2	3x3	2x2	3x3	2x2	3x3
# Integrated antennas	4	6	4	6	8	12
Integrated wireless switch ports	2	2	4	4	4	4
Integrated RF spectrum analyzer, threat sensors	Yes	Yes	Yes	Yes	Yes	Yes
1 Gigabit Uplink Ports	1	1	1	1	1	1
Wireless bandwidth	600 Mbps	900 Mbps	600 Mbps	900 Mbps	1.2 Gbps	1.8 Gbps
Users supported	480	480	480	480	960	960

XR-4000 Series Arrays

These Arrays include models with two Gigabit Ethernet ports and four or eight radios (IAPs), connecting up to 640 users at one time and offering a maximum wireless bandwidth of 3.6 Gbps (up to 450 Mbps per radio). Smaller models may be upgraded to eight radios later when your needs change.

Feature	XR-4420	XR-4430	XR-4820	XR-4830
Number of radios: 802.11a/b/g/n/monitor	4	4	8	8
Radio type	2x2	3x3	2x2	3x3
# Integrated antennas	8	12	16	24
Integrated wireless switch ports	8	8	8	8
Integrated RF spectrum analyzer, threat sensors	Yes	Yes	Yes	Yes
1 Gigabit Uplink Ports	2	2	2	2
Wireless bandwidth	1.2 Gbps	1.8 Gbps	2.4 Gbps	3.6 Gbps
Users supported	960	960	1920	1920

XR-6000 Series Arrays

These Arrays include models with four Gigabit Ethernet ports and up to sixteen radios, connecting up to 1280 users at one time and offering a maximum wireless bandwidth of 7.2 Gbps (up to 450 Mbps per radio). Smaller models may be upgraded to sixteen radios later when your needs change. A 10 Gigabit modular Ethernet expansion port (DVI connector) is available to meet high traffic demands. It is used only with an optional Xirrus 10 Gig fiber optics adapter.

Feature	XR-6820	XR-6830	XR-7220	XR-7230	XR-7620	XR-7630
Number of radios: 802.11a/b/g/n/monitor	8	8	12	12	16	16
Radio type	2x2	3x3	2x2	3x3	2x2	3x3
Number of integrated antennas	16	24	24	36	32	48
Integrated wireless switch ports	16	16	16	16	16	16
Integrated RF spectrum analyzer, threat sensors	Yes	Yes	Yes	Yes	Yes	Yes
1 Gigabit Uplink Ports	4	4	4	4	4	4
External 10 Gigabit Modular Expansion Port	1	1	1	1	1	1
Wireless bandwidth (Gbps)	2.4	3.6	3.6	5.4	4.8	7.2
Users supported	896	896	1344	1344	1792	1792

See Also

Key Features and Benefits

Wireless Array Product Overview

Power over Gigabit Ethernet (PoGE)

XN Wireless Array Product Family

The following tables provide an overview of the main features supported by the XN Array product family.

XN Family of Arrays

Feature	XN16	XN12	XN8	XN4
Number of 802.11a/b/g/n radios	4	4	4	4
Number of 802.11a/n radios	12	8	4	0
Total radios	**16**	**12**	**8**	**4**
Number of integrated antennas	48	36	36	20
Integrated Wi-Fi switch ports	16	12	8	4
Integrated RF spectrum analyzer, threat sensors	Yes	Yes	Yes	Yes
Uplink Ports	2	2	2	1
Wireless bandwidth	4.8 Gbps	3.6 Gbps	2.4 Gbps	1.2 Gbps
Users supported	1280	960	640	320

See Also

Key Features and Benefits
Wireless Array Product Overview
Power over Gigabit Ethernet (PoGE)
Why Choose the Xirrus Wireless Array?

Enterprise Class Security

The latest and most effective wireless encryption security standards, including WPA (Wireless Protected Access) and WPA2 with 802.11i AES (Advanced Encryption Standard) are available on the Wireless Array. In addition, the use of an embedded RADIUS server (or 802.1x with an external RADIUS server) ensures user authentication—multiple Arrays can authenticate to the optional XMS, ensuring only authorized Arrays become part of the wireless network. With the Xirrus Advanced Feature Sets, intrusion detection and prevention, site monitoring, and RF spectrum analysis are performed in the background by the Array automatically.

Deployment Flexibility

Xirrus' unique multi-radio architecture (on all Arrays except the XR500 Series) generates 360 degrees of sectored high-gain 802.11a/b/g/n coverage that provides extended range and the highest possible data rates for a large volume of clients. Each sector can be adjusted automatically or manually, creating a pattern of wireless coverage perfectly tailored to individual customer needs. For example:

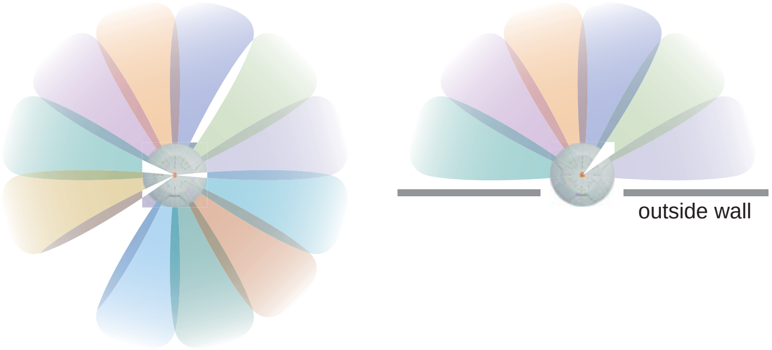


Figure 3. Wireless Coverage Patterns

Figure 3 depicts the following two scenarios:

- **Full pattern coverage**
  All radios are activated with coverage spanning 360 degrees. If within range, clients will always receive coverage regardless of their geographic

position relative to the Array. Radios may be assigned to 2.4 GHz and/or 5.0 GHz bands in any desired pattern.

- **Partial pattern coverage**
  If desired, the Wireless Array can be deployed close to an exterior wall. In this case, half of all available radios have been deactivated to prevent redundant signals from “bleeding” beyond the site’s perimeter wall. This configuration may also be used in those cases where you want to restrict wireless coverage to selected areas of the building’s interior.

Power over Gigabit Ethernet (PoGE)

The Xirrus-supplied XP1, XP2, and XP8 Power over Gigabit Ethernet modules provide power to your Arrays over the same Cat 5e or Cat 6 cable used for data, eliminating the need to run power cables and provide an AC power outlet in proximity to each unit. Managed modules provide the ability to control power using XMS.

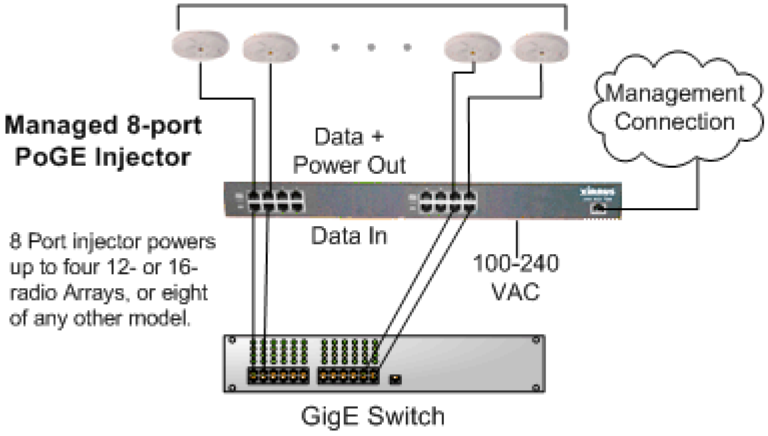
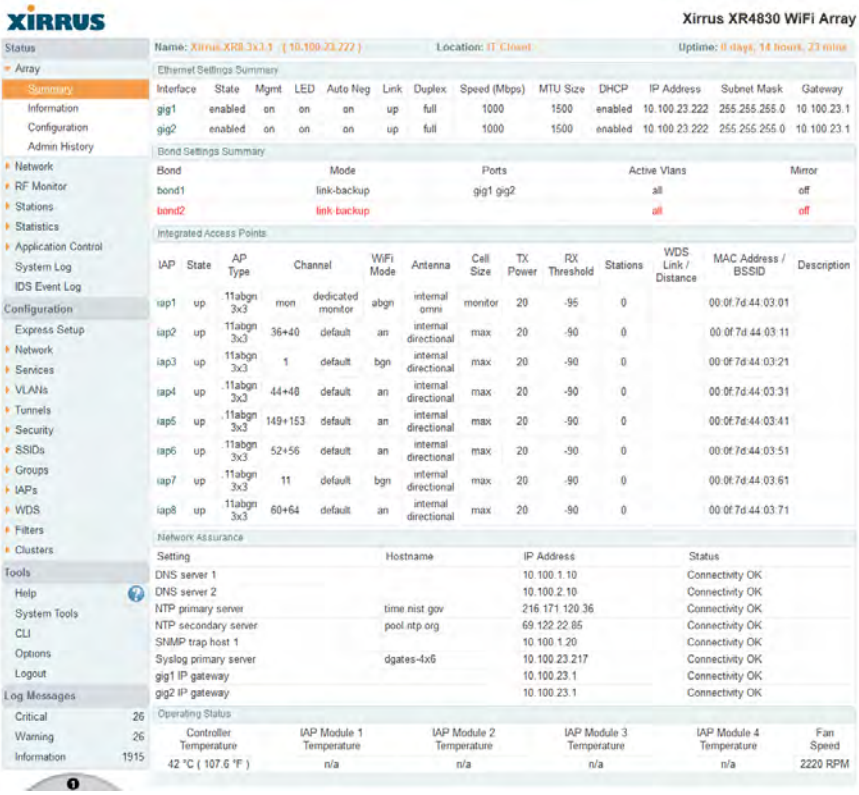

Managed 8-port PoGE Injector
Data + Power Out
Management Connection
8 Port injector powers up to four 12- or 16-radio Arrays, or eight of any other model.
Data In
100-240 VAC
GigE Switch

Figure 4. XP8 - Power over Ethernet Usage

Specific models of the Array are compatible with specific PoGE modules.

Enterprise Class Management

The Wireless Array can be configured with its default RF settings, or the RF settings can be customized using the Array's embedded Web Management Interface (WMI). The WMI enables easy configuration and control from a graphical console, plus a full complement of troubleshooting tools and statistics.



Xirrus XR4830 WiFi Array

Name: Xirrus.XR8.3x3.1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 14 hours, 23 mins

Ethernet Settings Summary

Interface	State	Mgmt	LED	Auto Neg	Link	Duplex	Speed (Mbps)	MTU Size	DHCP	IP Address	Subnet Mask	Gateway
gig1	enabled	on	on	on	up	full	1000	1500	enabled	10.100.23.222	255.255.255.0	10.100.23.1
gig2	enabled	on	on	on	up	full	1000	1500	enabled	10.100.23.222	255.255.255.0	10.100.23.1

Bond Settings Summary

Bond	Mode	Ports	Active Vlans	Mirror
bond1	link-backup	gig1 gig2	all	off
bond2	link-backup		all	off

Integrated Access Points

IAP	State	AP Type	Channel		WiFi Mode	Antenna	Cell Size	TX Power	RX Threshold	Stations	WDS Link / Distance	MAC Address / BSSID	Description
iap1	up	11abgn 3x3	mon	dedicated monitor	abgn	internal omni	monitor	20	-95	0		00:0f:7d:44:03:01	
iap2	up	11abgn 3x3	36+40	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:11	
iap3	up	11abgn 3x3	1	default	bgn	internal directional	max	20	-90	0		00:0f:7d:44:03:21	
iap4	up	11abgn 3x3	44+48	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:31	
iap5	up	11abgn 3x3	149+153	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:41	
iap6	up	11abgn 3x3	52+56	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:51	
iap7	up	11abgn 3x3	11	default	bgn	internal directional	max	20	-90	0		00:0f:7d:44:03:61	
iap8	up	11abgn 3x3	60+64	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:71	

Network Assurance

Setting	Hostname	IP Address	Status
DNS server 1		10.100.1.10	Connectivity OK
DNS server 2		10.100.2.10	Connectivity OK
NTP primary server	time.nist.gov	216.171.120.36	Connectivity OK
NTP secondary server	pool.ntp.org	69.122.22.85	Connectivity OK
SNMP trap host 1		10.100.1.20	Connectivity OK
Syslog primary server	dgates-4x6	10.100.23.217	Connectivity OK
gig1 IP gateway		10.100.23.1	Connectivity OK
gig2 IP gateway		10.100.23.1	Connectivity OK

Operating Status

Controller Temperature	IAP Module 1 Temperature	IAP Module 2 Temperature	IAP Module 3 Temperature	IAP Module 4 Temperature	Fan Speed
42 °C (107.6 °F)	n/a	n/a	n/a	n/a	2220 RPM

Figure 5. WMI: Array Status

In addition, a fully featured Command Line Interface (CLI) offers IT professionals a familiar management and control environment. SNMP (Simple Network Management Protocol) is also supported to allow management from an SNMP compliant management tool, such as the optional Xirrus Management System.

For deployments of more than five Arrays, we recommend that you use the Xirrus Management System (XMS). The XMS offers a rich set of features for fine control over large deployments.

Key Features and Benefits

This section describes some of the key product features and the benefits you can expect when deploying the Wireless Array (the XR-7630 product is used as an example in this section).

High Capacity and High Performance

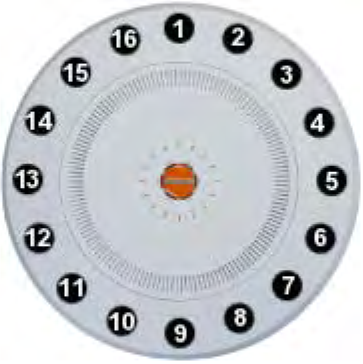


Figure 6. Layout of IAPs (XR-7630)

The XR-7630 version of the Wireless Array (Figure 6) enables wireless connectivity and easily handles time-sensitive traffic such as voice. This model includes four Gigabit uplink ports for connection to the wired network. Its sixteen IAPs (radios) provide a maximum wireless capacity of 7.2 Gbps, which offers ample reserves for the high demands of current and future applications. Of the sixteen IAPs, fifteen operate as radios which may be set up to serve your choice of client types—any or all of 802.11a/b/g/n (5 GHz or 2.4 GHz bands), providing backwards compatibility with 802.11b and 802.11g.

In the recommended configuration, one IAP is configured in RF monitoring and intrusion detection/prevention mode.

Extended Coverage

One XR-7630 solution enables you to replace fifteen access points (including one omnidirectional IAP for monitoring the network). Fifteen IAP radios with integrated directional antennas provide increased wireless range and enhanced data rates in all directions. With a Wireless Array deployed, far fewer access points are needed and wired-like resiliency is delivered throughout your wireless network. Your Wireless Array deployment ensures:

- Continuous connectivity if an IAP (radio) fails.
- Continuous connectivity if an Array fails.
- Continuous connectivity if a WDS link or switch fails.
- Continuous connectivity if a Gigabit uplink or switch fails.

Non-Overlapping Channels

Complete use of non-overlapping channels limits interference and delivers maximum capacity. On the XR-7630, up to 16 non-overlapping channels are fully utilized across the 5GHz and 2.4GHz spectrums (up to 12 across the 5GHz spectrum plus up to 3 across the 2.4 GHz spectrum—typically, one additional radio is used as a dedicated RF monitor).

SDMA Optimization

SDMA (Spatial Division Multiple Access) technology provides full 360° coverage while allowing independent channel and power output customization. Also supports fast inter-zone handoffs for time-sensitive applications and roaming.

Fast Roaming

Utilizes the Xirrus Roaming Protocol (XRP) ensuring fast and seamless roaming capabilities between IAPs or Arrays at both Layer 2 and Layer 3.

Easy Deployment

The Xirrus Management System (XMS) offers real time monitoring and management capabilities for the wireless network—ideal for the Enterprise market. It also allows you to import floor plans to help you plan your deployment. The Xirrus Wireless Array chassis has a plenum rated, lockable and tamper resistant case.

Secure Wireless Access

Multiple layers of authentication and encryption ensure secure data transmissions. The Wireless Array is 802.11i compliant with line-rate encryption support for 40 and 128 bit WEP, WPA and WPA2 with TKIP and AES encryption. Authentication is provided via 802.1x, including PEAP, EAP-TLS, EAP-TTLS, EAP-SIM, EAP-GRC, and LEAP (Lightweight Extensible Authentication Protocol) passthrough. Intrusion detection and prevention provide proactive monitoring of the environment for threats.

Applications Enablement

The Wireless Array's QoS (Quality of Service) functionality combined with true switch capabilities enable high density video and Voice over Wireless LAN deployments. Compliant with 802.1p and 802.1Q standards.

See Also

Wireless Array Product Overview
Power over Gigabit Ethernet (PoGE)
Why Choose the Xirrus Wireless Array?

Advanced Feature Sets

The Wireless Array offers a family of powerful functionality packages, including the RF Performance Manager (RPM), RF Security Manager (RSM), and RF Analysis Manager (RAM). These packages are separately licensed for operation on your Array.

Xirrus Advanced RF Performance Manager (RPM)

The Xirrus RPM optimizes the bandwidth usage and station performance of 802.11n wireless networks. Leveraging the multiple integrated access point (multi-radio) design of the Xirrus Wireless Array, RPM manages the allocation of wireless bandwidth to wireless stations across multiple RF channels. The result maximizes overall network performance with superior flexibility and capacity.

Today's wireless infrastructure is faced with ever increasing numbers and variations of wireless enabled clients, whether in the form of notebooks, netbooks, smart phones, IP phones, printers, projectors, cameras, RFID tags, etc. The advent of higher speed 802.11n wireless and its increased use of the 5GHz spectrum adds to the number of variables today's wireless networks must accommodate. Backwards compatibility with older clients is crucial, however their operation in a wireless network can significantly hinder the performance of faster clients. As an example, 802.11b wireless stations communicate more than 10 times slower than 802.11n stations.

With each of the Array’s multiple radios operating on a different channel, RPM selects the ideal radio for each station. High-speed stations are grouped together on radios with other high speed stations, while lower speed stations are combined with other lower speed stations. This ensures optimal performance for high-speed 802.11n stations without compromise.

The complete feature set of the RPM package includes:

- WDS (Wireless Distribution System) for point-to-point communication
- Wireless Mode per IAP
- Sharp Cell technology
- Wireless Data Rate Optimization
- Wireless Traffic Shaping
- Wireless Voice Call Admission Control
- Fast Layer 2 and 3 Roaming
- Standby Mode

Xirrus Advanced RF Security Manager (RSM)

The Xirrus RSM improves security and minimizes the risk in deploying 802.11n wireless networks. Leveraging an integrated 24/7 threat sensor and hardware-based encryption/decryption in each Array, RSM secures the wireless network from multiple types of threats. The result delivers uncompromised overall network security with superior flexibility and performance.

Today's wireless networks face a number of potential security threats in the form of rogue access points, ad-hoc clients, unauthorized clients, wireless-based attacks, eavesdropping, etc. As 802.11n is increasingly adopted in enterprise networks, defending against these threats becomes more critical. With the Array’s dedicated threat sensor radio scanning all channels in the 2.4GHz and 5GHz spectrums, RSM searches for security threats and automatically mitigates them.

High performance encryption/decryption in the enterprise wireless network is a must. The wireless network needs to support each client using the highest level of encryption (WPA2 Enterprise/128 bit AES) and without degrading the overall performance of the network. Xirrus incorporates hardware-based encryption/decryption into each Array, delivering line-rate encryption at the edge of the network instead of at a choke point within a centralized controller.

The complete feature set of the RSM package includes:

- Wireless IDS/IPS (Intrusion Detection/Prevention System)
- Wireless stateful firewall
- User group policies
- Authenticated guest access gateway
- NAC integration

Xirrus Advanced RF Analysis Manager (RAM)

The RF Advanced Analysis Manager (RAM) tests and troubleshoots 802.11n wireless networks. The deployment of 802.11n presents a set of unique challenges based on technology differences with legacy 802.11a/b/g networks, both on the wireless infrastructure and client side. Xirrus' RAM equips each Wireless Array with a powerful set of tools and features to optimally tune and verify an 802.11n installation, as well as give IT administrators the ability to troubleshoot issues that may occur within the wireless environment.

The 802.11n standard will continue to evolve over the next several years with additional performance and optional functions, along with ongoing stream of IEEE 802.11 amendments. This changing wireless landscape mandates that appropriate tools are available to the user to analyze, optimize, and troubleshoot their changing environments.

The distributed architecture of the Array enables the execution of powerful wireless and networking analysis at the edge of the network where packets traverse the wireless-to-wired boundary. The Array includes an embedded wireless controller with the necessary computing and memory resources to provide these functions securely at the network's edge.

The key elements of the RAM package include:

- RF Analysis – An embedded Spectrum Analyzer leverages the dedicated threat sensor radio in each Wireless Array to provide a continual view of utilization, interference, and errors across all available wireless channels.
- Packet Analysis – Integrated packet capture provides filterable views of all traffic traversing on the wired and wireless interfaces of the Array.
- Performance Analysis – Embedded traffic generation enables the throughput of the Array's wireless or wired interfaces to be analyzed.
- Failure Recovery – Radio Assurance provides an automatic self-test and self healing mechanism that ensures continuous system operation.
- Netflow Support
- Network Tools: ping, RADIUS ping, traceroute

About this User's Guide

This User's Guide provides detailed information and procedures that will enable wireless network administrators to install, configure and manage the Wireless Array so that end users can take full advantage of the product's features and functionality without technical assistance.

Organization

Topics and procedures are organized by function under the following chapter headings:

- **Introduction**

  Provides a brief introduction to wireless technology, an overview of the product, including its key features and benefits, and presents the product specifications.

- **Installing the Wireless Array**

  Defines prerequisites for deploying and installing the Array and provides instructions to help you plan and complete a successful installation.

- **The Web Management Interface**

  Offers an overview of the product's embedded Web Management Interface, including its content and structure. It emphasizes what you need to do to ensure that any configuration changes you make are applied, and provides a list of restricted characters. It also includes instructions for logging in to the Array with your Web browser.

- **Viewing Status on the Wireless Array**

  Describes the status and statistics displays available on the Array using its embedded Web Management Interface.

- **Configuring the Wireless Array**

  Contains procedures for configuring the Array using its embedded Web Management Interface.

- **Using Tools on the Wireless Array**

  Contains procedures for using utility tools provided in the Web Management Interface. It includes procedures for upgrading the system firmware, uploading and downloading configurations and other files, using diagnostic tools, and resetting the Array to its factory defaults.

- **The Command Line Interface**

  Includes the commands and the command structure used by the Wireless Array's Command Line Interface (CLI), and provides a procedure for establishing a Telnet connection to the Array. This chapter also includes some sample key configuration tasks using the CLI.

- **Appendix A: Quick Reference Guide**

  Contains the product's factory default settings.

- **Appendix B: Technical Support**

  Offers guidance to resolve technical issues, including general hints and tips to enhance your product experience, and a procedure for isolating problems within an Array-enabled wireless network. Also includes Frequently Asked Questions (FAQs) and Xirrus contact information.

- **Appendix C: Notices**

  Contains the legal notices, licensing, and compliance statements for the Array. Please read this section carefully.

- **Glossary of Terms**

  Provides an explanation of terms directly related to Xirrus product technology, organized alphabetically.

- **Index**

  The index is a valuable information search tool. Use the index to locate specific topics discussed in this User's Guide. Simply click on any page number in the index to jump to the referenced topic.

Notes and Cautions

The following symbols are used throughout this User's Guide:

✍ *This symbol is used for general notes that provide useful supplemental information.*

! *This symbol is used for cautions. Cautions provide critical information that may adversely affect the performance of the product.*

Screen Images

Some screen images of the Web Management Interface have been modified for clarity. For example, an image may have been cropped to highlight a specific area of the screen, and/or sample data may be included in some fields.

Product Specifications

Please refer to the Xirrus web site for the latest specifications for these Arrays—www.xirrus.com

Installing the Wireless Array

The instructions for completing a successful installation include the following topics:

- **"Installation Prerequisites" on page 23**.
- **"Planning Your Installation" on page 26**.
- **"Installation Workflow" on page 57**.
- **"Installing Your Wireless Array" on page 59**.
- **"Powering Up the Wireless Array" on page 63**.
- **"Establishing Communication with the Array" on page 66**.
- **"Performing the Express Setup Procedure" on page 71**.

Installation Prerequisites

Your Wireless Array deployment requires the presence of hardware and services in the host wired/wireless network, including:

- **Power Source**

  Most Arrays are powered via Xirrus-supplied Power over Gigabit Ethernet. PoGE supplies power over the same Cat 5e or Cat 6 cable used for data, thus reducing cabling and installation effort. PoGE power injector modules are available in 1-, 2-, and 8-port configurations and are typically placed near your Gigabit Ethernet switch. An AC outlet is required for each injector module. Current Array models have integrated splitters, so no separate splitter is required.

- **Ethernet ports**

  You need at least one 100/1000 BaseT port to establish wired Gigabit Ethernet connectivity. XR Series Arrays have one, two, or four Gigabit ports, depending on the model (see "XR Wireless Array Product Family" on page 6). XN Series Arrays have one or two Gigabit ports, depending on the model. Some models also have one 10/100 BaseT port which may be used for product management if desired. See "XN Wireless Array Product Family" on page 10.

! *The Array's Ethernet ports should be connected to an Ethernet switch, not an Ethernet hub—if a hub is used, we recommend that you do not bond-pair Ethernet ports.*

- **Secure Shell (SSH) utility**
  To establish secure remote command line access to the Array, you need a Secure Shell (SSH) utility, such as PuTTY. The utility **must** be configured to use SSH-2, since the Array will only allow SSH-2 connections.

- **Secure Web browser**

  Either Internet Explorer (version 7.0 or higher), Mozilla Firefox (version 3.0 or higher), Chrome (version 3.0 or higher), or Safari (version 5.0 or higher). A secure Web browser is required for Web-based management of the Array. The browser must be on the same subnet as the Array, or you must set a static route for management as described in the warning above.

- **Serial connection capability**
  To connect directly to the console port on the Array (all models except XR500 and XR-1000 Series), your computer must be equipped with a male 9-pin serial port and terminal emulation software (for example, HyperTerminal). The Xirrus Array only supports serial cable lengths up to 25′ per the RS-232 specification.

  Use the following settings when establishing a serial connection:

Bits per second	115,200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

Optional Network Components

The following network components are optional.

- **Xirrus Management System (XMS)**
  The optional XMS offers powerful management features for small or large Wireless Array deployments.

- **External RADIUS server**
  Although your Array comes with an embedded RADIUS server, for 802.1x authentication in large deployments you may want to add an external RADIUS server.

Client Requirements

The Wireless Array should only be used with Wi-Fi certified client devices.

See Also

Coverage and Capacity Planning
Failover Planning
Planning Your Installation

Planning Your Installation

This section provides guidelines and examples to help you plan your Xirrus Wireless Array deployment to achieve the best overall coverage and performance. We recommend you conduct a site survey to determine the best location and settings for each Array you install.

The following topics are discussed:

- **"General Deployment Considerations" on page 26**
- **"Coverage and Capacity Planning" on page 28**
- **"IEEE 802.11n Deployment Considerations" on page 35**
- **"Failover Planning" on page 42**
- **"Power Planning" on page 45**
- **"Security Planning" on page 46**
- **"Port Requirements" on page 48**
- **"Network Management Planning" on page 52**
- **"WDS Planning" on page 53**
- **"Common Deployment Options" on page 56**

For a complete discussion of implementing Voice over Wi-Fi on the Array, see the ***Xirrus Voice over Wireless Application Note*** *in the* ***Xirrus Resource Center****.*

General Deployment Considerations

For optimal placement of Arrays, we recommend that a site survey be performed by a qualified Xirrus partner.

The Wireless Array's unique multi-radio architecture generates 360 degrees of sectored high-gain 802.11a/b/g/n or 802.11a/b/g coverage that provides extended range. (Note that XR500 Series radios are omni-directional rather than sectored.) However, the number, thickness and location of walls, ceilings or other objects that the wireless signals must pass through may affect the range. Typical ranges vary depending on the types of materials and background RF (radio frequency) noise at your location. To maximize wireless range, follow these basic guidelines:

1. Keep the number of walls and ceilings between the Array and your receiving devices to a minimum—each wall or ceiling can reduce the wireless range from between 3 and 90 feet (1 to 30 meters). Position your devices so that the number of walls or ceilings is minimized.
2. Be aware of the direct line between each device. For example, a wall that is 1.5 feet thick (half a meter) at 90° is actually almost 3 feet thick (or 1 meter) when viewed at a 45° angle. At an acute 2° degree angle the same wall is over 42 feet (or 14 meters) thick! For best reception, try to ensure that your wireless devices are positioned so that signals will travel straight through a wall or ceiling.

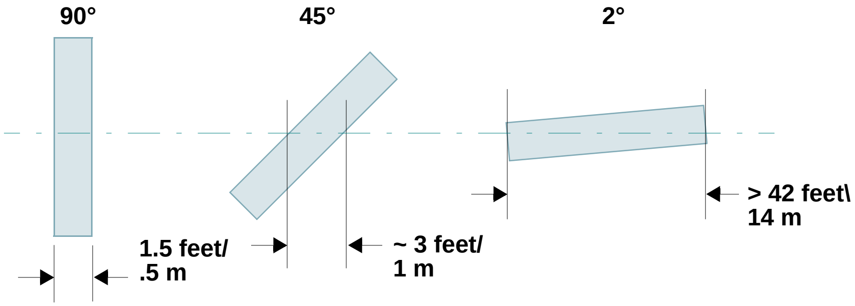


Figure 7. Wall Thickness Considerations

3. Try to position wireless client devices so that the signal passes through drywall (between studs) or open doorways and not other materials that can adversely affect the wireless signal.

See Also

Coverage and Capacity Planning

Common Deployment Options

Installation Prerequisites

Coverage and Capacity Planning

This section considers coverage and capacity for your deployment(s), including placement options, RF patterns and cell sizes, area calculations, roaming considerations, and channel allocations.

Note that several advanced features in this section are part of the Xirrus Advanced RF Performance Manager (RPM). *They require the license installed on the Array to include support for RPM. Please see* ***"About Licensing and Upgrades" on page 361****.*

XR500 Series radios are omni-directional rather than directional (sectored), and discussions involving sectored radios are not applicable to these Arrays.

Placement

Use the following guidelines when considering placement options:

1. The best placement option for the Array is ceiling-mounted within an open plan environment (cubicles rather than fixed walls).
2. Keep the Array away from electrical devices or appliances that generate RF noise. Because the Array is generally mounted on ceilings, be aware of its position relative to lighting (especially fluorescent lighting)—we recommend maintaining a distance of at least 3 to 6 feet (1 to 2 meters).

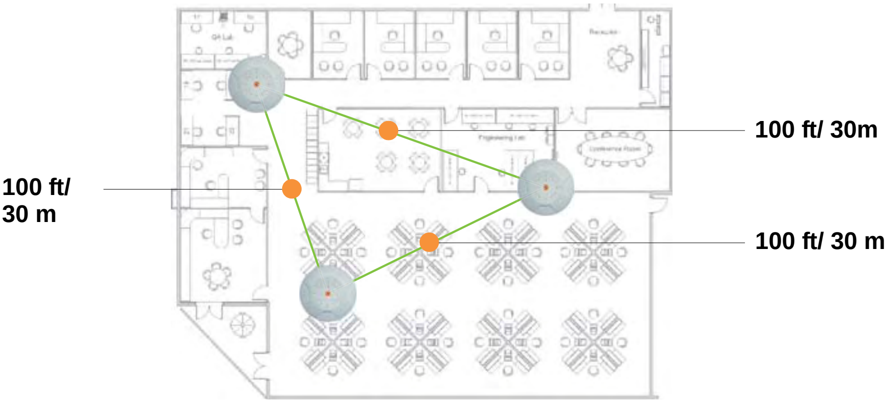


Figure 8. Unit Placement

3. If using multiple Arrays in the same area, maintain a distance of at least 100ft/30m between Arrays if there is direct line-of-sight between units, or at least 50ft/15m if a wall or other barrier exists between units.

RF Patterns

The Wireless Array allows you to control—automatically or manually—the pattern of wireless coverage that best suits your deployment needs. You can choose to operate with full coverage, half coverage, or custom coverage (by enabling or disabling individual sectors).

Full (Normal) Coverage

In normal operation, the Array provides a full 360 degrees of coverage.

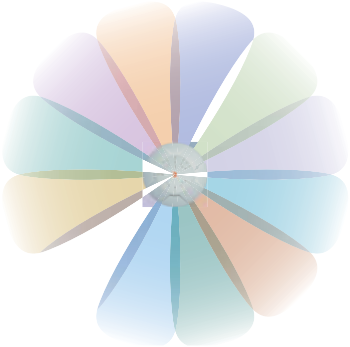


Figure 9. Full (Normal) Coverage

Half Coverage

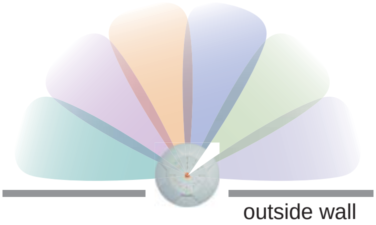


Figure 10. Adjusting RF Patterns

If installing a unit close to an exterior wall, you can deactivate half of the radios to prevent redundant signals from "bleeding" beyond the wall and extending service into public areas. The same principle applies if you want to restrict service to an adjacent room within the site.

Custom Coverage

Where there are highly reflective objects in proximity to the Array, you can turn off specific radios to avoid interference and feedback.

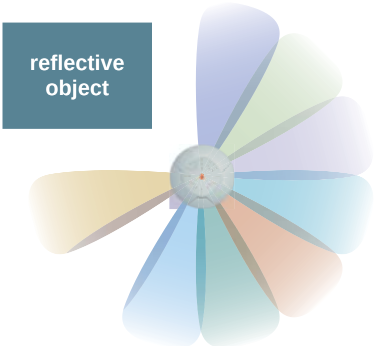


Figure 11. Custom Coverage

Capacity and Cell Sizes

Cell sizes should be estimated based on the number of users, the applications being used (for example, data/video/voice), and the number of Arrays available at the location. The capacity of a cell is defined as the minimum data rate desired for each sector multiplied by the total number of sectors being used.

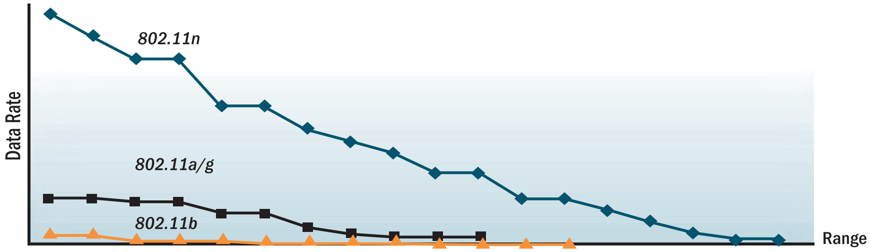


Figure 12. Connection Rate vs. Distance

Figure 12 shows relative connection rates for 802.11n vs. 802.11a/g and 802.11b, and the effect of distance on the connection rates. Wireless environments can vary greatly so the actual rates may be different depending on the specific network deployment.

The XN4 has a smaller range than the larger Arrays.

Fine Tuning Cell Sizes

Adjusting the transmit power allows you to fine tune cell sizes. There are four standard sizes—Small, Medium, Large, or Max (the default is **Max**). There is also an Auto setting that automatically determines the best cell size, and a Manual setting that allows you to choose your power settings directly.

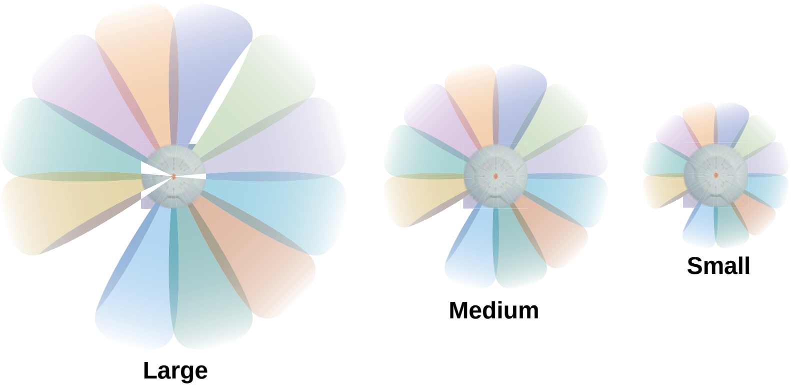


Figure 13. Transmit Power

Auto Cell Size is an automatic, self-tuning mechanism that balances cell size between Arrays to guarantee coverage while limiting the RF energy that could extend beyond the organizational boundary. Auto Cell uses communication between Arrays to dynamically set radio power so that complete coverage is provided to all areas, yet at the minimum power level required. This helps to minimize potential interference with neighboring networks. Additionally, Arrays running Auto Cell automatically detect and compensate for coverage gaps caused by system interruptions. To enable the Auto Cell Size feature, go to "RF Power & Sensitivity" on page 316. For a complete discussion of the Auto Cell size feature, see the *Xirrus Auto Cell Application Note* in the ***Xirrus Resource Center***.

If you are installing many units in proximity to each other, we recommend that you use Auto Cell Size; otherwise, reduce the transmit power using manual settings to avoid excessive interference with other Arrays or installed APs. See also, “Coverage and Capacity Planning” on page 28.

Sharp Cell

XR500 Series radios are omni-directional rather than directional (sectored),. This feature is not applicable to these Arrays.

This patented Xirrus RF management option automatically creates more intelligently defined cells and improves performance by creating smaller, high-throughput cells. By dynamically limiting each cell to a defined boundary (cell size), the trailing edge bleed of RF energy is reduced, thus minimizing interference between neighboring Wireless Arrays or other Access Points. To enable the Sharp Cell feature, go to “RF Power & Sensitivity” on page 316. For more information about this feature, see the *Xirrus Sharp Cell Application Note* in the ***Xirrus Resource Center***.

Roaming Considerations

Cells should overlap approximately 10 - 15% to accommodate client roaming.

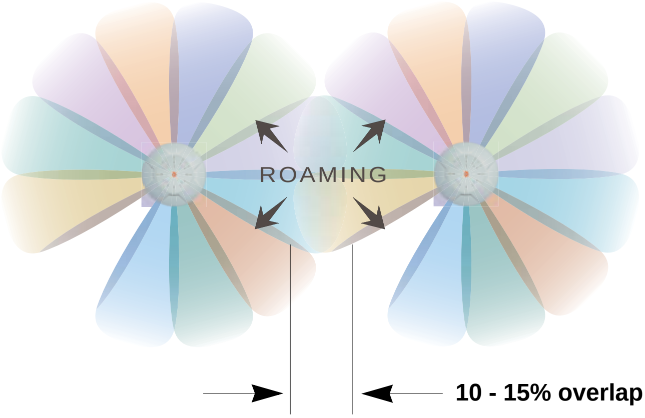


Figure 14. Overlapping Cells

Allocating Channels

Because the Wireless Array is a multi-channel device, allocating the best channels to radios is important if peak performance is to be maintained.

Automatic Channel Selection

We recommend that you allow the Array to make intelligent channel allocation decisions automatically. In the automatic mode, channels are allocated dynamically, driven by changes in the environment. Auto Channel assignment is performed by scanning the surrounding area for RF activity on all channels, then automatically selecting and setting channels on the Array to the best channels available. This function is typically executed when initially installing Arrays in a new location and may optionally be configured to execute periodically to account for changes in the RF environment over time. Auto Channel selection has significant advantages, including:

- Allows the Array to come up for the first time and not interfere with existing equipment that may be already running, thereby limiting co-channel interference.
- More accurately tunes the RF characteristics of a wireless installation than manual configuration since the radios themselves are scanning the environment from their physical location.
- May be configured to run periodically.

To set up the automatic channel selection feature, go to “Advanced RF Settings” on page 313.

Manual Channel Selection

You can manually assign channels on a per radio basis, though manual selection is not recommended (and not necessary).

To avoid co-channel interference, do not select adjacent channels for radios that are physically next to each other.

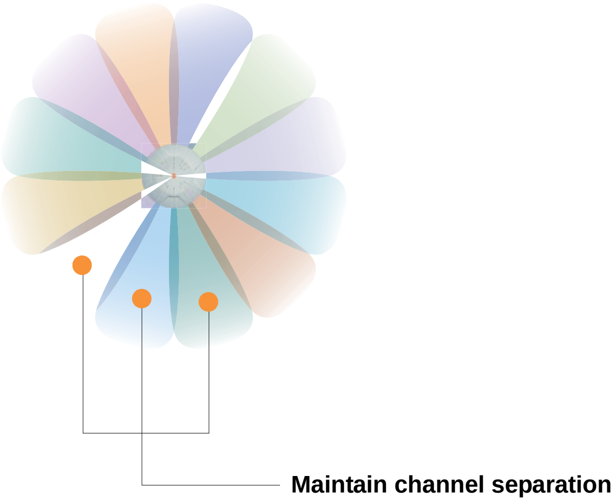


Figure 15. Allocating Channels Manually

See Also

Failover Planning

Installation Prerequisites

IEEE 802.11n Deployment Considerations

Note that the license installed on the Array must include support for 802.11n. Please see ***"About Licensing and Upgrades" on page 361****.*

The Xirrus Arrays support IEEE 802.11n on all IAPs, in both 2.4 GHz and 5 GHz bands. Use of 802.11n offers significant benefits:

- Higher data rates
- Higher throughput
- Supports more users
- More robust connections
- Increased coverage area
- More secure connections—supports WPA2 (Wi-Fi Protected Access 2)

These benefits result in better support for a wide range of applications such as voice and video, intensive usage such as CAD/CAM and backups, dense user environments, and for manufacturing and warehousing environments.

While 802.11n increases coverage area by almost doubling the reach, you must consider the legacy wireless devices in your network. Wireless stations connecting using 802.11a/b/g will still be subject to a reach of up to 100 feet, depending on the environment.

The techniques that 802.11n uses to realize these performance improvements, and the results that can be expected are discussed in:

- **"MIMO (Multiple-In Multiple-Out)" on page 36**
- **"Multiple Data Streams—Spatial Multiplexing" on page 38**
- **"Channel Bonding" on page 39**
- **"Improved MAC Throughput" on page 40**
- **"Short Guard Interval" on page 40**
- **"Obtaining Higher Data Rates" on page 41**
- **"802.11n Capacity" on page 42**

Two very important techniques to consider are Channel Bonding and Multiple Data Streams—Spatial Multiplexing because they contribute a large portion of

802.11n's speed improvements and because they are optional and configurable, as opposed to the parts of 802.11n that are fixed. While the settings for 802.11n IAPs come pre-configured on the Array for robust performance in typical usage, you should review the settings for your deployment, especially channel bonding. A global setting is provided to enable or disable 802.11n mode. See "Global Settings .11n" on page 304 to configure 802.11n operation.

MIMO (Multiple-In Multiple-Out)

MIMO (Multiple-In Multiple-Out) signal processing is one of the core technologies of 802.11n. It mitigates interference and maintains broadband performance even with weak signals.

Prior to 802.11n, a data stream was transmitted via one antenna. At the receiving end, the antenna with the best signal was selected to receive data. (Figure 16)

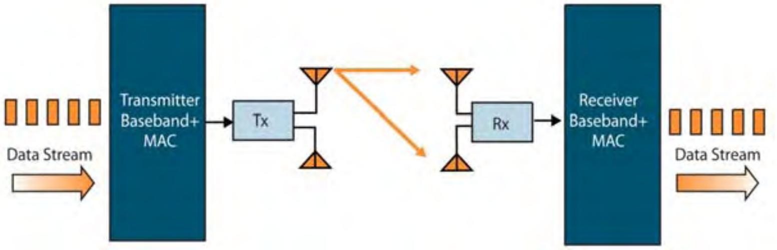


Figure 16. Classic 802.11 Signal Transmission

MIMO signal processing uses multiple antennas to send and receive data. It takes advantage of multipath reflections to improve signal coherence and greatly increase receiver sensitivity (Figure 17).

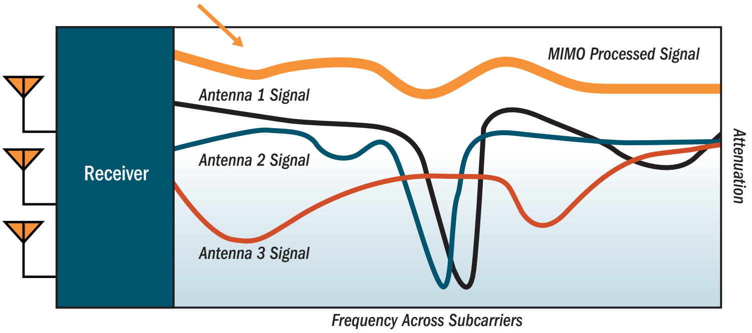


Figure 17. MIMO Signal Processing

Multipath signals were considered to be interference by 802.11a/b/g radios, and degraded performance. In 802.11n, these signals are used to enhance performance. This extra sensitivity can be used for greater range or higher data rates. The enhanced signal is the processed sum of individual antennas. Signal processing eliminates nulls and fading that any one antenna would see. MIMO signal processing is sophisticated enough to discern multiple spatial streams (see Multiple Data Streams—Spatial Multiplexing). There are no settings to configure for MIMO.

Multiple Data Streams—Spatial Multiplexing

Spatial Multiplexing transmits completely separate data streams on different antennas (in the same channel) that are recombined to produce new 802.11n data rates. Higher data rates are achieved by splitting the original data stream into separate data streams. Each separate stream is transmitted on a different antenna (using its own RF chain). MIMO signal processing at the receiver can detect and recover each stream. Streams are then recombined, yielding higher data rates.

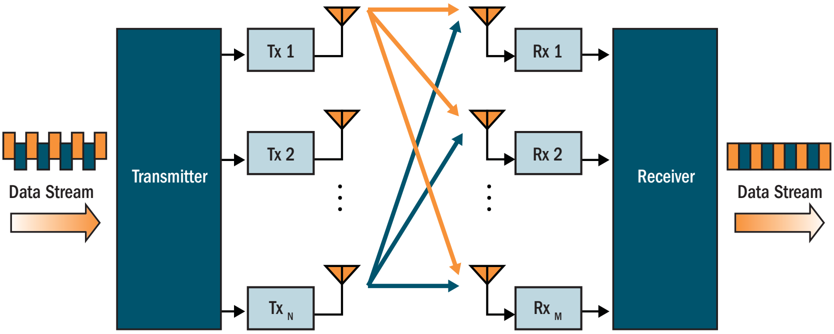


Figure 18. Spatial Multiplexing

Spatial multiplexing can double, triple, or quadruple the date rate, depending on the number of transmit antennas used. You can configure the number of chains (i.e., streams) separately for transmitting and receiving. By default, the Array uses three chains for transmitting and receiving (see "Global Settings .11n" on page 304).

Channel Bonding

Channel bonding increases data rates by combining two adjacent 20 MHz channels into one 40 MHz channel. This increases the data rate to slightly more than double.

A bonded 40 MHz channel is specified in terms of the Primary channel and the adjacent channel to Bond. The Bond channel is represented by **+1** to use the channel above the Primary channel, or **-1** to use the channel below. In the example shown, Channel 40 is the Primary channel and it is bonded to Channel 36, the channel below it, by specifying **-1**. Be aware that Channel Bonding can make channel planning more difficult, since you are using two channels for an IAP. We recommend the use of the 5 GHz band, since it has many more channels than the 2.4 GHz band, and thus more channels are available for bonding.

The Array provides an Automatic Channel Bonding setting that will automatically select the best channel for bonding on each IAP. If you enable this option, you may select whether bonding will be dynamic (the bonded channel changes in response to environmental conditions) or static (the bonded channel will not be changed. See “Global Settings .11n” on page 304. To configure channel bonding manually, on a per-IAP basis, see “IAP Settings” on page 274.

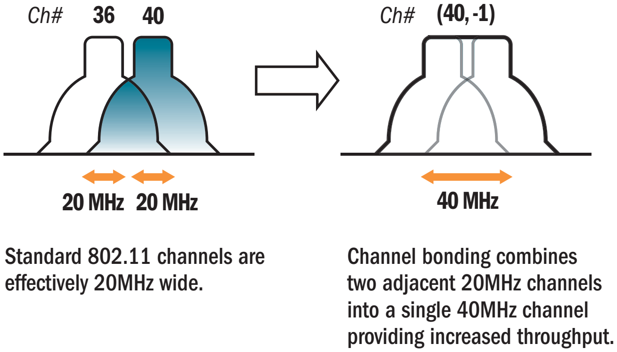

Ch#
36
40
20 MHz
20 MHz
Standard 802.11 channels are effectively 20MHz wide.
Ch#
(40, -1)
40 MHz
Channel bonding combines two adjacent 20MHz channels into a single 40MHz channel providing increased throughput.

Figure 19. Channel Bonding

Improved MAC Throughput

These changes make 802.11n transmission of MAC frames 40% more efficient than legacy transmission:

- MAC data frames are combined and given a single PHY header.
- Implicit Block ACK acknowledges all data frames within a combined frame.
- Spacing between frames is reduced.

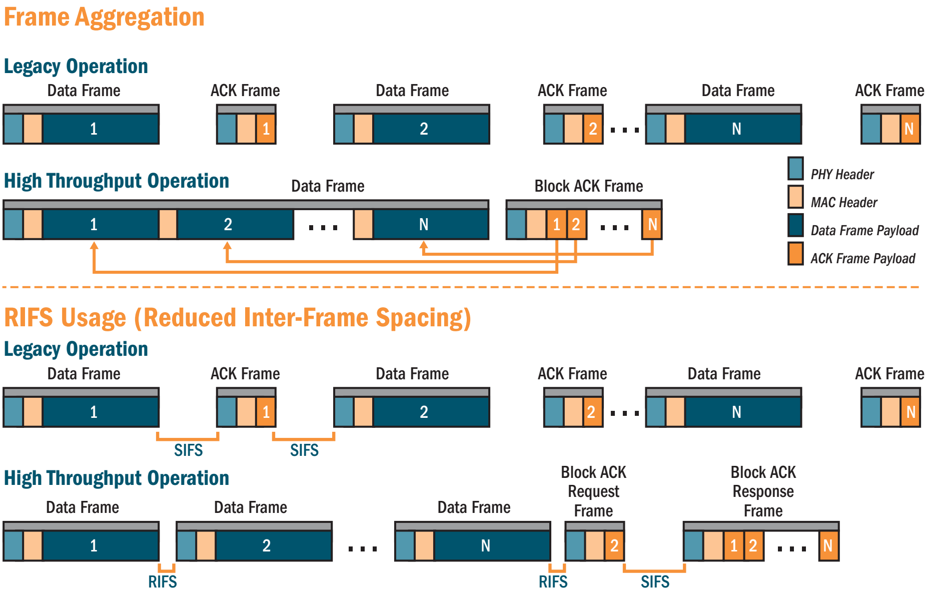


Figure 20. MAC Throughput Improvements

Short Guard Interval

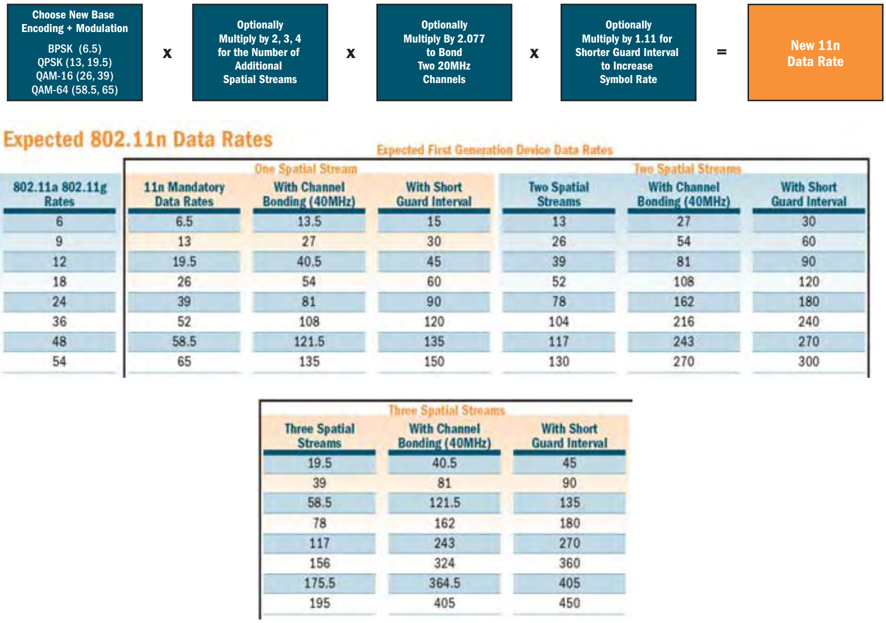
This option reduces the wait time between signals that are being sent out over the air. The guard interval provides immunity to propagation delays and reflections, and is normally 800 ns (long). By using a short guard interval (400 ns), the data rate is increased by approximately 11%. The short interval may be used in many environments (especially indoors). If the short guard interval is used in an inappropriate environment, the signal quality will suffer and throughput will decrease. See "Global Settings .11n" on page 304 to configure the guard interval.

Obtaining Higher Data Rates

The data rate increase obtained by using 802.11n on an Array is incremental, based on the technologies that are applied and the options that you select:

- Higher encoding rates (Mandatory in 802.11n)
- Spatial Streams (Mandatory, but multiplier varies directly with number of streams selected.)
- Channel Bonding (Mandatory in 802.11n, apply multiplier to IAP if it is bonded.)
- Short Guard Interval (Optional)

See Figure 21 to see the 802.11n data rate increase for an IAP. Apply this increase to the 802.11 a, b or g data rates selected for the Array.



Choose New Base Encoding + Modulation
BPSK (6.5)
QPSK (13, 19.5)
QAM-16 (26, 39)
QAM-64 (58.5, 65)
x
Optionally Multiply by 2, 3, 4 for the Number of Additional Spatial Streams
x
Optionally Multiply By 2.077 to Bond Two 20MHz Channels
x
Optionally Multiply by 1.11 for Shorter Guard Interval to Increase Symbol Rate
=
New 11n Data Rate

Expected 802.11n Data Rates

Expected First Generation Device Data Rates

	One Spatial Stream			Two Spatial Streams		
802.11a 802.11g Rates	11n Mandatory Data Rates	With Channel Bonding (40MHz)	With Short Guard Interval	Two Spatial Streams	With Channel Bonding (40MHz)	With Short Guard Interval
6	6.5	13.5	15	13	27	30
9	13	27	30	26	54	60
12	19.5	40.5	45	39	81	90
18	26	54	60	52	108	120
24	39	81	90	78	162	180
36	52	108	120	104	216	240
48	58.5	121.5	135	117	243	270
54	65	135	150	130	270	300

Three Spatial Streams		
Three Spatial Streams	With Channel Bonding (40MHz)	With Short Guard Interval
19.5	40.5	45
39	81	90
58.5	121.5	135
78	162	180
117	243	270
156	324	360
175.5	364.5	405
195	405	450

Figure 21. Computing 802.11n Data Rates

802.11n Capacity

802.11n offers major increases in capacity over previous 802.11 standards, as shown in the table below.

802.11 Mode	# Channels	Max Theoretical Capacity
Fast Ethernet	No	Yes
802.11 a/n: 3 Streams	23	23 * 450 Mbps = 10.2 Gbps
802.11 a/n: 2 Streams	23	23 * 300 Mbps = 6.8 Gbps
802.11 a/n: 1 Stream	23	23 * 150 Mbps = 3.4 Gbps
802.11 a	23	23 * 54 Mbps = 1.2 Gbps
802.11 g/n: 3 Streams	3	3 * 450 Mbps = 1.35 Gbps (1 or 2 streams have proportionally lower capacity)
802.11 g	3	3 * 54 Mbps = 162 Mbps
802.11 b	3	3 * 11 Mbps = 33 Mbps

Failover Planning

This section discusses failover protection at the unit and port levels. To ensure that service is continued in the event of a port failure, you can utilize two Gigabit Ethernet ports simultaneously as a bonded pair (on Arrays with two or more Gigabit ports).

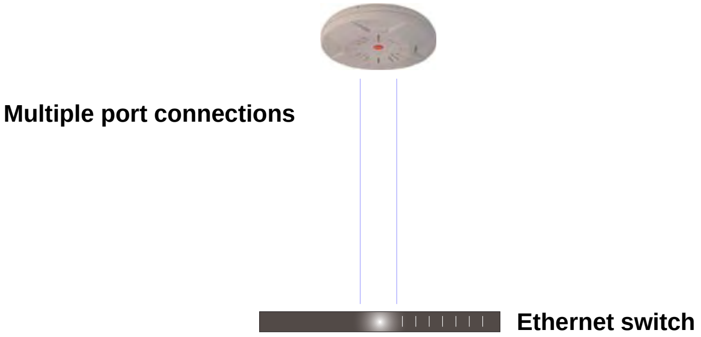


Figure 22. Port Failover Protection

In addition, the Array has full failover protection between the bonded-pair Gigabit ports (see following table).

Interface	Bridges Data?	Bridges Management Traffic?	Fails Over To:	IP address
Fast Ethernet	No	Yes	None	DHCP or static
Gigabit port	Yes	Yes	Bonded port	DHCP or static
Bonded Gigabit port	Yes	Yes	Bonded port	Same

The Wireless Array Gigabit Ethernet ports actually support a number of modes:

- 802.3ad Link Aggregation
- Load Balancing
- Broadcast
- Link Backup
- Mirrored

For more details on Gigabit port modes and their configuration, please see "Network Bonds" on page 175.

Switch Failover Protection

To ensure that service is continued in the event of a switch failure, you can connect Arrays having multiple Gigabit ports to more than one Ethernet switch (not a hub).

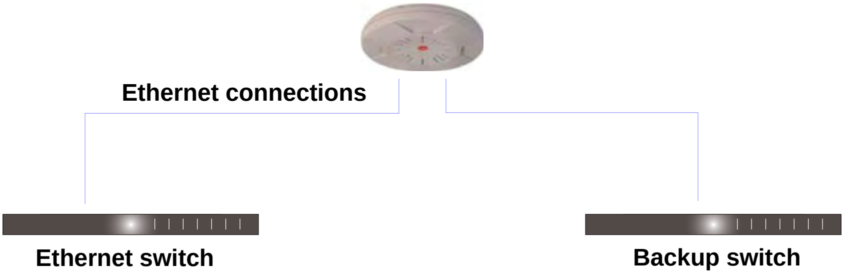


Figure 23. Switch Failover Protection

Gigabit Ethernet connections must be on the same subnet.

See Also

Coverage and Capacity Planning
Installation Prerequisites
Network Management Planning
Planning Your Installation
Power Planning
Security Planning

Power Planning

All XR and XN Series Array models support Power over Gigabit Ethernet (PoGE) with an integrated splitter. This section discusses PoGE power.

Power over Gigabit Ethernet

To deliver power to the Array, you must use Xirrus-supplied may use the optional XP1, XP2, or XP8 Power over Gigabit Ethernet (PoGE) modules. They provide power over Cat 5e or Cat 6 cables to the Array without running power cables—see Figure 4 on page 12.

Specific models of the Array are compatible with specific PoGE modules. For details, please see the *Power over Gigabit Ethernet Installation and User Guide*.

When using Cat 5e or Cat 6 cable, power can be provided up to a distance of 100m.

See Also

Coverage and Capacity Planning
Failover Planning
Network Management Planning
Security Planning

Security Planning

This section offers some useful guidelines for defining your preferred encryption and authentication method. For additional information, see "Understanding Security" on page 209 and the Security section of "Frequently Asked Questions" on page 452.

> *Note that several advanced features in this section are part of the* Xirrus Advanced RF Security Manager (RSM). *They require the license installed on the Array to include support for RSM. Please see* ***"About Licensing and Upgrades" on page 361****.*

Wireless Encryption

Encryption ensures that no user can decipher another user's data transmitted over the airwaves. There are three encryption options available to you, including:

- **WEP-40bit or WEP-128bit**
  Because WEP is vulnerable to cracks, we recommend that you only use this for legacy devices that cannot support a stronger encryption type.

- **Wi-Fi Protected Access (WPA)**
  This is much more secure than WEP and uses TKIP for encryption.

- **Wi-Fi Protected Access (WPA2) with AES**
  This is government-grade encryption—available on most new client adapters—and uses the AES–CCM encryption mode (Advanced Encryption Standard–Counter Mode).

Authentication

Authentication ensures users are who they say they are, and occurs when users attempt to join the wireless network and periodically thereafter. The following authentication methods are available with the Wireless Array:

- **RADIUS 802.1x**
  802.1x uses a remote RADIUS server to authenticate large numbers of clients, and can handle different authentication methods (EAP-TLS, EAP-TTLS, EAP-PEAP, and EAP-LEAP Passthrough). Administrators may

also be authenticated via RADIUS when preferred, or to meet particular security standards.

- **Xirrus Internal RADIUS server**
  Recommended for smaller numbers of users (about 100 or less). Supports EAP-PEAP only

- **Pre-Shared Key**
  Uses a pass-phrase or key that is manually distributed to all authorized users. The same passphrase is given to client devices and entered into each Array.

- **MAC Access Control Lists (ACLs)**
  MAC access control lists provide a list of client adapter MAC addresses that are allowed or denied access to the wireless network, and can be used in addition to any of the above authentication methods. ACLs are good for embedded devices, like printers and bar-code scanners (though MAC addresses can be spoofed). The Array supports 1,000 global ACL entries. You may also define per-SSID access control lists, with up to 1000 entries each.

See Also

Failover Planning
Network Management Planning
Power Planning

Port Requirements

A number of ports are used by various Array features and by the Xirrus Management System (XMS). The Port Requirements table on page 49 lists ports and the features that require them (XMS port requirements are included in the table for your convenience). If you are using a feature, please make sure that the ports that it requires are not blocked by firewalls or other policies, and that they do not conflict with any other port assignments.

As an example, XMS port requirements are illustrated in Figure 24. XMS requires ports 161, 162, and 443 to be passed between Arrays and the XMS server. Similarly, ports 9090 and 9091 are required for communication between the XMS server and XMS clients, and port 25 is typically used by the XMS server to access an SMTP server to send email notifications.

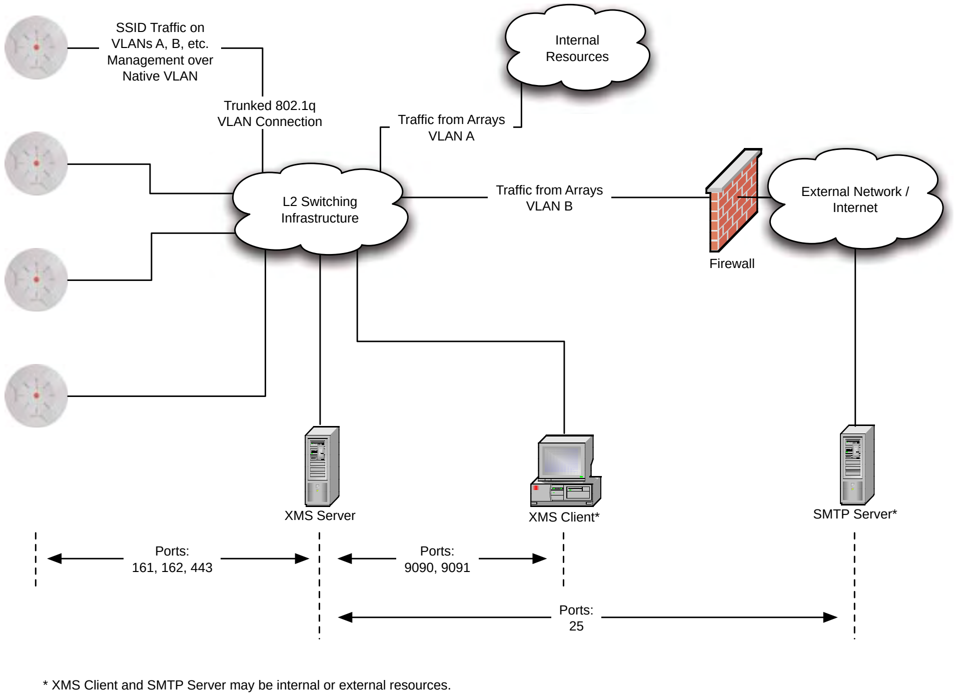


Figure 24. Port Requirements for XMS

The following table lists port requirements for the Array and for XMS, how they are used, and whether they may be changed.

Port	Application	Peer	Configurable
Array			
icmp	Ping	XMS Server	No
20 tcp 21 tcp	FTP	Client	Yes
22 tcp	SSH	Client	Yes
23 tcp	Telnet	Client	Yes
25 tcp	SMTP	Mail Server	No
69 udp	TFTP	TFTP Server	No
123 udp	NTP	NTP Server	No
161 udp	SNMP	XMS Server	No
162 udp	SNMP Traphost Note - Up to four Traphosts may be configured.	XMS Server	Yes - but required by XMS
443 tcp	HTTPS (WMI,WPR)	Client	Yes
514 udp	Syslog	Syslog Server	No
1812, 1645 udp	RADIUS (some servers use 1645)	RADIUS Server	Yes
1813, 1646 udp	RADIUS Accounting (some servers still use 1646)	RADIUS Accounting Server	Yes
2055 udp	Netflow	Client	Yes
5000 tcp	Virtual Tunnel	VTUN Server	Yes
22610 udp	XRP (Xirrus Roaming)	Arrays	Yes
22612 udp	Xircon (Console Utility)	Admin Workstation	Yes

Port	Application	Peer	Configurable
XMS			
icmp	Ping	Arrays	No
22 tcp	SSH	Arrays	Yes
25 tcp	SMTP	Mail Server	Yes
123 udp	NTP	NTP Server	No
161 udp	SNMP	Arrays	No
162 udp	SNMP Traphost 1	Arrays	Via XMS config file
443 tcp	HTTPS	Arrays	No
514 udp	Resident Syslog server	Internal*	Via XMS config file
1099 tcp	RMI Registry	Internal*	No
2000 tcp	XMS Back-end Server	Internal*	No
3306 tcp	MySQL Database	Internal*	No
8001 tcp	Status Viewer	Internal*	No
8007 tcp	Tomcat Shutdown	Internal*	During installation
8009 tcp	Web Container	Internal*	During installation
9090 tcp	XMS Webserver	XMS client	During installation
9091 tcp	XMS Client Server	XMS client	Via XMS config file
9092 tcp	XMS Client Server	XMS client	Via XMS config file
9443 tcp	XMS WMI SSL	XMS web client	No
* Internal to XMS Server, no ports need to be unblocked on other network devices			

See Also

Management Control

External Radius

Services

VLAN Management

Network Management Planning

Network management can be performed using any of the following methods:

- Command Line Interface, using an SSH (Secure Shell) utility, like PuTTY. The utility **must** be set up to use SSH-2, since the Array will only allow SSH-2 connections.
- Web-based management, using the Array's embedded Web Management Interface (WMI). This method provides configuration and basic monitoring tools, and is good for small deployments (one or two units).
- Centralized Web-based management, using the optional Xirrus Management System (XMS), which can be run on a dedicated Xirrus appliance or your own server. The XMS is used for managing large Wireless Array deployments from a centralized Web-based interface and offers the following features:
    - Globally manage large numbers of Arrays (up to 500)
    - Seamless view of the entire wireless network
    - Easily configure large numbers of Arrays
    - Rogue AP monitoring
    - Easily manage system-wide firmware updates
    - Monitor performance and trends
    - Aggregation of alerts and alarms

See Also

Failover Planning
Power Planning
Security Planning

WDS Planning

WDS (Wireless Distribution System) creates wireless backhauls between Arrays, allowing your wireless network to be expanded using multiple Arrays without the need for a wired backbone to link them (see Figure 25). WDS features include:

- One to three IAPs may be used to form a single WDS link, yielding up to 1350 Mbps bandwidth per link. Up to three different WDS links may be created on a single Array.
- Automatic IAP Load Balancing
- If desired, you may allow clients to associate to a BSS on the same radio interface used for a WDS Host Link. This will take bandwidth from the WDS link.

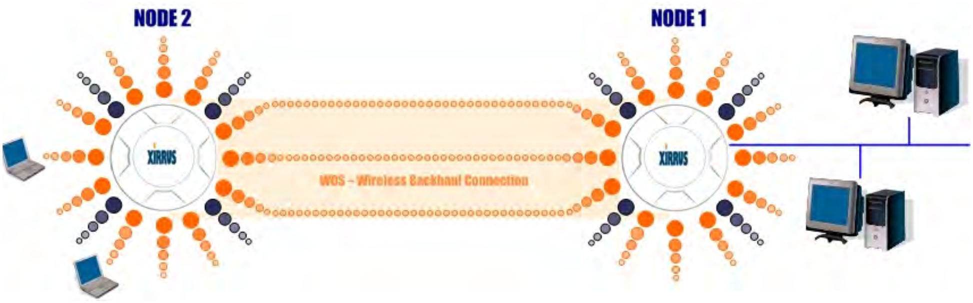


Figure 25. WDS Link

- Multiple links per Array allow you to configure multi-hop connections.

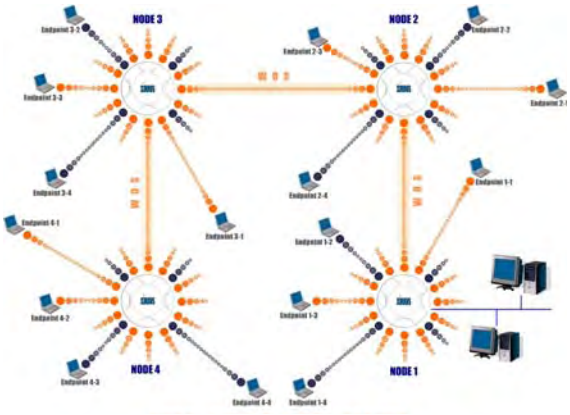


Figure 26. A Multiple Hop WDS Connection

- Multiple WDS links can provide link redundancy (failover capability - see Figure 27). A network protocol (Spanning Tree Protocol—STP) prevents Arrays from forming network loops.

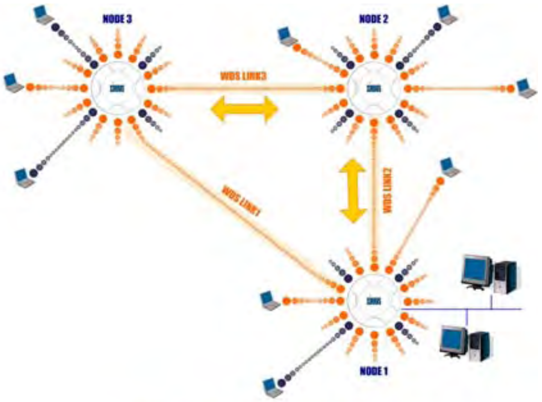


Figure 27. WDS Failover Protection

WDS links have a Host/Client relationship similar to the usual IAP/station pattern for Arrays:

- A *WDS Client Link* associates/authenticates to a host (target) Array in the same way that a station associates to an IAP. The client side of the link must be configured with the root MAC address of the target (host) Array.
- A *WDS Host Link* acts like an IAP by allowing one WDS Client Link to associate to it. An Array may have both client and host links.

WDS configuration is performed only on the client-side Array. See "WDS" on page 338. Note that both Arrays must be configured with the same SSID name.

Common Deployment Options

The following table lists some typical and recommended deployment options for a number of the features that have been discussed in this chapter.

Function	Number of Wireless Arrays	
	One or Two	Three or More
Power	Power over Gigabit Ethernet	Power over Gigabit Ethernet UPS backup (recommended)
Failover	Recommended	Highly recommended
VLANs	Optional	Optional use, Can be used to put all APs on one VLAN or map to existing VLAN scheme
Encryption	WPA2 with AES (recommended) PSK or 802.1x	WPA2 with AES (recommended) 802.1x keying
Authentication	Internal RADIUS server EAP-PEAP Pre-Shared Key	External RADIUS server
Management	Internal WMI Internal CLI (via SSHv2)	XMS (SNMP)

See Also

Coverage and Capacity Planning
Network Management Planning
Planning Your Installation
Power Planning
Security Planning

Installation Workflow

This workflow illustrates the steps that are required to install and configure your Wireless Array successfully. Review this flowchart before attempting to install the unit on a customer's network.

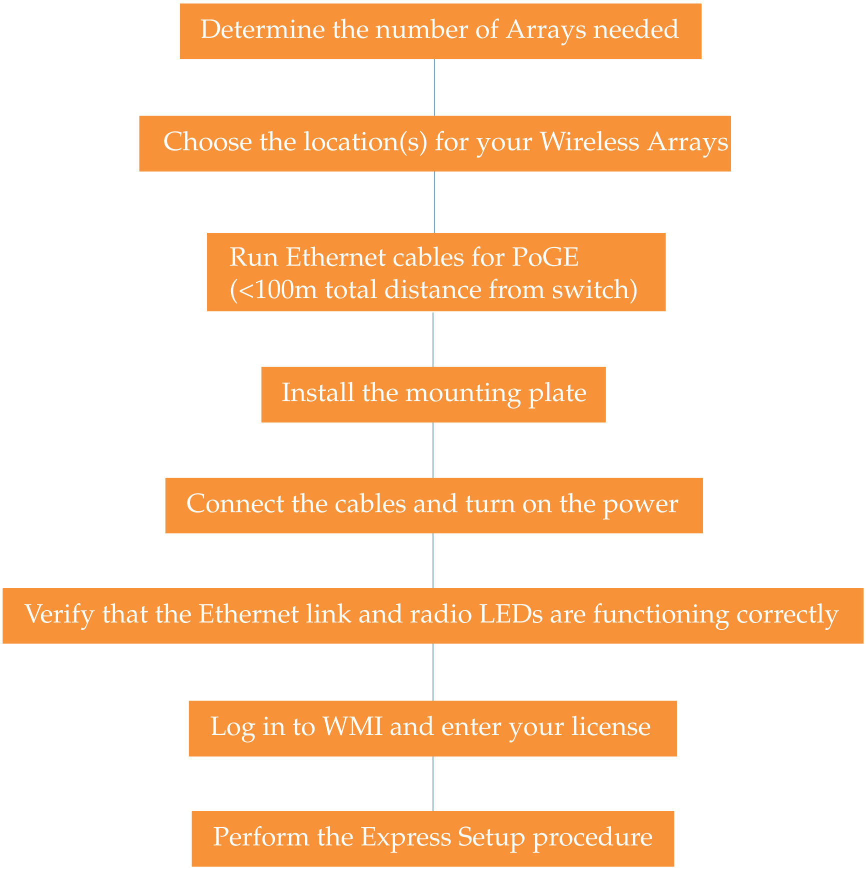

Determine the number of Arrays needed
Choose the location(s) for your Wireless Arrays
Run Ethernet cables for PoGE
(<100m total distance from switch)
Install the mounting plate
Connect the cables and turn on the power
Verify that the Ethernet link and radio LEDs are functioning correctly
Log in to WMI and enter your license
Perform the Express Setup procedure

Figure 28. Installation Workflow

See Also

Coverage and Capacity Planning
Common Deployment Options

Failover Planning
Installation Prerequisites
Planning Your Installation
Power Planning
Wireless Array Product Overview
Security Planning

Installing Your Wireless Array

This section provides instructions for completing a physical installation of your Xirrus Wireless Array.

Choosing a Location

Based on coverage, capacity and deployment examples previously discussed, choose a location for the Array that will provide the best results for your needs. The Wireless Array was designed to be mounted on a ceiling where the unit is unobtrusive and wireless transmissions can travel unimpeded throughout open plan areas.

You also have the option of mounting the Array on a wall, using the optional wall mount assembly kit.

Choose a location that is central to your users (see the following diagram for correct placement.

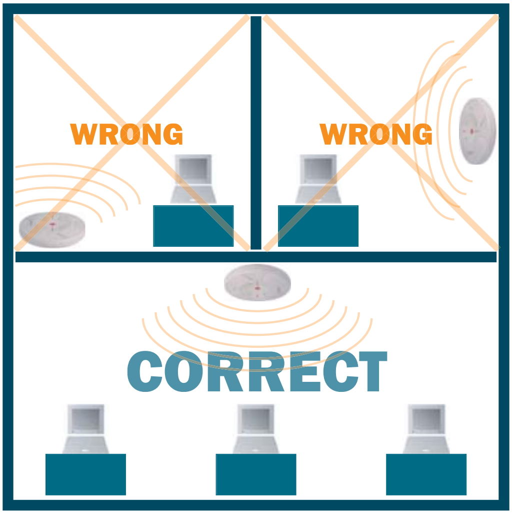


Figure 29. Array Placement

Wiring Considerations

Before using the Xirrus-supplied Power over Gigabit Ethernet modules (PoGE) to distribute power, see "Power over Gigabit Ethernet (PoGE)" on page 12.

Once you have determined the best location for your Wireless Array, you must run cables to the location for the following services:

Power

- No separate power cable to the Array is required when using PoGE modules. The PoGE module requires a dedicated AC power outlet (100 - 240 VAC).

Network

- Gigabit POE1—If using PoGE modules, the total of all Cat 5e or Cat 6 cable segments from the Gigabit Ethernet switch to an Array Ethernet port must be less than 100m long. The Array must be connected to PoGE networks without routing cabling to the outside plant, to ensure that cabling is not exposed to lightning strikes or possible high voltage crossover.
- Gigabit POE2—For Arrays with a second POE port, the same restrictions listed above apply.(optional, not available on the four-port Arrays)
- Fast Ethernet (optional, not available on the four-port Arrays)
- Serial cable (optional) — cable lengths up to 25′ per the RS-232 specification.

Important Notes About Network Connections

Read the following notes before making any network connections.

When the unit's IP address is unknown or a network connection has not been established, the serial cable is used for connecting directly with the Command Line Interface (CLI) via HyperTerminal. When a network connection is established, the Array can be managed from any of the available network connections, either Fast Ethernet, Gigabit 1 or Gigabit 2. For the XR-1000, the Xirrus Xircon utility may be used locally to set up an IP address if necessary.

! *The Array's Ethernet ports should be plugged into an Ethernet switch, not an Ethernet hub—if a hub is used, we recommend that you connect only one Ethernet port.*

! *The Gigabit1 Ethernet interface is the primary port for both data and management traffic. If a single Ethernet connection is used, it must be connected to the Gigabit1 Ethernet interface. See also, "Failover Planning" on page 42.*

The 10/100 Ethernet Port may be used for managing the Array out of band from the Gigabit Ethernet ports. The 10/100 port will route only management traffic, using a static route that may be configured for this interface. See "interface" on page 407.

See Also

Failover Planning
Installation Prerequisites
Installation Workflow
Mounting the Array
Power over Gigabit Ethernet (PoGE)

Mounting the Array

A number of options are available for mounting Arrays:

- Ceiling mount
- Wall mount
- Secure mount in a locking indoor enclosure
- I-Beam mount in a protective enclosure (gymnasium mount)
- Factory enclosure

A detailed Quick Installation Guide is provided with the mounting option that you selected when ordering your Array. Please follow the provided instructions carefully.

Dismounting the Array

To dismount any other Array model

For all Array models, push up on the Array (i.e., push it against the mounting plate). Then turn the Array to the left to remove it. This is similar to dismounting a smoke detector.

Powering Up the Wireless Array

When powering up, the Array follows a specific sequence of LED patterns showing the boot progress, and following a successful boot will provide extensive status information.

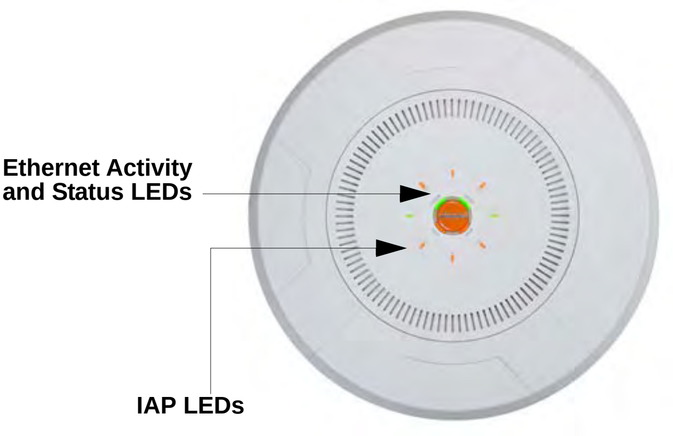


Figure 30. LED Locations

Array LED settings may be altered or disabled entirely for diagnostic purposes or for personal preference. Changes are made via the Array’s Command Line Interface or the Web Management Interface—refer to “LED Settings” on page 334.

Array LED Operating Sequences

Use the following tables to review the operating sequences of the Array's LEDs.

- **"LED Boot Sequence" on page 64**
- **"LED Operation when Array is Running" on page 65**

LED Boot Sequence

The normal boot LED sequence is as follows:

Array Activity	Status LED	IAP LEDs
Power ON	Blinking GREEN	All OFF
Boot loader power ON self-test	Blinking GREEN	All ON
Image load from compact FLASH	Blinking GREEN	Spinning pattern (rotate all to ON, then all to OFF)
Image load failure	Blinking ORANGE	All OFF
Hand off to ArrayOS	Solid GREEN	All OFF
System software initialization	Solid GREEN	Walking pattern—(LED rotating one position per second)
Up and running	Solid ON	ON for IAPs that are up: OFF for IAPs that are down. Green or orange per table on the next page. Behavior may be changed using "LED Settings" on page 334.

LED Operation when Array is Running

The normal LED operation when the Array is running is shown in the table below. Note that behavior may be modified using "LED Settings" on page 334 or via the CLI.

LED Status	Reason
IAP LED is OFF	IAP is down
IAP LED is solid ON	IAP is up, but no associations and no traffic
IAP LED heartbeat	IAP is up, with stations associated but no traffic
IAP LED flashing Flashing at 10 Hz Flashing at 5 Hz Flashing at 2.5 Hz	IAP is up, passing traffic Traffic > 1500 packets/sec Traffic > 150 packets/sec Traffic > 1 packet/sec
IAP LED is GREEN	IAP is operating in the 2.4 GHz band
IAP LED is ORANGE	IAP is operating in the 5 GHz band
IAP LED flashing ORANGE to GREEN at 1 Hz	The radio is in monitor mode (standard intrude detect)
Ethernet LEDs are dual color **Ethernet LED is ORANGE** **Ethernet LED is GREEN**	 Transferring data at 1 Gbps Transferring data at 10/100 Mbps

See Also

Installation Prerequisites
Installation Workflow
Installing Your Wireless Array
LED Settings

Establishing Communication with the Array

The Array may be configured through the Command Line Interface (CLI) using SSH, or on a browser via the graphical Web Management Interface (WMI). You may use the CLI via the serial management port (console—on all Arrays except the XR500 and XR-1000 Series), the Fast Ethernet port, or any of the Gigabit Ethernet ports. You can use the WMI via any of the Array's Ethernet ports.

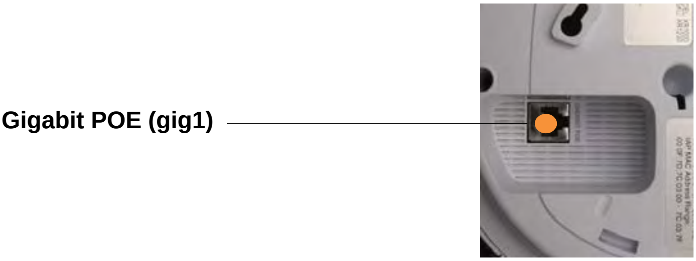


Figure 31. Network Interface Ports—XR-1000 Series

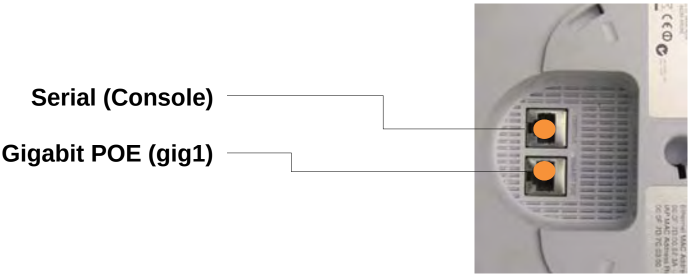


Figure 32. Network Interface Ports—XR-2000 Series

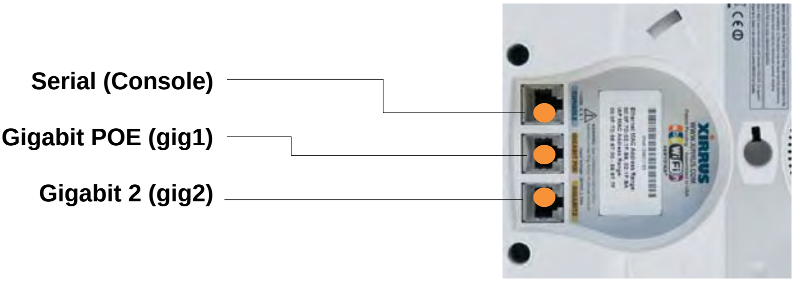


Figure 33. Network Interface Ports—XR-4000 Series

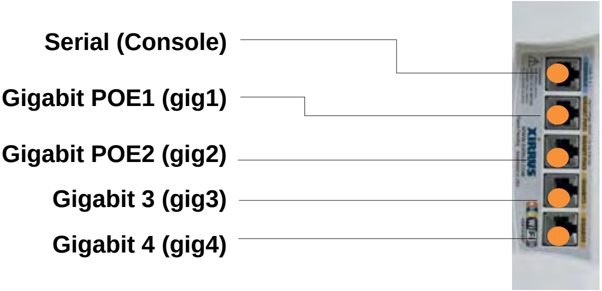


Figure 34. Network Interface Ports—XR-6000 Series

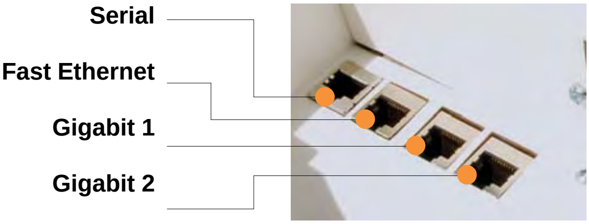


Figure 35. Network Interface Ports

The Xirrus Xircon utility may also be used to communicate with Arrays locally as an alternative to using a serial connection to the console. This is especially useful for the XR500 and XR-1000 Series, which do not have a console port. See "Securing Low Level Access to the Array" on page 78.

Using the Serial Port

If using the serial port to make your connection, use serial settings of 8 bits, no parity, no flow control, 1 stop bit (8N1) and a speed setting of 115200 baud. Use the communication package of your choice.

Using the Ethernet Ports

By default, the Array's Ethernet interfaces use DHCP to obtain an IP address. If the Array is booted and does not receive DHCP addresses on either the Fast Ethernet or Gigabit Ethernet ports, then the Fast Ethernet port will default to an

IP address of 10.0.1.1 and both Gigabit1 and its bonded pair port (if any) will default to 10.0.2.1 with a mask of 255.255.255.0.

If the Array is connected to a network that provides DHCP addresses, the IP address can be determined by the following three methods:

1. The simplest way to address the Array is using its default hostname which is the Array's serial number (for example, XR4012N0823091CACD). If your network provides DHCP and DNS, then you can use this hostname.
2. Otherwise, examine the DHCP tables on the server and find the addresses assigned to the Array (Xirrus MAC addresses begin with 000F7D).
3. Alternatively, you may query the Array using the CLI via the console port (on all models except the wall-1000 series). Log in using the default user name **admin** and password **admin**. Use the **show ethernet** command to view the IP addresses assigned to each port.
4. If the Array cannot obtain an IP address via DHCP, the factory default uses a static IP address of 10.0.2.1 with a mask of 255.255.255.0 on its Gigabit POE port.

Take care to ensure that your network is not using the 10.0.2.1 IP address prior to connecting the Array to the network.

To connect to the Array, you must set your laptop to be in the same subnet as the Array: set your laptop's IP address to be in the 10.0.2.xx subnet, and set its subnet mask to 255.255.255.0. If this subnet is already in use on your network, you may connect your laptop directly to the Array by connecting the laptop to the power injector's IN port temporarily (this port may be called the SWITCH port or the DATA port on your injector).

Starting the WMI

Use this procedure to log in to the WMI via your Web browser.

1. Establish a network connection and open your Web browser.
2. Connect to the Wireless Array using its host name or IP address as described in the previous section.

Logging In

When logging in to the Array, use the default user name and password—the default user name is **admin**, and the default password is **admin**.

See Also

Installation Workflow

Performing the Express Setup Procedure

Powering Up the Wireless Array

Entering the License

A license is needed to enable the full functionality of the Array. Without a license, the Array can be powered up and will only have a basic wireless network configuration including just one operating radio.

The Array's license determines many of the features that are available on the Array. For example, automatic cell sizing and channel allocation require a license supporting the RF Performance Manager (RPM). Also, IEEE 802.11n operation on Arrays requires a license.

The Array's license is not installed at the factory. **You must enter your license before proceeding to the next step**, Performing the Express Setup Procedure.

The procedure below describes entering the license key using the WMI. If you are using the Xirrus Management System (XMS), you may use it to easily manage and upgrade large numbers of licenses for the wireless network.

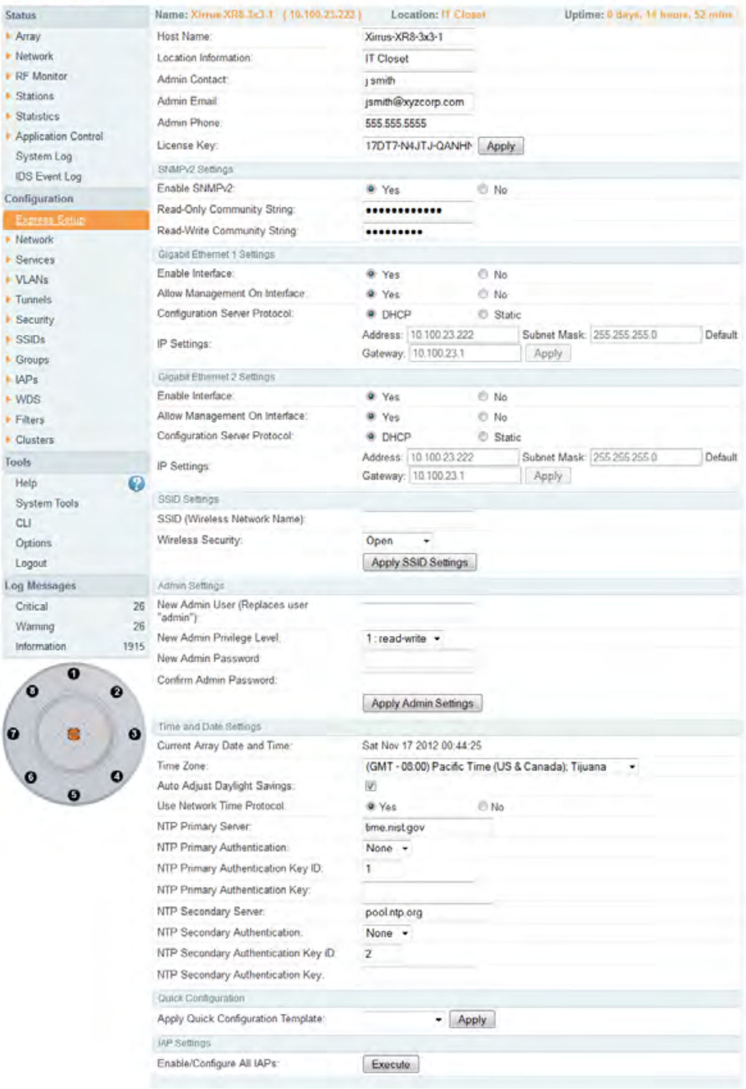
1. This procedure assumes that you have pointed a browser to the Array's IP address to start WMI, and that you have logged in with the default username and password above.

2. In the left hand frame, in the **Configuration** section, click **Express Setup**.
3. **License Key**: Enter the key that was provided for the Array. The key was provided to you in an email as an attachment in the form of an Excel file (.xls). Enter the key exactly as it appears in the file. Click the **Apply** button to apply the key.
4. Now you may verify the features provided by the key. In the **Status** section of the left hand frame, click **Array** and then click **Information**. Check the items listed in the **License Features** row.

If you are installing a large number of licenses and do not have XMS, a Xirrus Licensing Tool may be acquired from Xirrus Support to help push licenses to large number of Arrays.

Performing the Express Setup Procedure

The Express Setup procedure establishes global configuration settings that enable basic Array functionality. Changes made in this window will affect all radios.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 14 hours, 52 mins

Host Name: Xirrus-XR8-3x3-1
Location Information: IT Closet
Admin Contact: j smith
Admin Email: jsmith@xyzcorp.com
Admin Phone: 555.555.5555
License Key: 17DT7-N4JTJ-QANHI

SNMPv2 Settings
Enable SNMPv2: ● Yes ○ No
Read-Only Community String: •••••••••••••
Read-Write Community String: ••••••••••

Gigabit Ethernet 1 Settings
Enable Interface: ● Yes ○ No
Allow Management On Interface: ● Yes ○ No
Configuration Server Protocol: ● DHCP ○ Static
IP Settings: Address: 10.100.23.222 Subnet Mask: 255.255.255.0 Default Gateway: 10.100.23.1

Gigabit Ethernet 2 Settings
Enable Interface: ● Yes ○ No
Allow Management On Interface: ● Yes ○ No
Configuration Server Protocol: ● DHCP ○ Static
IP Settings: Address: 10.100.23.222 Subnet Mask: 255.255.255.0 Default Gateway: 10.100.23.1

SSID Settings
SSID (Wireless Network Name):
Wireless Security: Open

Admin Settings
New Admin User (Replaces user "admin"):
New Admin Privilege Level: 1 : read-write
New Admin Password
Confirm Admin Password:

Time and Date Settings
Current Array Date and Time: Sat Nov 17 2012 00:44:25
Time Zone: (GMT - 08:00) Pacific Time (US & Canada); Tijuana
Auto Adjust Daylight Savings: ☑
Use Network Time Protocol: ● Yes ○ No
NTP Primary Server: time.nist.gov
NTP Primary Authentication: None
NTP Primary Authentication Key ID: 1
NTP Primary Authentication Key:
NTP Secondary Server: pool.ntp.org
NTP Secondary Authentication: None
NTP Secondary Authentication Key ID: 2
NTP Secondary Authentication Key:

Quick Configuration
Apply Quick Configuration Template:

IAP Settings
Enable/Configure All IAPs:

Figure 36. Express Setup

Procedure for Performing an Express Setup

1. **Host Name**: Specify a unique host name for this Array. The host name is used to identify the Array on the network. Use a name that will be meaningful within your network environment, up to 64 alphanumeric characters. The default is **Xirrus-WiFi-Array**.

2. **Location Information**: Enter a brief but meaningful description that accurately defines the physical location of the Array. In an environment where multiple units are installed, clear definitions for their locations are important if you want to identify a specific unit.

3. **Admin Contact**: Enter the name and contact information of the person who is responsible for administering the Array at the designated location.

4. **Admin Email**: Enter the email address of the admin contact you entered in Step 3.

5. **Admin Phone**: Enter the telephone number of the admin contact you entered in Step 3.

6. **License Key**: If Xirrus issued you a license that differs from the current value shown, enter it now. See also, "Entering the License" on page 69.

7. Configure **SNMPv2**: Select whether to **Enable** SNMPv2 on the Array, and change the **SNMP Community Strings** if desired. If you are using the Xirrus Management System (XMS), these strings must match the values used by XMS. The default values for the Array match the defaults in XMS. For more details, including SNMPv3, see "SNMP" on page 194.

8. Configure the **Fast Ethernet** (10/100 Megabit) and **Gigabit** network interfaces. The fields for each of these interfaces are the same, and include:

   a. **Enable Interface**: Choose **Yes** to enable this network interface, or choose **No** to disable the interface.

   b. **Allow Management on Interface**: Choose **Yes** to allow management of the Array via this network interface, or choose **No** to deny all management privileges for this interface.

For improved security, you should also take the additional steps described in "Securing Low Level Access to the Array" on page 78.

c. **Configuration Server Protocol**: Choose **DHCP** to instruct the Array to use DHCP to assign IP addresses to the Array's Ethernet interfaces, or choose **Static** if you intend to enter IP addresses manually. If you choose the Static IP option, you must enter the following **IP Settings**:

- **Address**: Enter a valid IP address for this Array. To use any of the remote connections (Web, SNMP, or SSH), a valid IP address must be used.
- **Subnet Mask**: Enter a valid IP address for the subnet mask (the default is 255.255.255.0). The subnet mask defines the number of IP addresses that are available on the routed subnet where the Array is located.
- **Default Gateway**: Enter a valid IP address for the default gateway. This is the IP address of the router that the Array uses to forward data to other networks.
- Click the **Apply** button for this interface when done making IP changes.

9. **SSID Settings**: This section specifies the wireless network name and security settings.

a. **SSID (Wireless Network Name)**: The SSID (Service Set Identifier) is a unique name that identifies a wireless network. All devices attempting to connect to a specific WLAN must use the same SSID. The default for this field is "**xirrus**."

For additional information about SSIDs, go to the Multiple SSIDs section of "Frequently Asked Questions" on page 452.

b. **Wireless Security**: Select the desired wireless security scheme (Open, WEP, WPA, WPA2, or WPA-Both). WPA2 is recommended for the best Wi-Fi security.

- **Open**—This option offers no data encryption and is not recommended, though you might choose this option if clients are required to use a VPN connection through a secure SSH utility, like PuTTy.

- **WEP** (Wired Equivalent Privacy)—An optional IEEE 802.11 function that offers frame transmission privacy similar to a wired network. WEP generates secret shared encryption keys that both source and destination stations can use to alter frame bits to avoid disclosure to eavesdroppers.
- **WPA** (Wi-Fi Protected Access)—A Wi-Fi Alliance standard that contains a subset of the IEEE 802.11i standard, using TKIP or AES as an encryption method and 802.1x for authentication.
- **WPA2** (Wi-Fi Protected Access 2)—WPA2 is the follow-on security method to WPA for wireless networks and provides stronger data protection and network access control. It offers Enterprise and consumer Wi-Fi users with a high level of assurance that only authorized users can access their wireless networks. Like WPA, WPA2 is designed to secure all versions of 802.11 devices, including 802.11a, 802.11b, 802.11g, and 802.11n, multi-band and multi-mode.
- **WPA-Both** (WPA and WPA2)—This option makes use of both WPA and WPA2.

For more information about security, including a full review of all security options and settings, go to "Understanding Security" on page 209.

c. **WEP Encryption Key/Passphrase**: Depending on the wireless security scheme you selected, enter a unique WEP key or WPA passphrase. This field and the one below only appear if you select a **Wireless Security** option other than **Open**.

d. **Confirm Encryption Key/Passphrase**: If you entered a WEP key or WPA passphrase, confirm it here.

e. Click **Apply SSID Settings** when done.

10. **Admin Settings:** This section allows you to change the default admin username, password, and privileges for the Array. You may change the password and leave the user name as is, but we suggest that you change both to improve Array security.

    a. **New Admin User (Replaces user "admin")**: Enter the name of a new administrator user account. Be sure to record the new account name and password, because the default **admin** user will be deleted! Note that the Array also offers the option of authenticating administrators using a RADIUS server (see "Admin Management" on page 214)).

    For improved security, you should also take the additional steps described in "Securing Low Level Access to the Array" on page 78.

    b. **New Admin Privilege Level**: By default, the new administrator will have read/write privileges on the Array (i.e., the new user will be able to change the configuration of the Array). If you wish the new account to have different privileges, select the desired level from the drop-down list. For more information about user privileges, please see "Admin Privileges" on page 216.

    c. **New Admin Password**: Enter a new administration password for managing this Array. If you forget this password, you must reset the Array to its factory defaults so that the password is reset to **admin** (its default setting).

    d. **Confirm Admin Password**: If you entered a new administration password, confirm the new password here.

    e. Click **Apply Admin Settings** when done.

11. **Time and Date Settings:** This section specifies an optional time (NTP - Network Time Protocol) server or modifies the system time if you're not using a server.

    a. **Current Array Date and Time**: This read-only field shows the current time for your convenience.

b. **Time Zone**: Select your time zone from the choices available in the pull-down list.

c. **Auto Adjust Daylight Savings**: If you are not using NTP, check this box if you want the system to adjust for daylight savings automatically, otherwise leave this box unchecked (default).

d. **Use Network Time Protocol**: Check this box if you want to use an NTP server to synchronize the Array's clock. Use of NTP is mandatory for Arrays to be managed with XMS (the Xirrus Management System), and ensures that Syslog time-stamping is maintained across all units. If you check **Yes**, the NTP server fields are displayed. If you don't want to use an NTP server, leave this box unchecked (default) and set the system time on the Array manually.

e. **NTP Primary Server**: If you are using NTP, enter the IP address or domain name of the NTP server.

f. **NTP Primary Authentication**: If you are using authentication with NTP, select the type of key: **MD5** or **SHA1**. Select **None** if you are not using authentication (this is the default). For more information on authenticated NTP, see "Time Settings (NTP)" on page 185.

g. **NTP Primary Authentication Key ID**: Enter the key ID, which is a decimal integer.

h. **NTP Primary Authentication Key**: Enter your key, which is a string of characters.

i. **NTP Secondary Server**: Enter the IP address or domain name of an optional secondary NTP server to be used in case the Array is unable to contact the primary server. You may use the authentication fields as described above if you wish to set up authentication for the secondary server.

j. **Adjust Time (hrs:min:sec)**: If you are not using NTP, check this box if you want to adjust the current system time. When the box is checked, the time fields become active. Enter the revised time (hours, minutes, seconds, am/pm) in the corresponding fields. If you don't want to adjust the current time, this box should be left unchecked (default).

k. **Adjust Date (month/day/year)**: If you are not using NTP, check this box if you want to adjust the current system date. When the box is checked, the date fields become active. Enter the revised date (month, day and year) in the corresponding fields. If you don't want to adjust the current date, this box should be left unchecked (default).

12. **Quick Configuration:** This offers predefined configuration options such as **Classroom** and **High-Density** that capture best practices from years of field experience. If one of the options in the drop-down list is appropriate to your deployment, select it and click **Apply**. For example, the **High-Density** option uses best practices to configure the Array for high density settings such as lecture halls, convention centers, stadiums, etc.

13. **IAP Settings:**

Enable/Configure All IAPs: Click on the **Execute** button to enable and auto configure all IAPs (a message displays the countdown time—in seconds—to complete the auto-configuration task). When an IAP is enabled, its LED is switched on. (Figure 37, see also "Array LED Operating Sequences" on page 64.)

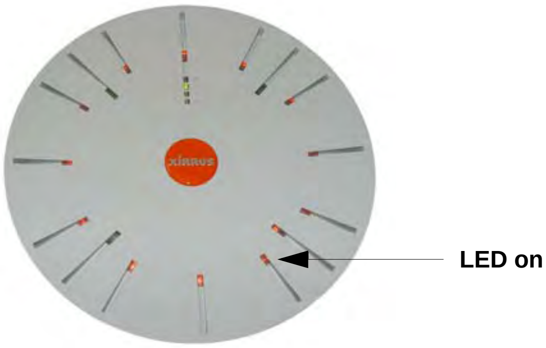


Figure 37. LEDs are Switched On

14. Click on the **Save changes to flash button** at the top right if you wish to make your changes permanent.

    This ends the Express Setup procedure.

See Also

Establishing Communication with the Array
Installation Prerequisites
Installation Workflow
Logging In
Multiple SSIDs
Security

Securing Low Level Access to the Array

Most management of the Xirrus Array is done via the Web Management Interface (WMI) as you just saw in "Performing the Express Setup Procedure" on page 71. Another often used option is CLI—see "The Command Line Interface" on page 377. The Array also has a lower level interface: XBL (Xirrus Boot Loader), which allows access to more primitive commands. You won't normally use XBL unless instructed to do so by Xirrus Customer Support. For proper security, you should replace the default XBL login username and password with your own, as instructed below. XBL has its own username and password, separate from the ArrayOS Admin User and Password (used for logging in to the WMI and CLI) that you changed in Step 10 on page 75.

Xirrus also provides the Xircon utility for connecting to Xirrus XR Arrays that are not reachable via the normal access methods (such as SSH or WMI) and that do not have a physical console port (XR500 and XR-1000 Series Arrays), or whose console port is not accessible. Xircon discovers Arrays on your network subnet by sending IP/UDP broadcast packets. Once an Array is discovered, Xircon can establish an encrypted console session to the Array via the network even if the Array IP configuration is incorrect. Xircon allows you to manage the Array using CLI, just as you would if connected to the console port. Xircon also has an option for easily accessing XBL.

In normal circumstances Xirrus Arrays should be configured and managed through secure shell (SSH) or via the Web Management Interface (WMI). A connection is established using either the Array hostname or DHCP-assigned IP address, or via the other options described in "Using the Ethernet Ports" on page 67. Xircon may be needed in special circumstances as directed by Xirrus Customer Support for troubleshooting Array problems or IP connectivity. (In this case, see the *Xircon User Guide* for detailed information.)

Xircon access to the Array may be controlled:

- You may enable or disable all Xircon access to the Array as instructed in the procedure below. There are also options to allow access only to CLI (i.e., ArrayOS access) or only to XBL.
- Since XR500 and XR-1000 Array models do not have a console port, these models have Xircon access to both XBL and CLI enabled by default. For Arrays that do not have a console port, to avoid potentially being locked out of the Array, Xircon should always be enabled at the XBL level at least.

! *If you disable Xircon access to both XBL and CLI on XR-1000 models, you must ensure that you do not lose track of the username and password to log in to CLI/WMI! In this situation, there is no way to recover from a lost password, other than returning the Array to Xirrus. If you have Xircon access to XBL enabled, you can reset the password, but this recovery will require setting the unit to factory defaults with loss of all configuration data.*

- On all other Array models (those with a console port), Xircon access to both XBL and CLI is disabled by default. If Xircon is not going to be used to access an Array, we recommend leaving Xircon access disabled.

Procedure for Securing Low Level Array Access

Use the following steps to replace the default XBL username and password, and optionally to change the type of Xircon management access that is allowed. These steps use CLI commands.

1. To access CLI via the WMI, click **CLI** under the **Tools** section on the left (for detailed instructions see "CLI" on page 371). Skip to Step 4 on page 80.

   To access CLI via SSH, see "Establishing a Secure Shell (SSH) Connection" on page 377. Then proceed to the next step.

2. At the **login as** prompt, log in to CLI using the username and password that you set in Step 10 on page 75.

   ```
   login as: jsmith
   jsmith@xr4012802207c's password:

   Xirrus Wi-Fi Array
   ArrayOS Version 6.1.2-3299
   Copyright (c) 2005-2012 Xirrus, Inc.
   http://www.xirrus.com

   XR4012802207C#
   ```

3. Type **configure** to enter the CLI config mode.

   ```
   hostname#configure
   ```

4. If Xircon access at the XBL level is to be allowed, use the following three commands to change the XBL username and password from the default values of **admin**/**admin**. In the example below, replace **newusername** and **newpassword** with your desired entries. Note that these entries are case-sensitive.

   ```
   (config)#boot-env set username newusername
   (config)#boot-env set password newpassword
   (config)#save
   ```

5. Enter the following commands if you wish to change Xircon access permission:

   ```
   (config)# management
   (config-mgmt)# xircon <management-status>
   (config-mgmt)# save
   (config-mgmt)# exit
   (config)#
   ```

   <*management-status*> may be one of :

   - **on** enables both CLI and XBL access

- **off** disables both CLI and XBL access
- **aos-only** enables only CLI (i.e. ArrayOS) access
- **boot-only** enables only XBL access

Note that there is a WMI setting for changing Xircon access, timeout period, and the UDP port used. This may be used instead of CLI if you wish. See “Management Control” on page 221. Note that you cannot change the XBL username and password via the WMI.

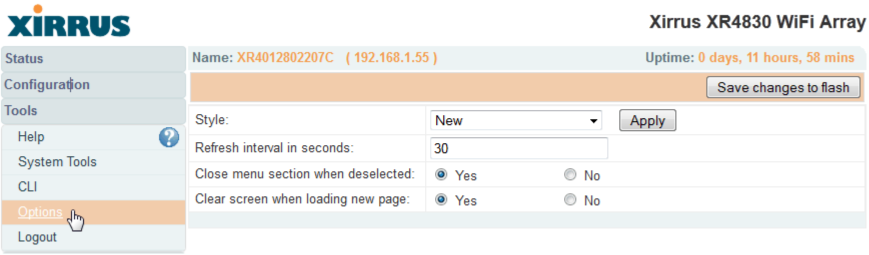
The Web Management Interface

This topic provides an overview of the Xirrus Wireless Array's embedded Web Management Interface (WMI), used for establishing your network's configuration settings and wireless operating parameters. It also includes login instructions. The following topics are discussed:

- **An Overview**
- **Structure of the WMI**
- **User Interface**
- **Logging In**
- **Applying Configuration Changes**

An Overview

The WMI is an easy-to-use graphical interface to your Wireless Array. It allows you to configure the product to suit your individual requirements and ensure that the unit functions efficiently and effectively. Options allow you to choose among different appearances for the WMI. See “Options” on page 373.

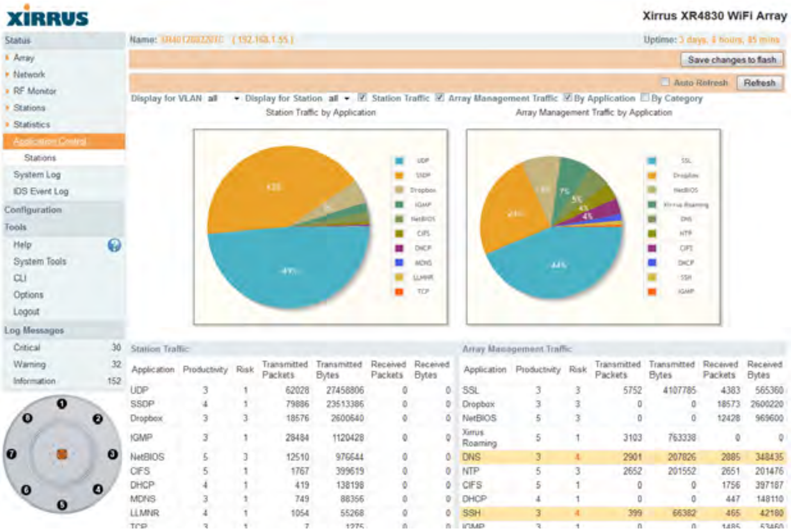


Name: XR4012802207C (192.168.1.55)

Uptime: 0 days, 11 hours, 58 mins

Style:	New
Refresh interval in seconds:	30
Close menu section when deselected:	● Yes ○ No
Clear screen when loading new page:	● Yes ○ No

Figure 38. Web Management Interface—Option = New Style



Name: XR4012802207C (192.168.1.55)

Uptime: 3 days, 4 hours, 45 mins

Display for VLAN all ▾ Display for Station all ▾ ☑ Station Traffic ☑ Array Management Traffic ☑ By Application □ By Category

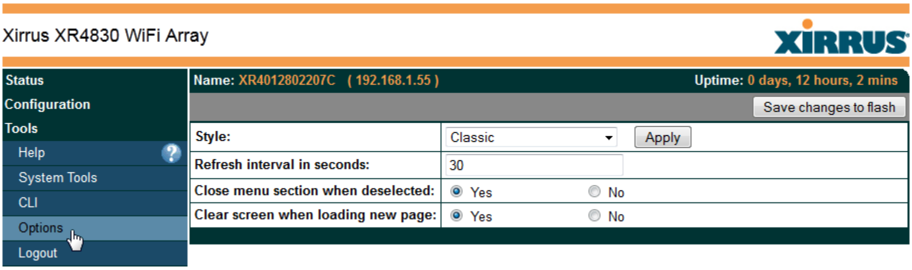
Station Traffic

Application	Productivity	Risk	Transmitted Packets	Transmitted Bytes	Received Packets	Received Bytes
UDP	3	1	62028	27458806	0	0
SSDP	4	1	79886	23513386	0	0
Dropbox	3	3	18576	2600640	0	0
IGMP	3	1	28484	1120428	0	0
NetBIOS	5	3	12510	976644	0	0
CIFS	5	1	1767	399619	0	0
DHCP	4	1	419	138198	0	0
MDNS	3	1	749	88356	0	0
LLMNR	4	1	1054	55268	0	0
TCP	3	1	7	1275	0	0

Array Management Traffic

Application	Productivity	Risk	Transmitted Packets	Transmitted Bytes	Received Packets	Received Bytes
SSL	3	3	5752	4107785	4383	565360
Dropbox	3	3	0	0	18573	2600220
NetBIOS	5	3	0	0	12428	969600
Xirrus Roaming	5	1	3103	763338	0	0
DNS	3	4	2901	207826	2885	348435
NTP	5	3	2652	201552	2651	201476
CIFS	5	1	0	0	1756	397187
DHCP	4	1	0	0	447	148110
SSH	3	4	399	66382	465	42180
IGMP	3	1	0	0	1485	53460

Figure 39. Web Management Interface—New Style



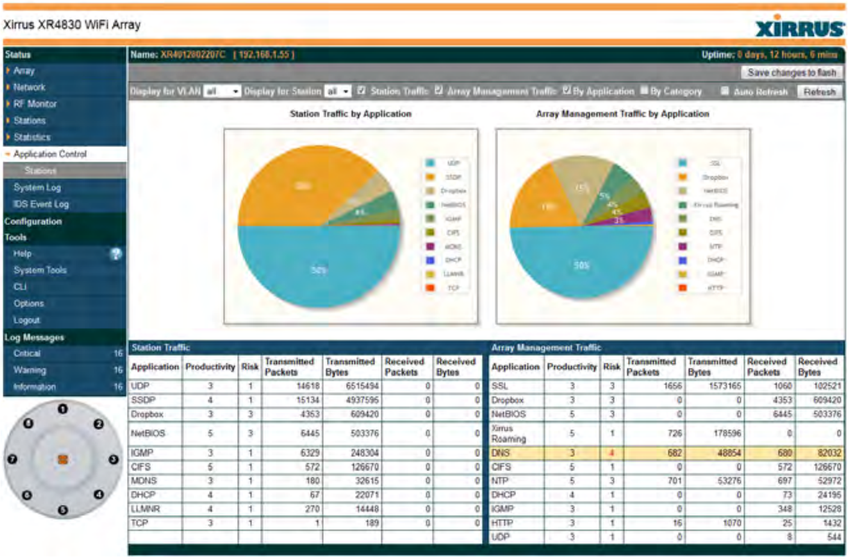
Xirrus XR4830 WiFi Array

- Status
- Configuration
- Tools
  - Help
  - System Tools
  - CLI
  - Options
  - Logout

Name: XR4012802207C (192.168.1.55) Uptime: 0 days, 12 hours, 2 mins

Style:	Classic ▾ Apply
Refresh interval in seconds:	30
Close menu section when deselected:	● Yes ○ No
Clear screen when loading new page:	● Yes ○ No

Figure 40. Web Management Interface—Option = Classic Style



Xirrus XR4830 WiFi Array

- Status
  - Array
  - Network
  - RF Monitor
  - Stations
  - Statistics
  - Application Control
    - Stations
  - System Log
  - IDS Event Log
- Configuration
- Tools
  - Help
  - System Tools
  - CLI
  - Options
  - Logout
- Log Messages
  - Critical 16
  - Warning 16
  - Information 16

Name: XR4012802207C (192.168.1.55) Uptime: 0 days, 12 hours, 6 mins

Display for VLAN all ▾ Display for Station all ▾ ☑ Station Traffic ☑ Array Management Traffic ☑ By Application □ By Category □ Auto Refresh

Station Traffic

Application	Productivity	Risk	Transmitted Packets	Transmitted Bytes	Received Packets	Received Bytes
UDP	3	1	14618	6515494	0	0
SSDP	4	1	15134	4937595	0	0
Dropbox	3	3	4363	609420	0	0
NetBIOS	5	3	6445	503376	0	0
IGMP	3	1	6329	248304	0	0
CIFS	5	1	572	126670	0	0
MDNS	3	1	180	32615	0	0
DHCP	4	1	67	22071	0	0
LLMNR	4	1	270	14448	0	0
TCP	3	1	1	189	0	0

Array Management Traffic

Application	Productivity	Risk	Transmitted Packets	Transmitted Bytes	Received Packets	Received Bytes
SSL	3	3	1656	1573165	1060	102521
Dropbox	3	3	0	0	4353	609420
NetBIOS	5	3	0	0	6445	503376
Xirrus Roaming	5	1	726	178596	0	0
DNS	3	4	682	48854	680	82032
CIFS	5	1	0	0	572	126670
NTP	5	3	701	53276	697	52972
DHCP	4	1	0	0	73	24195
IGMP	3	1	0	0	348	12528
HTTP	3	1	16	1070	25	1432
UDP	3	1	0	0	8	544

Figure 41. Web Management Interface—Classic Style

Structure of the WMI

The content of the WMI is organized by function and hierarchy, shown in the following table. Click on any item below to jump to the referenced destination.

- **Status Windows**
  - Array Status Windows
    - Array Summary
    - Array Information
    - Array Configuration
    - Admin History
  - Network Status Windows
    - Network Map
    - Spanning Tree Status
    - Routing Table
    - ARP Table
    - DHCP Leases
    - Connection Tracking/NAT
    - CDP Neighbors
    - Network Assurance
  - RF Monitor Windows
    - IAPs
    - Spectrum Analyzer
    - Intrusion Detection
    - Channel History
    - Radio Assurance
  - Station Status Windows
    - Stations
    - Location Map
    - RSSI
    - Signal-to-Noise Ratio (SNR)
    - Noise Floor
    - Max by IAP
    - Station Assurance
- Statistics Windows
  - IAP Statistics Summary
  - Per-IAP Statistics
  - Network Statistics
  - VLAN Statistics
  - WDS Statistics
  - IDS Statistics
  - Filter Statistics
  - Station Statistics
  - Per-Station Statistics
- Application Control Windows
- System Log Window
- IDS Event Log Window

Configuration Windows

- Express Setup
- Network
  - Network Interfaces
  - Network Bonds
  - DNS Settings
  - CDP Settings
- Services
  - Time Settings (NTP)
  - NetFlow
  - Wi-Fi Tag
  - System Log
  - SNMP
  - DHCP Server
- VLANs
  - VLAN Management
- Tunnels
  - Tunnel Management
- Security
  - Admin Management
  - Admin Privileges
  - Admin RADIUS
  - Management Control
  - Access Control List
  - Global Settings
  - External Radius
  - Internal Radius
  - Rogue Control List
- SSIDs
  - SSID Management
  - Active IAPs
  - Per-SSID Access Control List
- Groups
  - Group Management

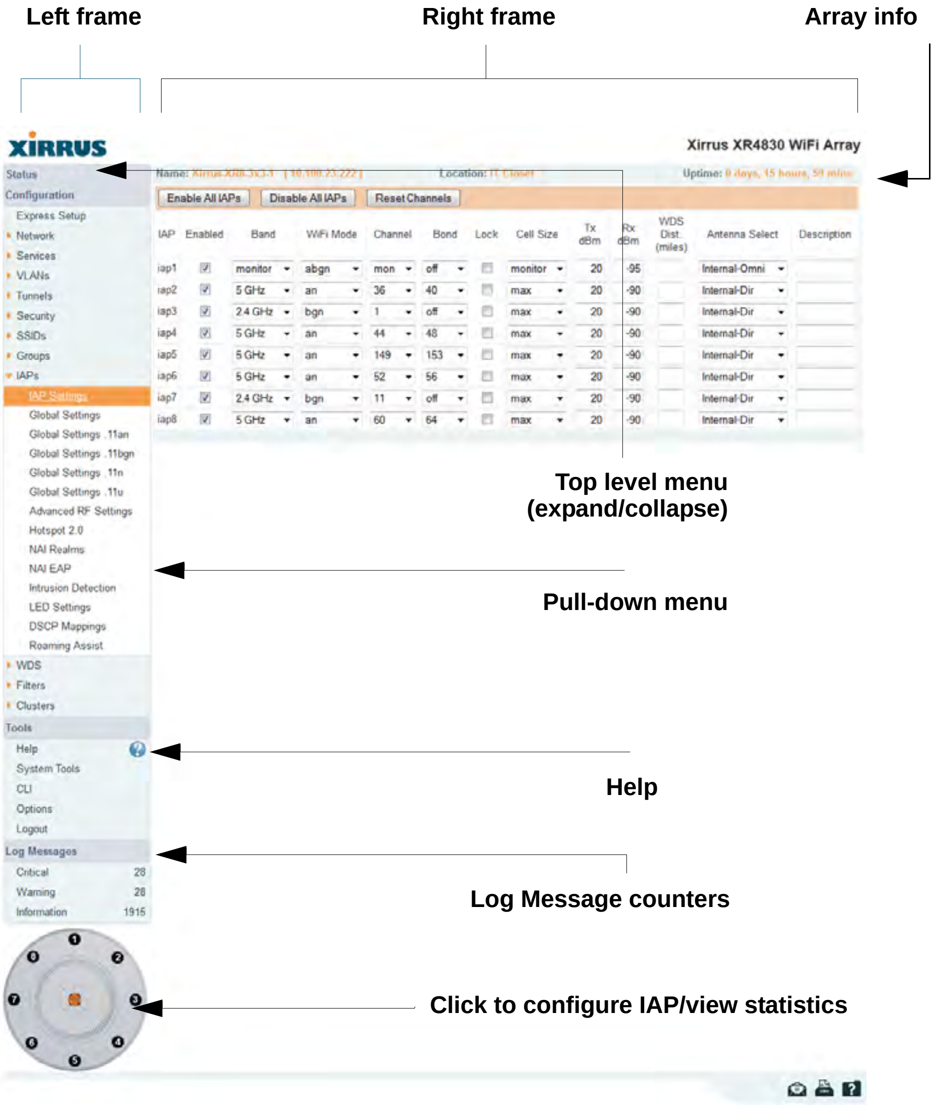
Configuration Windows (cont'd)

- IAPs
  - IAP Settings
  - Global Settings (IAP)
  - Global Settings .11an
  - Global Settings .11bgn
  - Global Settings .11n
  - Global Settings .11u
  - Advanced RF Settings
  - Hotspot 2.0
  - NAI Realms
  - NAI EAP
  - Intrusion Detection
  - LED Settings
  - DSCP Mappings
  - Roaming Assist
- WDS
  - WDS Client Links
- Filters
  - Filter Lists
  - Filter Management
- Clusters
  - Cluster Definition
  - Cluster Management
  - Cluster Operation

Tool Windows

- System Tools
- CLI
- Options
- Logout

User Interface



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 [10.100.23.222] Location: IT Closet Uptime: 0 days, 15 hours, 59 mins

IAP	Enabled	Band	WiFi Mode	Channel	Bond	Lock	Cell Size	Tx dBm	Rx dBm	WDS Dist. (miles)	Antenna Select	Description
iap1	☑	monitor	abgn	mon	off	□	monitor	20	-95		Internal-Omni	
iap2	☑	5 GHz	an	36	40	□	max	20	-90		Internal-Dir	
iap3	☑	2.4 GHz	bgn	1	off	□	max	20	-90		Internal-Dir	
iap4	☑	5 GHz	an	44	48	□	max	20	-90		Internal-Dir	
iap5	☑	5 GHz	an	149	153	□	max	20	-90		Internal-Dir	
iap6	☑	5 GHz	an	52	56	□	max	20	-90		Internal-Dir	
iap7	☑	2.4 GHz	bgn	11	off	□	max	20	-90		Internal-Dir	
iap8	☑	5 GHz	an	60	64	□	max	20	-90		Internal-Dir	

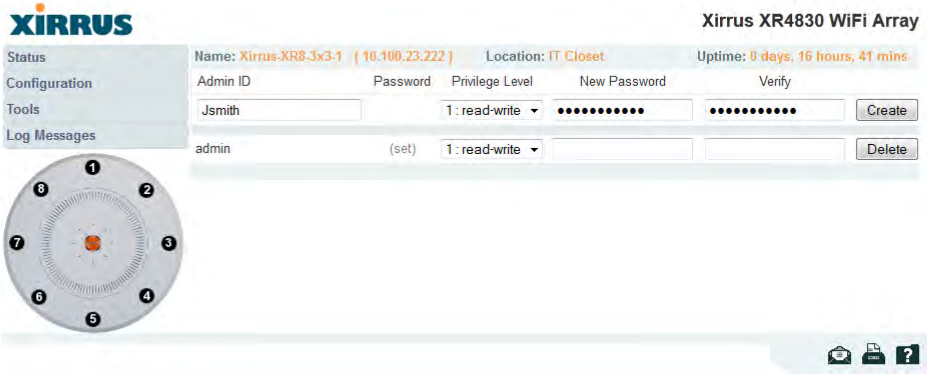
Critical	28
Warning	28
Information	1915

Figure 42. WMI: Frames

The WMI has been designed with simplicity in mind, making navigation quick and easy. In the following example, you'll see that windows are divided into left and right frames.

The left frame contains three main elements:

- Menu organized by function (for example, Network, SSIDs, Security, etc.). Click a heading, such as **Network**, to display a summary of its current configuration, as well as an associated pull-down menu. The three major menu sections (**Status**, **Configuration**, **Tools**) may each be collapsed down to hide the headings under them. Click again to display the headings. (Figure 43)
- Three **Log Messages** counters are located at the bottom of the menu. They provide a running total of messages generated by the ArrayOS Syslog subsystem during your session—organized into **Critical**, **Warning**, and **General** messages. Click on a counter to display the associated Syslog messages. Messages at the selected level or higher will be shown. For more information, please see "System Log Window" on page 156.
- The Array representation contains shortcut links. Click a radio to view statistics for it. Click the center of the Array to display the IAP Settings window, which allows you to configure the Array's radios.



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 16 hours, 41 mins

Admin ID	Password	Privilege Level	New Password	Verify	
Jsmith		1 : read-write	●●●●●●●●●●●	●●●●●●●●●●●	Create
admin	(set)	1 : read-write			Delete

Figure 43. Major Menu Sections Collapsed (on left)

The right frame displays the status information or configuration parameters for the Wireless Array. This is where you review the Array's current status and activity or input data (if you want to make changes). The green Array information bar at the top of the frame describes the Array—the Name and IP address allow you to quickly confirm that WMI is connected to the correct Array. The current Uptime since the last reboot is also shown.

Some settings are only available if the Array's license includes appropriate Xirrus ***Advanced Feature Sets****. If a setting is unavailable (grayed out), then your license does not support the feature. See* ***"About Licensing and Upgrades" on page 361****.*

Note that WMI provides options which allow you to change its appearance and behavior. You may change:

- **Style**—changes the colors and appearance of WMI (i.e., its "skin").
- **Refresh Interval**—the refresh time when automatic refresh is selected.
- **Close menu section when deselected**—changes the behavior of the menu in the left frame.
- **Clear screen when loading new page**.

See "Options" on page 373 for more information.

Utility Buttons

At the bottom of each window you will find a set of useful buttons—a **Feedback** button, a **Print** button and a **Help** button.

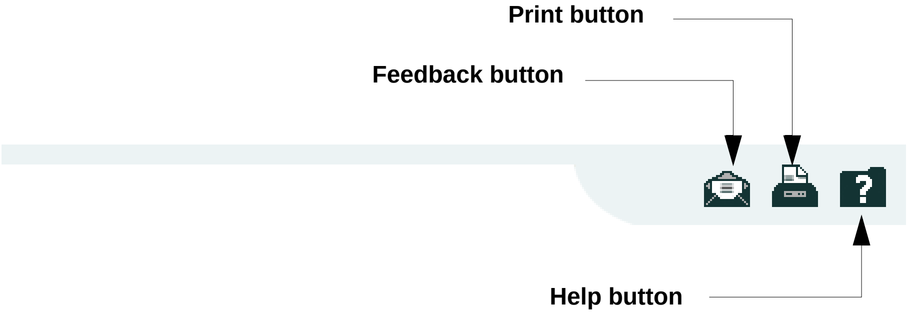


Figure 44. WMI: Utility Buttons

- Click on the **Feedback** button to generate a Web page that allows you to submit your comments to Xirrus, Inc.
- Click on the **Print** button to send a print file of the active window to your local printer.
- Click on the **Help** button to access the Array’s online help system.

Submitting Your Comments

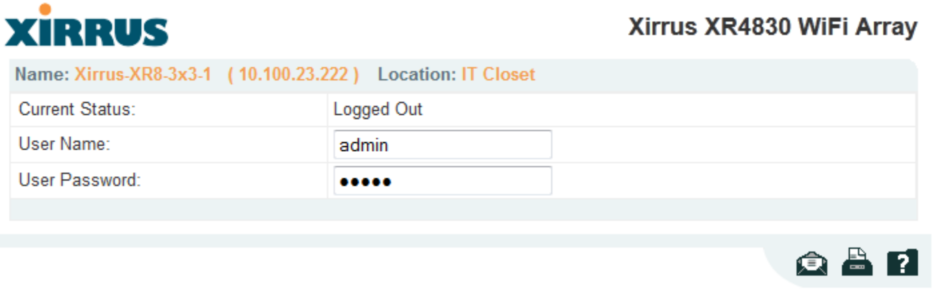
When submitting comments via the Feedback button (ensure that you provide as much detail as possible, including your contact information, the product model number that the comment relates to, and the ArrayOS software version (if known). When finished, click on the **Submit** button to submit your comment.

Logging In

Use this procedure to log in to the WMI via your Web browser.

1. Establish a network connection and open your Web browser.
2. If your network supports DHCP and DNS, enter the Array's default host name in the browser's URL. The default host name is simply the Array's serial number (for example, XN0823091CACD).

   Otherwise, enter the Array's IP address. This may be determined as described in "Using the Ethernet Ports" on page 67.
3. To log in to the Array's Web Management Interface, enter **admin** for both the user name and password.



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet

Current Status:	Logged Out
User Name:	admin
User Password:	●●●●●

Figure 45. Logging In to the Wireless Array

Applying Configuration Changes

In most of the WMI configuration windows, your changes to settings are applied to the Array as you make them. In most cases, there is no separate Apply button to click to make the changes take effect. There are a few exceptions to this rule. In these cases, a particular section of a page may have its own **Apply Settings** button right below the settings.

In both cases described above, the changes that you have made are not saved to the latest configuration file in the Array's flash memory, so they will not be restored after a reboot. Click the **Save changes to flash** button (located on the upper right of each page) in order to make sure that these changes will be applied after rebooting. This will save the entire current configuration, not only the changes on current WMI page.

Character Restrictions

When inputting strings in the WMI (for example, assigning SSIDs, host name, password, etc.), use common alphanumeric characters. Some of the fields in the WMI will not accept special characters, so use of the following characters should typically be avoided:

& < > ' “ / \

Viewing Status on the Wireless Array

These windows provide status information and statistics for your Array using the product's embedded Web Management Interface (WMI). You cannot make configuration changes to your Array from these windows. The following topics have been organized into functional areas that reflect the flow and content of the Status section of the navigation tree in the left frame of the WMI.

- **"Array Status Windows" on page 96**
- **"Network Status Windows" on page 103**
- **"RF Monitor Windows" on page 114**
- **"Station Status Windows" on page 125**
- **"Statistics Windows" on page 140**
- **"Application Control Windows" on page 150**
- **"System Log Window" on page 156**
- **"IDS Event Log Window" on page 157**

Configuration and Tools windows are not discussed here. For information on these windows, please see:

- **"Configuring the Wireless Array" on page 159**
- **"Using Tools on the Wireless Array" on page 359**

Note that the **Status** menu section may be collapsed down to hide the headings under it by clicking it. Click again to display the headings. (See Figure 43 on page 89)

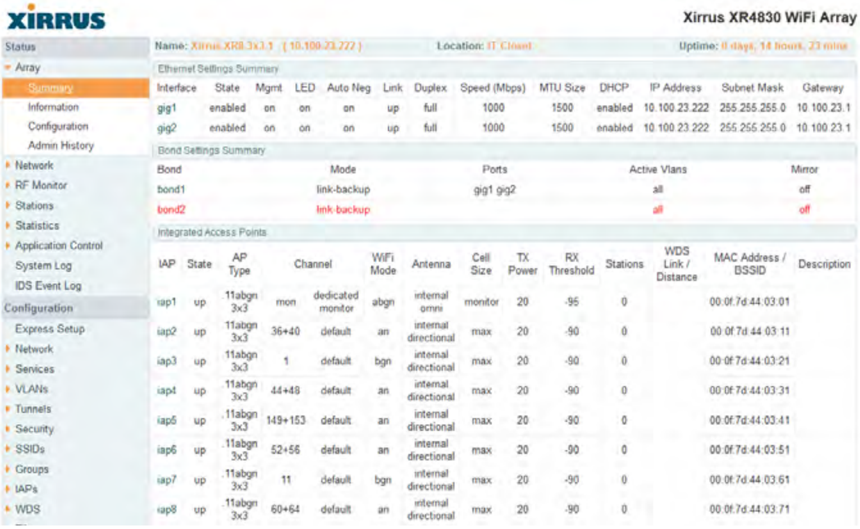
Array Status Windows

The following Array Status windows are available:

- **Array Summary**—displays information on the configuration of all Array interfaces, including IAPs.
- **Array Information**—provides version/serial number information for all Array components.
- **Array Configuration**—shows all configuration information for the Array in text format.
- **Admin History**—shows all current and past logins since the last reboot.

Array Summary

This is a status only window that provides a snapshot of the global configuration settings for all Wireless Array network interfaces and IAPs. You must go to the appropriate configuration window to make changes to any of the settings displayed here—configuration changes cannot be made from this window. Clicking on an interface or IAP will take you to the proper window for making configuration changes.



Name: Xirrus XR8 3x3.1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 14 hours, 23 mins

Ethernet Settings Summary

Interface	State	Mgmt	LED	Auto Neg	Link	Duplex	Speed (Mbps)	MTU Size	DHCP	IP Address	Subnet Mask	Gateway
gig1	enabled	on	on	on	up	full	1000	1500	enabled	10.100.23.222	255.255.255.0	10.100.23.1
gig2	enabled	on	on	on	up	full	1000	1500	enabled	10.100.23.222	255.255.255.0	10.100.23.1

Bond Settings Summary

Bond	Mode	Ports	Active Vlans	Mirror
bond1	link-backup	gig1 gig2	all	off
bond2	link-backup		all	off

Integrated Access Points

IAP	State	AP Type	Channel		WiFi Mode	Antenna	Cell Size	TX Power	RX Threshold	Stations	WDS Link / Distance	MAC Address / BSSID	Description
iap1	up	11abgn 3x3	mon	dedicated monitor	abgn	internal omni	monitor	20	-95	0		00:0f:7d:44:03:01	
iap2	up	11abgn 3x3	36+40	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:11	
iap3	up	11abgn 3x3	1	default	bgn	internal directional	max	20	-90	0		00:0f:7d:44:03:21	
iap4	up	11abgn 3x3	44+48	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:31	
iap5	up	11abgn 3x3	149+153	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:41	
iap6	up	11abgn 3x3	52+56	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:51	
iap7	up	11abgn 3x3	11	default	bgn	internal directional	max	20	-90	0		00:0f:7d:44:03:61	
iap8	up	11abgn 3x3	60+64	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:71	

Figure 46. Array Summary

Content of the Array Summary Window

The Array Summary window is sub-divided into the **Ethernet Interfaces** section and the **Integrated Access Points** (radio) section, providing you with the following information:

- **Ethernet Settings Summary**

  This section provides information about network interface devices. To make configuration changes to these devices, go to “Network Interfaces” on page 171.

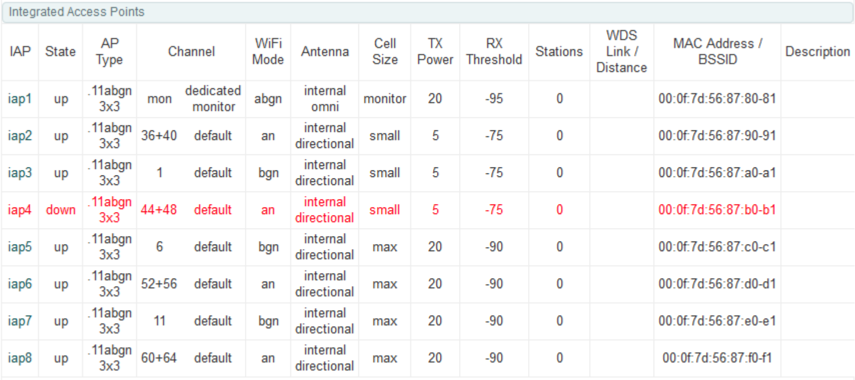
  - **Interface**: Lists the network interfaces that are available on the Array.
  - **State**: Shows the current state of each interface, either enabled or disabled.
  - **Mgmt**: Shows whether Array management traffic is allowed on this interface.
  - **Auto Neg**: Shows whether auto-negotiation is in use on this interface, to determine settings for speed, parity bits, etc.
  - **LED**: Shows whether LED display of interface status is enabled.
  - **Link**: Shows whether the link on this interface is up or down.
  - **Duplex**: Shows whether full duplex mode is in use.
  - **Speed**: Shows the speed of this interface in Mbps.
  - **MTU Size**: Shows the Maximum Transmission Unit size that has been configured. This is the largest packet size (in bytes) that the interface can pass along.
  - **DHCP**: Shows whether DHCP on this port is enabled or disabled.
  - **IP Address**: Shows the current IP address assigned to each network interface device.
  - **Subnet Mask**: Shows the subnet mask, which defines the number of IP addresses that are available on the routed subnet where the Array is located.
  - **Gateway**: Shows the IP address of the router that the Array uses to transmit data to other networks.

- **Bond Settings Summary**
  This section provides information about the relationship that has been selected for the Gigabit ports. For detailed explanations and to make configuration changes, see "Network Bonds" on page 175.

  - **Bond**: Lists all network bonds that have been configured.
  - **Mode**: Shows the type of relationship that has been selected for the Gigabit ports.
  - **Ports**: Shows the Gigabit ports that are part of this bond.
  - **Port Mode**: Shows the relationship that has been selected for the Ethernet ports. See "Network Bonds" on page 175 for details
  - **Active VLANs**: Shows the VLANs that are active in this bond.
  - **Mirror**: Shows whether mirroring is enabled on this bond.

- **Integrated Access Points Section**
  This section provides information about the Integrated Access Points (IAPs) that are contained within the Array. How many IAPs are listed depends on which product model you are using. To make configuration changes to these IAPs, go to "IAP Settings" on page 274.

  - **IAP**: Lists the IAPs that are available on the Array.
  - **State**: Shows the current state of each IAP, either up or down. IAPs that are down are shown in RED. Figure 47 shows an example where **iap7** is down.
  - **AP Type**: Shows the types of 802.11 clients supported by this IAP (11/a/b/g/n) and the number of separate data streams transmitted and received by the antennas of each IAP for 802.11n. For example, 3x3 means that the IAP supports three transmit chains and three receive chains. See "Multiple Data Streams—Spatial Multiplexing" on page 38.



Integrated Access Points

IAP	State	AP Type	Channel		WiFi Mode	Antenna	Cell Size	TX Power	RX Threshold	Stations	WDS Link / Distance	MAC Address / BSSID	Description
iap1	up	.11abgn 3x3	mon	dedicated monitor	abgn	internal omni	monitor	20	-95	0		00:0f:7d:56:87:80-81	
iap2	up	.11abgn 3x3	36+40	default	an	internal directional	small	5	-75	0		00:0f:7d:56:87:90-91	
iap3	up	.11abgn 3x3	1	default	bgn	internal directional	small	5	-75	0		00:0f:7d:56:87:a0-a1	
iap4	down	.11abgn 3x3	44+48	default	an	internal directional	small	5	-75	0		00:0f:7d:56:87:b0-b1	
iap5	up	.11abgn 3x3	6	default	bgn	internal directional	max	20	-90	0		00:0f:7d:56:87:c0-c1	
iap6	up	.11abgn 3x3	52+56	default	an	internal directional	max	20	-90	0		00:0f:7d:56:87:d0-d1	
iap7	up	.11abgn 3x3	11	default	bgn	internal directional	max	20	-90	0		00:0f:7d:56:87:e0-e1	
iap8	up	.11abgn 3x3	60+64	default	an	internal directional	max	20	-90	0		00:0f:7d:56:87:f0-f1	

Figure 47. Disabled IAP (Partial View)

- **Channel**: Shows which channel each IAP is using, and the channel setting. To avoid co-channel interference, adjacent radios should not be using adjacent channels. To make channel selections for a specific IAP, go to "IAP Settings" on page 274.
- **Wi-Fi Mode**: Shows the 802.11 client types that the IAP has been configured to support.
- **Antenna**: Shows which antenna is being used by each IAP.
- **Cell Size**: Indicates which cell size setting is currently active for each IAP—small, medium, large, max, automatic, or manually defined by you. The cell size of an IAP is a function of its transmit power and determines the IAP's overall coverage. To define cell sizes, go to "IAP Settings" on page 274. For additional information about cell sizes and the importance of planning for and defining the optimum cell sizes for your Array, go to "Coverage and Capacity Planning" on page 28.

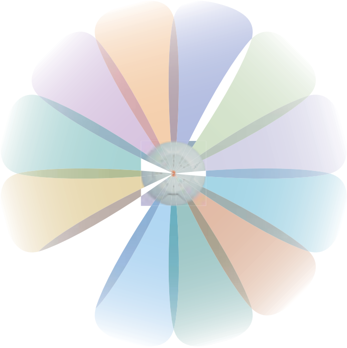


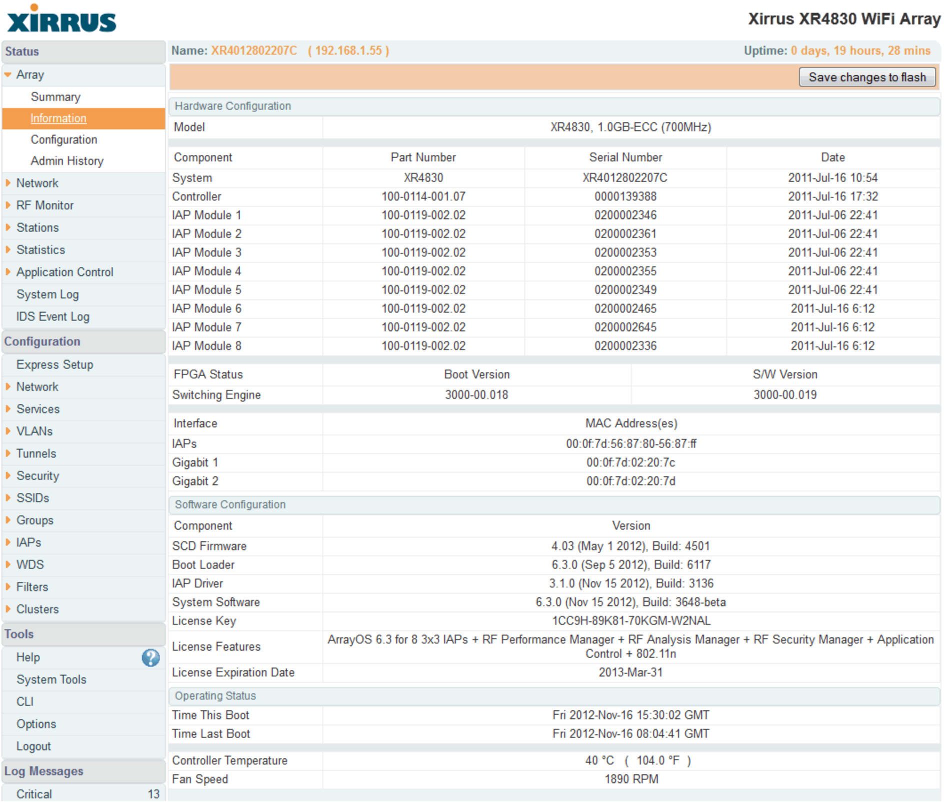
Figure 48. IAP Cells

- **Tx Power**: Shows the transmit power for each IAP.
- **Rx Threshold**: Shows the receive threshold for each IAP.
- **Stations**: Informs you how many client stations are currently associated with each IAP.
- **WDS Link/Distance**: The WDS Link on this radio (if any), and whether the link has been set to support Long Distance Links. See “WDS” on page 338.
- **MAC Address/BSSID**: Shows the MAC address for each IAP.
- **Description**: The description (if any) that you set for this IAP.

Array Information

This is a status only window that shows you the current firmware versions utilized by the Array, serial numbers assigned to each module, MAC addresses, licensing information, recent boot timestamps, and current internal temperatures and fan speed.

Note that the **License Features** row lists the features that are supported by your Array's license. See "About Licensing and Upgrades" on page 361 and "Advanced Feature Sets" on page 16 for more information.



Xirrus XR4830 WiFi Array

Name: XR4012802207C (192.168.1.55)

Uptime: 0 days, 19 hours, 28 mins

Hardware Configuration

Model	XR4830, 1.0GB-ECC (700MHz)		
Component	Part Number	Serial Number	Date
System	XR4830	XR4012802207C	2011-Jul-16 10:54
Controller	100-0114-001.07	0000139388	2011-Jul-16 17:32
IAP Module 1	100-0119-002.02	0200002346	2011-Jul-06 22:41
IAP Module 2	100-0119-002.02	0200002361	2011-Jul-06 22:41
IAP Module 3	100-0119-002.02	0200002353	2011-Jul-06 22:41
IAP Module 4	100-0119-002.02	0200002355	2011-Jul-06 22:41
IAP Module 5	100-0119-002.02	0200002349	2011-Jul-06 22:41
IAP Module 6	100-0119-002.02	0200002465	2011-Jul-16 6:12
IAP Module 7	100-0119-002.02	0200002645	2011-Jul-16 6:12
IAP Module 8	100-0119-002.02	0200002336	2011-Jul-16 6:12

FPGA Status	Boot Version	S/W Version
Switching Engine	3000-00.018	3000-00.019

Interface	MAC Address(es)
IAPs	00:0f:7d:56:87:80-56:87:ff
Gigabit 1	00:0f:7d:02:20:7c
Gigabit 2	00:0f:7d:02:20:7d

Software Configuration

Component	Version
SCD Firmware	4.03 (May 1 2012), Build: 4501
Boot Loader	6.3.0 (Sep 5 2012), Build: 6117
IAP Driver	3.1.0 (Nov 15 2012), Build: 3136
System Software	6.3.0 (Nov 15 2012), Build: 3648-beta
License Key	1CC9H-89K81-70KGM-W2NAL
License Features	ArrayOS 6.3 for 8 3x3 IAPs + RF Performance Manager + RF Analysis Manager + RF Security Manager + Application Control + 802.11n
License Expiration Date	2013-Mar-31

Operating Status

Time This Boot	Fri 2012-Nov-16 15:30:02 GMT
Time Last Boot	Fri 2012-Nov-16 08:04:41 GMT
Controller Temperature	40 °C (104.0 °F)
Fan Speed	1890 RPM

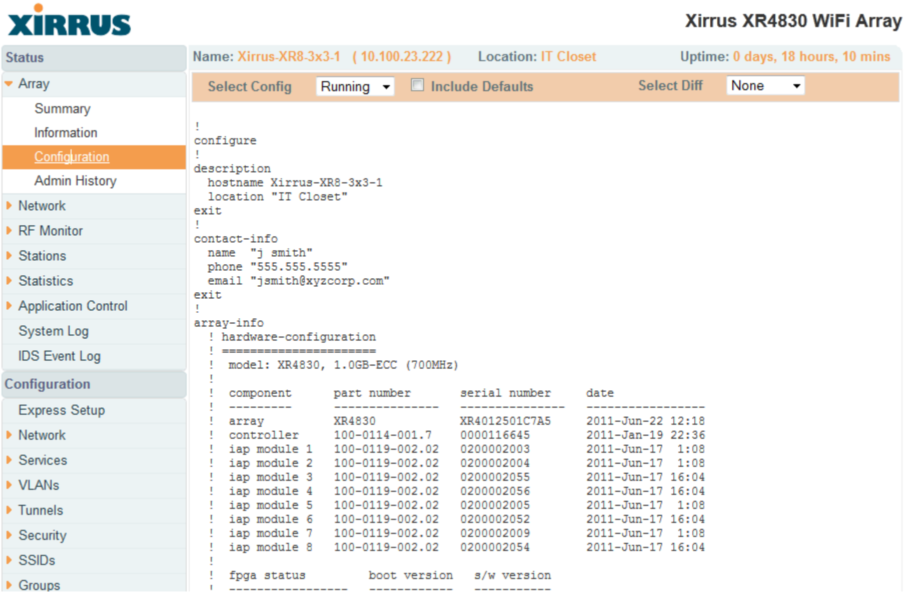
Figure 49. Array Information

You cannot make configuration changes in this window, but if you are experiencing issues with network services, you may want to print the content of this window for your records.

Array Configuration

This is a status only window that allows you to display the configuration settings assigned to the Array, based on the following filter options:

- **Running**—displays the current configuration (the one running now).
- **Saved**—displays the saved configuration from this session.
- **Lastboot**—displays the configuration as it was after the last reboot.
- **Factory**—displays the configuration established at the factory.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 18 hours, 10 mins

Select Config: Running ▾ ☐ Include Defaults Select Diff: None ▾

```
!
configure
!
description
  hostname Xirrus-XR8-3x3-1
  location "IT Closet"
exit
!
contact-info
  name  "j smith"
  phone "555.555.5555"
  email "jsmith@xyzcorp.com"
exit
!
array-info
  ! hardware-configuration
  ! ======================
  !  model: XR4830, 1.0GB-ECC (700MHz)
  !
  !  component      part number       serial number     date
  !  ---------      ---------------   ---------------   -----------------
  !  array          XR4830            XR4012501C7A5     2011-Jun-22 12:18
  !  controller     100-0114-001.7    0000116645        2011-Jan-19 22:36
  !  iap module 1   100-0119-002.02   0200002003        2011-Jun-17  1:08
  !  iap module 2   100-0119-002.02   0200002004        2011-Jun-17  1:08
  !  iap module 3   100-0119-002.02   0200002055        2011-Jun-17 16:04
  !  iap module 4   100-0119-002.02   0200002056        2011-Jun-17 16:04
  !  iap module 5   100-0119-002.02   0200002005        2011-Jun-17  1:08
  !  iap module 6   100-0119-002.02   0200002052        2011-Jun-17 16:04
  !  iap module 7   100-0119-002.02   0200002009        2011-Jun-17  1:08
  !  iap module 8   100-0119-002.02   0200002054        2011-Jun-17 16:04
  !
  !  fpga status         boot version   s/w version
  !  -----------------   ------------   -----------
```

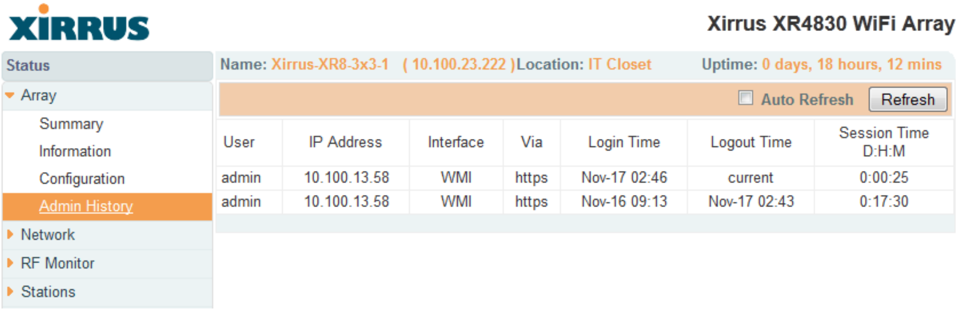
Figure 50. Show Configuration

If you want to see just the differences between the Running, Saved, Lastboot, and Factory configurations, you can do this by choosing a configuration option from the **Select Config** pull-down menu then selecting an alternative configuration option from the **Select Diff** pull-down menu.

To also include the default configuration settings in the output, choose your configuration then click in the **Include Defaults** check box. If **Include Defaults** is disabled, then only the changes from the default configuration are shown.

Admin History

It is useful to know who else is currently logged in to an array while you're configuring it. It's also nice to see who has logged in since the array booted. This status-only window shows you all administrator logins to the Array that have occurred since the last reboot. To determine who is currently logged in, check which entries say **active** in the **Logout Time** column.



Name: Xirrus-XR8-3x3-1 (10.100.23.222)Location: IT Closet Uptime: 0 days, 18 hours, 12 mins

User	IP Address	Interface	Via	Login Time	Logout Time	Session Time D:H:M
admin	10.100.13.58	WMI	https	Nov-17 02:46	current	0:00:25
admin	10.100.13.58	WMI	https	Nov-16 09:13	Nov-17 02:43	0:17:30

Figure 51. Admin Login History

Network Status Windows

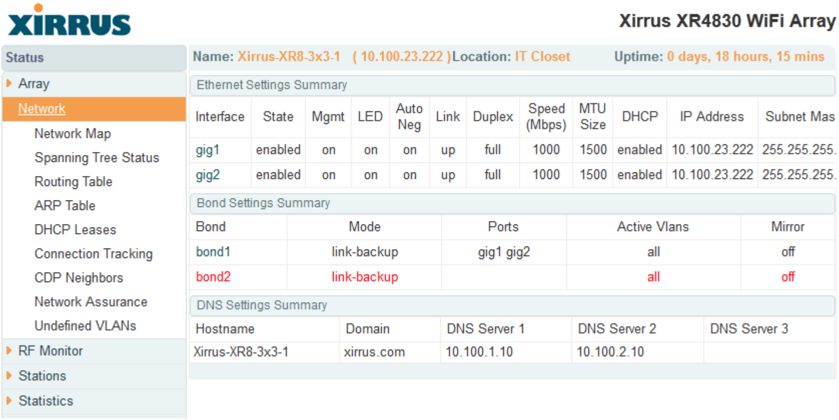
The following Network Status windows are available:

- **Network**—displays a summary of network interface settings.
- **Network Map**—displays information about this Array and neighboring Arrays that have been detected.
- **Spanning Tree Status**—displays the spanning tree status of network links on this Array.
- **Routing Table**—displays information about routing on this Array.
- **ARP Table**—displays information about Address Resolution Protocol on this Array.

- **DHCP Leases**—displays information about IP addresses (leases) that the Array has allocated to client stations.
- **Connection Tracking/NAT**—lists connections that have been established for client stations.
- **CDP Neighbors**—lists neighboring network devices using Cisco Discovery Protocol.
- **Network Assurance**—shows results of connectivity tests for network servers.
- **Undefined VLANs**—shows VLANs present on an 802.1Q connection to the Array, that are not configured in the Array's VLAN list.

Network

This window provides a snapshot of the configuration settings currently established for Array’s wired interfaces. This includes the Gigabit interfaces and their bonding settings. DNS Settings are summarized as well. You can click on any item in the **Interface** or **Bond** columns to go to the associated configuration window.



Name: Xirrus-XR8-3x3-1 (10.100.23.222)Location: IT Closet Uptime: 0 days, 18 hours, 15 mins

Ethernet Settings Summary

Interface	State	Mgmt	LED	Auto Neg	Link	Duplex	Speed (Mbps)	MTU Size	DHCP	IP Address	Subnet Mas
gig1	enabled	on	on	on	up	full	1000	1500	enabled	10.100.23.222	255.255.255.
gig2	enabled	on	on	on	up	full	1000	1500	enabled	10.100.23.222	255.255.255.

Bond Settings Summary

Bond	Mode	Ports	Active Vlans	Mirror
bond1	link-backup	gig1 gig2	all	off
bond2	link-backup		all	off

DNS Settings Summary

Hostname	Domain	DNS Server 1	DNS Server 2	DNS Server 3
Xirrus-XR8-3x3-1	xirrus.com	10.100.1.10	10.100.2.10	

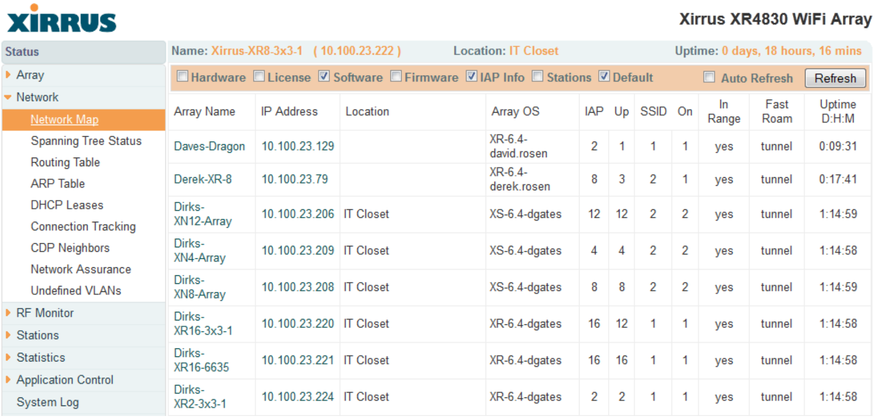
Figure 52. Network Settings

WMI windows that allow you to change or view configuration settings associated with the network interfaces include:

- **"Network Interfaces" on page 171**
- **"Network Bonds" on page 175**
- **"DNS Settings" on page 181**
- **"CDP Settings" on page 183**

Network Map

This window offers detailed information about this Array and all neighboring Arrays, including how the Arrays have been set up within your network.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 18 hours, 16 mins

□ Hardware □ License ☑ Software □ Firmware ☑ IAP Info □ Stations ☑ Default □ Auto Refresh

Array Name	IP Address	Location	Array OS	IAP	Up	SSID	On	In Range	Fast Roam	Uptime D:H:M
Daves-Dragon	10.100.23.129		XR-6.4-david.rosen	2	1	1	1	yes	tunnel	0:09:31
Derek-XR-8	10.100.23.79		XR-6.4-derek.rosen	8	3	2	1	yes	tunnel	0:17:41
Dirks-XN12-Array	10.100.23.206	IT Closet	XS-6.4-dgates	12	12	2	2	yes	tunnel	1:14:59
Dirks-XN4-Array	10.100.23.209	IT Closet	XS-6.4-dgates	4	4	2	2	yes	tunnel	1:14:58
Dirks-XN8-Array	10.100.23.208	IT Closet	XS-6.4-dgates	8	8	2	2	yes	tunnel	1:14:59
Dirks-XR16-3x3-1	10.100.23.220	IT Closet	XR-6.4-dgates	16	12	1	1	yes	tunnel	1:14:58
Dirks-XR16-6635	10.100.23.221	IT Closet	XR-6.4-dgates	16	16	1	1	yes	tunnel	1:14:58
Dirks-XR2-3x3-1	10.100.23.224	IT Closet	XR-6.4-dgates	2	2	1	1	yes	tunnel	1:14:58

Figure 53. Network Map

The Network Map has a number of options at the top of the page that allow you to customize your output by selecting from a variety of information that may be displayed. You may sort the rows based on any column that has an active column header, indicated when the mouse pointer changes to the hand icon ☝. Click **Refresh** to update the information at any time. Click **Auto Refresh** to instruct the Array to refresh this window automatically.

Content of the Network Map Window

By default, the network map shows the following status information for each Array:

- **Array Name**: The host name assigned to the Array. To establish the host name, go to "Express Setup" on page 161. You may click the host name to access WMI for this Array.
- **IP Address**: The Array's IP address. You may click the address to access WMI for this Array. If DHCP is enabled, the Array's IP address is assigned by the DHCP server. If DHCP is disabled, you must assign a static IP address. To enable DHCP or to assign a static IP address for the Array, go to "Express Setup" on page 161.
- **Location**: The location assigned to the Array. To establish the location information, go to "Express Setup" on page 161.
- **Array OS**: The software version running on the Array.
- **IAP**: The number of IAPs on the Array.
- **(IAP) Up**: Informs you how many IAPs are currently up and running. To enable or disable all IAPs, go to "Express Setup" on page 161. To enable or disable individual IAPs, go to "IAP Settings" on page 274.
- **SSID**: Informs you how many SSIDs have been assigned for the Array. To assign an SSID, go to "SSID Management" on page 249.
- **(SSID) On**: Informs you how many SSIDs are enabled. To enable or disable SSIDs, go to "SSID Management" on page 249.
- **In Range**: Informs you whether the Array is within wireless range of another Wireless Array.
- **Fast Roam**: Informs you whether or not the Xirrus fast roaming feature is enabled. This feature utilizes the Xirrus Roaming Protocol (XRP) ensuring fast and seamless roaming capabilities between IAPs or Arrays at both Layer 2 and Layer 3. To enable or disable fast roaming, go to "Global Settings (IAP)" on page 280.
- **Uptime (D:H:M)**: Informs you how long the Array has been up and running (in Days, Hours and Minutes).

To see additional information, select from the following checkboxes at the bottom of the page. This will show the columns described below.

Hardware

- **Model**: The model number of each Array (XR-4820, XR-7630, etc.), plus the amount of RAM memory and the speed of the processor.
- **Serial**: Displays the serial number of each Array.

License

- **License**: The license key of each Array.
- **Licensed Features**: Lists the optional features enabled by the key, if any.

Software (enabled by default)

- Enable/disable display of the Array OS column.

Firmware

- **Boot Loader**: The software version number of the boot loader on each Array.
- **SCD Firmware**: The software version number of the SCD firmware on each Array.

IAP Info (enabled by default)

- Enable/disable display of the IAP/Up columns.

Stations

- **Stations**: Tells you how many stations are currently associated to each Array. To deauthenticate a station, go to "Stations" on page 126.

  The columns to the right (**H**, **D**, **W**, and **M**) show the highest number of stations that have been associated over various periods of time: the previous hour, day, week, and month.

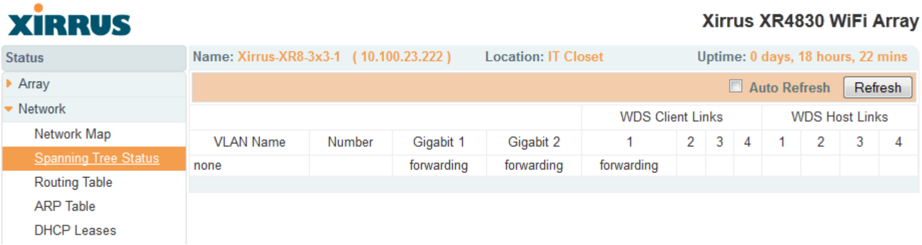
Default

- Sets the columns displayed to the default settings. By default, only Software and IAP Info are selected.

Spanning Tree Status

Multiple active paths between stations can cause loops in the network. If a loop exists in the network topology, the potential exists for the duplication of messages. The spanning tree protocol is a link management protocol that provides path redundancy while preventing undesirable loops. For a wireless network to function properly, only one active path can exist between two stations.

To facilitate path redundancy, the spanning tree protocol defines a tree that spans all stations in the network and forces certain redundant data paths into a standby (blocked) state. If one segment in the spanning tree becomes unreachable, the spanning tree algorithm reconfigures the network topology and reestablishes the link by activating the standby path. The spanning tree function is transparent to client stations.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 18 hours, 22 mins

				WDS Client Links				WDS Host Links			
VLAN Name	Number	Gigabit 1	Gigabit 2	1	2	3	4	1	2	3	4
none		forwarding	forwarding	forwarding							

Figure 54. Spanning Tree Status

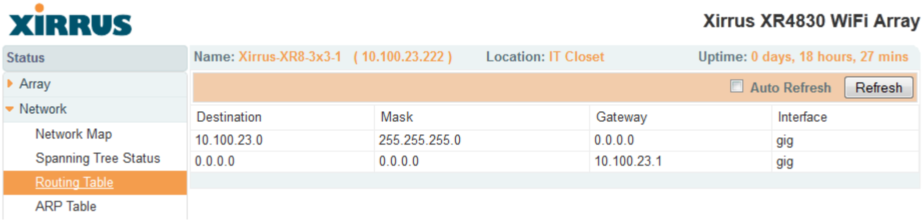
This window shows the spanning tree status (forwarding or blocked) for path segments that terminate on the gigabit ports and WDS links of this Array. You may sort the rows based on the **VLAN Name** or **Number** columns by clicking the column header. Click **Refresh** to update the information at any time. Click **Auto Refresh** to instruct the Array to refresh this window automatically.

See Also

Network
Network Interfaces
Network Status Windows
VLANs
WDS

Routing Table

This status-only window lists the entries in the Array's routing table. The table provides the Array with instructions for sending each packet to its next hop on its route across the network.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 18 hours, 27 mins

Destination	Mask	Gateway	Interface
10.100.23.0	255.255.255.0	0.0.0.0	gig
0.0.0.0	0.0.0.0	10.100.23.1	gig

Figure 55. Routing Table

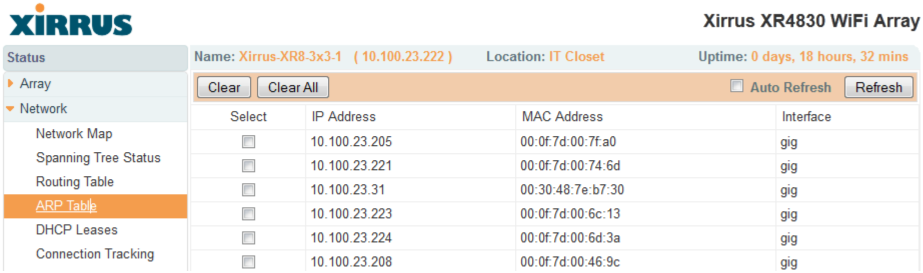
See Also

VLANs

Configuring VLANs on an Open SSID

ARP Table

This status-only window lists the entries in the Array's ARP table. For a device with a given IP address, this table lists the device's MAC address. It also shows the Array interface through which this device may be reached. The table typically includes devices that are on the same local area network segment as the Array.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 18 hours, 32 mins

Select	IP Address	MAC Address	Interface
□	10.100.23.205	00:0f:7d:00:7f:a0	gig
□	10.100.23.221	00:0f:7d:00:74:6d	gig
□	10.100.23.31	00:30:48:7e:b7:30	gig
□	10.100.23.223	00:0f:7d:00:6c:13	gig
□	10.100.23.224	00:0f:7d:00:6d:3a	gig
□	10.100.23.208	00:0f:7d:00:46:9c	gig

Figure 56. ARP Table

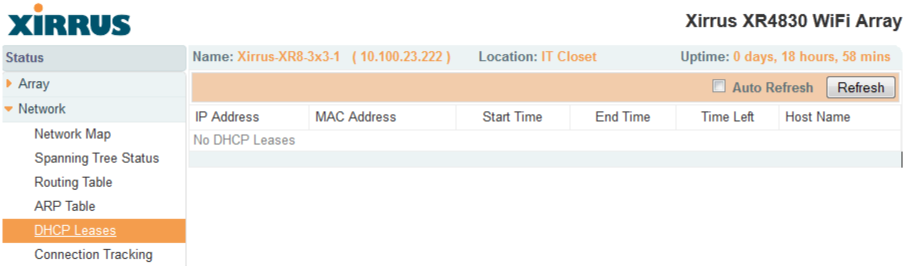
See Also

Routing Table

ARP Filtering

DHCP Leases

This status-only window lists the IP addresses (leases) that the Array has allocated to client stations. For each, it shows the IP address assigned from one of the defined DHCP pools, and the MAC address and host name of the client station. The start and end time of the lease show how long the allocation is valid. The same IP address is normally renewed at the expiration of the current lease.



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 18 hours, 58 mins

IP Address	MAC Address	Start Time	End Time	Time Left	Host Name
No DHCP Leases					

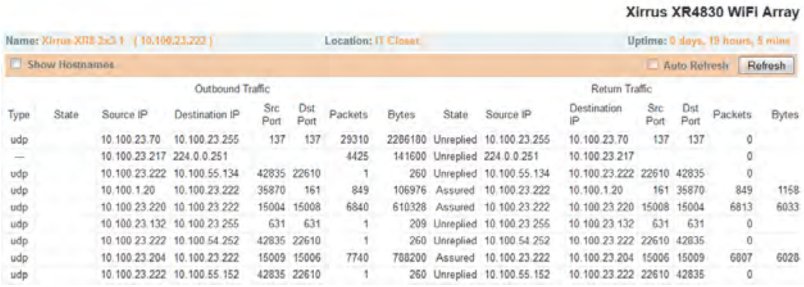
Figure 57. DHCP Leases

See Also

DHCP Server

Connection Tracking/NAT

This status-only window lists the session connections that have been created on behalf of clients. This table may also be used to view information about current NAT sessions.



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 19 hours, 5 mins

Outbound Traffic								Return Traffic						
Type	State	Source IP	Destination IP	Src Port	Dst Port	Packets	Bytes	State	Source IP	Destination IP	Src Port	Dst Port	Packets	Bytes
udp		10.100.23.70	10.100.23.255	137	137	29310	2286180	Unreplied	10.100.23.255	10.100.23.70	137	137	0	
—		10.100.23.217	224.0.0.251			4425	141600	Unreplied	224.0.0.251	10.100.23.217			0	
udp		10.100.23.222	10.100.55.134	42835	22610	1	260	Unreplied	10.100.55.134	10.100.23.222	22610	42835	0	
udp		10.100.1.20	10.100.23.222	35870	161	849	106976	Assured	10.100.23.222	10.100.1.20	161	35870	849	1158
udp		10.100.23.220	10.100.23.222	15004	15008	6840	610328	Assured	10.100.23.222	10.100.23.220	15008	15004	6813	6033
udp		10.100.23.132	10.100.23.255	631	631	1	209	Unreplied	10.100.23.255	10.100.23.132	631	631	0	
udp		10.100.23.222	10.100.54.252	42835	22610	1	260	Unreplied	10.100.54.252	10.100.23.222	22610	42835	0	
udp		10.100.23.204	10.100.23.222	15009	15006	7740	788200	Assured	10.100.23.222	10.100.23.204	15006	15009	6807	6028
udp		10.100.23.222	10.100.55.152	42835	22610	1	260	Unreplied	10.100.55.152	10.100.23.222	22610	42835	0	

Figure 58. Connection Tracking

Click the **Show Hostnames** checkbox at the top of the page to display name information (if any) for the source and destination location of the connection. The Hostname columns will replace traffic statistics columns.

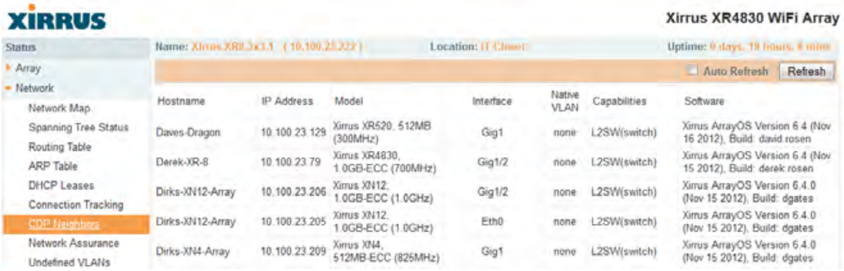
You may sort the rows based on any column that has an active column header, indicated when the mouse pointer changes to the hand icon ☝. Click **Refresh** to update the information at any time. Click **Auto Refresh** to instruct the Array to refresh this window automatically.

See Also

Filters

CDP Neighbors

This status-only window lists devices on the Array's network that support the Cisco Discovery Protocol (CDP).



Hostname	IP Address	Model	Interface	Native VLAN	Capabilities	Software
Daves-Dragon	10.100.23.129	Xirrus XR520, 512MB (300MHz)	Gig1	none	L2SW(switch)	Xirrus ArrayOS Version 6.4 (Nov 16 2012), Build: david.rosen
Derek-XR-8	10.100.23.79	Xirrus XR4830, 1.0GB-ECC (700MHz)	Gig1/2	none	L2SW(switch)	Xirrus ArrayOS Version 6.4 (Nov 15 2012), Build: derek.rosen
Dirks-XN12-Array	10.100.23.206	Xirrus XN12, 1.0GB-ECC (1.0GHz)	Gig1/2	none	L2SW(switch)	Xirrus ArrayOS Version 6.4.0 (Nov 15 2012), Build: dgates
Dirks-XN12-Array	10.100.23.205	Xirrus XN12, 1.0GB-ECC (1.0GHz)	Eth0	none	L2SW(switch)	Xirrus ArrayOS Version 6.4.0 (Nov 15 2012), Build: dgates
Dirks-XN4-Array	10.100.23.209	Xirrus XN4, 512MB-ECC (825MHz)	Gig1	none	L2SW(switch)	Xirrus ArrayOS Version 6.4.0 (Nov 15 2012), Build: dgates

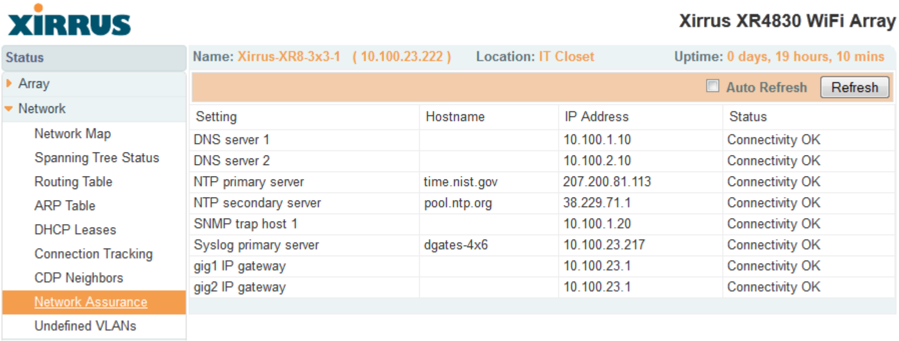
Figure 59. CDP Neighbors

The Array performs discovery on the network on an ongoing basis. This list shows the devices that have been discovered—Cisco devices and other devices on the network that have CDP running. For each, it shows the device's host name, IP address, manufacturer and model name, the device interface that is connected to the network (i.e., the port that was discovered), and the network capabilities of the device (switch, router, supported protocols, etc.).

CDP must be enabled on the Array in order to gather and display this information. For details and some restrictions, see "CDP Settings" on page 183.

Network Assurance

This status-only window shows the results of ongoing network assurance testing.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 19 hours, 10 mins

Setting	Hostname	IP Address	Status
DNS server 1		10.100.1.10	Connectivity OK
DNS server 2		10.100.2.10	Connectivity OK
NTP primary server	time.nist.gov	207.200.81.113	Connectivity OK
NTP secondary server	pool.ntp.org	38.229.71.1	Connectivity OK
SNMP trap host 1		10.100.1.20	Connectivity OK
Syslog primary server	dgates-4x6	10.100.23.217	Connectivity OK
gig1 IP gateway		10.100.23.1	Connectivity OK
gig2 IP gateway		10.100.23.1	Connectivity OK

Figure 60. Network Assurance

The Array checks connectivity to network servers that you have configured (for example, DNS and NTP servers) on an ongoing basis. For each server, this list shows the server’s host name (if any), IP address, and status.

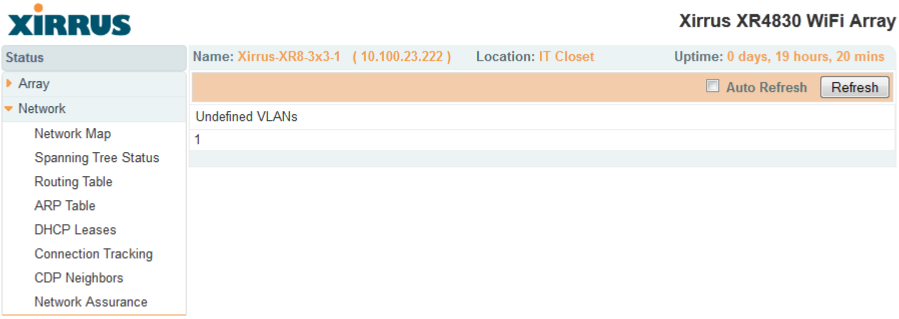
Network assurance must be enabled on the Array in order to perform these connectivity tests and display this information. See “Management Control” on page 221.

See Also

Management Control

Undefined VLANs

This status-only window lists VLANs that have not been configured on the Array, but that are being detected on the Array's trunk port(s), i.e. wired ports. See "VLANs" on page 199.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 19 hours, 20 mins

Undefined VLANs
1

Figure 61. Undefined VLANs

This feature alerts you to the fact that an 802.1Q trunk to the Array has VLANs that are not being properly handled on the Array. To reduce unnecessary traffic, only VLANs that are actually needed on the Array should normally be on the trunk, e.g., the management VLAN and SSID VLANs. In some cases such as multicast forwarding for Apple Bonjour you may want to extend other VLANs to the Array, in order to forward Bonjour or other multicast packets (see "Advanced Traffic Optimization" on page 284).

See Also

VLANs

RF Monitor Windows

Every Wireless Array includes an integrated RF spectrum analyzer as a standard feature. The spectrum analyzer allows you to characterize the RF environment by monitoring throughput, signal, noise, errors, and interference levels continually per channel. This capability uses the assigned threat-sensor (monitor) radio. The associated software is part of the ArrayOS.

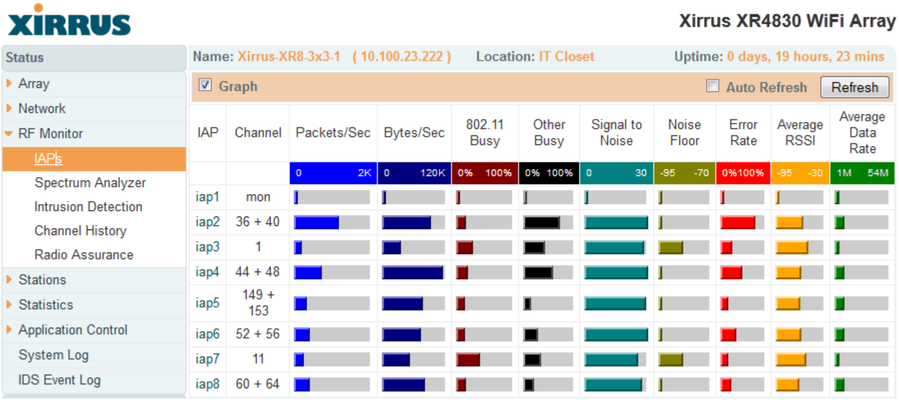
The following RF Status windows are available:

- **IAPs**—displays current statistics and RF measurements for each of the Array's IAPs.
- **Spectrum Analyzer**—displays current statistics and RF measurements for each of the Array's channels.
- **Intrusion Detection**—displays rogue APs that have been detected by the Array.
- **Channel History**—charts ongoing statistics and RF measurements for one selected channel over time.
- **Radio Assurance**—displays counts of types of problems that caused each IAP to reset.

Some status information is only available if the Array's license includes ***Advanced Feature Sets****. For example, the Spectrum Analyzer requires the* ***Xirrus Advanced RF Analysis Manager (RAM)****. If a feature is unavailable, then your license does not support the feature and you will get an error message if you try to set the feature. See* ***"About Licensing and Upgrades" on page 361****.*

IAPs

The RF Monitor—IAPs window displays traffic statistics and RF readings observed by each Array IAP (radio). Note that the data is an instantaneous snapshot for the IAP—it is not an average or a cumulative total. To graph these values over time for a particular channel, see “Channel History” on page 121. For detailed information on the measurements displayed, please see “Spectrum Analyzer Measurements” on page 118.



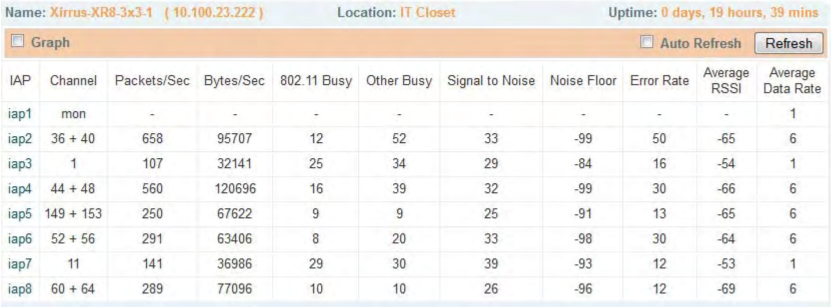
Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 19 hours, 23 mins

☑ Graph

IAP	Channel	Packets/Sec	Bytes/Sec	802.11 Busy	Other Busy	Signal to Noise	Noise Floor	Error Rate	Average RSSI	Average Data Rate
		0 2K	0 120K	0% 100%	0% 100%	0 30	-95 -70	0% 100%	-95 -30	1M 54M
iap1	mon									
iap2	36 + 40									
iap3	1									
iap4	44 + 48									
iap5	149 + 153									
iap6	52 + 56									
iap7	11									
iap8	60 + 64									

Figure 62. RF Monitor—IAPs

Figure 62 presents the data as a graphical display, enabled by selecting the **Graph** checkbox on the upper left. If this option is not selected, data is presented as a numerical table.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 19 hours, 39 mins

☐ Graph ☐ Auto Refresh Refresh

IAP	Channel	Packets/Sec	Bytes/Sec	802.11 Busy	Other Busy	Signal to Noise	Noise Floor	Error Rate	Average RSSI	Average Data Rate
iap1	mon	-	-	-	-	-	-	-	-	1
iap2	36 + 40	658	95707	12	52	33	-99	50	-65	6
iap3	1	107	32141	25	34	29	-84	16	-54	1
iap4	44 + 48	560	120696	16	39	32	-99	30	-66	6
iap5	149 + 153	250	67622	9	9	25	-91	13	-65	6
iap6	52 + 56	291	63406	8	20	33	-98	30	-64	6
iap7	11	141	36986	29	30	39	-93	12	-53	1
iap8	60 + 64	289	77096	10	10	26	-96	12	-69	6

Figure 63. RF Monitor—IAPs

You may sort the rows based on any column that has an active column header, indicated when the mouse pointer changes to the hand icon ☝. Click **Refresh** to update the information at any time. Click **Auto Refresh** to instruct the Array to refresh this window automatically.

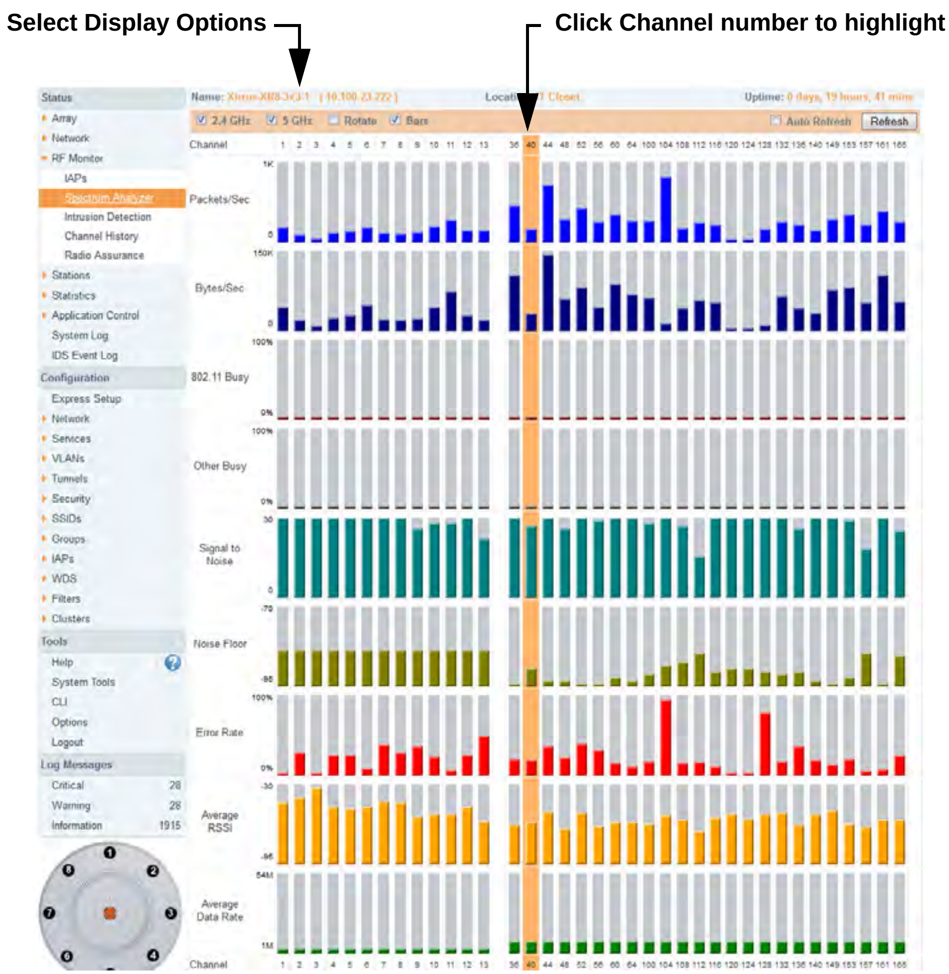
Spectrum Analyzer

The RF measurements for this feature are obtained by the monitor radio. You ***must*** *have a radio set to* ***monitor*** *mode for any data to be available. See "IAP Settings" on page 274.*

Spectrum analysis on Wireless Arrays is a distributed capability that automatically covers the entire wireless network, since a sensor is present in every unit. Arrays monitor the network 24/7 and analyze interference anywhere in the network from your desk. There's no need to walk around with a device as with traditional spectrum analyzers, thus you don't have to be in the right place to find outside sources that may cause network problems or pose a security threat. The Array monitors all 802.11 radio bands (a/b/g/n), not just those currently used for data transmission.

The RF Spectrum Analyzer window displays instantaneous traffic statistics and RF readings for all channels, as measured by the Array's monitor radio. This differs from the RF Monitor-IAPs window, which displays values measured by each IAP radio for its current assigned channel. For the spectrum analyzer, the monitor radio is in a listen-only mode, scanning across all wireless channels. Each channel is scanned in sequence, for a 250 millisecond interval per channel. The spectrum analyzer window presents the data as a graphical display of vertical bar graphs for each statistic as shown in Figure 64 (the default presentation), or horizontally as bar graphs or numerical RF measurements. The measurements displayed are explained in "Spectrum Analyzer Measurements" on page 118.

As an aid to viewing data for a particular channel, click the channel number. The channel will be highlighted down the page (or across the page for a rotated view, in both text and graph modes). Click additional channels to highlight them for easy comparison. To remove the highlighting from a channel, click the channel number again. Click **Refresh** to update the information at any time. Click **Auto Refresh** to instruct the Array to refresh this window automatically.


Select Display Options

Click Channel number to highlight

Figure 64. RF Spectrum Analyzer

The Spectrum Analyzer offers several display options:

- To display horizontal bar graphs, click the **Rotate** checkbox at the bottom of the data window.
- In the rotated view, if you wish to view data as a numerical table, click the **Text** checkbox. Click again to return to a graphical display. The text option is only available in the rotated view.

- When viewing a graphical display, click **Bars** to have the bar graphs displayed against a gray background—you may find this easier on the eyes. This operation is not available when Text is selected.
- You may sort the rows based on any column that has an active column header, indicated when the mouse pointer changes to the hand icon ☝. Sorting is only available in the rotated view.
- At the bottom left of the frame, you may select whether to display only 2.4 GHz channels, 5 GHz channels, or both (the default is both). Note that the data is an instantaneous snapshot—it is not an average or a cumulative total.

Spectrum Analyzer Measurements

The spectrum analyzer displays the following information:

- **Packets/Sec:** Total number of wireless packets per second on the channel, both valid and errored packets.
- **Bytes/Sec:** Total number of wireless bytes per second on the channel, valid packets only.
- **802.11 Busy:** Percentage of time that 802.11 activity is seen on the channel.
- **Other Busy:** Percentage of time that the channel is unavailable due to non-802.11 activity.

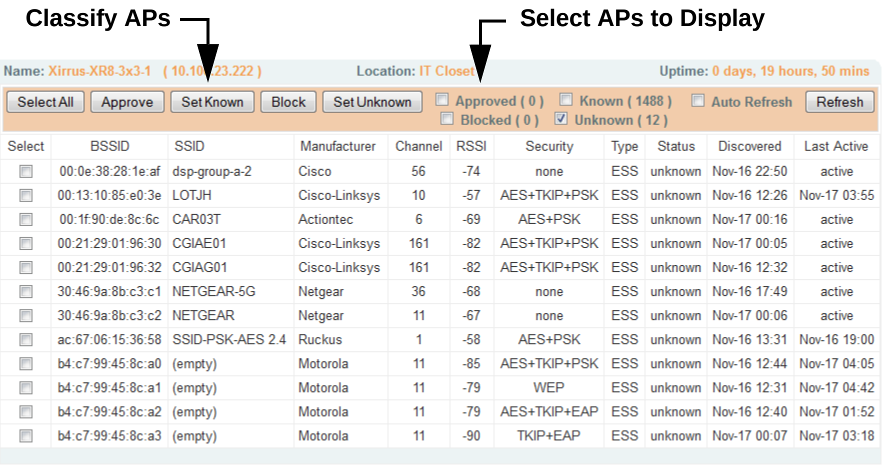
  The total busy time (802.11 Busy plus Other Busy) will never total more than 100%. The remaining time (100% minus total busy time) is quiet time—the time that no activity was seen on the channel.
- **Signal to Noise:** Average SNR (signal to noise ratio) seen on the channel, calculated from the signal seen on valid 802.11 packets less the noise floor level. A dash value “-“means no SNR data was available for the interval.
- **Noise Floor:** Average noise floor reading seen on the channel (ambient noise). A dash value “-“means no noise data was available for the interval.
- **Error Rate:** Percentage of the total number of wireless packets seen on the channel that have CRC errors. The Error rate percentage may be high on

some channels since the monitor radio is set to receive at a very sensitive level, enabling it to hear packets from devices at far distances.

- **Average RSSI:** Average RSSI level seen on 802.11 packets received on the channel. A dash value "-"means no RSSI data was available for the interval.
- **Average Data Rate:** Average data rate over time (per byte, not per packet) seen on 802.11 packets received on the channel. A dash value "-"means no data rate information was available for the interval. A higher date rate (above 6 Mbps) typically indicates user data traffic on the channel. Otherwise, the data rate reflects control packets at the lower basic rates.

Intrusion Detection

This window displays all detected access points, according to the classifications you select from the checkboxes at the top—**Blocked**, **Unknown**, **Known**, or **Approved**. This includes ad hoc access points (station-to-station connections). For more information about intrusion detection, rogue APs, and blocking, please see "About Blocking Rogue APs" on page 331.



Name: Xirrus-XR8-3x3-1 (10.10 23.222) Location: IT Closet Uptime: 0 days, 19 hours, 50 mins

Select	BSSID	SSID	Manufacturer	Channel	RSSI	Security	Type	Status	Discovered	Last Active
□	00:0e:38:28:1e:af	dsp-group-a-2	Cisco	56	-74	none	ESS	unknown	Nov-16 22:50	active
□	00:13:10:85:e0:3e	LOTJH	Cisco-Linksys	10	-57	AES+TKIP+PSK	ESS	unknown	Nov-16 12:26	Nov-17 03:55
□	00:1f:90:de:8c:6c	CAR03T	Actiontec	6	-69	AES+PSK	ESS	unknown	Nov-17 00:16	active
□	00:21:29:01:96:30	CGIAE01	Cisco-Linksys	161	-82	AES+TKIP+PSK	ESS	unknown	Nov-17 00:05	active
□	00:21:29:01:96:32	CGIAG01	Cisco-Linksys	161	-82	AES+TKIP+PSK	ESS	unknown	Nov-16 12:32	active
□	30:46:9a:8b:c3:c1	NETGEAR-5G	Netgear	36	-68	none	ESS	unknown	Nov-16 17:49	active
□	30:46:9a:8b:c3:c2	NETGEAR	Netgear	11	-67	none	ESS	unknown	Nov-17 00:06	active
□	ac:67:06:15:36:58	SSID-PSK-AES 2.4	Ruckus	1	-58	AES+PSK	ESS	unknown	Nov-16 13:31	Nov-16 19:00
□	b4:c7:99:45:8c:a0	(empty)	Motorola	11	-85	AES+TKIP+PSK	ESS	unknown	Nov-16 12:44	Nov-17 04:05
□	b4:c7:99:45:8c:a1	(empty)	Motorola	11	-79	WEP	ESS	unknown	Nov-16 12:31	Nov-17 04:42
□	b4:c7:99:45:8c:a2	(empty)	Motorola	11	-79	AES+TKIP+EAP	ESS	unknown	Nov-16 12:40	Nov-17 01:52
□	b4:c7:99:45:8c:a3	(empty)	Motorola	11	-90	TKIP+EAP	ESS	unknown	Nov-17 00:07	Nov-17 03:18

Figure 65. Intrusion Detection/Rogue AP List

The Intrusion Detection window provides the easiest method for classifying rogue APs as Blocked, Known, Approved, or Unknown. Choose one or more APs using the checkbox in the **Select** column, then use the buttons on the upper left to classify them with the following actions: **Approve**, **Set Known**, **Block**, or **Set Unknown**.

You can sort the results based on the following parameters by clicking the desired column header:

- SSID
- BSSID
- Manufacturer
- Channel
- RSSI
- Security
- Type
- Status
- Discovered
- Last Active

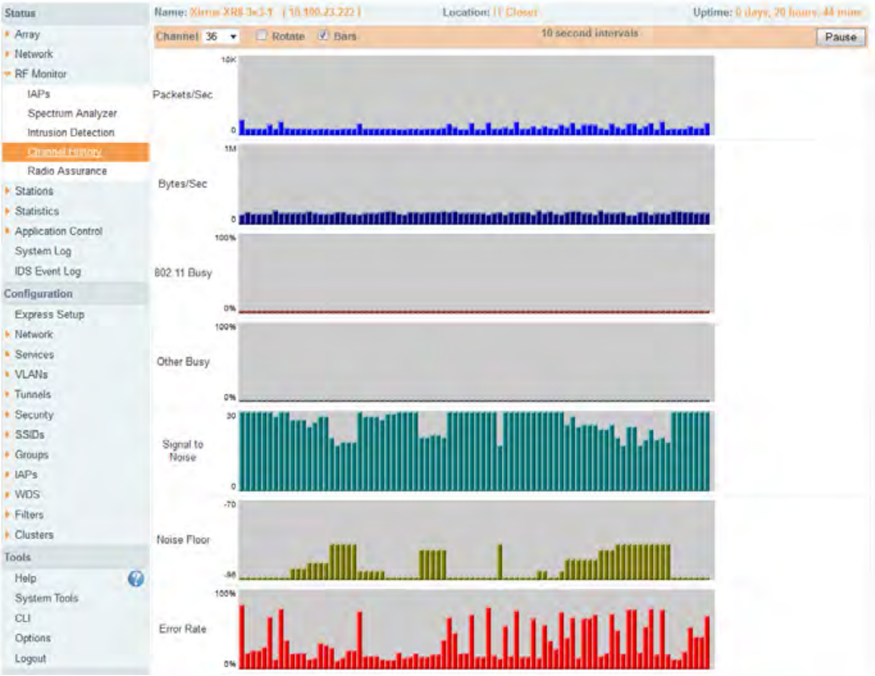
You can refresh the list at any time by clicking on the **Refresh** button, or click in the **Auto Refresh** check box to instruct the Array to refresh the list automatically.

See Also

Network Map
Rogue Control List
SSIDs
SSID Management

Channel History

The RF Monitor—Channel History window focuses on traffic statistics and RF readings observed for just one channel that you select in the **Channel** field. A new set of readings is added every 10 seconds for a 5 GHz channel, or every 5 seconds for a 2.4 GHz channel. For descriptions of the measurements displayed, please see "Spectrum Analyzer Measurements" on page 118.



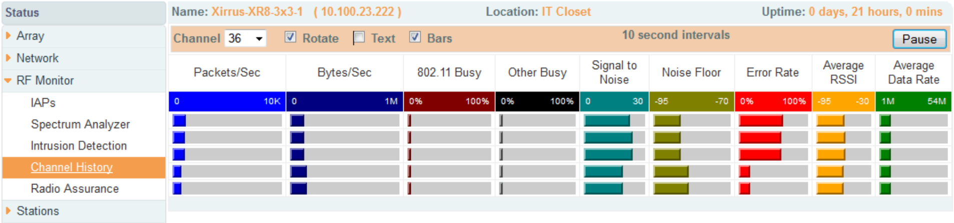
Name: Xirrus XR8-3x3-1 | 10.100.23.222 | Location: IT Closet Uptime: 0 days, 20 hours, 44 mins

Channel 36 ☐ Rotate ☑ Bars 10 second intervals

Figure 66. RF Monitor—Channel History

Figure 66 presents the data in graphical form. New data appears at the left, with older readings shifting to the right. To make the data appear as a barchart, click the **Bar** checkbox which will shade the background.

You also have the option of clicking the **Rotate** checkbox to give each statistic its own column. In other words, the graph for each statistic will grow down the page as new readings display at the top. (Figure 67)



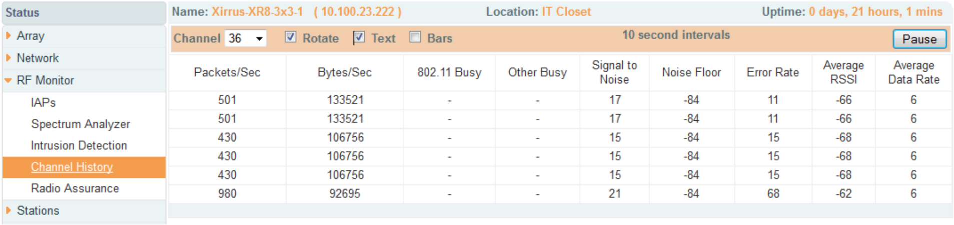
Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 21 hours, 0 mins

Channel 36 ☑ Rotate ☐ Text ☑ Bars 10 second intervals

Figure 67. RF Monitor—Channel History (Rotated)

If you select **Rotate** and **Text** together, data is presented as a numerical table. (Figure 68)

Click **Pause** to stop collecting data, or **Resume** to continue.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 21 hours, 1 mins

Channel 36 ☑ Rotate ☑ Text ☐ Bars 10 second intervals

Packets/Sec	Bytes/Sec	802.11 Busy	Other Busy	Signal to Noise	Noise Floor	Error Rate	Average RSSI	Average Data Rate
501	133521	-	-	17	-84	11	-66	6
501	133521	-	-	17	-84	11	-66	6
430	106756	-	-	15	-84	15	-68	6
430	106756	-	-	15	-84	15	-68	6
430	106756	-	-	15	-84	15	-68	6
980	92695	-	-	21	-84	68	-62	6

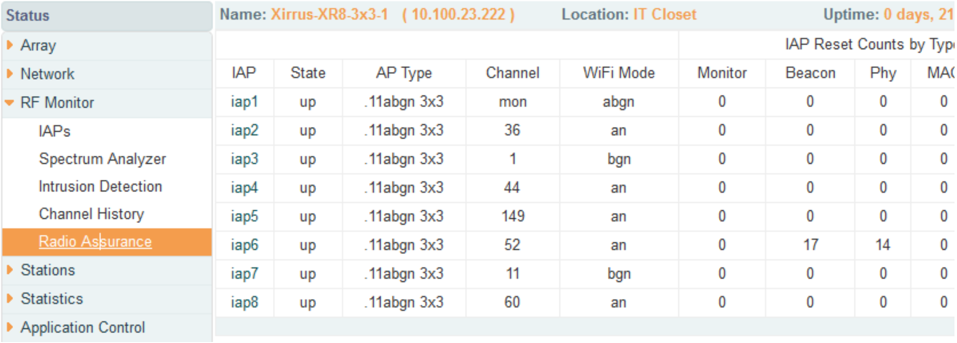
Figure 68. RF Monitor—Channel History (Text)

Radio Assurance

Radio Assurance mode is only available if the Array's license includes the ***Xirrus Advanced RF Analysis Manager (RAM)****. If a setting is unavailable (grayed out), then your license does not support the feature. Please see* ***"About Licensing and Upgrades" on page 361****.*

When Radio Assurance mode is enabled, the monitor radio performs loopback tests on the Array's radios. When problems are encountered, the Array can take various actions to correct them by performing different levels of reset on the affected radio. This window shows which resets, if any, have been performed on which radios since the last reboot.

The Array's response to radio problems is controlled by the **Radio Assurance Mode** selected, as described in "RF Resilience" on page 315. If you have selected **Failure Alerts & Repairs** (with or without reboots), then the Array can take corrective action if a problem is detected. Note that radio assurance requires RF Monitor Mode to be enabled in Advanced RF Settings to turn on self-monitoring functions. It also requires a radio to be set to monitoring mode. For a detailed discussion of the operation of this feature and the types of resets performed, see "Radio Assurance" on page 461.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 21

					IAP Reset Counts by Typ			
IAP	State	AP Type	Channel	WiFi Mode	Monitor	Beacon	Phy	MA
iap1	up	.11abgn 3x3	mon	abgn	0	0	0	0
iap2	up	.11abgn 3x3	36	an	0	0	0	0
iap3	up	.11abgn 3x3	1	bgn	0	0	0	0
iap4	up	.11abgn 3x3	44	an	0	0	0	0
iap5	up	.11abgn 3x3	149	an	0	0	0	0
iap6	up	.11abgn 3x3	52	an	0	17	14	0
iap7	up	.11abgn 3x3	11	bgn	0	0	0	0
iap8	up	.11abgn 3x3	60	an	0	0	0	0

Figure 69. Radio Assurance

For each of the Array's radios, this window shows the radio's state, its type (IEEE 802.11 type, and antenna type—2x2 or 3x3), the assigned channel, and the selected 802.11 wireless mode. To the right, the table shows counts for the number of times, if any, that radio assurance has performed each of the following types of resets since the last reboot, as described in Radio Assurance:

- Monitor
- Beacon
- Phy
- MAC
- System (i.e., reboot the Array)

See Also

IAPs
Xirrus Advanced RF Analysis Manager (RAM)
RF Resilience
Radio Assurance

Station Status Windows

The following Station Status windows are available:

- **Stations**—this list describes all stations associated to the Array.
- **Location Map**—displays a map showing the approximate locations of all stations associated to the array.
- **RSSI**—for each associated station, this displays the Received Signal Strength Indicator at each of the Array's IAPs.
- **Signal-to-Noise Ratio (SNR)**—for each associated station, this displays the SNR at each of the Array's IAPs.
- **Noise Floor**—for each associated station, this displays the ambient noise (silence) value at each of the Array's IAPs.
- **Max by IAP**—for each IAP, this shows the historical maximum number of stations that have been associated to it over various periods of time.
- **Station Assurance**— displays stations that are having connectivity problems.

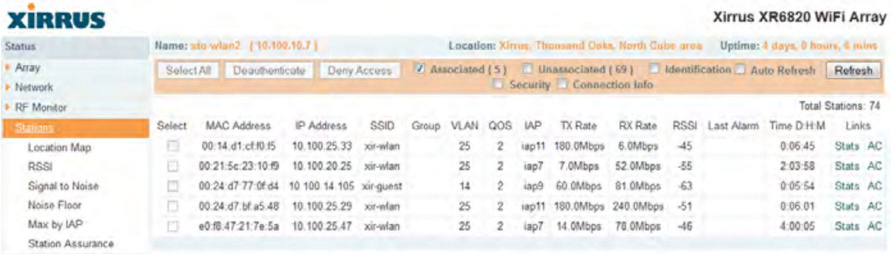
Some status information is only available if the Array's license includes the ***Xirrus Advanced RF Analysis Manager (RAM)****. If a feature is unavailable, then your license does not support the feature and you will get an error message if you try to set the feature. See* ***"About Licensing and Upgrades" on page 361****.*

Stations

This status-only window shows client stations currently visible to the Array. You may choose to view only stations that have **Associated** to the Array, or only stations that are **Unassociated**, or both, by selecting the appropriate checkboxes above the list. The list always shows the MAC address of each station, its IP address, the SSID used for the association, the Group (if any) that this station belongs to, its VLAN, its QoS, the IAP used for the association, transmit and receive rates, the RSSI for each station, and how long each association has been active (up time).

You may click other checkboxes above the list to show a number of additional columns:

- **Identification**: shows more identifying information for the station—its **User Name, Host Name, Manufacturer, Device Type,** and **Device Class** (for example, notebook, iPad, etc.).
- **Security**: includes security settings used by the connection—**Enc**(ryption) type, **Cipher** used, **Key Mgmt** used, and **Media** supported by the station.
- **Connection Info**: shows the **Band** (5GHz or 2.4 GHz) and **Channel**(s) used (plus bonded channel, if any, for 802.11n). Shows additional RF measurements that affect the quality of the connection: **SNR** (signal to noise ratio) and **Silence**—the ambient noise (floor) value.



Name: xto-wlan2 (10.100.10.7)   Location: Xirrus, Thousand Oaks, North Cube area   Uptime: 4 days, 0 hours, 4 mins

☑ Associated (5) □ Unassociated (69) □ Identification □ Auto Refresh
□ Security □ Connection Info

Total Stations: 74

Select	MAC Address	IP Address	SSID	Group	VLAN	QOS	IAP	TX Rate	RX Rate	RSSI	Last Alarm	Time D:H:M	Links
□	00:14:d1:cf:f0:f5	10.100.25.33	xir-wlan		25	2	iap11	180.0Mbps	6.0Mbps	-45		0:06:45	Stats AC
□	00:21:5c:23:10:f9	10.100.20.25	xir-wlan		25	2	iap7	7.0Mbps	52.0Mbps	-55		2:03:58	Stats AC
□	00:24:d7:77:0f:d4	10.100.14.105	xir-guest		14	2	iap9	60.0Mbps	81.0Mbps	-63		0:05:54	Stats AC
□	00:24:d7:bf:a5:48	10.100.25.29	xir-wlan		25	2	iap11	180.0Mbps	240.0Mbps	-51		0:06:01	Stats AC
□	e0:f8:47:21:7e:5a	10.100.25.47	xir-wlan		25	2	iap7	14.0Mbps	78.0Mbps	-46		4:00:05	Stats AC

Figure 70. Stations

You may sort the rows based on any column that has an active column header, indicated when the mouse pointer changes to the hand icon 🖑. Click again to reverse the sort order. You may select a specific station and perform one of the following actions by clicking the associated button:

- **Deny Access:** Sends a de-authentication frame to the selected station and explicitly denies it access by adding its MAC address to the Deny List in the Access Control List window. To permit access again, go to "Access Control List" on page 227 and delete the station from the **Deny** list.
- **Deauthenticate:** Sends a de-authentication frame to the selected station. The station may re-authenticate.

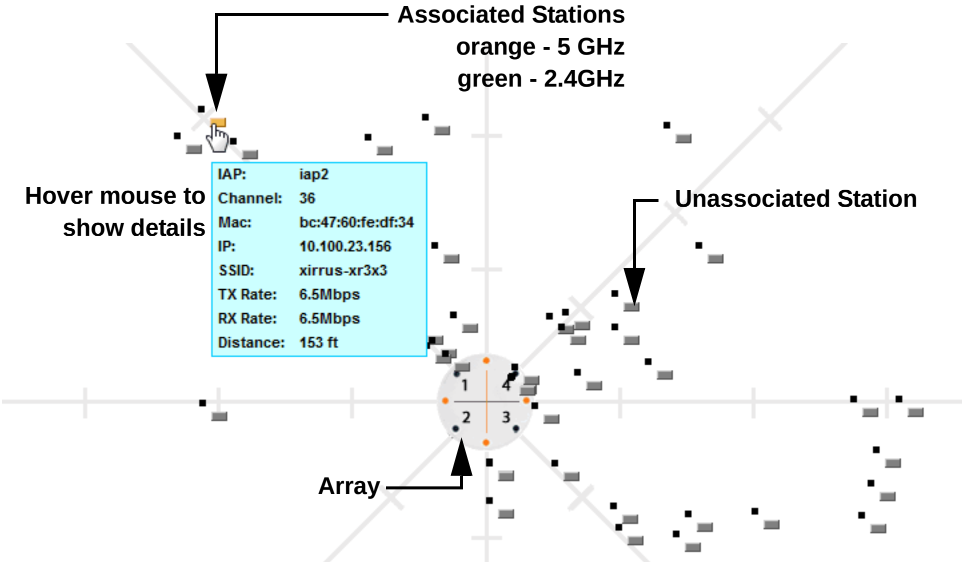
Click on the **Refresh** button to refresh the station list, or click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

See Also

Access Control List
Station Status Windows

Location Map

The Location Map shows the approximate locations of stations relative to this Array. The location of each station is computed based on the RSSI of its signal as received by the Array. The distance is adjusted based on the environment setting that you selected. You may display just the stations associated to this Array, unassociated stations (shown in gray), or both. The station count is shown on the right, above the map. You may also choose to display only 5 GHz stations (shown in orange) or 2.4 GHz stations (shown in green), or both.



IAP:	iap2
Channel:	36
Mac:	bc:47:60:fe:df:34
IP:	10.100.23.156
SSID:	xirrus-xr3x3
TX Rate:	6.5Mbps
RX Rate:	6.5Mbps
Distance:	153 ft

Figure 71. Location Map

The map and Array are shown as if you were looking down on the Array from above, say from a skylight on the roof. Thus the positions of the radios are a mirror image of the way they are typically drawn when looking at the face of the Array. Radios are marked on the map to show the orientation of the Array.

A station is identified by the type of **Preferred Label** that you select: **Netbios Name**, **IP Address**, **MAC Address**, or **Manufacturer**. If multiple stations are near each other, they will be displayed slightly offset so that one station does not completely obscure another. You may minimize a station that is not of interest by clicking it. There is also a **Minimize All** button.

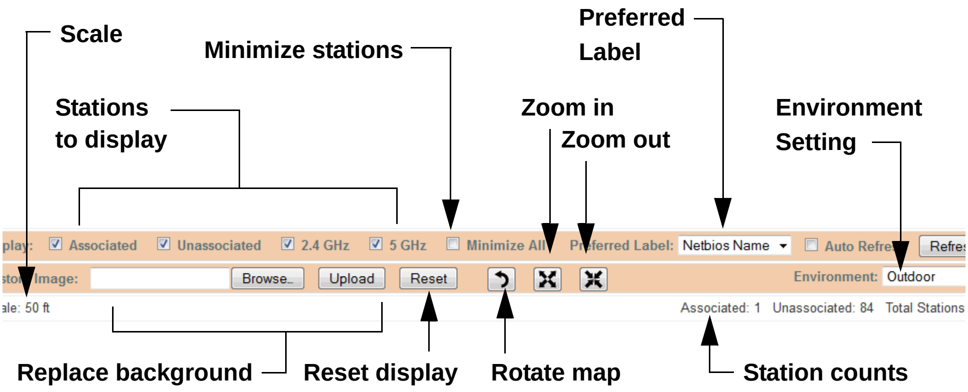
You may replace the range-finder background image above with your own custom image of the floorplan of the area served by the Array—see "Working with the Custom Image" on page 131

Hover the mouse over a station to show detailed information. (Figure 71) For a station that is associated to this Array, the details include:

- The **IAP, Channel**, and **SSID** to which the station is associated.
- The **MAC** and **IP** address and **Netbios** name of the station.
- The **TX Rate** and **RX Rate** of this connection.
- The approximate **Distance** of this station from the Array. The distance is estimated using the received signal strength and your environment setting. The environment determines the typical signal attenuation due to walls and other construction that affect signal reception.

Controls and items displayed on the Location Map window

The Location Map has its own scroll bars in addition to the browser's scroll bars. If you narrow the browser window, the map's scroll bar may be hidden. Use the browser's bottom scroll bar if you need to move it into view.



play: ☑ Associated ☑ Unassociated ☑ 2.4 GHz ☑ 5 GHz □ Minimize All Preferred Label: Netbios Name ▾ □ Auto Refre Refres

stom Image: Environment: Outdoor

ale: 50 ft Associated: 1 Unassociated: 84 Total Stations

Figure 72. Controls for Location Map

- **Display Associated/Unassociated**: Select whether to display stations that are associated to the Array, stations that are not associated, or both.
- **Display 2.4 GHz/5 GHz**: Select whether to display 802.11bgn stations, or 802.11an stations, or both.
- **Preferred Label**: This field is located on the top of the window towards the right. It selects the type of label to be displayed for stations: **Netbios Name**, **IP Address**, **MAC Address**, or **Manufacturer**. If you select NetBIOS (this is the default), then that name, if known, will be used to label each Array. Else, its IP or MAC address will be used, in that order.
- **Auto Refresh:** Instructs the Array to refresh this window automatically.
- **Refresh:** Updates the stations displayed.

- **Custom Image**: Use this feature to replace the default background image with your own image of the floor plan of your location. Click the **Browse** button and browse to the desired file on your computer. This may be a .gif, .jpg, .jpeg., .png, .htm, or .html file. The scale of the file should be 100 feet per inch. Then click **Upload** (see below). For more information on using the custom, image, see "Working with the Custom Image" on page 131.
- **Upload**: After browsing to the desired custom image, click the **Upload** button to install it. The map is redisplayed with your new background. No hash marks (for the map scale) are added to the image display.
- **Reset**: Click this button to restore the map display to the factory settings. All attributes are restored—including the stations selected for display, the scale, the rotation, and the background map.
- **Rotate**: Click this button to rotate the orientation of the entire map. It rotates the map 45^{o} counter-clockwise.
- **Enlarge**: Click this button to enlarge (zoom in on) the map. The displayed **Scale** is updated with the new scale for the map.
- **Reduce**: Click this button to reduce (zoom out on) the map. The displayed **Scale** is updated with the new scale for the map.

- **Environment**: This field is located on the top right of the window. Select the type of environment for this Array's deployment: **Indoor open** (few walls or obstructions), **Indoor walled** (typical wall or cubicle construction), or **Indoor dense** (many walls or obstructions, or unusually dense walls).
- **Scale**: This view-only value shows the approximate distance represented by each hashmark on the default map background.
- **Associated**, **Unassociated**, **Total Stations**: These view-only values show the station counts observed by the Array.

See Also

Station Status Windows

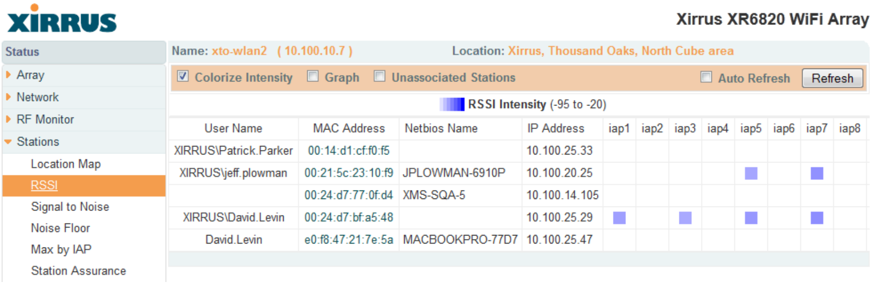
Working with the Custom Image

After you have uploaded a custom image (see **Custom Image** and **Upload** in "Controls and items displayed on the Location Map window" on page 129), you should move the display of the Array on your map to correspond with its actual location at your site.

To move the Array on the map, simply click it, then drag and drop it to the desired location. The Array will continue to follow the mouse pointer to allow you to make further changes to its location. When you are satisfied with its location, click the Array again to return to normal operation.

RSSI

For each station that is associated to the Array, the RSSI (Received Signal Strength Indicator) window shows the station's RSSI value as measured by each IAP. In other words, the window shows the strength of the station's signal at each radio. You may choose to display **Unassociated Stations** as well with a checkbox at the bottom of the window.



Name: xto-wlan2 (10.100.10.7)   Location: Xirrus, Thousand Oaks, North Cube area

☑ Colorize Intensity ☐ Graph ☐ Unassociated Stations ☐ Auto Refresh

RSSI Intensity (-95 to -20)

User Name	MAC Address	Netbios Name	IP Address	iap1	iap2	iap3	iap4	iap5	iap6	iap7	iap8
XIRRUS\Patrick.Parker	00:14:d1:cf:f0:f5		10.100.25.33								
XIRRUS\jeff.plowman	00:21:5c:23:10:f9	JPLOWMAN-6910P	10.100.20.25					■		■	
	00:24:d7:77:0f:d4	XMS-SQA-5	10.100.14.105								
XIRRUS\David.Levin	00:24:d7:bf:a5:48		10.100.25.29	■		■		■		■	
David.Levin	e0:f8:47:21:7e:5a	MACBOOKPRO-77D7	10.100.25.47								

Figure 73. Station RSSI Values

By default, the RSSI is displayed numerically. You may display the relative strength using color if you select **Colorize Intensity**, with the strongest signals indicated by the most intense color. (Figure 73) If you select **Graph**, then the RSSI is shown on a representation of the Array, either colorized or numerically based on your selection. (Figure 74) The stations are listed to the left of the Array—click on a station to show its RSSI values on the Array.

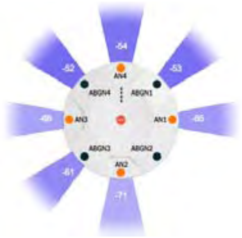


Figure 74. Station RSSI Values—Colorized Graphical View

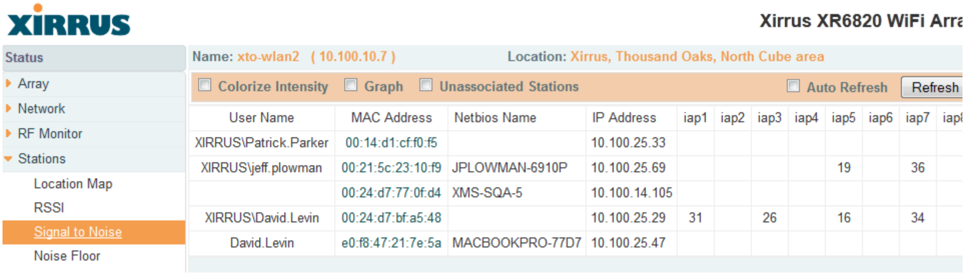
In either graphical or tabular view, you may sort the rows based on any column that has an active column header, indicated when the mouse pointer changes to the hand icon 👆. Click on the **Refresh** button to refresh the station list, or click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

See Also

Station Status Windows
RF Monitor Windows

Signal-to-Noise Ratio (SNR)

For each station that is associated to the Array, the Signal-to-Noise Ratio (SNR) window shows the station's SNR value as measured by each IAP. In other words, the window shows the SNR of the station's signal at each IAP radio. The signal-to-noise ratio can be very useful for determining the cause of poor performance at a station. A low value means that action may need to be taken to reduce sources of noise in the environment and/or improve the signal from the station.



Name: xto-wlan2 (10.100.10.7) Location: Xirrus, Thousand Oaks, North Cube area

User Name	MAC Address	Netbios Name	IP Address	iap1	iap2	iap3	iap4	iap5	iap6	iap7	iap
XIRRUS\Patrick.Parker	00:14:d1:cf:f0:f5		10.100.25.33								
XIRRUS\jeff.plowman	00:21:5c:23:10:f9	JPLOWMAN-6910P	10.100.25.69					19		36	
	00:24:d7:77:0f:d4	XMS-SQA-5	10.100.14.105								
XIRRUS\David.Levin	00:24:d7:bf:a5:48		10.100.25.29	31		26		16		34	
David.Levin	e0:f8:47:21:7e:5a	MACBOOKPRO-77D7	10.100.25.47								

Figure 75. Station Signal-to-Noise Ratio Values

You may choose to display **Unassociated Stations** as well with a checkbox at the bottom of the window.

By default, the SNR is displayed numerically. (Figure 75) You may display the relative value using color if you select **Colorize Intensity**, with the highest SNR indicated by the most intense color. (Figure 76) If you select **Graph**, then the SNR is shown on a representation of the Array, either colorized or numerically based on your selection. The stations are listed to the left of the Array—click on a station to show its SNR values on the Array.

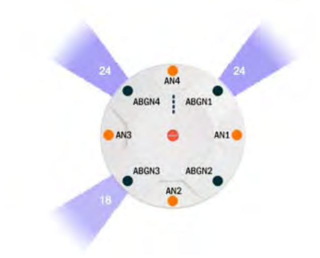


Figure 76. Station SNR Values—Colorized Graphical View

In either graphical or tabular view, you may sort the rows based on any column that has an active column header, indicated when the mouse pointer changes to the hand icon ☝. Click on the **Refresh** button to refresh the station list, or click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

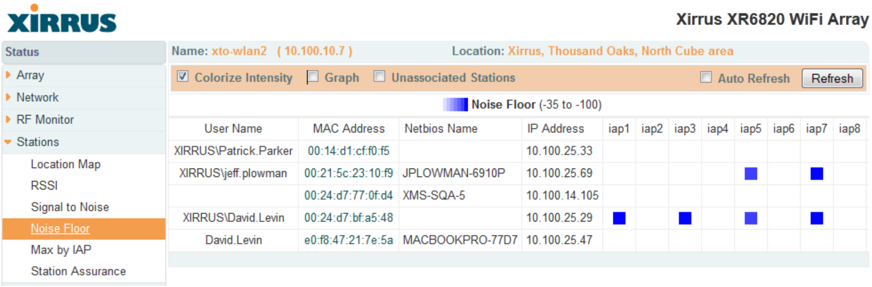
See Also

Station Status Windows

RF Monitor Windows

Noise Floor

For each station that is associated to the Array, the Noise Floor window shows the ambient noise affecting a station’s signal as measured by each IAP. The noise floor is the RSSI value when the station is not transmitting, sometimes called a Silence value. In other words, the window shows the noise floor of the station’s signal at each IAP radio. The noise floor value can be very useful for characterizing the environment of a station to determine the cause of poor performance. A relatively high value means that action may need to be taken to reduce sources of noise in the environment.



Name: xto-wlan2 (10.100.10.7) Location: Xirrus, Thousand Oaks, North Cube area

☑ Colorize Intensity □ Graph □ Unassociated Stations □ Auto Refresh

Noise Floor (-35 to -100)

User Name	MAC Address	Netbios Name	IP Address	iap1	iap2	iap3	iap4	iap5	iap6	iap7	iap8
XIRRUS\Patrick.Parker	00:14:d1:cf:f0:f5		10.100.25.33								
XIRRUS\jeff.plowman	00:21:5c:23:10:f9	JPLOWMAN-6910P	10.100.25.69					■		■	
	00:24:d7:77:0f:d4	XMS-SQA-5	10.100.14.105								
XIRRUS\David.Levin	00:24:d7:bf:a5:48		10.100.25.29	■		■		■		■	
David.Levin	e0:f8:47:21:7e:5a	MACBOOKPRO-77D7	10.100.25.47								

Figure 77. Station Noise Floor Values

You may choose to display **Unassociated Stations** as well with a checkbox at the bottom of the window.

By default, the noise floor is displayed numerically. (Figure 77) You may display the relative value using color if you select **Colorize Intensity**, with the highest noise indicated by the most intense color. If you select **Graph**, then the ambient noise is shown on a representation of the Array, either colorized or numerically based on your selection.(Figure 78) The stations are listed to the left of the Array—click on a station to show its values on the Array.

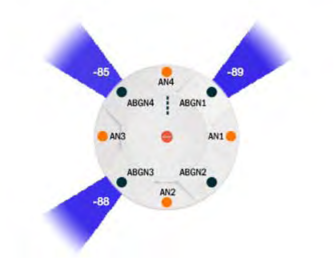


Figure 78. Station Noise Floor Values—Colorized Graphical View

In either graphical or tabular view, you may sort the rows based on any column that has an active column header, indicated when the mouse pointer changes to the hand icon 👆. Click on the **Refresh** button to refresh the station list, or click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

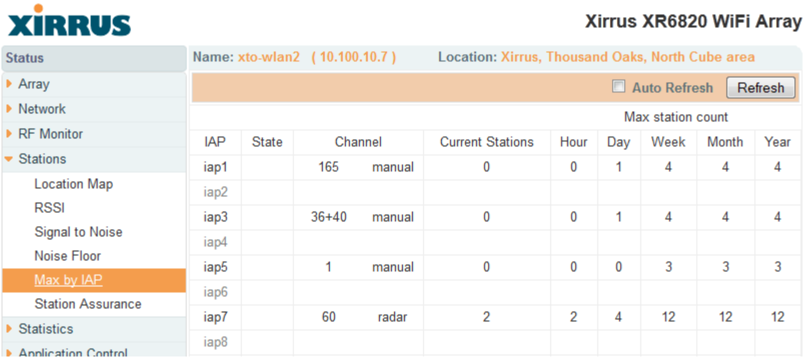
See Also

Station Status Windows

RF Monitor Windows

Max by IAP

This status-only window shows the maximum number of client stations that have historically been associated to the Array. For each IAP, the list shows the IAP's state and channel number, the current number of stations associated, and the highest number of stations that have been associated over various periods of time: hour, day, week, month, and year. In other words, the Max Station Count shows the "high water mark" over the selected period of time—the maximum count of stations for the selected period, rather than a cumulative count of all stations that have associated. This information aids in network administration and in planning for additional capacity.



Xirrus XR6820 WiFi Array

Name: xto-wlan2 (10.100.10.7) Location: Xirrus, Thousand Oaks, North Cube area

					Max station count				
IAP	State	Channel		Current Stations	Hour	Day	Week	Month	Year
iap1		165	manual	0	0	1	4	4	4
iap2									
iap3		36+40	manual	0	0	1	4	4	4
iap4									
iap5		1	manual	0	0	0	3	3	3
iap6									
iap7		60	radar	2	2	4	12	12	12
iap8									

Figure 79. Max by IAP

You may click an IAP to go to the IAP Settings window. Click on the **Refresh** button to refresh the station list, or click **Auto Refresh** to instruct the Array to refresh this window automatically.

See Also

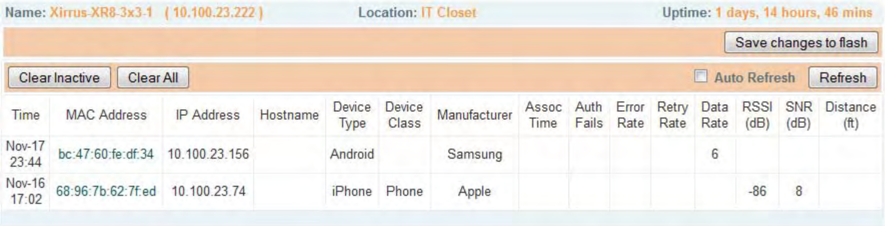
IAPs

Station Status Windows

Station Assurance

Station assurance monitors the quality of the connections that users are experiencing on the wireless network. This window shows client stations that have had connectivity issues. You may enable or disable the station assurance feature and set thresholds for the problems that it checks, such as excessive packet retry or packet error rates, or stations that are unable to stay associated to the Array. Please see “Station Assurance” on page 320 for more information about these settings. When the Array detects that a station has reached the threshold value for one or more of the issues checked, it adds the station to this page. In addition, an event is triggered, a trap is generated, and a Syslog message is logged.

For each station, this list shows the MAC address, its IP address, its host name, its device type, device class, and manufacturer. It also shows the values of the various statistics that were monitored for problems as described in “Station Assurance” on page 320: associated time, authentication failures, packet error rate, packet retry rate, packet data rate, RSSI, signal to noise ratio (SNR), and distance.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 14 hours, 46 mins

Time	MAC Address	IP Address	Hostname	Device Type	Device Class	Manufacturer	Assoc Time	Auth Fails	Error Rate	Retry Rate	Data Rate	RSSI (dB)	SNR (dB)	Distance (ft)
Nov-17 23:44	bc:47:60:fe:df:34	10.100.23.156		Android		Samsung					6			
Nov-16 17:02	68:96:7b:62:7f:ed	10.100.23.74		iPhone	Phone	Apple						-86	8	

Figure 80. Station Assurance

You may click the **Clear Inactive** button to remove stations that are no longer connected to the Array from the list. Click the **Clear All** button to remove all entries and start fresh to add problem stations to the list as they are detected. Click on the **Refresh** button to refresh the station list, or click **Auto Refresh** to instruct the Array to refresh this window automatically.

See Also

IAPs

Station Status Windows

Station Assurance

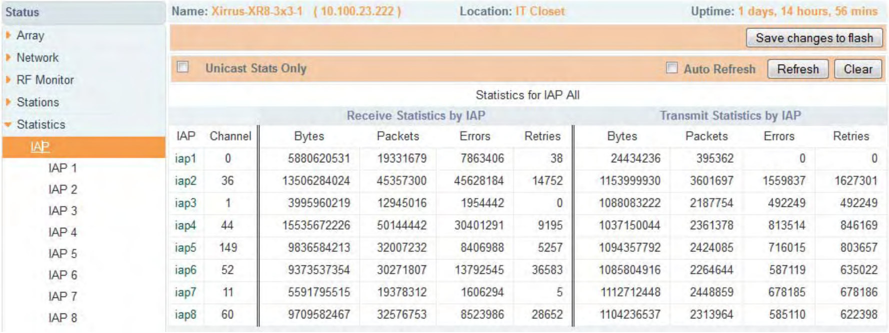
Statistics Windows

The following Array Statistics windows are available:

- **IAP Statistics Summary**—provides an overview of the statistical data associated with all IAPs. Expands to show links for displaying detailed statistics for individual IAPs.
- **Per-IAP Statistics**—provides detailed statistics for an individual IAP.
- **Network Statistics**—displays statistical data associated with each network (Ethernet) interface.
- **VLAN Statistics**—provides statistical data associated with your assigned VLANs.
- **WDS Statistics**—provides statistical data for all WDS client and host links.
- **Filter Statistics**—provides statistical data for all configured filters.
- **Station Statistics**—provides statistical data associated with each station.

IAP Statistics Summary

This is a status only window that provides an overview of the statistical data associated with all IAPs. It also shows the channel used by each IAP. For detailed statistics for a specific IAP, see "Per-IAP Statistics" on page 141. Click the **Unicast Stats Only** checkbox on the lower left to filter the results, or clear the checkbox to show statistics for all wireless traffic.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 14 hours, 56 mins

□ Unicast Stats Only

Statistics for IAP All

		Receive Statistics by IAP				Transmit Statistics by IAP			
IAP	Channel	Bytes	Packets	Errors	Retries	Bytes	Packets	Errors	Retries
iap1	0	5880620531	19331679	7863406	38	24434236	395362	0	0
iap2	36	13506284024	45357300	45628184	14752	1153999930	3601697	1559837	1627301
iap3	1	3995960219	12945016	1954442	0	1088083222	2187754	492249	492249
iap4	44	15535672226	50144442	30401291	9195	1037150044	2361378	813514	846169
iap5	149	9836584213	32007232	8406988	5257	1094357792	2424085	716015	803657
iap6	52	9373537354	30271807	13792545	36583	1085804916	2264644	587119	635022
iap7	11	5591795515	19378312	1606294	5	1112712448	2448859	678185	678186
iap8	60	9709582467	32576753	8523986	28652	1104236537	2313964	585110	622398

Figure 81. IAP Statistics Summary Page

You can **Refresh** the data (update the window with the latest information) or **Clear** the data (reset all content to zero and begin counting again) at any time by clicking on the appropriate button. You can also click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

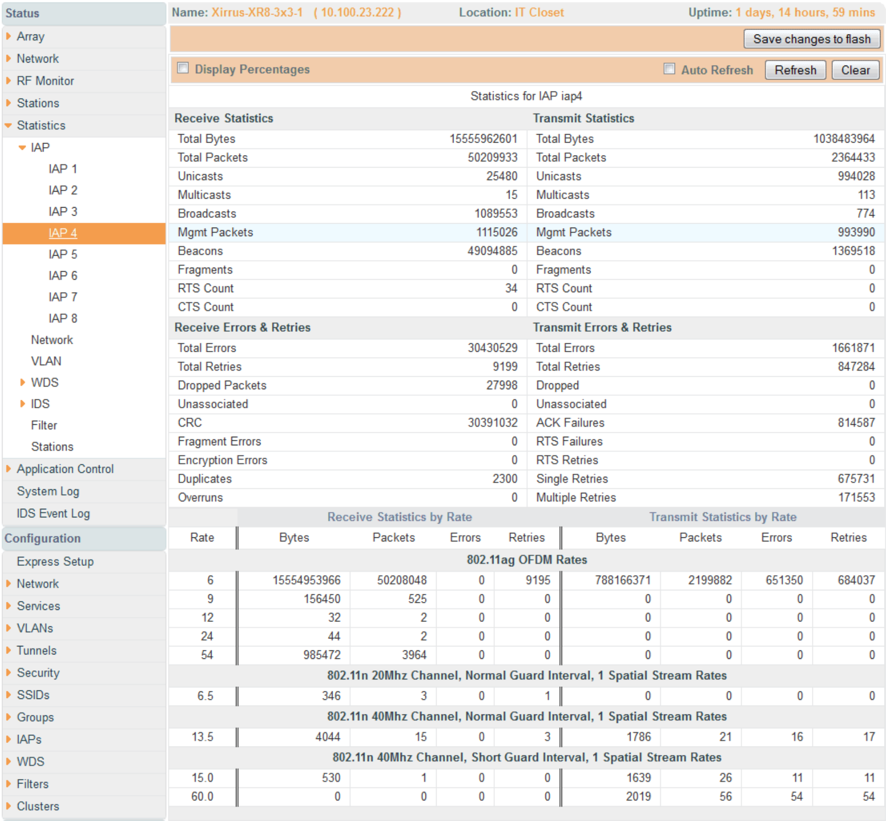
See Also

System Log Window
Global Settings (IAP)
Global Settings .11an
Global Settings .11bgn
IAPs

Per-IAP Statistics

This is a status only window that provides detailed statistics for the selected IAP. If you click the link for **IAP All** in the left frame, each detailed statistic field will show the sum of that statistic for all IAPs. For a summary of statistics for all IAPs, see "IAP Statistics Summary" on page 140. Use the **Display Percentages** checkbox at the lower left to select the output format—check this option to express each statistic as a percentage of the total at the top of the column, or leave it blank to display raw numbers.

A quick way to display the statistics for a particular IAP is by clicking the Array graphic at the bottom left of the WMI window. Click the desired IAP, and the selected statistics will be displayed. See "User Interface" on page 88.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 14 hours, 59 mins

Statistics for IAP iap4

Receive Statistics		Transmit Statistics	
Total Bytes	15555962601	Total Bytes	1038483964
Total Packets	50209933	Total Packets	2364433
Unicasts	25480	Unicasts	994028
Multicasts	15	Multicasts	113
Broadcasts	1089553	Broadcasts	774
Mgmt Packets	1115026	Mgmt Packets	993990
Beacons	49094885	Beacons	1369518
Fragments	0	Fragments	0
RTS Count	34	RTS Count	0
CTS Count	0	CTS Count	0
Receive Errors & Retries		**Transmit Errors & Retries**	
Total Errors	30430529	Total Errors	1661871
Total Retries	9199	Total Retries	847284
Dropped Packets	27998	Dropped	0
Unassociated	0	Unassociated	0
CRC	30391032	ACK Failures	814587
Fragment Errors	0	RTS Failures	0
Encryption Errors	0	RTS Retries	0
Duplicates	2300	Single Retries	675731
Overruns	0	Multiple Retries	171553

	Receive Statistics by Rate				Transmit Statistics by Rate			
Rate	Bytes	Packets	Errors	Retries	Bytes	Packets	Errors	Retries
802.11ag OFDM Rates								
6	15554953966	50208048	0	9195	788166371	2199882	651350	684037
9	156450	525	0	0	0	0	0	0
12	32	2	0	0	0	0	0	0
24	44	2	0	0	0	0	0	0
54	985472	3964	0	0	0	0	0	0
802.11n 20Mhz Channel, Normal Guard Interval, 1 Spatial Stream Rates								
6.5	346	3	0	1	0	0	0	0
802.11n 40Mhz Channel, Normal Guard Interval, 1 Spatial Stream Rates								
13.5	4044	15	0	3	1786	21	16	17
802.11n 40Mhz Channel, Short Guard Interval, 1 Spatial Stream Rates								
15.0	530	1	0	0	1639	26	11	11
60.0	0	0	0	0	2019	56	54	54

Figure 82. Individual IAP Statistics Page

You can **Refresh** the data (update the window with the latest information) or **Clear** the data (reset all content to zero and begin counting again) at any time by clicking on the appropriate button. You can also click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

See Also

System Log Window

Global Settings (IAP)

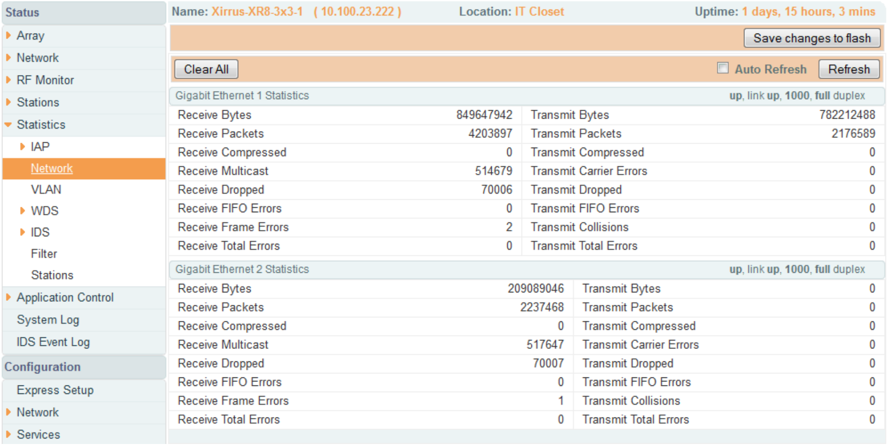
Global Settings .11an

Global Settings .11bgn

IAPs

Network Statistics

This is a status only window that allows you to review statistical data associated with each network (Ethernet) interface and its activity. You can **Refresh** the data (update the window with the latest information) or **Clear** the data (reset all content to zero and begin counting again) at any time by clicking on the appropriate button. You can also click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically. If you are experiencing problems on the Array, you may also want to print this window for your records



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 15 hours, 3 mins

Gigabit Ethernet 1 Statistics — up, link up, 1000, full duplex

Receive Bytes	849647942	Transmit Bytes	782212488
Receive Packets	4203897	Transmit Packets	2176589
Receive Compressed	0	Transmit Compressed	0
Receive Multicast	514679	Transmit Carrier Errors	0
Receive Dropped	70006	Transmit Dropped	0
Receive FIFO Errors	0	Transmit FIFO Errors	0
Receive Frame Errors	2	Transmit Collisions	0
Receive Total Errors	0	Transmit Total Errors	0

Gigabit Ethernet 2 Statistics — up, link up, 1000, full duplex

Receive Bytes	209089046	Transmit Bytes	0
Receive Packets	2237468	Transmit Packets	0
Receive Compressed	0	Transmit Compressed	0
Receive Multicast	517647	Transmit Carrier Errors	0
Receive Dropped	70007	Transmit Dropped	0
Receive FIFO Errors	0	Transmit FIFO Errors	0
Receive Frame Errors	1	Transmit Collisions	0
Receive Total Errors	0	Transmit Total Errors	0

Figure 83. Network Statistics

See Also

DHCP Server

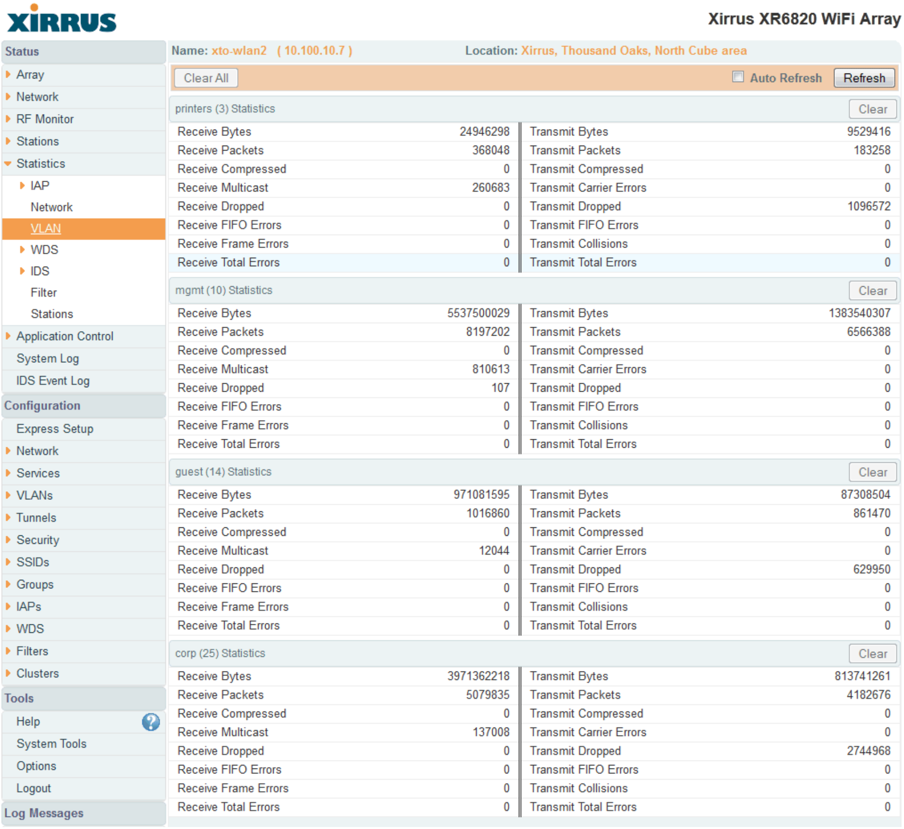
DNS Settings

Network

Network Interfaces

VLAN Statistics

This is a status only window that allows you to review statistical data associated with your assigned VLANs. You can refresh the information that is displayed on this page at any time by clicking on the **Refresh** button, or select the **Auto Refresh** option for this window to refresh automatically. The **Clear All** button at the lower left allows you to clear (zero out) all VLAN statistics.



Name: xto-wlan2 (10.100.10.7) Location: Xirrus, Thousand Oaks, North Cube area

☐ Auto Refresh

printers (3) Statistics — Clear

Receive Bytes	24946298	Transmit Bytes	9529416
Receive Packets	368048	Transmit Packets	183258
Receive Compressed	0	Transmit Compressed	0
Receive Multicast	260683	Transmit Carrier Errors	0
Receive Dropped	0	Transmit Dropped	1096572
Receive FIFO Errors	0	Transmit FIFO Errors	0
Receive Frame Errors	0	Transmit Collisions	0
Receive Total Errors	0	Transmit Total Errors	0

mgmt (10) Statistics — Clear

Receive Bytes	5537500029	Transmit Bytes	1383540307
Receive Packets	8197202	Transmit Packets	6566388
Receive Compressed	0	Transmit Compressed	0
Receive Multicast	810613	Transmit Carrier Errors	0
Receive Dropped	107	Transmit Dropped	0
Receive FIFO Errors	0	Transmit FIFO Errors	0
Receive Frame Errors	0	Transmit Collisions	0
Receive Total Errors	0	Transmit Total Errors	0

guest (14) Statistics — Clear

Receive Bytes	971081595	Transmit Bytes	87308504
Receive Packets	1016860	Transmit Packets	861470
Receive Compressed	0	Transmit Compressed	0
Receive Multicast	12044	Transmit Carrier Errors	0
Receive Dropped	0	Transmit Dropped	629950
Receive FIFO Errors	0	Transmit FIFO Errors	0
Receive Frame Errors	0	Transmit Collisions	0
Receive Total Errors	0	Transmit Total Errors	0

corp (25) Statistics — Clear

Receive Bytes	3971362218	Transmit Bytes	813741261
Receive Packets	5079835	Transmit Packets	4182676
Receive Compressed	0	Transmit Compressed	0
Receive Multicast	137008	Transmit Carrier Errors	0
Receive Dropped	0	Transmit Dropped	2744968
Receive FIFO Errors	0	Transmit FIFO Errors	0
Receive Frame Errors	0	Transmit Collisions	0
Receive Total Errors	0	Transmit Total Errors	0

Figure 84. VLAN Statistics

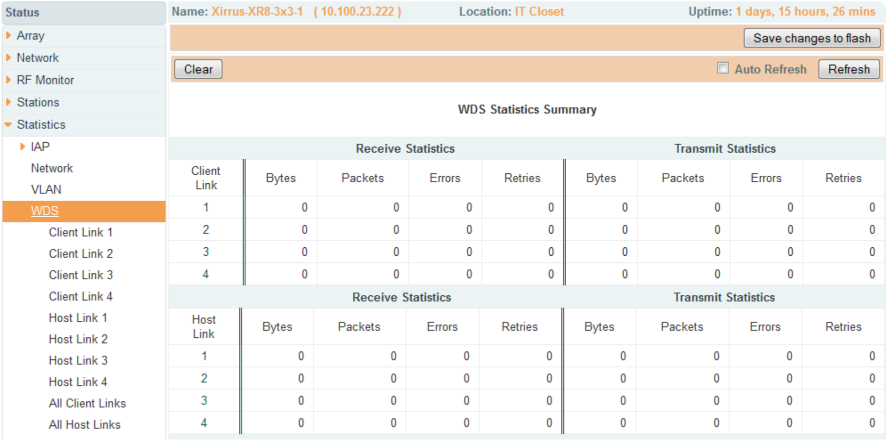
See Also

VLAN Management

VLANs

WDS Statistics

The main WDS Statistics window provides statistical data for all WDS client and host links. To access data about a specific WDS client or host link, simply click on the desired link in the left frame to access the appropriate window. You may also choose to view a sum of the statistics for all client links, all host links, or all links (both client and host links).



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 15 hours, 26 mins

WDS Statistics Summary

	Receive Statistics				Transmit Statistics			
Client Link	Bytes	Packets	Errors	Retries	Bytes	Packets	Errors	Retries
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0

	Receive Statistics				Transmit Statistics			
Host Link	Bytes	Packets	Errors	Retries	Bytes	Packets	Errors	Retries
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0

Figure 85. WDS Statistics

See Also

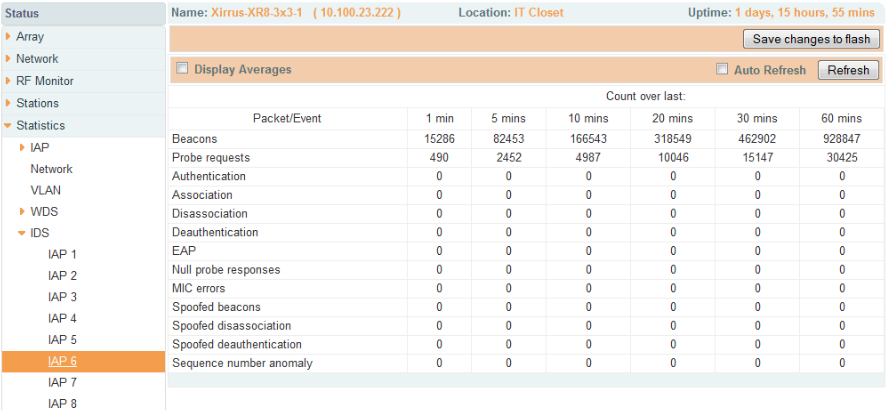
SSID Management

WDS

IDS Statistics

The Xirrus Array employs a number of IDS/IPS (Intrusion Detection System/ Intrusion Prevention System) strategies to detect and prevent malicious attacks on the wireless network. This status-only window provides detailed intrusion detection statistics for the selected IAP. Use the **Display Averages** checkbox at the upper left to select the output format—check this option to express each statistic as an average rate, or leave it blank to display raw counts.

Note that you must have **Intrusion Detection Mode** enabled to collect IDS statistics. See "Intrusion Detection" on page 328. Information about IDS events is discussed in the "IDS Event Log Window" on page 157



Name: Xirrus-XR8-3x3-1 (10.100.23.222)   Location: IT Closet   Uptime: 1 days, 15 hours, 55 mins

□ Display Averages   □ Auto Refresh

Count over last:

Packet/Event	1 min	5 mins	10 mins	20 mins	30 mins	60 mins
Beacons	15286	82453	166543	318549	462902	928847
Probe requests	490	2452	4987	10046	15147	30425
Authentication	0	0	0	0	0	0
Association	0	0	0	0	0	0
Disassociation	0	0	0	0	0	0
Deauthentication	0	0	0	0	0	0
EAP	0	0	0	0	0	0
Null probe responses	0	0	0	0	0	0
MIC errors	0	0	0	0	0	0
Spoofed beacons	0	0	0	0	0	0
Spoofed disassociation	0	0	0	0	0	0
Spoofed deauthentication	0	0	0	0	0	0
Sequence number anomaly	0	0	0	0	0	0

Figure 86. IDS Statistics Page

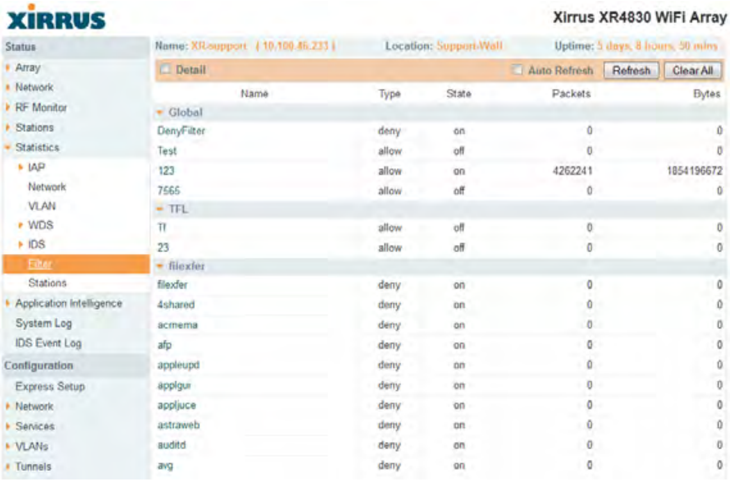
You can **Refresh** the data (update the window with the latest information) at any time by clicking on the appropriate button. You can also click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

See Also

Intrusion Detection
IDS Event Log Window

Filter Statistics

The Filter Statistics window provides statistical data for all configured filters. The name, state (enabled—on or off), and type (allow or deny) of each filter is shown. For enabled filters, this window shows the number of packets and bytes that met the filter criteria. Click on a column header to sort the rows based on that column. Click on a filter name to edit the filter settings.



Name: XR-support (10.100.46.233) Location: Support-Wall Uptime: 5 days, 8 hours, 50 mins

Name	Type	State	Packets	Bytes
Global				
DenyFilter	deny	on	0	0
Test	allow	off	0	0
123	allow	on	4262241	1854196672
7565	allow	off	0	0
TFL				
Tf	allow	off	0	0
23	allow	off	0	0
filexfer				
filexfer	deny	on	0	0
4shared	deny	on	0	0
acmema	deny	on	0	0
afp	deny	on	0	0
appleupd	deny	on	0	0
applgui	deny	on	0	0
appljuce	deny	on	0	0
astraweb	deny	on	0	0
auditd	deny	on	0	0
avg	deny	on	0	0

Figure 87. Filter Statistics

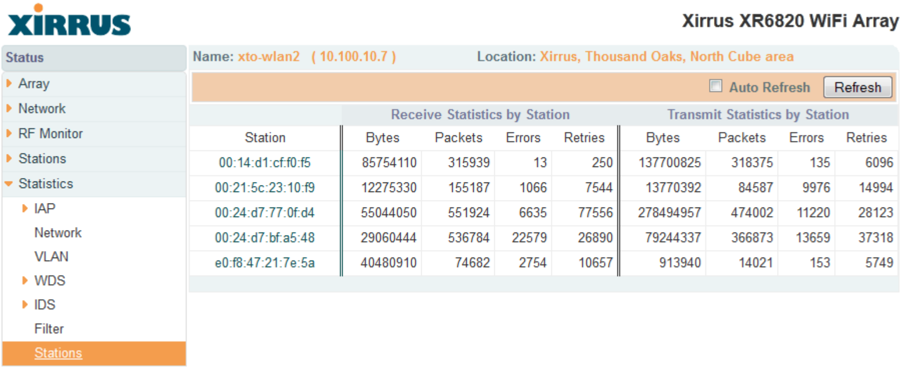
See Also

Filters

Application Control Windows

Station Statistics

This status-only window provides an overview of statistical data for all stations. Stations are listed by MAC address, and Receive and Transmit statistics are summarized for each. For detailed statistics for a specific station, click the desired MAC address in the **Station** column and see “Per-Station Statistics” on page 149.



Name: xto-wlan2 (10.100.10.7) Location: Xirrus, Thousand Oaks, North Cube area

	Receive Statistics by Station				Transmit Statistics by Station			
Station	Bytes	Packets	Errors	Retries	Bytes	Packets	Errors	Retries
00:14:d1:cf:f0:f5	85754110	315939	13	250	137700825	318375	135	6096
00:21:5c:23:10:f9	12275330	155187	1066	7544	13770392	84587	9976	14994
00:24:d7:77:0f:d4	55044050	551924	6635	77556	278494957	474002	11220	28123
00:24:d7:bf:a5:48	29060444	536784	22579	26890	79244337	366873	13659	37318
e0:f8:47:21:7e:5a	40480910	74682	2754	10657	913940	14021	153	5749

Figure 88. Station Statistics

Note that you can clear the data for an individual station (see Per-Station Statistics), but you cannot clear the data for all stations using this window.

You can **Refresh** the data (update the window with the latest information) at any time by clicking on the appropriate button. You can also click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

See Also

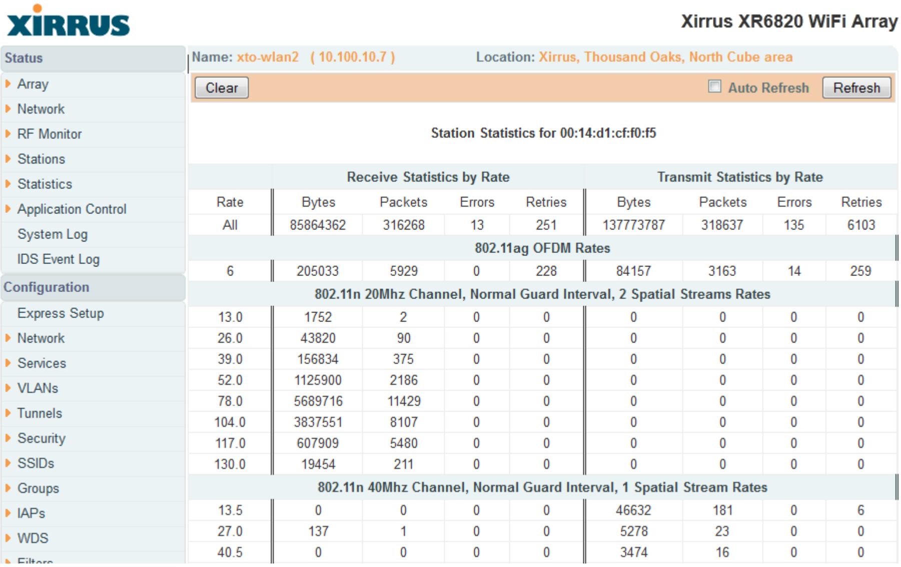
Per-Station Statistics

Per-Station Statistics

This window provides detailed statistics for the selected station. This window is accessed from the Station Statistics window—click the MAC address of the desired entry in the **Station** column to display its Per-Station Statistics window.

Receive and Transmit statistics are listed by **Rate**—this is the data rate in Mbps. For a summary of statistics for all stations, see “Station Statistics” on page 148.

You can **Refresh** the data (update the window with the latest information) or **Clear** the data (reset all content to zero and begin counting again) at any time by clicking on the appropriate button. You can also click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.



Name: xto-wlan2 (10.100.10.7) Location: Xirrus, Thousand Oaks, North Cube area

Station Statistics for 00:14:d1:cf:f0:f5

	Receive Statistics by Rate				Transmit Statistics by Rate			
Rate	Bytes	Packets	Errors	Retries	Bytes	Packets	Errors	Retries
All	85864362	316268	13	251	137773787	318637	135	6103
802.11ag OFDM Rates								
6	205033	5929	0	228	84157	3163	14	259
802.11n 20Mhz Channel, Normal Guard Interval, 2 Spatial Streams Rates								
13.0	1752	2	0	0	0	0	0	0
26.0	43820	90	0	0	0	0	0	0
39.0	156834	375	0	0	0	0	0	0
52.0	1125900	2186	0	0	0	0	0	0
78.0	5689716	11429	0	0	0	0	0	0
104.0	3837551	8107	0	0	0	0	0	0
117.0	607909	5480	0	0	0	0	0	0
130.0	19454	211	0	0	0	0	0	0
802.11n 40Mhz Channel, Normal Guard Interval, 1 Spatial Stream Rates								
13.5	0	0	0	0	46632	181	0	6
27.0	137	1	0	0	5278	23	0	0
40.5	0	0	0	0	3474	16	0	0

Figure 89. Individual Station Statistics Page

See Also

Station Statistics

Application Control Windows

*This feature is only available if the Array license includes **Application Control**. See **"About Licensing and Upgrades" on page 361**.*

Application Control data is only available from XR Series Array models. It is not available on XN Arrays.

The Application Control feature provides real-time visibility of application usage by users across the wireless network. Network usage has changed enormously in the last few years, with the increase in smartphone and tablet usage stressing networks. Increasing traffic from legitimate business needs such as cloud- and web-based applications, streaming media and VoIP must be handled with an adequate quality of experience.

Application Control is discussed in the following topics:

- **About Application Control**—an overview of this feature.
- **Application Control**—displays information about applications running on the wireless network.
- **Stations (Application Control)**—displays a list of stations. Click one to analyze application control information for only that station.

About Application Control

The Array uses Deep Packet Inspection (DPI) to determine what applications are being used and by whom, and how much bandwidth they are consuming. These applications are rated by their degree of risk and productiveness. Filters may then be put in place to implement per-application policies that keep network usage focused on productive uses:

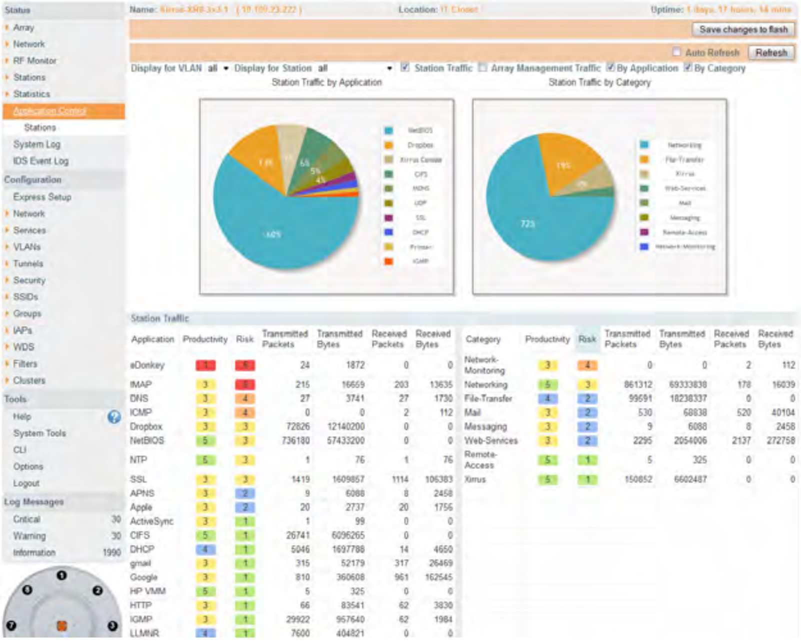
- Usage of non-productive and risky applications like BitTorrent can be restricted using Filters.
- Traffic for mission-critical applications like VoIP and WebEx may be given higher priority (QoS).
- Non- critical traffic from applications like YouTube may be given lower priority (QoS).

- Traffic flows for specific applications may be controlled by sending them into VLANs that are designated for that type of traffic.

Application Control can track application usage over time to monitor trends. Usage may be tracked by Array, VLAN, or station. Many hundreds of applications are recognized and grouped into a number of categories. The distributed architecture of Xirrus Arrays allows Application Control to scale naturally as you grow the network.

Application Control

This display-only window provides a snapshot of the application usage on your Array. In order to view the Application Control window, the Array must have a licence that supports this feature, and you must have enabled the **Application Control** option on the **Filter Lists** page (see“Filter Lists” on page 345).



Name: Xirrus-XR8-3x3.1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 17 hours, 14 mins

□ Auto Refresh

Display for VLAN all ▾ Display for Station all ▾ ☑ Station Traffic □ Array Management Traffic ☑ By Application ☑ By Category

Application	Productivity	Risk	Transmitted Packets	Transmitted Bytes	Received Packets	Received Bytes
eDonkey	1	5	24	1872	0	0
IMAP	3	5	215	16659	203	13635
DNS	3	4	27	3741	27	1730
ICMP	3	4	0	0	2	112
Dropbox	3	3	72826	12140200	0	0
NetBIOS	5	3	736180	57433200	0	0
NTP	5	3	1	76	1	76
SSL	3	3	1419	1609857	1114	106383
APNS	3	2	9	6088	8	2458
Apple	3	2	20	2737	20	1756
ActiveSync	3	1	1	99	0	0
CIFS	5	1	26741	6096265	0	0
DHCP	4	1	5046	1697788	14	4650
gmail	3	1	315	52179	317	26469
Google	3	1	810	360608	961	162545
HP VMM	5	1	5	325	0	0
HTTP	3	1	66	83541	62	3830
IGMP	3	1	29922	957640	62	1984
LLMNR	4	1	7600	404821	0	0

Category	Productivity	Risk	Transmitted Packets	Transmitted Bytes	Received Packets	Received Bytes
Network-Monitoring	3	4	0	0	2	112
Networking	5	3	861312	69333838	178	16039
File-Transfer	4	2	99691	18238337	0	0
Mail	3	2	530	68838	520	40104
Messaging	3	2	9	6088	8	2458
Web-Services	3	2	2295	2054006	2137	272758
Remote-Access	5	1	5	325	0	0
Xirrus	5	1	150852	6602487	0	0

Figure 90. Application Control

The Application Control window has three sections:

- **Selection Criteria** allow you to choose the type of data to show, and to filter for a single VLAN or station.
- **Pie Charts** present a color coded at-a-glance view of the top ten applications being used by the network.
- **Traffic Tables** beneath the pie charts list the applications in use along with traffic statistics. Unique **Productivity** and **Risk** ratings let you easily assess the nature of applications in use, so that you can take action using Filter Management.

Selection Criteria

At the top of the window, the options in the gray ribbon allow you to customize the display with the following choices:

- **Display for VLAN**: Use the drop-down list if you wish to select just one VLAN to analyze, or leave the default value of **all** to see data from all VLANs.
- **Display for Station**: Use the drop-down list if you wish to select just one station to analyze (stations are listed by their MAC address), or leave the default value of **all** to see data from all stations. You may also use the Stations window to select a station to display. See "Stations (Application Control)" on page 155.
- **Station Traffic**: Check this box if you wish to analyze traffic from stations, listing the applications that they are using.
- **Array Management Traffic**: Check this box if you wish to analyze management traffic on this Array, including the load due to functions such as Xirrus Roaming. Tracking traffic into the array on the management side can alert you to nefarious activity—and even to traffic on the wired network that would best be blocked before it hits the Array. You may display both station and Array management traffic, if you wish.
- **By Application**: Check this box if you wish to analyze and list traffic by what specific applications are in use, such as WebEx or BitTorrent.

- **By Category**: Check this box if you wish to analyze and list traffic by what types of applications are in use, such as Games or Collaboration.
- **Auto Refresh** instructs the Array to periodically refresh this window automatically. Use the **Refresh** button to refresh the window right now.

Pie Charts

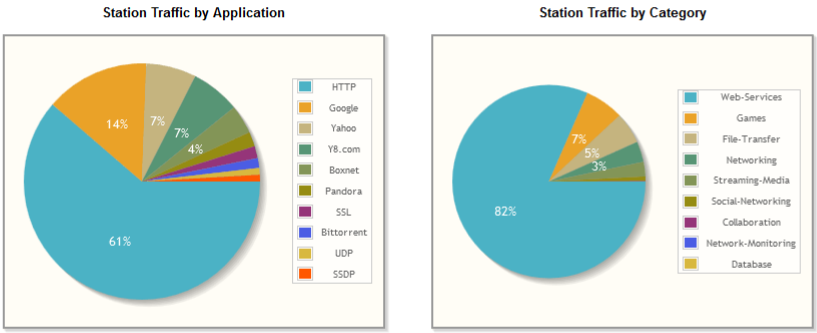
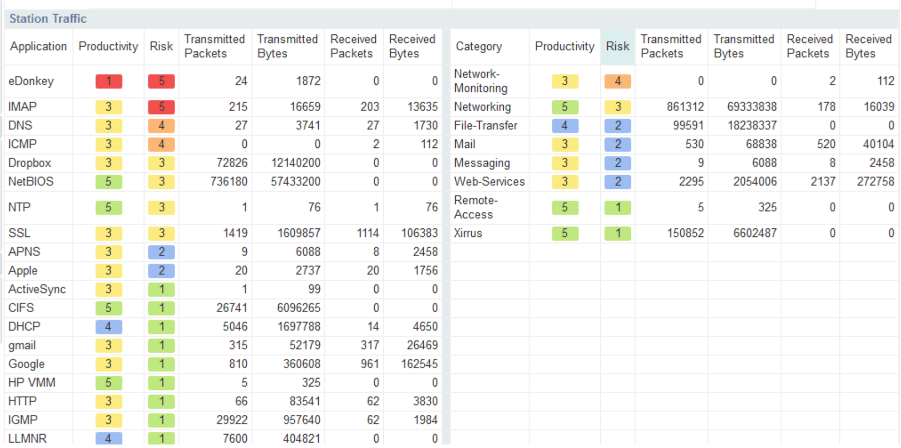


Figure 91. Application Control (Pie Charts)

These charts provide a quick way to determine how your wireless bandwidth is being used. There are charts for **Station Traffic** and/or **Array Management Traffic**, depending on which checkboxes you selected. Similarly, there are charts for **By Application** and/or **By Category**, depending on your selections. The top ten applications or categories are listed, by percentage of bandwidth usage.

Traffic Tables



Station Traffic

Application	Productivity	Risk	Transmitted Packets	Transmitted Bytes	Received Packets	Received Bytes
eDonkey	1	5	24	1872	0	0
IMAP	3	5	215	16659	203	13635
DNS	3	4	27	3741	27	1730
ICMP	3	4	0	0	2	112
Dropbox	3	3	72826	12140200	0	0
NetBIOS	5	3	736180	57433200	0	0
NTP	5	3	1	76	1	76
SSL	3	3	1419	1609857	1114	106383
APNS	3	2	9	6088	8	2458
Apple	3	2	20	2737	20	1756
ActiveSync	3	1	1	99	0	0
CIFS	5	1	26741	6096265	0	0
DHCP	4	1	5046	1697788	14	4650
gmail	3	1	315	52179	317	26469
Google	3	1	810	360608	961	162545
HP VMM	5	1	5	325	0	0
HTTP	3	1	66	83541	62	3830
IGMP	3	1	29922	957640	62	1984
LLMNR	4	1	7600	404821	0	0

Category	Productivity	Risk	Transmitted Packets	Transmitted Bytes	Received Packets	Received Bytes
Network-Monitoring	3	4	0	0	2	112
Networking	5	3	861312	69333838	178	16039
File-Transfer	4	2	99591	18238337	0	0
Mail	3	2	530	68838	520	40104
Messaging	3	2	9	6088	8	2458
Web-Services	3	2	2295	2054006	2137	272758
Remote-Access	5	1	5	325	0	0
Xirrus	5	1	150852	6602487	0	0

Figure 92. Application Control (Station Traffic)

These tables provide detailed information about how your wireless bandwidth is being used. There are tables for **Station Traffic** and/or **Array Management Traffic**, depending on which checkboxes you selected. Similarly, there are tables for **By Application** and/or **By Category**, depending on your selections.

In addition to showing traffic statistics, there are two unique and highly useful columns. **Risk** estimates the likelihood of an application causing problems for your business, such as a file-sharing utility introducing viruses or exposing you to legal problems. Risk is rated from 1 (low risk, e.g., Google) to 5 (high risk, e.g., BitTorrent). Risky applications (rated at 4 or 5) are flagged for your attention by highlighting the entry in pale red. **Productivity** estimates the value of an activity to your business, from 1 (unproductive, e.g., Y8 gaming site) to 5 (productive, e.g., WebEx).

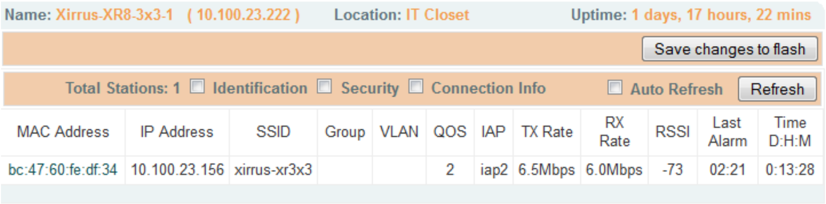
You may click the heading of any column to sort based on that column. Click again to sort in the reverse order. For instance, sort on **Risk** to find problem applications, or sort on **Productivity** to find applications that should be given increased or decreased handling priority.

When you find risky or unproductive applications taking up bandwidth on the network, you can easily create Filters to control them. See “Filter Management” on page 347. You may use filters to:

- Block problematic traffic, such as BitTorrent or Y8.
- Prioritize mission critical traffic—by increasing the QoS assigned to the traffic. See “Understanding QoS Priority on the Wireless Array” on page 244.
- Lower the priority of less productive traffic—use filters to decrease the QoS assigned to traffic for applications like YouTube and Facebook.

Stations (Application Control)

This status-only window shows client stations currently visible to the Array. The MAC address in the first column is a link. Click on a selected station, and the Application Control window opens with the **Display for Station** field set to that station, to perform a detailed analysis of its application usage.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 17 hours, 22 mins

Total Stations: 1 □ Identification □ Security □ Connection Info □ Auto Refresh

MAC Address	IP Address	SSID	Group	VLAN	QOS	IAP	TX Rate	RX Rate	RSSI	Last Alarm	Time D:H:M
bc:47:60:fe:df:34	10.100.23.156	xirrus-xr3x3			2	iap2	6.5Mbps	6.0Mbps	-73	02:21	0:13:28

Figure 93. Stations (Application Control)

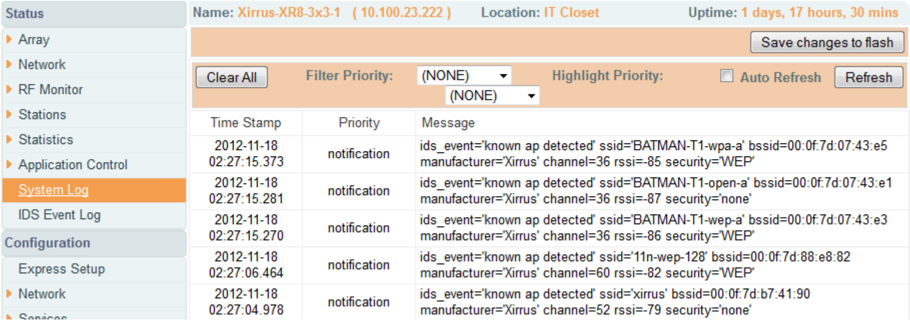
The rest of the fields and display options on this window (including the **Identification**, **Security**, and **Connection Info** checkboxes) are as described in “Stations” on page 126.

System Log Window

This is a status only window that allows you to review the system log, where system alerts and messages are displayed. Although there are no configuration options available in this window, you do have the usual choice of deciding how the event messages are sorted by clicking in the column header for the desired field (Time Stamp, Priority, or Message).

- **Time Stamp**—sorts the list based on the time the event occurred.
- **Priority**—sorts the list based on the priority assigned to the message.
- **Message**—sorts the list based on the message category

The displayed messages may be filtered by using the **Filter Priority** option, which allows control of the minimum priority level displayed. For example, you may choose (under **Services >System Log**) to log messages at or above Debug level but use **Filter Priority** to display only those at Information level and above.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 17 hours, 30 mins

Filter Priority: (NONE) Highlight Priority: (NONE)

Time Stamp	Priority	Message
2012-11-18 02:27:15.373	notification	ids_event='known ap detected' ssid='BATMAN-T1-wpa-a' bssid=00:0f:7d:07:43:e5 manufacturer='Xirrus' channel=36 rssi=-85 security='WEP'
2012-11-18 02:27:15.281	notification	ids_event='known ap detected' ssid='BATMAN-T1-open-a' bssid=00:0f:7d:07:43:e1 manufacturer='Xirrus' channel=36 rssi=-87 security='none'
2012-11-18 02:27:15.270	notification	ids_event='known ap detected' ssid='BATMAN-T1-wep-a' bssid=00:0f:7d:07:43:e3 manufacturer='Xirrus' channel=36 rssi=-86 security='WEP'
2012-11-18 02:27:06.464	notification	ids_event='known ap detected' ssid='11n-wep-128' bssid=00:0f:7d:88:e8:82 manufacturer='Xirrus' channel=60 rssi=-82 security='WEP'
2012-11-18 02:27:04.978	notification	ids_event='known ap detected' ssid='xirrus' bssid=00:0f:7d:b7:41:90 manufacturer='Xirrus' channel=52 rssi=-79 security='none'

Figure 94. System Log (Alert Level Highlighted)

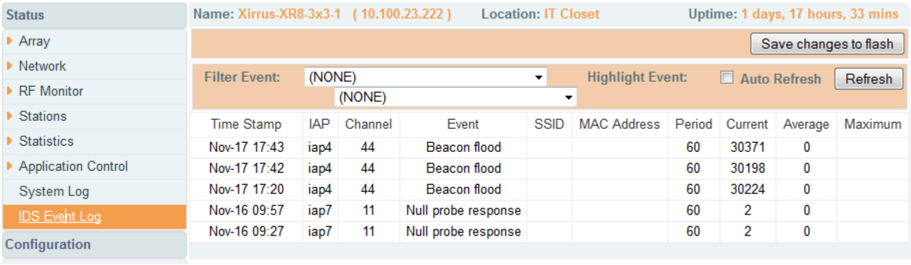
Use the **Highlight Priority** field if you wish to highlight messages at the selected priority level. Click on the **Refresh** button to refresh the message list, or click on the **Clear All** button at the upper left to delete all messages. You can also click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

Note that there is a shortcut way to view system log messages. If you click **Log Messages** near the bottom of the left hand frame, WMI displays counts of log messages at different severity levels. Click a count to display just those messages in the System Log window. See Figure 42 on page 88 for more information.

IDS Event Log Window

This status only window displays the Intrusion Detection System (IDS) Event log, listing any detected attacks on your network. For descriptions of the types of attacks detected, as well as the settings to fine-tune IDS on the Array, please see "Intrusion Detection" on page 328.

The displayed messages may be filtered by using the **Filter Event** setting, which allows you to select just one type of intrusion to display. For example, you may choose to display only beacon flood attacks.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 17 hours, 33 mins

Filter Event: (NONE) Highlight Event: (NONE) □ Auto Refresh

Time Stamp	IAP	Channel	Event	SSID	MAC Address	Period	Current	Average	Maximum
Nov-17 17:43	iap4	44	Beacon flood			60	30371	0	
Nov-17 17:42	iap4	44	Beacon flood			60	30198	0	
Nov-17 17:20	iap4	44	Beacon flood			60	30224	0	
Nov-16 09:57	iap7	11	Null probe response			60	2	0	
Nov-16 09:27	iap7	11	Null probe response			60	2	0	

Figure 95. IDS Event Log

Use the **Highlight Event** field if you wish to highlight all events of one particular type in the list. Click on the **Refresh** button to refresh the message list, or click the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

Although there are no configuration options available in this window, you do have the usual choice of deciding how the event messages are sorted by clicking in the column header for the desired field.

- **Time Stamp**—the time that the event occurred.
- **IAP**—the affected radio.
- **Channel**—the affected channel.
- **Event**—the type of attack, as described in Intrusion Detection.
- **SSID**—the SSID that was attacked.
- **MAC Address**—the MAC address of the attacker.

- **Period**—the length of the window used to determine whether the count of this type of event exceeded the threshold.
- **Current**—the count of this type of event for the current period.
- **Average**—the average count per period of this type of event.
- **Maximum**—the maximum count per period of this type of event.

Configuring the Wireless Array

The following topics include procedures for configuring the Array using the product's embedded Web Management Interface (WMI). Procedures have been organized into functional areas that reflect the flow and content of the WMI.

The following WMI windows allow you to establish configuration parameters for your Array, and include:

- **"Express Setup" on page 161**
- **"Network" on page 169**
- **"Services" on page 184**
- **"VLANs" on page 199**
- **"Tunnels" on page 204**
- **"Security" on page 208**
- **"SSIDs" on page 242**
- **"Groups" on page 264**
- **"IAPs" on page 271**
- **"WDS" on page 338**
- **"Filters" on page 344**
- **"Clusters" on page 352**

After making changes to the configuration settings of an Array you must click on the **Save changes to flash** button at the top of the configuration window, otherwise the changes you make will not be applied the next time the Array is rebooted.

*Some settings are only available if the Array's license includes appropriate Xirrus **Advanced Feature Sets**. If a setting is unavailable (grayed out), then your license does not support the feature. See **"About Licensing and Upgrades" on page 361**.*

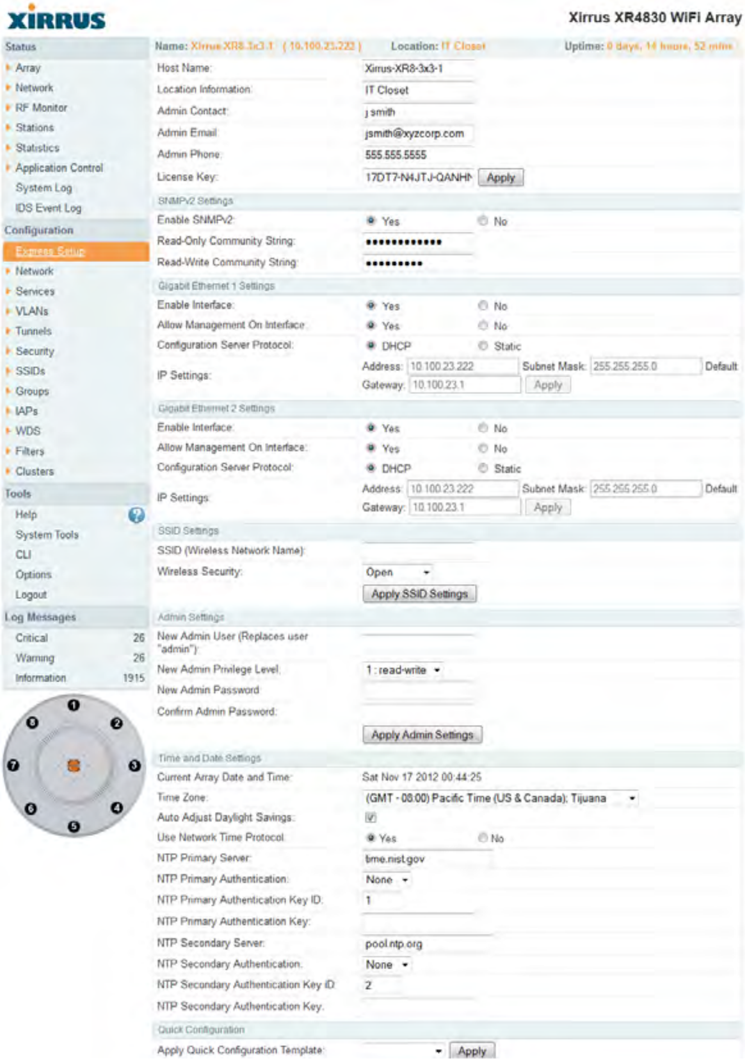
Note that the **Configuration** menu section may be collapsed down to hide the headings under it by clicking it. Click again to display the headings. (See Figure 43 on page 89.)

This chapter only discusses using the configuration windows on the Array. To view status or use system tools on the Array, please see:

- **"Viewing Status on the Wireless Array" on page 95**
- **"Using Tools on the Wireless Array" on page 359**

Express Setup

Use the Express Setup page to establish global configuration settings that enable basic Array functionality. Any changes you make in this window will affect all radios.



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 14 hours, 52 mins

Host Name: Xirrus-XR8-3x3-1
Location Information: IT Closet
Admin Contact: j smith
Admin Email: jsmith@xyzcorp.com
Admin Phone: 555.555.5555
License Key: 17DT7-N4JTJ-QANHN Apply

SNMPv2 Settings
Enable SNMPv2: ● Yes ○ No
Read-Only Community String: •••••••••••••
Read-Write Community String: ••••••••••

Gigabit Ethernet 1 Settings
Enable Interface: ● Yes ○ No
Allow Management On Interface: ● Yes ○ No
Configuration Server Protocol: ● DHCP ○ Static
IP Settings: Address: 10.100.23.222 Subnet Mask: 255.255.255.0 Default Gateway: 10.100.23.1 Apply

Gigabit Ethernet 2 Settings
Enable Interface: ● Yes ○ No
Allow Management On Interface: ● Yes ○ No
Configuration Server Protocol: ● DHCP ○ Static
IP Settings: Address: 10.100.23.222 Subnet Mask: 255.255.255.0 Default Gateway: 10.100.23.1 Apply

SSID Settings
SSID (Wireless Network Name):
Wireless Security: Open
Apply SSID Settings

Admin Settings
New Admin User (Replaces user "admin"):
New Admin Privilege Level: 1 : read-write
New Admin Password
Confirm Admin Password:
Apply Admin Settings

Time and Date Settings
Current Array Date and Time: Sat Nov 17 2012 00:44:25
Time Zone: (GMT - 08:00) Pacific Time (US & Canada); Tijuana
Auto Adjust Daylight Savings: ☑
Use Network Time Protocol: ● Yes ○ No
NTP Primary Server: time.nist.gov
NTP Primary Authentication: None
NTP Primary Authentication Key ID: 1
NTP Primary Authentication Key:
NTP Secondary Server: pool.ntp.org
NTP Secondary Authentication: None
NTP Secondary Authentication Key ID: 2
NTP Secondary Authentication Key:

Quick Configuration
Apply Quick Configuration Template: Apply

Figure 96. WMI: Express Setup

When finished, click **Save changes to flash** if you wish to make your changes permanent.

Procedure for Performing an Express Setup

1. **Host Name:** Specify a unique host name for this Array. The host name is used to identify the Array on the network. Use a name that will be meaningful within your network environment, up to 64 alphanumeric characters. The default is the Array's serial number.

2. **Location Information**: Enter a brief but meaningful description that accurately defines the physical location of the Array. In an environment where multiple units are installed, clear definitions for their locations are important if you want to identify a specific unit.

3. **Admin Contact**: Enter the name and contact information of the person who is responsible for administering the Array at the designated location.

4. **Admin Email**: Enter the email address of the admin contact you entered in Step 3.

5. **Admin Phone**: Enter the telephone number of the admin contact you entered in Step 3.

6. **License Key**: If Xirrus issued you a license that differs from the current value shown, enter it now.

7. Configure **SNMPv2**: Select whether to **Enable SNMPv2** on the Array, and set the SNMPv2 community strings. The factory default value for the **Read-Only Community String** is **xirrus_read_only**. The factory default value for the **Read-Write Community String** is **xirrus**. If you are using the Xirrus Management System (XMS), the read-write string must match the string used by XMS. XMS also uses the default value **xirrus**.

8. Configure the **Gigabit Ethernet** network interface settings. Please see "Network Interfaces" on page 171 for more information. For XN Arrays, configure the **10/100 Ethernet 0** (10/100 Mb) port as well.

   The fields for each of these interfaces are similar, and include:

a. **Enable Interface**: Choose **Yes** to enable this network interface, or choose **No** to disable the interface.

b. **Allow Management on Interface**: Choose **Yes** to allow management of the Array via this Gigabit interface, or choose **No** to deny all management privileges for this interface. Note that for XN Arrays, the 10/100 Ethernet port is also known as the Management Port, and management is **always** enabled on this port.

c. **Configuration Server Protocol**: Choose **DHCP** to instruct the Array to use DHCP to assign IP addresses to the Array's Ethernet interfaces, or choose **Static** if you intend to enter IP addresses manually. If you choose the Static IP option, you must enter the following **IP Settings**:

- **Address**: Enter a valid IP address for this Array. To use a remote connection (Web, SNMP, or SSH), a valid IP address must be used.
- **Subnet Mask**: Enter a valid IP address for the subnet mask (the default is 255.255.255.0). The subnet mask defines the number of IP addresses that are available on the routed subnet where the Array is located.
- **Default Gateway**: Enter a valid IP address for the default gateway. This is the IP address of the router that the Array uses to forward data to other networks.
- Click the **Apply** button for this interface when done making IP changes.

9. **SSID Settings**: This section specifies the wireless network name and security settings.

a. The **SSID (Wireless Network Name)** is a unique name that identifies a wireless network (SSID stands for Service Set Identifier). All devices attempting to connect to a specific WLAN must use the same SSID. The default SSID is **xirrus**. Entering a value in this field will replace the default SSID with the new name.

For additional information about SSIDs, go to the Multiple SSIDs section of "Frequently Asked Questions" on page 452.

b. **Wireless Security**: Select the desired wireless security scheme (Open, WEP or WPA). Make your selection from the choices available in the pull-down list.

- **Open**—This option offers no data encryption and is not recommended, though you might choose this option if clients are required to use a VPN connection through a secure SSH utility, like PuTTy.
- **WEP** (Wired Equivalent Privacy)—An optional IEEE 802.11 function that offers frame transmission privacy similar to a wired network. WEP generates secret shared encryption keys that both source and destination stations can use to alter frame bits to avoid disclosure to eavesdroppers.
- **WPA** (Wi-Fi Protected Access)—A Wi-Fi Alliance standard that contains a subset of the IEEE 802.11i standard, using TKIP or AES as an encryption method and 802.1x for authentication. WPA is the stronger of the two wireless security schemes.
- **WPA2** (Wi-Fi Protected Access 2)—WPA2 is the follow-on security method to WPA for wireless networks and provides stronger data protection and network access control. It offers Enterprise and consumer Wi-Fi users with a high level of assurance that only authorized users can access their wireless networks. Like WPA, WPA2 is designed to secure all versions of 802.11 devices, including 802.11a, 802.11b, 802.11g, and 802.11n, multi-band and multi-mode.
- **WPA-Both** (WPA and WPA2)—This option makes use of both WPA and WPA2.

For more information about security, including a full review of all security options and settings, go to "Understanding Security" on page 209.

c. **WEP Encryption Key/Passphrase**: Depending on the wireless security scheme you selected, enter a unique WEP key or WPA passphrase. This field and the one below only appear if you select a **Wireless Security** option other than **Open**.

d. **Confirm Encryption Key/Passphrase**: If you entered a WEP key or WPA passphrase, confirm it here.

e. Click **Apply SSID Settings** when done.

10. **Admin Settings:** This section allows you to change the default admin username, password, and privileges for the Array. You may change the password and leave the user name as is, but we suggest that you change both to improve Array security.

    a. **New Admin User (Replaces user "admin")**: Enter the name of a new administrator user account. Be sure to record the new account name and password, because the default **admin** user will be deleted! Note that the Array also offers the option of authenticating administrators using a RADIUS server (see "Admin Management" on page 214)).

    b. **New Admin Privilege Level**: By default, the new administrator will have read/write privileges on the Array (i.e., the new user will be able to change the configuration of the Array). If you wish the new account to have different privileges, select the desired level from the drop-down list. For more information about user privileges, please see "Admin Privileges" on page 216. Take care to make sure to leave yourself enough read/write privileges on at least one account to be able to administer the Array.

    c. **New Admin Password**: Enter a new administration password for managing this Array. If you forget this password, you must reset the Array to its factory defaults so that the password is reset to **admin** (its default setting).

    d. **Confirm Admin Password**: If you entered a new administration password, confirm the new password here.

    e. Click **Apply Admin Settings** when done.

11. **Time and Date Settings:** Specify an optional time (NTP - Network Time Protocol) server or modify the system time if you're not using a server.

    a. **Current Array Date and Time**: This read-only field shows the current time for your convenience.

b. **Time Zone**: Select your time zone from the choices available in the pull-down list.

c. **Auto Adjust Daylight Savings**: If you are not using NTP, check this box if you want the system to adjust for daylight savings automatically, otherwise leave this box unchecked (default).

d. **Use Network Time Protocol**: Check this box if you want to use an NTP server to synchronize the Array's clock. Use of NTP is mandatory for Arrays to be managed with XMS (the Xirrus Management System), and ensures that Syslog time-stamping is maintained across all units. Without using an NTP server (no universal clock), each Array will use its own internal clock and stamp times accordingly, which may result in discrepancies. If you select **Yes**, the NTP server fields are displayed. If you don't want to use an NTP server, select **No** (default) and set the system time on the Array manually.

e. **NTP Primary Server**: If you are using NTP, enter the IP address or domain name of the NTP server.

f. **NTP Primary Authentication**: (optional) If you are using authentication with NTP, select the type of key: **MD5** or **SHA1**. Select **None** if you are not using authentication (this is the default). For more information on authenticated NTP, see "Time Settings (NTP)" on page 185.

g. **NTP Primary Authentication Key ID**: Enter the key ID, which is a decimal integer.

h. **NTP Primary Authentication Key**: Enter your key, which is a string of characters.

i. **NTP Secondary Server**: Enter the IP address or domain name of an optional secondary NTP server to be used in case the Array is unable to contact the primary server. You may use the authentication fields as described above if you wish to set up authentication for the secondary server.

j. **Adjust Time (hrs:min:sec)**: If you are not using NTP, check this box if you want to adjust the current system time. When the box is checked, the time fields become active. Enter the revised time (hours, minutes, seconds, am/pm) in the corresponding fields. If you don't want to adjust the current time, this box should be left unchecked (default).

k. **Adjust Date (month/day/year)**: If you are not using NTP, check this box if you want to adjust the current system date. When the box is checked, the date fields become active. Enter the revised date (month, day and year) in the corresponding fields. If you don't want to adjust the current date, this box should be left unchecked (default).

12. **Quick Configuration:** This offers predefined configuration options such as **Classroom** and **High-Density** that capture best practices from years of field experience. If one of the options in the drop-down list is appropriate to your deployment, select it and click **Apply**. For example, the **High-Density** option uses best practices to configure the Array for high density settings such as lecture halls, convention centers, stadiums, etc.

13. **IAP Settings:**

Enable/Configure All IAPs: Click on the **Execute** button to enable and auto configure all IAPs (a message displays the countdown time—in seconds—to complete the auto-configuration task). When an IAP is enabled, its LED is switched on.

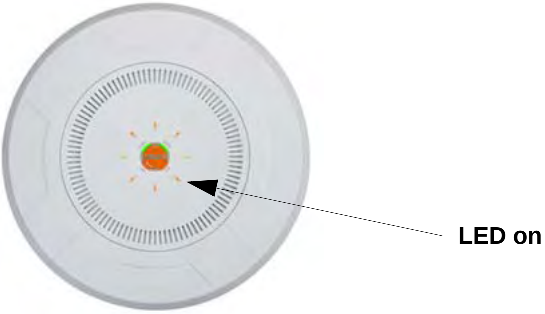
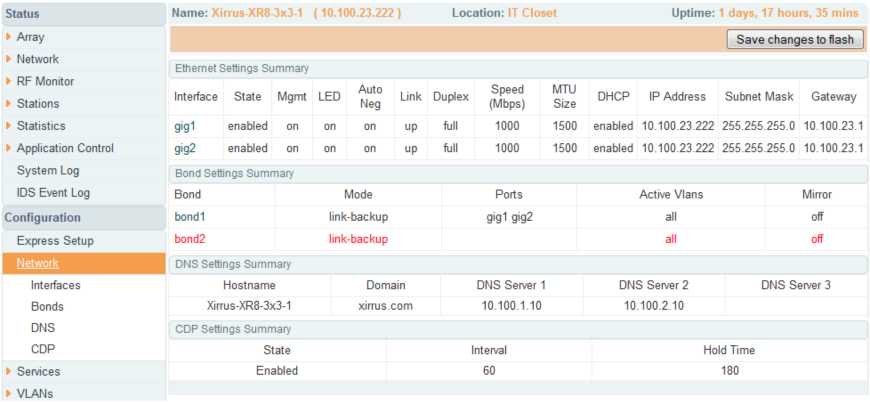


Figure 97. LEDs are Switched On

14. Click **Save changes to flash** at the upper right to make your changes permanent, i.e., these settings will still be in effect after a reboot.

Network

This is a status-only window that provides a snapshot of the configuration settings currently established for the Ethernet interfaces. DNS Settings and CDP Settings (Cisco Discovery Protocol) are summarized as well. You must go to the appropriate configuration window to make changes to any of the settings displayed here (configuration changes cannot be made from this window). You can click on any item in the **Interface** column to "jump" to the associated configuration window.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 17 hours, 35 mins

Ethernet Settings Summary

Interface	State	Mgmt	LED	Auto Neg	Link	Duplex	Speed (Mbps)	MTU Size	DHCP	IP Address	Subnet Mask	Gateway
gig1	enabled	on	on	on	up	full	1000	1500	enabled	10.100.23.222	255.255.255.0	10.100.23.1
gig2	enabled	on	on	on	up	full	1000	1500	enabled	10.100.23.222	255.255.255.0	10.100.23.1

Bond Settings Summary

Bond	Mode	Ports	Active Vlans	Mirror
bond1	link-backup	gig1 gig2	all	off
bond2	link-backup		all	off

DNS Settings Summary

Hostname	Domain	DNS Server 1	DNS Server 2	DNS Server 3
Xirrus-XR8-3x3-1	xirrus.com	10.100.1.10	10.100.2.10	

CDP Settings Summary

State	Interval	Hold Time
Enabled	60	180

Figure 98. Network Interfaces

WMI windows that allow you to change or view configuration settings associated with the network interfaces include:

- **"Network Interfaces" on page 171**
- **"Network Bonds" on page 175**
- **"DNS Settings" on page 181**
- **"CDP Settings" on page 183**

See Also

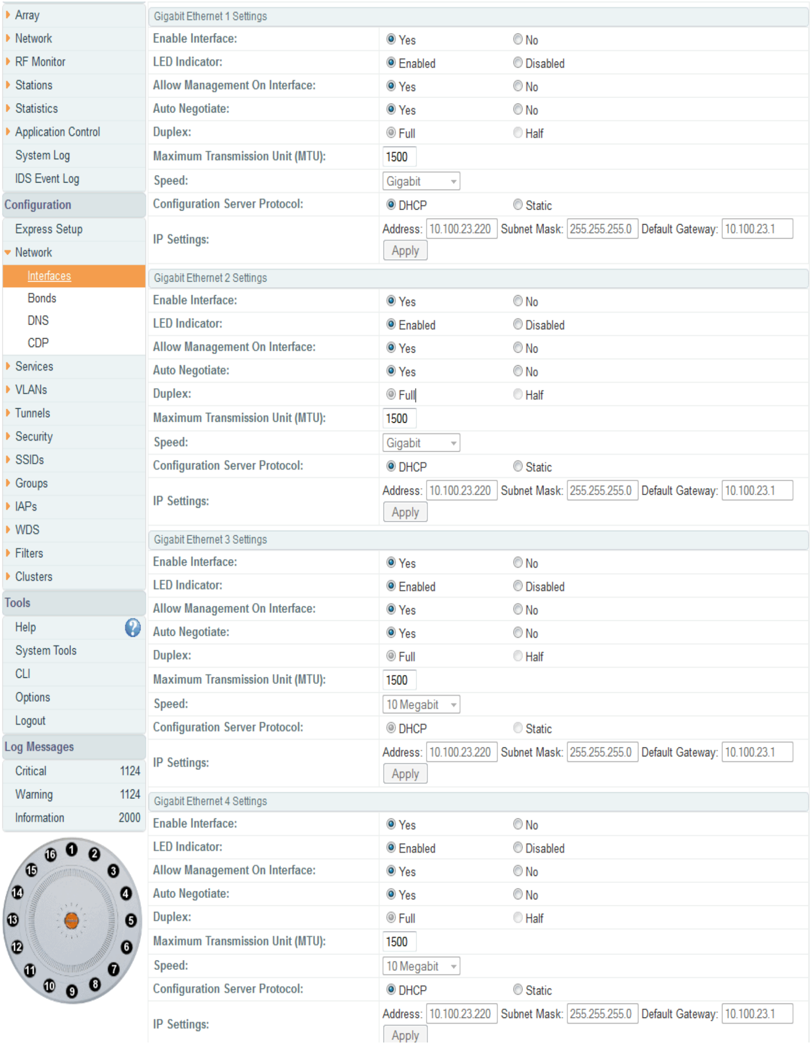
DNS Settings
Network Interfaces
Network Status Windows

Spanning Tree Status

Network Statistics

Network Interfaces

XR500, XR-1000, and XR-2000 Series Arrays have one Gigabit Ethernet interface, while XR-4000 Series Arrays have two, and XR-6000 Series models have four. This window allows you to establish configuration settings for these interfaces.



Gigabit Ethernet 1 Settings

Enable Interface:	● Yes	○ No
LED Indicator:	● Enabled	○ Disabled
Allow Management On Interface:	● Yes	○ No
Auto Negotiate:	● Yes	○ No
Duplex:	● Full	○ Half
Maximum Transmission Unit (MTU):	1500	
Speed:	Gigabit	
Configuration Server Protocol:	● DHCP	○ Static
IP Settings:	Address: 10.100.23.220 Subnet Mask: 255.255.255.0 Default Gateway: 10.100.23.1 Apply	

Gigabit Ethernet 2 Settings

Enable Interface:	● Yes	○ No
LED Indicator:	● Enabled	○ Disabled
Allow Management On Interface:	● Yes	○ No
Auto Negotiate:	● Yes	○ No
Duplex:	● Full	○ Half
Maximum Transmission Unit (MTU):	1500	
Speed:	Gigabit	
Configuration Server Protocol:	● DHCP	○ Static
IP Settings:	Address: 10.100.23.220 Subnet Mask: 255.255.255.0 Default Gateway: 10.100.23.1 Apply	

Gigabit Ethernet 3 Settings

Enable Interface:	● Yes	○ No
LED Indicator:	● Enabled	○ Disabled
Allow Management On Interface:	● Yes	○ No
Auto Negotiate:	● Yes	○ No
Duplex:	● Full	○ Half
Maximum Transmission Unit (MTU):	1500	
Speed:	10 Megabit	
Configuration Server Protocol:	● DHCP	○ Static
IP Settings:	Address: 10.100.23.220 Subnet Mask: 255.255.255.0 Default Gateway: 10.100.23.1 Apply	

Gigabit Ethernet 4 Settings

Enable Interface:	● Yes	○ No
LED Indicator:	● Enabled	○ Disabled
Allow Management On Interface:	● Yes	○ No
Auto Negotiate:	● Yes	○ No
Duplex:	● Full	○ Half
Maximum Transmission Unit (MTU):	1500	
Speed:	10 Megabit	
Configuration Server Protocol:	● DHCP	○ Static
IP Settings:	Address: 10.100.23.220 Subnet Mask: 255.255.255.0 Default Gateway: 10.100.23.1 Apply	

Figure 99. Network Settings

On XN Series Arrays, this window configures the 10/100 Fast Ethernet interface and the Gigabit 1 and Gigabit2 interfaces

When finished making changes, click **Save changes to flash** if you wish to make your changes permanent. When the status of a port changes, a Syslog entry is created describing the change.

Network Interface Ports

The following diagram shows the location of network interface ports on the underside of an XR Series Array.

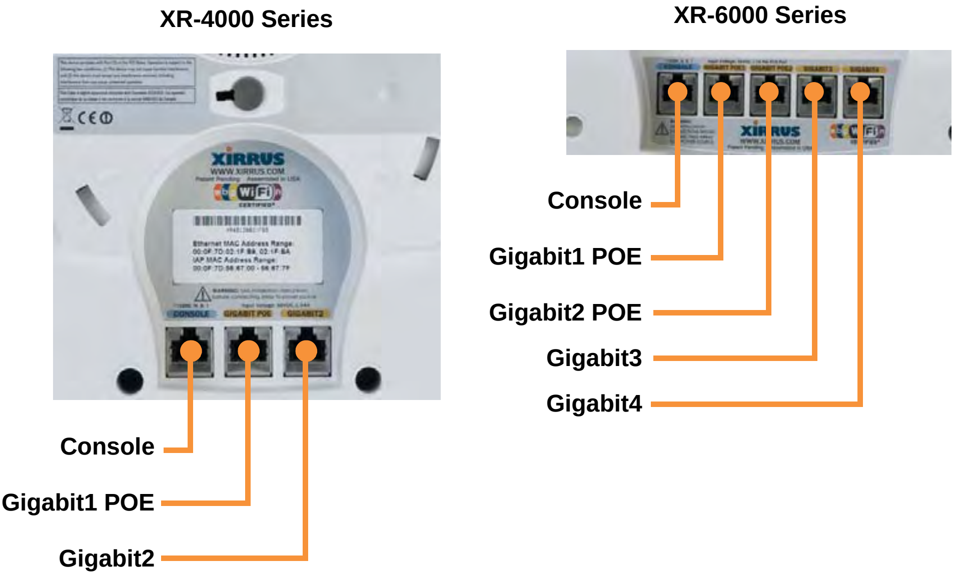


Figure 100. Network Interface Ports

Procedure for Configuring the Network Interfaces

Configure the **Gigabit** network interfaces (for XN Arrays, configure the **Fast Ethernet** port as well). The fields for each of these interfaces are the same, and include:

1. **Enable Interface:** Choose **Yes** to enable this network interface, or choose No to disable the interface.

2. **LED Indicator**: Choose **Enabled** to allow the LED for this interface to blink with traffic on the port, or choose **Disabled** to turn the LED off. The LED will still light during the boot sequence, then turn off. This option is only available for the Gigabit interfaces.

3. **Allow Management on Interface**: Choose **Yes** to allow management of this Array via the selected network interface, or choose **No** to deny all management privileges for this interface. For XN Arrays, this option is only available for the Gigabit interfaces—management is always enabled on the 10/100 interface (sometimes called the Management Port).

4. **Auto Negotiate**: This feature allows the Array to negotiate the best transmission rates automatically. Choose **Yes** to enable this feature, or choose **No** to disable this feature—the default is enabled. If you disable the Auto Negotiate feature, you must define the Duplex and Speed options manually (otherwise these options are not available). Both sides of the link **must** have the same values for the following settings, or the connection will have errors.

   a. **Duplex**: Full-duplex mode transmits data in two directions simultaneously (for example, a telephone is a full-duplex device because both parties can talk and be heard at the same time). Half-duplex allows data transmission in one direction at a time only (for example, a walkie-talkie is a half-duplex device). If the Auto-Negotiate feature is disabled, you can manually choose **Half** or **Full** duplex for your data transmission preference.

   b. **MTU**: the Maximum Transmission Unit size. This is the largest packet size (in bytes) that the interface can pass along.

   c. **Speed**: If the Auto-Negotiate feature is disabled, you must manually choose the desired data transmission speed from the pull-down list. For XN Arrays, when configuring the Fast Ethernet interface the options are **10 Megabit** or **100 Megabit**. For configuring the Gigabit interfaces the options are **10 Megabit** or **100 Megabit**. (Note that 1000 Megabit speed can only be set by Auto-Negotiation.)

5. **Configuration Server Protocol / IP Settings**: Choose **DHCP** to instruct the Array to use DHCP when assigning IP addresses to the Array, or choose **Static IP** if you intend to enter IP addresses manually. If you select the Static IP option you must specify the IP address, IP subnet mask and default gateway.

   a. **Address**: If you selected the Static IP option, enter a valid IP address for the Array. To use any of the remote connections (Web, SNMP, or SSH), a valid IP address must be established.

   b. **Subnet Mask**: If you selected the Static IP option, enter a valid IP address for the subnet mask (the default for Class C is 255.255.255.0). The subnet mask defines the number of IP addresses that are available on the routed subnet where the Array is located.

   c. **Default Gateway**: If you selected the Static IP option, enter a valid IP address for the default gateway. This is the IP address of the router that the Array uses to send data to other networks. (You don't need to enter the gateway if it is on the same subnet as the Array.)

   d. Click the **Apply** button for this interface when done making IP changes.

6. **Static Route (IP Address/Mask)**: (For XN Arrays, Fast Ethernet port only) The 10-100 Ethernet Port may be used for managing the Array out of band from the Gigabit Ethernet ports. The 10-100 port will route only management traffic, using a static route that may be configured using this field.

7. When done configuring all interfaces as desired, click **Save changes to flash** if you wish to make your changes permanent.

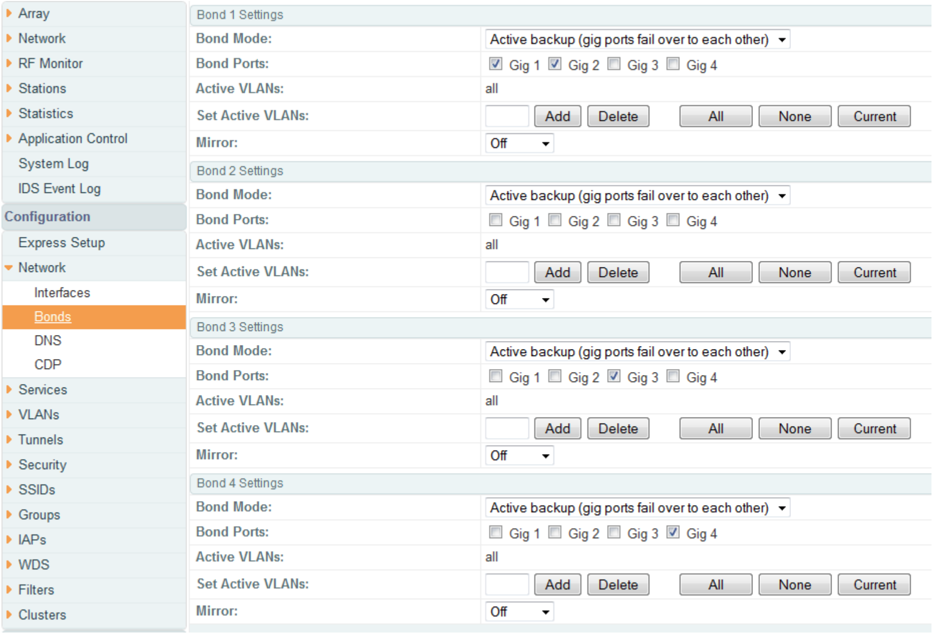
See Also

Network Bonds
DNS Settings
Network
Network Statistics
Spanning Tree Status

Network Bonds

On models with more than one Gigabit port these ports may be bonded, i.e. configured to work together in sets. For example, one port may provide active backup or load balancing for another, or other options as described in this section. XR-6000 Series Arrays have four Gigabit ports, and you may specify which ports are bonded to work together as a pair. You may also select more than two ports to work together in one group.

You may use the mirror option to have all the traffic that is ingressing and egressing one bond be transmitted by the bond you are configuring. For example, if you configure Bond2 to mirror Bond1, then all traffic going in and out of Bond1's Gigabit ports will be transmitted out of Bond2's Gigabit ports. This way of duplicating one bond's traffic to another bond is very useful for troubleshooting with a network analyzer.



Bond 1 Settings

Bond Mode:	Active backup (gig ports fail over to each other)
Bond Ports:	☑ Gig 1 ☑ Gig 2 □ Gig 3 □ Gig 4
Active VLANs:	all
Set Active VLANs:	
Mirror:	Off

Bond 2 Settings

Bond Mode:	Active backup (gig ports fail over to each other)
Bond Ports:	□ Gig 1 □ Gig 2 □ Gig 3 □ Gig 4
Active VLANs:	all
Set Active VLANs:	
Mirror:	Off

Bond 3 Settings

Bond Mode:	Active backup (gig ports fail over to each other)
Bond Ports:	□ Gig 1 □ Gig 2 ☑ Gig 3 □ Gig 4
Active VLANs:	all
Set Active VLANs:	
Mirror:	Off

Bond 4 Settings

Bond Mode:	Active backup (gig ports fail over to each other)
Bond Ports:	□ Gig 1 □ Gig 2 □ Gig 3 ☑ Gig 4
Active VLANs:	all
Set Active VLANs:	
Mirror:	Off

Figure 101. Network Bonds

If a set of Gigabit ports have been bonded, the IP address, IP mask, IP gateway, IP DHCP, and Management settings are shared between bonded ports. Any changes you make to these settings on one member will be reflected in the settings of the other members. Other settings may be configured individually.

Procedure for Configuring Network Bonds

Configure the bonding behavior of the **Gigabit** network interfaces. The fields for each of these bonds are the same, and include:

1. **Bond Mode:** Select the desired behavior for a set of bonded Gigabit Ethernet ports from the following options.

   The modes below describe the relationship between a set of Gigabit ports—for example, load balancing or active backup. Use the **Bond Ports** field to select the ports that are bonded (set in Step 2). Two or more ports may be bonded. You may also include just one single port in a bond—this is useful for mirroring one Gigabit port to another port (Step 5 on page 180). In Arrays that have four Gigabit ports, you have the option of bonding three or four ports together. In this discussion, we call two ports that are bonded **Gig*x*** and **Gig*y***.

   a. **Active Backup (gig ports fail over to each other)**—This mode provides fault tolerance and is the default mode. Gig*x* acts as the primary link. Gig*y* is the backup link and is passive. Gig*y* assumes the IP properties of Gig*x*. If Gig*x* fails, the Array automatically fails over to Gig*y*. When a failover occurs in this mode, Gig*y* issues gratuitous ARPs to allow it to substitute for Gig*x* at Layer 3 as well as Layer 2. See Figure 102 (a). You may include more than two ports in the bond with Active Backup to provide additional fault tolerance. For example, if you have three Gigabit ports configured in a bond, if the first two ports in the bond were to go down, the Array would fail over traffic to the third Gigabit port.

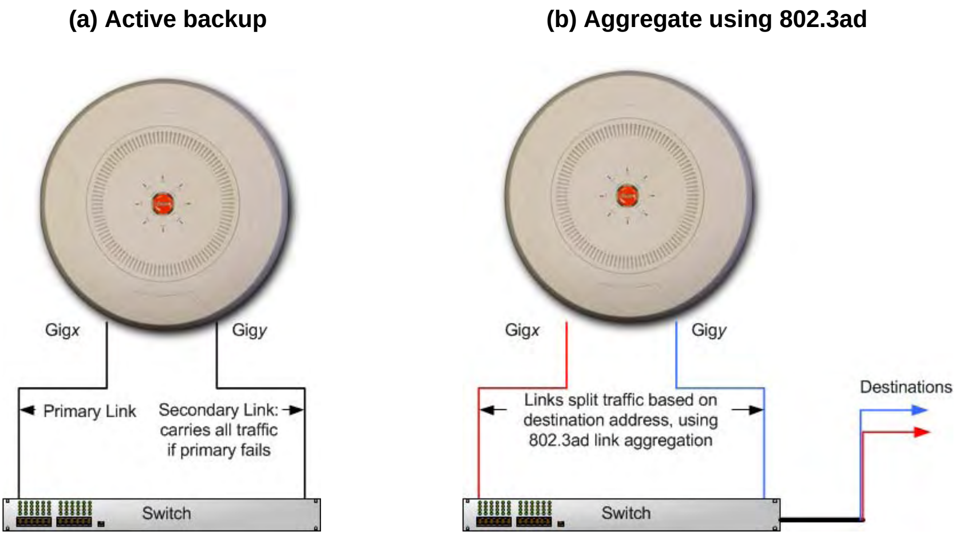

(a) Active backup
(b) Aggregate using 802.3ad
Gigx
Gigy
Primary Link
Secondary Link: carries all traffic if primary fails
Switch
Gigx
Gigy
Links split traffic based on destination address, using 802.3ad link aggregation
Destinations
Switch

Figure 102. Port Modes (a, b)

b. **Aggregate Traffic from gig ports using 802.3ad**—The Array sends network traffic across all member Gigabit ports to increase link speed to the network. These ports act as a single logical interface, using a load balancing algorithm to balance traffic across the ports. For non-IP traffic (such as ARP), the last byte of the destination MAC address is used to do the calculation. If the packet is a fragment or not TCP or UDP, the source and destination IP addresses are used to do the calculation. If the packet is TCP or UDP over IP then the source IP address, destination IP address, source port number and destination port number are all used to do the calculation. The network switch must also support 802.3ad. If a port fails, the connection degrades gracefully—the other port still transmits. See Figure 102 (b).

c. **Transmit Traffic on all gig ports**—Transmits incoming traffic on all Gigabit ports. Any traffic received on Gigabit ports is sent to the onboard processor. This mode provides fault tolerance. See Figure 103 (c).

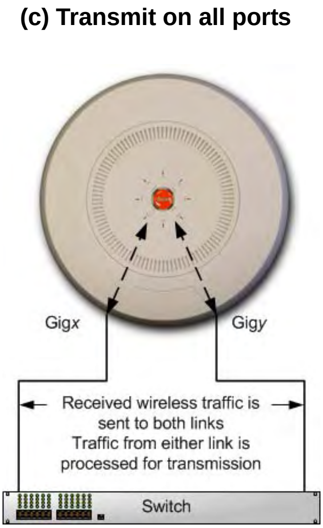

(c) Transmit on all ports
Gigx
Gigy
Received wireless traffic is sent to both links
Traffic from either link is processed for transmission
Switch

Figure 103. Port Modes (c)

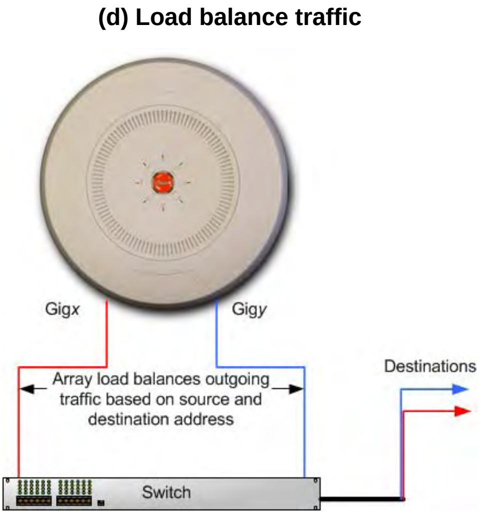

(d) Load balance traffic
Gigx
Gigy
Array load balances outgoing traffic based on source and destination address
Destinations
Switch

Figure 104. Port Modes (d)

d. **Load balance traffic between gig ports**—This option provides trunking, similar to option (b)—**Aggregate Traffic from gig1 & gig2 using 802.3ad**, but it does not use 802.3ad and it uses a different load balancing algorithm to determine the outgoing Gigabit port. The outgoing port used is based on an exclusive OR of the source and destination MAC address. Like option (b), this mode also provides load balancing and fault tolerance. See Figure 104 (d).

2. **Bond Ports**: Select the ports to be members of this bond for the behavior specified by **Bond Mode**. By default, Bond1 contains Gig1 and Gig2. You may also set up a bond with a single port, for example, if you wish to mirror one Gigabit port to another. In Arrays that have four Gigabit ports, you also have the option of bonding three or four ports together.

   When you check off a port to be a member of a bond, that port is automatically removed from any other bonds that contain it.

3. **Active VLANs**: **Active VLANs** is a read-only field that shows the VLANs that you have selected to be passed through this port. You may modify this list by making selections in **Set Active VLANs**.

4. **Set Active VLANs**: Create and manage the list of VLANs that are allowed to be passed through this port. Traffic will be dropped for VLANs that are not in this list. You may view the complete list of VLANs whose traffic will be passed in the **Active VLANs** list, above. The default setting is to pass All VLANs.

   a. To add a VLAN to the list of allowed VLANs, type its name or number, and click **Add**. To allow all VLANs (current or future) to be passed, click the **All** button.

   b. To remove a VLAN from the list of allowed VLANs, type its name or number, and click **Delete**. To remove all VLANs from the Active VLANs list, click **None**.

   c. To allow only the set of currently defined VLANs (see "VLANs" on page 199) to be passed, click the **Current** button. Essentially, this "fixes" the Active VLANs list to contain the Array's currently defined VLANs, and only this set, until you make explicit changes to the

Active VLANs list. If you create new VLANs, they will not be passed unless you take action to add them to the list.

5. **Mirror**—Specify one of the active bonds (Bond*x*) that is to be mirrored by this bond (Bond*y*). (Figure 105) All wireless traffic received on the Array is transmitted out both Bond*x* and Bond*y*. All traffic received on Bond*x* is passed on to the onboard processor as well as out Bond*y*. All traffic received on Bond*y* is passed on to the onboard processor as well as out Bond*x*. This allows a network analyzer to be plugged into Bond*y* to capture traffic for troubleshooting, while the bonded ports provide network connectivity for data traffic.

   Mirroring is also used to duplicate the traffic from one bond to another bond—traffic received on Bond*x* is transmitted by Bond*y*; similarly, traffic received on Bond*y* is transmitted by Bond*x*. This allows the Array to act as a wired bridge and allows Arrays to be daisy-chained and still maintain wired connectivity.

   If each bond contains just one port as is the case for XN Arrays, then you have the simple case of one port mirroring another.

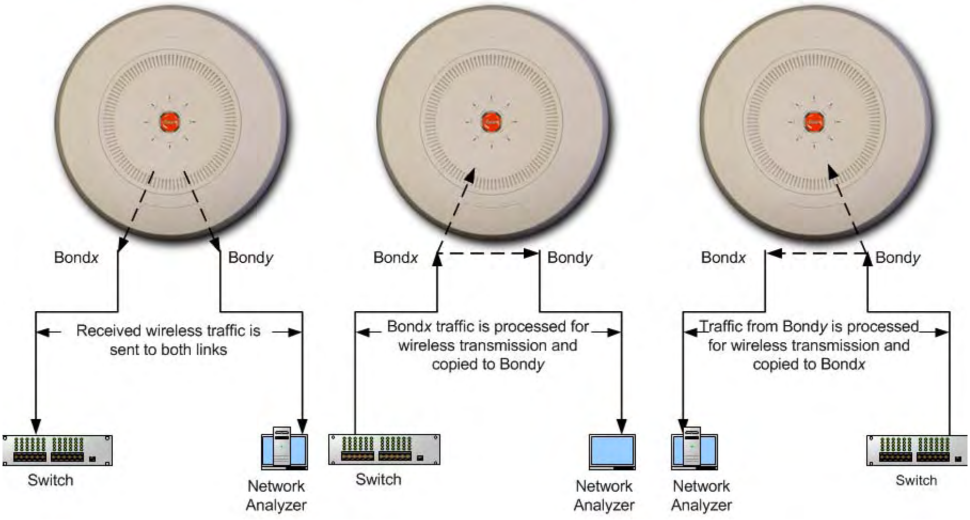

Bondx
Bondy
Received wireless traffic is sent to both links
Switch
Network Analyzer
Bondx
Bondy
Bondx traffic is processed for wireless transmission and copied to Bondy
Switch
Network Analyzer
Bondx
Bondy
Traffic from Bondy is processed for wireless transmission and copied to Bondx
Network Analyzer
Switch

Figure 105. Mirroring Traffic

6. When done configuring bonds as desired, click **Save changes to flash** if you wish to make your changes permanent.

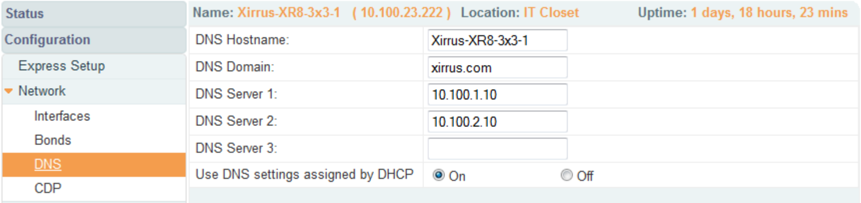
See Also

Network Interfaces
DNS Settings
Network
Network Statistics
Spanning Tree Status

DNS Settings

This window allows you to establish your DNS (Domain Name System) settings. The Array uses these DNS servers to resolve host names into IP addresses. The Array also registers its own Host Name with these DNS servers, so that others may address the Array using its name rather than its IP address. An option allows you to specify that the Array's DNS servers will be assigned via a DHCP server on the wired network.

Note that the DNS servers defined here are not used by wireless clients—servers for stations associated to the Array are defined along with DHCP pools. See "DHCP Server" on page 197. At least one DNS server must be set up if you want to offer clients associating with the Array the ability to use meaningful host names instead of numerical IP addresses. When finished, click **Save changes to flash** if you wish to make your changes permanent.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 18 hours, 23 mins

DNS Hostname:	Xirrus-XR8-3x3-1
DNS Domain:	xirrus.com
DNS Server 1:	10.100.1.10
DNS Server 2:	10.100.2.10
DNS Server 3:	
Use DNS settings assigned by DHCP	● On ○ Off

Figure 106. DNS Settings

Procedure for Configuring DNS Servers

1. **DNS Host Name:** Enter a valid DNS host name.
2. **DNS Domain**: Enter the DNS domain name.
3. **DNS Server 1**: Enter the IP address of the primary DNS server.
4. **DNS Server 2** and **DNS Server 3**: Enter the IP address of the secondary and tertiary DNS servers (if required).
5. **Use DNS settings assigned by DHCP**: If you are using DHCP to assign the Array's IP address, you may turn this option **On**. The Array will then obtain its DNS domain and server settings from the network DHCP server that assigns an IP address to the Array, rather than using the DNS Server fields above. You may also configure that DHCP server to assign a host name to the Array.
6. Click **Save changes to flash** if you wish to make your changes permanent.

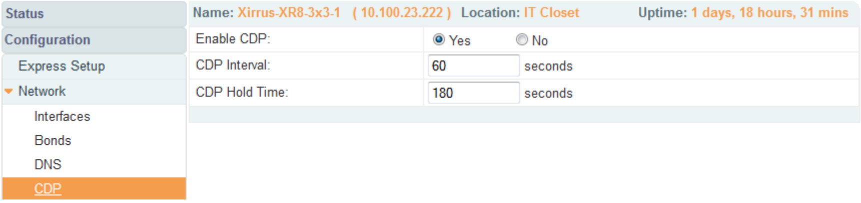
See Also

DHCP Server
Network
Network Interfaces
Network Statistics
Spanning Tree Status

CDP Settings

CDP (Cisco Discovery Protocol) is a layer 2 network protocol used to share information (such as the device manufacturer and model, network capabilities, and IP address) with other directly connected network devices. Wireless Arrays can both advertise their presence by sending CDP announcements, and gather and display information sent by neighbors (see "CDP Neighbors" on page 111).

This window allows you to establish your CDP settings. When finished, **Save changes to flash** if you wish to make your changes permanent.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 1 days, 18 hours, 31 mins

Enable CDP:	● Yes ○ No	
CDP Interval:	60	seconds
CDP Hold Time:	180	seconds

Figure 107. CDP Settings

Procedure for Configuring CDP Settings

1. **Enable CDP:** When CDP is enabled, the Array sends out CDP announcements of the Array's presence, and gathers CDP data sent by neighbors. When disabled, it does neither. CDP is enabled by default.

2. **CDP Interval**: The Array sends out CDP announcements advertising its presence at this interval. The default is 60 seconds.

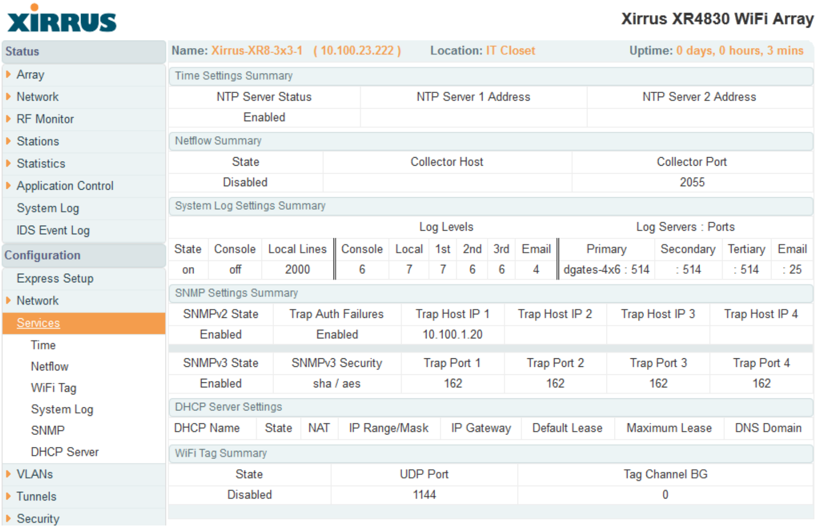
3. **CDP Hold Time**: CDP information received from neighbors is retained for this period of time before aging out of the Array's neighbor list. Thus, if a neighbor stops sending announcements, it will no longer appear on the CDP Neighbors window after CDP Hold Time seconds from its last announcement. The default is 180 seconds.

See Also

CDP Neighbors
Network
Network Interfaces
Network Statistics

Services

This is a status-only window that allows you to review the current settings and status for services on the Array, including DHCP, SNMP, Syslog, and Network Time Protocol (NTP) services. For example, for the DHCP server, it shows each DHCP pool name, whether the pool is enabled, the IP address range, the gateway address, lease times, and the DNS domain being used. There are no configuration options available in this window, but if you are experiencing issues with network services, you may want to print this window for your records.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 0 hours, 3 mins

Time Settings Summary

NTP Server Status	NTP Server 1 Address	NTP Server 2 Address
Enabled		

Netflow Summary

State	Collector Host	Collector Port
Disabled		2055

System Log Settings Summary

			Log Levels						Log Servers : Ports			
State	Console	Local Lines	Console	Local	1st	2nd	3rd	Email	Primary	Secondary	Tertiary	Email
on	off	2000	6	7	7	6	6	4	dgates-4x6 : 514	: 514	: 514	: 25

SNMP Settings Summary

SNMPv2 State	Trap Auth Failures	Trap Host IP 1	Trap Host IP 2	Trap Host IP 3	Trap Host IP 4
Enabled	Enabled	10.100.1.20			
SNMPv3 State	SNMPv3 Security	Trap Port 1	Trap Port 2	Trap Port 3	Trap Port 4
Enabled	sha / aes	162	162	162	162

DHCP Server Settings

DHCP Name	State	NAT	IP Range/Mask	IP Gateway	Default Lease	Maximum Lease	DNS Domain

WiFi Tag Summary

State	UDP Port	Tag Channel BG
Disabled	1144	0

Figure 108. Services

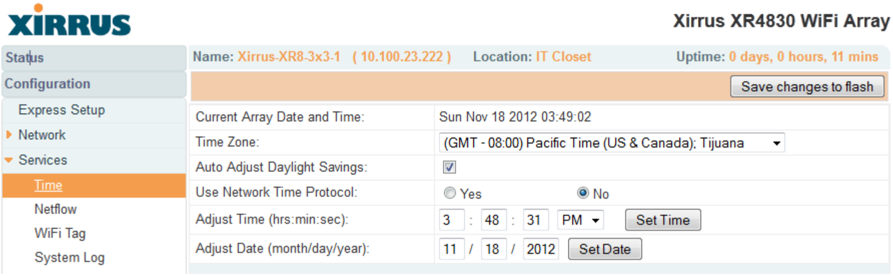
The following sections discuss configuring services on the Array:

- **"Time Settings (NTP)" on page 185**
- **"NetFlow" on page 187**
- **"Wi-Fi Tag" on page 188**
- **"System Log" on page 190**
- **"SNMP" on page 194**
- **"DHCP Server" on page 197**

Time Settings (NTP)

This window allows you to manage the Array's time settings, including synchronizing the Array's clock with a universal clock from an NTP (Network Time Protocol) server. We recommend that you use NTP for proper operation of SNMP in XMS (the Xirrus Management System), since a lack of synchronization will cause errors to be detected. Synchronizing the Array's clock with an NTP server also ensures that Syslog time-stamping is maintained across all units.

It is possible to use authentication with NTP to ensure that you are receiving synchronization from a known source. For example, the instructions for requesting a key for the NIST Authenticated NTP server are available at http://www.nist.gov/pml/div688/grp00/upload/ntp_instructions.pdf. The Array allows you to enter optional authentication information.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 0 hours, 11 mins

Current Array Date and Time:	Sun Nov 18 2012 03:49:02
Time Zone:	(GMT - 08:00) Pacific Time (US & Canada); Tijuana
Auto Adjust Daylight Savings:	☑
Use Network Time Protocol:	○ Yes ● No
Adjust Time (hrs:min:sec):	3 : 48 : 31 PM
Adjust Date (month/day/year):	11 / 18 / 2012

Figure 109. Time Settings (Manual Time)

Procedure for Managing the Time Settings

1. **Current Array Date and Time:** Shows the current time for your convenience.

2. **Time Zone**: Select the time zone you want to use (normally your local time zone) from the pull-down list.

3. **Auto Adjust Daylight Savings**: Check this box if you want the system to adjust for daylight savings automatically, otherwise leave this box unchecked (default).

4. **Use Network Time Protocol:** select whether to set time manually or use NTP to manage system time.

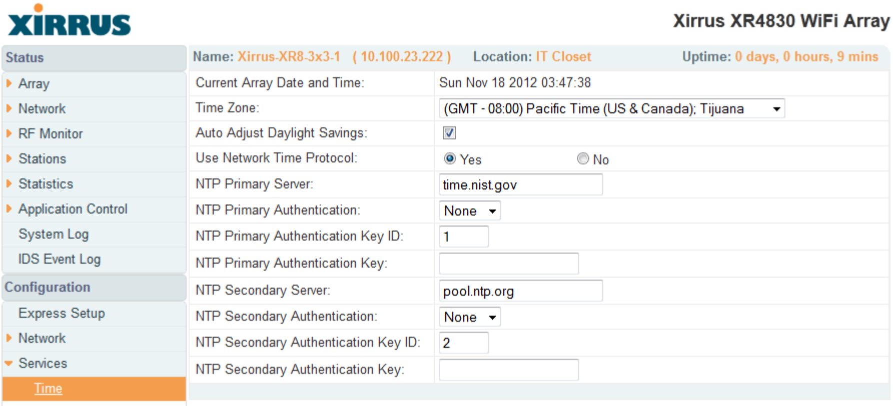
5. **Setting Time Manually**

   a. **Adjust Time (hrs:min:sec)**: If you are not using NTP, check this box if you want to adjust the current system time. When the box is checked, you may enter a revised time (hours, minutes, seconds, am/pm) in the corresponding fields. If you don't want to adjust the current time, this box should be left unchecked (default).

   b. **Adjust Date (month/day/year)**: If you are not using NTP, check this box if you want to adjust the current system date. When the box is checked, you may enter a revised date (month, day and year) in the corresponding fields. If you don't want to adjust the current date, this box should be left unchecked (default).

6. **Using an NTP Server**

   a. **NTP Primary Server**: If you are using NTP, enter the IP address or domain name of the NTP server.



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 0 hours, 9 mins

Current Array Date and Time:	Sun Nov 18 2012 03:47:38
Time Zone:	(GMT - 08:00) Pacific Time (US & Canada); Tijuana
Auto Adjust Daylight Savings:	☑
Use Network Time Protocol:	● Yes ○ No
NTP Primary Server:	time.nist.gov
NTP Primary Authentication:	None
NTP Primary Authentication Key ID:	1
NTP Primary Authentication Key:	
NTP Secondary Server:	pool.ntp.org
NTP Secondary Authentication:	None
NTP Secondary Authentication Key ID:	2
NTP Secondary Authentication Key:	

Figure 110. Time Settings (NTP Time Enabled)

   b. **NTP Primary Authentication**: (optional) If you are using authentication with NTP, select the type of key: **MD5** or **SHA1**. Select **None** if you are not using authentication (this is the default).

   c. **NTP Primary Authentication Key ID**: Enter the key ID, which is a decimal integer.

d. **NTP Primary Authentication Key**: Enter your key, which is a string of characters.

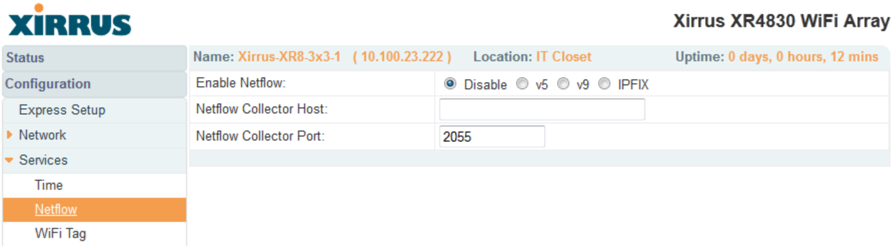
e. **NTP Secondary Server**: Enter the IP address or domain name of an optional secondary NTP server to be used in case the Array is unable to contact the primary server. You may use the authentication fields as described above if you wish to set up authentication for the secondary server.

See Also

Express Setup
Services
SNMP
System Log

NetFlow

This window allows you to enable or disable the sending of NetFlow information to a designated collector. NetFlow is a proprietary but open network protocol developed by Cisco Systems for collecting IP traffic information. When NetFlow is enabled, the Array will send IP flow information (traffic statistics) to the designated collector.



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 0 hours, 12 mins

Enable Netflow:	● Disable ○ v5 ○ v9 ○ IPFIX
Netflow Collector Host:	
Netflow Collector Port:	2055

Figure 111. NetFlow

NetFlow sends per-flow network traffic information from the Array. Network managers can use a NetFlow collector to view the statistics on a per-flow basis and use this information to make key decisions. Knowing how many packets and bytes are sent to and from certain IP addresses or across specific network interfaces allows administrators to track usage by various areas. Traffic flow information may be used to engineer networks for better performance.

Some features, such as Netflow, are only available if the Array's license includes the ***Xirrus Advanced RF Analysis Manager (RAM)****. If a setting is unavailable (grayed out), then your license does not support the feature. See* ***"About Licensing and Upgrades" on page 361****.*

Procedure for Configuring NetFlow

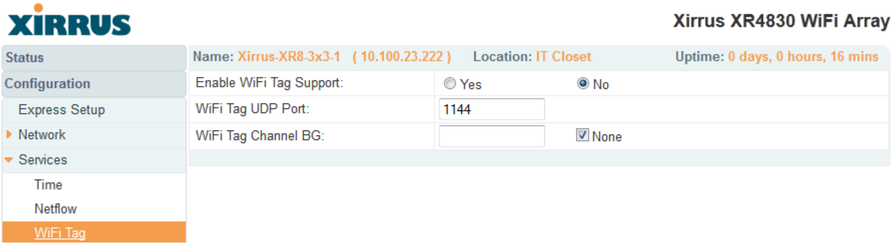
1. **Enable NetFlow:** Select one of the Netflow versions to enable NetFlow functionality: **v5**, **v9**, or **IPFIX**. Internet Protocol Flow Information Export (IPFIX) is an IETF protocol (www.ietf.org**)** performing many of the same functions as Netflow. Choose **Disable** if you wish to disable this feature.

2. **NetFlow Collector Host (Domain or IP)**: If you enabled NetFlow, enter the domain name or IP address of the collector.

3. **NetFlow Collector Port**: If you enabled NetFlow, enter the port on the collector host to which to send data.

Wi-Fi Tag

This window enables or disables Wi-Fi tag capabilities. When enabled, the Array listens for and collects information about Wi-Fi RFID tags sent on the designated channel. These tags are transmitted by specialized tag devices (for example, AeroScout Tags). A Wi-Fi tagging server (such as AeroScout) then queries the Array for a report on the tags that it has received. The Wi-Fi tagging server uses proprietary algorithms to determine locations for devices sending tag signals.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 0 hours, 16 mins

Enable WiFi Tag Support:	○ Yes	● No
WiFi Tag UDP Port:	1144	
WiFi Tag Channel BG:		☑ None

Figure 112. Wi-Fi Tag

Procedure for Configuring Wi-Fi Tag

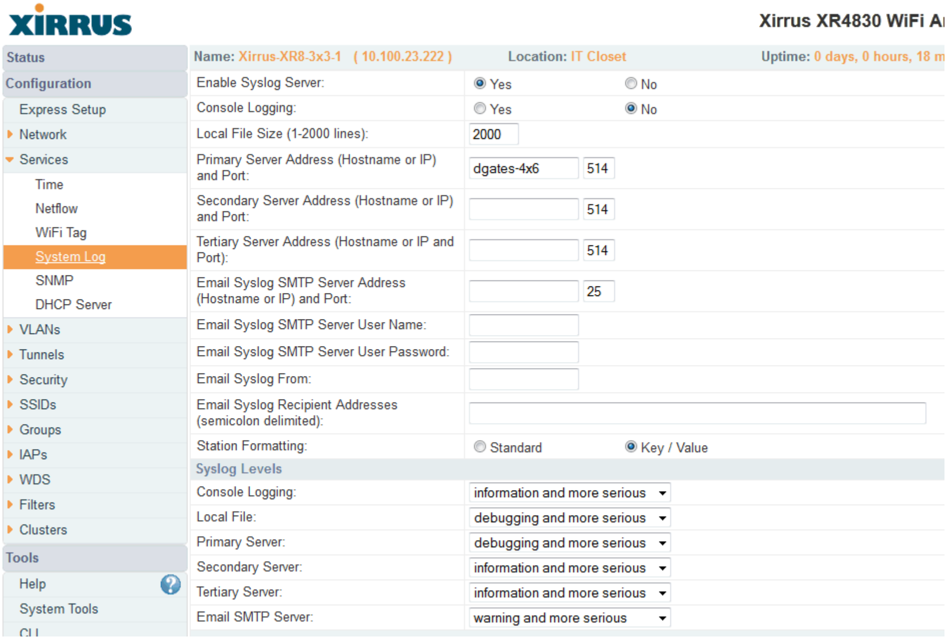
1. **Enable Wi-Fi Tag:** Choose **Yes** to enable Wi-Fi tag functionality, or choose **No** to disable this feature.

2. **Wi-Fi Tag UDP Port**: If you enabled Wi-Fi tagging, enter the port on the Array which the Wi-Fi tagging server will use to query the Array for tagging data. When queried, the Array will send back information on the tags it has observed. For each, the Array sends information such as the MAC address of the tag transmitting device, and the RSSI and noise floor observed.

3. **Wi-Fi Tag Channel**: If you enabled Wi-Fi tagging, enter the 802.11 channel on which the Array will listen for tags. The tag devices must be set up to transmit on this channel. Only one channel may be configured, and it must be an 802.11b/g channel in the range of Channel 1 to 11.

System Log

This window allows you to enable or disable the Syslog server, define primary, secondary, and tertiary servers, set up email notification, and set the level for Syslog reporting for each server and for email notification—the Syslog service will send Syslog messages at the selected severity or above to the defined Syslog servers and email address. An option allows you to use a Splunk application to analyze Array events by sending data in key:value pairs, as described in "About Using the Splunk Application for Xirrus Arrays" on page 193.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 0 hours, 18 m

Enable Syslog Server:	● Yes	○ No
Console Logging:	○ Yes	● No
Local File Size (1-2000 lines):	2000	
Primary Server Address (Hostname or IP) and Port:	dgates-4x6	514
Secondary Server Address (Hostname or IP) and Port:		514
Tertiary Server Address (Hostname or IP and Port):		514
Email Syslog SMTP Server Address (Hostname or IP) and Port:		25
Email Syslog SMTP Server User Name:		
Email Syslog SMTP Server User Password:		
Email Syslog From:		
Email Syslog Recipient Addresses (semicolon delimited):		
Station Formatting:	○ Standard	● Key / Value
Syslog Levels		
Console Logging:	information and more serious	
Local File:	debugging and more serious	
Primary Server:	debugging and more serious	
Secondary Server:	information and more serious	
Tertiary Server:	information and more serious	
Email SMTP Server:	warning and more serious	

Figure 113. System Log

Procedure for Configuring Syslog

1. **Enable Syslog Server:** Choose **Yes** to enable Syslog functionality, or choose **No** to disable this feature.

2. **Console Logging**: If you enabled Syslog, select whether or not to echo Syslog messages to the console as they occur. If you enable console logging, be sure to set the Console Logging level (see Step 8 below).

3. **Local File Size** (1-2000 lines): Enter a value in this field to define how many Syslog records are retained locally on the Array's internal Syslog file. The default is 2000.

4. **Primary Server Address (Hostname or IP) and Port**: If you enabled Syslog, enter the hostname or IP address of the primary Syslog server. You may also change the port used on the server if you do not wish to use 514, the default port.

5. **Secondary/Tertiary Server Address (Hostname or IP) and Port**: (Optional) If you enabled Syslog, you may enter the hostname or IP address of one or two additional Syslog servers to which messages will also be sent. You may also change the port used on each server if you do not wish to use 514, the default port. You may set one of the server addresses to the address of a server for Splunk (see "About Using the Splunk Application for Xirrus Arrays" on page 193).

6. **Email Notification**: (Optional) The following parameters allow you to send an email to a designated address each time a Syslog message is generated. The email will include the text of the Syslog message.

   a. **Email Syslog SMTP Server Address (Hostname or IP) and Port**: The hostname or the IP address of the SMTP server to be used for sending the email. Note that this specifies the mail server, **not** the email recipient. You may also change the port used on the server if you do not wish to use 25, the default SMTP port.

   b. **Email Syslog SMTP User Name**: Specify a user name for logging in to an account on the mail server designated in Step a.

   c. **Email Syslog SMTP User Password**: Specify a password for logging in to an account on the mail server designated in Step a.

   d. **Email Syslog SMTP From**: Specify the "From" email address to be displayed in the email.

   e. **Email Syslog SMTP Recipient Addresses**: Specify the entire email address of the recipient of the email notification. You may specify additional recipients by separating the email addresses with semicolons (;).

7. **Station Formatting**: If you are sending event information to a Splunk server, select **Key/Value** to send data in Splunk's expected format, otherwise leave this at the default value of **Standard**. See "About Using the Splunk Application for Xirrus Arrays" on page 193.

8. **Syslog Levels**: For each of the Syslog destinations, choose your preferred level of Syslog reporting from the pull-down list. Messages with criticality at the selected level and above will be shown. The default level varies depending on the destination.

   a. **Console Logging**: For messages to be echoed to the console, the default level is **Critical and more serious**. This prevents large numbers of non-critical messages from being displayed on the console. If you set this level too low, the volume of messages may make it very difficult to work with the CLI or view other output on the console.

   b. **Local File**: For records to be stored on the Array's internal Syslog file, choose your preferred level of Syslog reporting from the pull-down list. The default level is **Debugging and more serious**.

   c. **Primary Server**: Choose the preferred level of Syslog reporting for the primary server. The default level is **Debugging and more serious**.

   d. **Secondary/Tertiary Server**: Choose the preferred level of reporting for the secondary/tertiary server. The default level is **Information and more serious**. (Optional)

   e. **Email SMTP Server**: Choose the preferred level of Syslog reporting for the email notifications. The default level is **Warning and more serious**. This prevents your mailbox from being filled up with a large number of less severe messages such as informational messages.

9. Click **Save changes to flash** if you wish to make your changes permanent.

About Using the Splunk Application for Xirrus Arrays

Splunk may be used to provide visibility into client experience and analyze usage on XR Series Wireless Arrays. A Splunk application (Splunk for Xirrus XR Wireless Arrays) has been developed to present this operational intelligence at a glance. The app includes field extractions, event types, searches and dashboards to help shine a light on station status and activity.

To use Splunk, set up your Splunk server with the Splunk application—available from the Splunk web site at **Splunk for Xirrus XR Wireless Arrays**. Configure the Array to send data to Splunk by setting a **Primary**, **Secondary**, or **Tertiary Server Address** to the IP address or hostname of your Splunk server. Then set **Station Formatting** to **Key/Value** to send data in Splunk's expected format.

You may specify Server Addresses for Syslog servers and a Splunk server on the same Array.

See Also

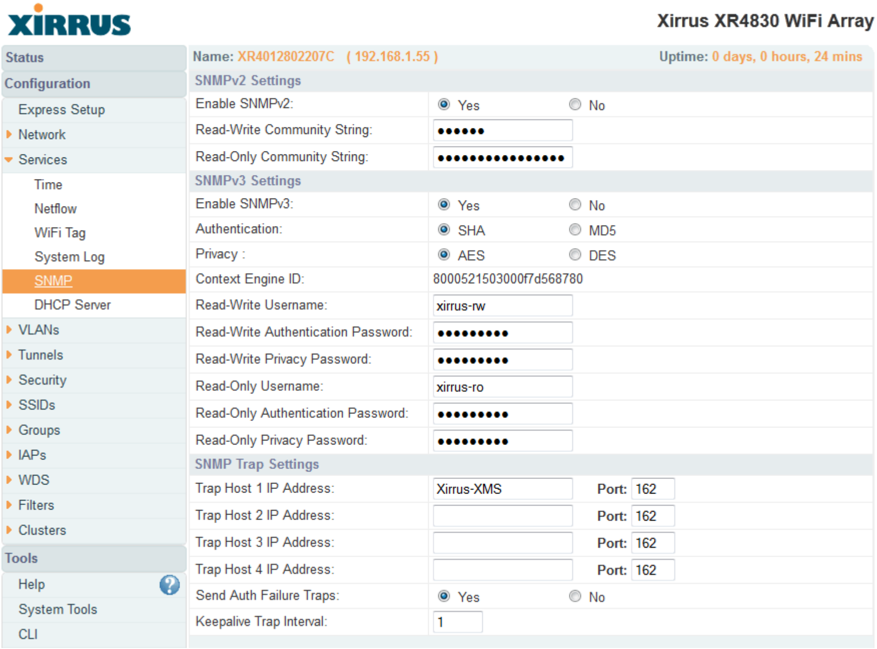
System Log Window
Services
SNMP
Time Settings (NTP)

SNMP

This window allows you to enable or disable SNMP v2 and SNMP v3 and define the SNMP parameters. SNMP allows remote management of the Array by the Xirrus Management System (XMS) and other SNMP management tools. SNMP v3 was designed to offer much stronger security. You may enable either SNMP version, neither, or both.

Complete SNMP details for the Array, including trap descriptions, are found in the Xirrus MIB, available at support.xirrus.com, in the **Downloads** section (login is required to download the MIB).

> ***NOTE:*** *If you are managing your Arrays with XMS (the Xirrus Management System), it is very important to make sure that your SNMP settings match those that you have configured for XMS. XMS uses both SNMP v2 and v3, with v3 given preference.*



Name: XR4012802207C (192.168.1.55) Uptime: 0 days, 0 hours, 24 mins

SNMPv2 Settings		
Enable SNMPv2:	● Yes	○ No
Read-Write Community String:	••••••	
Read-Only Community String:	••••••••••••••••	
SNMPv3 Settings		
Enable SNMPv3:	● Yes	○ No
Authentication:	● SHA	○ MD5
Privacy :	● AES	○ DES
Context Engine ID:	8000521503000f7d568780	
Read-Write Username:	xirrus-rw	
Read-Write Authentication Password:	•••••••••	
Read-Write Privacy Password:	•••••••••	
Read-Only Username:	xirrus-ro	
Read-Only Authentication Password:	•••••••••	
Read-Only Privacy Password:	•••••••••	
SNMP Trap Settings		
Trap Host 1 IP Address:	Xirrus-XMS	Port: 162
Trap Host 2 IP Address:		Port: 162
Trap Host 3 IP Address:		Port: 162
Trap Host 4 IP Address:		Port: 162
Send Auth Failure Traps:	● Yes	○ No
Keepalive Trap Interval:	1	

Figure 114. SNMP

Procedure for Configuring SNMP

SNMPv2 Settings

1. **Enable SNMPv2:** Choose **Yes** to enable SNMP v2 functionality, or choose No to disable this feature. When used in conjunction with the Xirrus Management System, SNMP v2 (**not** SNMP v3) must be enabled on each Array to be managed with XMS. The default for this feature is Yes (enabled).
2. **SNMP Read-Write Community String**: Enter the read-write community string. The default is **xirrus**.
3. **SNMP Read-Only Community String**: Enter the read-only community string. The default is **xirrus_read_only**.

SNMPv3 Settings

4. **Enable SNMPv3**: Choose **Yes** to enable SNMP v3 functionality, or choose No to disable this feature. The default for this feature is Yes (enabled).
5. **Authentication**: Select the desired method for authenticating SNMPv3 packets: **SHA** (Secure Hash Algorithm) or **MD5** (Message Digest Algorithm 5).
6. **Privacy**: Select the desired method for encrypting data: **DES** (Data Encryption Standard) or the stronger **AES** (Advanced Encryption Standard).
7. **Context Engine ID**: The unique identifier for this SNMP server. We recommend that you do not change this value. The Context Engine ID must be set if data collection is to be done via a proxy agent. This ID helps the proxy agent to identify the target agent from which data is to be collected.
8. **SNMP Read-Write Username**: Enter the read-write user name. This username and password allow configuration changes to be made on the Array. The default is **xirrus-rw**.
9. **SNMP Read-Write Authentication Password**: Enter the read-write password for authentication (i.e., logging in). The default is **xirrus-rw**.

10. **SNMP Read-Write Privacy Password**: Enter the read-write password for privacy (i.e., a key for encryption). The default is **xirrus-rw**.

11. **SNMP Read-Only Username**: Enter the read-only user name. This username and password do not allow configuration changes to be made on the Array. The default is **xirrus-ro**.

12. **SNMP Read-Only Authentication Password**: Enter the read-only password for authentication (i.e., logging in). The default is **xirrus-ro**.

13. **SNMP Read-Only Privacy Password**: Enter the read-only password for privacy (i.e., a key for encryption). The default is **xirrus-ro**.

SNMP Trap Settings

14. **SNMP Trap Host IP Address**: Enter the **IP Address** or hostname, as well as the **Port** number, of an SNMP management station that is to receive SNMP traps. You may specify up to four hosts that are to receive traps. Note that by default, **Trap Host 1** sends traps to **Xirrus-XMS**. Thus, the Array will automatically communicate its presence to XMS (as long as the network is configured correctly to allow this host name to be resolved—note that DNS is not normally case-sensitive).

    For a definition of the traps sent by Xirrus Wireless Arrays, you may download the Xirrus MIB from support.xirrus.com (login required). Search for the string **TRAP** in the MIB file.

15. **Send Auth Failure Traps**: Choose **Yes** to log authentication failure traps or **No** to disable this feature.

16. **Keepalive Trap Interval** (minutes): Traps are sent out at this interval to indicate the presence of the Array on the network. Keepalive traps are required for proper operation with XMS. To disable keepalive traps, set the value to **0**.

17. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

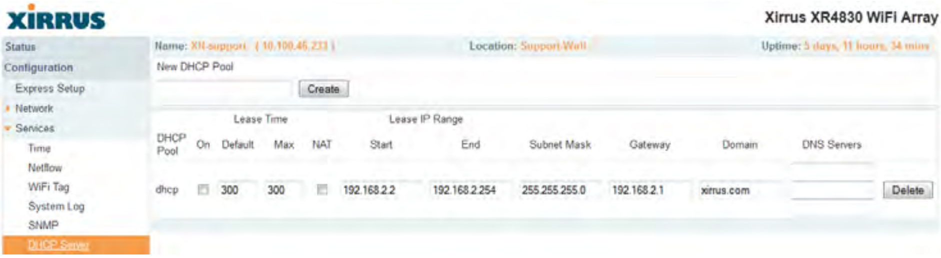
Services

System Log
Time Settings (NTP)

DHCP Server

This window allows you to create, enable, modify and delete DHCP (Dynamic Host Configuration Protocol) address pools. DHCP allows the Array to provide wireless clients with IP addresses and other networking information. The DHCP server will not provide DHCP services to the wired side of the network. If you do not use the DHCP server on the Array, then your wired network must be configured to supply DHCP addresses and gateway and DNS server addresses to wireless clients.

When you create a DHCP pool, you must define the DHCP lease time (default and maximum), the IP address ranges (pools) that the DHCP server can assign, and the gateway address and DNS servers to be used by clients.



Name: XR-support (10.100.46.233) Location: Support Wall Uptime: 5 days, 11 hours, 34 mins

New DHCP Pool

DHCP Pool	On	Lease Time Default	 Max	NAT	Lease IP Range Start	 End	Subnet Mask	Gateway	Domain	DNS Servers
dhcp	□	300	300	□	192.168.2.2	192.168.2.254	255.255.255.0	192.168.2.1	xirrus.com	

Figure 115. DHCP Management

DHCP usage is determined in several windows—see SSID Management, Group Management, and VLAN Management.

Procedure for Configuring the DHCP Server

1. **New Internal DHCP Pool**: Enter a name for the new DHCP pool, then click on the **Create** button. The new pool ID is added to the list of available DHCP pools.
2. **On**: Click this checkbox to make this pool of addresses available, or clear it to disable the pool.

3. **Lease Time—Default**: This field defines the default DHCP lease time (in seconds). The factory default is 300 seconds, but you can change the default at any time.

4. **Lease Time—Max**: Enter a value (in seconds) to define the maximum allowable DHCP lease time. The default is 300 seconds.

5. **Network Address Translation (NAT)**: Check this box to enable the Network Address Translation feature.

6. **Lease IP Range—Start**: Enter an IP address to define the start of the IP range that will be used by the DHCP server. The default is 192.168.1.100.

7. **Lease IP Range—End**: Enter an IP address to define the end of the IP range that will be used by the DHCP server. The DHCP server will only use IP addresses that fall between the start and end range that you define on this page. The default is 192.168.1.200.

8. **Subnet Mask**: Enter the subnet mask for this IP range for the DHCP server. The default is 255.255.255.0.

9. **Gateway**: If necessary, enter the IP address of the gateway.

10. **Domain**: Enter the DNS domain name. See "DNS Settings" on page 181.

11. **DNS Servers** (1 to 3): Enter the IP address of the primary DNS server, secondary DNS server and tertiary DNS server. These DNS server addresses will be passed to stations when they associate, along with the assigned IP address. Note that if you leave these blank, no DNS information is sent to the stations. DHCP will **not** default to sending the DNS servers that are configured in DNS Settings. See also, "DNS Settings" on page 181.

12. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

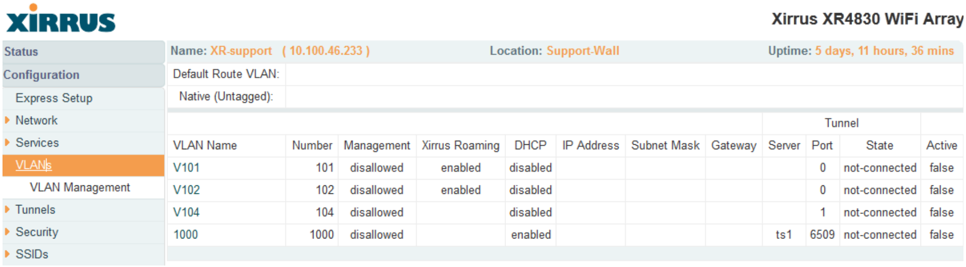
DHCP Leases
DNS Settings
Network Map

VLANs

This is a status-only window that allows you to review the current status of configured VLANs. VLANS are virtual LANs used to create broadcast domains.

You should create VLAN entries on the Array for all of the VLANs in your wired network if you wish to make traffic from those VLANs available on the wireless network. Each tagged VLAN should be associated with a wireless SSID (see "VLAN Management" on page 201). The Array will discard any VLAN-tagged packets arriving on its wired ports, unless the same VLAN has been defined on the Array. See "Undefined VLANs" on page 113.

In addition to listing all VLANs, this window shows your settings for the Default Route VLAN and the Native (Untagged) VLAN (Step 1 page 202).



Name: XR-support (10.100.46.233) Location: Support-Wall Uptime: 5 days, 11 hours, 36 mins

Default Route VLAN:

Native (Untagged):

								Tunnel			
VLAN Name	Number	Management	Xirrus Roaming	DHCP	IP Address	Subnet Mask	Gateway	Server	Port	State	Active
V101	101	disallowed	enabled	disabled					0	not-connected	false
V102	102	disallowed	enabled	disabled					0	not-connected	false
V104	104	disallowed		disabled					1	not-connected	false
1000	1000	disallowed		enabled				ts1	6509	not-connected	false

Figure 116. VLANs

For a discussion of implementing Voice over Wi-Fi on the Array, see the ***Xirrus Voice over Wireless Application Note*** *in the* ***Xirrus Resource Center****.*

Understanding Virtual Tunnels

Xirrus Arrays support Layer 2 tunneling. This allows an Array to use tunnels to transport traffic for one or more SSID-VLAN pairs onto a single destination network through the Layer 3 core network. Tunnels may be implemented with:

- The Xirrus Tunnel Server (XTS)—see the *Xirrus Tunnel Server User's Guide*.
- Virtual Tunnel Server (VTS)—see below.

Virtual Tunnel Server (VTS)

Tunneling capability is provided by a Virtual Tunnel Server. You supply the server and deploy it in your network using open-source VTun software, available from vtun.sourceforge.net. To enable the Array to use tunneling for a VLAN, simply enter the IP address, port and secret for the tunnel server as described in Step 11 on page 203.

VTun may be configured for a number of different tunnel types, protocols, and encryption types. For use with Arrays, we recommend the following configuration choices:

- Tunnel Type: Ether (Ethernet tunnel)
- Protocol: UDP
- Encryption Type: select one of the encryption types supported by VTun (AES and Blowfish options are available)
- Keepalive: yes

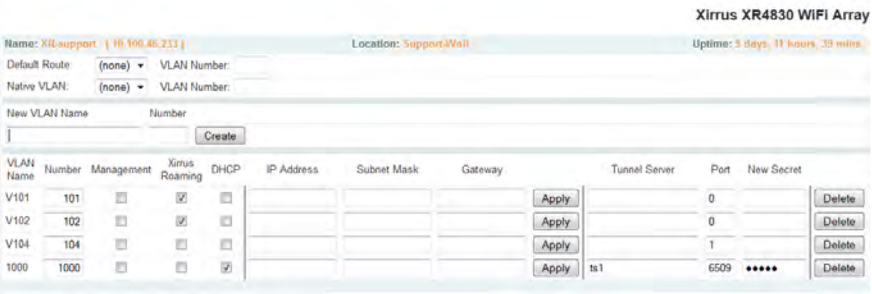
VTS Client-Server Interaction

The Array is a client of the Virtual Tunnel Server. When you specify a VTS for an active VLAN-SSID pair, the Array contacts the VTS. The server then creates a tunnel session to the Array. VTun encapsulated packets will cross the Layer 3 network from the Array to the VTS. When packets arrive at the VTS, they will be de-encapsulated and the resultant packets will be passed to your switch with 802.1q VLAN tags for final Layer 2 processing. The process occurs in reverse for packets traveling in the other direction.

We recommend that you enable the VTun keep-alive option. This will send a keep-alive packet once per second to ensure that the tunnel remains active. Tunnels can be configured to come up on demand but this is a poor choice for wireless, since tunnel setup can take roughly 5-20 seconds and present a problem for authentication.

VLAN Management

This window allows you to assign and configure VLANs. After creating a new VLAN (added to the list of VLANs), you can modify the configuration parameters of an existing VLAN or delete a selected VLAN. You may create up to 32 VLANs.



Xirrus XR4830 WiFi Array

Name: XR-support (10.100.46.233) Location: Support-Wall Uptime: 5 days, 11 hours, 39 mins

Default Route: (none) ▾ VLAN Number:

Native VLAN: (none) ▾ VLAN Number:

New VLAN Name Number

Create

VLAN Name	Number	Management	Xirrus Roaming	DHCP	IP Address	Subnet Mask	Gateway		Tunnel Server	Port	New Secret	
V101	101	□	☑	□				Apply		0		Delete
V102	102	□	☑	□				Apply		0		Delete
V104	104	□	□	□				Apply		1		Delete
1000	1000	□	□	☑				Apply	ts1	6509	●●●●●	Delete

Figure 117. VLAN Management

*The Wireless Array supports dynamic VLAN assignments specified by RADIUS policy settings. When RADIUS sends these assignments, the Array dynamically assigns wireless stations to VLANs as requested. VLAN tags on traffic are passed through the Array (i.e., VLAN tags are not stripped). Once a station has been dynamically moved to a new VLAN, it will be shown in the Stations window as a member of the new VLAN. (**Figure 70 on page 126**)*

It is critical to configure all VLANs to be used on the Array, even those that will be dynamically assigned.

Procedure for Managing VLANs

1. **Default Route:** This option sets a default route from the Array. The Array supports a default route on native and tagged interfaces. Once the default route is configured the Array will attempt to use Address Resolution Protocol (ARP) to find the default router. ARP finds the MAC address of a device with a given IP address by sending out a broadcast message requesting this information. This option allows you to choose a default VLAN route from the pull-down list. The IP Gateway must be established for this function to work. After changing the **Default Route**, you *must* click **Save changes to flash** *and then reboot*.

2. **Native VLAN**: This option sets whether the Array management is tagged or untagged. If you select a Native VLAN, then that VLAN will use an untagged (Native) link. Otherwise, the Array will use 802.1Q tagging and a specific VLAN ID with management enabled for management of the Array.

3. **New VLAN Name/Number**: Enter a name and number for the new VLAN in this field, then click on the **Create** button. The new VLAN is added to the list.

4. **VLAN Number**: Enter a number for this VLAN (1-4094).

5. **Management**: Check this box to allow management over this VLAN.

6. **Xirrus Roaming**: Check this box to allow roaming over this VLAN.

7. **DHCP**: Check this box if you want the DHCP server to assign the IP address, subnet mask and gateway address to the VLAN automatically, otherwise you must go to the next step and assign these parameters manually.

8. **IP Address**: If the DHCP option is disabled, enter a valid IP address for this VLAN association.

9. **Subnet Mask**: If the DHCP option is disabled, enter the subnet mask IP address for this VLAN association.

10. **Gateway**: If the DHCP option is disabled, enter the IP gateway address for this VLAN association.

11. **Tunnel Server**: If this VLAN is to be tunneled, enter the IP address or host name of the tunnel server that will perform the tunneling. For more information on virtual tunnels, please see "Understanding Virtual Tunnels" on page 199.

12. **Port**: If this VLAN is to be tunneled, enter the port number of the tunnel server.

13. **New Secret**: Enter the password expected by the tunnel server.

14. **Delete**: To delete the selected VLAN, simply click the **Delete** button to remove the VLAN from the list.

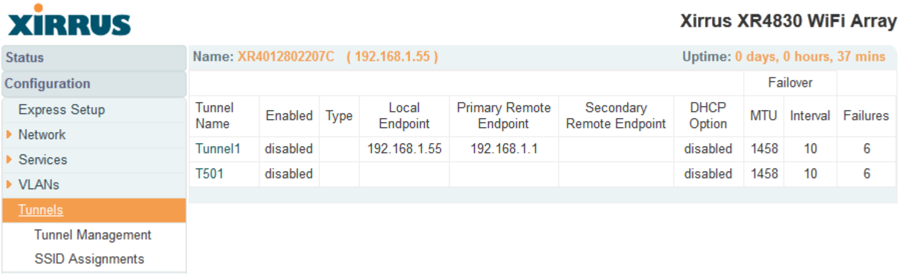
15. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

VLAN Statistics
VLANs
Tunnels

Tunnels

This read-only window allows you to review the tunnels that have been defined on the Array. It lists all tunnels and their settings, including the type of authentication and the local and remote endpoints for each tunnel.



Name: XR4012802207C (192.168.1.55)

Uptime: 0 days, 0 hours, 37 mins

							Failover		
Tunnel Name	Enabled	Type	Local Endpoint	Primary Remote Endpoint	Secondary Remote Endpoint	DHCP Option	MTU	Interval	Failures
Tunnel1	disabled		192.168.1.55	192.168.1.1		disabled	1458	10	6
T501	disabled					disabled	1458	10	6

Figure 118. Tunnel Summary

About Xirrus Tunnels

Xirrus Arrays offer GRE (Generic Routing Encapsulation) tunneling with VLAN support. This allows an Array to use tunnels to bridge Layer 2 traffic for one or more SSID-VLAN pairs onto a single destination network through the Layer 3 network. GRE tunneling is quite flexible, and can encapsulate many network layer protocols. As a result, it can support a variety of applications. For example, a Wi-Fi hotspot can allow guest logins and use the tunnel to give guests direct access to the Internet, without allowing access to the local network. In a small office, you may define a tunnel to connect users to the corporate office network. Tunnels may also used when providing cellular offload capability.

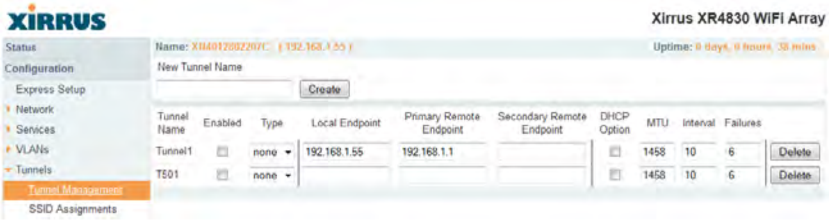
Tunnels may be implemented with:

- The Xirrus Tunnel Server (XTS)—see the *Xirrus Tunnel Server User's Guide*.
- VTS —see "Virtual Tunnel Server (VTS)" on page 200.

To create a tunnel, you specify the **Local Endpoint**, which should be one of the Array's wired ports, and the **Primary Remote Endpoint**. A **Secondary Remote Endpoint** may also be specified in case of a failure at the first endpoint. Traffic for a VLAN-SSID pair is sent in GRE encapsulated packets across the Layer 3 network from the Array to the remote endpoint. When packets arrive, the encapsulation is stripped and the resultant packets are passed to your switch with 802.1q VLAN tags for final Layer 2 processing. The process occurs in reverse for packets traveling in the other direction. One tunnel is able to transport up to 16 VLANs.

Tunnel Management

This window allows you to create tunnels.



Name: XI14012802207C (192.168.1.55) Uptime: 0 days, 0 hours, 38 mins

New Tunnel Name

Tunnel Name	Enabled	Type	Local Endpoint	Primary Remote Endpoint	Secondary Remote Endpoint	DHCP Option	MTU	Interval	Failures	
Tunnel1	□	none	192.168.1.55	192.168.1.1		□	1458	10	6	Delete
T501	□	none				□	1458	10	6	Delete

Figure 119. Tunnel Management

Procedure for Managing Tunnels

1. **New Tunnel Name**: Enter a name for the new tunnel in this field, then click on the **Create** button. The new tunnel is added to the list.

2. **Enabled**: The new tunnel is created in the disabled state. Click this checkbox to enable it.

3. **Type**: Enter the type of tunnel, **none** or **gre**.

4. **Local Endpoint**: Enter the IP address of the Array Gigabit or 10 Gigabit port where the tunnel is to begin.

5. **Primary Remote Endpoint**: Enter the IP address of the remote endpoint of the tunnel.

6. **Secondary Remote Endpoint**: This provides a failover capability. If the primary tunnel fails, traffic is switched over to the secondary tunnel. Enter the IP address of the remote endpoint of the secondary tunnel.

7. **DHCP Option**: Check this box if you want the DHCP server to assign the IP address, subnet mask and gateway address when a station makes a DHCP request.

8. **MTU**: Set maximum transmission unit (MTU) size.

9. **Interval**: The tunnel mechanism will ping the current remote endpoint periodically to ensure that it is still reachable. Enter the ping interval (in seconds).

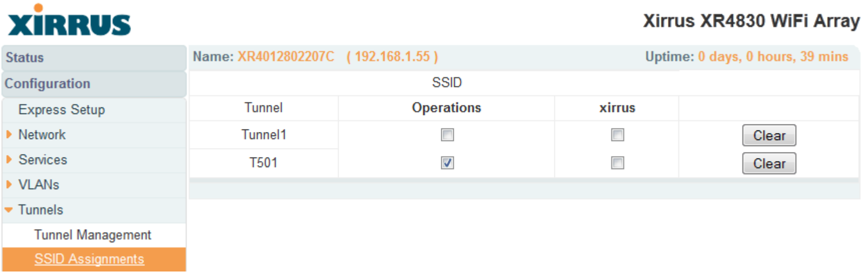
10. **Failures**: Enter the number of consecutive ping failures that will cause the Array to consider the tunnel to be down.

11. Click **Save changes to flash** if you wish to make your changes permanent.

12. Proceed to SSID Assignments to define the SSIDs (and associated VLANs) for which each tunnel will bridge data. You may create up to 16 tunnels. Each will need an SSID/VLAN pair assigned to it so that it can function properly.

SSID Assignments

This window allows you to select the SSIDs to be bridged by each tunnel.



Xirrus XR4830 WiFi Array

Name: XR4012802207C (192.168.1.55) Uptime: 0 days, 0 hours, 39 mins

	SSID		
Tunnel	Operations	xirrus	
Tunnel1	☐	☐	Clear
T501	☑	☐	Clear

Figure 120. Tunnel SSID Assignments

Procedure for Assigning SSIDs

This window lists the tunnels and SSIDs that you have defined. SSIDs to be tunnelled should be associated with a VLAN (see “SSID Management” on page 249).

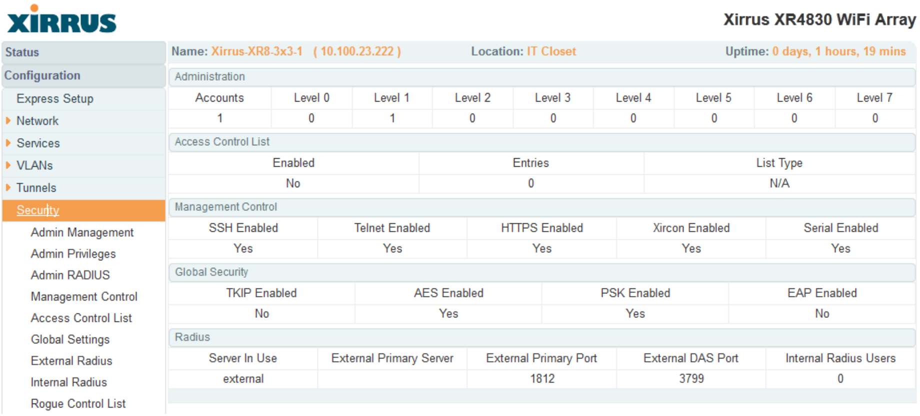
1. For each tunnel, select the SSIDs that are to be bridged to the remote endpoint. Clear the checkbox for any SSID that you no longer wish to include in the tunnel.
2. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

Tunnels
VLANs
SSIDs

Security

This status- only window allows you to review the Array's security parameters. It includes the assigned network administration accounts, Access Control List (ACL) values, management settings, encryption and authentication protocol settings, and RADIUS configuration settings. There are no configuration options available in this window, but if you are experiencing issues with security, you may want to print this window for your records.



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 1 hours, 19 mins

Administration

Accounts	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
1	0	1	0	0	0	0	0	0

Access Control List

Enabled	Entries	List Type
No	0	N/A

Management Control

SSH Enabled	Telnet Enabled	HTTPS Enabled	Xircon Enabled	Serial Enabled
Yes	Yes	Yes	Yes	Yes

Global Security

TKIP Enabled	AES Enabled	PSK Enabled	EAP Enabled
No	Yes	Yes	No

Radius

Server In Use	External Primary Server	External Primary Port	External DAS Port	Internal Radius Users
external		1812	3799	0

Figure 121. Security

For additional information about wireless network security, refer to:

- **"Security Planning" on page 46**
- **"Understanding Security" on page 209**
- **The Security section of "Frequently Asked Questions" on page 452**

For information about secure use of the WMI, refer to:

- **"Certificates and Connecting Securely to the WMI" on page 212**
- **"Using the Array's Default Certificate" on page 212**
- **"Using an External Certificate Authority" on page 213**
- **"About Creating Admin Accounts on the RADIUS Server" on page 218**
- **"About Creating User Accounts on the RADIUS Server" on page 234**

Security settings are configured with the following windows:

- **"Admin Management" on page 214**
- **"Admin Privileges" on page 216**
- **"Admin RADIUS" on page 218**
- **"Management Control" on page 221**
- **"Access Control List" on page 227**
- **"Global Settings" on page 230**
- **"External Radius" on page 234**
- **"Internal Radius" on page 238**
- **"Rogue Control List" on page 240**

Understanding Security

The Xirrus Wireless Array incorporates many configurable security features. After initially installing an Array, always change the default administrator password (the default is admin), and choose a strong replacement password (containing letters, numbers and special characters). When appropriate, issue read-only administrator accounts.

Other security considerations include:

- **SSH versus Telnet**: Be aware that Telnet is not secure over network connections and should be used only with a direct serial port connection. When connecting to the unit's Command Line Interface over a network connection, you must use a Secure SHell version 2 (SSH-2) utility. SSH-2 provides stronger security than SSH-1. The most commonly used freeware providing SSH tools is PuTTY.
- **Configuration auditing**: The optional Xirrus Management System (XMS) offers powerful management features for small or large Xirrus wireless deployments, and can audit your configuration settings automatically. In addition, using the XMS eliminates the need for an FTP server.
- **Choosing an encryption method**: Wireless data encryption prevents eavesdropping on data being transmitted or received over the airwaves.

The Array allows you to establish the following data encryption configuration options:

- **Open**—this option offers no data encryption and is not recommended, though you might choose this option if clients are required to use a VPN connection through a secure SSH utility, like PuTTy.
- **WEP (Wired Equivalent Privacy)**—this option provides minimal protection (though much better than using an open network). An early standard for wireless data encryption and supported by all Wi-Fi certified equipment, WEP is vulnerable to hacking and is therefore not recommended for use by Enterprise networks.
- **WPA (Wi-Fi Protected Access) and WPA2**—these are much stronger encryption modes than WEP, using TKIP (Temporal Key Integrity Protocol) or AES (Advanced Encryption Standard) to encrypt data.

  WPA solves security issues with WEP. It also allows you to establish encryption keys on a per-user-basis, with key rotation for added security. In addition, TKIP provides Message Integrity Check (MIC) functionality and prevents active attacks on the wireless network.

  AES is the strongest encryption standard and is used by government agencies; however, old legacy hardware may not be capable of supporting the AES mode (it probably won't work on older wireless clients). Because AES is the strongest encryption standard currently available, WPA2 with AES is highly recommended for Enterprise networks.

Any of the above encryption methods can be used and an Array can support multiple encryption methods simultaneously, but only one method may be selected per SSID (except that selecting **WPA-Both** allows WPA and WPA2 to be used at the same time on the same SSID). Otherwise, if multiple security methods are needed, you must define multiple SSIDs.

The encryption mode (WEP, WPA, etc.) is selected in the **SSIDs >SSID Management** window (see "SSID Management" on page 249). The encryption standard used with WPA or WPA2 (AES or TKIP) is selected in the **Security>Global Settings** window under **WPA Settings** (see "Global Settings" on page 230).

- **Choosing an authentication method**: User authentication ensures that users are who they say they are. For this purpose, the Array allows you to choose between the following user authentication methods:
  - **Pre-Shared Key**—users must manually enter a key (passphrase) on the client side of the wireless network that matches the key stored by the administrator in the Array.

    This method should be used only for smaller networks when a RADIUS server is unavailable. If PSK must be used, choose a strong passphrase containing between 8 and 63 characters (20 is preferred). Always use a combination of letters, numbers and special characters. Never use English words separated by spaces.
  - **RADIUS 802.1x with EAP**—802.1x uses a RADIUS server to authenticate large numbers of clients, and can handle different EAP (Extensible Authentication Protocol) authentication methods, including EAP-TLS, EAP-TTLS, EAP-PEAP, and LEAP-Passthrough. The RADIUS server can be internal (provided by the Wireless Array) or external. An external RADIUS server offers more functionality and security, and is recommended for large deployments. When using this method, user names and passwords must be entered into the RADIUS server for user authentication.
  - **MAC Address ACLs (Access Control Lists)**—MAC address ACLs provide a list of client adapter MAC addresses that are allowed or denied access to the wireless network. Access Control Lists work well when there are a limited number of users—in this case, enter the MAC address of each user in the Allow list. In the event of a lost or stolen MAC adapter, enter the affected MAC

address in the Deny list. The Wireless Array will accept up to 1,000 ACL entries.

Certificates and Connecting Securely to the WMI

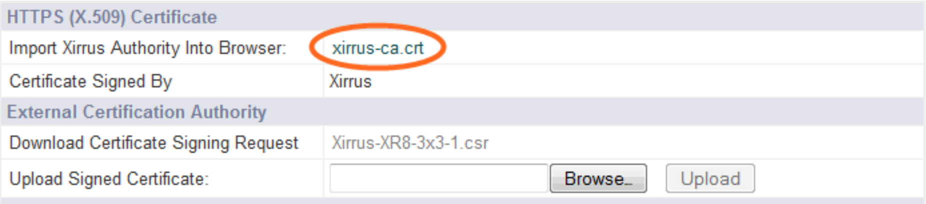
When you point your browser to the Array to connect to the WMI, the Array presents an X.509 security certificate to the browser to establish a secure channel. One significant piece of information in the certificate is the Array's host name. This ties the certificate to a particular Array and ensures the client that it is connecting to that host.

Certificate Authorities (CAs) are entities that digitally sign certificates, using their own certificates (for example, VeriSign is a well-known CA). When the Array presents its certificate to the client's browser, the browser looks up the CA that signed the certificate to decide whether to trust it. Browsers ship with a small set of trusted CAs already installed. If the browser trusts the certificate's CA, it checks to ensure the host name (and IP address) match those on the certificate. If any of these checks fail, you get a security warning when connecting to the WMI.

The Array ships with a default certificate that is signed by the Xirrus CA. You may choose to use this certificate, or to use a certificate issued by the CA of your choice, as described in the following sections:

- Using the Array's Default Certificate
- Using an External Certificate Authority

Using the Array's Default Certificate



HTTPS (X.509) Certificate	
Import Xirrus Authority Into Browser:	xirrus-ca.crt
Certificate Signed By	Xirrus
External Certification Authority	
Download Certificate Signing Request	Xirrus-XR8-3x3-1.csr
Upload Signed Certificate:	Browse... Upload

Figure 122. Import Xirrus Certificate Authority

The Array's certificate is signed by a Xirrus CA that is customized for your Array and its current host name. By default, browsers will not trust the Array's certificate. You may import the Xirrus certificate to instruct the browser to trust the Xirrus CA on all future connections to Arrays. The certificate for the Xirrus CA is available on the Array, so that you can import it into your browser's cache of trusted CAs (right alongside VeriSign, for example). On the Management Control window of the WMI you will see the **xirrus-ca.crt** file. (Figure 122)

By clicking and opening this file, you can follow your browser's instructions and import the Xirrus CA into your CA cache (see page 225 for more information). This instructs your browser to trust any of the certificates signed by the Xirrus CA, so that when you connect to any of our Arrays you should no longer see the warning about an untrusted site. Note however, that this only works if you use the host name when connecting to the Array. If you use the IP address to connect, you get a lesser warning saying that the certificate was only meant for 'hostname'.

Since an Array's certificate is based on the Array's host name, any time you change the host name the Array's CA will regenerate and sign a new certificate. This happens automatically the next time you reboot after changing the host name. If you have already installed the Xirrus CA on a browser, this new Array certificate should automatically be trusted.

When you install the Xirrus CA in your browser, it will trust a certificate signed by any Xirrus Array, as long as you connect using the Array's host name.

Using an External Certificate Authority

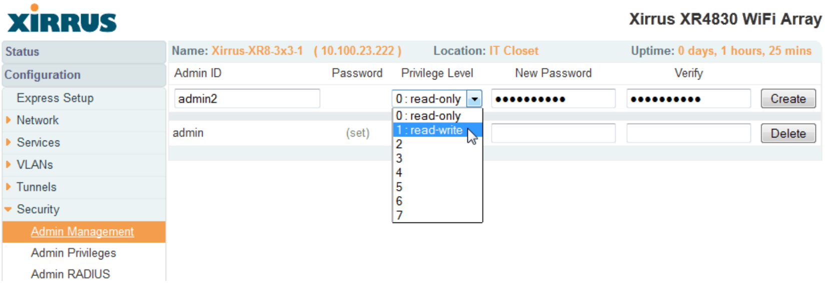
If you prefer, you may install a certificate on your Array signed by an outside CA.

Why use a certificate from an external CA? The Array's certificate is used for security when stations attempt to associate to an SSID that has Web Page Redirect enabled. In this case, it is preferable for the Array to present a certificate from an external CA that is likely to be trusted by most browsers. When a WPR login page is presented, the user will not see a security error if the Array's certificate was obtained from an external CA that is already trusted by the user's browser.

WMI provides options for creating a Certificate Signing Request that you can send to an external CA, and for uploading the signed certificate to the Array after you obtain it from the CA. This certificate will be tied to the Array's host name and private key. See "External Certification Authority" on page 226 for more details.

Admin Management

This window allows you to manage network administrator accounts (create, modify and delete). It also allows you to limit account access to a read only status. When finished, click on the **Save changes to flash** button if you wish to make your changes permanent.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 1 hours, 25 mins

Admin ID	Password	Privilege Level	New Password	Verify	
admin2		0 : read-only	••••••••••	••••••••••	Create
admin	(set)				Delete

Figure 123. Admin Management

Procedure for Creating or Modifying Network Administrator Accounts

1. **Admin ID:** Enter the login name for a new network administrator ID. The length of the ID must be between 5 and 50 characters, inclusive.

2. **Read/Write**: Choose **1:read-write** if you want to give this administrator ID full read/write privileges, or choose **0:read-only** to restrict this user to read only status. In the read only mode, administrators cannot save changes to configurations. Or you may select one of your custom-defined privilege levels (see "Admin Privileges" on page 216).

3. **New Password**: Enter a password for this ID. The length of the password must be between 5 and 50 characters, inclusive.

4. **Verify**: Re-enter the password in this field to verify that you typed the password correctly. If you do not re-enter the correct password, an error message is displayed).

5. Click on the **Create** button to add this administrator ID to the list.

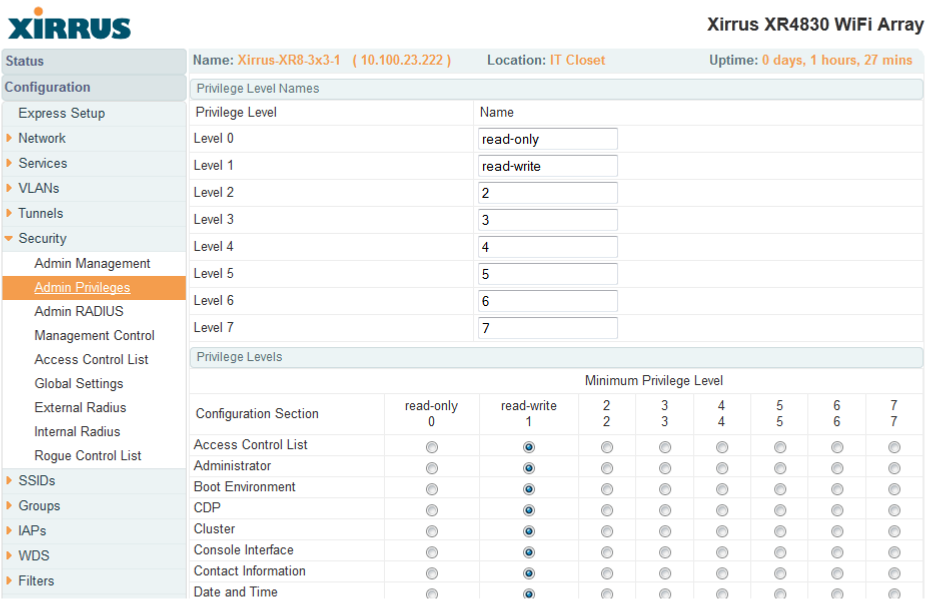
6. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

Admin Privileges
External Radius
Global Settings (IAP)
Internal Radius
Management Control

Admin Privileges

This window provides a detailed level of control over the privileges of Array administrators. Administrators may be assigned one of eight **Privilege Levels**. You may define the privilege level of each major feature (**Configuration Section**) that may be configured on the Array. For example, say that you set the privilege level to 4 for Reboot Array, Security, Radius Server, and SNMP, and you leave all other configuration sections at the default privilege level of 1. In this case, any administrator with a privilege level of 4 or higher may perform any operation on the Array, while an administrator with a privilege level lower than 4 but at least 1 may perform any operation except those whose level was set to 4. An error message will be displayed if an operation is attempted without a sufficient privilege level.



Xirrus XR4830 WiFi Array

Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 1 hours, 27 mins

Privilege Level Names

Privilege Level	Name
Level 0	read-only
Level 1	read-write
Level 2	2
Level 3	3
Level 4	4
Level 5	5
Level 6	6
Level 7	7

Privilege Levels

	Minimum Privilege Level							
Configuration Section	read-only 0	read-write 1	2 2	3 3	4 4	5 5	6 6	7 7
Access Control List	○	●	○	○	○	○	○	○
Administrator	○	●	○	○	○	○	○	○
Boot Environment	○	●	○	○	○	○	○	○
CDP	○	●	○	○	○	○	○	○
Cluster	○	●	○	○	○	○	○	○
Console Interface	○	●	○	○	○	○	○	○
Contact Information	○	●	○	○	○	○	○	○
Date and Time	○	●	○	○	○	○	○	○

Figure 124. Admin Privileges

Privilege level 0 is **read-only**. As a minimum, all administrators have permission for read access to all areas of Array configuration. Higher privilege levels may be used to define additional privileges for specific configuration sections.

If you are using an Admin RADIUS server to define administrator accounts, please see "RADIUS Vendor Specific Attribute (VSA) for Xirrus" on page 463 to set the privilege level for each administrator.

Procedure for Configuring Admin Privileges

1. **Privilege Level Names** (optional): You may assign a **Name** to each Privilege Level. The name may be used to describe the access granted by this level. By default, levels **0** and **1** are named **read-only** and **read-write**, respectively, and levels **2** through **7** have the same name as their level number.
2. **Privilege Levels**: Use this section to assign a **Minimum Privilege Level** to selected **Configuration Sections** as desired. By default, all sections are assigned level 1. When you select a higher privilege level for a configuration section, then only administrators who have at least that privilege level will be able to make configuration changes to that section.
3. You may click **^** at the bottom of any row to toggle the values in the entire column to either on or off.
4. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

External Radius
Groups
Admin Management
Admin RADIUS
Security

Admin RADIUS

This window allows you to set up authentication of network administrators via RADIUS. Using RADIUS to control administrator accounts for logging in to Arrays has these benefits:

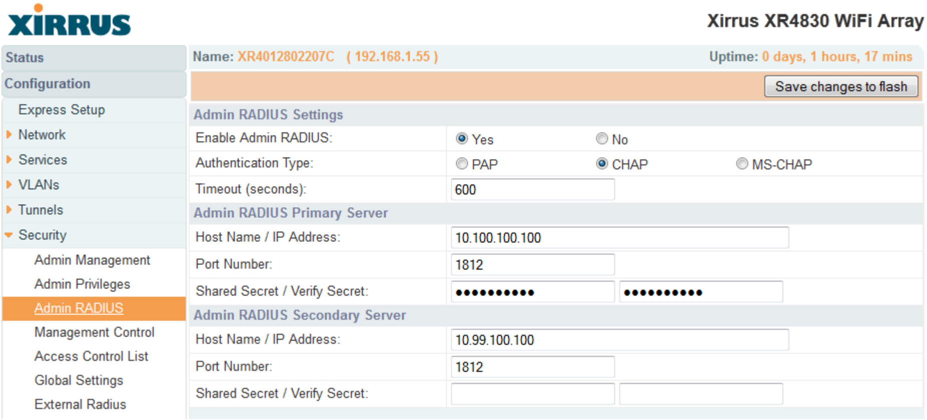
- Centralized control of administrator accounts.
- Less effort—you don't have to set up user names and passwords on each Array; just enter them once on the RADIUS server and then all of the Arrays can pull from the RADIUS server.
- Enforced policies—you may set password rules (e.g., passwords must contain at least one number and be at least 12 characters in length), and you may set expiration times for passwords.

Admin RADIUS settings override any local administrator accounts configured on the Admin Management window. If you have Admin RADIUS enabled, all administrator authentication is done via the configured RADIUS servers. The only exception to this is when you are connected via the Console port (using CLI). If you are using the Console port, the Array will authenticate administrators using accounts configured on the Admin Management window first, and then use the RADIUS servers. This provides a safety net to be ensure that you are not completely locked out of an Array if the RADIUS server is down.

About Creating Admin Accounts on the RADIUS Server

Permissions for RADIUS administrator accounts are controlled by the RADIUS **Xirrus-Admin-Role** attribute. This is a Vendor Specific Attribute (VSA). To define the privileges permitted to an administrator account, set the value of its Xirrus-Admin-Role attribute to the desired **Privilege Level Name** string, as defined in “Admin Privileges” on page 216. For more information about the RADIUS VSAs used by Xirrus, see “RADIUS Vendor Specific Attribute (VSA) for Xirrus” on page 463.

When configuring administrator accounts on the RADIUS server, you must observe the same restrictions for length and legal characters as when creating these accounts on the Array using the Admin Management window: the user name and password must be between 5 and 50 characters, inclusive.



Name: XR4012802207C (192.168.1.55)   Uptime: 0 days, 1 hours, 17 mins

Admin RADIUS Settings

Enable Admin RADIUS:	● Yes	○ No	
Authentication Type:	○ PAP	● CHAP	○ MS-CHAP
Timeout (seconds):	600		

Admin RADIUS Primary Server

Host Name / IP Address:	10.100.100.100	
Port Number:	1812	
Shared Secret / Verify Secret:	●●●●●●●●●●	●●●●●●●●●●

Admin RADIUS Secondary Server

Host Name / IP Address:	10.99.100.100	
Port Number:	1812	
Shared Secret / Verify Secret:		

Figure 125. Admin RADIUS

Procedure for Configuring Admin RADIUS

Use this window to enable/disable administrator authentication via RADIUS, and to set up primary and secondary servers to use for authentication of administrators attempting to log in to the Array.

1. **Admin RADIUS Settings:**

   a. **Enable Admin RADIUS**: Click **Yes** to enable the use of RADIUS to authenticate administrators logging in to the Array. You will need to specify the RADIUS server(s) to be used.

   b. **Authentication Type**: Select the protocol used for authentication of administrators, **CHAP** or **PAP** (the default).

      - PAP (Password Authentication Protocol), is a simple protocol. PAP transmits ASCII passwords over the network “in the clear” (unencrypted) and is therefore considered insecure.
      - CHAP (Challenge-Handshake Authentication Protocol) is a more secure protocol. The login request is sent using a one-way hash function.

   c. **Timeout (seconds)**: Define the maximum idle time (in seconds) before the RADIUS server's session times out. The default is 600 seconds.

2. **Admin RADIUS Primary Server**: This is the RADIUS server that you intend to use as your primary server.

   a. **Host Name / IP Address**: Enter the IP address or domain name of this external RADIUS server.

   b. **Port Number**: Enter the port number of this RADIUS server. The default is 1812.

   c. **Shared Secret / Verify Secret**: Enter the shared secret that this RADIUS server will be using, then re-enter the shared secret to verify that you typed it correctly.

   The shared secret that you define must match the secret used by the RADIUS server.

3. **Admin RADIUS Secondary Server** (optional): If desired, enter an alternative external RADIUS server. If the primary RADIUS server becomes unreachable, the Array will "failover" to the secondary RADIUS server (defined here).

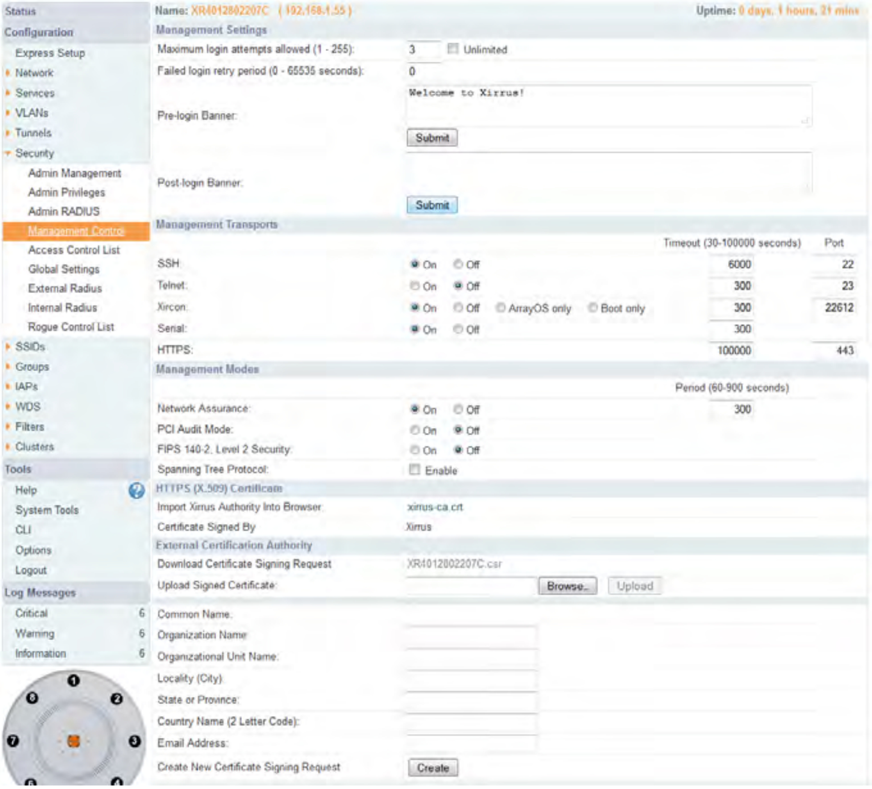
   a. **Host Name / IP Address**: Enter the IP address or domain name of this RADIUS server.

   b. **Port Number**: Enter the port number of this RADIUS server. The default is 1812.

   c. **Shared Secret / Verify Secret**: Enter the shared secret that this RADIUS server will be using, then re-enter the shared secret to verify that you typed it correctly.

Management Control

This window allows you to enable or disable the Array management interfaces and set their inactivity time-outs. The supported range is 300 (default) to 100,000 seconds.



Name: XR4012802207C (192.168.1.55) Uptime: 0 days, 1 hours, 21 mins

Management Settings

Maximum login attempts allowed (1 - 255): 3 □ Unlimited

Failed login retry period (0 - 65535 seconds): 0

Pre-login Banner: Welcome to Xirrus! [Submit]

Post-login Banner: [Submit]

Management Transports

					Timeout (30-100000 seconds)	Port
SSH:	● On	○ Off			6000	22
Telnet:	○ On	● Off			300	23
Xircon:	● On	○ Off	○ ArrayOS only	○ Boot only	300	22612
Serial:	● On	○ Off			300	
HTTPS:					100000	443

Management Modes

			Period (60-900 seconds)
Network Assurance:	● On	○ Off	300
PCI Audit Mode:	○ On	● Off	
FIPS 140-2, Level 2 Security:	○ On	● Off	
Spanning Tree Protocol:	□ Enable		

HTTPS (X.509) Certificate

Import Xirrus Authority Into Browser: xirrus-ca.crt

Certificate Signed By: Xirrus

External Certification Authority

Download Certificate Signing Request: XR4012802207C.csr

Upload Signed Certificate: [Browse...] [Upload]

Common Name:

Organization Name:

Organizational Unit Name:

Locality (City):

State or Province:

Country Name (2 Letter Code):

Email Address:

Create New Certificate Signing Request [Create]

Figure 126. Management Control

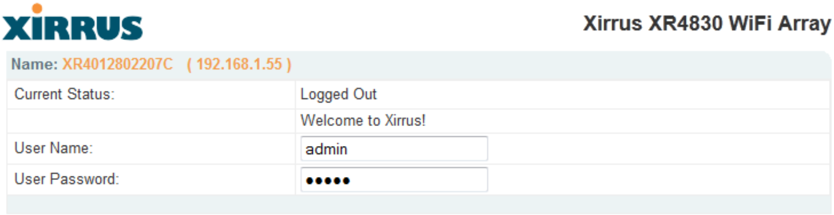
Procedure for Configuring Management Control

1. **Management Settings:**

   a. **Maximum login attempts allowed (1-255)**: After this number of consecutive failing administrator login attempts via ssh or telnet, the **Failed login retry period** is enforced. The default is 3.

b. **Failed login retry period (0-65535 seconds)**: After the maximum number (defined above) of consecutive failing administrator login attempts via ssh or telnet, the administrator's IP address is denied access to the array for the specified period of time (in seconds). The default is 0.

c. **Pre-login Banner**: Text that you enter here will be displayed above the WMI login prompt. (Figure 127)



Xirrus XR4830 WiFi Array

Name: XR4012802207C (192.168.1.55)

Current Status:	Logged Out
	Welcome to Xirrus!
User Name:	admin
User Password:	•••••

Figure 127. Pre-login Banner

d. **Post-login Banner**: Text that you enter here will be displayed in a message box after a user logs in to the WMI.

2. **SSH**

a. **On/Off**: Choose **On** to enable management of the Array over a Secure Shell (SSH-2) connection, or **Off** to disable this feature. Be aware that only SSH-2 connections are supported by the Array. SSH clients used for connecting to the Array must be configured to use SSH-2.

b. **Connection Timeout 30-100000 (Seconds)**: Enter a value in this field to define the timeout (in seconds) before your SSH connection is disconnected. The value you enter here must be between 30 seconds and 100,000 seconds.

c. **Port**: Enter a value in this field to define the port used by SSH. The default port is 22.

3. **Telnet:**

   a. **On/Off**: Choose **On** to enable Array management over a Telnet connection, or **Off** to disable this feature. SSH offers a more secure connection than Telnet, and is recommended over Telnet.

   b. **Connection Timeout 30-100000 (Seconds)**: Enter a value in this field to define the timeout (in seconds) before your Telnet connection is disconnected. The value you enter here must be between 30 seconds and 100,000 seconds.

   c. **Port**: Enter a value in this field to define the port used by Telnet. The default port is 23.

4. **Xircon**

   The Xircon utility is not used with XN Arrays. For those Arrays, this setting should always be turned **Off**.

   The Xircon utility connects to Xirrus Arrays that are not reachable via the normal access methods (such as SSH or WMI) and that do not have a physical console port (XR-1000 models), or whose console port is not accessible. Please see "Securing Low Level Access to the Array" on page 78 for more information about Xircon. You can enable or disable Xircon access to the Array as instructed below.

! *Warning: If you disable Xircon access completely on XR-1000 models, you* ***must*** *ensure that you do not lose track of the username and password to log in to CLI/WMI! There is no way to recover from a lost password, other than returning the Array to Xirrus.*

   a. **On/Off**: Choose **On** to enable Xircon access to the Array at the ArrayOS (CLI) and Xirrus Boot Loader (XBL) levels, or **Off** to disable access at both levels. On XR-1000 Array models only, Xircon access is **On** by default. On all other Array models, Xircon access is **Off** by default.

   b. **ArrayOS only**: Choose this radio button to enable Xircon access at the ArrayOS level only (i.e., Xircon can access CLI only). Access to the Array at the Xirrus Boot Loader (XBL) level is disabled.

   c. **Boot only**: Choose this radio button to enable Xircon access at the Xirrus Boot Loader (XBL) level only. ArrayOS level (CLI) access to the Array is disabled.

   d. **Connection Timeout 30-100000 (Seconds)**: Enter a value in this field to define the timeout (in seconds) before your Xircon connection is disconnected. The value you enter here must be between 30 seconds and 100,000 seconds.

   e. **Port**: Enter a value in this field to define the port used by Xircon. The default port is 22612.

5. **Serial**

   a. **On/Off**: Choose **On** to enable management of the Array via a serial connection, or choose **Off** to disable this feature.

   b. **Connection Timeout 30-100000 (Seconds)**: Enter a value in this field to define the timeout (in seconds) before your serial connection is disconnected. The value you enter here must be between 30 seconds and 100,000 seconds.

6. **HTTPS**

   a. **Connection Timeout 30-100000 (Seconds)**: Enter a value in this field to define the timeout (in seconds) before your HTTPS connection is disconnected. The value you enter here must be between 30 seconds and 100,000 seconds. Management via HTTPS (i.e., the Web Management Interface) cannot be disabled on this window. To disable management over HTTPS, you must use the Command Line Interface.

   b. **Port**: Enter a value in this field to define the port used by SSH. The default port is 443.

7. **Management Modes**

   a. **Network Assurance**: Click the **On** button to enable this mode. Network assurance checks network connectivity to each server that you configure, such as the NTP server, RADIUS servers, SNMP trap hosts, etc. By proactively identifying network resources that are unavailable, the network manager can be alerted of problems potentially before end-users notice an issue. The distributed intelligence of Arrays provides this monitoring at multiple points across the network, adding to the ability to isolate the problem and expedite the resolution

      Connectivity is checked when you configure a server. If a newly configured server is unreachable, you will be notified directly and a Syslog entry is created. Configured servers are checked once per **Period** which by default is 300 seconds (five minutes). Servers are checked regardless of whether they are configured as IP addresses or host names.

      If a server becomes unreachable, a Syslog message is generated. When the server again becomes reachable, another Syslog message is generated.

      To view the status of all configured servers checked by this feature, please see "Network Assurance" on page 112.

8. **HTTPS (X.509) Certificate**

   a. **Import Xirrus Authority into Browser**: This feature imports the Xirrus Certificate Authority (CA) into your browser (for a discussion, please see "Certificates and Connecting Securely to the WMI" on page 212). Click the link (**xirrus-ca.crt**), and then click **Open** to view or install the current Xirrus CA certificate. Click **Install Certificate** to start your browser's Certificate Install Wizard. We recommend that you use this process to install Xirrus as a root authority in your browser.

      When you assign a **Host Name** to your Array using the Express Setup window, then the next time you reboot the Array it automatically creates a security certificate for that host name. That certificate uses Xirrus as the signing authority. Thus, in order to avoid having certificate errors on your browser when using WMI:

- You must have assigned a host name to the Array and rebooted at some time after that.
- Use **Import Xirrus Authority into Browser**
- Access WMI by using the host name of the Array rather than its IP address.

b. **HTTPS (X.509) Certificate Signed By**: This read-only field shows the signing authority for the current certificate.

9. **External Certification Authority**

This Step and Step 10 allow you to obtain a certificate from an external authority and install it on an Array. "Using an External Certificate Authority" on page 213 discusses reasons for using an external CA.

For example, to obtain and install a certificate from VeriSign on the Array, follow these steps:

- If you don't already have the certificate from the external (non-Xirrus) Certificate Authority, see Step 10 to create a request for a certificate.
- Use Step 9a to review the request and copy its text to send to VeriSign.
- When you receive the new certificate from VeriSign, upload it to the Array using Step 9b.

External Certification Authority has the following fields:

a. **Download Certificate Signing Request**: After creating a certificate signing request (.csr file—Step 10), click the **View** button to review it. If it is satisfactory, click the name of the .csr file to display the text of the request. You can then copy this text and use it as required by the CA. You may also click on the filename of the .csr file to download it to your local computer.

b. **Upload Signed Certificate**: To use a custom certificate signed by an authority other than Xirrus, use the **Browse** button to locate the certificate file, then click **Upload** to copy it to the Array. The Array's web server will be restarted and will pick up the new certificate. This will terminate any current web sessions, and you will need to reconnect and re-login to the Array.

10. **To create a Certificate Signing Request**

    a. Fill in the fields in this section: **Common Name, Organization Name, Organizational Unit Name, Locality (City), State or Province, Country Name,** and **Email Address**. Spaces may be used in any of the fields, except for Common Name, Country Name, or Email Address. Click the **Create** button to create the certificate signing request. See Step 9 above to use this request.

11. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

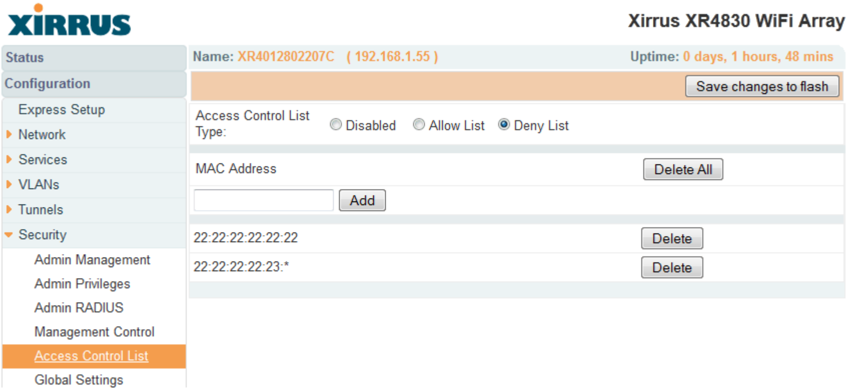
Network Interfaces - to enable/disable management over an Ethernet interface
Global Settings (IAP) - to enable/disable management over IAPs
Admin Management
External Radius
Global Settings (IAP)
Internal Radius
Access Control List
Security

Access Control List

This window allows you to enable or disable the use of the global Access Control List (ACL), which controls whether a station with a particular MAC address may associate to the Array. You may create station access control list entries and delete existing entries, and control the type of list.

There is only one global ACL, and you may select whether its type is an Allow List or a Deny List, or whether use of the list is disabled.

There is also a per-SSID ACL (see "Per-SSID Access Control List" on page 262). If the same MAC address is listed in both the global ACL and in an SSID's ACL, and if either ACL would deny that station access to that SSID, then access will be denied.



Name: XR4012802207C (192.168.1.55)

Uptime: 0 days, 1 hours, 48 mins

Access Control List Type: ○ Disabled ○ Allow List ● Deny List

MAC Address

22:22:22:22:22:22

22:22:22:22:23:*

Figure 128. Access Control List

Procedure for Configuring Access Control Lists

1. **Access Control List Type:** Select **Disabled** to disable use of the Access Control List, or select the ACL type—either **Allow List** or **Deny List**.

   - **Allow List**: Only allows the listed MAC addresses to associate to the Array. All others are denied.
   - **Deny List**: Denies the listed MAC addresses permission to associate to the Array. All others are allowed.

   In addition to these lists, other authentication methods (for example, RADIUS) are still enforced for users.

2. **MAC Address**: If you want to add a MAC address to the ACL, enter the new MAC address here, then click on the **Add** button. The MAC address is added to the ACL. You may use a wildcard (*) for one or more digits to match a range of addresses. You may create up to 1000 entries.

3. **Delete**: You can delete selected MAC addresses from this list by clicking their **Delete** buttons.
4. Click **Save changes to flash** if you wish to make your changes permanent.

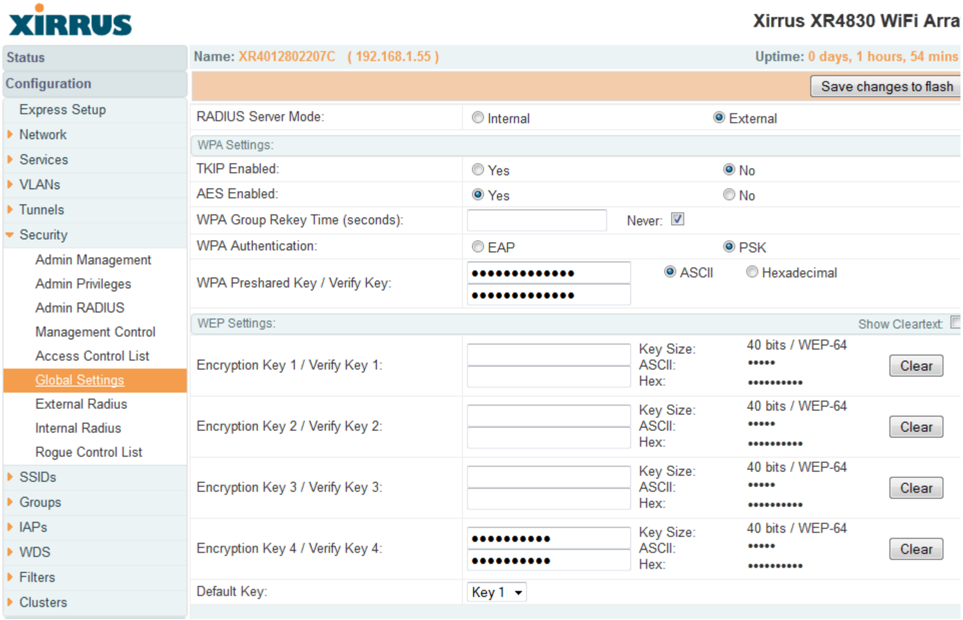
See Also

External Radius
Global Settings (IAP)
Internal Radius
Management Control
Security
Station Status Windows (list of stations that have been detected by the Array)

Global Settings

This window allows you to establish the security parameters for your wireless network, including WEP, WPA, WPA2 and RADIUS authentication. When finished, click **Save changes to flash** if you wish to make your changes permanent.

For additional information about wireless network security, refer to “Security Planning” on page 46 and “Understanding Security” on page 209.



Name: XR4012802207C (192.168.1.55)

Uptime: 0 days, 1 hours, 54 mins

RADIUS Server Mode:	○ Internal	● External
WPA Settings:		
TKIP Enabled:	○ Yes	● No
AES Enabled:	● Yes	○ No
WPA Group Rekey Time (seconds):		Never: ☑
WPA Authentication:	○ EAP	● PSK
WPA Preshared Key / Verify Key:	•••••••••••••• ••••••••••••••	● ASCII ○ Hexadecimal

WEP Settings: Show Cleartext: □

Encryption Key 1 / Verify Key 1:		Key Size: ASCII: Hex:	40 bits / WEP-64 ••••• ••••••••••	Clear
Encryption Key 2 / Verify Key 2:		Key Size: ASCII: Hex:	40 bits / WEP-64 ••••• ••••••••••	Clear
Encryption Key 3 / Verify Key 3:		Key Size: ASCII: Hex:	40 bits / WEP-64 ••••• ••••••••••	Clear
Encryption Key 4 / Verify Key 4:	••••••••••• •••••••••••	Key Size: ASCII: Hex:	40 bits / WEP-64 ••••• ••••••••••	Clear
Default Key:	Key 1			

Figure 129. Global Settings (Security)

Procedure for Configuring Network Security

1. **RADIUS Server Mode**: Choose the RADIUS server mode you want to use, either **Internal** or **External**. Parameters for these modes are configured in "External Radius" on page 234 and "Internal Radius" on page 238.

WPA Settings

These settings are used if the **WPA** or **WPA2** encryption type is selected on the **SSIDs >SSID Management** window or the **Express Setup** window (on this window, encryption type is set in the **SSID Settings: Wireless Security** field).

2. **TKIP Enabled**: Choose **Yes** to enable TKIP (Temporal Key Integrity Protocol), or choose **No** to disable TKIP.

TKIP encryption does not support high throughput rates (see ***Improved MAC Throughput****), per the IEEE 802.11n specification.*

TKIP should never be used for ***WDS*** *links on XR or XN Arrays.*

3. **AES Enabled**: Choose **Yes** to enable AES (Advanced Encryption Standard), or choose **No** to disable AES. If both AES and TKIP are enabled, the station determines which will be used.
4. **WPA Group Rekey Time (seconds)**: Enter a value to specify the group rekey time (in seconds). The default is **Never**.
5. **WPA Preshared Key / Verify Key**: If you enabled PSK, enter a passphrase here, then re-enter the passphrase to verify that you typed it correctly.

WEP Settings

These settings are used if the **WEP** encryption type is selected on the **SSIDs > SSID Management** window or the **Express Setup** window (on this window, encryption type is set in the **SSID Settings: Wireless Security** field).

Click the **Show Cleartext** button to make the text that you type in to the Key fields visible.

WEP encryption does not support high throughput rates or features like frame aggregation or block acknowledgements (see ***Improved MAC Throughput****), per the IEEE 802.11n specification.*

WEP should never be used for WDS links on Arrays.

6. **Encryption Key 1 / Verify Key 1:**

   Key Size: Key length is automatically computed based on the Encryption Key that you enter

   - 5 ASCII characters (10 hex) for 40 bits (WEP-64)
   - 13 ASCII characters for (26 hex) 104 bits (WEP-128)

   Encryption Key 1 / Verify Key 1: Enter an encryption key in ASCII or hexadecimal. The ASCII and translated hexadecimal values will appear to the right if you selected the **Show Cleartext** button.

   Re-enter the key to verify that you typed it correctly. You may include special ASCII characters, except for the double quote symbol (").

7. **Encryption Key 2 to 4/ Verify Key 2 to 4/ Key Mode/Length** (optional): If desired, enter up to four encryption keys, in the same way that you entered the first key.

8. **Default Key**: Choose which key you want to assign as the default key. Make your selection from the pull-down list.

9. Click **Save changes to flash** if you wish to make your changes permanent.

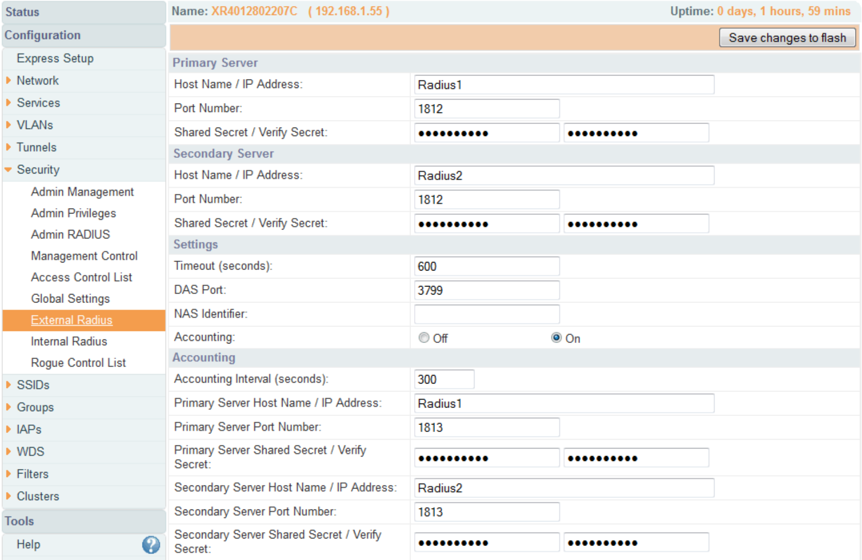
   After configuring network security, the configuration must be applied to an SSID for the new functionality to take effect.

See Also

Admin Management
External Radius
Internal Radius
Access Control List
Management Control
Security
Security Planning
SSID Management

External Radius

This window allows you to define the parameters of an external RADIUS server for user authentication. To set up an external RADIUS server, you must choose **External** as the RADIUS server mode in Global Settings. Refer to “Global Settings” on page 230.



Name: XR4012802207C (192.168.1.55) Uptime: 0 days, 1 hours, 59 mins

Primary Server		
Host Name / IP Address:	Radius1	
Port Number:	1812	
Shared Secret / Verify Secret:	••••••••••	••••••••••
Secondary Server		
Host Name / IP Address:	Radius2	
Port Number:	1812	
Shared Secret / Verify Secret:	••••••••••	••••••••••
Settings		
Timeout (seconds):	600	
DAS Port:	3799	
NAS Identifier:		
Accounting:	○ Off	● On
Accounting		
Accounting Interval (seconds):	300	
Primary Server Host Name / IP Address:	Radius1	
Primary Server Port Number:	1813	
Primary Server Shared Secret / Verify Secret:	••••••••••	••••••••••
Secondary Server Host Name / IP Address:	Radius2	
Secondary Server Port Number:	1813	
Secondary Server Shared Secret / Verify Secret:	••••••••••	••••••••••

Figure 130. External RADIUS Server

If you want to include user group membership in the RADIUS account information for users, see “Understanding Groups” on page 264. User groups allow you to easily apply a uniform configuration to a user on the Array.

About Creating User Accounts on the RADIUS Server

A number of attributes of user (wireless client) accounts are controlled by RADIUS Vendor Specific Attributes (VSAs) defined by Xirrus. For example, you would use the VSA named **Xirrus-User-VLAN** if you wish to set the VLAN for a user account in RADIUS. For more information about the RADIUS VSAs used by Xirrus, see “RADIUS Vendor Specific Attribute (VSA) for Xirrus” on page 463.

Procedure for Configuring an External RADIUS Server

1. **Primary Server:** This is the external RADIUS server that you intend to use as your primary server.

   a. **Host Name / IP Address**: Enter the IP address or domain name of this external RADIUS server.

   b. **Port Number**: Enter the port number of this external RADIUS server. The default is 1812.

   c. **Shared Secret / Verify Secret**: Enter the shared secret that this external RADIUS server will be using, then re-enter the shared secret to verify that you typed it correctly.

   The shared secret that you define must match the secret used by the external RADIUS server.

2. **Secondary Server** (optional): If desired, enter an alternative external RADIUS server. If the primary RADIUS server becomes unreachable, the Array will “failover” to the secondary RADIUS server (defined here).

   a. **Host Name / IP Address**: Enter the IP address or domain name of this external RADIUS server.

   b. **Port Number**: Enter the port number of this external RADIUS server. The default is 1812.

   c. **Shared Secret / Verify Secret**: Enter the shared secret that this external RADIUS server will be using, then re-enter the shared secret to verify that you typed it correctly.

3. **Settings**: Define the session timeout, the NAS Identifier, and whether accounting will be used.

   a. **Timeout (seconds)**: Define the maximum idle time (in seconds) before the external RADIUS server’s session times out. The default is 600 seconds.

   b. **DAS Port**: RADIUS Dynamic Authorization port. Some RADIUS servers have the ability to contact the Array (referred to as an NAS, see below) to terminate a user with a Disconnect Message (DM). Or RADIUS may send a Change-of-Authorization (CoA) Message to the Array to change a user's privileges due to dynamically changing session authorizations. RADIUS will use the DAS port on the Array for this purpose. The default is port **3799**.

c. **NAS Identifier**: From the point of view of a RADIUS server, the Array is a client, also called a network access server (NAS). Enter the NAS Identifier (IP address) that the RADIUS servers expect the Array to use—this is normally the IP address of the Array's Gigabit1 port.

d. **Accounting**: If you would like the Array to send RADIUS Start, Stop, and Interim records to a RADIUS accounting server, click the **On** button. The account settings appear, and must be configured.

4. **Accounting Settings**:

Note that RADIUS accounting start packets sent by the Array will include the client station's Framed-IP-Address attribute.

a. **Accounting Interval (seconds)**: Specify how often Interim records are to be sent to the server. The default is 300 seconds.

b. **Primary Server Host Name / IP Address**: Enter the IP address or domain name of the primary RADIUS accounting server that you intend to use.

c. **Primary Port Number**: Enter the port number of the primary RADIUS accounting server. The default is 1813.

d. **Primary Shared Secret / Verify Secret**: Enter the shared secret that the primary RADIUS accounting server will be using, then re-enter the shared secret to verify that you typed it correctly.

e. **Secondary Server Host Name / IP Address** (optional): If desired, enter an IP address or domain name for an alternative RADIUS accounting server. If the primary server becomes unreachable, the Array will "failover" to this secondary server (defined here).

f. **Secondary Port Number**: If using a secondary accounting server, enter its port number. The default is 1813.

g. **Secondary Shared Secret / Verify Secret**: If using a secondary accounting server, enter the shared secret that it will be using, then re-enter the shared secret to verify that you typed it correctly.

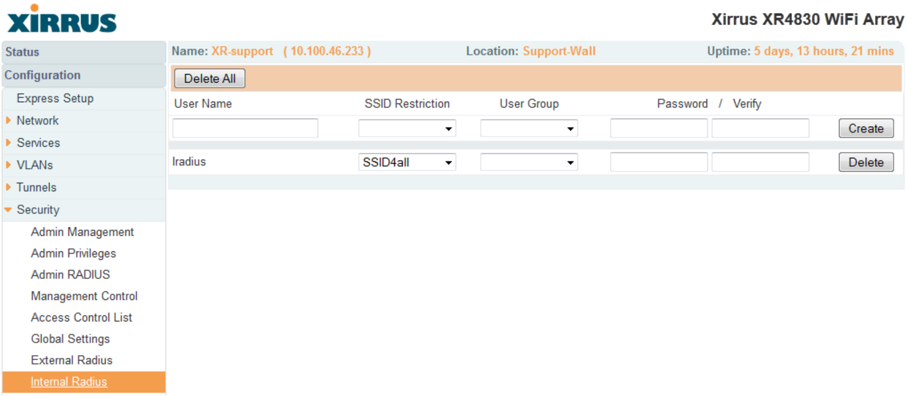
5. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

Admin Management
Global Settings (IAP)
Internal Radius
Access Control List
Management Control
Security
Understanding Groups

Internal Radius

This window allows you to define the parameters for the Array's internal RADIUS server for user authentication. However, the internal RADIUS server will only authenticate wireless clients that want to associate to the Array. This can be useful if an external RADIUS server is not available. To set up the internal RADIUS server, you must choose **Internal** as the RADIUS server mode in Global Settings. Refer to "Global Settings" on page 230.



Xirrus XR4830 WiFi Array

Name: XR-support (10.100.46.233) Location: Support-Wall Uptime: 5 days, 13 hours, 21 mins

User Name	SSID Restriction	User Group	Password / Verify
Iradius	SSID4all		

Figure 131. Internal RADIUS Server

*Clients using PEAP may have difficulty authenticating to the Array using the Internal RADIUS server due to invalid security certificate errors. To prevent this problem, the user may disable the **Validate Server Certificate** option on the station. Do this by displaying the station's wireless devices and then displaying the properties of the desired wireless interface. In the security properties, disable **Validate server certificate**. In some systems, this may be found by setting the authentication method to PEAP and changing the associated settings.*

Procedure for Creating a New User

1. **User Name:** Enter the name of the user that you want to authenticate to the internal RADIUS server.
2. **SSID Restriction**: (Optional) If you want to restrict this user to associating to a particular SSID, choose an SSID from the pull-down list.
3. **User Group**: (Optional) If you want to make this user a member of a previously defined user group, choose a group from the pull-down list. This will apply all of the user group's settings to the user. See "Understanding Groups" on page 264.
4. **Password**: (Optional) Enter a password for the user.
5. **Verify**: (Optional) Retype the user password to verify that you typed it correctly.
6. Click on the **Create** button to add the new user to the list.

Procedure for Managing Existing Users

1. **SSID Restriction:** (Optional) If you want to restrict a user to associating to a particular SSID, choose an SSID from its pull-down list.
2. **User Group**: (Optional) If you want to change the user's group, choose a group from the pull-down list. This will apply all of the user group's settings to the user. See "Understanding Groups" on page 264.
3. **Password**: (Optional) Enter a new password for the selected user.
4. **Verify Password**: (Optional) Retype the user password to verify that you typed it correctly.
5. If you want to delete one or more users, click their **Delete** buttons.
6. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

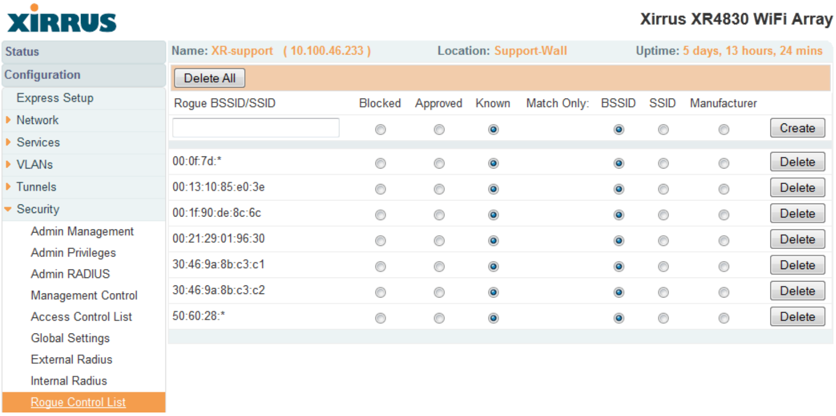
Admin Management
External Radius
Global Settings (IAP)

Access Control List
Management Control
Security
Understanding Groups

Rogue Control List

This window allows you to set up a control list for rogue APs, based on a type that you define. You may classify rogue APs as blocked, so that the Array will take steps to prevent stations from associating with the blocked AP. See “About Blocking Rogue APs” on page 331. The Array can keep up to 5000 entries in this list.

*The **RF Monitor > Intrusion Detection** window provides an alternate method for classifying rogues. You can list all Unknown stations and select all the rogues that you’d like to set to Known or Approved, rather than entering the SSID/BSSID as described below. See **“Intrusion Detection” on page 119**.*



Name: XR-support (10.100.46.233) Location: Support-Wall Uptime: 5 days, 13 hours, 24 mins

Rogue BSSID/SSID	Blocked	Approved	Known	Match Only: BSSID	SSID	Manufacturer	
	○	○	●	●	○	○	Create
00:0f:7d:*	○	○	●	●	○	○	Delete
00:13:10:85:e0:3e	○	○	●	●	○	○	Delete
00:1f:90:de:8c:6c	○	○	●	●	○	○	Delete
00:21:29:01:96:30	○	○	●	●	○	○	Delete
30:46:9a:8b:c3:c1	○	○	●	●	○	○	Delete
30:46:9a:8b:c3:c2	○	○	●	●	○	○	Delete
50:60:28:*	○	○	●	●	○	○	Delete

Figure 132. Rogue Control List

Procedure for Establishing Rogue AP Control

1. **Rogue BSSID/SSID:** Enter the BSSID, SSID, or manufacturer string to match for the new rogue control entry. The **Match Only** radio buttons specify what to match (e.g., the MAC address, SSID, or manufacturer).

   You may use the "*" character as a wildcard to match any string at this position. For example, 00:0f:7d:* matches any string that starts with 00:0f:7d:. Xirrus Arrays start with 00:0f:7d: or 50:60:28:. By default, the Rogue Control List contains two entries that match **00:0f:7d:*** and **50:60:28:*** and apply the classification **Known** to all Xirrus Arrays.

2. **Rogue Control Classification**: Enter the classification for the specified rogue AP(s), either **Blocked**, **Known** or **Approved**.

3. **Match Only**: Select the match criterion to compare the **Rogue BSSID/SSID** string against: **BSSID**, **Manufacturer**, or **SSID**. The BSSID field contains the MAC address.

4. Click **Create** to add this rogue AP to the Rogue Control List.

5. **Rogue Control List**: If you want to edit the control type for a rogue AP, just click the radio button for the new type for the entry: **Blocked**, **Known** or **Approved**.

6. To delete rogue APs from the list, click their **Delete** buttons.

7. Click **Save changes to flash** if you wish to make your changes permanent.

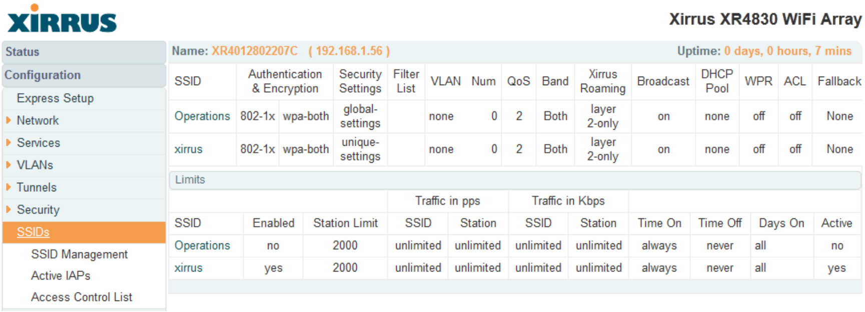
See Also

Network Map
Intrusion Detection
SSIDs
SSID Management

SSIDs

This status-only window allows you to review SSID (Service Set IDentifier) assignments. It includes the SSID name, whether or not an SSID is visible on the network, any security and QoS parameters defined for each SSID, associated VLAN IDs, radio availability, and DHCP pools defined per SSID. Click on an SSID's name to jump to the edit page for the SSID. There are no configuration options available on this page, but if you are experiencing problems or reviewing SSID management parameters, you may want to print this page for your records.

*For a complete discussion of implementing Voice over Wi-Fi on the Array, see the **Xirrus Voice over Wireless Application Note** in the **Xirrus Resource Center**.*



Xirrus XR4830 WiFi Array

Name: XR4012802207C (192.168.1.56) Uptime: 0 days, 0 hours, 7 mins

SSID	Authentication & Encryption		Security Settings	Filter List	VLAN	Num	QoS	Band	Xirrus Roaming	Broadcast	DHCP Pool	WPR	ACL	Fallback
Operations	802-1x	wpa-both	global-settings		none	0	2	Both	layer 2-only	on	none	off	off	None
xirrus	802-1x	wpa-both	unique-settings		none	0	2	Both	layer 2-only	on	none	off	off	None

Limits

			Traffic in pps		Traffic in Kbps					
SSID	Enabled	Station Limit	SSID	Station	SSID	Station	Time On	Time Off	Days On	Active
Operations	no	2000	unlimited	unlimited	unlimited	unlimited	always	never	all	no
xirrus	yes	2000	unlimited	unlimited	unlimited	unlimited	always	never	all	yes

Figure 133. SSIDs

The read-only **Limits** section of the SSIDs window allows you to review any limitations associated with your defined SSIDs. For example, this window shows the current state of an SSID (enabled or not), how much SSID and station traffic is allowed, time on and time off, days on and off, and whether each SSID is currently active or inactive.

For information to help you understand SSIDs and how multiple SSIDs are managed by the Wireless Array, go to "Understanding SSIDs" on page 243 and the Multiple SSIDs section of "Frequently Asked Questions" on page 452. For a description of how QoS operates on the Array, see "Understanding QoS Priority on the Wireless Array" on page 244.

SSIDs are managed with the following windows:

- **"SSID Management" on page 249**
- **"Active IAPs" on page 261**
- **"Per-SSID Access Control List" on page 262**

SSIDs are discussed in the following topics:

- **"Understanding SSIDs" on page 243**
- **"Understanding QoS Priority on the Wireless Array" on page 244**

Understanding SSIDs

The SSID (Service Set Identifier) is a unique identifier that wireless networking devices use to establish and maintain wireless connectivity. Multiple access points on a network or sub-network can use the same SSIDs. SSIDs are case-sensitive and can contain up to 32 alphanumeric characters (do not include spaces when defining SSIDs).

Multiple SSIDs

A BSSID (Basic SSID) refers to an individual access point radio and its associated clients. The identifier is the MAC address of the access point radio that forms the BSS. A group of BSSs can be formed to allow stations in one BSS to communicate to stations in another BSS via a backbone that interconnects each access point.

The Extended Service Set (ESS) refers to the group of BSSIDs that are grouped together to form one ESS. The ESSID (often referred to as SSID or "wireless network name") identifies the Extended Service Set. Clients must associate to a single ESS at any given time. Clients ignore traffic from other Extended Service Sets that do not have the same SSID.

Legacy access points typically support one SSID per access point. Wireless Arrays support the ability to define and use multiple SSIDs simultaneously.

Using SSIDs

The creation of different wireless network names allows system administrators to separate types of users with different requirements. The following policies can be tied to an SSID:

- The wireless security mode needed to join this SSID.
- The wireless Quality of Service (QoS) desired for this SSID.
- The wired VLAN associated with this SSID.

As an example, one SSID named **accounting** might require the highest level of security, while another named **guests** might have low security requirements.

Another example may define an SSID named **voice** that supports voice over Wireless LAN phones with the highest Quality of Service (QoS) definition. This SSID might also forward traffic to specific VLANs on the wired network.

See Also

SSID Management

SSIDs

Understanding SSIDs

Understanding QoS Priority on the Wireless Array

For a complete discussion of implementing Voice over Wi-Fi on the Array, see the ***Xirrus Voice over Wireless Application Note*** *in the* ***Xirrus Resource Center****.*

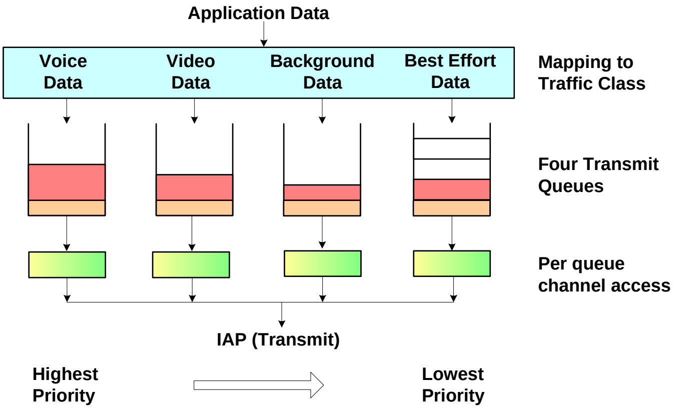


Figure 134. Four Traffic Classes

The Wireless Array's Quality of Service Priority feature (QoS) allows traffic to be prioritized according to your requirements. For example, you typically assign the highest priority to voice traffic, since this type of traffic requires delay to be under 10 ms. The Array has four separate queues for handling wireless traffic at different priorities, and thus it supports four traffic classes (QoS levels).

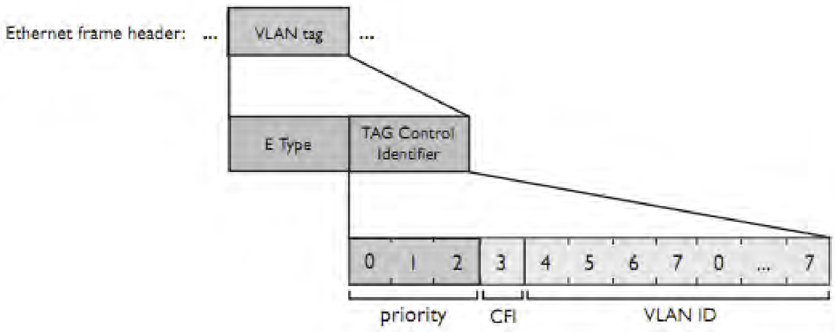


Figure 135. Priority Level—IEEE 802.1p (Layer 2)

IEEE802.1p uses three bits in an Ethernet frame header to define eight priority levels at the MAC level (Layer 2) for wired networks. Each data packet may be tagged with a priority level, i.e., a **user priority** tag. Since there are eight possible user priority levels and the Array implements four wireless QoS levels, user priorities are mapped to QoS as described below.

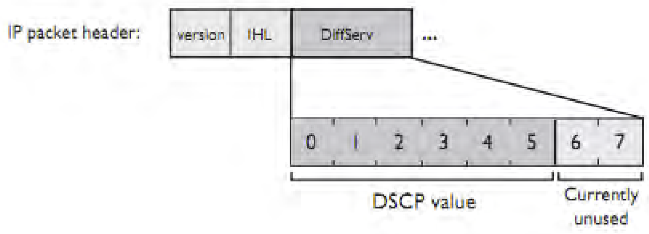


Figure 136. Priority Level—DSCP (DiffServ - Layer 3)

DSCP (Differentiated Services Code Point or DiffServ) uses 6 bits in the IPv4 or IPv6 packet header, defined in RFC2474 and RFC2475. The DSCP value classifies a Layer 3 packet to determine the Quality of Service (QoS) required. DSCP replaces the outdated Type of Service (TOS) field.

The description below describes how both of these priority levels are mapped to the Array's four traffic classes.

End-to-End QoS Handling

- Wired QoS - Ethernet Port:

  Ingress: Incoming wired packets are assigned QoS priority based on their SSID and 802.1p tag (if any), as shown in the table below. This table follows the mapping recommended by IEEE802.11e.

FROM Priority Tag 802.1p (Wired)	**TO** Array QoS (Wireless)	Typical Use
0	0 (Lowest priority)	Best Effort
1	1	Background—explicitly designated as low-priority and non-delay sensitive
2	1	Spare
3	0	Excellent Effort
4	2	Controlled Load
5	2	Video
6	3	Voice - requires delay <10ms
7 (Highest priority)	3 (Highest priority)	Network control

- Egress: Outgoing wired packets are IEEE 802.1p tagged at the Ethernet port for upstream traffic, thus enabling QoS at the edge of the network.

FROM Array QoS (Wireless)	**TO** Priority Tag 802.1p (Wired)
1 (Lowest priority)	1
0	0
2 (Default)	5
3 (Highest priority)	6

Wireless QoS - Radios:

- Each SSID can be assigned a separate QoS priority (i.e., traffic class) from 0 to 3, where 3 is highest priority and 2 is the default. See "SSID Management" on page 249. If multiple SSIDs are used, packets from the SSID with higher priority are transmitted first.
- The Array supports IEEE802.11e Wireless QoS for downstream traffic. Higher priority packets wait a shorter time before gaining access to the air and contend less with all other 802.11 devices on a channel.
- How QoS is set for a packet in case of conflicting values:

  a. If an SSID has a QoS setting, and an incoming wired packet's user priority tag is mapped to a higher QoS value, then the higher QoS value is used.

  b. If a group or filter has a QoS setting, this overrides the QoS value above. See "Groups" on page 264, and "Filters" on page 344.

  c. Voice packets have the highest priority (see Voice Support, below).

  d. If **DSCP to QoS Mapping Mode** is enabled, the IP packet is mapped to QoS level 0 to 3 as specified in the DSCP Mappings table. This value overrides any of the settings in cases a to c above.

     In particular, by default:

     - DSCP 8 is set to QoS level 1.

- DSCP 40 is typically used for video traffic and is set to QoS level 2.
- DSCP 48 is typically used for voice traffic and is set to QoS level 3—the highest level
- All other DSCP values are set to QoS level 0 (the lowest level—Best Effort).

Packet Filtering QoS classification

- Filter rules can be used to redefine the QoS priority level to override defaults. See “Filter Management” on page 347. This allows the QoS priority level to be assigned based on protocol, source, or destination.

Voice Support

- The QoS priority implementation on the Array give voice packets the highest priority to support voice applications.

High Density 2.4G Enhancement—Honeypot SSID

Some situations pose problems for all wireless APs. For example, iPhones will remember every SSID and flood the airwaves with probes, even when the user doesn’t request or desire this behavior. In very high density deployments, these probes can consume a significant amount of the available wireless bandwidth.

The Array offers a feature targeting this problem—a “honeypot” SSID. Simply create an SSID named **honeypot** on the Array. Once this SSID is created and enabled, it will respond to any station probe looking for an open (unencrypted) SSID that is not configured on the Array.

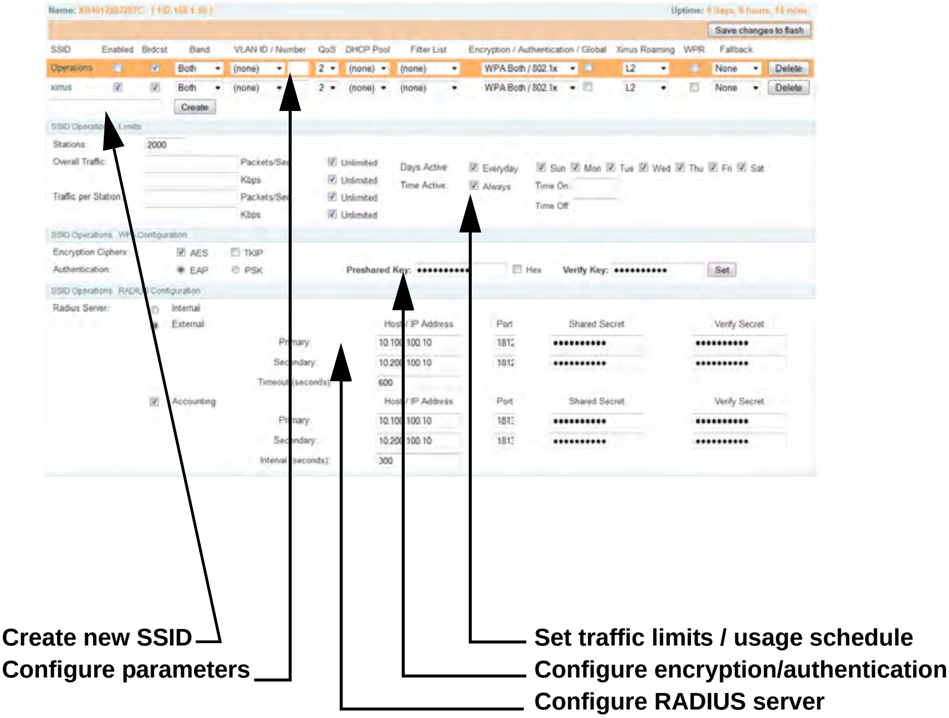
Traffic for a station connected to the honeypot SSID may be handled in a various ways:

- it may be directed to WPR to display a splash page or offer the user the opportunity to sign in to your service (see “Web Page Redirect Configuration Settings” on page 255);
- it may be filtered;
- or it may be dead-ended by defining a specific dead-end VLAN on the honeypot SSID to “trap” stations.

Use the honeypot feature carefully as it could interfere with legitimate SSIDs and prevent clients from associating to another available network.

SSID Management

This window allows you to manage SSIDs (create, edit and delete), assign security parameters and VLANs on a per SSID basis, and configure the Web Page Redirect functionality.



Name: XR4012802207C (192.168.1.58) Uptime: 9 days, 0 hours, 14 mins

Save changes to flash

SSID	Enabled	Brdcst	Band	VLAN ID / Number		QoS	DHCP Pool	Filter List	Encryption / Authentication / Global		Xirrus Roaming	WPR	Fallback	
Operations	☐	☑	Both	(none)		2	(none)	(none)	WPA Both / 802.1x	☐	L2	☐	None	Delete
xirrus	☑	☑	Both	(none)		2	(none)	(none)	WPA Both / 802.1x	☐	L2	☐	None	Delete

Create

SSID Operations Limits

Stations: 2000

Overall Traffic: Packets/Sec ☑ Unlimited
Kbps ☑ Unlimited

Traffic per Station: Packets/Sec ☑ Unlimited
Kbps ☑ Unlimited

Days Active: ☑ Everyday ☑ Sun ☑ Mon ☑ Tue ☑ Wed ☑ Thu ☑ Fri ☑ Sat

Time Active: ☑ Always Time On: Time Off:

SSID Operations WPA Configuration

Encryption Ciphers ☑ AES ☐ TKIP

Authentication ● EAP ○ PSK Preshared Key: •••••••••• ☐ Hex Verify Key: •••••••••• Set

SSID Operations RADIUS Configuration

Radius Server: ○ Internal ● External

	Host / IP Address	Port	Shared Secret	Verify Secret
Primary:	10.100.100.10	1812	••••••••••	••••••••••
Secondary:	10.200.100.10	1812	••••••••••	••••••••••
Timeout (seconds):	600			

☑ Accounting

	Host / IP Address	Port	Shared Secret	Verify Secret
Primary:	10.100.100.10	1813	••••••••••	••••••••••
Secondary:	10.200.100.10	1813	••••••••••	••••••••••
Interval (seconds):	300			

Create new SSID
Configure parameters
Set traffic limits / usage schedule
Configure encryption/authentication
Configure RADIUS server

Figure 137. SSID Management

Procedure for Managing SSIDs

1. **New SSID Name:** To create a new SSID, enter a new SSID name to the left of the Create button (Figure 137), then click Create. The SSID name may only consist of the characters A-Z, a-z, 0-9, dash, and underscore. You may create up to 16 SSIDs.

SSID List (top of page)

2. **SSID**: Shows all currently assigned SSIDs. When you create a new SSID, the SSID name appears in this table. Click any SSID in this list to select it.

3. **On**: Check this box to activate this SSID or clear it to deactivate it.

4. **Brdcast**: Check this box to make the selected SSID visible to all clients on the network. Although the Wireless Array will not broadcast SSIDs that are hidden, clients can still associate to a hidden SSID if they know the SSID name to connect to it. Clear this box if you do not want this SSID to be visible on the network.

5. **Band**: Choose which wireless band the SSID will be beaconed on. Select either **5 GHz**—802.11an, **2.4 GHz**—802.11bgn or **Both**.

6. **VLAN ID / Number**: From the pull-down list, select a VLAN that you want this traffic to be forwarded to on the wired network. Select **numeric** to enter the number of a previously defined VLAN in the **Number** field (see “VLANs” on page 199). This step is optional.

7. **QoS**: (Optional) Select a value in this field for QoS (Quality of Service) priority filtering. The QoS value must be one of the following:

   - 0—The lowest QoS priority setting, where QoS makes its best effort at filtering and prioritizing data, video and voice traffic without compromising the performance of the network. Use this setting in environments where traffic prioritization is not a concern.
   - 1—Medium, with QoS prioritization aggregated across all traffic types.
   - 2—High, normally used to give priority to video traffic.

- 3—The highest QoS priority setting, normally used to give priority to voice traffic.

The QoS setting you define here will prioritize wireless traffic for this SSID over other SSID traffic, as described in "Understanding QoS Priority on the Wireless Array" on page 244. The default value for this field is 2.

8. **DHCP Pool**: If you want to associate an internal DHCP pool to this SSID, choose the pool from the pull--down list. An internal DHCP pool must be created before it can be assigned. To create an internal DHCP pool, go to "DHCP Server" on page 197.

9. **Filter List**: If you wish to apply a set a filters to this SSID's traffic, select the desired Filter List. See "Filters" on page 344.

10. **Authentication**: The following authentication options are available:

    - **Open:** This option provides no authentication and is not recommended.

    - **RADIUS MAC:** Uses an external RADIUS server to authenticate stations onto the wireless network, based on the user's MAC address. Accounting for these stations is performed according to the accounting options that you have configured specifically for this SSID or globally (see Step 12 below).

    If this SSID is on a VLAN, the VLAN must have management turned on in order to pass CHAP authentication challenges from the client station to the RADIUS server.

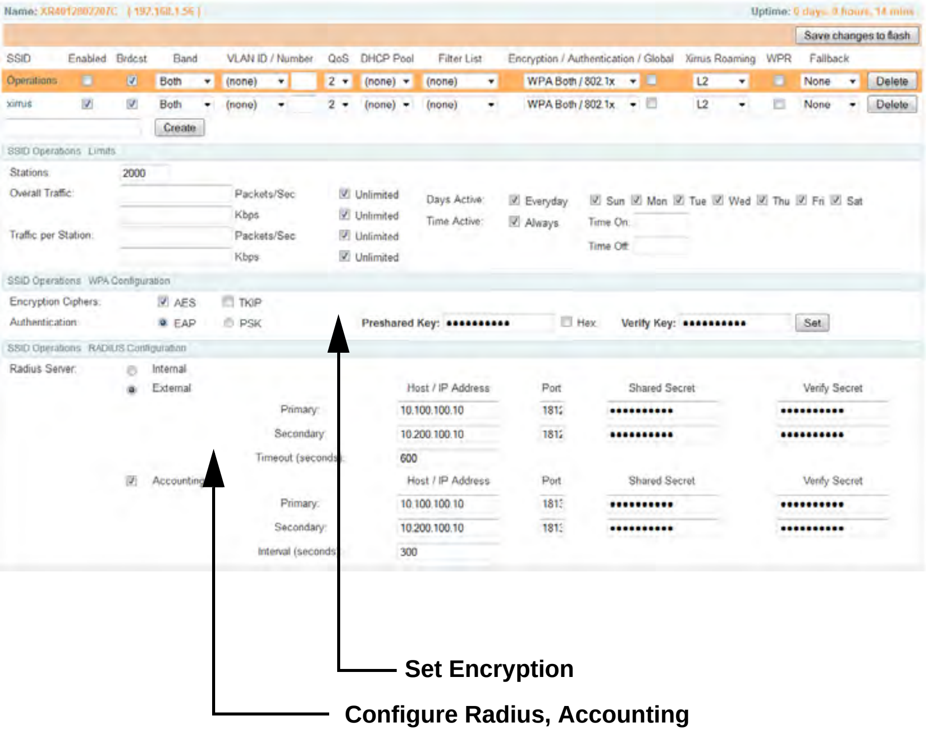
    - **802.1x:** Authenticates stations onto the wireless network via a RADIUS server using 802.1x with EAP. The RADIUS server can be internal (provided by the Wireless Array) or external.

11. **Encryption**: From the pull-down list, choose the encryption that will be required—specific to this SSID—either None, WEP, WPA, WPA2 or WPA-Both. The None option provides no security and is not recommended; WPA2 provides the best practice Wi-Fi security.

Each SSID supports only one encryption type at a time (except that WPA and WPA2 are both supported on an SSID if you select WPA-Both). If you need to support other encryption types, you must define additional SSIDs. The encryption standard used with WPA or WPA2 is selected in the Security>Global Settings window (page 230). For an overview of the security options, see "Security Planning" on page 46 and "Understanding Security" on page 209.

*XN model Arrays cannot use the SSID-specific WEP keys specified in this step. They can only use the global WEP keys specified in the **Global Settings** window.*

12. **Global**: Check the checkbox if you want this SSID to use the security settings established at the global level (refer to "Global Settings" on page 230). Clear the checkbox if you want the settings established here to take precedence. Additional sections will be displayed to allow you to configure encryption, RADIUS, and RADIUS accounting settings. The **WPA Configuration** encryption settings have the same parameters as those described in "Procedure for Configuring Network Security" on page 231. The external RADIUS and accounting settings are configured in the same way as for an external RADIUS server (see "Procedure for Configuring an External RADIUS Server" on page 235). Note that external RADIUS servers may be specified using IP addresses or domain names.



Name: XR4012802707C (197.168.1.56) Uptime: 0 days, 0 hours, 14 mins

Save changes to flash

SSID	Enabled	Brdcst	Band	VLAN ID / Number		QoS	DHCP Pool	Filter List	Encryption / Authentication / Global		Xirrus Roaming	WPR	Fallback	
Operations	☐	☑	Both	(none)		2	(none)	(none)	WPA Both / 802.1x	☐	L2	☐	None	Delete
xirrus	☑	☑	Both	(none)		2	(none)	(none)	WPA Both / 802.1x	☐	L2	☐	None	Delete
			Create											

SSID Operations Limits

Stations: 2000

Overall Traffic: Packets/Sec ☑ Unlimited
Kbps ☑ Unlimited

Traffic per Station: Packets/Sec ☑ Unlimited
Kbps ☑ Unlimited

Days Active: ☑ Everyday ☑ Sun ☑ Mon ☑ Tue ☑ Wed ☑ Thu ☑ Fri ☑ Sat

Time Active: ☑ Always Time On: Time Off:

SSID Operations WPA Configuration

Encryption Ciphers: ☑ AES ☐ TKIP

Authentication: ● EAP ○ PSK Preshared Key: ●●●●●●●●●●● ☐ Hex Verify Key: ●●●●●●●●●●● Set

SSID Operations RADIUS Configuration

Radius Server: ○ Internal
● External

	Host / IP Address	Port	Shared Secret	Verify Secret
Primary:	10.100.100.10	1812	●●●●●●●●●●●	●●●●●●●●●●●
Secondary:	10.200.100.10	1812	●●●●●●●●●●●	●●●●●●●●●●●
Timeout (seconds):	600			

☑ Accounting

	Host / IP Address	Port	Shared Secret	Verify Secret
Primary:	10.100.100.10	1813	●●●●●●●●●●●	●●●●●●●●●●●
Secondary:	10.200.100.10	1813	●●●●●●●●●●●	●●●●●●●●●●●
Interval (seconds):	300			

Set Encryption

Configure Radius, Accounting

Figure 138. SSID Management

13. **Roaming**: For this SSID, select whether to enable fast roaming between IAPs or Arrays at **L2&L3** (Layer 2 and Layer 3), at **L2** (Layer 2 only), or disable roaming (**Off**). You may only select fast roaming at Layers 2 and 3 if this has been selected in Global Settings (IAP). See "Understanding Fast Roaming" on page 273.

14. **WPR (Web Page Redirect)**: Check the checkbox to enable the Web Page Redirect functionality, or clear it to disable this option. If enabled, WPR configuration fields will be displayed under the SSID Limits section. This feature may be used to provide an alternate mode of authentication, or to simply display a splash screen when a user first associates to the wireless network. After that, it can (optionally) redirect the user to an alternate

URL. For example, some wireless devices and users may not have a correctly configured 802.1x (RADIUS) supplicant. Utilizing WPR's Web-based login, users may be authenticated without using an 802.1x supplicant. See "Web Page Redirect Configuration Settings" on page 255 for details of WPR usage and configuration.

*When using WPR, it is particularly important to adhere to the SSID naming restrictions detailed in **Step 1**.*

15. **Fallback**: Network Assurance checks network connectivity for the Array. When Network Assurance detects a failure, perhaps due to a bad link or WDS failure, if Fallback is set to **Disable** the Array will automatically disable this SSID. This will disassociate current clients, and prevent new clients from associating. Since the Array's network connectivity has failed, this gives clients a chance to connect to other, operational parts of the wireless network. No changes are made to WDS configuration. See Step a on page 225 for more information on Network Assurance.

The lower part of the window contains a few sections of additional settings to configure for the currently selected SSID, depending on the values chosen for the settings described above.

- **"SSID Limits" on page 254**
- **"Web Page Redirect Configuration Settings" on page 255**
- **"WPA Configuration Settings" on page 259**
- **"RADIUS Configuration Settings" on page 260**

SSID Limits

See "Group Limits" on page 268 for a discussion of the interaction of SSID limits and group limits. To eliminate confusion, we recommend that you configure one set of limits or the other, but not both.

16. **Stations**: Enter the maximum number of stations allowed on this SSID. This step is optional. Note that the IAPs - Global Settings window also has a station limit option—**Max Station Association per IAP**. If both

station limits are set, both will be enforced. As soon as either limit is reached, no new stations can associate until some other station has terminated its association.

17. **Overall Traffic**: Choose **Unlimited** if you do not want to place a restriction on the traffic for this SSID, or enter a value in the **Packets/Sec** field to force a traffic restriction.

18. **Traffic per Station**: Choose **Unlimited** if you do not want to place a restriction on the traffic per station for this SSID, or enter a value in the **Packets/Sec** field or the **Kbps** field to force a traffic restriction. If you set both values, the Array will enforce the limit it reaches first.

19. **Days Active**: Choose **Everyday** if you want this SSID to be active every day of the week, or select only the specific days that you want this SSID to be active. Days that are not checked are considered to be the inactive days.

20. **Time Active**: Choose **Always** if you want this SSID active without interruption, or enter values in the **Time On** and **Time Off** fields to limit the time that this SSID is active.

21. To delete SSIDs, click their **Delete** buttons.

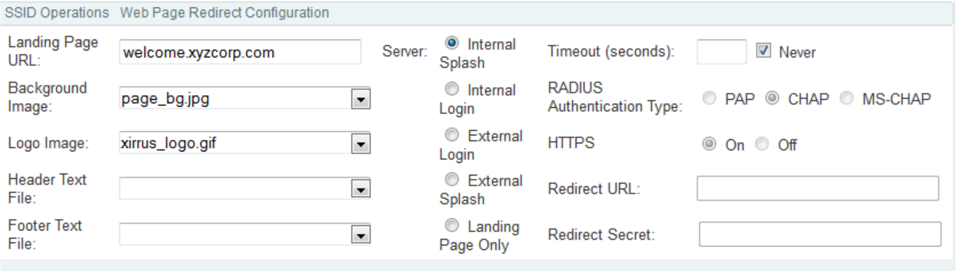
22. Click **Save changes to flash** if you wish to make your changes permanent.

Web Page Redirect Configuration Settings

If you enable WPR, the SSID Management window displays additional fields that must be configured. For example configurations and complete examples, please see the *Xirrus Web Page Redirect Application Note* in the ***Xirrus Resource Center***.

If enabled, WPR displays a splash or login page when a user associates to the wireless network and opens a browser to any URL (provided the URL does not point to a resource directly on the user’s machine). The user-requested URL is captured, the user’s browser is redirected to the splash or login page, and then the browser is redirected either to your specified landing page, if any, or else back to the captured URL. The landing page may be specified for a user group as well.

See “Group Management” on page 266. Note that if you change the management HTTPS port, WPR uses that port, too. See “HTTPS” on page 224.



SSID Operations   Web Page Redirect Configuration

Landing Page URL:	welcome.xyzcorp.com	Server:	● Internal Splash	Timeout (seconds):	☑ Never
Background Image:	page_bg.jpg		○ Internal Login	RADIUS Authentication Type:	○ PAP ● CHAP ○ MS-CHAP
Logo Image:	xirrus_logo.gif		○ External Login	HTTPS	● On ○ Off
Header Text File:			○ External Splash	Redirect URL:	
Footer Text File:			○ Landing Page Only	Redirect Secret:	

Figure 139. WPR Internal Splash Page Fields (SSID Management)

Note that when users roam between Arrays, their WPR Authentication will follow them so that re-authentication is not required.

You may select among five different modes for use of the Web Page Redirect feature, each displaying a different set of parameters that must be entered:

- Internal Login page

  This option displays a login page (residing on the Array) instead of the first user-requested URL. There is an upload function that allows you to replace the default login page, if you wish. Please see “Web Page Redirect” on page 368 for more information.

  To set up internal login, set **Server** to **Internal Login**. Set **HTTPS** to **On** for a secure login, or select **Off** to use HTTP. You may also customize the login page with logo and background images and header and footer text. See “Customizing an Internal Login or Splash page” on page 258.

  The user name and password are obtained by the login page, and authentication occurs according to your configured authentication information (starting with Step 10 on page 251 above). These authentication parameters are configured as described in “Procedure for Configuring Network Security” on page 231.

After authentication, the browser is redirected back to the captured URL. If you want the user redirected to a specific landing page instead, enter its address in **Landing Page URL**.

Both the Internal Login and External Login options of WPR perform authentication using your configured RADIUS servers.

- Internal Splash page

  This option displays a splash page instead of the first user-requested URL. The splash page files reside on the Array. Note that there is an upload function that allows you to replace the default splash page, if you wish. Please see "Web Page Redirect" on page 368 for more information. You may also customize the splash page with logo and background images and header and footer text. See "Customizing an Internal Login or Splash page" on page 258.

  To use an internal splash page, set **Server** to **Internal Splash**. Enter a value in the **Timeout** field to define how many seconds the splash screen is displayed before timing out, or select **Never** to prevent the page from timing out automatically. After the splash page, the user is redirected to the captured URL. If you want the user redirected to a specific landing page instead, enter its address in **Landing Page URL**.

- External Login page

  This option redirects the user to a login page on an external web server for authentication, instead of the first user-requested URL. Login information (user name and password) must be obtained by that page, and returned to the Array for authentication.

  Authentication occurs according to your configured RADIUS information. These parameters are configured as described in "Procedure for Configuring Network Security" on page 231, except that the **RADIUS Authentication Type** is selected here, as described below. After authentication, the browser is redirected back to the captured URL. If you want the user redirected to a specific landing page instead, enter its address in **Landing Page URL**.

To set up external login page usage, set **Server** to **External Login**. Enter the URL of the external web server in **Redirect URL**, and enter that server's shared secret in **Redirect Secret**.

Select the **RADIUS Authentication Type**. This is the protocol used for authentication of users, **CHAP** or **PAP** (the default).

- **PAP** (Password Authentication Protocol), is a simple protocol. PAP transmits ASCII passwords over the network "in the clear" (unencrypted) and is therefore considered insecure.
- **CHAP** (Challenge-Handshake Authentication Protocol) is a more secure Protocol. The login request is sent using a one-way hash function.

- External Splash page

  This option displays a splash page instead of the first user-requested URL. The splash page files reside on an external web server.

  To set up external splash page usage, set **Server** to **External Splash**. Enter the URL of the external web server in **Redirect URL**, and enter that server's shared secret in **Redirect Secret**.

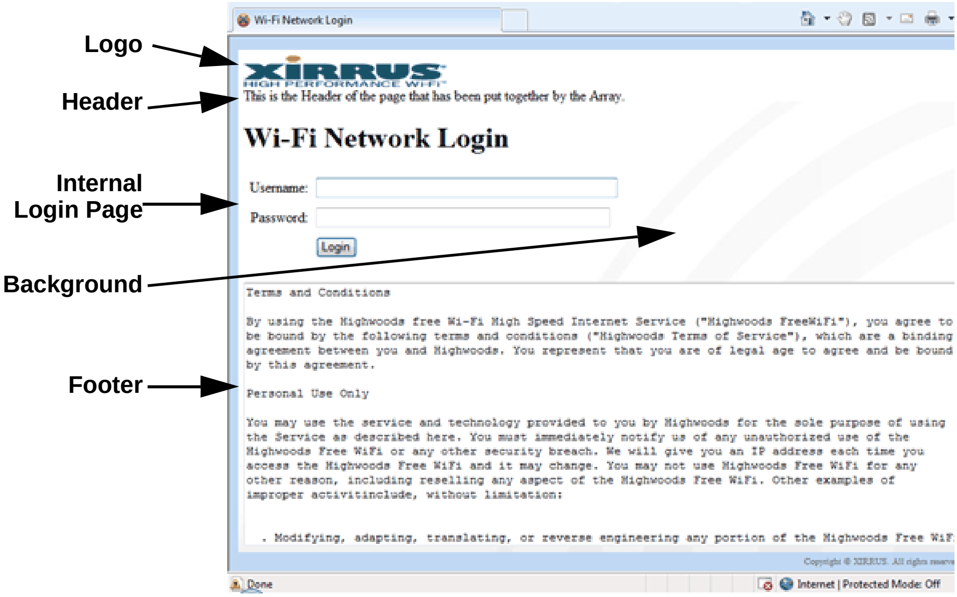
  After the splash page, the user is redirected to the captured URL. If you want the user redirected to a specific landing page instead, enter its address in **Landing Page URL**.

- Landing Page Only

  This option redirects the user to a specific landing page. If you select this option, enter the desired address in **Landing Page URL**.

Customizing an Internal Login or Splash page

You may customize these pages with a logo and/or background image, and header and/or footer text, as shown below in Figure 140.



This is the Header of the page that has been put together by the Array.

Wi-Fi Network Login

```
Terms and Conditions

By using the Highwoods free Wi-Fi High Speed Internet Service ("Highwoods FreeWiFi"), you agree to
be bound by the following terms and conditions ("Highwoods Terms of Service"), which are a binding
agreement between you and Highwoods. You represent that you are of legal age to agree and be bound
by this agreement.

Personal Use Only

You may use the service and technology provided to you by Highwoods for the sole purpose of using
the Service as described here. You must immediately notify us of any unauthorized use of the
Highwoods Free WiFi or any other security breach. We will give you an IP address each time you
access the Highwoods Free WiFi and it may change. You may not use Highwoods Free WiFi for any
other reason, including reselling any aspect of the Highwoods Free WiFi. Other examples of
improper activitinclude, without limitation:


  . Modifying, adapting, translating, or reverse engineering any portion of the Highwoods Free WiF
```

Copyright © XIRRUS. All rights reserve

Figure 140. Customizing an Internal Login or Splash Page

- **Background Image**—specify an optional jpg, gif, or png file to display in the background of the page. Other customizations (logo, header, footer) will overlay the background, so that it will not be visible in those areas.
- **Logo Image**—specify an optional jpg, gif, or png file to display at the top of the page.
- **Header Text File**—specify an optional .txt file to display at the top of the page (beneath the logo, if any).
- **Footer Text File**—specify an optional .txt file to display at the bottom of the page.

WPA Configuration Settings

If you set **Encryption** for this SSID to one of the WPA selections (Step 11 on page 251) and you did not check the **Global** checkbox (Step 12), this section will be displayed. The **WPA Configuration** encryption settings have the same parameters as those described in “Procedure for Configuring Network Security” on page 231

RADIUS Configuration Settings

The RADIUS settings section will be displayed if you set **Authentication** (Step 10 on page 251) to **RADIUS MAC** and you did not check the **Global** checkbox (Step 12). This means that you wish to set up a RADIUS server to be used for this particular SSID. If **Global** is checked, then the security settings (including the RADIUS server, if any) established at the global level are used instead (see “Global Settings” on page 230).

The RADIUS and accounting settings are configured in the same way as for an external RADIUS server (see “Procedure for Configuring an External RADIUS Server” on page 235).

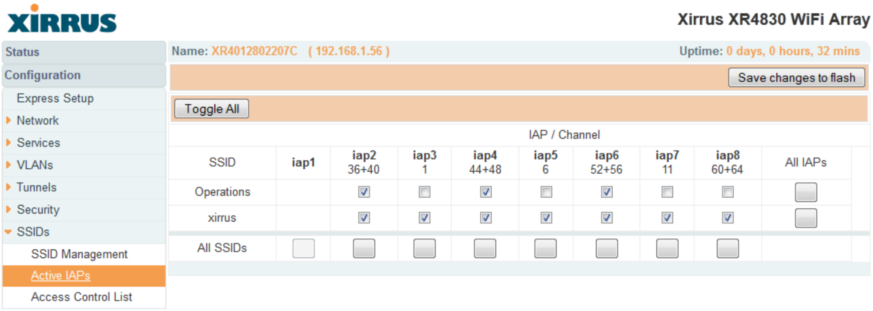
See Also

DHCP Server
External Radius
Global Settings (IAP)
Internal Radius
Security Planning
SSIDs
Understanding QoS Priority on the Wireless Array

Active IAPs

By default, when a new SSID is created, that SSID is active on all IAPs. This window allows you to specify which IAPs will offer that SSID. Put differently, you can specify which SSIDs are active on each IAP.

This feature is useful in conjunction with WDS. You may use this window to configure the WDS link IAPs so that only the WDS link SSIDs are active on them.



Name: XR4012802207C (192.168.1.56)

Uptime: 0 days, 0 hours, 32 mins

				IAP / Channel					
SSID	iap1	iap2 36+40	iap3 1	iap4 44+48	iap5 6	iap6 52+56	iap7 11	iap8 60+64	All IAPs
Operations		☑	□	☑	□	☑	□	□	□
xirrus		☑	☑	☑	☑	☑	☑	☑	□
All SSIDs	□	□	□	□	□	□	□	□	

Figure 141. Setting Active IAPs per SSID

Procedure for Specifying Active IAPs

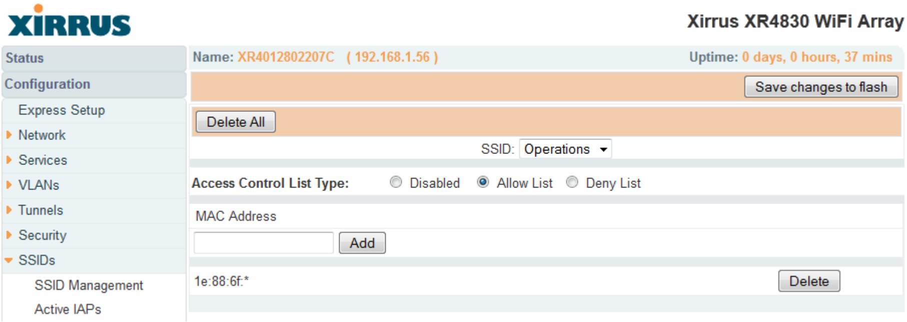
1. **SSID:** For a given SSID row, check off the IAPs on which that SSID is to be active. Uncheck any IAPs which should not offer that SSID.
2. **All IAPs**: This button, in the last column, may be used to deny this SSID on all IAPs. Click again to activate the SSID on all IAPs.
3. **All SSIDs**: This button, in the bottom row, may be used to activate all SSIDs on this IAP. Click again to deny all SSIDs on this IAP.
4. **Toggle All**: This button, on the lower left, may be used to deny all SSIDs on all IAPs. Click again to activate all SSIDs on all IAPs.
5. Click **Save changes to flash** if you wish to make your changes permanent.

Per-SSID Access Control List

This window allows you to enable or disable the use of the per-SSID Access Control List (ACL), which controls whether a station with a particular MAC address may associate to this SSID. You may create access control list entries and delete existing entries, and control the type of list.

There is one ACL per SSID, and you may select whether its type is an Allow List or a Deny List, or whether use of this list is disabled. You may create up to 1000 entries per SSID.

There is also a global ACL (see “Access Control List” on page 227). If the same MAC address is listed in both the global ACL and in an SSID’s ACL, and if either ACL would deny that station access to that SSID, then access will be denied.



Xirrus XR4830 WiFi Array

Name: XR4012802207C (192.168.1.56)

Uptime: 0 days, 0 hours, 37 mins

SSID: Operations

Access Control List Type: ○ Disabled ● Allow List ○ Deny List

MAC Address

1e:88:6f:*

Figure 142. Per-SSID Access Control List

Procedure for Configuring Access Control Lists

1. **SSID**: Select the SSID whose ACL you wish to manage.
2. **Access Control List Type**: Select Disabled to disable use of the Access Control List for this SSID, or select the ACL type—either Allow List or Deny List.
    - **Allow List**: Only allows the listed MAC addresses to associate to the Array. All others are denied.

- **Deny List**: Denies the listed MAC addresses permission to associate to the Array. All others are allowed.

In addition to these lists, other authentication methods (for example, RADIUS) are still enforced for users.

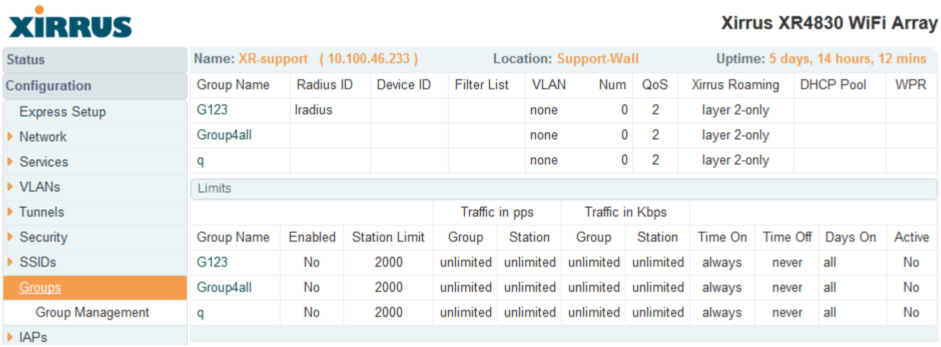
3. **MAC Address**: If you want to add a MAC address to the ACL, enter the new MAC address here, then click the **Add** button. The MAC address is added to the ACL. You may use a wildcard (*) for one or more digits to match a range of addresses. **Delete**: You may delete selected MAC addresses from this list by clicking their **Delete** buttons.
4. **Delete All**: This button, on the upper left, may be used to delete all the MAC entries in an ACL.
5. Click **Save changes to flash** if you wish to make your changes permanent.

Groups

This is a status-only window that allows you to review user (i.e., wireless client) Group assignments. It includes the group name, Radius ID, Device ID, VLAN IDs and QoS parameters and roaming layer defined for each group, and DHCP pools and web page redirect information defined for the group. You may click on a group's name to jump to the edit page for the group. There are no configuration options available on this page, but if you are experiencing problems or reviewing group management parameters, you may want to print this page for your records.

The **Limits** section of this window shows any limitations configured for your defined groups. For example, this window shows the current state of a group (enabled or disabled), how much group and per-station traffic is allowed, time on and time off, and days on and off.

For information to help you understand groups, see Understanding Groups below. For an in-depth discussion, please see the *Xirrus User Groups Application Note* in the *Xirrus Resource Center*.



Xirrus XR4830 WiFi Array

Name: XR-support (10.100.46.233) Location: Support-Wall Uptime: 5 days, 14 hours, 12 mins

Group Name	Radius ID	Device ID	Filter List	VLAN	Num	QoS	Xirrus Roaming	DHCP Pool	WPR
G123	Iradius			none	0	2	layer 2-only		
Group4all				none	0	2	layer 2-only		
q				none	0	2	layer 2-only		

Limits

			Traffic in pps		Traffic in Kbps					
Group Name	Enabled	Station Limit	Group	Station	Group	Station	Time On	Time Off	Days On	Active
G123	No	2000	unlimited	unlimited	unlimited	unlimited	always	never	all	No
Group4all	No	2000	unlimited	unlimited	unlimited	unlimited	always	never	all	No
q	No	2000	unlimited	unlimited	unlimited	unlimited	always	never	all	No

Figure 143. Groups

Understanding Groups

User groups allow administrators to assign specific network parameters to users (wireless clients) through RADIUS privileges rather than having to map users to an SSID tailored for that set of privileges. Groups provide flexible control over user privileges without the need to create large numbers of SSIDs.

A group allows you to define a set of parameter values to be applied to selected users. For example, you might define the user group **Students**, and set its VLAN, security parameters, web page redirect (WPR), and traffic limits. When a new user is created, you can apply all of these settings just by making the user a member of the group. The group allows you to apply a uniform configuration to a set of users in one step.

In addition, you can restrict the group so that it only applies its settings to group members who are connecting using a specific device type, such as iPad or phone. Thus, you could define a group named **Student-Phone** with **Device ID** set to **Phone**, and set the group's **VLAN Number** to 100. This group's settings will only be applied to group members who connect using a phone, and they will all use VLAN 100. Note that settings for the group in the RADIUS server will override any settings on this WMI page.

Almost all of the parameters that can be set for a group are the same as SSID parameters. This allows you to configure features at the user group level, rather than for an entire SSID. If you set parameter values for an SSID, and then enter different values for the same parameters for a user group, the **user group values have priority** (i.e., group settings will override SSID settings).

Group names are case-sensitive and can contain up to 32 alphanumeric characters (do not include spaces when defining Groups).

Using Groups

User accounts are used to authenticate wireless clients that want to associate to the Array. These accounts are established in one of two ways, using the **Security> Internal Radius** window or the **Security> External Radius** window. In either case, you may select a user group for the user, and that user group's settings will apply to the user:

- Internal Radius—when you add or modify a user entry, select a user group to which the user will belong.
- External Radius—when you add or modify a user account, specify the **Radius ID** for the user group to which the user will belong. This must be the same Radius ID that was entered in the Group Management window. When the user is authenticated, the external Radius server will send the

Radius ID to the Array. This will allow the Array to identify the group to which the user belongs.

See Also

External Radius

Internal Radius

SSIDs

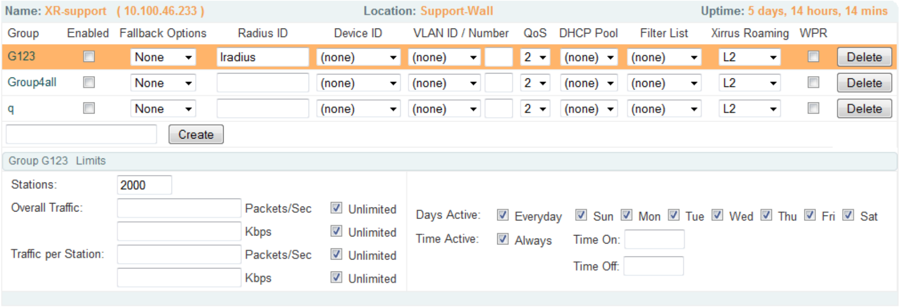
Understanding QoS Priority on the Wireless Array

Web Page Redirect Configuration Settings

Understanding Fast Roaming

Group Management

This window allows you to manage groups (create, edit and delete), assign usage limits and other parameters on a per group basis, and configure the Web Page Redirect functionality.



Name: XR-support (10.100.46.233) Location: Support-Wall Uptime: 5 days, 14 hours, 14 mins

Group	Enabled	Fallback Options	Radius ID	Device ID	VLAN ID / Number		QoS	DHCP Pool	Filter List	Xirrus Roaming	WPR	
G123	□	None	Iradius	(none)	(none)		2	(none)	(none)	L2	□	Delete
Group4all	□	None		(none)	(none)		2	(none)	(none)	L2	□	Delete
q	□	None		(none)	(none)		2	(none)	(none)	L2	□	Delete

Create

Group G123 Limits

Stations: 2000

Overall Traffic: Packets/Sec ☑ Unlimited

Kbps ☑ Unlimited

Traffic per Station: Packets/Sec ☑ Unlimited

Kbps ☑ Unlimited

Days Active: ☑ Everyday ☑ Sun ☑ Mon ☑ Tue ☑ Wed ☑ Thu ☑ Fri ☑ Sat

Time Active: ☑ Always Time On:

Time Off:

Figure 144. Group Management

Procedure for Managing Groups

1. **New Group Name:** To create a new group, enter a new group name next to the Create button, then click **Create**. You may create up to 16 groups.

   To configure and enable this group, proceed with the following steps.

2. **Group**: This column lists currently defined groups. When you create a new group, the group name appears in this list. Click on any group to select it, and then proceed to modify it as desired.

3. **Enabled**: Check this box to enable this group or leave it blank to disable it. When a group is disabled, users that are members of the group will behave as if the group did not exist. In other words, the options configured for the SSID will apply to the users, rather than the options configured for the group.

4. **Radius ID**: Enter a unique Radius ID for the group, to be used on an external Radius server. When adding a user account to the external server, this Radius ID value should be entered for the user. When the user is authenticated, Radius sends this value to the Array. This tells the Array that the user is a member of the group having this Radius ID.

5. **Device ID**: You may select a device type from this drop-down list, for example, **Notebook**, **phone**, **iPhone**, or **Android**. This allows you to apply the group settings only if a station authenticates as a user that is a member of the group and the station's device type matches **Device ID. Select none** if you do not want to consider the device type. If you have a Radius ID you should not enter a Device ID.

6. **VLAN ID**: (Optional) From the pull-down list, select a VLAN for this user's traffic to use. Select **numeric** and enter the number of a previously defined VLAN (see "VLANs" on page 199). This user group's VLAN settings supersede Dynamic VLAN settings (which are passed to the Array by the Radius server). To avoid confusion, we recommend that you avoid specifying the VLAN for a user in two places.

7. **QoS Priority**: (Optional) Select a value in this field for QoS (Quality of Service) priority filtering. The QoS value must be one of the following:

   - 0—The lowest QoS priority setting, where QoS makes its best effort at filtering and prioritizing data, video and voice traffic without compromising the performance of the network. Use this setting in environments where traffic prioritization is not a concern.
   - 1—Medium; QoS prioritization is aggregated across all traffic types.
   - 2—High, normally used to give priority to video traffic.
   - 3—The highest QoS priority setting, normally used to give priority to voice traffic.

The QoS setting you define here will prioritize wireless traffic for this group versus other traffic, as described in "Understanding QoS Priority on the Wireless Array" on page 244. The default value for this field is 2.

8. **DHCP Pool**: (Optional) To associate an internal DHCP pool to this group, select it from the pull--down list. Only one pool may be assigned. An internal DHCP pool must be created before it can be assigned. To create a DHCP pool, go to "DHCP Server" on page 197.

9. **Filter List**: (Optional) If you wish to apply a set of filters to this user group's traffic, select the desired Filter List. See "Filters" on page 344.

10. **Xirrus Roaming**: (Optional) For this group, select roaming behavior. Select **L2&L3** to enable fast roaming between IAPs or Arrays at Layer 2 and Layer 3. If you select **L2**, then roaming uses Layer 2 only. You may only select fast roaming at Layers 2 and 3 if this has been selected in Global Settings (IAP). You may select **Off** to disable fast roaming. See "Understanding Fast Roaming" on page 273.

11. **WPR (Web Page Redirect)**: (Optional) Check this box if you wish to enable the Web Page Redirect functionality. This will open a **Web Page Redirect** details section in the window, where your WPR parameters may be entered. This feature may be used to display a splash screen when a user first associates to the wireless network. After that, it can (optionally) redirect the user to an alternate URL. See "Web Page Redirect Configuration Settings" on page 255 for details of WPR usage and configuration. Note that the Group Management window only allows you to set up an **Internal Splash** page and a **Landing Page URL**. The authentication options that are offered on the SSID Management page are not offered here. Since the group membership of a user is provided to the Array by a Radius server, this means the user has already been authenticated.

Group Limits

The Limits section allows you to limit the traffic or connection times allowed for this user group. Note that the IAPs—Global Settings window and the SSID management windows also have options to limit the number of stations, limit traffic, and/or limit connection times. If limits are set in more than one place, all limits will be enforced:

- As soon as any station limit is reached, no new stations can associate until some other station has terminated its association.
- As soon as any traffic limit is reached, it is enforced.
- If any connection date/time restriction applies, it is enforced.

You can picture this as a logical AND of all restrictions. For example, suppose that a station's SSID is available MTWTF between 8:00am and 5:00pm, and the User Group is available MWF between 6:00am and 8:00pm, then the station will be allowed on MWF between 8:00am and 5:00pm.

To eliminate confusion, we recommend that you configure one set of limits or the other, but not both.

12. **Stations**: Enter the maximum number of stations allowed on this group. The default is 1536.
13. **Overall Traffic**: Check the **Unlimited** checkbox if you do not want to place a restriction on the traffic for this group, or enter a value in the Packets/Sec field and make sure that the Unlimited box is unchecked to force a traffic restriction.
14. **Traffic per Station**: Check the **Unlimited** checkbox if you do not want to place a restriction on the traffic per station for this group, or enter a value in the **Packets/Sec** or **Kbps** field and make sure that the Unlimited box is unchecked to force a traffic restriction.
15. **Days Active**: Choose **Everyday** if you want this group to be active every day of the week, or select only the specific days that you want this group to be active. Days that are not checked are considered to be the inactive days.
16. **Time Active**: Choose **Always** if you want this group active without interruption, or enter values in the **Time On** and **Time Off** fields to limit the time that group members may associate.
17. To delete an entry, click its **Delete** button.

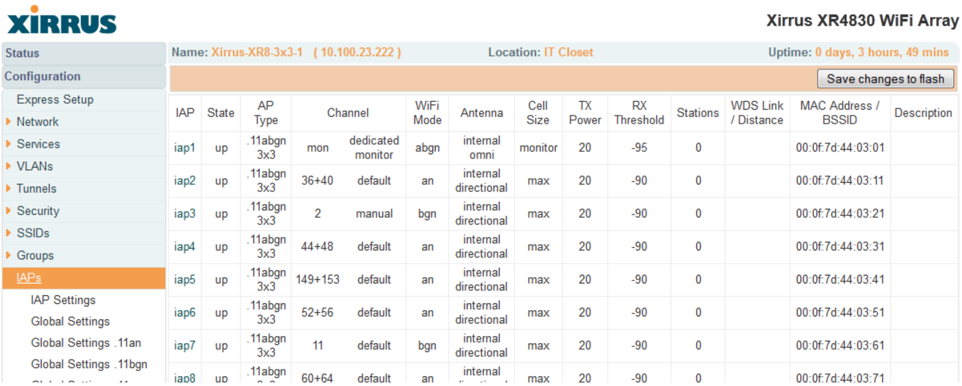
18. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

DHCP Server
External Radius
Internal Radius
Security Planning
SSIDs

IAPs

This status-only window summarizes the status of the Integrated Access Points (radios). For each IAP, it shows whether it is up or down, the channel and wireless mode, the antenna that it is currently using, its cell size and transmit and receive power, how many users (stations) are currently associated to it, whether it is part of a WDS link, and its MAC address.



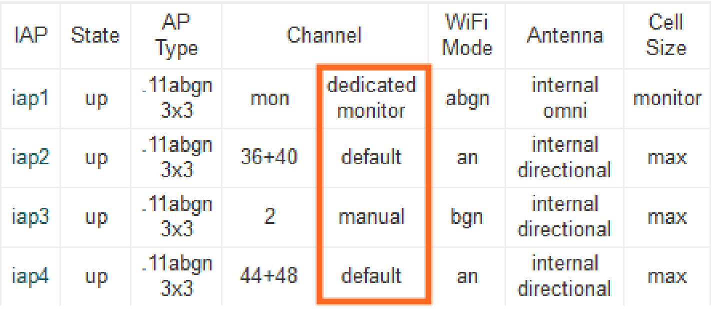
Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 3 hours, 49 mins

IAP	State	AP Type	Channel		WiFi Mode	Antenna	Cell Size	TX Power	RX Threshold	Stations	WDS Link / Distance	MAC Address / BSSID	Description
iap1	up	.11abgn 3x3	mon	dedicated monitor	abgn	internal omni	monitor	20	-95	0		00:0f:7d:44:03:01	
iap2	up	.11abgn 3x3	36+40	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:11	
iap3	up	.11abgn 3x3	2	manual	bgn	internal directional	max	20	-90	0		00:0f:7d:44:03:21	
iap4	up	.11abgn 3x3	44+48	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:31	
iap5	up	.11abgn 3x3	149+153	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:41	
iap6	up	.11abgn 3x3	52+56	default	an	internal directional	max	20	-90	0		00:0f:7d:44:03:51	
iap7	up	.11abgn 3x3	11	default	bgn	internal directional	max	20	-90	0		00:0f:7d:44:03:61	
iap8	up	.11abgn	60+64	default	an	internal	max	20	-90	0		00:0f:7d:44:03:71	

Figure 145. IAPs

The **Channel** column displays some status information that is not found elsewhere: the source of a channel setting. (Figure 146) If you set a channel manually (via IAP Settings), it will be labeled as **manual** next to the channel number (Figure 146). If an autochannel operation changed a channel, then it is labeled as **auto**. If the channel is set to the current factory default setting, the source will be **default**. This column also shows whether the channel selection is **locked**, or whether the IAP was automatically switched to this channel because the Array detected the signature of **radar** in operation on a conflicting channel (see also, Step 8 on page 282).

There are no configuration options in this window, but if you are experiencing problems or simply reviewing the IAP assignments, you may print this window for your records. Click any **IAP** name to open the associated configuration page.



IAP	State	AP Type	Channel		WiFi Mode	Antenna	Cell Size
iap1	up	.11abgn 3x3	mon	dedicated monitor	abgn	internal omni	monitor
iap2	up	.11abgn 3x3	36+40	default	an	internal directional	max
iap3	up	.11abgn 3x3	2	manual	bgn	internal directional	max
iap4	up	.11abgn 3x3	44+48	default	an	internal directional	max

Figure 146. Source of Channel Setting

Arrays have a fast roaming feature, allowing them to maintain sessions for applications such as voice, even while users cross boundaries between Arrays. Fast roaming is set up in the Global Settings (IAP) window and is discussed in:

- **"Understanding Fast Roaming" on page 273**

IAPs are configured using the following windows:

- **"IAP Settings" on page 274**
- **"Global Settings (IAP)" on page 280**
- **"Global Settings .11an" on page 293**
- **"Global Settings .11bgn" on page 298**
- **"Global Settings .11n" on page 304**
- **"Advanced RF Settings" on page 313**
- **"LED Settings" on page 334**
- **"DSCP Mappings" on page 335**
- **"Roaming Assist" on page 336**

See Also

IAP Statistics Summary

Understanding Fast Roaming

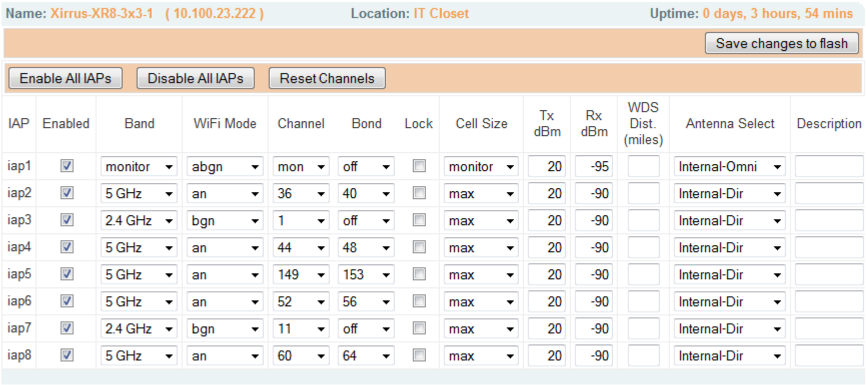
To maintain sessions for real-time data traffic, such as voice and video, users must be able to maintain the same IP address through the entire session. With traditional networks, if a user crosses VLAN or subnet boundaries (i.e., roaming between domains), a new IP address must be obtained.

Mobile wireless users are likely to cross multiple roaming domains during a single session (especially wireless users of VoIP phones). **Layer 3 roaming** allows a user to maintain the same IP address through an entire real-time data session. The user may be associated to any of the VLANs defined on the Array. The Layer 3 session is maintained by establishing a tunnel back to the originating Array. You should decide whether or not to use Layer 3 roaming based on your wired network design. Layer 3 roaming incurs extra overhead and may result in additional traffic delays.

Fast Roaming is configured on two pages. To enable the fast roaming options that you want to make available on your Array, see Step 28 to Step 30 in "Global Settings (IAP)" on page 280. To choose which of the enabled options are used by an SSID or Group, see "Procedure for Managing SSIDs" on page 250 (Step 13) or "Procedure for Managing Groups" on page 266.

IAP Settings

This window allows you to enable/disable IAPs, define the wireless mode for each IAP, specify the channel to be used and the cell size for each IAP, lock the channel selection, establish transmit/receive parameters, select antennas, and reset channels. Buttons at the bottom of the list allow you to **Reset Channels**, **Enable All IAPs,** or **Disable All IAPs**. When finished, click **Save changes to flash** if you wish to make your changes permanent.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 3 hours, 54 mins

IAP	Enabled	Band	WiFi Mode	Channel	Bond	Lock	Cell Size	Tx dBm	Rx dBm	WDS Dist. (miles)	Antenna Select	Description
iap1	☑	monitor	abgn	mon	off	☐	monitor	20	-95		Internal-Omni	
iap2	☑	5 GHz	an	36	40	☐	max	20	-90		Internal-Dir	
iap3	☑	2.4 GHz	bgn	1	off	☐	max	20	-90		Internal-Dir	
iap4	☑	5 GHz	an	44	48	☐	max	20	-90		Internal-Dir	
iap5	☑	5 GHz	an	149	153	☐	max	20	-90		Internal-Dir	
iap6	☑	5 GHz	an	52	56	☐	max	20	-90		Internal-Dir	
iap7	☑	2.4 GHz	bgn	11	off	☐	max	20	-90		Internal-Dir	
iap8	☑	5 GHz	an	60	64	☐	max	20	-90		Internal-Dir	

Figure 147. IAP Settings

You may also access this window by clicking on the Array image at the lower left of the WMI window—click the orange Xirrus logo in the center of the Array. See "User Interface" on page 88.

Procedure for Auto Configuring IAPs

You can auto-configure channel and cell size of radios by clicking on the **Auto Configure** buttons on the relevant WMI page (auto configuration only applies to enabled radios):

- For all radios, go to "Advanced RF Settings" on page 313.
- For all 802.11a settings, go to "Global Settings .11an" on page 293.
- For all 802.11bg settings, go to "Global Settings .11bgn" on page 298.
- For all 802.11n settings, go to "Global Settings .11n" on page 304.

Procedure for Manually Configuring IAPs

1. In the **Enabled** column, check the box for an IAP to enable it, or uncheck the box if you want to disable the IAP.

   In the **Band** column, select the wireless band for this IAP from the choices available in the pull-down menu, either **2.4GHz** or **5 GHz**. Choosing the **5GHz** band will automatically select an adjacent channel for bonding. If the band displayed is **auto**, the **Band** is about to be changed based on a new **Channel** selection that you made that requires the change.

   One of the IAPs must be set to **monitor** mode to support Spectrum Analyzer, Radio Assurance (loopback testing), and Intrusion Detection features.

For XN16 Arrays only—
The XN16 allows up to 12 IAPs to operate as 5 GHz—802.11an radios concurrently using internal antennas. Do not set Mode to 5 GHz for more than 12 IAPs unless you are using external antennas. Please contact Xirrus Customer Support for details.

2. In the **WiFi Mode** column, select the IEEE 802.11 wireless mode (or combination) that you want to allow on this IAP. The drop-down list will only display the appropriate choices for the selected **Band**. For example, the 5 GHz band allows you to select **an**, **a-only**, or **n-only**, while 2.4GHz also includes 802.11b and 802.11g choices. When you select a WiFi Mode for an IAP, your selection in the **Channel** column will be checked to ensure that it is a valid choice for that WiFi Mode.

   By selecting appropriate WiFi Modes for the radios on your Arrays, you can greatly improve wireless network performance. For example, if you have 802.11b and 802.11n stations using the same IAP, throughput on that radio is reduced greatly for the 802.11n stations. By supporting 802.11b stations only on selected radios in your network, the rest of your 802.11a or 11n radios will have greatly improved performance. Take care to ensure that your network provides adequate coverage for the types of stations that you need to support.

3. In the **Channel** column, select the channel you want this IAP to use from the channels available in the pull-down list. The list shows the channels available for the IAP selected (depending on which band the IAP is using). Channels that are shown in color indicate conditions that you need to keep in mind:

   - RED—Usage is not recommended, for example, because of overlap with neighboring radios.
   - YELLOW—The channel has less than optimum separation (some degree of overlap with neighboring radios).
   - GRAY—The channel is already in use.

   The channels that are available for assignment to an IAP will differ, depending on the country of operation. If **Country** is set to **United States** in the Global Settings (IAP) window, then 21 channels are available to 802.11an radios.

   As mandated by FCC/IC law, Arrays continually scan for signatures of radar. If such a signature is detected, the Array will switch operation from conflicting channels to new ones. The Array will switch back to the original channel after 30 minutes if the channel is clear. If a radio was turned off because there were no available channels not affected by radar, the Array will now bring that radio back up after 30 minutes if that channel is clear. The 30 minute time frame complies with FCC/IC regulations.

4. The **Bond** column works together with the channel bonding options selected on the Global Settings .11n page. Also see the discussion of 802.11n bonding in "Channel Bonding" on page 39.

   - **Channel number**—If a channel number appears, then this channel is already bonded to the listed channel.
   - **Off**—Do not bond his channel to another channel.
   - **On**—Bond this channel to an adjacent channel. The bonded channel is selected automatically by the Array based on the **Channel** (Step 3). The choice of banded channel is static—fixed once the selection is made.

- **+1**—Bond this channel to the next higher channel number. Auto Channel bonding does not apply. This option is only available for some of the channels.
- **-1**—Bond this channel to the next lower channel number. Auto Channel bonding does not apply. This option is only available for some of the channels.

5. Click the **Lock** check box if you want to lock in your channel selection so that an autochannel operation (see Advanced RF Settings) can't change it.

6. In the **Cell Size** column, select **auto** to allow the optimal cell size to be automatically computed (see also, "RF Power & Sensitivity" on page 316). To set the cell size yourself, choose either **small**, **medium**, **large**, or **max** to use the desired pre-configured cell size, or choose **manual** to define the wireless cell size manually. If you choose Manual, you must specify the transmit and receive power—in dB—in the **Tx dBm** (transmit) and **Rx dBm** (receive) fields. The default is **max**. If you select a value other than **auto**, the cell size will not be affected by cell size auto configuration. Note that ultra low power **Tx dBm** settings are possible. Values from -15dB to 5dB are provided specifically to help in high density 2.4 GHz environments.

   When other Arrays are within listening range of this one, setting cell sizes to **Auto** allows the Array to change cell sizes so that coverage between cells is maintained. Each cell size is optimized to limit interference between sectors of other Arrays on the same channel. This eliminates the need for a network administrator to manually tune the size of each cell when installing multiple Arrays. In the event that an Array or a radio goes offline, an adjacent Array can increase its cell size to help compensate.

   The number of users and their applications are major drivers of bandwidth requirements. The network architect must account for the number of users within the Array's cell diameter. In a large office, or if multiple Arrays are in use, you may choose **Small** cells to achieve a higher data rate, since walls and other objects will not define the cells naturally.

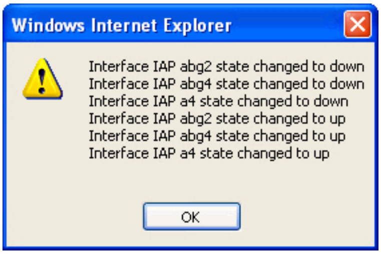
For additional information about cell sizes, go to "Coverage and Capacity Planning" on page 28.

7. If you are using WDS to provide backhaul over an extended distance, use **WDS Dist. (Miles)** to prevent timeout problems associated with long transmission times. Set the approximate distance in miles between this IAP and the connected Array in this column. This increases the wait time for frame transmission accordingly.

8. In the **Antenna Select** column, choose the antenna you want this radio to use from the pull-down list. The list of available antennas will be different (or no choices will be available), depending on the Array model and on the wireless mode you selected for the IAP.

9. If desired, enter a description for this IAP in the **Description** field.

10. You may reset all of the enabled IAPs by clicking the **Reset Channels** button at the bottom of the list. A message will inform you that all enabled radios have been taken down and brought back up.



Windows Internet Explorer

Interface IAP abg2 state changed to down
Interface IAP abg4 state changed to down
Interface IAP a4 state changed to down
Interface IAP abg2 state changed to up
Interface IAP abg4 state changed to up
Interface IAP a4 state changed to up

11. Buttons at the bottom of the list allow you to **Enable All IAPs** or **Disable All IAPs**.

12. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

Coverage and Capacity Planning
Global Settings (IAP)
Global Settings .11an

Global Settings .11bgn

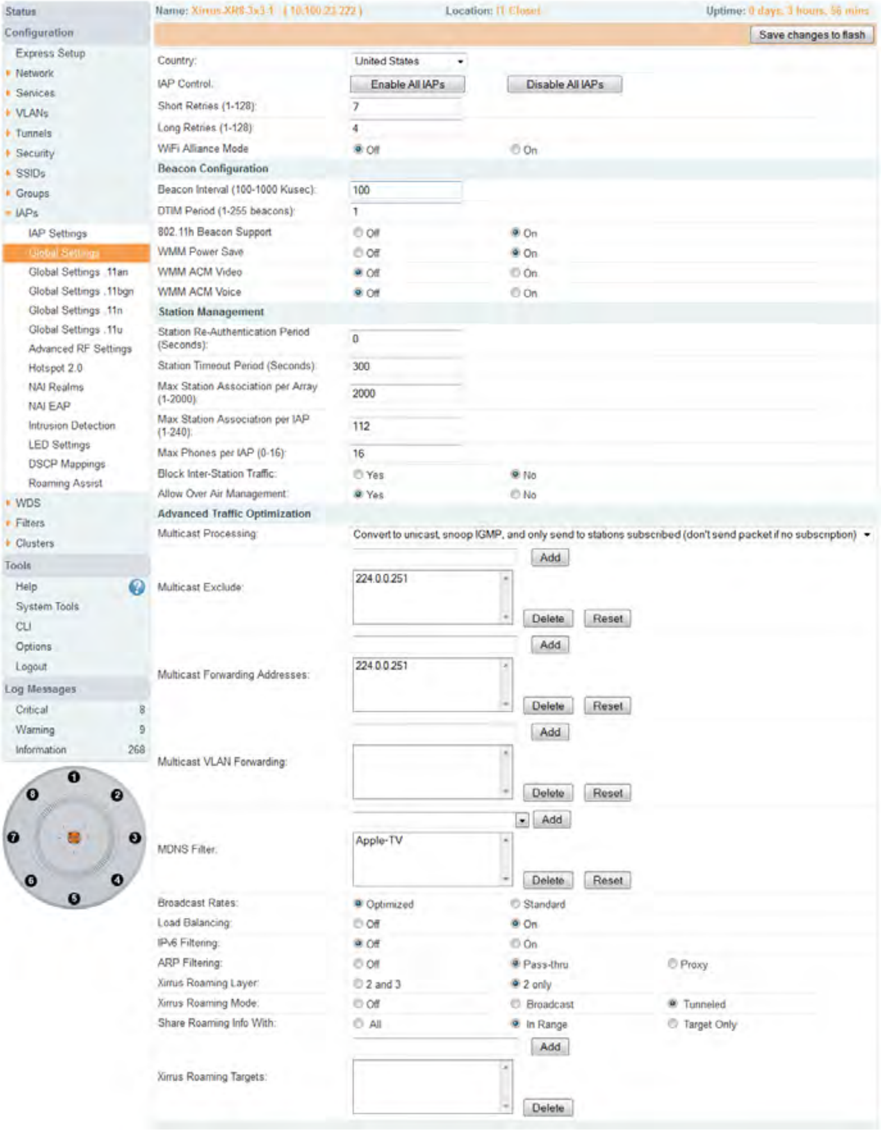
Global Settings .11n

IAPs

IAP Statistics Summary

LED Settings

Global Settings (IAP)



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: I1 Closet Uptime: 0 days, 3 hours, 56 mins

Country:	United States		
IAP Control:	Enable All IAPs	Disable All IAPs	
Short Retries (1-128):	7		
Long Retries (1-128):	4		
WiFi Alliance Mode	● Off	○ On	
Beacon Configuration			
Beacon Interval (100-1000 Kusec):	100		
DTIM Period (1-255 beacons):	1		
802.11h Beacon Support	○ Off	● On	
WMM Power Save	○ Off	● On	
WMM ACM Video	● Off	○ On	
WMM ACM Voice	● Off	○ On	
Station Management			
Station Re-Authentication Period (Seconds):	0		
Station Timeout Period (Seconds):	300		
Max Station Association per Array (1-2000):	2000		
Max Station Association per IAP (1-240):	112		
Max Phones per IAP (0-16):	16		
Block Inter-Station Traffic:	○ Yes	● No	
Allow Over Air Management:	● Yes	○ No	
Advanced Traffic Optimization			
Multicast Processing:	Convert to unicast, snoop IGMP, and only send to stations subscribed (don't send packet if no subscription)		
Multicast Exclude:	224.0.0.251		
Multicast Forwarding Addresses:	224.0.0.251		
Multicast VLAN Forwarding:			
MDNS Filter:	Apple-TV		
Broadcast Rates:	● Optimized	○ Standard	
Load Balancing:	○ Off	● On	
IPv6 Filtering:	● Off	○ On	
ARP Filtering:	○ Off	● Pass-thru	○ Proxy
Xirrus Roaming Layer:	○ 2 and 3	● 2 only	
Xirrus Roaming Mode:	○ Off	○ Broadcast	● Tunneled
Share Roaming Info With:	○ All	● In Range	○ Target Only
Xirrus Roaming Targets:			

Figure 148. Global Settings (IAPs)

This window allows you to establish global IAP settings. Global IAP settings include enabling or disabling all IAPs (regardless of their operating mode), and changing settings for beacons, station management, and advanced traffic optimization—including multicast processing, load balancing, and roaming. Changes you make on this page are applied to all IAPs, without exception.

Procedure for Configuring Global IAP Settings

*Some of the features below, such as Load Balancing, are only available if the Array's license includes the **Xirrus Advanced RF Performance Manager (RPM)**. If a setting is unavailable (grayed out), then your license does not support the feature. See **"About Licensing and Upgrades" on page 361**.*

1. **Country**: This is a display-only value. Once a country has been set, it may not be changed.

   The channels that are available for assignment to an IAP will differ, depending on the country of operation. If **Country** is set to **United States**, then 21 channels are available for 802.11a/n.

   If no country is displayed, the channel set defaults to channels and power levels that are legal worldwide—this set only includes the lower eight 5 GHz channels.

2. **IAP Control**: Click on the **Enable All IAPs** button to enable all IAPs for this Array, or click on the **Disable All IAPs** button to disable all IAPs.

3. **Short Retries**: This sets the maximum number of transmission attempts for a frame, the length of which is less than or equal to the RTS Threshold, before a failure condition is indicated. The default value is 7. Enter a new value (1 to 128) in the **Short Retry Limit** field if you want to increase or decrease this attribute.

4. **Long Retries**: This sets the maximum number of transmission attempts for a frame, the length of which is greater than the RTS Threshold, before a failure condition is indicated. The default value is 4. Enter a new value (1 to 128) in the **Long Retry Limit** field if you want to increase or decrease this attribute.

5. **Wi-Fi Alliance Mode**: Set this **On** if you need Array behavior to conform completely to Wi-Fi Alliance standards. This mode is normally set to **Off**.

Beacon Configuration

6. **Beacon Interval**: When the Array sends a beacon, it includes with it a beacon interval, which specifies the period of time before it will send the beacon again. Enter the desired value in the **Beacon Interval** field, between 20 and 1000 Kusecs. A Kusec is 1000 microseconds = 1 millisecond. The value you enter here is applied to all IAPs.

7. **DTIM Period**: A DTIM (Delivery Traffic Indication Message) is a signal sent as part of a beacon by the Array to a client device in sleep mode, alerting the device to broadcast traffic awaiting delivery. The **DTIM Period** is a multiple of the **Beacon Interval**, and it determines how often DTIMs are sent out. By default, the DTIM period is 1, which means that it is the same as the beacon interval. Enter the desired multiple, between 1 and 255. The value you enter here is applied to all IAPs.

8. **802.11h Beacon Support**: This option enables beacons on all of the Array's radios to conform to 802.11h requirements, supporting dynamic frequency selection (DFS) and transmit power control (TPC) to satisfy regulatory requirements for operation in Europe.

9. **WMM Power Save**: Click **On** to enable Wireless Multimedia Power Save support, as defined in IEEE802.11e. This option saves power and increases battery life by allowing the client device to doze between packets to save power, while the Array buffers downlink frames. The default setting is **On**.

10. **WMM ACM Video**: Click **On** to enable Wireless Multimedia Admission Control for video traffic. When admission control for video is enabled, the Array evaluates a video request from a client device against the network load and channel conditions. If the network is not congested, it accepts the request and grants the client the medium time for its traffic stream. Otherwise, it rejects the request. Some clients contain sufficient

intelligence to decide to either delay the traffic stream, associate with a different AP, or establish a best-effort traffic stream outside the operation of WMM-Admission Control. The default setting is **Off**.

11. **WMM ACM Voice**: Click **On** to enable Wireless Multimedia Admission Control for voice calls. When admission control for voice is enabled, the Array evaluates a voice request from a client device against the network load and channel conditions. If the network is not congested, it accepts the request and grants the client the medium time for its call. Otherwise, it rejects the request. Some clients contain sufficient intelligence to decide to either delay the traffic stream, associate with a different AP, or establish a best-effort traffic stream outside the operation of WMM-Admission Control. The default setting is **Off**.

Station Management

12. **Station Re-Authentication Period**: This specifies an interval (in seconds) for station reauthentications. This is the minimum time period between station authentication attempts, enforced by the Array. This feature is part of the Xirrus Advanced RF Security Manager (RSM).

13. **Station Timeout Period**: Specify a time (in seconds) in this field to define the timeout period for station associations.

14. **Max Station Association per Array**: This option allows you to define how many station associations are allowed per Array (up to 1280 stations per Array). Note that the **Max Station Association per IAP** limit (below) may not be exceeded. If you have an unlicensed Array, this value is set to 1, which simply allows you to test the ability to connect to the Array.

15. **Max Station Association per IAP**: This defines how many station associations are allowed per IAP. Note that the SSIDs—SSID Management window also has a station limit option—**Station Limit** (page 254). If both station limits are set, both will be enforced. As soon as either limit is reached, no new stations can associate until some other station has terminated its association.

16. **Max Phones per IAP**: This option allows you to control the maximum number of phones that are allowed per IAP. The default is set to a maximum of 16 but you can reduce this number, as desired. Enter a value in this field between 0 (no phones allowed) and 16.

This admission control feature applies only to Spectralink phones. It does not apply to all VoIP phones in general.

17. **Block Inter-Station Traffic:** This option allows you to block or allow traffic between wireless clients that are associated to the Array. Choose either **Yes** (to block traffic) or **No** (to allow traffic).

18. **Allow Over Air Management**: Choose **Yes** to enable management of the Array via the IAPs, or choose **No** (recommended) to disable this feature.

Advanced Traffic Optimization

19. **Multicast Processing:** This sets how multicast traffic is handled. Multicast traffic can be received by a number of subscribing stations at the same time, thus saving a great deal of bandwidth. In some of the options below, the Array uses IGMP snooping to determine the stations that are subscribed to the multicast traffic. IGMP (Internet Group Management Protocol) is used to establish and manage the membership of multicast groups.

    Multicast handling options are only applicable to traffic transmitted from the Array to wireless stations. Select one of the following options:

    - **Send multicasts unmodified**. This is useful when multicast is not needed because no video or audio streaming is required or when it is used only for discovering services in the network. Some situations where you might use this option are:
        - for compatibility with ordinary operation, i.e., there is no optimization or modification of multicast traffic.
        - if you have an application where many subscribers need to see the multicast—a large enough number that it would be less efficient to convert to unicast and better just to send out multicast

even though it must be sent out at the speed of the slowest connected station.

An example of a situation that might benefit from the use of this mode is ghosting all the laptops in a classroom using multicast. One multicast stream at, say, 6 Mbps is probably more efficient than thirty unicast streams.

The next three options convert multicast to unicast. Packets are sent directly to the stations at the best possible data rates. This approach significantly improves the quality of the voice and video multicast streams.

- **Convert to unicast and send unicast packets to all stations**. This may be useful in link-local multicast situations.
- **Convert to unicast, snoop IGMP, and only send to stations subscribed (send as multicast if no subscription)**. This option is useful when you need to stream voice or video multicast traffic to all stations, but some stations are capable of subscribing to multicast groups while other stations are not. The stations that do not subscribe will not benefit from conversion to unicast; their video or voice quality may be compromised.
- **Convert to unicast, snoop IGMP, and only send to stations subscribed (don't send packet if no subscription)**. This option is useful in well controlled environments when you need to stream voice or video multicast traffic only to stations that are capable of subscribing to multicast groups and there is no need for the rest of the stations to receive the data stream.

20. **Multicast Exclude:** This is a list of multicast IP addresses that will not be subject to multicast-to-unicast conversion. This list is useful on networks where applications such as those using multicast Domain Name System (mDNS) are in use. For example, Apple Bonjour finds local network devices such as printers or other computers using mDNS. By default, the list contains the IPv4 multicast address for Apple Bonjour mDNS: 224.0.0.251.

To add a new IP address to the list, type it in the top field and click the **Add** button to its right. You may only enter IP addresses—host names are not allowed. This is because mDNS is a link local multicast address, and does not require IGMP to the gateway.

To remove an entry, select it in the list and click **Delete**. To remove *all* entries from the list, click **Reset**.

21. **Multicast Forwarding**

Multicast Forwarding is a Xirrus feature that forwards selected multicast traffic between wired VLANs and wireless SSIDs. For example, Apple devices use mDNS to advertise and find services, using local network multicasts that are not routed. This creates an issue when you are using Apple devices on the Wireless LAN, and have other devices that provide services connected on the wired infrastructure in a different VLAN, for example, printers and AppleTV devices. One way to address this issue is to set up multicast forwarding between the wireless SSID and the wired VLAN. This requires the wired VLAN to be trunked to the Array. Once configured correctly, mDNS traffic will be forwarded from the specified wireless network(s) to the specified wired VLANs and vice-versa, subject to any mDNS service filtering defined (Step 23).

Use multicast forwarding together with multicast VLAN forwarding (Step 22) and mDNS filtering (Step 23) to make services available across VLANs as follows:

- In **Multicast Forwarding Addresses**, enter a list of multicast addresses that you want forwarded, for example, 224.0.0.251 (the multicast address for Bonjour).
- In **Multicast VLAN Forwarding**, enter a list of VLANs that participate in the multicast forwarding.
- In **MDNS Filter**, specify the mDNS service types that are allowed to be forwarded.
    - If you leave this field blank, then there is ***no*** filter, and *mDNS packets for all service types are passed*.

- If you enter service types, then this acts as an allow filter, and *mDNS packets are passed* ***only*** *for the listed service types*.

Note that mDNS filtering may be used to filter the mDNS packet types that are forwarded within the same VLAN. Also, in conjunction with multicast forwarding, it may be used to filter the mDNS packet types that are forwarded across configured VLANs.

After you have entered these settings, when multicast packets arrive from the wired network from one of the **Multicast Forwarding Addresses** on any VLAN specified in **Multicast VLAN Forwarding,** they are forwarded to the corresponding wireless SSID for that VLAN. .

Multicast packets coming in from the wireless network on an SSID tied to one of the specified VLANs and matching one of the **Multicast Forwarding Addresses** are forwarded to the specified VLANs on the wired network.

No modifications are made to the forwarded packets – they are just forwarded between specified VLANs and associated SSIDs.

Xirrus strongly recommends the use of MDNS Filters (Step 23) *when using multicast forwarding. Only allow required services to be forwarded.*

Carefully monitor results, as forwarding may flood your network with multicast traffic. Experience has shown Bonjour devices to be very chatty. Also note that since this is link local multicast traffic, it will be sent to every wired port in the VLAN, as IGMP snooping does not work with link local multicast addresses.

To specify **Multicast Forwarding Addresses:** enter each IP address in the top field and click the **Add** button to its right. You may only enter IPv4 multicast addresses - host names are not allowed. To remove an entry, select it in the list and click **Delete**. To remove *all* entries from the list, click **Reset**.

22. **Multicast VLAN Forwarding:** This is a list of VLANs that participate in the multicast forwarding. Please see the description of multicast forwarding in Step 21 above.

The VLANs you enter must be explicitly defined (see "VLANs" on page 199) in order to participate in multicast forwarding. In fact, the Array discards packets from undefined VLANs.

To add a new VLAN to the list, enter its number or name in the top field and click the **Add** button to its right. You may enter multiple VLANs at once, separated by a space. To remove an entry, select it in the list and click **Delete**. To remove *all* entries from the list, click **Reset**.

These VLANs must be trunked to the Array from the LAN switch, and be defined on the Array. See "VLAN Management" on page 201 and "SSID Management" on page 249.

Note that Multicast Forwarding and mDNS Filtering capabilities also work if both devices are wireless. For example, let's say that AppleTV is using wireless to connect to an SSID that is associated with VLAN 56, and the wireless client is on an SSID that is associated with VLAN 58. Normally the wireless client would not be able to use Bonjour to discover the AppleTV because they are on separate VLANs. But if you add 224.0.0.251 to the ***Multicast Forwarding Addresses****, then add VLANs 56 and 58 to the* ***Multicast VLAN Forwarding*** *list, then the wireless client will be able to discover the AppleTV. In this same scenario you could add AppleTV to the* ***MDNS Filter*** *list so that only MDNS packets for the AppleTV service type would be forwarded between VLANs 56 and 58.*

Note that all the VLANs that you add to this list do not have to be associated with SSIDs. As an example, say that AppleTV is on the wired network on VLAN 56, while the wireless device is connected to an SSID that is associated to VLAN 58. In this case, VLAN 56 and 58 need to be defined on the Array but only VLAN 58 needs to be associated to a SSID.

23. **MDNS Filter:** There are many different types of services that may be specified in multicast query and response packets. The mDNS filters let you restrict forwarding, so that multicast packets are forwarded only for the services that you explicitly specify. This list may be used to restrict the amount of Apple Bonjour multicast traffic forwarding. For example, you may restrict forwarding to just AppleTV and printing services. Please see the description of multicast forwarding in Step 21 above.

    The **MDNS Filter** operates as follows:

    - If you leave this field blank, then there is ***no*** filter, and *mDNS packets for all service types are passed*.
    - If you enter service types, then this acts as an allow filter, and *mDNS packets are passed* ***only*** *for the listed service types*.

    To add an mDNS packet type to the list of packets that may be forwarded, select it from the drop-down list in the top field and click the **Add** button to its right. The drop-down list offers packet types such as **AirTunes**, **Apple-TV**, **iChat**, **iPhoto**, **iTunes**, **iTunes-Home-Sharing**, **Internet-Printing**, **Mobile-Device-Sync**, and **Secure-Telnet**.

    For example, to allow mirroring of an iPad on an Apple-TV, select **Apple-TV**.

    You may define your own type if you do not see the service you want in the drop-down list. Simply enter the mDNS service name that you would like to allow through. Custom mDNS packet types must be prefixed with an underscore, e.g., **_airvideoserver**.

    To remove an entry, select it in the list and click **Delete**. To remove *all* entries from the list, click **Reset**.

24. **Broadcast Rates**: This changes the rates of broadcast traffic sent by the Array (including beacons). When set to **Optimized**, each broadcast or multicast packet that is transmitted on each radio is sent at the lowest transmit rate used by any client associated to that radio at that time. This results in each IAP broadcasting at the highest Array TX data rate that can be heard by all associated stations, improving system performance. The rate is determined dynamically to ensure the best broadcast/multicast

performance possible. The benefit is dramatic. Consider a properly designed network (having -70db or better everywhere), where virtually every client should have a 54Mbps connection. In this case, broadcasts and multicasts will all go out at 54Mbps vs. the standard rate. Thus, with broadcast rate optimization on, broadcasts and multicasts use between 2% and 10% of the bandwidth that they would in Standard mode.

When set to **Standard** (the default), broadcasts are sent out at the lowest basic rate only—6 Mbps for 5GHz clients, or 1 Mbps for 2.4GHz clients. The option you select here is applied to all IAPs.

25. **Load Balancing:** The Xirrus Wireless Array supports an automatic load balancing feature designed to distribute wireless stations across multiple radios rather than having stations associate to the closest radios with the strongest signal strength, as they normally would. In wireless networks, the station decides to which radio it will associate. The Array cannot actually force load balancing, however the Array can “encourage” stations to associate in a more uniform fashion across all of the radios of the Array. This option enables or disables active load balancing between the Array IAPs. For an in-depth discussion, see the *Xirrus Station Load Balancing Application Note* in the ***Xirrus Resource Center***.

    If you select **On** and an IAP is overloaded, that IAP will send an “AP Full” message in response to Probe, Association, or Authentication requests. This prevents determined clients from forcing their way onto overloaded IAPs. Note that some clients are so determined to associate to a particular IAP that they will not try to associate to another IAP, and thus they never get on the network.

    Choose **Off** to disable load balancing.

26. **ARP Filtering:** Address Resolution Protocol finds the MAC address of a device with a given IP address by sending out a broadcast message requesting this information. ARP filtering allows you to reduce the proliferation of ARP messages by restricting how they are forwarded across the network.

    You may select from the following options for handling ARP requests:

- **Off**: ARP filtering is disabled. ARP requests are broadcast to radios that have stations associated to them.
- **Pass-thru**: The Array forwards the ARP request. It passes along only ARP messages that target the stations that are associated to it. This is the default value.
- **Proxy**: The Array replies on behalf of the stations that are associated to it. The ARP request is not broadcast to the stations.

Note that the Array has a broadcast optimization feature that is always on (it is not configurable). Broadcast optimization restricts all broadcast packets (not just ARP broadcasts) to only those radios that need to forward them. For instance, if a broadcast comes in from VLAN 10, and there are no VLAN 10 users on a radio, then that radio will not send out that broadcast. This increases available air time for other traffic.

27. **IPv6 Filtering:** this setting allows blocking of IPv6 traffic which may be a concern for IT managers. The Xirrus Array currently bridges IPv6 traffic. Set IPv6 filtering **On** if you wish to prevent the forwarding of IPv6 packets through the Array in both directions—wired network to wireless and wireless network to wired. The default is **Off**.

28. **Xirrus Roaming Layer:** Select whether to enable roaming capabilities between IAPs or Arrays at Layer **2 and 3**, or at Layer **2 only**. Depending on your wired network, you may wish to allow fast roaming at Layer 3. This may result in delayed traffic.

29. **Xirrus Roaming Mode:** This feature utilizes the Xirrus Roaming Protocol (XRP) ensuring fast and seamless roaming capabilities between IAPs or Arrays at Layer 2 and Layer 3 (as specified in Step 30), while maintaining security. Fast roaming eliminates long delays for re-authentication, thus supporting time-sensitive applications such as Voice over Wi-Fi (see “Understanding Fast Roaming” on page 273 for a discussion of this feature). XRP uses a discovery process to identify other Xirrus Arrays as fast roaming targets. This process has two modes:

    - **Broadcast**—the Array uses a broadcast technique to discover other Arrays that may be targets for fast roaming.

- **Tunneled**—in this Layer 3 technique, fast roaming target Arrays must be explicitly specified.

To enable fast roaming, choose **Broadcast** or **Tunneled**, and set additional fast roaming attributes (Step 30). To disable fast roaming, choose **Off**. If you enable Fast Roaming, the following ports **cannot** be blocked:

- **Port 22610**—reserved for Layer 2 roaming using UDP to share PMK information between Arrays.
- **Ports 15000 to 17999**—reserved for Layer 3 roaming (tunneling between subnets).

30. **Share Roaming Info With:** Three options allow your Array to share roaming information with all Arrays; just with those that are within range; or with specifically targeted Arrays. Choose either **All**, **In Range** or **Target Only**, respectively.

    a. **Xirrus Roaming Targets:** If you chose **Target Only**, use this option to add target MAC addresses. Enter the MAC address of each target Array, then click on **Add** (add as many targets as you like). To find a target's MAC address, open the **Array Info** window on the target Array and look for **IAP MAC Range**, then use the starting address of this range.

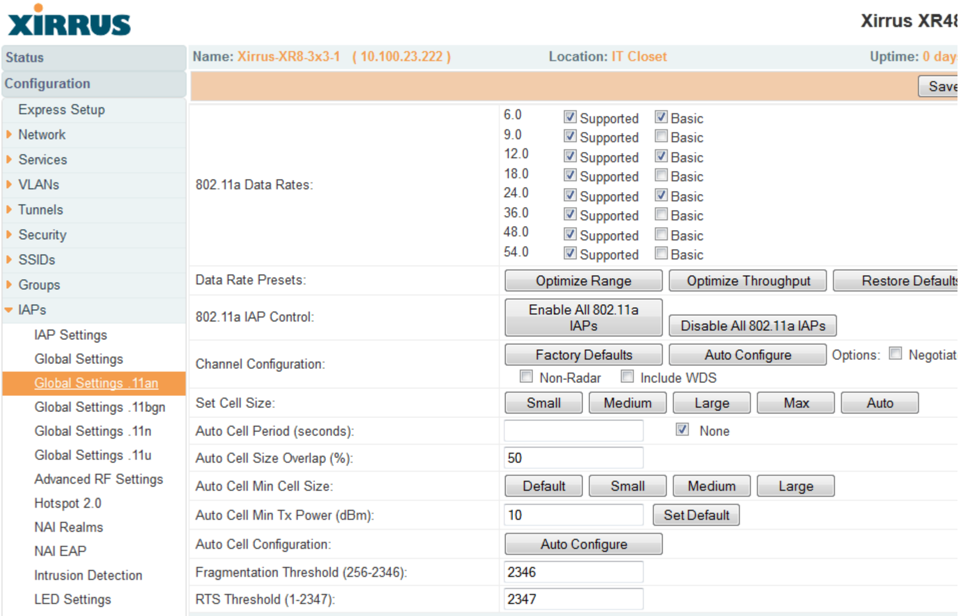
    To delete a target, select it from the list, then click **Delete**.

See Also

Coverage and Capacity Planning
Global Settings .11an
Global Settings .11bgn
Global Settings .11n
Advanced RF Settings
IAPs
IAP Statistics Summary
LED Settings
IAP Settings

Global Settings .11an

This window allows you to establish global 802.11a IAP settings. These settings include defining which 802.11a data rates are supported, enabling or disabling all 802.11an IAPs, auto-configuration of channel allocations for all 802.11an IAPs, and specifying the fragmentation and RTS thresholds for all 802.11an IAPs.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 day

802.11a Data Rates:	6.0 ☑ Supported ☑ Basic 9.0 ☑ Supported □ Basic 12.0 ☑ Supported ☑ Basic 18.0 ☑ Supported □ Basic 24.0 ☑ Supported ☑ Basic 36.0 ☑ Supported □ Basic 48.0 ☑ Supported □ Basic 54.0 ☑ Supported □ Basic	
Data Rate Presets:	Optimize Range	Optimize Throughput Restore Default
802.11a IAP Control:	Enable All 802.11a IAPs	Disable All 802.11a IAPs
Channel Configuration:	Factory Defaults Auto Configure	Options: □ Negotiat □ Non-Radar □ Include WDS
Set Cell Size:	Small Medium Large Max Auto	
Auto Cell Period (seconds):		☑ None
Auto Cell Size Overlap (%):	50	
Auto Cell Min Cell Size:	Default Small Medium Large	
Auto Cell Min Tx Power (dBm):	10	Set Default
Auto Cell Configuration:	Auto Configure	
Fragmentation Threshold (256-2346):	2346	
RTS Threshold (1-2347):	2347	

Figure 149. Global Settings .11an

Procedure for Configuring Global 802.11an IAP Settings

1. **802.11a Data Rates:** The Array allows you to define which data rates are supported for all 802.11an radios. Select (or deselect) data rates by clicking in the corresponding **Supported** and **Basic** data rate check boxes.

   - **Basic Rate**—a wireless station (client) must support this rate in order to associate.
   - **Supported Rate**—data rates that can be used to transmit to clients.

2. **Data Rate Presets**: The Wireless Array can optimize your 802.11a data rates automatically, based on range or throughput. Click **Optimize Range**

to optimize data rates based on range, or click **Optimize Throughput** to optimize data rates based on throughput. The **Restore Defaults** button will take you back to the factory default rate settings.

3. **802.11a IAP Control**: Click **Enable 802.11a IAPs** to enable all 802.11an IAPs for this Array, or click **Disable 802.11a IAPs** to disable all 802.11an IAPs.

*Some of the features below, such as Auto Configure for Cell Size and Channel Configuration, are only available if the Array's license includes the **Xirrus Advanced RF Performance Manager (RPM)**. If a setting is unavailable (grayed out), then your license does not support the feature. Please see **"About Licensing and Upgrades" on page 361**.*

4. **Channel Configuration**: Click **Auto Configure** to instruct the Array to determine the best channel allocation settings for each 802.11an IAP and select the channel automatically, based on changes in the environment. This is the recommended method for 802.11a channel allocation (see "RF Spectrum Management" on page 318).

   Click **Factory Defaults** if you wish to instruct the Array to return all IAPs to their factory preset channels. As of release 6.3, Arrays no longer all use the same factory preset values for channel assignments. Instead, if the Array has been deployed for a while and already has data from the spectrum analyzer and Xirrus Roaming Protocol about channel usage on neighboring arrays, it performs a quick auto channel using that information (without doing a full RF scan) to make an intelligent choice of channel assignments. If the Array has been rebooted and has no saved configuration or is just being deployed for the first time, it has no prior data about its RF environment. In this case, it will pick a set of compatible channel assignments at random.

*On the XR500 and XR-1000 Series Arrays, the **Factory Defaults** button will not restore iap1 to monitor mode. You will need to restore this setting manually. Also, you may need to set **Timeshare Mode** again - see "RF Monitor" on page 314.*

The following options may be selected for auto configuration:

- **Non-Radar**: give preference to channels that are not required to use dynamic frequency selection (DFS) to avoid communicating in the same frequency range as some radar (also see Step 8 on page 282).

Channels Required to Use DFS Radar Avoidance in USA			
36+40	Non-radar	116+120	DFS required
44+48	Non-radar	124+128	DFS required
52+56	DFS required	132+136	DFS required
60+64	DFS required	149+153	Non-radar
100+104	DFS required	157+161	Non-radar
108+112	DFS required		

- **Negotiate**: negotiate air-time with other Arrays before performing a full scan.
- **Full Scan**: perform a full traffic scan on all channels on all IAPs to determine the best channel allocation.
- **Include WDS**: automatically assign 5GHz to WDS client links.

To use the Auto Cell Size feature, the following additional settings are required:

RF Monitor Mode must be turned ***On****. See* ***"RF Monitor" on page 314***

One of the radios must be in ***monitor*** *mode with the default* ***RxdBm*** *setting of* ***-95****, and all other IAPs that will use Auto Cell must have* ***Cell Size*** *set to* ***auto****. See* ***"Procedure for Manually Configuring IAPs" on page 275****.*

5. **Set Cell Size**: Cell Size may be set globally for all 802.11an IAPs to **Auto**, **Large, Medium, Small**, or **Max** using the buttons.

For an overview of RF power and cell size settings, please see "RF Power & Sensitivity" on page 316, "Capacity and Cell Sizes" on page 30, and "Fine Tuning Cell Sizes" on page 31.

6. **Auto Cell Period (seconds)**: You may set up auto-configuration to run periodically, readjusting optimal cell sizes for the current conditions. Enter a number of seconds to specify how often auto-configuration will run. If you select **None**, then auto-configuration of cell sizing will not be run periodically. You do not need to run Auto Cell often unless there are a lot of changes in the environment. If the RF environment is changing often, running Auto Cell every twenty-four hours (86400 seconds) should be sufficient). The default value is **None**.

7. **Auto Cell Size Overlap (%)**: Enter the percentage of cell overlap that will be allowed when the Array is determining automatic cell sizes. For 100% overlap, the power is adjusted such that neighboring Arrays that hear each other best will hear each other at -70dB. For 0% overlap, that number is -90dB. The default value is **50%**.

8. **Auto Cell Min Cell Size**: Use this setting if you wish to set the minimum cell size that Auto Cell may assign. The values are **Default**, **Large, Medium,** or **Small**.

9. **Auto Cell Min Tx Power (dBm)**: Enter the minimum transmit power that the Array can assign to a radio when adjusting automatic cell sizes. The default value is **10**.

10. **Auto Cell Configuration**: Click this button to instruct the Array to determine and set the best cell size for each 802.11an IAP whose **Cell Size** is **auto** on the IAP Settings window, based on changes in the environment. This is the recommended method for setting cell size. You may look at the Tx and Rx values on the IAP Settings window to view the cell size settings that were applied.

11. **Fragmentation Threshold**: This is the maximum size for directed data packets transmitted over the 802.11an radio. Larger frames fragment into several packets, their maximum size defined by the value you enter here.

Smaller fragmentation numbers can help to “squeeze” packets through in noisy environments. Enter the desired **Fragmentation Threshold** value in this field, between 256 and 2346.

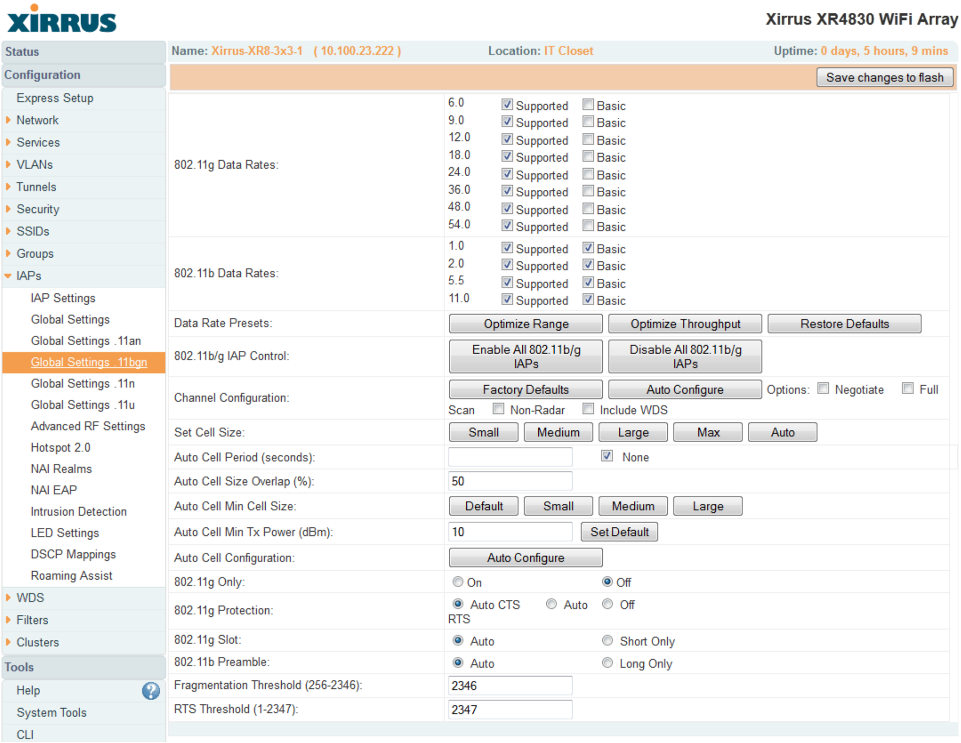
12. **RTS Threshold**: The RTS (Request To Send) Threshold specifies the packet size. Packets larger than the RTS threshold will use CTS/RTS prior to transmitting the packet—useful for larger packets to help ensure the success of their transmission. Enter a value between 1 and 2347.

See Also

Coverage and Capacity Planning
Global Settings (IAP)
Global Settings .11bgn
Global Settings .11n
IAPs
IAP Statistics Summary
Advanced RF Settings
IAP Settings

Global Settings .11bgn

This window allows you to establish global 802.11b/g IAP settings. These settings include defining which 802.11b and 802.11g data rates are supported, enabling or disabling all 802.11b/g IAPs, auto-configuring 802.11b/g IAP channel allocations, and specifying the fragmentation and RTS thresholds for all 802.11b/g IAPs.



Name: Xirrus-XR8-3x3-1 (10.100.23.222) Location: IT Closet Uptime: 0 days, 5 hours, 9 mins

802.11g Data Rates:	6.0 ☑ Supported □ Basic 9.0 ☑ Supported □ Basic 12.0 ☑ Supported □ Basic 18.0 ☑ Supported □ Basic 24.0 ☑ Supported □ Basic 36.0 ☑ Supported □ Basic 48.0 ☑ Supported □ Basic 54.0 ☑ Supported □ Basic
802.11b Data Rates:	1.0 ☑ Supported ☑ Basic 2.0 ☑ Supported ☑ Basic 5.5 ☑ Supported ☑ Basic 11.0 ☑ Supported ☑ Basic
Data Rate Presets:	Optimize Range · Optimize Throughput · Restore Defaults
802.11b/g IAP Control:	Enable All 802.11b/g IAPs · Disable All 802.11b/g IAPs
Channel Configuration:	Factory Defaults · Auto Configure · Options: □ Negotiate □ Full Scan □ Non-Radar □ Include WDS
Set Cell Size:	Small · Medium · Large · Max · Auto
Auto Cell Period (seconds):	☑ None
Auto Cell Size Overlap (%):	50
Auto Cell Min Cell Size:	Default · Small · Medium · Large
Auto Cell Min Tx Power (dBm):	10 · Set Default
Auto Cell Configuration:	Auto Configure
802.11g Only:	○ On ● Off
802.11g Protection:	● Auto CTS ○ Auto RTS ○ Off
802.11g Slot:	● Auto ○ Short Only
802.11b Preamble:	● Auto ○ Long Only
Fragmentation Threshold (256-2346):	2346
RTS Threshold (1-2347):	2347

Figure 150. Global Settings .11bgn

Some of the features below, such as Auto Configure for Cell Size and Channel Configuration, are only available if the Array's license includes the ***Xirrus Advanced RF Performance Manager (RPM)****. If a setting is unavailable (grayed out), then your license does not support the feature. Please see* ***"About Licensing and Upgrades" on page 361****.*

Procedure for Configuring Global 802.11b/g IAP Settings

1. **802.11g Data Rates:** The Array allows you to define which data rates are supported for all 802.11g radios. Select (or deselect) 11g data rates by clicking in the corresponding **Supported** and **Basic** data rate check boxes.

   - **Basic Rate**—a wireless station (client) must support this rate in order to associate.
   - **Supported Rate**—data rates that can be used to transmit to clients.

2. **802.11b Data Rates**: This task is similar to Step 1, but these data rates apply only to 802.11b IAPs.

3. **Data Rate Presets**: The Wireless Array can optimize your 802.11b/g data rates automatically, based on range or throughput. Click **Optimize Range** button to optimize data rates based on range, or click on the **Optimize Throughput** to optimize data rates based on throughput. **Restore Defaults** will take you back to the factory default rate settings.

4. **802.11b/g IAP Control**: Click **Enable All 802.11b/g IAPs** to enable all 802.11b/g IAPs for this Array, or click **Disable All 802.11b/g IAPs** to disable them.

5. **Channel Configuration**: Click **Auto Configure** to instruct the Array to determine the best channel allocation settings for each 802.11b/g IAP and select the channel automatically, based on changes in the environment. This is the recommended method for channel allocation (see "RF Spectrum Management" on page 318).

   Click **Factory Defaults** if you wish to instruct the Array to return all IAPs to their factory preset channels. As of release 6.3, Arrays no longer all use the same factory preset values for channel assignments. Instead, if the Array has been deployed for a while and already has data from the spectrum analyzer and Xirrus Roaming Protocol about channel usage on neighboring arrays, it performs a quick auto channel using that information (without doing a full RF scan) to make an intelligent choice of channel assignments. If the Array has been rebooted and has no saved configuration or is just being deployed for the first time, it has no prior data about its RF environment. In this case, it will pick a set of compatible channel assignments at random.

On the XR500 and XR-1000 Series Arrays, the ***Factory Defaults*** *button will not restore iap1 to monitor mode. You will need to restore this setting manually. Also, you may need to set* ***Timeshare Mode*** *again - see "RF Monitor" on page 314.*

The following options may be selected for auto configuration:

- **Negotiate**: negotiate air-time with other Arrays before performing a full scan.
- **Full Scan**: perform a full traffic scan on all channels on all IAPs to determine the best channel allocation.
- **Non-Radar**: give preference to channels without radar-detect. See table in "Procedure for Configuring Global 802.11an IAP Settings" on page 293.
- **Include WDS**: automatically assign 5GHz to WDS client links.

To use the Auto Cell Size feature, the following additional settings are required:

RF Monitor Mode must be turned ***On****. See* ***"RF Monitor" on page 314***

One of the radios must be in ***monitor*** *mode with the default* ***RxdBm*** *setting of* ***-95****, and all other IAPs that will use Auto Cell must have* ***Cell Size*** *set to* ***auto****. See* ***"Procedure for Manually Configuring IAPs" on page 275****.*

6. **Set Cell Size/ Autoconfigure**: Cell Size may be set globally for all 802.11b/g IAPs to **auto**, **large, medium, small**, or **max** using the drop down menu.

   For an overview of RF power and cell size settings, please see "RF Power & Sensitivity" on page 316, "Capacity and Cell Sizes" on page 30, and "Fine Tuning Cell Sizes" on page 31.

7. **Auto Cell Period (seconds)**: You may set up auto-configuration to run periodically, readjusting optimal cell sizes for the current conditions. Enter a number of seconds to specify how often auto-configuration will run. If you select **None**, then auto-configuration of cell sizing will not be run periodically. You do not need to run Auto Cell often unless there are a lot of changes in the environment. If the RF environment is changing often, running Auto Cell every twenty-four hours (86400 seconds) should be sufficient). The default value is **None**.

8. **Auto Cell Size Overlap (%)**: Enter the percentage of cell overlap that will be allowed when the Array is determining automatic cell sizes. For 100% overlap, the power is adjusted such that neighboring Arrays that hear each other best will hear each other at -70dB. For 0% overlap, that number is -90dB. The default value is **50%**.

9. **Auto Cell Min Cell Size**: Use this setting if you wish to set the minimum cell size that Auto Cell may assign. The values are **Default**, **Large, Medium,** or **Small**.

10. **Auto Cell Min Tx Power (dBm)**: Enter the minimum transmit power that the Array can assign to a radio when adjusting automatic cell sizes. The default value is **10**.

11. **Auto Cell Configuration**: Click **Auto Configure** to instruct the Array to determine and set the best cell size for each enabled 802.11b/g IAP whose **Cell Size** is **auto** on the IAP Settings window, based on changes in the environment. This is the recommended method for setting cell size. You may look at the Tx and Rx values on the IAP Settings window to view the cell size settings that were applied.

12. **802.11g Only**: Choose **On** to restrict use to 802.11g mode only. In this mode, no 802.11b rates are transmitted. Stations that only support 802.11b will not be able to associate.

13. **802.11g Protection**: You should select **Auto CTS** or **Auto RTS** to provide automatic protection for all 802.11g radios in mixed networks (802.11 b and g). You may select **Off** to disable this feature, but this is not recommended. Protection allows 802.11g stations to share an IAP with

older, slower 802.11b stations. Protection avoids collisions by preventing 802.11b and 802.11g stations from transmitting simultaneously. When **Auto CTS** or **Auto RTS** is enabled and any 802.11b station is associated to the IAP, additional frames are sent to gain access to the wireless network.

- Auto CTS requires 802.11g stations to send a slow Clear To Send frame that locks out other stations. Automatic protection reduces 802.11g throughput when 802.11b stations are present—Auto CTS adds less overhead than Auto RTS. The default value is Auto CTS.
- With Auto RTS, 802.11g stations reserve the wireless media using a Request To Send/Clear To Send cycle. This mode is useful when you have dispersed nodes. It was originally used in 802.11b only networks to avoid collisions from "hidden nodes"—nodes that are so widely dispersed that they can hear the Array, but not each other.

When there are no 11b stations associated and an auto-protection mode is enabled, the Array will not send the extra frames, thus avoiding unnecessary overhead.

14. **802.11g Slot**: Choose **Auto** to instruct the Array to manage the 802.11g slot times automatically, or choose **Short Only**. Xirrus recommends using **Auto** for this setting, especially if 802.11b devices are present.

15. **802.11b Preamble**: The preamble contains information that the Array and client devices need when sending and receiving packets. All compliant 802.11b systems have to support the long preamble. A short preamble improves the efficiency of a network's throughput when transmitting special data, such as voice, VoIP (Voice-over IP) and streaming video. Select **Auto** to instruct the Array to manage the preamble (long and short) automatically, or choose **Long Only**.

16. **Fragmentation Threshold**: This is the maximum size for directed data packets transmitted over the 802.11b/g IAP. Larger frames fragment into several packets, their maximum size defined by the value you enter here. Enter the desired **Fragmentation Threshold** value, between 256 and 2346.

17. **RTS Threshold**: The RTS (Request To Send) Threshold specifies the packet size. Packets larger than the RTS threshold will use CTS/RTS prior to transmitting the packet—useful for larger packets to help ensure the success of their transmission. Enter a value between 1 and 2347.

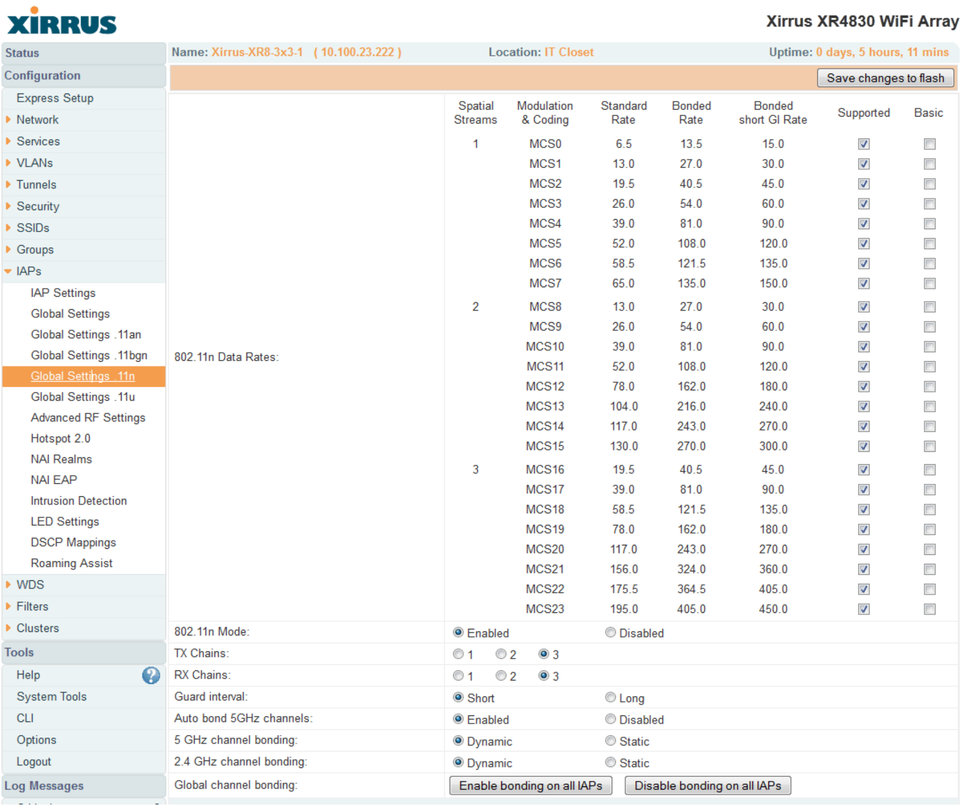
See Also

Coverage and Capacity Planning
Global Settings (IAP)
Global Settings .11an
Global Settings .11n
Advanced RF Settings
LED Settings
IAP Settings
IAP Statistics Summary

Global Settings .11n

This window allows you to establish global 802.11n IAP settings. These settings include enabling or disabling 802.11n mode for the entire Array, specifying the number of transmit and receive chains (data stream) used for spatial multiplexing, setting a short or standard guard interval, auto-configuring channel bonding, and specifying whether auto-configured channel bonding will be static or dynamic.

Before changing your settings for 802.11n, please read the discussion in “IEEE 802.11n Deployment Considerations” on page 35.



Name: Xirrus-XR8-3x3-1 (10.100.23.222)   Location: IT Closet   Uptime: 0 days, 5 hours, 11 mins

802.11n Data Rates:

Spatial Streams	Modulation & Coding	Standard Rate	Bonded Rate	Bonded short GI Rate	Supported	Basic
1	MCS0	6.5	13.5	15.0	☑	□
	MCS1	13.0	27.0	30.0	☑	□
	MCS2	19.5	40.5	45.0	☑	□
	MCS3	26.0	54.0	60.0	☑	□
	MCS4	39.0	81.0	90.0	☑	□
	MCS5	52.0	108.0	120.0	☑	□
	MCS6	58.5	121.5	135.0	☑	□
	MCS7	65.0	135.0	150.0	☑	□
2	MCS8	13.0	27.0	30.0	☑	□
	MCS9	26.0	54.0	60.0	☑	□
	MCS10	39.0	81.0	90.0	☑	□
	MCS11	52.0	108.0	120.0	☑	□
	MCS12	78.0	162.0	180.0	☑	□
	MCS13	104.0	216.0	240.0	☑	□
	MCS14	117.0	243.0	270.0	☑	□
	MCS15	130.0	270.0	300.0	☑	□
3	MCS16	19.5	40.5	45.0	☑	□
	MCS17	39.0	81.0	90.0	☑	□
	MCS18	58.5	121.5	135.0	☑	□
	MCS19	78.0	162.0	180.0	☑	□
	MCS20	117.0	243.0	270.0	☑	□
	MCS21	156.0	324.0	360.0	☑	□
	MCS22	175.5	364.5	405.0	☑	□
	MCS23	195.0	405.0	450.0	☑	□

802.11n Mode:	● Enabled	○ Disabled
TX Chains:	○ 1 ○ 2 ● 3	
RX Chains:	○ 1 ○ 2 ● 3	
Guard interval:	● Short	○ Long
Auto bond 5GHz channels:	● Enabled	○ Disabled
5 GHz channel bonding:	● Dynamic	○ Static
2.4 GHz channel bonding:	● Dynamic	○ Static
Global channel bonding:	Enable bonding on all IAPs	Disable bonding on all IAPs

Figure 151. Global Settings .11n

Procedure for Configuring Global 802.11n IAP Settings

*802.11n operation is allowed only if the Array's license includes this feature. Please see **"About Licensing and Upgrades" on page 361**.*

1. **802.11n Data Rates**: The Array allows you to define which data rates are supported for all 802.11n radios. Select (or deselect) 11n data rates by clicking in the corresponding **Supported** and **Basic** data rate check boxes.

   - **Basic Rate**—a wireless station (client) must support this rate in order to associate.
   - **Supported Rate**—data rates that can be used to transmit to clients.

2. **802.11n Mode**: Select **Enabled** to allow the Array to operate in 802.11n mode. Use of this mode is controlled by the Array's license key. The key must include 802.11n capability, or you will not be able to enable this mode. See "License" on page 107 to view the features supported by your license key. Contact Xirrus Customer support for questions about your license.

   If you select **Disabled**, then 802.11n operation is disabled on the Array. For XN Arrays, IAPs abgn1 though abgn4 will operate in 802.11abg mode; the 802.11a/n IAPs will operate in 802.11a mode.

3. **TX Chains**: Select the number of separate data streams transmitted by the antennas of each IAP. The default is 3. See "Multiple Data Streams—Spatial Multiplexing" on page 38.

4. **RX Chains**: Select the number of separate data streams received by the antennas of each IAP. This number should be greater than or equal to **TX Chains**. The default is 3. See "Multiple Data Streams—Spatial Multiplexing" on page 38.

5. **Guard interval**: Select **Short** to increase the data transmission rate by decreasing wait intervals in signal transmission. Select **Long** to use the standard interval. The default is Short. See "Short Guard Interval" on page 40.

6. **Auto bond 5 GHz channels**: Select **Enabled** to use Channel Bonding on 5 GHz channels and automatically select the best channels for bonding. The default is **Enabled**. See “Channel Bonding” on page 39.

7. **5 GHz channel bonding**: Select **Dynamic** to have auto-configuration for bonded 5 GHz channels be automatically updated as conditions change. For example, if there are too many clients to be supported by a bonded channel, dynamic mode will automatically break the bonded channel into two channels. Select **Static** to have the bonded channels remain the same once they are selected. The Dynamic option is only available when **Auto bond 5 GHz channels** is enabled. The default is **Dynamic**. See “Channel Bonding” on page 39.

8. **2.4 GHz channel bonding**: Select **Dynamic** to have auto-configuration for bonded 2.4 GHz channels be automatically updated as conditions change. Select **Static** to have the bonded channels remain the same once they are selected. The default is **Dynamic**. See “Channel Bonding” on page 39.

9. **Global channel bonding**: These buttons allow you to turn channel bonding on or off for all IAPs in one step. The effect of using one of these buttons will be shown if you go to the **IAP Settings** window and look at the **Bond** column. Clicking **Enable bonding on all IAPs** causes all IAPs to be bonded to their auto-bonding channel immediately, if appropriate. For example, an IAP will not be bonded if it is set to monitor mode, and 2.4 GHz radios will not be bonded. Click **Disable bonding on all IAPs** to turn off bonding on all IAPs immediately. See “Channel Bonding” on page 39. Settings in Step 7 and Step 8 are independent of global channel bonding.

Global Settings .11u

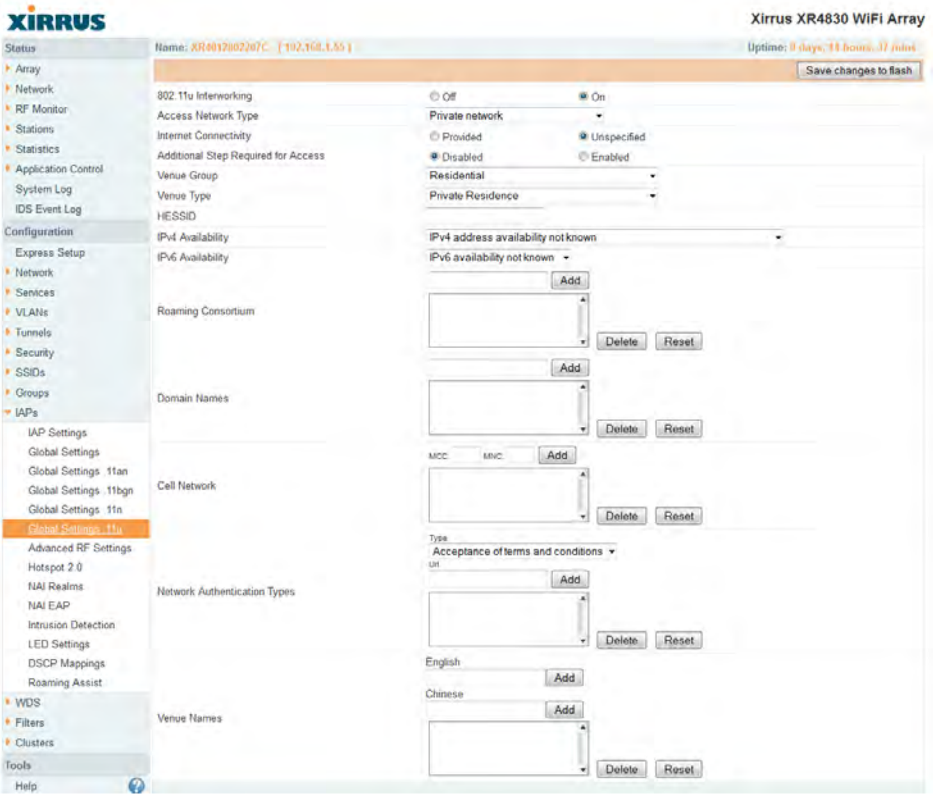
Understanding 802.11u

As the number of access points available in public venues increases, mobile devices users have a harder time distinguishing usable SSIDs from the tens, if not hundreds of access points visible. Using the 802.11u protocol, access points may broadcast information about the services and access that they offer and to respond to queries for additional information related to the facilities that the downstream service network provides.

The type of information broadcast or available from 802.11u-compliant access points includes:

- **Access Network Type**. Indicates the type of network available. For example: public or private, free or charged, etc.
- **Internet Connectivity**. Indicates whether the network provides Internet connectivity.
- **Authentication**. Indicates whether additional authentication steps will be required to use the network as well as the network authentication types that are in use.
- **Venue Information**. The type and name of the location where the access point is found.
- **Identification**. A globally unique identification for the access point.
- **IPv4/IPv6 Addressing.** Indicate the type of IP addressing (IPv4 and/or IPv6) and NATing that is performed by the network.
- **Roaming Consortium.** The service network may be connected to one or more roaming providers, called consortia, that allow access points from multiple service providers to be used transparently through a single paid service. The access point may advertise multiple consortia to mobile devices.
- **Domain Names.** A list of domain names to which the mobile user may end up belonging based on authentication credentials used.

- **Cellular Networks.** The service network may have arrangements with one or more cellular service providers who can transparently provide wireless and Internet connectivity.



Xirrus XR4830 WiFi Array

Name: XR4012802207C [192.168.1.55]

Uptime: 0 days, 11 hours, 37 mins

802.11u Interworking ○ Off ● On

Access Network Type: Private network

Internet Connectivity ○ Provided ● Unspecified

Additional Step Required for Access ● Disabled ○ Enabled

Venue Group: Residential

Venue Type: Private Residence

HESSID

IPv4 Availability: IPv4 address availability not known

IPv6 Availability: IPv6 availability not known

Roaming Consortium

Domain Names

Cell Network: MCC MNC

Network Authentication Types: Type: Acceptance of terms and conditions; Url

Venue Names: English; Chinese

Figure 152. 802.11u Global Settings

Procedure for Configuring 802.11u Settings

Use this window to establish the 802.11u configuration.

1. **802.11u Internetworking.** Click **On** to enable 802.11u protocol operation.
2. **Access Network Type**: This indicates the type of network supported by the access point. The choices are:

a. **Chargeable public network**

b. **Emergency services only network**

c. **Free public network**

d. **Personal device network**

e. **Private network with guest access**

f. **Test or experimental network**

g. **Wildcard**

3. **Internet Connectivity.** Click **Provided** if Internet connectivity is available through the access point from the back end provider to which the mobile user ends up belonging. Click **Unspecified** otherwise—for example, depending on the SLAs (service level agreements) of the mobile user, Internet access may or may not be provided.

4. **Additional Step Required for Access.** Click **Disabled** if no additional authentication steps will be required to complete the connection and **Enabled** otherwise. The available authentication techniques are described in the **Network Authentication Types** field (Step 13).

5. **Venue Group.** Select the general type of venue that the access point is located in. Various choices are available, including **Business, Residential,** and **Outdoor.** For each **Venue Group**, a further set of sub-choices are available in the **Venue Type** field below. The particular name of the venue is specified in the **Venue Names** field (Step 14).

6. **Venue Type**. For each of the **Venue Group** choices, a further set of sub-choices are available. For example, if you set **Venue Group** to **Assembly**, the choices include **Amphitheater, Area, Library,** and **Theatre.**

7. **HESSID**. Enter the globally unique homogeneous ESS ID. This SSID is marked as being HotSpot 2.0 capable. This SSID attribute is global—if 802.11u is enabled and HotSpot 2.0 is enabled, then all SSIDs will have HotSpot 2.0 capability.

8. **IPv4 Availability.** Select the type of IPv4 addressing that will be assigned by the network upon connection. NATed addresses are IP addresses that have been changed by mapping the IP address and port number to IP addresses and new port numbers routable by other networks. **Double NATed** addresses go through two levels of NATing. **Port restricted IPv4 addresses** refer to specific UDP and TCP port numbers associated with standard Internet services; for example, port 80 for web pages. The choices for this field are:

    a. **Double NATed private IPv4 address available**

    b. **IPv4 address not available**

    c. **IPv4 address availability not known**

    d. **Port-restricted IPv4 address available**

    e. **Port-restricted IPv4 address and double NATed IPv4 address available**

    f. **Port-restricted IPv4 address and single NATed IPv4 address available**

    g. **Public IPv4 address available**

    h. **Single NATed private IPv4 address available**

9. **IPv6 Availability.** Select the type of IPv6 addressing that is available from the network upon connection.

    a. **IPv6 address not available**

    b. **IPv6 address availability not known**

    c. **IPv6 address available**

10. **Roaming Consortium.** Each of the roaming consortia has an organizational identifier (OI) obtained from IEEE that unique identifies the organization. This is similar to the OUI part of a MAC address. Use this control to build up a list of OIs for the consortia available. Enter the OI as a hexadecimal string of between 6 and 30 characters in the **Add** field

and click **Add**. The OI will appear in the list. An OI may be deleted by selecting it in the list and clicking **Delete**. All OIs may be deleted by clicking **Reset**.

11. **Domain Names.** Use this control to build up a list of domain names. Enter the name in the **Add** field and click **Add**, and it will appear in the list. A name may be deleted by selecting it in the list and clicking **Delete**. All names may be deleted by clicking **Reset**.

12. **Cell Network.** Each of the cell networks is identified by a mobile country code (MCC) and mobile network code (MNC). Use this control to build up a list of cell networks. Enter the MCC as a three digit number and the MNC as a two or three digit number and click **Add**. The cell network will appear in the list. A cell network may be deleted by selecting it in the list and clicking **Delete**. All networks may be deleted by clicking **Reset**.

13. **Network Authentication Types**. Each network authentication that is in use on the network should be specified in this list. The choices are:

    a. **Acceptance of terms and conditions.** This choice displays a web page asking for the user's acceptance of terms and conditions of use. The URL should be specified in the URL field before clicking **Add.**

    b. **DNS redirection.**

    c. **HTTP/HTTPS redirection.** This choice causes the user's first web page reference to be redirected to a different URL for login or other information. The URL should be specified in the URL field before clicking **Add.**

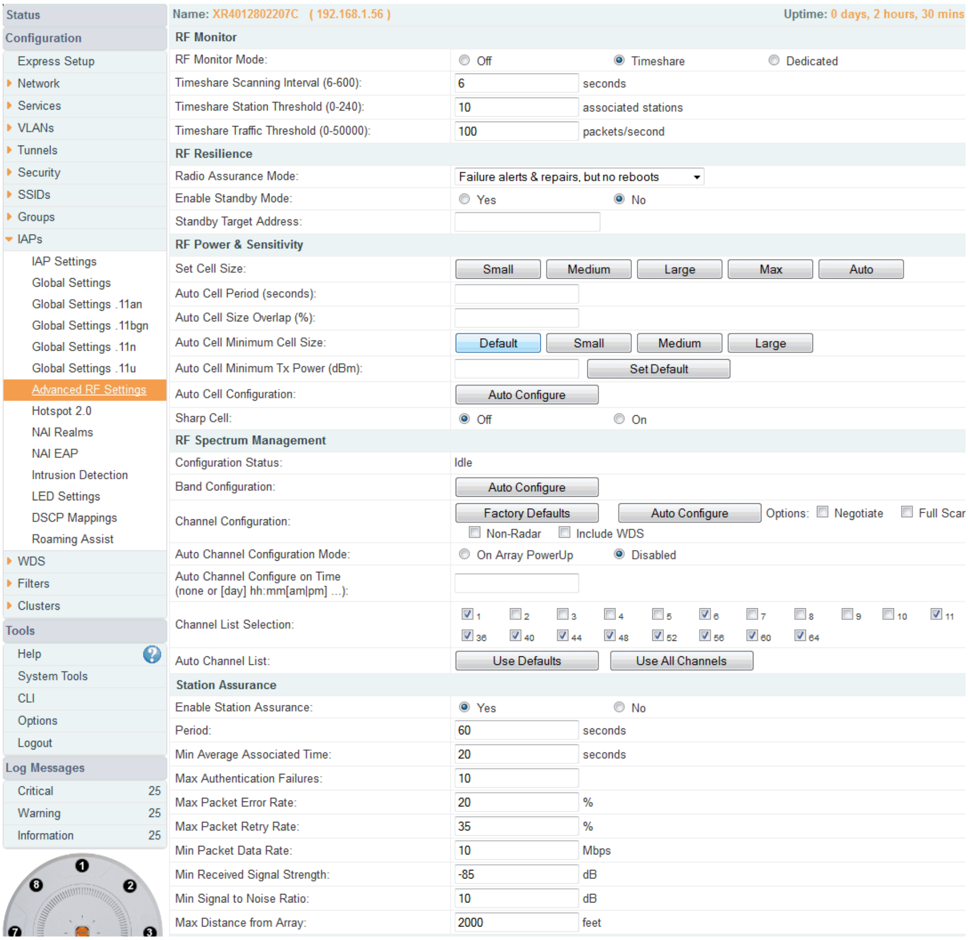
    d. **On-line enrollment supported.** This choice indicates that the user may sign up for network access as part of the authentication process.

    When **Add** is clicked the authentication type and optional URL will appear in the list. An authentication type may be deleted by selecting it in the list and clicking **Delete**. All authentication types may be deleted by clicking **Reset**.

14. **Venue Names.** The list of names associated with the venue are specified here. A venue name may be added to the list in English or Chinese. Enter the name in the appropriate field and click **Add.** The name will appear in the list. A name may be deleted by selecting it in the list and clicking **Delete**. All names may be deleted by clicking **Reset**.

Advanced RF Settings

This window allows you to establish RF settings, including automatically configuring channel allocation and cell size, and configuring radio assurance and standby modes. Changes you make on this page are applied to all IAPs, without exception.



Name: XR4012802207C (192.168.1.56) Uptime: 0 days, 2 hours, 30 mins

RF Monitor	
RF Monitor Mode:	○ Off ● Timeshare ○ Dedicated
Timeshare Scanning Interval (6-600):	6 seconds
Timeshare Station Threshold (0-240):	10 associated stations
Timeshare Traffic Threshold (0-50000):	100 packets/second
RF Resilience	
Radio Assurance Mode:	Failure alerts & repairs, but no reboots
Enable Standby Mode:	○ Yes ● No
Standby Target Address:	
RF Power & Sensitivity	
Set Cell Size:	Small Medium Large Max Auto
Auto Cell Period (seconds):	
Auto Cell Size Overlap (%):	
Auto Cell Minimum Cell Size:	Default Small Medium Large
Auto Cell Minimum Tx Power (dBm):	Set Default
Auto Cell Configuration:	Auto Configure
Sharp Cell:	● Off ○ On
RF Spectrum Management	
Configuration Status:	Idle
Band Configuration:	Auto Configure
Channel Configuration:	Factory Defaults Auto Configure Options: □ Negotiate □ Full Scar □ Non-Radar □ Include WDS
Auto Channel Configuration Mode:	○ On Array PowerUp ● Disabled
Auto Channel Configure on Time (none or [day] hh:mm[am|pm] ...):	
Channel List Selection:	☑ 1 □ 2 □ 3 □ 4 □ 5 ☑ 6 □ 7 □ 8 □ 9 □ 10 ☑ 11 ☑ 36 ☑ 40 ☑ 44 ☑ 48 ☑ 52 ☑ 56 ☑ 60 ☑ 64
Auto Channel List:	Use Defaults Use All Channels
Station Assurance	
Enable Station Assurance:	● Yes ○ No
Period:	60 seconds
Min Average Associated Time:	20 seconds
Max Authentication Failures:	10
Max Packet Error Rate:	20 %
Max Packet Retry Rate:	35 %
Min Packet Data Rate:	10 Mbps
Min Received Signal Strength:	-85 dB
Min Signal to Noise Ratio:	10 dB
Max Distance from Array:	2000 feet

Figure 153. Advanced RF Settings

About Standby Mode

Standby Mode supports the Array-to-Array fail-over capability. When you enable Standby Mode, the Array functions as a backup unit, and it enables its radios if it detects that its designated target Array has failed. The use of redundant Arrays to provide this fail-over capability allows Arrays to be used in mission-critical applications. In Standby Mode, an Array monitors beacons from the target Array. When the target has not been heard from for 40 seconds, the standby Array enables its radios until it detects that the target Array has come back online. Standby Mode is off by default. Note that you must ensure that the configuration of the standby Array is correct. This window allows you to enable or disable Standby Mode and specify the primary Array that is the target of the backup unit. See also, "Failover Planning" on page 42.

Procedure for Configuring Advanced RF Settings

Some of the features below, such as Auto Configure for Cell Size and Channel Configuration, are only available if the Array's license includes the ***Xirrus Advanced RF Performance Manager (RPM)****. If a setting is unavailable (grayed out), then your license does not support the feature. Please see* ***"About Licensing and Upgrades" on page 361****.*

Other features below, such as RF Intrusion Detection, are only available if the Array's license includes the ***Xirrus Advanced RF Security Manager (RSM)****.*

RF Monitor

1. **RF Monitor Mode:** RF monitoring permits the operation of features like intrusion detection. The monitor may operate in **Dedicated** mode, or in **Timeshare** mode which allows the radio to divide its time between monitoring and acting as a standard radio that allows stations to associate to it. **Timeshare** mode is especially useful for small Arrays with two IAPs, such as the XR500 and XR-1000 Series, allowing one IAP to be shared between monitoring the airwaves for problems and providing services to stations. Settings allow you to give priority to monitoring or wireless services, depending on your needs.

If **Timeshare** mode is selected, you may adjust the following settings:

- **Timeshare Scanning Interval (6-600)**: number of seconds between monitor (off-channel) scans.
- **Timeshare Station Threshold (0-240)**: when the number of stations associated to the monitor radio exceeds this threshold, scanning is halted.
- **Timeshare Traffic Threshold (0-50000)**: when the number of packets per second handled by the monitor radio exceeds this threshold, scanning is halted.

RF Resilience

2. **Radio Assurance Mode**: When this mode is enabled, the monitor radio performs loopback tests on the Array. This mode requires RF Monitor Mode to be enabled (Step 1) to enable self-monitoring functions. It also requires a radio to be set to monitoring mode (see "Enabling Monitoring on the Array" on page 460).

   Operation of Radio Assurance mode is described in detail in "Array Monitor and Radio Assurance Capabilities" on page 460.

   The Radio Assurance mode scans and sends out probe requests on each channel, in turn. It listens for all probe responses and beacons. These tests are performed continuously (24/7). If no beacons or probe responses are observed from a radio for a predetermined period, Radio Assurance mode will take action according to the preference that you have specified:

   - **Failure alerts only**—The Array will issue alerts in the Syslog, but will not initiate repairs or reboots.
   - **Failure alerts & repairs, but no reboots**—The Array will issue alerts and perform resets of one or all of the radios if needed.
   - **Failure alerts & repairs & reboots if needed**—The Array will issue alerts, perform resets, and schedule reboots if needed.
   - **Disabled**—Disable IAP radio assurance tests (no self-monitoring occurs). Loopback tests are disabled by default.

3. **Enable Standby Mode**: Choose **Yes** to enable this Array to function as a backup unit for the target Array, or choose **No** to disable this feature. See "About Standby Mode" on page 314.

4. **Standby Target Address**: If you enabled the Standby Mode, enter the MAC address of the target Array (i.e., the address of the primary Array that is being monitored and backed up by this Array). To find this MAC address, open the Array Info window on the target Array, and use the Gigabit1 MAC Address.

RF Power & Sensitivity

For an overview of RF power and cell size settings, please see "Capacity and Cell Sizes" on page 30 and "Fine Tuning Cell Sizes" on page 31.

To use the Auto Cell Size feature, the following additional settings are required:

RF Monitor Mode must be turned ***On****. See* ***"RF Monitor" on page 314.***

One of the radios must be in ***monitor*** *mode, and all other IAPs that will use Auto Cell must have* ***Cell Size*** *set to* ***auto****. See* ***"Procedure for Manually Configuring IAPs" on page 275****.*

5. **Set Cell Size**: Cell Size may be set globally for all enabled IAPs to **Auto**, **Large, Medium, Small**, or **Max** using the buttons.

6. **Auto Cell Period (seconds)**: You may set up auto-configuration to run periodically, readjusting optimal cell sizes for the current conditions. Enter a number of seconds to specify how often auto-configuration will run. If you select **None**, then auto-configuration of cell sizing will not be run periodically. You do not need to run Auto Cell often unless there are a lot of changes in the environment. If the RF environment is changing often, running Auto Cell every twenty-four hours (86400 seconds) should be sufficient). The default value is **None**.

7. **Auto Cell Size Overlap (%)**: Enter the percentage of cell overlap that will be allowed when the Array is determining automatic cell sizes. For 100% overlap, the power is adjusted such that neighboring Arrays that hear each other best will hear each other at -70dB. For 0% overlap, that number is -90dB. The default value is **50%**.

8. **Auto Cell Min Cell Size**: Use this setting if you wish to set the minimum cell size that Auto Cell may assign. The values are **Default**, **Large, Medium,** or **Small**.

9. **Auto Cell Min Tx Power (dBm)**: Enter the minimum transmit power that the Array can assign to a radio when adjusting automatic cell sizes. The default value is **10**.

10. **Auto Cell Configuration**: Click this button to instruct the Array to determine and set the best cell size for each enabled IAP whose **Cell Size** is **auto** on the IAP Settings window, based on changes in the environment. This is the recommended method for setting cell size. You may look at the Tx and Rx values on the IAP Settings window to view the cell size settings that were applied.

11. **Sharp Cell:** This feature reduces interference between neighboring Arrays or other Access Points by limiting to a defined boundary (cell size) the trailing edge bleed of RF energy. Choose **On** to enable the Sharp Cell functionality, or choose **Off** to disable this feature. See also, "Fine Tuning Cell Sizes" on page 31.

    The Sharp Cell feature only works when the cell size is Small, Medium, or Large (or Auto)—but not Max. If an IAP cell size is set to Max, the Sharp Cell feature will be disabled for that radio.

RF Spectrum Management

12. **Configuration Status**: Shows the status of auto channel configuration. If an operation is in progress, the approximate time remaining until completion is displayed; otherwise **Idle** is displayed.

13. **Band Configuration**: Automatic band configuration is the recommended method for assigning bands to the abgn IAPs. It runs only on command, assigning IAPs to the 2.4GHz or 5GHz band when you click the **Auto Configure** button. The Array uses its radios to listen for other APs on the same channel, and it assigns bands based on where it finds the least interference.

    Auto band assigns as many IAPs to the 5 GHz band as possible when there are other Arrays within earshot. It does this by determining how many Arrays are in range and then picking the number of radios to place in the 2.4 GHz band. Note that for another Array to be considered to be in range, the other Array must be visible via both the wireless and wired networks—the Array must be listed in the Network Map table, its entry must have **In Range** set to **Yes**, and it must have at least one active IAP with an SSID that has broadcast enabled.

    Auto band runs separately from auto channel configuration. If the band is changed for an IAP, associated stations will be disconnected and will then reconnect.

14. **Channel Configuration**: Automatic channel configuration is the recommended method for channel allocation. When the Array performs auto channel configuration, you may optionally instruct it to first negotiate with any other nearby Arrays that have been detected, to determine whether to stagger the start time for the procedure slightly. Thus, nearby Arrays will not run auto channel at the same time. This prevents Arrays from interfering with each other’s channel assignments.

    The **Configuration Status** field displays whether an Auto Configure cycle is currently running on this Array or not.

    Click **Auto Configure** to instruct the Array to determine the best channel allocation settings for each enabled IAP and select the channel automatically, based on changes in the environment. This is the recommended method for channel allocation (see "RF Spectrum Management" on page 318). The following options may be selected for auto configuration:

- **Negotiate**: negotiate air-time with other Arrays before performing a full scan. Negotiating is slower, but if multiple Arrays are configuring channels at the same time the Negotiate option ensures that multiple Arrays don't select the same channels. Turning off the Negotiate option allows the **Auto Configure** button to manually perform auto channel without waiting, and may be used when you know that no other nearby Arrays are configuring their channels.
- **Full Scan**: perform a full traffic scan on all channels on all IAPs to determine the best channel allocation.
- **Non-Radar**: give preference to channels without radar-detect. See table in "Procedure for Configuring Global 802.11an IAP Settings" on page 293.
- **Include WDS**: automatically assign 5GHz to WDS client links.

Click **Factory Defaults** if you wish to instruct the Array to return all IAPs to their factory preset channels. As of release 6.3, Arrays no longer all use the same factory preset values for channel assignments. Instead, if the Array has been deployed for a while and already has data from the spectrum analyzer and Xirrus Roaming Protocol about channel usage on neighboring arrays, it performs a quick auto channel using that information (without doing a full RF scan) to make an intelligent choice of channel assignments. If the Array has been rebooted and has no saved configuration or is just being deployed for the first time, it has no prior data about its RF environment. In this case, it will pick a set of compatible channel assignments at random.

*On the XR-1000 Series Arrays, the **Factory Defaults** button will not restore iap1 to monitor mode. You will need to restore this setting manually. Also, you may need to set **RF Monitor Mode** to **Timeshare Mode** again - see "RF Monitor" on page 314.*

15. **Auto Channel Configuration Mode**: This option allows you to instruct the Array to auto-configure channel selection for each enabled IAP when the Array is powered up. Choose **On Array PowerUp** to enable this feature, or choose **Disabled** to disable this feature.

16. **Auto Channel Configure on Time**: This option allows you to instruct the Array to auto-configure channel selection for each enabled IAP at a time you specify here. Leave this field blank unless you want to specify a time at which the auto-configuration utility is initiated. Time is specified in hours and minutes, using the format: **[day]hh:mm [am|pm]**. If you omit the optional **day** specification, channel configuration will run daily at the specified time. If you do not specify am or pm, time is interpreted in 24-hour military time. For example, Sat 11:00 pm and Saturday 23:00 are both acceptable and specify the same time.

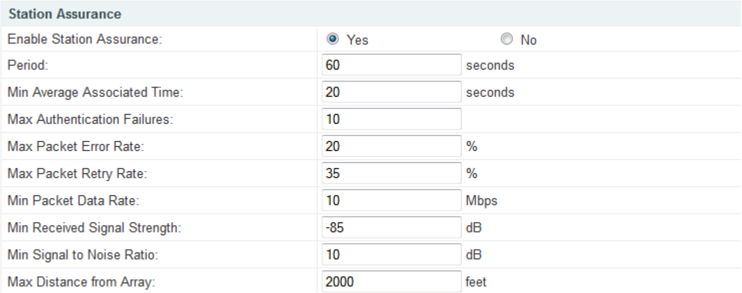
17. **Channel List Selection**: This list selects which channels are available to the auto channel algorithm. Channels that are not checked are left out of the auto channel selection process. Note that channels that have been locked by the user are also not available to the auto channel algorithm.

18. **Auto Channel List**: **Use All Channels** selects all available channels (this does not include locked channels). **Use Defaults** sets the auto channel list back to the defaults. This omits newer channels (100-140)—many wireless NICs don't support these channels.

Station Assurance

Station assurance monitors the quality of the connections that users are experiencing on the wireless network. You can quickly detect stations that are having problems and take steps to correct them. Use these settings to establish threshold values for errors and other problems. Station assurance is enabled by default, with a set of useful default thresholds that you may adjust as desired.

When a connection is experiencing problems and reaches one of these thresholds in the specified period of time, the Array responds with several actions: an event is triggered, a trap is generated, and a Syslog message is logged. For example, if a client falls below the threshold for **Min Average Associated Time**, this "bouncing" behavior might indicate roaming problems with the network's RF design, causing the client to bounce between multiple arrays and not stay connected longer than the time to re-associate and then jump again. This can be corrected with RF adjustments. Station assurance alerts you to the fact that this station is encountering problems.



Station Assurance		
Enable Station Assurance:	● Yes	○ No
Period:	60	seconds
Min Average Associated Time:	20	seconds
Max Authentication Failures:	10	
Max Packet Error Rate:	20	%
Max Packet Retry Rate:	35	%
Min Packet Data Rate:	10	Mbps
Min Received Signal Strength:	-85	dB
Min Signal to Noise Ratio:	10	dB
Max Distance from Array:	2000	feet

Figure 154. Station Assurance (Advanced RF Settings)

19. **Enable Station Assurance**: This is enabled by default. Click No if you wish to disable it, and click Yes to re-enable it. When station assurance is enabled, the Array will monitor connection quality indicators listed below and will display associated information on the Station Assurance Status page. When a threshold is reached, an event is triggered, a trap is generated, and a Syslog message is logged.

20. **Period**: In seconds, the period of time for a threshold to be reached. For example, the Array will check whether Max Authentication Failures has been reached in this number of seconds.

21. **Min Average Associated Time**: (seconds) Station assurance detects whether the average length of station associations falls below this threshold during a period.

22. **Max Authentication Failures**: Station assurance detects whether the number of failed login attempts reaches this threshold during a period.

23. **Max Packet Error Rate**: (%) Station assurance detects whether the packet error rate percentage reaches this threshold during a period.

24. **Max Packet Retry Rate**: (%) Station assurance detects whether the packet retry rate percentage reaches this threshold during a period.

25. **Min Packet Data Rate**: (Mbps) Station assurance detects whether the packet data rate falls below this threshold during a period.

26. **Min Received Signal Strength**: (dB) Station assurance detects whether the strength of the signal received from the station falls below this threshold during a period.

27. **Min Signal to Noise Ratio**: (dB) Station assurance detects whether the ratio of signal to noise received from the station falls below this threshold during a period.

28. **Max Distance from Array**: **Min Received Signal Strength**: (feet) Station assurance detects whether the distance of the station from the Array reaches this threshold during a period.

See Also

Coverage and Capacity Planning
Global Settings .11an
Global Settings .11bgn
Global Settings .11n
IAPs
IAP Settings
Radio Assurance

Hotspot 2.0

Understanding Hotspot 2.0

Hotspot 2.0 is a part of the Wi-Fi Alliance's Passpoint certification program. It specifies additional information above and beyond that found in 802.11u, which allows mobile clients to automatically discover, select, and connect to networks based on preferences and network optimization. Mobile clients that support Hotspot 2.0 are informed of an access point's support via its beacon message.

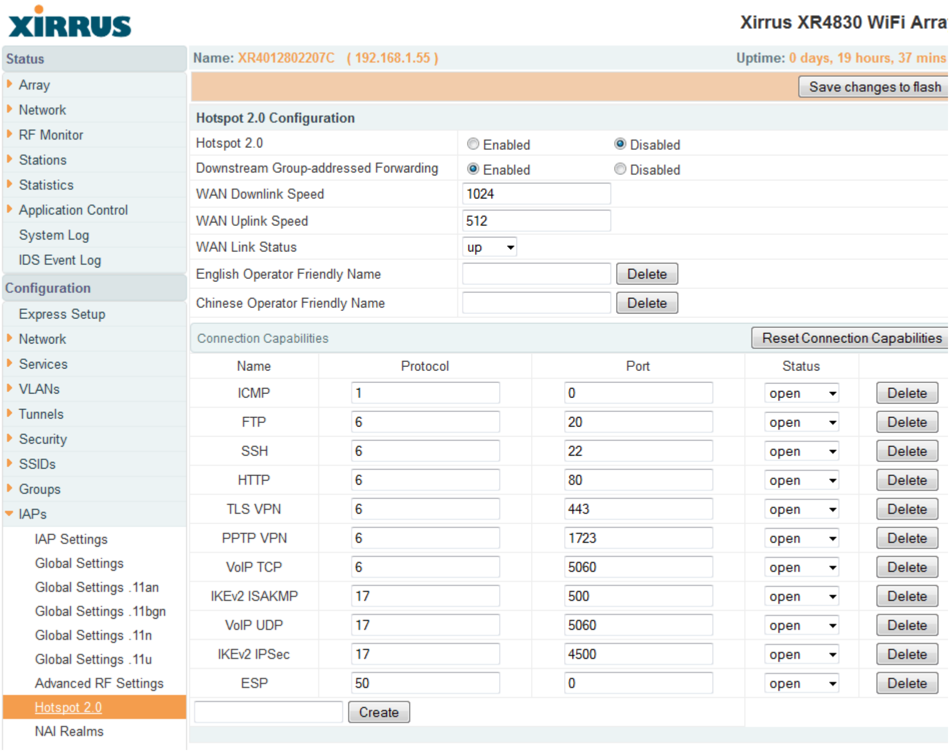
Hotspot 2.0 messages forward several types of information to clients, including:

- **Uplink and Downlink Speeds**
- **Link Status**
- **Friendly Name**
- **Connection Capabilities** The access point will restrict the protocols that can be used by a specification of protocol and port numbers.

Procedure for Hotspot 2.0 Settings

Use this window to establish the Hotspot 2.0 configuration.

1. **Hotspot 2.0.** Click **Enabled to** enable Hotspot 2.0 operation**.**
2. **Downstream Group-addressed Forwarding.** Click **Enabled** to allow the access point to forward group-addressed traffic (broadcast and multicast) to all connected devices. Click **Disabled** to cause the access point to convert group-addressed traffic to unicast messages.
3. **WAN Downlink Speed.** Enter the WAN downlink speed in kbps into the field.
4. **WAN Uplink Speed.** Enter the WAN uplink speed in kbps into the field.



Name: XR4012802207C (192.168.1.55) Uptime: 0 days, 19 hours, 37 mins

Hotspot 2.0 Configuration

Hotspot 2.0	○ Enabled	● Disabled
Downstream Group-addressed Forwarding	● Enabled	○ Disabled
WAN Downlink Speed	1024	
WAN Uplink Speed	512	
WAN Link Status	up	
English Operator Friendly Name		Delete
Chinese Operator Friendly Name		Delete

Connection Capabilities

Name	Protocol	Port	Status	
ICMP	1	0	open	Delete
FTP	6	20	open	Delete
SSH	6	22	open	Delete
HTTP	6	80	open	Delete
TLS VPN	6	443	open	Delete
PPTP VPN	6	1723	open	Delete
VoIP TCP	6	5060	open	Delete
IKEv2 ISAKMP	17	500	open	Delete
VoIP UDP	17	5060	open	Delete
IKEv2 IPSec	17	4500	open	Delete
ESP	50	0	open	Delete

Figure 155. Hotspot 2.0 Settings

5. **English/Chinese Operator Friendly Name.** Enter an English or Chinese name into one of the fields. An incorrectly entered name can be deleted by clicking the corresponding **Delete.**

6. **Connection Capabilities.** A Hotspot 2.0 access point limits the particular protocols that clients may use. The set of default protocols is shown initially. This table specifies the protocols in terms of:

   a. A common **Name**, such as FTP or HTTP.

   b. A **Protocol** number. For example 1 for ICMP, 6 for TCP, 17 for UDP, and 50 for Encapsulated Security Protocol in IPsec VPN connections.

   c. **Port** number for UDP/TCP connection.

d. **Status**: one of **open, closed** or **unknown.**

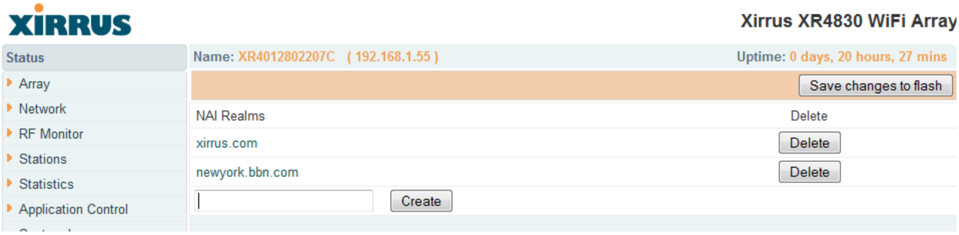
Any of the entries may be deleted by clicking the corresponding **Delete** button. New entries may be created by entering the name of the protocol in the box beside the **Create** button, and then clicking **Create.** The new protocol will be added to the list with zeros in the protocol fields and **unknown** for the status. Enter the appropriate **Protocol** and **Port** values before setting the **Status** field to **open.**

NAI Realms

Understanding NAI Realm Authentication

A network access identifier (NAI) is a specification of a particular user. A NAI takes the general form of e-mail addresses. Examples of NAIs are:

```
joe@example.com
fred@foo-9.example.com
jack@3rd.depts.example.com
fred.smith@example.com
```



Xirrus XR4830 WiFi Array

Name: XR4012802207C (192.168.1.55)   Uptime: 0 days, 20 hours, 27 mins

NAI Realms	Delete
xirrus.com	Delete
newyork.bbn.com	Delete

Figure 156. NAI Realms

The **NAI Realm** is the part of the NAI following the @ sign. In the examples above, the realms are: **example.com**, **3rd.depts.example.com**, and **foo-9.example.com**. Use the **NAI Realms** page, in conjunction with the **NAI EAP** page, to specify the authentication techniques to be used to access that realm with appropriate parameters.

Procedure for NAI Realms Settings

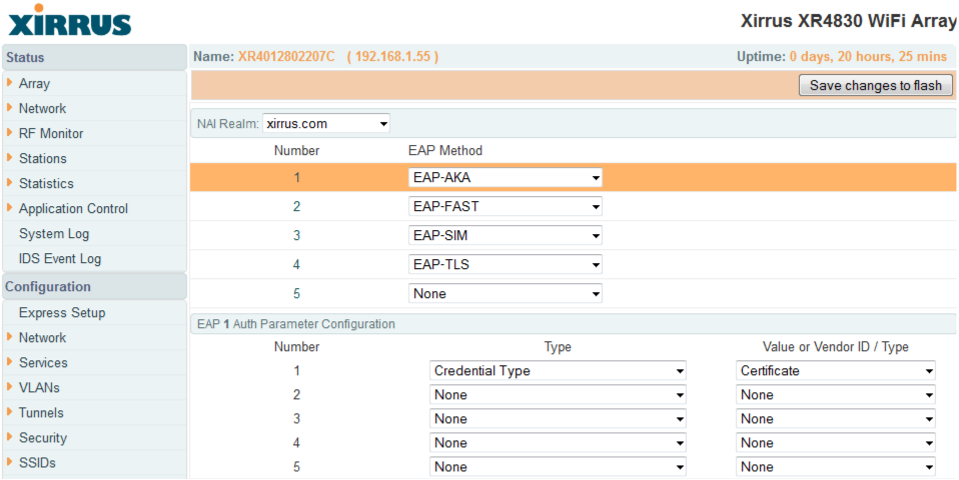
Use this window to establish the names of the supported realms.

1. **Enter the realm name.** Enter the name of a realm in the box to the left of the **Create** button and click **Create**. The realm will be added to the **NAI Realms** list. Any of the realms may be deleted by clicking the corresponding **Delete** button**.**

2. **Enter Authentication Information.** The NAI EAP page is used to specify authentication for a realm. Click on the name of a realm to go to the NAI EAP page for that realm. See “NAI EAP” on page 326.

NAI EAP

This window allows specification of the authentication techniques for a realm.



Name: XR4012802207C (192.168.1.55) Uptime: 0 days, 20 hours, 25 mins

NAI Realm: xirrus.com

Number	EAP Method
1	EAP-AKA
2	EAP-FAST
3	EAP-SIM
4	EAP-TLS
5	None

EAP 1 Auth Parameter Configuration

Number	Type	Value or Vendor ID / Type
1	Credential Type	Certificate
2	None	None
3	None	None
4	None	None
5	None	None

Figure 157. NAI EAP

Procedure for NAI Realms Settings

1. Select the realm to be configured in the **NAI Realm** drop down.

2. Select **EAP Methods**. Each realm may support up to five EAP authentication methods. Beside each of the five numbers (1, 2, 3, 4, 5) select the method from the drop down. The choices are:

   - **EAP-AKA**
   - **EAP-AKA’ (EAP-AKA prime)**

- **EAP-FAST**
- **EAP-MSCHAP-V2**
- **EAP-SIM**
- **EAP-TLS**
- **EAP-TTLS**
- **GTC**
- **MD5-Challenge**
- **None**
- **PEAP**

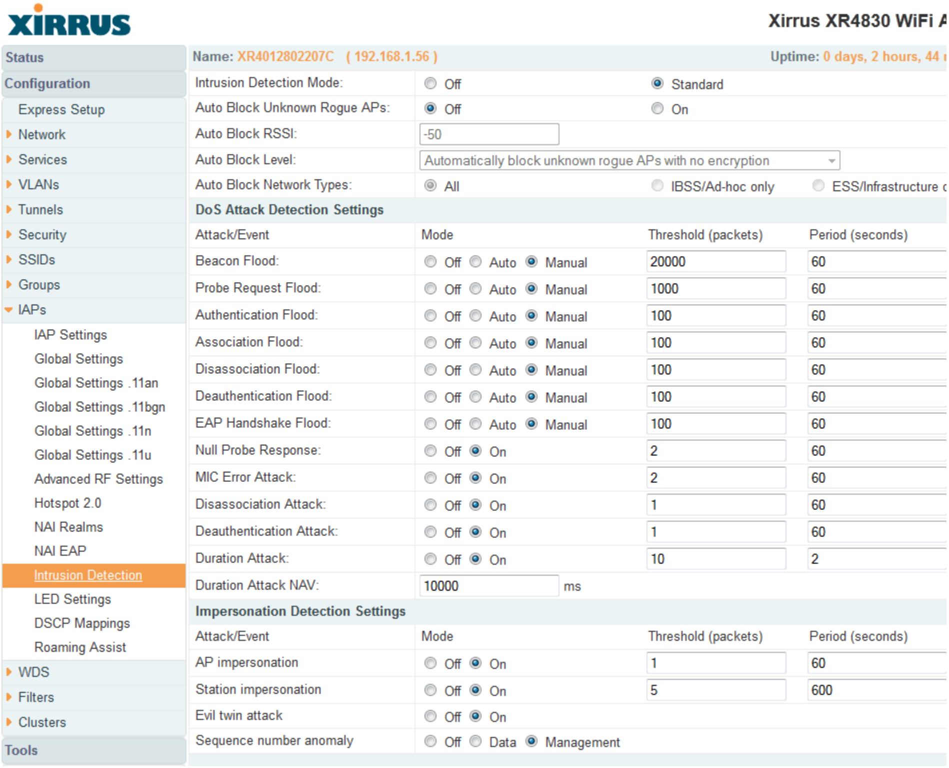
3. **Specify Authentication Parameters.** Each of the authentication methods may specify up to five authentication parameters. To specify the parameters click on the number corresponding to the authentication method; i.e. **1, 2, 3, 4,** or **5.** This displays the **EAP n Auth Parameter Configuration** below the list of **EAP Methods**. For up to five of the parameters, select the **Type** and **Value or Vendor ID / Type.** The choices for the **Type** are:

    - **Credential Type**
    - **Expanded EAP Method**
    - **Expanded Inner EAP Method**
    - **Inner Authentication EAP Method Type**
    - **Non-EAP Inner Authentication Type**
    - **None**
    - **Tunneled EAP Method Credential Type**

    For each type, a value or a vendor ID and type must be specified, as applicable.

Intrusion Detection

The Xirrus Array employs a number of IDS/IPS (Intrusion Detection System/ Intrusion Prevention System) strategies to detect and prevent malicious attacks on the wireless network. Use this window to adjust intrusion detection settings.



Name: XR4012802207C (192.168.1.56) Uptime: 0 days, 2 hours, 44

Intrusion Detection Mode: ○ Off ● Standard

Auto Block Unknown Rogue APs: ● Off ○ On

Auto Block RSSI: -50

Auto Block Level: Automatically block unknown rogue APs with no encryption

Auto Block Network Types: ● All ○ IBSS/Ad-hoc only ○ ESS/Infrastructure o

DoS Attack Detection Settings

Attack/Event	Mode	Threshold (packets)	Period (seconds)
Beacon Flood:	○ Off ○ Auto ● Manual	20000	60
Probe Request Flood:	○ Off ○ Auto ● Manual	1000	60
Authentication Flood:	○ Off ○ Auto ● Manual	100	60
Association Flood:	○ Off ○ Auto ● Manual	100	60
Disassociation Flood:	○ Off ○ Auto ● Manual	100	60
Deauthentication Flood:	○ Off ○ Auto ● Manual	100	60
EAP Handshake Flood:	○ Off ○ Auto ● Manual	100	60
Null Probe Response:	○ Off ● On	2	60
MIC Error Attack:	○ Off ● On	2	60
Disassociation Attack:	○ Off ● On	1	60
Deauthentication Attack:	○ Off ● On	1	60
Duration Attack:	○ Off ● On	10	2
Duration Attack NAV:	10000 ms		

Impersonation Detection Settings

Attack/Event	Mode	Threshold (packets)	Period (seconds)
AP impersonation	○ Off ● On	1	60
Station impersonation	○ Off ● On	5	600
Evil twin attack	○ Off ● On		
Sequence number anomaly	○ Off ○ Data ● Management		

Figure 158. Intrusion Detection Settings

The Array provides a suite of intrusion detection and prevention options to improve network security. You can separately enable detection of the following types of problems:

- **Rogue Access Point Detection and Blocking**

  Unknown APs are detected, and may be automatically blocked based on a number of criteria. See "About Blocking Rogue APs" on page 331.

- **Denial of Service (DoS) or Availability Attack Detection**

  A DoS attack attempts to flood an Array with communications requests so that it cannot respond to legitimate traffic, or responds so slowly that it becomes effectively unavailable. The Array can detect a number of types of DoS attacks, as described in the table below.

- **Impersonation Detection**

  These malicious attacks use various techniques to impersonate a legitimate AP or station, often in order to eavesdrop on wireless communications. The Array detects a number of types of impersonation attacks, as described in the table below.

Type of Attack	Description
DoS Attacks	
Beacon Flood	Generating thousands of counterfeit 802.11 beacons to make it hard for stations to find a legitimate AP.
Probe Request Flood	Generating thousands of counterfeit 802.11 probe requests to overburden the Array.
Authentication Flood	Sending forged Authenticates from random MAC addresses to fill the Array's association table.
Association Flood	Sending forged Associates from random MAC addresses to fill the Array's association table.
Disassociation Flood	Flooding the Array with forged Disassociation packets.
Deauthentication Flood	Flooding the Array with forged Deauthenticates.
EAP Handshake Flood	Flooding an AP with EAP-Start messages to consume resources or crash the target.
Null Probe Response	Answering a station probe-request frame with a null SSID. Many types of popular NIC cards cannot handle this situation, and will freeze up.

Type of Attack	Description
MIC Error Attack	Generating invalid TKIP data to exceed the Array's MIC error threshold, suspending WLAN service.
Disassociation Attack (Omerta)	Sending forged disassociation frames to all stations on a channel in response to data frames.
Deauthentication Attack	Sending forged deauthentication frames to all stations on a channel in response to data frames.
Duration Attack (Duration Field Spoofing)	Injecting packets into the WLAN with huge duration values. This forces the other nodes in the WLAN to keep quiet, since they cannot send any packet until this value counts down to zero. If the attacker sends such frames continuously it silences other nodes in the WLAN for long periods, thereby disrupting the entire wireless service.
Impersonation Attacks	
AP impersonation	Reconfiguring an attacker's MAC address to pose as an authorized AP. Administrators should take immediate steps to prevent the attacker from entering the WLAN.
Station impersonation	Reconfiguring an attacker's MAC address to pose as an authorized station. Administrators should take immediate steps to prevent the attacker from entering the WLAN.
Evil twin attack	Masquerading as an authorized AP by beaconing the WLAN's service set identifier (SSID) to lure users.
Sequence number anomaly	A sender may use an Add Block Address request (ADDBA - part of the Block ACK mechanism) to specify a sequence number range for packets that the receiver can accept. An attacker spoofs an ADDBA request, asking the receiver to reset its sequence number window to a new range. This causes the receiver to drop legitimate frames, since their sequence numbers will not fall in that range.

About Blocking Rogue APs

If you classify a rogue AP as **blocked** (see “Rogue Control List” on page 240), then the Array will take measures to prevent stations from staying associated to the rogue. When the monitor radio is scanning, any time it hears a beacon from a blocked rogue it sends out a broadcast “deauth” signal using the rogue's BSSID and source address. This has the effect of disconnecting all of a rogue AP’s clients approximately every 5 to 10 seconds, which is enough to make the rogue frustratingly unusable.

The Advanced RF Settings window allows you to set up **Auto Block** parameters so that unknown APs get the same treatment as explicitly blocked APs. This is basically a “shoot first and ask questions later” mode. By default, auto blocking is turned off. Auto blocking provides two parameters for qualifying blocking so that APs must meet certain criteria before being blocked. This keeps the Array from blocking every AP that it detects. You may:

- Set a minimum RSSI value for the AP—for example, if an AP has an RSSI value of -90, it is probably a harmless AP belonging to a neighbor and not in your building.
- Block based on encryption level.
- Block based on whether the AP is part of an ad hoc network or infrastructure network.

Procedure for Configuring Intrusion Detection

RF Intrusion Detection and Auto Block Mode

1. **Intrusion Detection Mode:** This option allows you to choose the **Standard** intrusion detection method, or you can choose **Off** to disable this feature. See “Array Monitor and Radio Assurance Capabilities” on page 460 for more information.

    - **Standard**—enables the monitor radio to collect Rogue AP information.
    - **Off**—intrusion detection is disabled.

2. **Auto Block Unknown Rogue APs:** Enable or disable auto blocking (see “About Blocking Rogue APs” on page 331). Note that in order to set **Auto Block RSSI** and **Auto Block Level**, you must set Auto Block Unknown Rogue APs to **On**. Then the remaining Auto Block fields will be active.

3. **Auto Block RSSI:** Set the minimum RSSI for rogue APs to be blocked. APs with lower RSSI values will not be blocked. They are assumed to be farther away, and probably belonging to neighbors and posing a minimal threat.

4. **Auto Block Level:** Select rogue APs to block based on the level of encryption that they are using. The choices are:

   - Automatically block unknown rogue APs regardless of encryption.
   - Automatically block unknown rogue APs with no encryption.
   - Automatically block unknown rogue APs with WEP or no encryption.

5. **Auto Block Network Types:** Select rogues to automatically block by applying the criteria above only to networks of the type specified below. The choices are:

   - **All**—the unknown rogues may be part of any wireless network.
   - **IBSS/AD Hoc only**—only consider auto blocking rogues if they belong to an ad hoc wireless network (a network of client devices without a controlling Access Point, also called an Independent Basic Service Set—IBSS).
   - **ESS/Infrastructure only**—only consider auto blocking rogue APs if they are in infrastructure mode rather than ad hoc mode.

DoS Attack Detection Settings

6. **Attack/Event**: The types of DoS attack that you may detect are described in the Type of Attack Table on page 329. Detection of each attack type may be separately enabled or disabled. For each attack, a default **Threshold** and **Period (seconds)** are specified. If the number of occurrences of the type of packet being detected exceeds the threshold in

the specified number of seconds, then the Array declares that an attack has been detected. You may modify the **Threshold** and **Period**.

For the Flood attack settings, you also have a choice of **Auto** or **Manual**.

- **Manual** mode—threshold and period settings are used to detect a flood. Packets received are simply counted for the specified time period and compared against the flood threshold. The default for all of the floods is **Manual** mode.
- **Auto** mode—the Array analyzes current traffic for packets of a given type versus traffic over the past hour to determine whether a packet flood should be detected. In this mode, threshold and period settings are ignored. This mode is useful for floods like beacon or probe floods, where the numbers of such packets detected in the air can vary greatly from installation to installation.

7. **Duration Attack NAV (ms)**: For the duration attack, you may also modify the default duration value that is used to determine whether a packet may be part of an attack. If the number of packets having at least this duration value exceeds the **Threshold** number in the specified **Period**, an attack is detected.

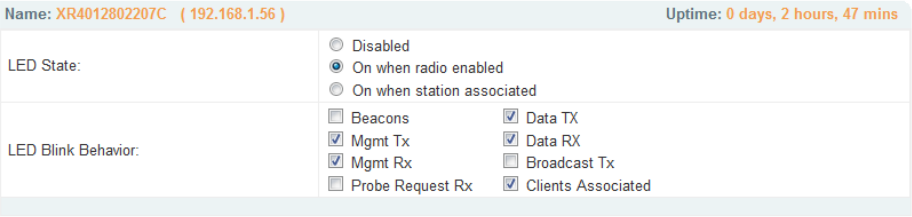
Impersonation Detection Settings

8. **Attack/Event**: The types of impersonation attack that you may detect are described in Impersonation Attacks on page 330. Detection of each attack type may be turned **On** or **Off** separately. For **AP** or **Station Impersonation** attacks, a default **Threshold** and **Period (seconds)** are specified. If the number of occurrences of the type of packet being detected exceeds the threshold in the specified number of seconds, then the Array declares that an attack has been detected. You may modify the **Threshold** and **Period**.

9. **Sequence number anomaly**: You may specify whether to detect this type of attack in **Data** traffic or in **Management** traffic, or turn **Off** this type of detection.

LED Settings

This window assigns behavior preferences for the Array’s IAP LEDs.



Name: XR4012802207C (192.168.1.56)   Uptime: 0 days, 2 hours, 47 mins

LED State:	○ Disabled ● On when radio enabled ○ On when station associated	
LED Blink Behavior:	□ Beacons ☑ Mgmt Tx ☑ Mgmt Rx □ Probe Request Rx	☑ Data TX ☑ Data RX □ Broadcast Tx ☑ Clients Associated

Figure 159. LED Settings

Procedure for Configuring the IAP LEDs

1. **LED State:** This option determines which event triggers the LEDs, either when an IAP is enabled or when an IAP first associates with the network. Choose **On Radio Enabled** or **On First Association**, as desired. You may also choose Disabled to keep the LEDs from being lit. The LEDs will still light during the boot sequence, then turn off.

2. **LED Blink Behavior**: This option allows you to select when the IAP LEDs blink, based on the activities you check here. From the choices available, select one or more activities to trigger when the LEDs blink. For default behavior, see “Array LED Operating Sequences” on page 64.

3. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

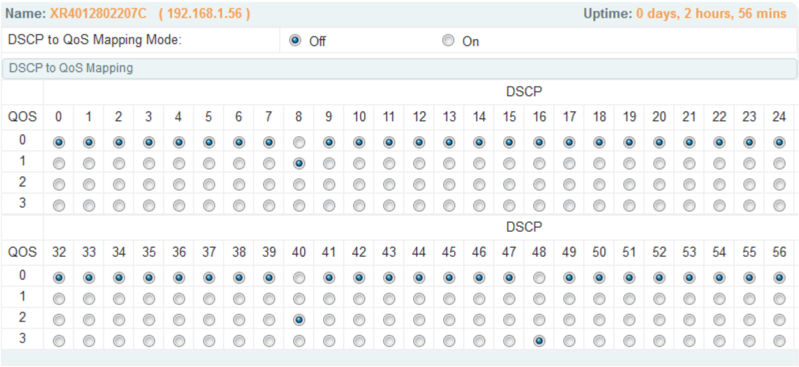
Global Settings (IAP)
Global Settings .11an
Global Settings .11bgn
IAPs
LED Boot Sequence

DSCP Mappings

DSCP is the 6-bit Differentiated Services Code Point (DiffServ) field in the IPv4 or IPv6 packet header, defined in RFC2474 and RFC2475. The DSCP value classifies the packet to determine the Quality of Service (QoS) required. DSCP replaces the outdated Type of Service (TOS) field.

The DSCP Mappings page shows the default mapping of each of the 64 DSCP values to one of the Array's four QoS levels, and allows you to change these mappings.

For a detailed discussion of the operation of QoS and DSCP mappings on the Array, please see "Understanding QoS Priority on the Wireless Array" on page 244.



Name: XR4012802207C (192.168.1.56) Uptime: 0 days, 2 hours, 56 mins

DSCP to QoS Mapping Mode: ● Off ○ On

DSCP to QoS Mapping

	DSCP																								
QOS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
0	●	●	●	●	●	●	●	●	○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
1	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

	DSCP																								
QOS	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
0	●	●	●	●	●	●	●	●	○	●	●	●	●	●	●	●	○	●	●	●	●	●	●	●	●
1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○

Figure 160. DSCP Mappings

Procedure for Configuring DSCP Mappings

1. **DSCP to QoS Mapping Mode:** Use the **On** and **Off** buttons to enable or disable the use of the DSCP mapping table to determine the QoS level applied to each packet.

2. **DSCP to QoS Mapping:** The radio buttons in this table show all DSCP values (0 to 63), and the QoS level to which each is mapped. To change the QoS level applied to a DSCP value, click the desired QoS level (0 to 3) underneath it.

Roaming Assist

Roaming assist is a Xirrus feature that helps clients roam to Arrays that will give them high quality connections. Some smart phones and tablets will stay connected to a radio with poor signal quality, even when there's a radio with better signal strength within range. When roaming assist is enabled, the Array "assists" the device by deauthenticating it when certain parameters are met. This encourages a client with a high roaming threshold (i.e., a device that may not roam until signal quality has seriously dropped) to move to an Array that gives it a better signal. The deauthentication is meant to cause the client to choose a different radio. You can specify the device types that will be assisted in roaming.

The roaming threshold is the difference in signal strength between radios that will trigger a deauthentication. If the client's signal is lower than the sum of the threshold and the stronger neighbor radio's RSSI, then we "assist" the client. For example:

Threshold = -5
RSSI of neighbor Array = -65
RSSI of client = -75
-75 < (-5 + -65) : Client will roam

Another example:

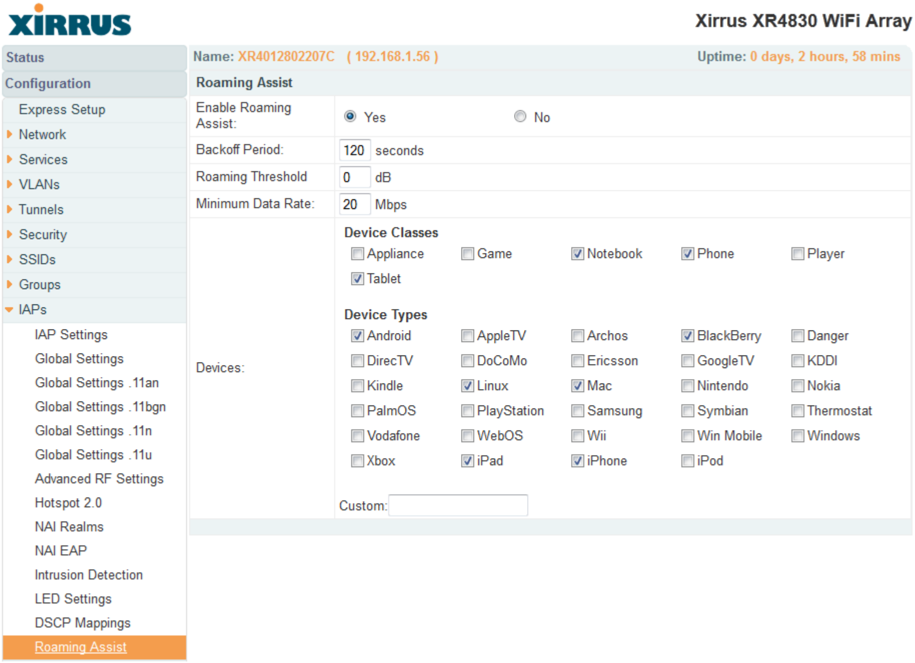
Threshold = -15
RSSI of neighbor array = -60
RSSI of station = -70
-70 > (-15 + -60) : Client will not roam

Procedure for Configuring Roaming Assist

1. **Enable Roaming Assist:** Use the **Yes** and **No** buttons to enable or disable this feature.

2. **Backoff Period**: After deauthenticating a station, it may re-associate to the same radio. To prevent the Array from repeatedly deauthenticating the station when it comes back, there is a backoff period. This is the number of seconds the station is allowed to stay connected before another deauthentication.

3. **Roaming Threshold**: This is the difference in signal strength between radios that will trigger a deauthentication, as described in the discussion above. In most cases, this will be a negative number.



Name: XR4012802207C (192.168.1.56) Uptime: 0 days, 2 hours, 58 mins

Roaming Assist

Enable Roaming Assist: ● Yes ○ No

Backoff Period: 120 seconds

Roaming Threshold: 0 dB

Minimum Data Rate: 20 Mbps

Devices:

Device Classes

☐ Appliance ☐ Game ☑ Notebook ☑ Phone ☐ Player
☑ Tablet

Device Types

☑ Android ☐ AppleTV ☐ Archos ☑ BlackBerry ☐ Danger
☐ DirecTV ☐ DoCoMo ☐ Ericsson ☐ GoogleTV ☐ KDDI
☐ Kindle ☑ Linux ☑ Mac ☐ Nintendo ☐ Nokia
☐ PalmOS ☐ PlayStation ☐ Samsung ☐ Symbian ☐ Thermostat
☐ Vodafone ☐ WebOS ☐ Wii ☐ Win Mobile ☐ Windows
☐ Xbox ☑ iPad ☑ iPhone ☐ iPod

Custom:

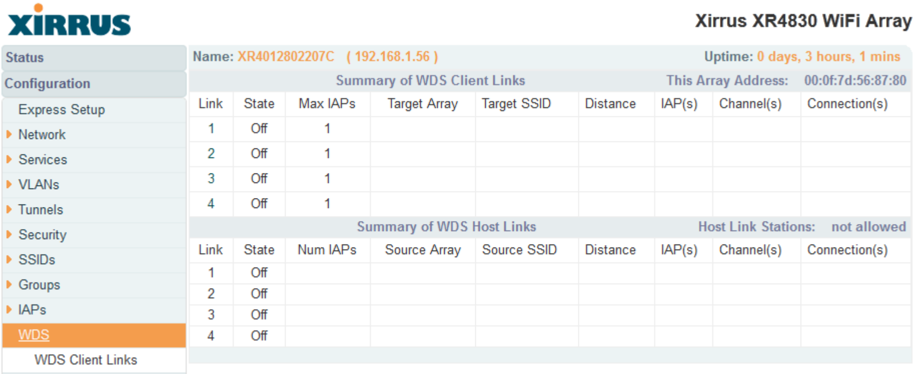
Figure 161. Roaming Assist

4. **Minimum Data Rate**: If the station's data rate (either Tx or Rx) falls below this rate, it will trigger a deauthentication.

5. **Device Classes and Device Types**: You can configure the device classes or types that will be assisted in roaming. Many small, embedded devices (such as the default device types: phones, tablets, music players) are sticky—they have high roaming thresholds that tend to keep them attached to the same radio despite the presence of radios with better signal strength. You may check off one or more entries, but use care since roaming assist may cause poor results in some cases.

WDS

This is a status-only window that provides an overview of all WDS links that have been defined. WDS (Wireless Distribution System) is a system that enables the interconnection of access points wirelessly, allowing your wireless network to be expanded using multiple access points without the need for a wired backbone to link them. The **Summary of WDS Client Links** shows the WDS links that you have defined on this Array and identifies the target Array for each by its base MAC address. The **Summary of WDS Host Links** shows the WDS links that have been established on this Array as a result of client Arrays associating to this Array (i.e., the client Arrays have this Array as their target). The summary identifies the source (client) Array for each link. Both summaries identify the IAPs that are part of the link and whether the connection for each is up or down. See “WDS Planning” on page 53 for an overview.



Name: XR4012802207C (192.168.1.56)

Uptime: 0 days, 3 hours, 1 mins

Summary of WDS Client Links

This Array Address: 00:0f:7d:56:87:80

Link	State	Max IAPs	Target Array	Target SSID	Distance	IAP(s)	Channel(s)	Connection(s)
1	Off	1						
2	Off	1						
3	Off	1						
4	Off	1						

Summary of WDS Host Links

Host Link Stations: not allowed

Link	State	Num IAPs	Source Array	Source SSID	Distance	IAP(s)	Channel(s)	Connection(s)
1	Off							
2	Off							
3	Off							
4	Off							

Figure 162. WDS

About Configuring WDS Links

A WDS link connects a client Array and a host Array (see Figure 163 on page 339). The host must be the Array that has a wired connection to the LAN. Client links from one or more Arrays may be connected to the host, and the host may also have client links. See “WDS Planning” on page 53 for more illustrations.

The configuration for WDS is performed on the client Array only, as described in “WDS Client Links” on page 340. No WDS configuration is performed on the host Array. First you will set up a client link, defining the target (host) Array and SSID, and the maximum number of IAPs in the link. Then you will select the IAPs to be used in the link. When the client link is created, each member IAP will associate to an IAP on the host Array.

You may wish to consider configuring the WDS link IAPs so that only the WDS link SSIDs are active on them. See "Active IAPs" on page 261.

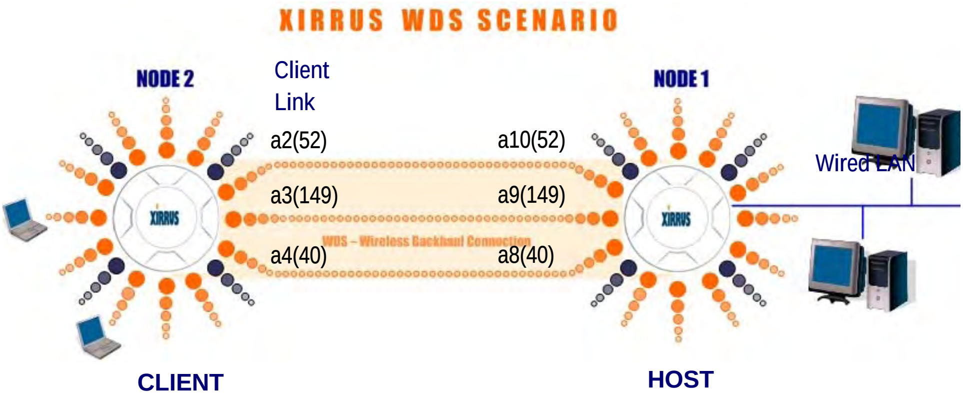


Figure 163. Configuring a WDS Link

Once an IAP has been selected to act as a WDS client link, you will not be allowed to use auto-configured cell sizing on that IAP (since the cell must extend all the way to the other Array).

*When configuring WDS, if you use WPA-PSK (Pre-Shared Key) as a security mechanism, ensure that EAP is disabled. Communication between two Arrays in WDS mode will not succeed if the client Array has both PSK and EAP enabled on the SSID used by WDS. See **SSID Management**.*

*TKIP encryption does not support high throughput rates, per IEEE 802.11n. TKIP should **never** be used for WDS links on XR and XN arrays.*

Long Distance Links

If you are using WDS to provide backhaul over an extended distance, use the **WDS Dist. (Miles)** setting to prevent timeout problems associated with long transmission times. (See "IAP Settings" on page 274) Set the approximate distance in miles between this IAP and the connected Array in the **WDS Dist. (Miles)** column. This will increase the wait time for frame transmission accordingly.

See Also

SSID Management

Active IAPs

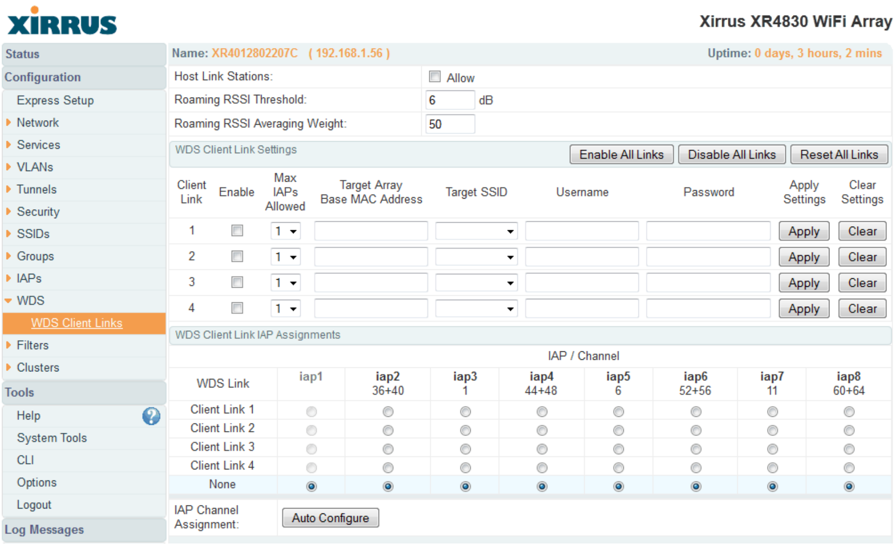
WDS Client Link IAP Assignments:

WDS Client Links

WDS Statistics

WDS Client Links

This window allows you to set up a maximum of four WDS client links.



Name: XR4012802207C (192.168.1.56) Uptime: 0 days, 3 hours, 2 mins

Host Link Stations:	☐ Allow
Roaming RSSI Threshold:	6 dB
Roaming RSSI Averaging Weight:	50

WDS Client Link Settings [Enable All Links] [Disable All Links] [Reset All Links]

Client Link	Enable	Max IAPs Allowed	Target Array Base MAC Address	Target SSID	Username	Password	Apply Settings	Clear Settings
1	☐	1					Apply	Clear
2	☐	1					Apply	Clear
3	☐	1					Apply	Clear
4	☐	1					Apply	Clear

WDS Client Link IAP Assignments

	IAP / Channel							
WDS Link	iap1	iap2 36+40	iap3 1	iap4 44+48	iap5 6	iap6 52+56	iap7 11	iap8 60+64
Client Link 1	○	○	○	○	○	○	○	○
Client Link 2	○	○	○	○	○	○	○	○
Client Link 3	○	○	○	○	○	○	○	○
Client Link 4	○	○	○	○	○	○	○	○
None	●	●	●	●	●	●	●	●

IAP Channel Assignment: [Auto Configure]

Figure 164. WDS Client Links

Procedure for Setting Up WDS Client Links

WDS Client Link Settings:

1. **Host Link Stations**: Check the **Allow** checkbox to instruct the Array to allow stations to associate to IAPs on a host Array that participates in a WDS link. The WDS host IAP will send beacons announcing its availability to wireless clients. This is disabled by default.

Once an IAP has been selected to act as a WDS client link, no other association will be allowed on that IAP. However, wireless associations will be allowed on the WDS host side of the WDS session.

2. **Spanning Tree Protocol** (STP): Check the **Enable** checkbox to instruct the Array to enforce the Spanning Tree Protocol on all WDS links. This is enabled by default. Use of STP is strongly recommended in most situations. However, in situations like the one in the next step, where WDS is used by an Array mounted on a high speed train, STP can add significant delay (often on the order of 30 to 60 seconds) while initially analyzing network topology. In such a situation, it may be desirable to disable STP.

Caution: If STP is disabled and a network connection is made on the WDS Client Array's Gigabit link that can reach the WDS Host Array, broadcast and multicast packets will not be blocked. A broadcast storm may cause a network outage.

3. **Roaming RSSI Threshold**: If an Array is deployed on a mobile site (on a train, for example), you can use WDS to implement a wireless backhaul that will roam between Arrays at fixed locations. When another candidate Array for WDS host target is found, the client link will roam to the new Array if its RSSI is stronger than the RSSI of the current host connection by at least the **Roaming RSSI Threshold.** The default is 6 dB.

4. **Roaming RSSI Averaging Weight**: This weight changes how much the latest RSSI reading influences the cumulative weighted RSSI value utilized in checking the threshold (above) to make a roaming decision.

The higher the weight, the lower the influence of a new RSSI reading. This is not exactly a percentage, but a factor in the formula for computing the current RSSI value based on new readings:

StoredRSSI = (StoredRSSI * RoamingAvgWeight
+ NewRSSIReading * (100 - RoamingAvgWeight)) / 100

This prevents erroneous or out-of-line RSSI readings from causing the WDS link to jump to a new array. Such readings can result from temporary obstructions, external interference, etc.

5. Click **Save changes to flash** after you are finished making changes on this page if you wish to make your changes permanent.

WDS Client Link IAP Setting:

6. **Enable/Disable/Reset All Links**: Click the appropriate button to:
   - **Enable All Links**—this command activates all WDS links configured on the Array.
   - **Disable All Links**—this command deactivates all WDS links configured on the Array. It leaves all your settings unchanged, ready to re-enable.
   - **Reset All Links**—this command tears down all links configured on the Array and sets them back to their factory defaults, effective immediately.
7. **Client Link**: Shows the ID (1 to 4) of each of the four possible WDS links.
8. **Enabled**: Check this box if you want to enable this WDS link, or uncheck the box to disable the link.
9. **Max IAPs Allowed (1-3)**: Enter the maximum number of IAPs for this link, between 1 and 3.
10. **Target Array Base MAC Address**: Enter the base MAC address of the target Array (the host Array at the other side of this link). To find this MAC address, open the **WDS** window on the ***target*** Array, and use **This Array Address** located on the right under the Summary of WDS Host

Links. To allow any Xirrus Array to be accepted as a WDS target, enter the Xirrus OUI: **00:0f:7d:00:00:00** (this is useful for roaming in a mobile deployment, as described in Step 3 on page 341.

11. **Target SSID**: Enter the SSID that the target Array is using.
12. **Username**: Enter a username for this WDS link. A username and password is required if the SSID is using PEAP for WDS authentication from the internal RADIUS server.
13. **Password**: Enter a password for this WDS link.
14. **Clear Settings**: Click on the **Clear** button to reset all of the fields on this line.

WDS Client Link IAP Assignments:

15. For each desired client link, select the IAPs that are part of that link. The IAP channel assignments are shown in the column headers.
16. **IAP Channel Assignment**: Click **Auto Configure** to instruct the Array to automatically determine the best channel allocation settings for each IAP that participates in a WDS link, based on changes in the environment. These changes are executed immediately, and are automatically applied.

See Also

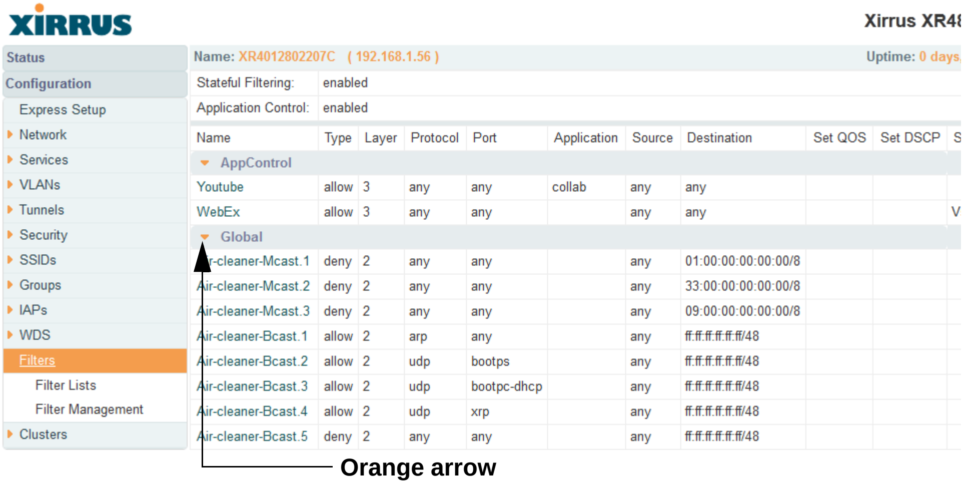
SSID Management
WDS Planning
WDS
WDS Statistics

Filters

This feature is only available if the Array's license includes the ***Xirrus Advanced RF Security Manager (RSM)****. If a setting is unavailable (grayed out), then your license does not support the feature. Please see* ***"About Licensing and Upgrades" on page 361****.*

The Wireless Array's integrated firewall uses stateful inspection to speed the decision of whether to allow or deny traffic. Filters are used to define the rules used for blocking or passing traffic. Filters can also set the VLAN and QoS level for selected traffic.

The air cleaner feature offers a number of predetermined filter rules that eliminate a great deal of unnecessary wireless traffic. See "Air Cleaner" on page 403.



Name: XR4012802207C (192.168.1.56) Uptime: 0 days,

Stateful Filtering:	enabled
Application Control:	enabled

Name	Type	Layer	Protocol	Port	Application	Source	Destination	Set QOS	Set DSCP	S
AppControl										
Youtube	allow	3	any	any	collab	any	any			
WebEx	allow	3	any	any		any	any			V
Global										
r-cleaner-Mcast.1	deny	2	any	any		any	01:00:00:00:00:00/8			
Air-cleaner-Mcast.2	deny	2	any	any		any	33:00:00:00:00:00/8			
Air-cleaner-Mcast.3	deny	2	any	any		any	09:00:00:00:00:00/8			
Air-cleaner-Bcast.1	allow	2	arp	any		any	ff:ff:ff:ff:ff:ff/48			
Air-cleaner-Bcast.2	allow	2	udp	bootps		any	ff:ff:ff:ff:ff:ff/48			
Air-cleaner-Bcast.3	allow	2	udp	bootpc-dhcp		any	ff:ff:ff:ff:ff:ff/48			
Air-cleaner-Bcast.4	allow	2	udp	xrp		any	ff:ff:ff:ff:ff:ff/48			
Air-cleaner-Bcast.5	deny	2	any	any		any	ff:ff:ff:ff:ff:ff/48			

Orange arrow expands/collapses display

Figure 165. Filters

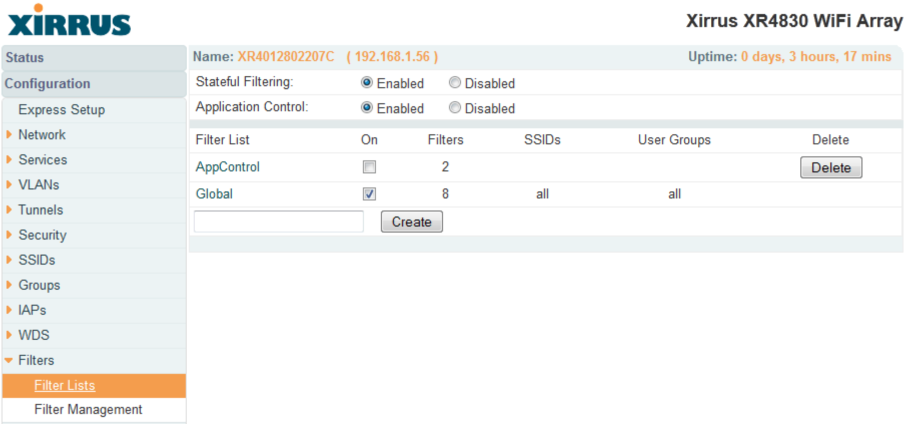
User connections managed by the firewall are maintained statefully—once a user flow is established through the Array, it is recognized and passed through without application of all defined filtering rules. Stateful inspection runs automatically on the Array. The rest of this section describes how to view and manage filters.

Filters are organized in groups, called Filter Lists. A filter list allows you to apply a uniform set of filters to SSIDs or Groups very easily.

The read-only Filters window provides you with an overview of all filter lists that have been defined for this Array, and the filters that have been created in each list. Filters are listed in the left side column by name under the filter list to which they belong. Each filter entry is a link that takes you to its Filter Management entry, and the list includes information about the type of filter, the protocol it is filtering, which port it applies to, source and destination addresses, and QoS and VLAN assignments.

Filter Lists

This window allows you to create filter lists. The Array comes with one predefined list, named **Global**, which cannot be deleted. Filter lists (including Global) may be applied to SSIDs or to Groups. Only one filter list at a time may be applied to a group or SSID (although the filter list may contain a number of filters). All filters are created within filter lists.



Name: XR4012802207C (192.168.1.56)

Uptime: 0 days, 3 hours, 17 mins

Stateful Filtering: ● Enabled ○ Disabled

Application Control: ● Enabled ○ Disabled

Filter List	On	Filters	SSIDs	User Groups	Delete
AppControl	☐	2			Delete
Global	☑	8	all	all	

Figure 166. Filter Lists

Procedure for Managing Filter Lists

1. **Stateful Filtering:** Stateful operation of the integrated firewall can be **Enabled** or **Disabled**. If you have a large number of filters and you don't want to apply them in a stateful manner, you may use this option to turn the firewall off.

2. **Application Control:** Operation of the Application Control feature may be **Enabled** or **Disabled**. See "Application Control Windows" on page 150.

> *The Application Control feature is only available if the Array license includes* ***Application Control****. If a setting is unavailable (grayed out), then your license does not support the feature. See* ***"About Licensing and Upgrades" on page 361****.*
>
> *Application Control data is only available from XR Series Array models. It is not available on XN Arrays.*

3. **New Filter List Name**: Enter a name for the new filter list in this field, then click on the Create button to create the list. All new filters are disabled when they are created. The new filter list is added to the Filter List table in the window. Click on the filter list name, and you will be taken to the Filter Management window for that filter list.

4. **On**: Check this box to enable this filter list, or leave it blank to disable the list. If the list is disabled, you may still add filters to it or modify it, but none of the filters will be applied to data traffic.

5. **Filters**: This read-only field displays the number of filters that belong to this filter list.

6. **SSIDs**: This read-only field lists the SSIDs that use this filter list.

7. **User Groups**: This read-only field lists the Groups that use this filter list.

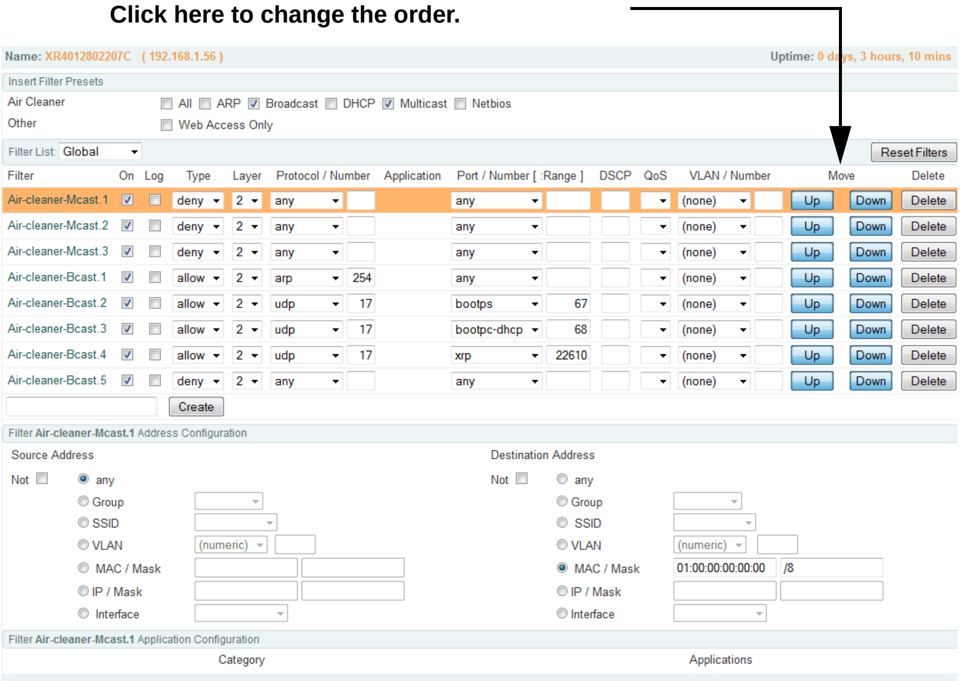
8. **Delete**: Click this button to delete this filter list. The **Global** filter list may not be deleted.

9. Click **Save changes to flash** if you wish to make your changes permanent.

10. Click a filter list to go to the Filter Management window to create and manage the filters that belong to this list.

Filter Management

This window allows you to create and manage filters that belong to a selected filter list, based on the filter criteria you specify. Filters are an especially powerful feature when combined with the intelligence provided by the "Application Control Windows" on page 150.



Filters are applied in order, from top to bottom.
Click here to change the order.

Name: XR4012802207C (192.168.1.56) Uptime: 0 days, 3 hours, 10 mins

Insert Filter Presets

Air Cleaner ☐ All ☐ ARP ☑ Broadcast ☐ DHCP ☑ Multicast ☐ Netbios

Other ☐ Web Access Only

Filter List: Global Reset Filters

Filter	On	Log	Type	Layer	Protocol / Number		Application	Port / Number [:Range]		DSCP	QoS	VLAN / Number		Move		Delete
Air-cleaner-Mcast.1	☑	☐	deny	2	any			any				(none)		Up	Down	Delete
Air-cleaner-Mcast.2	☑	☐	deny	2	any			any				(none)		Up	Down	Delete
Air-cleaner-Mcast.3	☑	☐	deny	2	any			any				(none)		Up	Down	Delete
Air-cleaner-Bcast.1	☑	☐	allow	2	arp	254		any				(none)		Up	Down	Delete
Air-cleaner-Bcast.2	☑	☐	allow	2	udp	17		bootps	67			(none)		Up	Down	Delete
Air-cleaner-Bcast.3	☑	☐	allow	2	udp	17		bootpc-dhcp	68			(none)		Up	Down	Delete
Air-cleaner-Bcast.4	☑	☐	allow	2	udp	17		xrp	22610			(none)		Up	Down	Delete
Air-cleaner-Bcast.5	☑	☐	deny	2	any			any				(none)		Up	Down	Delete

Create

Filter **Air-cleaner-Mcast.1** Address Configuration

Source Address			Destination Address		
Not ☐	● any		Not ☐	○ any	
	○ Group			○ Group	
	○ SSID			○ SSID	
	○ VLAN	(numeric)		○ VLAN	(numeric)
	○ MAC / Mask			● MAC / Mask	01:00:00:00:00:00 /8
	○ IP / Mask			○ IP / Mask	
	○ Interface			○ Interface	

Filter **Air-cleaner-Mcast.1** Application Configuration

Category Applications

Figure 167. Filter Management

Based on Application Control's analysis of your wireless traffic, you can create filters to enhance wireless usage for your business needs:

- Usage of non-productive and risky applications like BitTorrent can be restricted.
- Traffic for mission-critical applications like VoIP and WebEx may be given higher priority (QoS).
- Non- critical traffic from applications like YouTube may be given lower priority (QoS).
- Traffic flows for specific applications may be controlled by sending them into VLANs that are designated for that type of traffic.

Note that filtering is secondary to the stateful inspection performed by the integrated firewall. Traffic for established connections is passed through without the application of these filtering rules.

Procedure for Managing Filters

1. **Filter List:** Select the filter list to display and manage on this window. All of the filters already defined for this list are shown, and you may create additional filters for this list.

2. **Add Preset Filter**: A number of predefined "Air Cleaner" filters are available using these buttons. You can use these rules to eliminate a great deal of unnecessary wireless traffic, resulting in improved performance. For more information, please see "Air Cleaner" on page 403.

3. **New Filter Name**: To add a new filter, enter its name in the field next to the **Create** button at the bottom of the list, then click **Create**. All new filters are added to the table of filters in the window. The filter name must be unique within the list, but it may have the same name as a filter in a different filter list. Two filters with the same name in different filter lists will be completely unrelated to each other—they may be defined with different parameter values.

Viewing or modifying existing filter entries:

4. **Filter**: Select a filter entry if you wish to modify it. Source and destination details are displayed below the bottom of the list.

5. **On**: Use this field to enable or disable this filter.

6. **Log**: Log usage of this filter to Syslog.

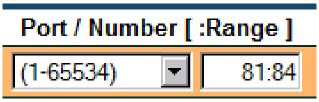
7. **Type**: Choose whether this filter will be an **Allow** filter or a **Deny** filter. If you define the filter as an Allow filter, then any associations that meet the filter criteria will be allowed. If you define the filter as a Deny filter, any associations that meet the filter criteria will be denied.

8. **Layer**: Select network layer **2** or **3** for operation of this filter.

9. **Protocol/Number**: Choose a specific filter protocol from the pull-down list, or choose **numeric** and enter a **Number**, or choose **any** to instruct the Array to use the best filter. This is a match criterion.

10. **Port/Number**: This is a match criterion. From the pull-down list, choose the target port type for this filter. Choose **any** to instruct the Array to apply the filter to any port, or choose **1-65534** and enter a **Number**.

    To enter a **Range** of port numbers, separate the start and end numbers with a colon as shown: **Start # : End #**.



Port / Number [:Range]

(1-65534) ▾ 81:84

11. **QoS**: (Optional) Set packets that match the filter criteria to this QoS level (0 to 3), selected from the pull-down list. Level 0 has the lowest priority; level 3 has the highest priority. By default, this field is blank and the filter does not modify QoS level. See "Understanding QoS Priority on the Wireless Array" on page 244.

12. **VLAN/Number**: (Optional) Set packets that match the filter criteria to this VLAN. Select a VLAN from the pull-down list, or select **numeric** and enter the number of a previously defined VLAN (see "VLANs" on page 199).

13. **Move Up/Down**: The filters are applied in the order in which they are displayed in the list, with filters on the top applied first. To change an entry's position in the list, just click its **Up** or **Down** button.

14. To delete a filter, click its **Delete** button.

Select an existing filter entry in the list to view or modify the following, shown below the list of filters:

15. **Source Address**: Define a source address to match as a filter criterion. Click the radio button for the desired type of address (or other attribute) to match. Then specify the value to match in the field to the right of the button. Choose **Any** to use any source address. Check **Not** to match any address except for the specified address.

16. **Destination Address**: Define a destination address to match as a filter criterion. Click the radio button for the desired type of address (or other attribute) to match. Then specify the value to match in the field to the right of the button. Choose **any** to use any source address. Check **Not** to match any address except for the specified address.

Below the Source and Destination Addresses, you may enter a **Category** or an **Application** to be matched by the filter:

17. **Category**: If you wish this filter to apply to a particular category of application, such as **File-Transfer** or **Database**, select it from the listed options.

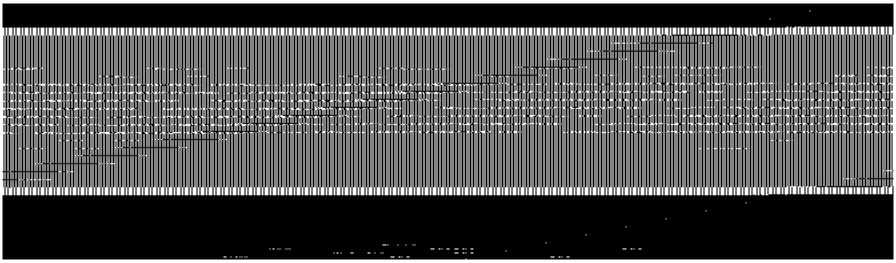


Figure 168. Filter Category or Application

18. **Applications**: If you wish this filter to apply to a specific application, such as **WebEx**, click the letter or number that it starts with. Then select the desired application. You may select a **Category** or an **Application**, but not both.

19. Click **Save changes to flash** if you wish to make your changes permanent.

See Also

Filters
Filter Statistics
Understanding QoS Priority on the Wireless Array
VLANs

Clusters

This feature is not avialable on XR500 Series Arrays.

Clusters allow you to configure multiple Arrays at the same time. Using WMI (or CLI), you may define a set of Arrays that are members of the cluster. Then you may enter Cluster mode for a selected cluster, which sends all successive configuration commands issued via CLI or WMI to all of the member Arrays. When you exit cluster mode, configuration commands revert to applying only to the Array to which you are connected.

The read-only Clusters window provides you with an overview of all clusters that have been defined for this Array, and the Arrays that have been added to each. Arrays are listed in the left hand column by name under the cluster to which they belong. Each Array entry displays its IP Address, Username, and Password.

Figure 169. Clusters

Clusters are discussed in the following topics:

- **Cluster Definition**
- **Cluster Management**
- **Cluster Operation**

Cluster Definition

This window allows you to create clusters. All existing clusters are shown, along with the number of Arrays currently in each. Up to 16 clusters may be created, with up to 50 Arrays in each.

Figure 170. Cluster Definition

Procedure for Managing Cluster Definition

1. **New Cluster Name:** Enter a name for the new cluster in the field to the left of the **Create** button, then click **Create** to add this entry. The new cluster is added to the list in the window. Click on the cluster name, and you will be taken to the Cluster Management window for that cluster.

2. **Delete**: To delete a cluster, click its **Delete** button.

3. Click **Save changes to flash** if you wish to make your changes permanent.

4. Click a cluster to go to the Cluster Management window to add or remove Arrays in the cluster.

Cluster Management

This window allows you to add Arrays to or delete them from a selected cluster. A cluster may include a maximum of 50 Arrays.

Note that the Array on which you are currently running WMI is not automatically a member of the cluster. If you would like it to be a member, you must add it explicitly.

Figure 171. Cluster Management

Procedure for Managing Clusters

1. **Edit Cluster:** Select the cluster to display and manage on this window. All of the Arrays already defined for this cluster are shown, and you may add additional Arrays to this list.

2. **Array**: Enter the hostname or IP address of the Array that you wish to add to this cluster.

3. **Username/Password**: In these columns, enter the administrator name and password for access to the Array.

4. Click the **Add Array** button to enter the Array.

5. To delete an Array, click its **Delete** button.

6. Click **Save changes to flash** if you wish to make your changes permanent.

Cluster Operation

This window puts WMI into Cluster Mode. In this mode, all configuration operations that you execute in WMI or CLI are performed on the members of the cluster. They are **not** performed on the Array where you are running WMI, unless it is a member of the cluster.

An XR-1000 Series Array cannot act as the Cluster controller. It will operate correctly as a member of a cluster.

You must use the **Save changes to flash** button at the top of configuration windows to permanently save your changes in Cluster Mode, just as you would in normal operation. When you are done configuring Arrays in the cluster, return to this window and click the **Exit** button to leave Cluster Mode.

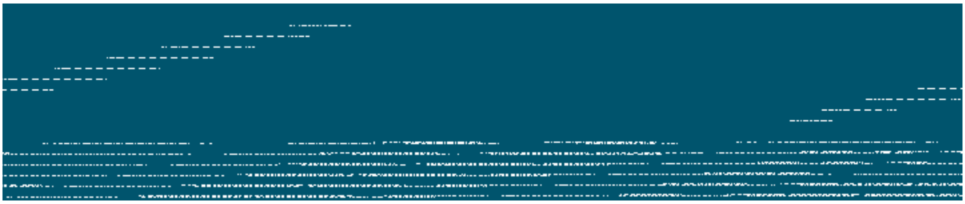


Figure 172. Cluster Mode Operation

Procedure for Operating in Cluster Mode

1. **Operate:** Click the **Operate** button to the right of the desired cluster. A message informs you that you are operating in cluster mode. Click **OK**. The **Operate** button is replaced with an **Exit** button.

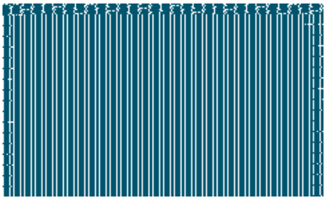


Figure 173. Cluster Mode Activation

2. Select a WMI window for settings that you wish to configure for the cluster, and proceed to make the desired changes.

3. Proceed to any additional pages where you wish to make changes.

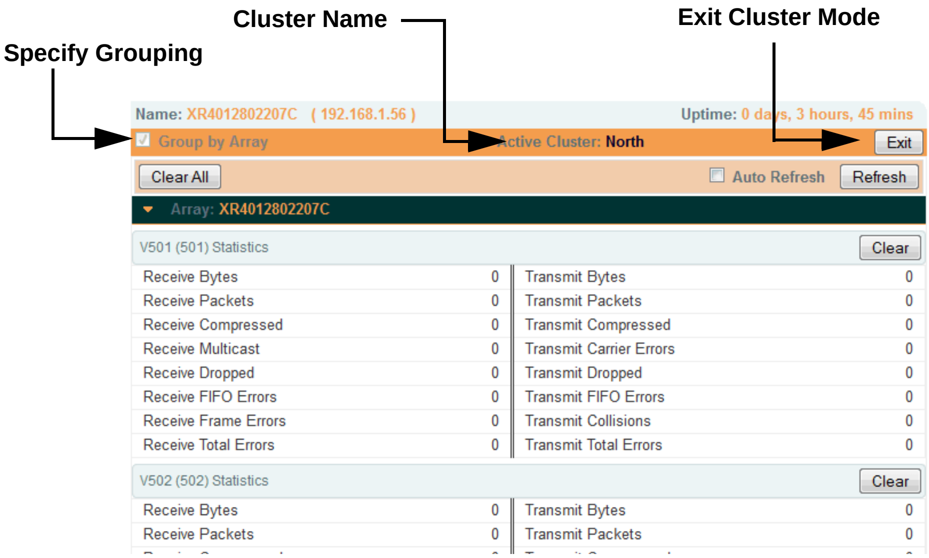
4. Some Status and Statistics windows will present information for all Arrays in the cluster.

5. Click the **Save** button when done if you wish to save changes on the cluster member Arrays.

6. **Exit:** Click the **Exit** button to the right of the operating cluster to terminate Cluster Mode. The WMI returns to normal operation—managing only the Array to which it is connected.

Status and Statistics Windows in Cluster Mode

In Cluster Mode, many of the Status and Statistics windows will display information for all of the members of the cluster. You can tell whether a window displays cluster information—if so, it will display the Cluster Name near the top, as shown in Figure 174.



Name: XR4012802207C (192.168.1.56) Uptime: 0 days, 3 hours, 45 mins

☑ Group by Array Active Cluster: North

□ Auto Refresh

Array: XR4012802207C

V501 (501) Statistics

Receive Bytes	0	Transmit Bytes	0
Receive Packets	0	Transmit Packets	0
Receive Compressed	0	Transmit Compressed	0
Receive Multicast	0	Transmit Carrier Errors	0
Receive Dropped	0	Transmit Dropped	0
Receive FIFO Errors	0	Transmit FIFO Errors	0
Receive Frame Errors	0	Transmit Collisions	0
Receive Total Errors	0	Transmit Total Errors	0

V502 (502) Statistics

Receive Bytes	0	Transmit Bytes	0
Receive Packets	0	Transmit Packets	0

Figure 174. Viewing Statistics in Cluster Mode

You have the option to show aggregate information for the cluster members, or click the **Group by Array** check box to separate it out for each Array.

You may terminate cluster mode operation by clicking the Exit button to the right of the Group by Array check box.

Using Tools on the Wireless Array

These WMI windows allow you to perform administrative tasks on your Array, such as upgrading software, rebooting, uploading and downloading configuration files, and other utility tasks. Tools are described in the following sections:

- **"System Tools" on page 360**
- **"CLI" on page 371**
- **"Options" on page 373**
- **"Logout" on page 376**

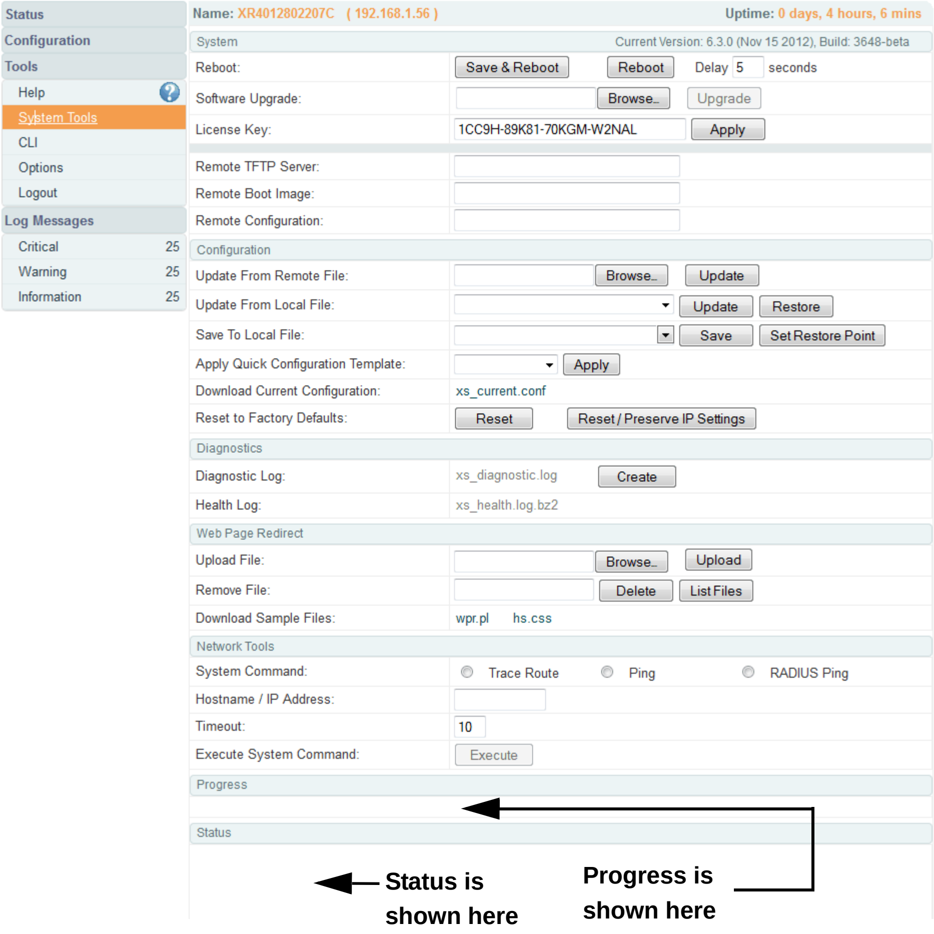
Note that the **Tools** menu section may be collapsed down to hide the headings under it by clicking it. Click again to display the headings. (See Figure 43 on page 89)

This section does not discuss using status or configuration windows. For information on those windows, please see:

- **"Viewing Status on the Wireless Array" on page 95**
- **"Configuring the Wireless Array" on page 159**

System Tools

This window allows you to manage files for software images, configuration, and Web Page Redirect (WPR), manage the system’s configuration parameters, reboot the system, and use diagnostic tools.



Critical 25
Warning 25
Information 25

Name: XR4012802207C (192.168.1.56) Uptime: 0 days, 4 hours, 6 mins

System — Current Version: 6.3.0 (Nov 15 2012), Build: 3648-beta

Reboot:	Save & Reboot · Reboot · Delay 5 seconds
Software Upgrade:	Browse... · Upgrade
License Key:	1CC9H-89K81-70KGM-W2NAL · Apply
Remote TFTP Server:	
Remote Boot Image:	
Remote Configuration:	

Configuration

Update From Remote File:	Browse... · Update
Update From Local File:	Update · Restore
Save To Local File:	Save · Set Restore Point
Apply Quick Configuration Template:	Apply
Download Current Configuration:	xs_current.conf
Reset to Factory Defaults:	Reset · Reset / Preserve IP Settings

Diagnostics

Diagnostic Log:	xs_diagnostic.log · Create
Health Log:	xs_health.log.bz2

Web Page Redirect

Upload File:	Browse... · Upload
Remove File:	Delete · List Files
Download Sample Files:	wpr.pl hs.css

Network Tools

System Command:	○ Trace Route ○ Ping ○ RADIUS Ping
Hostname / IP Address:	
Timeout:	10
Execute System Command:	Execute

Progress

Status

Status is shown here

Progress is shown here

Figure 175. System Tools

Some tools, such as Network Tools and Diagnostics, are only available if the Array's license includes the ***Xirrus Advanced RF Analysis Manager (RAM)****. If a tool is unavailable (grayed out), then your license does not support the feature. See* ***"About Licensing and Upgrades" on page 361****.*

About Licensing and Upgrades

The Array's license determines many of the features that are available on the Array. For example, automatic cell sizing and channel allocation require a license that includes the Xirrus Advanced RF Performance Manager (RPM). Also, IEEE 802.11n operation on XN model Arrays is a licensed feature. To check the features supported by your license, see "Array Information" on page 101.

If you are upgrading the Array to add new features that are not supported by your existing license, **you must enter the new license key that includes the upgrade's features before upgrading**.

Similarly, if you are upgrading the Array for a new release, you must enter the new license key that enables the operation of that release before upgrading. If you do not enter the new license first, the Array will display a message and revert to the previous software image, rather than trying to run new software for which it is not licensed. Major releases will need a new license key, but minor releases will not. For example, to upgrade from ArrayOS Release 5.0.5 to Release 5.1, you must enter a new license key. To upgrade from ArrayOS Release 5.0.5 to Release 5.0.6, use your existing license key.

If you will be entering license keys and performing upgrades on many Arrays, the effort will be streamlined by using the Xirrus Management System (XMS).

Procedure for Configuring System Tools

These tools are broken down into the following sections:

- **System**
- **Configuration**
- **Diagnostics**
- **Web Page Redirect**

- Network Tools
- Progress and Status Frames

System

1. **Save & Reboot** or **Reboot**: Use **Save & Reboot** to save the current configuration and then reboot the Array. The LEDs on the Array indicate the progress of the reboot, as described in "Powering Up the Wireless Array" on page 63. Alternatively, use the **Reboot** button to discard any configuration changes which have not been saved since the last reboot. You may specify an optional **Delay** period in seconds to wait before the reboot starts.

2. **Software Upgrade**: This feature upgrades the ArrayOS to a newer version provided by Xirrus. **Please note that you typically will need to enter a new license key to cover the upgrade's features before clicking the Upgrade button.** See "About Licensing and Upgrades" on page 361 for details.

   Enter the filename and directory location (or click on the **Browse** button to locate the software upgrade file), then click on the **Upgrade** button to upload the new file to the Array. Progress of the operation will be displayed below, in the **Progress** section. Completion status of the operation is shown in the **Status** section.

   This operation does not run the new software or change any configured values. The existing software continues to run on the Array until you reboot, at which time the uploaded software will be used.

If you have difficulty upgrading the Array using the WMI, see ***"Upgrading the Array via CLI" on page 464*** *for a lower-level procedure you may use.*

Software Upgrade always uploads the file in binary mode. If you transfer any image file to your computer to have it available for the Software Upgrade command, it is ***critical*** *to remember to transfer it (ftp, tftp) in* ***binary*** *mode!*

3. **License Key**: If Xirrus provides you with a new license key for your Array, use this field to enter it, then click the **Apply** button to the right. A valid license is required for Array operation, and it controls the features available on the Array. If you upgrade your Array for additional features, you will be provided with a license key to activate those capabilities.

   If you attempt to enter an invalid key, you will receive an error message and the current key will not be replaced.

Automatic Updates from Remote Image or Configuration File

The Array software image or configuration file can be downloaded from an external server. In large deployments, all Arrays can be pointed to one TFTP server instead of explicitly initiating software image uploads to all Arrays. When the Array boots, the Array will download the software image from the specified TFTP server. Similarly, if you decide to change a setting in the Arrays, you can simply modify a single configuration file. After the Arrays are rebooted, they will automatically download the new configuration file from a single location on the specified TFTP server.

4. **Remote TFTP Server**: This field defines the path to a TFTP server to be used for automated remote update of software image and configuration files when rebooting. You may specify the server using an IP address or host name.

5. **Remote Boot Image**: When the Array boots up, it fetches the software image file specified here from the TFTP server defined above, and upgrades to this image before booting. This must be an Array image file with a **.bin** extension.

   Make sure to place the file on the TFTP server. If you disable the remote boot image (by blanking out this field) or if the image can't be transferred, the Array will fall back to booting whatever image is on the compact flash.

The Remote Boot Image or Configuration update happens every time that the Array reboots. If you only want to fetch the remote image or configuration file one time, be sure to turn off the remote option (blank out the field on the System Tools page) after the initial download. When a remote boot image is used, the image is transferred directly into memory and is never written to the compact flash.

6. **Remote Configuration:** When the Array boots up, it fetches the specified configuration file from the TFTP server defined above, and applies this configuration **after** the local configuration is applied. The remote configuration must be an Array configuration file with a **.conf** extension. Make sure to place the file on the TFTP server.

   A partial configuration file may be used. For instance, if you wish to use a single configuration file for all of your Arrays but don't want to have the same IP address for each Array, you may remove the **ipaddr** line from the file. You can then load the file on each Array and the local IP addresses will not change.

   A remote configuration is never saved to the compact flash unless you issue a Save command.

Configuration

7. **Update from Remote File**: This field allows you to define the path to a configuration file (one that you previously saved—see Step 9 and Step 10 below). Click on the **Browse** button if you need to browse for the location of the file, then click **Update** to update your configuration settings.

8. **Update from Local File**: This field updates Array settings from a local configuration file on the Array. Select one of the following files from the drop-down list:

   - **factory.conf**: The factory default settings.
   - **lastboot.conf**: The setting values from just before the last reboot.
   - **saved.conf**: The last settings that were explicitly saved using the **Save changes to flash** button at the top of each window.

- **history/saved-yyyymmdd-pre-update.conf**:
  history/saved-yyyymmdd-post-update.conf:

  Two files are saved for an upgrade: the setting values from just before an upgrade was performed, and the initial values afterward. The filename includes the upgrade date.

- **history/saved-yyyymmdd-auto.conf**: Each time you use the **Save changes to flash** button, an "auto" file is saved with the settings current at that time.

- **history/saved-yyyymmdd-pre-reset.conf**:
  history/saved-yyyymmdd-post-reset.conf:

  Each time you use one of the **Reset to Factory Default** buttons, two files are saved: the setting values from just before the reset, and the initial values afterward. The filename includes the reset date.

- **history/saved-yyyymmdd-hhmm.conf**: The setting values that were explicitly saved using the **Set Restore Point** button (see Step 9 below).

Click **Update** to update your configuration settings. Note that the History folder allows a maximum of 16 files. The oldest file is automatically deleted to make room for each new file.

9. **Save to Local File:** There are a few options for explicitly requesting the Array to save your current configuration to a file on the Array:

   - To view the list of configuration files currently on the Array, click the down arrow to the right of this field. If you wish to replace one of these files (i.e., save the current configuration under an existing file name), select the file, then click **Save**. Note that you cannot save to the file names f**actory.conf**, **lastboot.conf**, and **saved.conf** - these files are write-protected.
   - You may enter the desired file name, then click **Save**.
   - Click **Set Restore Point** to save a copy of the current configuration, basing the file name on the current date and time. For example:

     history/saved-20100318-1842.conf

Note that the configuration is automatically saved to a file in a few situations, as described in Step 8 above.

Important! When you have initially configured your Array, or have made significant changes to its configuration, we strongly recommend that you save the configuration to a file in order to have a safe backup of your working configuration.

10. **Download Current Configuration:** Click on the link titled **xs_current.conf** to download the Array's current configuration settings to a file (that you can upload back to the Array at a later date). The system will prompt you for a destination for the file. The file will contain the Array's current configuration values.

11. **Reset to Factory Defaults**: Click on the **Reset/Preserve IP Settings** button to reset the system's current configuration settings to the factory default values, *except for the Array's management IP address which is left unchanged*. This function allows you to maintain management connectivity to the Array even after the reset. This will retain the Gigabit Ethernet port's IP address (see "Network Interfaces" on page 171), or if you have configured management over a VLAN it will maintain the management VLAN's IP address (see "VLAN Management" on page 201). *All other previous configuration settings will be lost*.

    Click **Reset** to reset all of the system's current configuration settings to the factory default values, including the management IP address—*all previous configuration settings will be lost*. The Array's Gigabit Ethernet ports default to using DHCP to obtain an IP address.

If the IP settings change, the connection to the WMI may be lost.

Diagnostics

12. **Diagnostic Log**: Click the **Create** button to save a snapshot of Array information for use by Xirrus Customer Support personnel. The Progress and Status Frames show the progress of this operation. When the process

is complete, the filename `xs_diagnostic.log` will be displayed in blue and provides a link to the newly created log file. Click the link to download this file to the `C:\` folder on your local computer. (Figure 176)

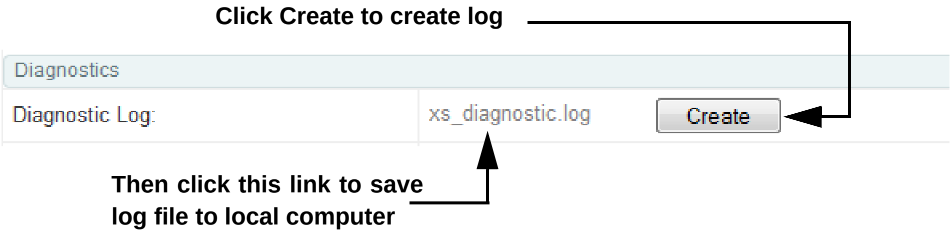

Click Create to create log
Diagnostics
Diagnostic Log:
xs_diagnostic.log
Create
Then click this link to save log file to local computer

Figure 176. Saving the Diagnostic Log

This feature is only used at the request of Customer Support. It saves all of the information regarding your Array, including status, configuration, statistics, log files, and recently performed actions.

The diagnostic log is always saved as a file named `xs_diagnostic.log` on your `C:\` drive, so you should immediately rename the file to save it. This way, it will not be lost the next time you save a diagnostic log. Often, Customer Support will instruct you to save two diagnostic logs about ten minutes apart so that they can examine the difference in statistics between the two snapshots (for example, to see traffic and error statistics for the interval). Thus, you must rename the first diagnostic log file.

All passwords are stored on the array in an encrypted form and will not be exposed in the diagnostic log.

Web Page Redirect

The Array uses a Perl script and a cascading style sheet to define the default splash/login Web page that the Array delivers for WPR. You may replace these files with files for one or more custom pages of your own. See Step 15 below to view the default files. See Step 14 on page 253 for more information about WPR and how the splash/login page is used.

Each SSID that has WPR enabled may have its own page. Custom files for a specific SSID **must** be named based on the SSID name. For example, if the SSID is named **Public**, the default `wpr.pl` and `hs.css` files should be modified as desired and renamed to `wpr-Public.pl` and `hs-Public.css` before uploading to the Array. If you modify and upload files named `wpr.pl` and `hs.css`, they will replace the factory default files and will be used for any SSID that does not have its own custom files, per the naming convention just described. Be careful not to replace the default files unintentionally.

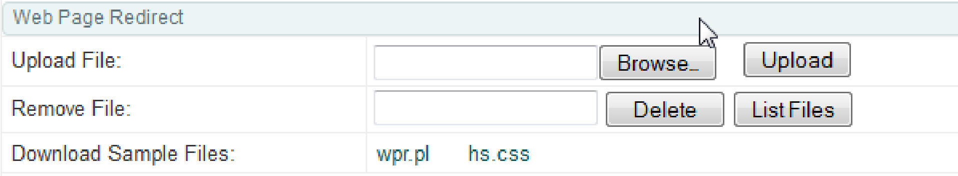


Figure 177. Managing WPR Splash/Login page files

13. **Upload File**: Use this to install files for your own custom WPR splash/login page (as described above) on the Array. Note that uploaded files are not immediately used - you must reboot the Array first. At that time, the Array looks for and uses these files, if found.

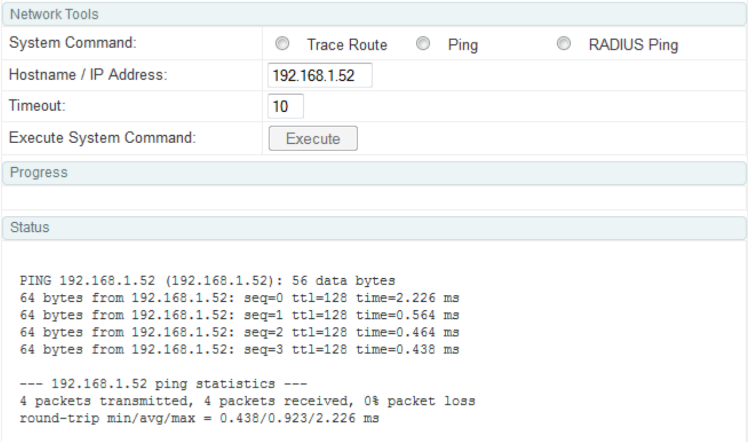
    Enter the filename and directory location (or click **Browse** to locate the splash/login page files), then click on the **Upload** button to upload the new files to the Array. You must reboot to make your changes take effect.

14. **Remove File**: Enter the name of the WPR file you want to remove, then click on the **Delete** button. You can use the **List Files** button to show you a list of files that have been saved on the Array for WPR. The list is displayed in the **Status** section at the bottom of the WMI window. You must reboot to make your changes take effect.

15. **Download Sample Files**: Click on a link to access the corresponding sample WPR files:

    - **wpr.pl**—a sample Perl script.
    - **hs.css**—a sample cascading style sheet.

Network Tools



Network Tools

System Command:	○ Trace Route ○ Ping ○ RADIUS Ping
Hostname / IP Address:	192.168.1.52
Timeout:	10
Execute System Command:	Execute

Progress

Status

```
PING 192.168.1.52 (192.168.1.52): 56 data bytes
64 bytes from 192.168.1.52: seq=0 ttl=128 time=2.226 ms
64 bytes from 192.168.1.52: seq=1 ttl=128 time=0.564 ms
64 bytes from 192.168.1.52: seq=2 ttl=128 time=0.464 ms
64 bytes from 192.168.1.52: seq=3 ttl=128 time=0.438 ms

--- 192.168.1.52 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max = 0.438/0.923/2.226 ms
```

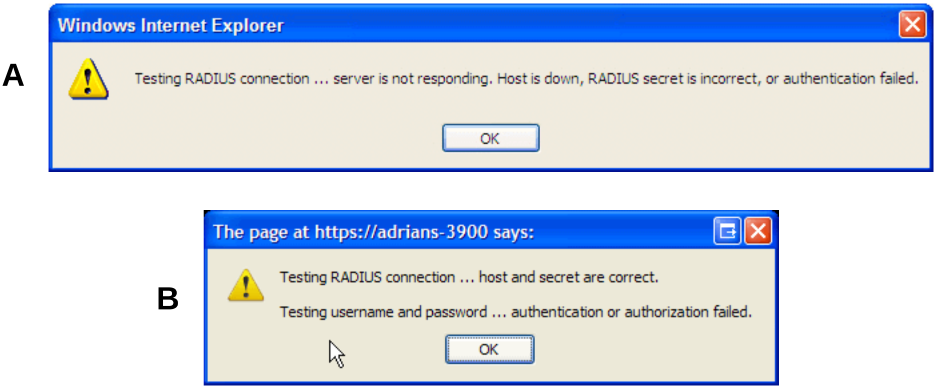
Figure 178. System Command (Ping)

16. **System Command**: Choose **Trace Route**, **Ping**., or **RADIUS Ping**. For Trace Route and Ping, fill in **IP Address** and **Timeout**. Then click the **Execute** button to run the command.

    The RADIUS Ping command is a simple utility that tests connectivity to a RADIUS server by attempting to log in with the specified Username and Password. When using a RADIUS server, this command allows you to verify that the server configuration is correct and whether a particular Username and Password are set up properly. If a client is having trouble accessing the network, you can quickly determine if there is a basic RADIUS problem by using the RADIUS Ping tool. For example, in Figure 179 (A), RADIUS Ping is unable to contact the server. In Figure 179 (B), RADIUS Ping verifies that the host information and secret for a RADIUS server are correct, but that the user account information is not.

Select RADIUS allows you to select a RADIUS server that you have already configured. When you make a choice in this field, additional fields will be displayed. Set **Select RADIUS** to External Radius, Internal Radius, or a server specified for a particular SSID, or select **Other Server** to specify another server by entering its **Host** name or IP address, **Port**, and shared **Secret**.

Enter the **RADIUS Credentials**: **Username** and **Password**. Select the **Authentication Type**, **PAP** or **CHAP**. Click the **Execute** button to run the command. The message **Testing RADIUS connection** appears. Click **OK** to proceed.


A
Windows Internet Explorer
OK
B
The page at https://adrians-3900 says:
OK

Testing RADIUS connection ... server is not responding. Host is down, RADIUS secret is incorrect, or authentication failed.

Testing RADIUS connection ... host and secret are correct.

Testing username and password ... authentication or authorization failed.

Figure 179. Radius Ping Output

17. **IP Address**: For Ping or Trace Route, enter the IP address of the target device.
18. **Timeout**: For Ping or Trace Route, enter a value (in seconds) before the action times out.

19. **Execute System Command**: Click **Execute** to start the specified command. Progress of command execution is displayed in the **Progress** frame. Results are displayed in the **Status** frame.

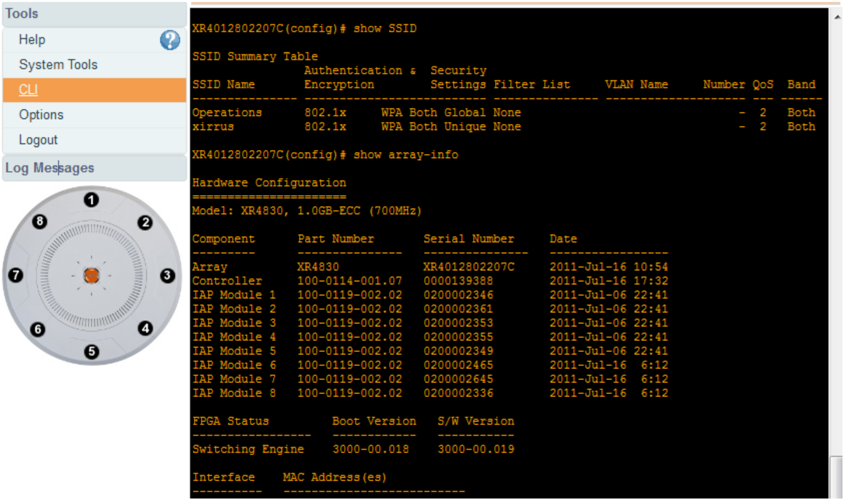
Progress and Status Frames

The **Progress** frame displays a progress bar for commands such as Software Upgrade and Ping. The **Status** frame presents the output from system commands (Ping and Trace Route), as well as other information, such as the results of software upgrade.

20. If you want to save the parameters you established in this window for future sessions, click on the **Save changes to flash** button.

CLI

The WMI provides this window to allow you to use the Array's Command Line Interface (CLI). You can enter commands to configure the Array, or display information using show commands. You will not need to log in - you already logged in to the Array when you started the WMI.



```
XR4012802207C(config)# show SSID

SSID Summary Table
                Authentication &  Security
SSID Name       Encryption        Settings Filter List     VLAN Name     Number QoS  Band
--------------- ------------------------- --------------- -------------------- --- ------
Operations      802.1x     WPA Both Global None                                -  2   Both
xirrus          802.1x     WPA Both Unique None                                -  2   Both

XR4012802207C(config)# show array-info

Hardware Configuration
======================
Model: XR4830, 1.0GB-ECC (700MHz)

Component      Part Number      Serial Number     Date
---------      ---------------  ---------------   -----------------
Array          XR4830           XR4012802207C     2011-Jul-16 10:54
Controller     100-0114-001.07  0000139388        2011-Jul-16 17:32
IAP Module 1   100-0119-002.02  0200002346        2011-Jul-06 22:41
IAP Module 2   100-0119-002.02  0200002361        2011-Jul-06 22:41
IAP Module 3   100-0119-002.02  0200002353        2011-Jul-06 22:41
IAP Module 4   100-0119-002.02  0200002355        2011-Jul-06 22:41
IAP Module 5   100-0119-002.02  0200002349        2011-Jul-06 22:41
IAP Module 6   100-0119-002.02  0200002465        2011-Jul-16  6:12
IAP Module 7   100-0119-002.02  0200002645        2011-Jul-16  6:12
IAP Module 8   100-0119-002.02  0200002336        2011-Jul-16  6:12

FPGA Status         Boot Version   S/W Version
-----------------   ------------   -----------
Switching Engine    3000-00.018    3000-00.019

Interface    MAC Address(es)
----------   -------------------------
```

Figure 180. CLI Window

To enter a command, simply type it in. The command is echoed and output is shown in the normal way—that is, the same way it would be if you were using the CLI directly. You may use the extra scroll bar inside the right edge of the window to scroll through your output. If output runs past the right edge of the screen, there is also a horizontal scroll bar at the bottom of the page.

This window has some minor differences, compared to direct use of the CLI via the console or an SSH connection:

- The CLI starts in **config** mode. All configuration and show commands are available in this mode. You can "drill down" the mode further in the usual way. For example, you can type **interface iap** to change the mode to **config-iap**. The prompt will indicate the current command mode, for example:

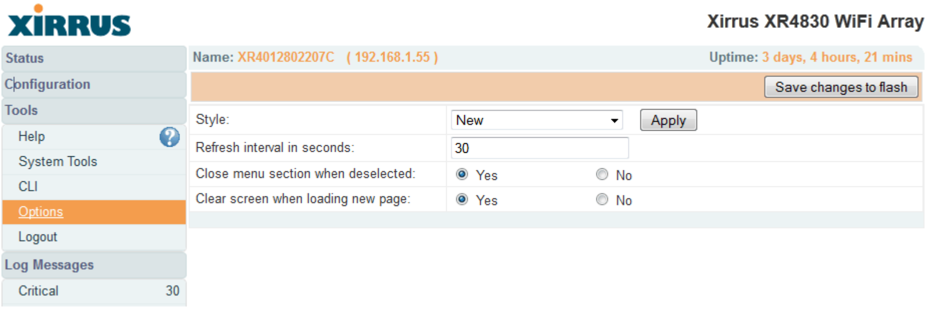
  ```
  My-Array(config-iap) #
  ```

- You can abbreviate a command and it will be executed if you have typed enough of the command to be unambiguous. The command will not auto-complete, however. Only the abbreviated command that you actually typed will be shown. You can type a partial command and press Tab to have the command auto-complete. If the partial command is ambiguous a list of legal endings is displayed.
- Entering **quit** will return you to the previously viewed WMI page.
- Most, but not all, CLI commands can be run in this window. Specifically the **run-test** menu of commands is **not** available in this window. To use the run-test command, please connect using SSH and use CLI directly, or use the System Tools described in this chapter, such as Trace Route, Ping, and RADIUS Ping.

Help commands (the **?** character) are available, either at the prompt or after you have typed part of a command.

Options

This window allows you to customize the behavior and appearance of the WMI. By default, the Array uses the **New** style option, shown below.



Name: XR4012802207C (192.168.1.55) Uptime: 3 days, 4 hours, 21 mins

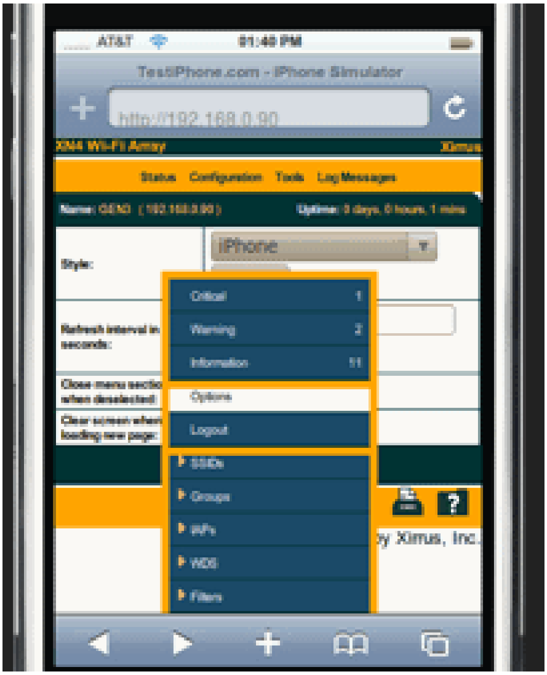
Style:	New	
Refresh interval in seconds:	30	
Close menu section when deselected:	● Yes	○ No
Clear screen when loading new page:	● Yes	○ No

Figure 181. WMI Display Options

Procedure for Configuring Options

1. **Style**: This option allows you to change the appearance and operation of the user interface. Select one of the available styles from the drop-down list. Click the **Apply** button to view the WMI with the selected style.

   Note that some styles just change the display appearance (the skin) of WMI, in much the same way as changing the display theme used in Windows 7. Other styles include more extensive changes to the interface.



AT&T 01:40 PM

TestiPhone.com - iPhone Simulator

http://192.168.0.90

XN4 Wi-Fi Array Xirrus

Name: GENO (192.168.0.90) Uptime: 3 days, 0 hours, 1 mins

Style: iPhone

Refresh interval in seconds:

Close menu sectio when deselected:

Clear screen when loading new page:

Figure 182. iPhone Style Option

For example, the **iPhone** style option (Figure 182) has a more compact display, suitable for use on smart phones. It shows the main menu in the orange bar at the top, rather than as a tree in its own frame on the left. Clicking one of the menu choices at the top in Figure 182 will display a drop-down menu with the options for that menu choice. Menus may be toggled on and off by clicking on the headers (Status, Configuration, etc.).

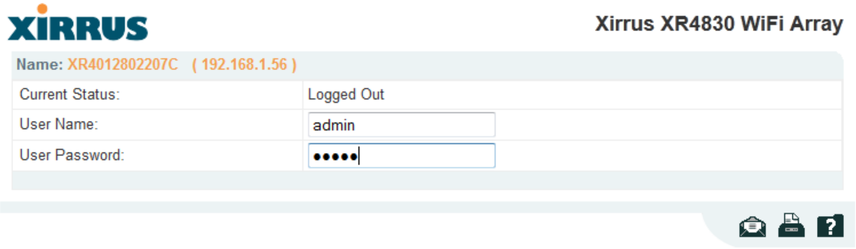
2. **Refresh Interval in Seconds**: Many of the windows in the Status section of the WMI have an Auto Refresh option. You may use this setting to change how often a status or statistics window is refreshed, if its auto refresh option is enabled. Enter the desired number of seconds between refreshes. The default refresh interval is 30 seconds.

3. **Close Menu Section when Deselected**: When you click a main section such as **SSIDs** in the left frame of the WMI (the navigation tree), the section is expanded to show submenu choices. Click **Yes** to automatically close any open submenus when you select a different section. If you click **No**, all menu sections will remain expanded once opened. **No** is the default. Note that if you enable this feature and you expand a section by clicking its orange arrow, the section will stay open as you select windows in other menu sections.

4. **Clear Screen When Loading New Page**: When this option is enabled and you click on a page that takes a long time to load for any reason, the main area of the screen is blanked out and displays a **Loading…** message. If this option is disabled, WMI simply shows the page you were viewing until the new page loads.

Logout

Click on the Logout button to terminate your session. When the session is terminated, you are presented with the Array's login window.



Xirrus XR4830 WiFi Array

Name: XR4012802207C (192.168.1.56)

Current Status:	Logged Out
User Name:	admin
User Password:	●●●●●

Figure 183. Login Window