User's Guide

XIRRUS®

Wi-Fi Arrays

October 28, 2009

Wi-Fi Array™

XN16, XN12, XN8, XN4

XS16, XS12, XS8, XS4

XS-3900, XS-3700, XS-3500

Part Number: 800-0006-001
(Revision W)

XIRRUS®

Trademarks

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Please see Legal Notices, Warnings, Compliance Statements, and Warranty and License Agreements in "Appendix F: Notices" on page 433.

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Introduction

These topics introduce the Xirrus Wi-Fi Array, including an overview of its key features and benefits, and a detailed listing of the product's physical, environmental, technology and regulatory specifications.

The Xirrus Family of Products

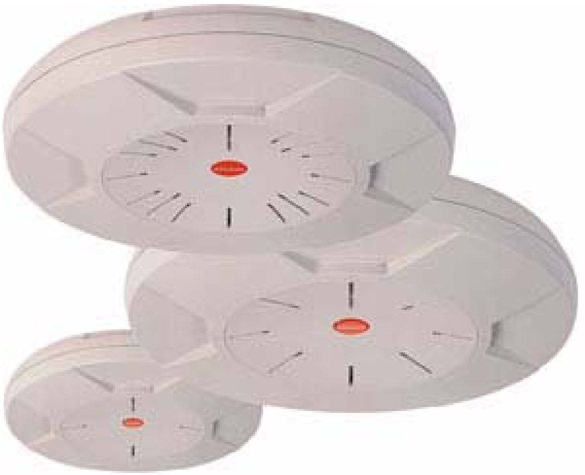


Figure 1. Xirrus Arrays

The Xirrus family of products includes the following:

- **The XS Series of Xirrus Wi-Fi Arrays (XS16 / XS12 / XS8 / XS4)**
  XS 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, Wi-Fi controller, and firewall into a single device, along with a dedicated Wi-Fi threat sensor and an embedded spectrum analyzer. The Wi-Fi Array provides more than enough bandwidth, security, and control to replace switched Ethernet to the desktop as the primary network connection. The XS16 has 16 IAPs, the XS12 has 12 IAPs, the XS8 has 8 IAPs, and the XS4 has 4 IAPs.

- **The XN Series of Xirrus Wi-Fi Arrays (XN16 / XN12 / XN8 / XN4)**
  The newest Xirrus Wi-Fi Arrays add the speed and reach of IEEE 802.11n technology to the XS series of Arrays. The XN Series of Arrays feature the capacity and performance needed to replace switched Ethernet to the desktop. The XN16 has 16 IAPs, the XN12 has 12 IAPs, the XN8 has 8 IAPs, and the XN4 has 4 IAPs.

- **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 XM-33xx-CC Management Platform Series, or as a software package (XA-3300-CC) to be installed on your own server hardware.

  Figure 2 illustrates the elements of the Xirrus Management System. 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 Wi-Fi Arrays via SNMP.

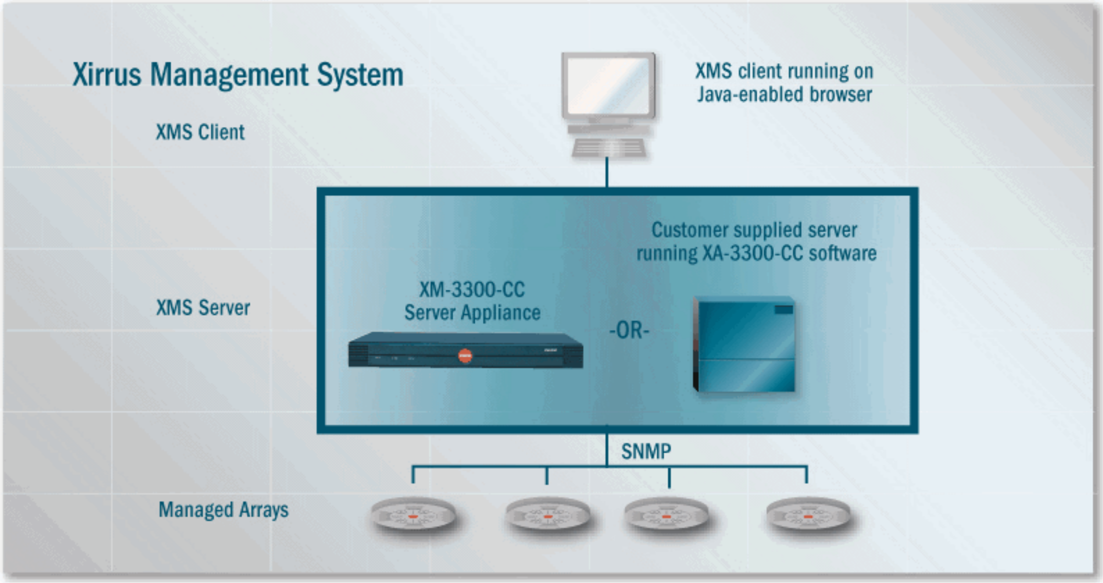

Xirrus Management System
XMS Client
XMS client running on Java-enabled browser
XMS Server
Customer supplied server running XA-3300-CC software
XM-3300-CC Server Appliance
-OR-
SNMP
Managed Arrays

Figure 2. The Xirrus Management System

  If you need detailed information about this product, refer to the XMS User's Guide, part number 800-0007-001.

- **Xirrus Power over Gigabit Ethernet (PoGE)**
  The PoGE modules eliminate the need for running separate power cabling. Additionally, an 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 Wi-Fi 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, XN16, XS12, or XS-3500). The Wi-Fi 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 XS series of Arrays have two types of radios—the 5 GHz 802.11a radios are named **a1** to **a12** (for 16-port models). The 802.11a/b/g radios are named **abg1** to **abg4**, and they support both 2.4GHz and 5 GHz. The XN series of Arrays also 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. When referring to a port that may be on either an XN or XS model, the nomenclature **abg(n)** and **a(n)** will be used, e.g., **abg(n)2** or **a(n)6**.

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

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

- Configuring the Wi-Fi Array
  Contains procedures for configuring the Array using its embedded Web Management Interface.

- Using Tools on the Wi-Fi 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 Wi-Fi 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: Servicing the Wi-Fi Array
  Contains procedures for servicing the Array, including the removal and reinstallation of major hardware components.

- Appendix B: Quick Reference Guide
  Contains the product's factory default settings.

- Appendix C: 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 D: Implementing PCI DSS
  Discusses meeting security standards with the Array, including FIPS and PCI DSS.
- Appendix F: 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.

Your User's Guide as a PDF Document

This User's Guide is also made available as a secure PDF (Portable Document Format) file and can be viewed using the Adobe® Acrobat Reader® product. It cannot be edited or modified. If you don't have Acrobat Reader, you can downloaded it free-of-charge from: http://www.adobe.com.

Hyperlinks

If you click on body text that appears in the color TEAL (with the exception of headings or notes) the embedded hyperlink within the text will immediately take you to the referenced destination. All internal and external cross-references, including page numbers within the List of Figures and the Index, have associated hyperlinks. After "jumping" to a referenced topic, if you want to return to the previous page (reference source), simply click on Acrobat's **previous page** button.

Window or Page?

Is a window a page, or is a page a window? There seems to be some dispute as to what the correct term should be. For the sake of consistency, this document uses the term **Window** when referring to how the Wi-Fi Array's Web Management Interface is displayed on your monitor.

Why Choose the Xirrus Wi-Fi Array?

The deployment of wireless LANs is becoming increasingly common as businesses strive for greater flexibility in the workplace and the need for employee mobility rises. The only requirements for an effective wireless deployment are a power source, a couple of screws, and a little imagination.

Wireless LAN is also fully compatible with standard Ethernet protocols, so connectivity with existing wired infrastructures 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 infrastructure (it's only the plug that no longer exists).

Wireless LAN 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 300 Mbps, 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
Wi-Fi Array Product Overview
Product Specifications—XN16, XN12, and XN8
Product Specifications—XS4/XS-3500
Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700
The Xirrus Family of Products

Wi-Fi Array Product Overview

Part of the family of Xirrus products, the Wi-Fi Array is a high capacity, multi-mode device designed for the Enterprise market, with twice the range and up to eight times the capacity of competitive wireless products.

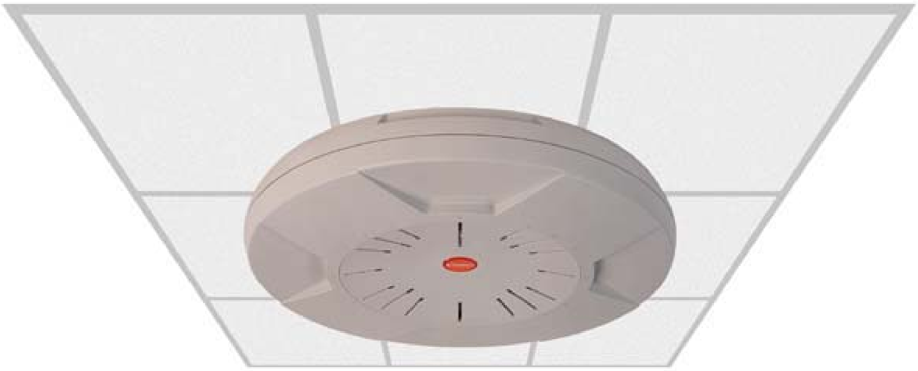


Figure 3. Wi-Fi Array (XN16)

The Wi-Fi Array (regardless of the product model) is Wi-Fi® compliant and simultaneously supports 802.11a, 802.11b and 802.11g clients. XN model arrays add the enhanced abilities of 802.11n to this combination. 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: 16 IAPs (XN16, XS16, XS-3900), 12 IAPs (XN12, XS12), 8 IAPs (XN8, XS8, XS-3700), and 4 IAPs (XN4, XS4, XS-3500).

Enterprise Class Security

The latest and most effective wireless encryption security standards, including WPA (Wi-Fi Protected Access) and WPA2 with 802.11i AES (Advanced Encryption Standard) are provided with the Wi-Fi 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. Rogue AP detection, site monitoring, and RF spectrum analysis are performed in the background by the Array automatically.

Wi-Fi Array Product Family

The following tables provide an overview of the main features supported by the Wi-Fi 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	24	12
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
Wi-Fi bandwidth	4.8 Gbps	3.6 Gbps	2.4 Gbps	1.2 Gbps
Users supported	1,024	768	512	256

XS Family of Arrays

Feature	XS16, XS-3900	XS12	XS8, XS-3700	XS4, XS-3500
Number of 802.11a/b/g radios	4	4	4	4
Number of 802.11a radios	12	8	4	0
Total radios	**16**	**12**	**8**	**4**
Integrated Wi-Fi switch ports	16	12	8	4
Integrated RF spectrum analyzer and threat sensors	Yes	Yes	Yes	Yes
Uplink Ports	2	2	2	1
Wi-Fi bandwidth	864 Mb	648 Mb	432 Mb	216 Mb
Users supported	1,024	768	512	256

See Also

Key Features and Benefits

Wi-Fi Array Product Overview

Product Specifications—XN16, XN12, and XN8

Product Specifications—XS4/XS-3500

Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700

Power over Gigabit Ethernet (PoGE) (Optional)

Why Choose the Xirrus Wi-Fi Array?

Deployment Flexibility

Xirrus' 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 and the highest possible data rates for a large volume of clients. Each sector can be controlled automatically or manually, creating a pattern of wireless coverage perfectly tailored to individual customer needs. For example:

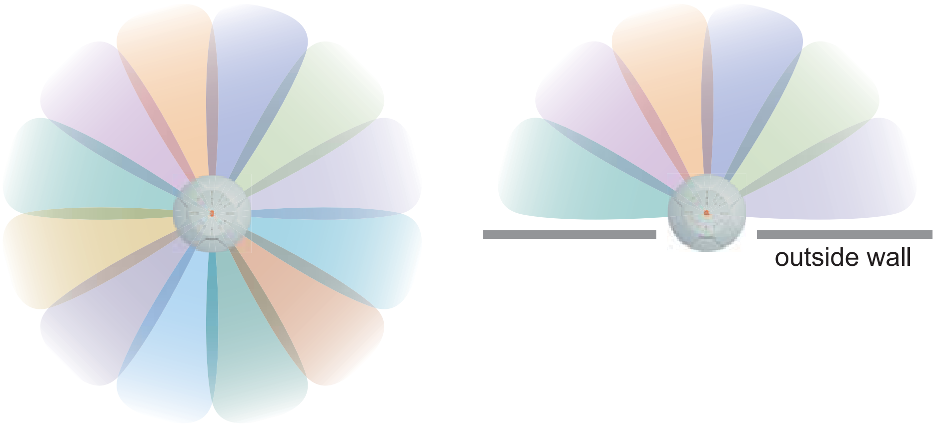


Figure 4. Wireless Coverage Patterns

Figure 4 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.

- **Partial pattern coverage**
  If desired, the Wi-Fi 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.

See also, "Flexible Coverage Schemes" on page 18.

Power over Gigabit Ethernet (PoGE) (Optional)

The Xirrus XP1 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.

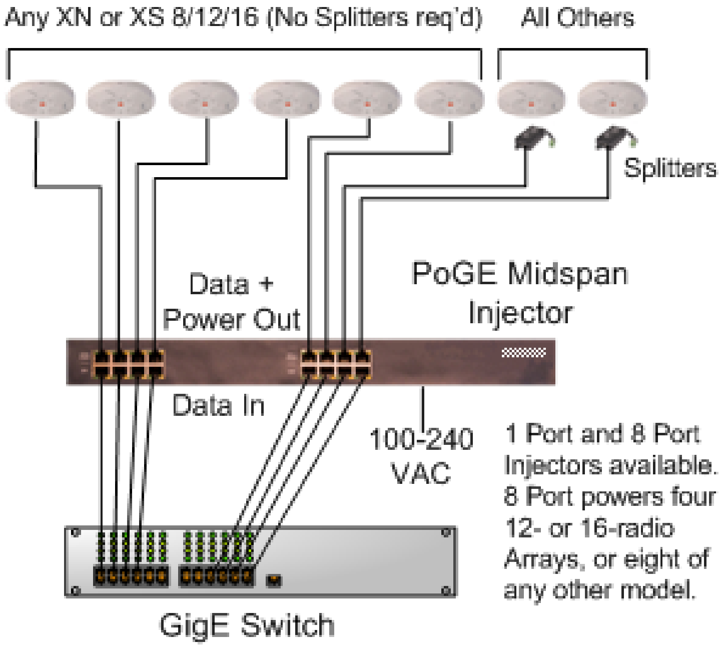


Figure 5. XP8 - Power over Ethernet Usage

Specific models of the Array are compatible with specific PoGE modules. For details, please see **"Power over Gigabit Ethernet Compatibility Matrix" on page 414.**

See Also

Key Features and Benefits

Wi-Fi Array Product Overview

Product Specifications—XN16, XN12, and XN8

Product Specifications—XS4/XS-3500

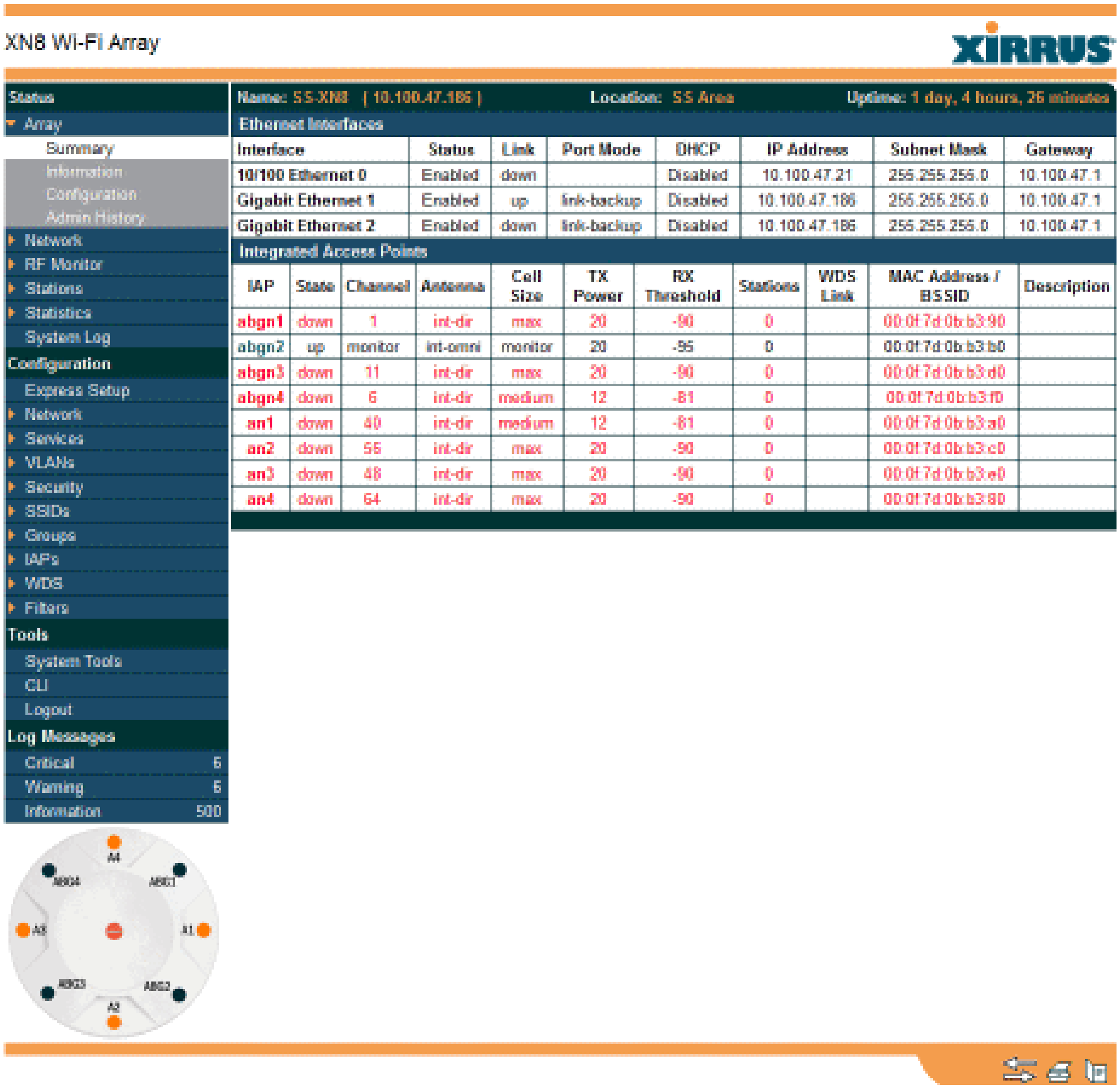
Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700

The Xirrus Family of Products

Why Choose the Xirrus Wi-Fi Array?

Enterprise Class Management

The Wi-Fi 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, along with a full compliment of troubleshooting tools and statistics.



Name: SS-XN8 | 10.100.47.186 | Location: SS Area Uptime: 1 day, 4 hours, 26 minutes

Ethernet Interfaces

Interface	Status	Link	Port Mode	DHCP	IP Address	Subnet Mask	Gateway
10/100 Ethernet 0	Enabled	down		Disabled	10.100.47.21	255.255.255.0	10.100.47.1
Gigabit Ethernet 1	Enabled	up	link-backup	Disabled	10.100.47.186	255.255.255.0	10.100.47.1
Gigabit Ethernet 2	Enabled	down	link-backup	Disabled	10.100.47.186	255.255.255.0	10.100.47.1

Integrated Access Points

IAP	State	Channel	Antenna	Cell Size	TX Power	RX Threshold	Stations	WDS Link	MAC Address / BSSID	Description
abgn1	down	1	int-dir	max	20	-90	0		00:0f:7d:0b:b3:90	
abgn2	up	monitor	int-omni	monitor	20	-95	0		00:0f:7d:0b:b3:b0	
abgn3	down	11	int-dir	max	20	-90	0		00:0f:7d:0b:b3:d0	
abgn4	down	6	int-dir	medium	12	-81	0		00:0f:7d:0b:b3:f0	
an1	down	40	int-dir	medium	12	-81	0		00:0f:7d:0b:b3:a0	
an2	down	56	int-dir	max	20	-90	0		00:0f:7d:0b:b3:c0	
an3	down	48	int-dir	max	20	-90	0		00:0f:7d:0b:b3:e0	
an4	down	64	int-dir	max	20	-90	0		00:0f:7d:0b:b3:80	

Figure 6. 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.

See Also

Key Features and Benefits
Product Specifications—XN16, XN12, and XN8
Product Specifications—XN4
Product Specifications—XS4/XS-3500
Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700
Power over Gigabit Ethernet (PoGE) (Optional)
The Xirrus Family of Products
Why Choose the Xirrus Wi-Fi Array?

Key Features and Benefits

This section describes some of the key product features and the benefits you can expect when deploying the Wi-Fi Array (the XN16 product is highlighted in this section).

High Capacity and High Performance

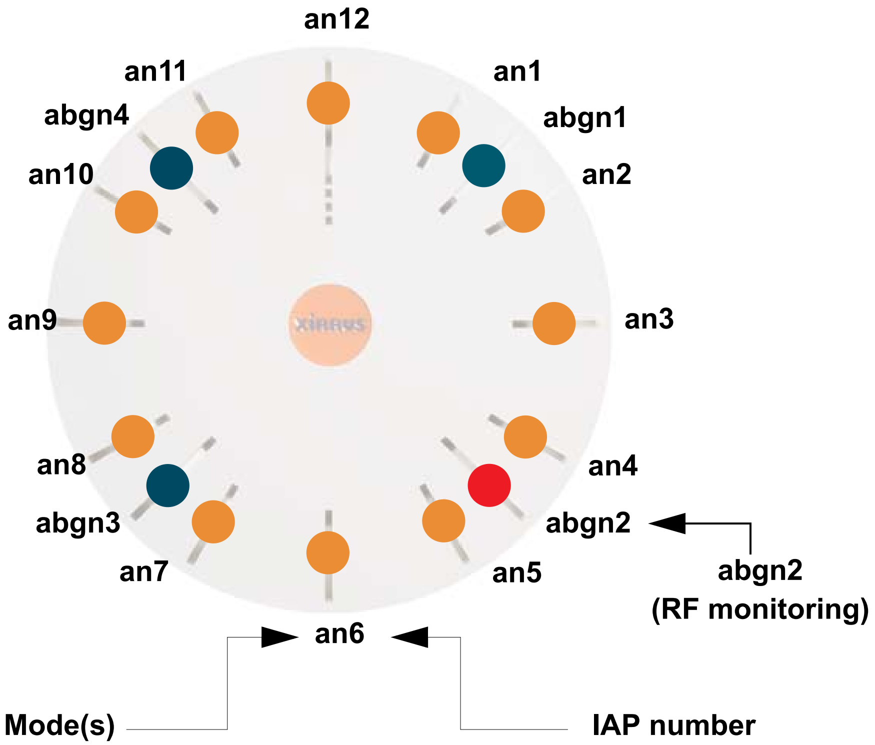


Figure 7. Layout of IAPs (XN16)

The XN16 version of the Wi-Fi Array (Figure 7) easily handles time-sensitive traffic such as voice, and can enable wireless connectivity for 1,024 users. The unit includes two Gigabit uplink ports for connection to the wired network. A total of sixteen IAPs provides a maximum wireless capacity of 4.8 Gbps, which offers ample reserves for the high demands of current and future applications. Of the sixteen IAPs, twelve operate as 802.11a/n radios (5 GHz band), and four operate as 802.11a/b/g/n radios (5 GHz or 2.4 GHz bands), providing backwards compatibility with 802.11b and 802.11g.

In the recommended configuration, IAP (radio) **abg(n)2** is configured in RF monitoring and rogue AP detection mode.

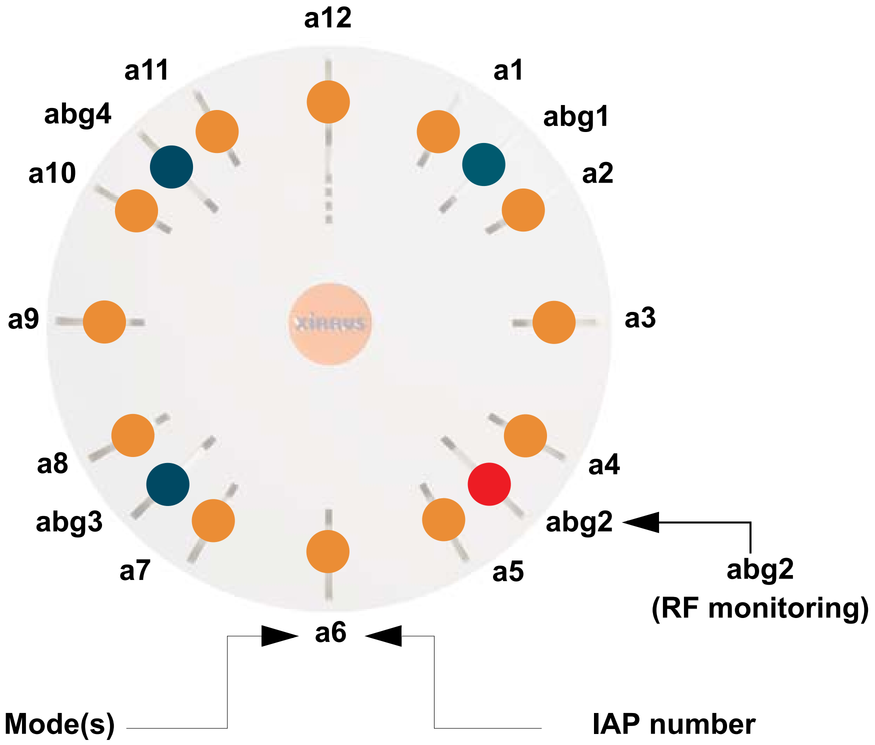


Figure 8. Naming of IAPs (XS16)

Extended Coverage

One XN16 solution enables you to replace up to sixteen access points (includes 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 Wi-Fi Array deployed, far fewer access points are needed and wired-like resiliency is delivered throughout your wireless network. Your Wi-Fi 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.

Flexible Coverage Schemes

Your Wi-Fi Array offers flexible coverage schemes for each wireless technology.

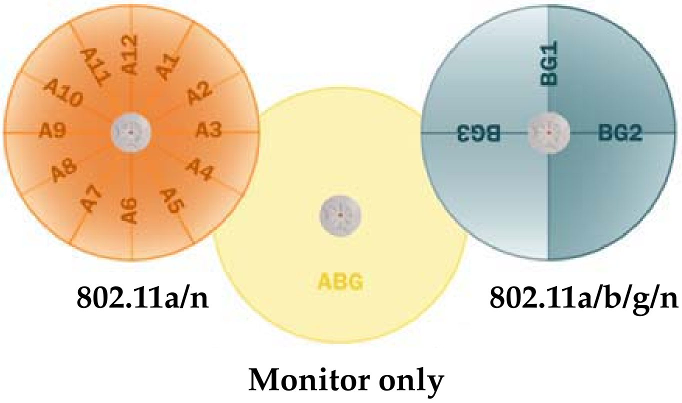


Figure 9. Coverage Schemes

- **802.11a/n, 802.11a**
  Delivers 60° wireless coverage per IAP, with 6 dBi of gain.
- **802.11b/g/n, 802.11b/g**
  Delivers 180° wireless coverage, with 3 dBi of gain.
- **802.11a/b/g/n, 802.11a/b/g (monitor only)**
  Delivers 360° wireless coverage, with 2 dBi of gain.

Non-Overlapping Channels

Complete use of non-overlapping channels limits interference and delivers maximum capacity. On the XN16, 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).

Secure Wireless Access

Multiple layers of authentication and encryption ensure secure data transmissions. The Wi-Fi Array is 802.11i compliant with encryption support for 40 bit and 128 bit WEP, WPA and WPA2 with TKIP and AES encryption. Authentication support is provided via 802.1x, including PEAP, EAP-TLS, EAP-TTLS, and LEAP (Lightweight Extensible Authentication Protocol) passthrough.

Applications Enablement

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.

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 support.

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 of the wireless network—ideal for the Enterprise market. It also allows you to import floor plans to help you plan your deployment. The Xirrus Wi-Fi Array chassis has a plenum rated, lockable and tamper resistant case.

See Also

Wi-Fi Array Product Overview
Product Specifications—XN16, XN12, and XN8
Product Specifications—XS4/XS-3500)
Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700
Power over Gigabit Ethernet (PoGE) (Optional)
The Xirrus Family of Products
Why Choose the Xirrus Wi-Fi Array?

Product Specifications—XN16, XN12, and XN8

Element	Specifications
Number of Users	Maximum of 64 associated users per radio XN16: 1024 users per Array XN12: 768 users per Array XN8: 512 users per Array
Physical	Diameter: 18.65 inches (47.37 cm) Height: 3.87 inches (9.83 cm) Weight: 10 lbs (3.63 kg)
Environmental	**Operating Temperature:** 0°C to 55°C 0% to 90% relative humidity (non-condensing) **Storage Temperature:** -20°C to 60°C 5% to 95% relative humidity (non-condensing)
System	1 GHz CPU 1 GB RAM 1 GB system flash
Integrated Switch	2.1 Gbps integrated wireless switch
Chassis	Lockable mounting plate, Kensington lock slot

Element	Specifications
Electrical	Each Array supports both AC and PoGE AC Input Power: 100-240VAC at 50-60 Hz PoGE (DC) Input Power: Power over Gigabit Ethernet—no splitter required, 48VDC, Maximum 2A **Nominal Power:** XN16: 90W XN12: 75W XN8: 60W **All Models:** For PoGE, see "Power over Gigabit Ethernet Compatibility Matrix" on page 414.
Interfaces	**Serial Console Port:** 1 x RS232 – RJ45 connector, for local configuration **Ethernet Interfaces:** 2 x Gigabit 100/1000 Mbps uplink ports for link aggregation, redundancy, or bridging 1 x Fast Ethernet 10/100 Mbps, for out of band management **Status LEDs:** System status, Ethernet, Radio
Networking	DHCP client, DHCP server (multiple DHCP pools), DNS Client, NTP client, NAT

Element	Specifications
Management	Xirrus Management System (XMS)—Layer 3 Element Management System HTTPS Web Management Interface (WMI) CLI via SSHv2, Telnet, local serial Console Enable/disable management for any interface Read-write and read-only admin accounts may be authenticated via RADIUS SNMP v2c, v3 Configuration Files—text-based files may be imported, exported, or compared NetFlow—IP flow information (traffic statistics may be sent to an external Collector FTP, TFTP Syslog reporting for alerts/alarms—messages may be stored on internal Syslog server or sent to up to three external syslog servers. Cisco Discovery Protocol (CDP)—obtain protocol addresses and platform information for neighboring devices
Quality of Service (QoS) Support	**Multiple SSIDs:** 16 unique SSIDs per Array Each SSID beacons a unique BSSID per radio VLAN and QoS settings for each SSID **VLANs:** Up to 16 VLANs, 802.1Q, 802.1p **Prioritization:** 802.11e wireless prioritization 802.1p wired prioritization Fair queuing of downstream traffic **Wireless Voice Support:** Spectralink Voice Priority (SVP) protocol

Element	Specifications
Security	**Wireless Encryption** Line speed, hardware-accelerated encryption modes: WPA TKIP WPA2 AES WEP 40/64 WEP 104/128 **Wireless Authentication:** Open Pre-shared Key 802.1X EAP PEAP EAP-TLS EAP-TTLS EAP-LEAP Pass-through Web Page Redirect (Captive Portal) MAC Address Access Control List (ACL) CHAP, PAP **Firewall:** Integrated stateful-inspection, rules-based firewall **IDS/IPS:** Integrates with Xirrus XDM Intrusion Detection/ Prevention System for real-time wireless security protection **Rogue AP detection and blocking:** Integrated Rogue AP detection and alerting via dedicated internal RF Threat Sensor. Rogue AP can be shielded **Integrated RADIUS Server:** Integrated 802.1x Authentication Server supporting EAP-PEAP

Element	Specifications
Security (continued)	**Time of Day Access:** Specify when access is allowed, per SSID or User Group **Station-Station Blocking:** Station-to-Station traffic blocking option
Wireless	**Wireless Standards:** 802.11a 802.11b 802.11d 802.11g 802.11e 802.11h 802.11i 802.11j 802.11n **Number of Radios:** **XN16**: 12 x 802.11a/n radios 4 x 802.11a/b/g/n radios Only 12 radios should be used as 802.11a/n radios (i.e., 5 GHz band) concurrently. 48 integrated antennas **XN12**: 8 x 802.11a/n radios 4 x 802.11a/b/g/n radios 36 integrated antennas **XN8**: 4 x 802.11a/n radios 4 x 802.11a/b/g/n radios Advanced RF design includes 36 integrated antennas **Spectrum Analyzer:** 1 integrated into Array

Element	Specifications
Wireless (continued)	**Frequency Bands:** 11a/n: 4.945 – 4.985 (restricted Public Safety band) 11a/n: 5.15-5.25 GHz (UNII 1) 11a/n: 5.15-5.25 GHz (TELEC) 11a/n: 5.25-5.35 GHz (UNII 2) 11a/n: 5.470-5.725 (ETSI) 11a/n: 5.725-5.825 GHz (UNII 3) 11b/g/n: 2.412-2.462 GHz (FCC) 11b/g/n: 2.412-2.472 GHz (ETSI) 11b/g/n: 2.412-2.484 GHz (TELEC) **Channel Selection:** Manual and Automatic **802.11a/n Antennas** Integrated 6dBi, sectorized **802.11b/g/n Antennas** Integrated 3dBi, sectorized **Wi-Fi Monitoring:** 1 Integrated Access Point can be set as a dedicated Wi-Fi Threat Sensor 2 dBi 360° omni-directional antenna **802.11a/b/g/n External Antenna Connectors:** 3 RP-TNC connectors (**NOTE**: TNC antenna connection is not for outside plant connection.)
Performance	**Client Load Balancing** Automatic load balancing between system radios

Element	Specifications
Compliance	**Electromagnetic:** ICES-003 (Canada) EN 301.893 (Europe) EN 301.489-1 and -17 (Europe) **Safety:** EN 60950 EN 50371 to 50385 CE Mark
Certifications	Wi-Fi Alliance: 802.11a/b/g, WPA, WPA2, and extended EAP types. Our certifications may be viewed here.
Warranty	**Hardware:** Five Year Standard (extendable) **Software:** 90 Days Standard (extendable)

See Also

Key Features and Benefits
Wi-Fi Array Product Overview
Product Specifications—XN4
Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700
Product Specifications—XS4/XS-3500
Power over Gigabit Ethernet (PoGE) (Optional)
The Xirrus Family of Products
Why Choose the Xirrus Wi-Fi Array?

Product Specifications—XN4

Element	Specifications
Number of Users	Maximum of 64 associated users per radio, 256 users per XN4
Physical	Diameter: 12.58 inches (31.95 cm) Height: 2.58 inches (6.55 cm) Weight: 4lbs (1.81 kg)
Environmental	**Operating Temperature:** 0°C to 55°C 0% to 90% relative humidity (non-condensing) **Storage Temperature:** -20°C to 60°C 5% to 95% relative humidity (non-condensing)
System	825 MHz CPU 512 MB RAM 1 GB system flash
Integrated Switch	2.1 Gbps integrated wireless switch
Chassis	Lockable mounting plate, Kensington lock slot
Electrical	XN4 supports Power over Gigabit Ethernet (PoGE) only, no splitter required PoGE (DC) Input Power: 48VDC, Maximum 2A Nominal Power: 35W For PoGE, see "Power over Gigabit Ethernet Compatibility Matrix" on page 414.

Element	Specifications
Interfaces	**Serial Console Port:** 1 x RS232 – RJ45 connector, for local configuration **Ethernet Interfaces:** 1 x Gigabit 100/1000 Mbps uplink port **Status LEDs:** System status, Ethernet, Radio
Networking	DHCP client, DHCP server (multiple DHCP pools), DNS Client, NTP client, NAT
Management	Xirrus Management System (XMS)—Layer 3 Element Management System HTTPS Web Management Interface (WMI) CLI via SSHv2, Telnet, local serial Console Enable/disable management for any interface Read-write and read-only admin accounts may be authenticated via RADIUS SNMP v2c, v3 Configuration Files—text-based files may be imported, exported, or compared NetFlow—IP flow information (traffic statistics may be sent to an external Collector FTP, TFTP Syslog reporting for alerts/alarms—messages may be stored on internal Syslog server or sent to up to three external syslog servers. Cisco Discovery Protocol (CDP)—obtain protocol addresses and platform information for neighboring devices

Element	Specifications
Quality of Service (QoS) Support	**Multiple SSIDs:** 16 unique SSIDs per Array Each SSID beacons a unique BSSID per radio VLAN and QoS settings for each SSID **VLANs:** Up to 16 VLANs, 802.1Q, 802.1p **Prioritization:** 802.11e wireless prioritization 802.1p wired prioritization Fair queuing of downstream traffic **Wireless Voice Support:** Spectralink Voice Priority (SVP) protocol

Element	Specifications
Security	**Wireless Encryption** Line speed, hardware-accelerated encryption modes: WPA TKIP WPA2 AES WEP 40/64 WEP 104/128 **Wireless Authentication:** Open Pre-shared Key 802.1X EAP PEAP EAP-TLS EAP-TTLS EAP-LEAP Pass-through Web Page Redirect (Captive Portal) MAC Address Access Control List (ACL) CHAP, PAP **Firewall:** Integrated stateful-inspection, rules-based firewall **IDS/IPS:** Integrates with Xirrus XDM Intrusion Detection/ Prevention System for real-time wireless security protection **Rogue AP detection and blocking:** Integrated Rogue AP detection and alerting via dedicated internal RF Threat Sensor. Rogue AP can be shielded **Integrated RADIUS Server:** Integrated 802.1x Authentication Server supporting EAP-PEAP

Element	Specifications
Security (continued)	**Time of Day Access:** Specify when access is allowed, per SSID or User Group **Station-Station Blocking:** Station-to-Station traffic blocking option
Wireless	**Wireless Standards:** 802.11a 802.11b 802.11d 802.11g 802.11e 802.11h 802.11i 802.11j 802.11n **Number of Radios:** 4 x 802.11a/b/g/n radios Advanced RF design includes 20 integrated antennas **Spectrum Analyzer:** 1 integrated into Array

Element	Specifications
Wireless (continued)	**Frequency Bands:** 11a/n: 4.945 – 4.985 (restricted Public Safety band) 11a/n: 5.15-5.25 GHz (UNII 1) 11a/n: 5.15-5.25 GHz (TELEC) 11a/n: 5.25-5.35 GHz (UNII 2) 11a/n: 5.470-5.725 (ETSI) 11a/n: 5.725-5.825 GHz (UNII 3) 11b/g/n: 2.412-2.462 GHz (FCC) 11b/g/n: 2.412-2.472 GHz (ETSI) 11b/g/n: 2.412-2.484 GHz (TELEC) **Channel Selection:** Manual and Automatic **802.11a/n Antennas** Integrated 6dBi, sectorized **802.11b/g/n Antennas** Integrated 3dBi, sectorized **Wi-Fi Monitoring:** 1 Integrated Access Point can be set as a dedicated Wi-Fi Threat Sensor 2 dBi 360° omni-directional antenna **802.11a/b/g/n External Antenna Connectors:** 1 RP-TNC connector (**NOTE**: TNC antenna connection is not for outside plant connection.)
Performance	**Client Load Balancing** Automatic load balancing between system radios

Element	Specifications
Compliance	**Electromagnetic:** ICES-003 (Canada) EN 301.893 (Europe) EN 301.489-1 and -17 (Europe) **Safety:** EN 60950 EN 50371 to 50385 CE Mark
Certifications	Wi-Fi Alliance: 802.11a/b/g, WPA, WPA2, and extended EAP types. Our certifications may be viewed here.
Warranty	**Hardware:** Five Year Standard (extendable) **Software:** 90 Days Standard (extendable)

See Also

Key Features and Benefits

Wi-Fi Array Product Overview

Product Specifications—XN16, XN12, and XN8

Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700

Product Specifications—XS4/XS-3500

Power over Gigabit Ethernet (PoGE) (Optional)

The Xirrus Family of Products

Why Choose the Xirrus Wi-Fi Array?

Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700

Element	Specifications
Number of Users	Maximum of 64 associated users per radio 1024 users per Array (XS16/XS-3900) 768 users per Array (XS12) 512 users per Array (XS8/XS-3700)
Physical	Diameter: 18.65 inches (47.37 cm) Height: 3.87 inches (9.83 cm) Weight: 8lbs (3.63 kg)
Environmental	**Operating Temperature:** -10°C to 50°C 0% to 90% relative humidity (non-condensing) **Storage Temperature:** -20°C to 60°C 5% to 95% relative humidity (non-condensing)
System	**XS16/XS12/XS8:** 1 GHz CPU 1 GB RAM 1 GB system flash Expansion slot for future options **XS-3900/XS-3700:** 825 MHz CPU 512 MB RAM (XS-3900/XS-3700) 512 MB system flash Expansion slot for future options

Element	Specifications
Interfaces	**Serial:** 1 x RS232 – RJ45 connector **Ethernet Interfaces:** 2 x Gigabit 100/1000 Mbps w/failover 1 x Fast Ethernet 10/100 Mbps **Status LEDs:** System status, Ethernet, Radio
Electrical	**XS16/XS8:** Each Array supports both AC and PoGE AC Input Power: 90-265VAC at 47-63Hz PoGE Input Power: Power over Gigabit Ethernet—no splitter required, 48VDC Nominal Power: XS16: 70W XS8: 45W **XS-3900/XS-3700:** Separate AC and DC versions Input Power (AC version): 90VAC to 265VAC at 47Hz to 63Hz Input Power (DC version): 48VDC PoGE: requires modified DC version and splitter. **All Models:** For PoGE, see “Power over Gigabit Ethernet Compatibility Matrix” on page 414.
Networking	DHCP client, DHCP server, NTP client, NAT
VLAN Support	802.1Q, 802.1p VLAN Supports up to 16 VLANs
Multiple SSID Support	Allows up to 16 separate SSIDs to be defined with map security, VLAN and QoS settings for each SSID

Element	Specifications
Performance	**Client Load Balancing** Automatic load balancing between system radios **Quality of Service:** 802.1p wired traffic prioritization Wireless packet prioritization MAP CoS to TCID Fair queuing of downstream traffic
Security	**Wireless Security:** WEP 40bit/128bit encryption WPA and WPA2 with TKIP and AES encryption Rogue AP detection, with alerts and classification **User and System Authentication:** WPA and WPA2 Pre-Shared Key authentication Internal RADIUS Server, supports EAP-PEAP only 802.1x EAP-TLS 802.1x EAP-TTLS/MSCHAPv2 802.1x PEAPv0/EAP-MSCHAPv2 802.1x PEAPv1/EAP-GTC 802.1x EAP-SIM 802.1x EAP-LEAP Passthrough External RADIUS servers Authentication of Wi-Fi Arrays to the Xirrus Management System (XMS)

Element	Specifications
Wireless	**Number of Radios:** **XS16/XS-3900**: 12 x 802.11a radios 4 x 802.11a/b/g radios Only 12 radios should be used as 802.11a radios concurrently. **XS12**: 8 x 802.11a radios 4 x 802.11a/b/g radios **XS8/XS-3700**: 4 x 802.11a radios 4 x 802.11a/b/g radios **Wireless Standards:** 802.11a/b/g and g-only mode 802.11e, 802.11i **Channel Selection:** Manual and Automatic **Frequency Bands:** 11a: 4.945 – 4.985 (restricted Public Safety band) 11a: 5.15-5.25 GHz (UNII 1) 11a: 5.15-5.25 GHz (TELEC) 11a: 5.25-5.35 GHz (UNII 2) 11a: 5.470-5.725 (ETSI) 11a: 5.725-5825 GHz (UNII 3) 11b/g: 2.412-2.462 GHz (FCC) 11b/g: 2.412-2.472 GHz (ETSI) 11b/g: 2.412-2.484 GHz (TELEC) **Antennas (XS16/XS-3900):** 12 x internal 6 dBi 60° 802.11a sectorized 4 x internal 3 dBi 180° 802.11b/g sectorized 1 x internal 2 dBi 360° omni-directional (for RF monitoring) 3 x external RP-TNC connectors for three 802.11a/b/g radios *

Element	Specifications
Wireless (continued)	**Antennas (XS12):** 8 x internal 6 dBi 60° 802.11a sectorized 4 x internal 3 dBi 180° 802.11b/g sectorized 1 x internal 2 dBi 360° omni-directional (for RF monitoring) 3 x external RP-TNC connectors for three 802.11a/b/g radios * **Antennas (XS8/XS-3700):** 4 x internal 6 dBi 60° 802.11a sectorized 4x internal 3 dBi 180° 802.11b/g sectorized 1 x internal 2 dBi 360° omni-directional (for RF monitoring) 3 x external RP-TNC connectors for three 802.11a/b/g radios * **Radio Approvals:** FCC (United States) and EN 301.893 (Europe) * Note: External RP-TNC antenna connectors are not for outside plant connection.
Management	Web-based HTTPS SNMP v2c, v3 CLI via SSHv2 or Telnet FTP TFTP Serial Xirrus Management System (XMS) Syslog reporting for alerts/alarms

Element	Specifications
Compliance	UL / cUL 60950 and EN 60950 FCC Part 15.107 and 15109, Class A EN 301.489 (Europe) EN60601 EU medical equipment directive for EMC
Certifications	Wi-Fi Alliance: 802.11a/b/g, WPA, WPA2, and extended EAP types. Our certifications may be viewed here. Federal Information Processing Standard (FIPS) Publication 140 -2, Level 2.
Warranty	One year (hardware and software)

See Also

Key Features and Benefits

Wi-Fi Array Product Overview

Product Specifications—XN4

Product Specifications—XN16, XN12, and XN8

Product Specifications—XS4/XS-3500

Power over Gigabit Ethernet (PoGE) (Optional)

The Xirrus Family of Products

Why Choose the Xirrus Wi-Fi Array?

Product Specifications—XS4/XS-3500

Element	Specifications
Number of Users	Maximum of 64 associated users per radio (256 users per Array)
Physical	Diameter: 12.58 inches (31.95 cm) Height: 2.58 inches (6.55 cm) Weight: 4lbs (1.81 kg)
Environmental	**Operating Temperature:** -10°C to 50°C 0% to 90% relative humidity (non-condensing) **Storage Temperature:** -20°C to 60°C 5% to 95% relative humidity (non-condensing)
System	825 MHz CPU (XS4) 666 MHz CPU (XS-3500) 512 MB RAM, expandable (XS4) 256 MB RAM, expandable (XS-3500) 512 MB system flash, expandable Expansion slot for future options

Element	Specifications
Electrical	**XS4:** Each Array supports both AC and PoGE AC Input Power: 90-265VAC at 47-63Hz Nominal power usage: 27W **XS-3500:** AC Input Power: 90-265VAC at 47-63Hz Input Power (DC version): 48VDC **All Models:** Power over Gigabit Ethernet (PoGE): all 4-port models work with all Xirrus PoGE modules, splitter required, 48VDC See "Power over Gigabit Ethernet Compatibility Matrix" on page 414.
Interfaces	**Serial:** 1 x RS232 – RJ45 connector **Ethernet Interfaces:** 1 x Gigabit 100/1000 Mbps **Status LEDs:** System status, Ethernet, Radio
Management	Web-based HTTPS SNMP v2c, v3 CLI via SSHv2 or Telnet FTP TFTP Serial Xirrus Management System (XMS) Syslog reporting for alerts/alarms
Networking	DHCP client, DHCP server, NTP client, NAT

Element	Specifications
VLAN Support	802.1Q, 802.1p VLAN Supports up to 16 VLANs
Multiple SSID Support	Allows up to 16 separate SSIDs to be defined with map security, VLAN and QoS settings for each SSID
Performance	**Client Load Balancing** Automatic load balancing between system radios **Quality of Service:** 802.1p wired traffic prioritization Wireless packet prioritization MAP CoS to TCID Fair queuing of downstream traffic
Security	**Wireless Security:** WEP 40bit/128bit encryption WPA and WPA2 with TKIP and AES encryption Rogue AP detection, with alerts and classification **User and System Authentication:** WPA Pre-Shared Key authentication Internal RADIUS Server, supports EAP-PEAP only 802.1x EAP-TLS 802.1x EAP-TTLS/MSCHAPv2 802.1x PEAPv0/EAP-MSCHAPv2 802.1x PEAPv1/EAP-GTC 802.1x EAP-SIM 802.1x EAP-LEAP Passthrough External RADIUS servers Authentication of Wi-Fi Arrays to the Xirrus Management System (XMS)

Element	Specifications
Wireless	**Number of Radios:** 4 x 802.11a/b/g radios **Wireless Standards:** 802.11a/b/g and g-only mode 802.11e, 802.11i **Channel Selection:** Manual and Automatic **Frequency Bands:** 11a: 4.945 – 4.985 (restricted Public Safety band) 11a: 5.15-5.25 GHz (UNII 1) 11a: 5.15-5.25 GHz (TELEC) 11a: 5.25-5.35 GHz (UNII 2) 11a: 5.470-5.725 (ETSI) 11a: 5.725-5825 GHz (UNII 3) 11b/g: 2.412-2.462 GHz (FCC) 11b/g: 2.412-2.472 GHz (ETSI) 11b/g: 2.412-2.484 GHz (TELEC) **Antennas (XS-3500):** 4 x internal 3 dBi 180° 802.11b/g sectorized 1 x internal 2 dBi 360° omni-directional (for RF monitoring) 1 x external RP-TNC connector for one 802.11a/b/g radio (**NOTE**: TNC antenna connection is not for outside plant connection.) **Radio Approvals:** FCC (United States) and EN 301.893 (Europe)
Compliance	UL / cUL 60950 and EN 60950 FCC Part 15.107 and 15109, Class A EN 301.489 (Europe) EN60601 EU medical equipment directive for EMC

Element	Specifications
Certifications	Wi-Fi Alliance: 802.11a/b/g, WPA, WPA2, and extended EAP types. Our certifications may be viewed here. Federal Information Processing Standard (FIPS) Publication 140 -2, Level 2.
Warranty	One year (hardware and software)

See Also

Key Features and Benefits

Wi-Fi Array Product Overview

Product Specifications—XN16, XN12, and XN8

Product Specifications—XN4

Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700

Power over Gigabit Ethernet (PoGE) (Optional)

The Xirrus Family of Products

Why Choose the Xirrus Wi-Fi Array?

Installing the Wi-Fi Array

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

Installation Prerequisites

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

- **Power Source**

  Most Arrays are powered via Xirrus 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 port 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.

  Specific models of the Array are compatible with specific PoGE modules. For details, please see **"Power over Gigabit Ethernet Compatibility Matrix" on page 414.**

  If your Arrays are equipped to accept AC power (and you are not using PoGE), you need a dedicated power outlet to supply AC power to each unit deployed at the site.

- **Ethernet port**
  You need at least one 100/1000 BaseT port to establish wired Gigabit Ethernet connectivity (via the product's Gigabit 1 or Gigabit 2 port) and one 10/100 BaseT port (if desired) for product management.

  ! *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 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, "Port Failover Protection" on page 67.*

  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 336.

- **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 6.0 or higher), Netscape Navigator (version 7.0 or higher), or Mozilla Firefox (version 1.01 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, 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 Wi-Fi 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 Wi-Fi Array should only be used with Wi-Fi certified client devices.

See Also

Coverage and Capacity Planning
Deployment Examples
Failover Planning
Planning Your Installation

Planning Your Installation

This section provides guidelines and examples to help you plan your Xirrus Wi-Fi 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 48
- "Coverage and Capacity Planning" on page 50
- "IEEE 802.11n Deployment Considerations" on page 59
- "Failover Planning" on page 67
- "Power Planning" on page 69
- "Security Planning" on page 70
- "Port Requirements" on page 72
- "Network Management Planning" on page 75
- "WDS Planning" on page 76
- "Common Deployment Options" on page 79

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

General Deployment Considerations

The Wi-Fi 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. 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.

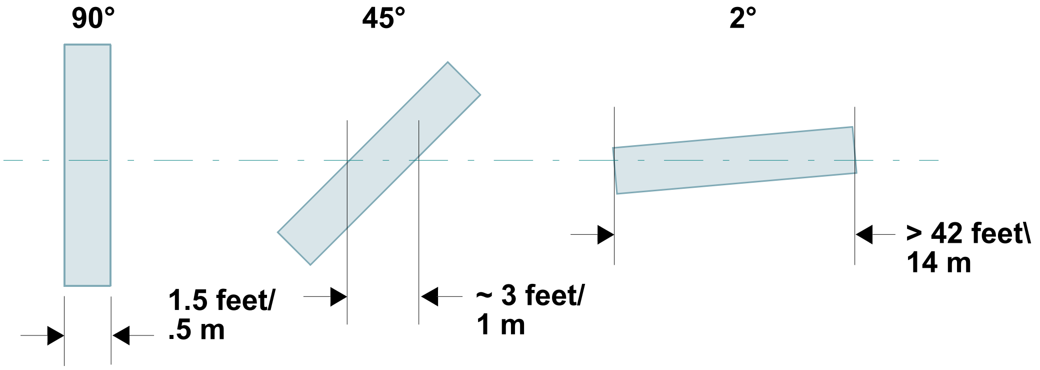


Figure 10. Wall Thickness Considerations

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

Deployment Examples

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.

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

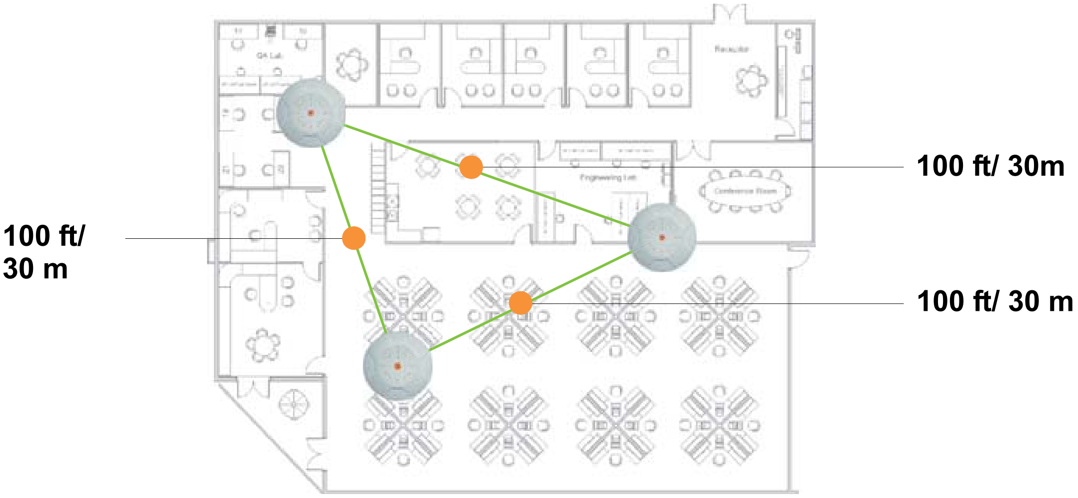


Figure 11. Unit Placement

RF Patterns

The Wi-Fi 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.

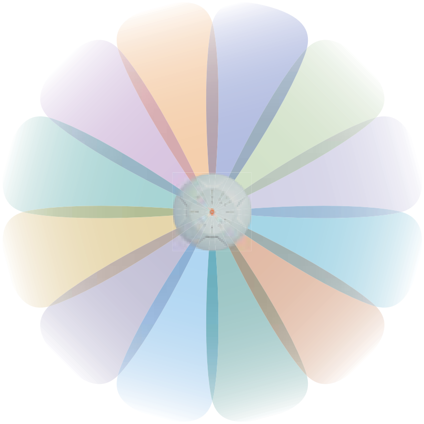


Figure 12. Full (Normal) Coverage

Half Coverage

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.

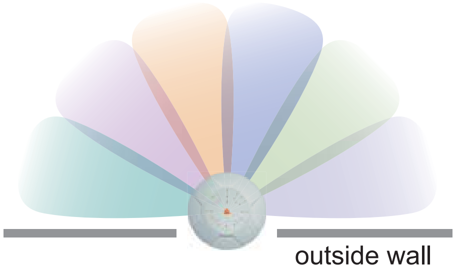


Figure 13. Adjusting RF Patterns

Custom Coverage

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

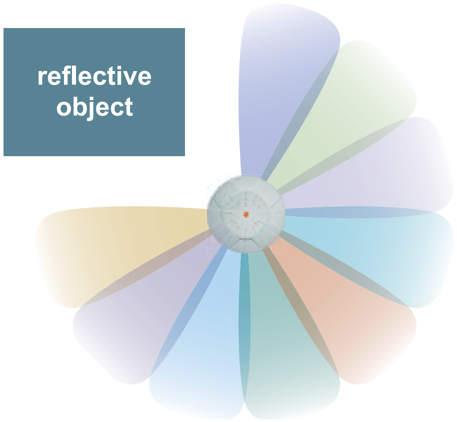


Figure 14. Custom Coverage

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.

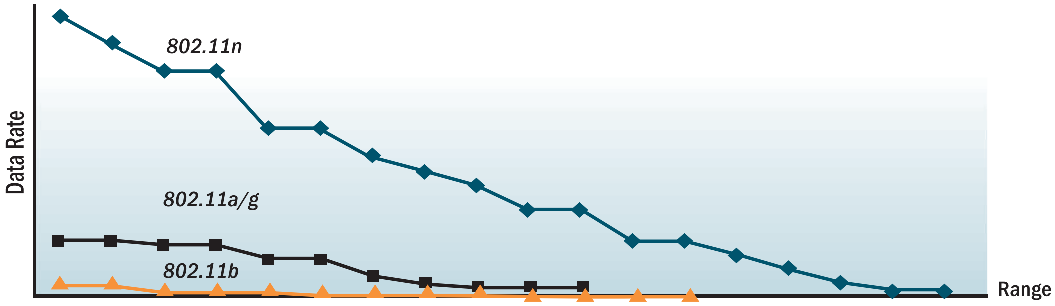


Figure 15. Connection Rate vs. Distance

Figure 15 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 XS4 and XN4 have 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.

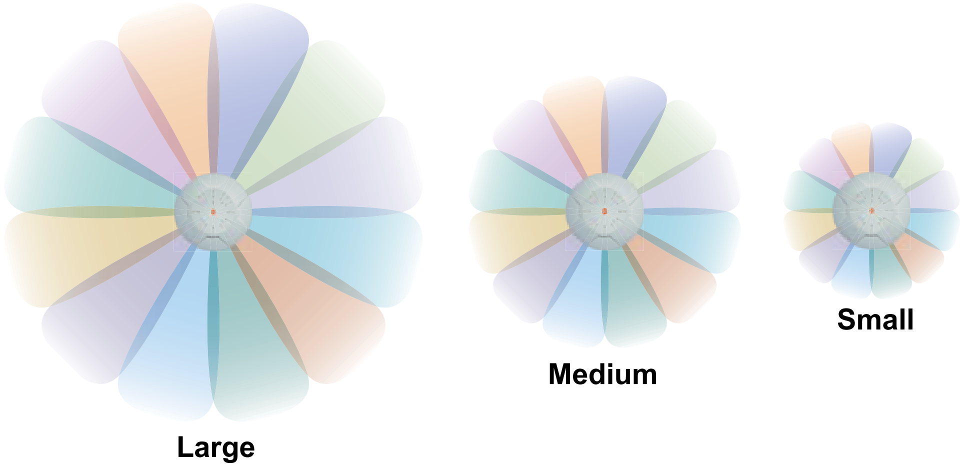


Figure 16. Transmit Power

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 279. For a complete discussion of the Auto Cell size feature, see the *Xirrus Auto Cell Application Note* in the ***Xirrus Library***.

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 50.

Sharp Cell

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 Wi-Fi Arrays or other Access Points. To enable the Sharp Cell feature, go to "RF Power & Sensitivity" on page 279. For more information about this feature, see the *Xirrus Sharp Cell Application Note* in the *Xirrus Library*.

Roaming Considerations

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

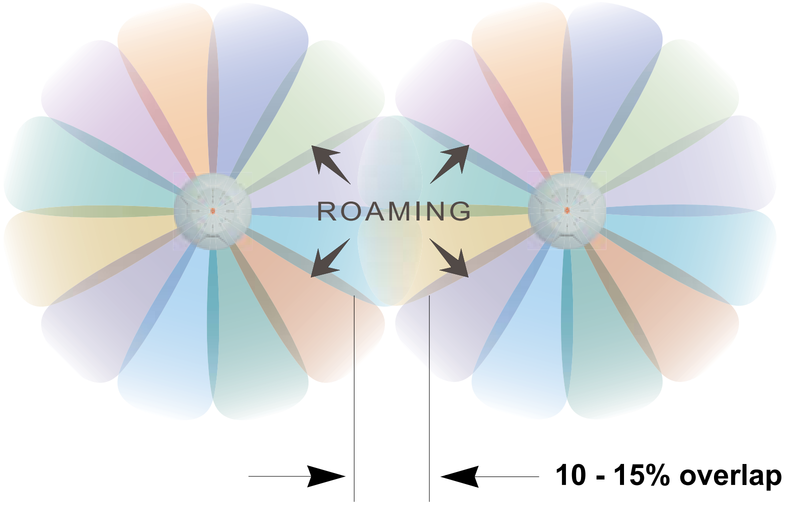


Figure 17. Overlapping Cells

Allocating Channels

Because the Wi-Fi 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 Wi-Fi 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 275. For more information about this feature, see the *Xirrus Auto Channel Application Note* in the ***Xirrus Library***.

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.

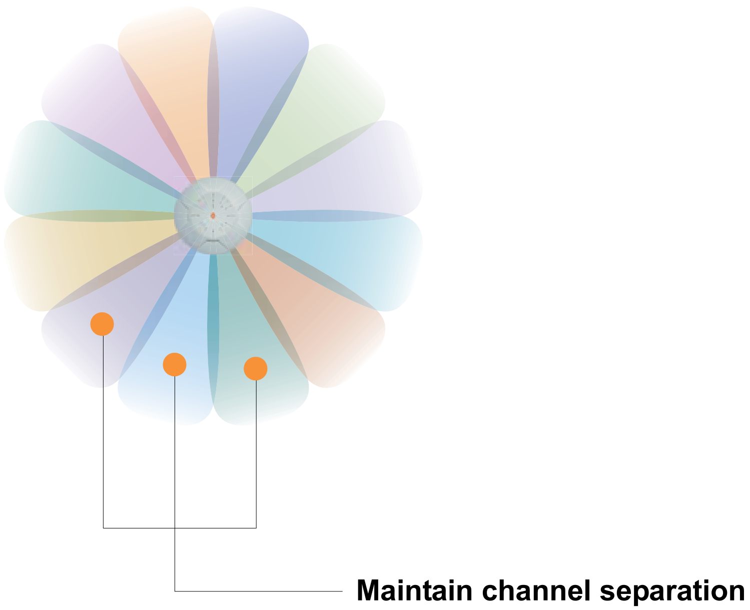


Figure 18. Allocating Channels Manually

See Also

Deployment Examples

Failover Planning

Installation Prerequisites

Deployment Examples

The following examples employ 802.11a cells, each offering minimum throughputs of 54 Mbps, 36 Mbps, and 18 Mbps per sector respectively, and assume a floor plan covering a total area of about 60,000 square feet (5574 sq m).

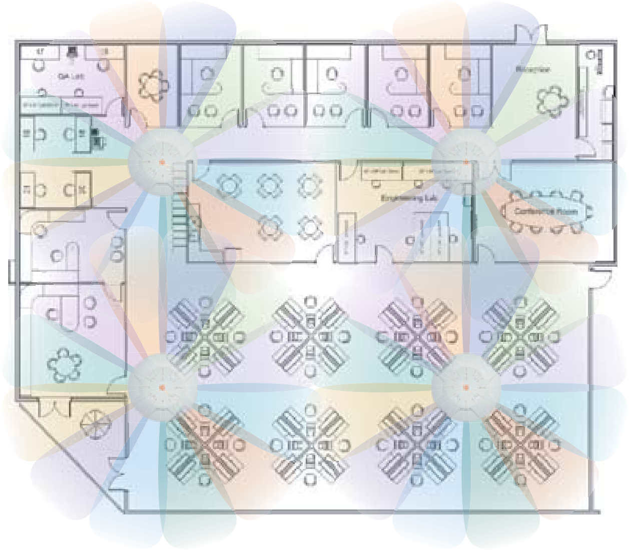


Figure 19. Deployment Scenario (54 Mbps)—Per Sector

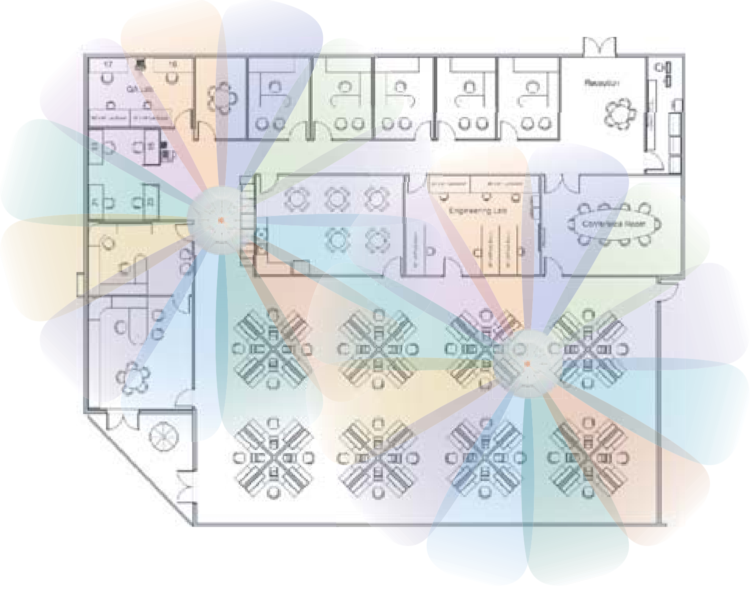


Figure 20. Deployment Scenario (36 Mbps)—Per Sector

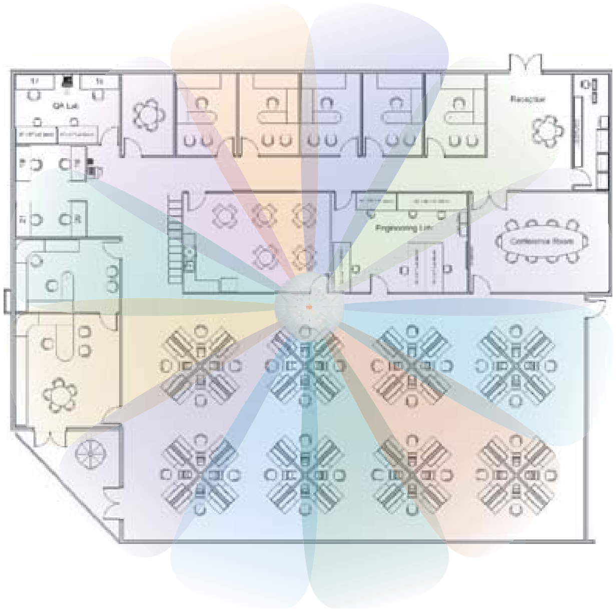


Figure 21. Deployment Scenario (18 Mbps)—Per Sector

See Also

Coverage and Capacity Planning

Failover Planning

Planning Your Installation

IEEE 802.11n Deployment Considerations

IEEE 802.11n features are supported only on XN Array models, and this section applies only to those Arrays.

The Xirrus XN 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 60
- "Multiple Data Streams—Spatial Multiplexing" on page 62
- "Channel Bonding" on page 63
- "Improved MAC Throughput" on page 64
- "Short Guard Interval" on page 64
- "Obtaining Higher Data Rates" on page 65
- "802.11n Capacity" on page 66

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 273 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 22)

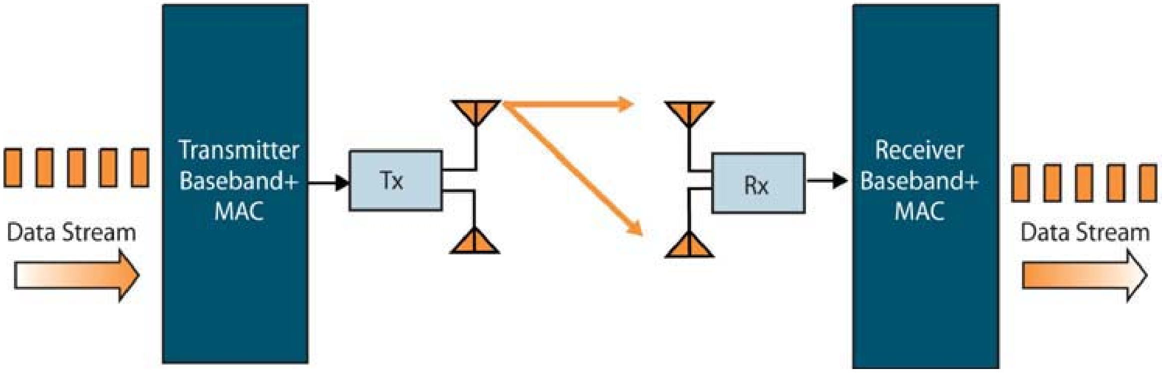


Figure 22. Classic 802.11 Signal Transmission

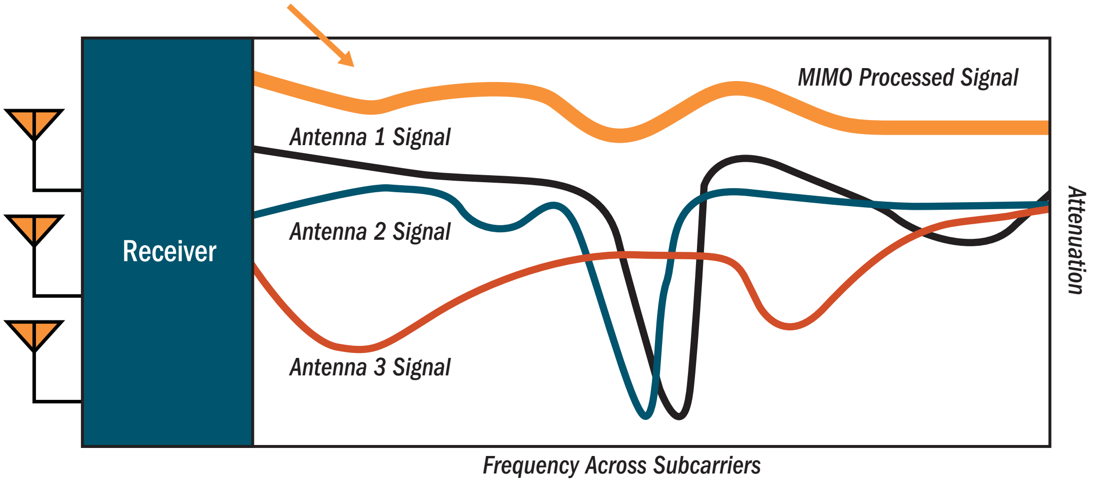


Figure 23. MIMO Signal Processing

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 23). 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.

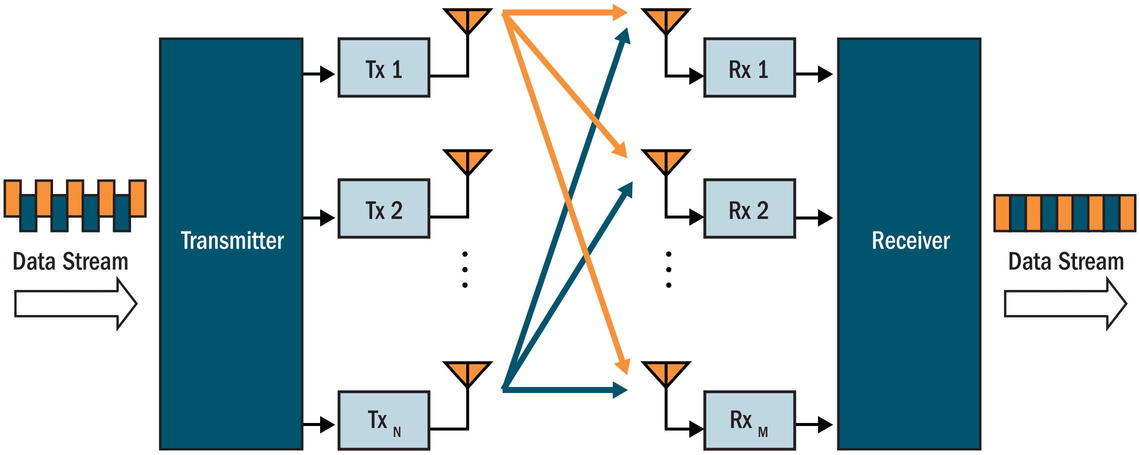


Figure 24. Spatial Multiplexing

Spatial multiplexing can double, triple, or quadruple the date rate, depending on the number of transmit antennas used. The Array uses three chains for transmitting and receiving.

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 273. To configure channel bonding manually, on a per-IAP basis, see "IAP Settings" on page 255.

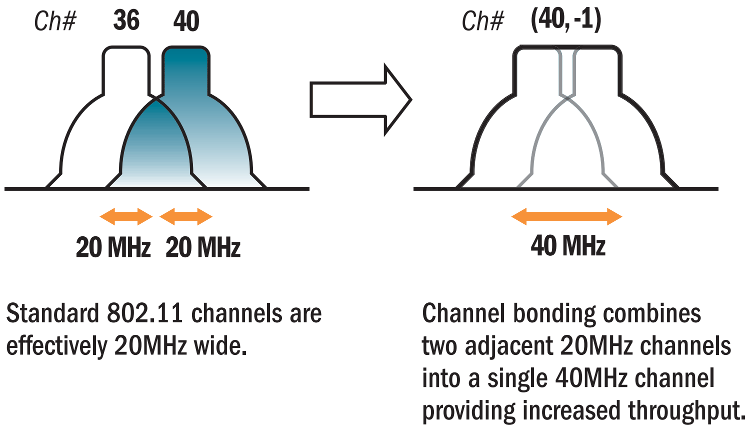

Ch#
36
40
20 MHz
20 MHz
Standard 802.11 channels are effectively 20MHz wide.
Ch#
(40, -1)
40 MHz
Channel bonding combines two adjacent 20MHz channels into a single 40MHz channel providing increased throughput.

Figure 25. 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.

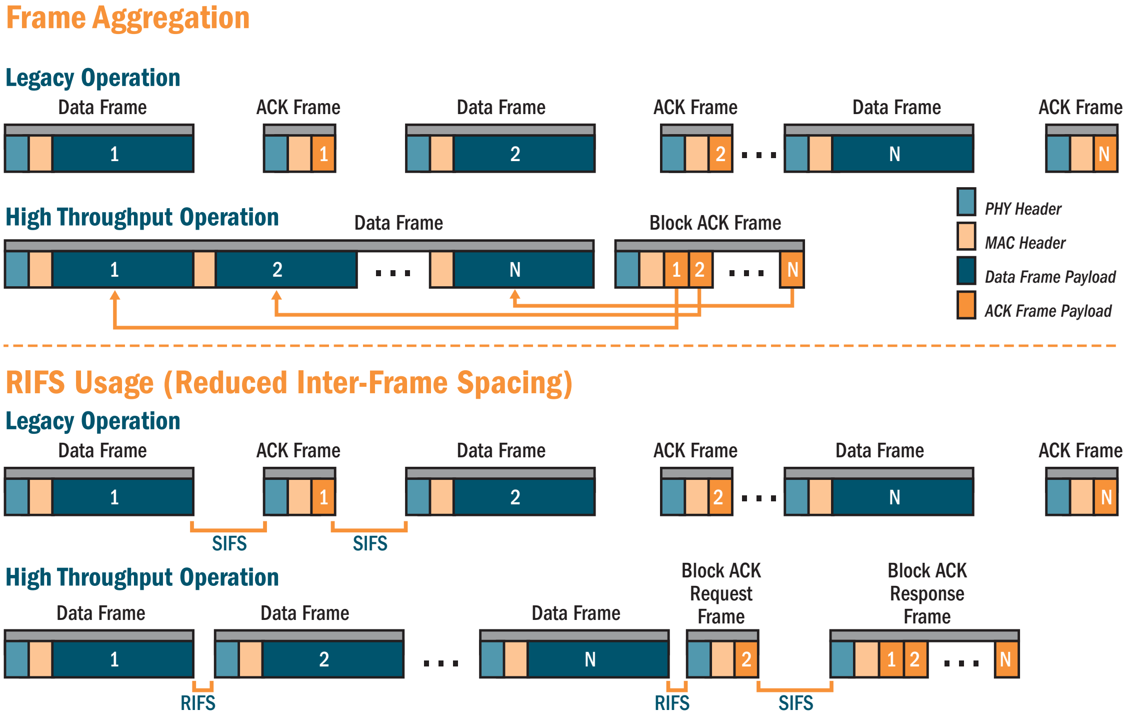


Figure 26. MAC Throughput Improvements

Short Guard Interval

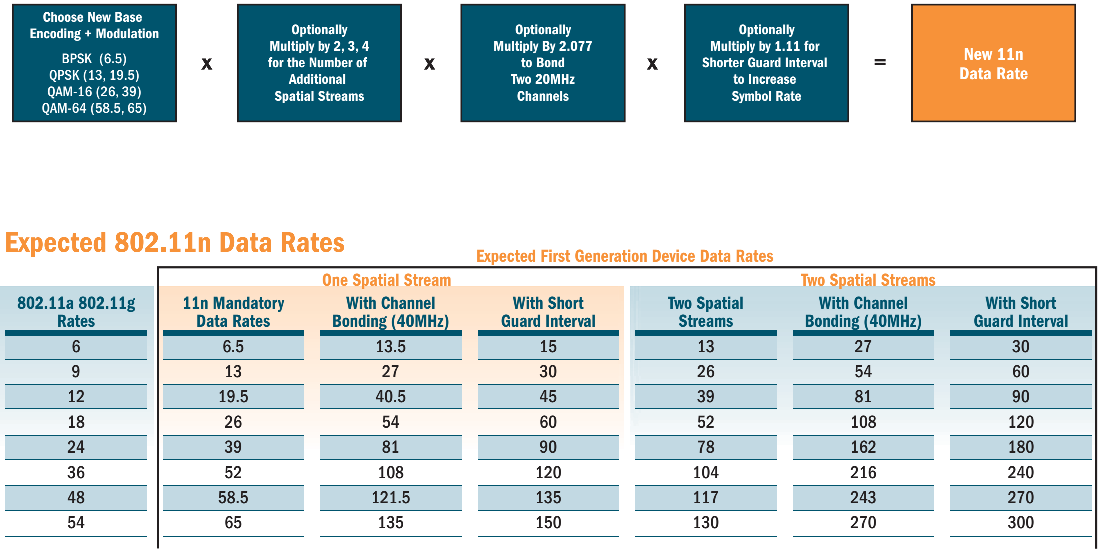
This option reduces the wait time between signals that are being sent out over the air. The guard interval provides immunity to propagation delays and reflections, and is normally 800 ns (long). By using a short guard interval (400 ns), the data rate is increased by approximately 11%. The short interval 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 273 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 27 to compute your 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.

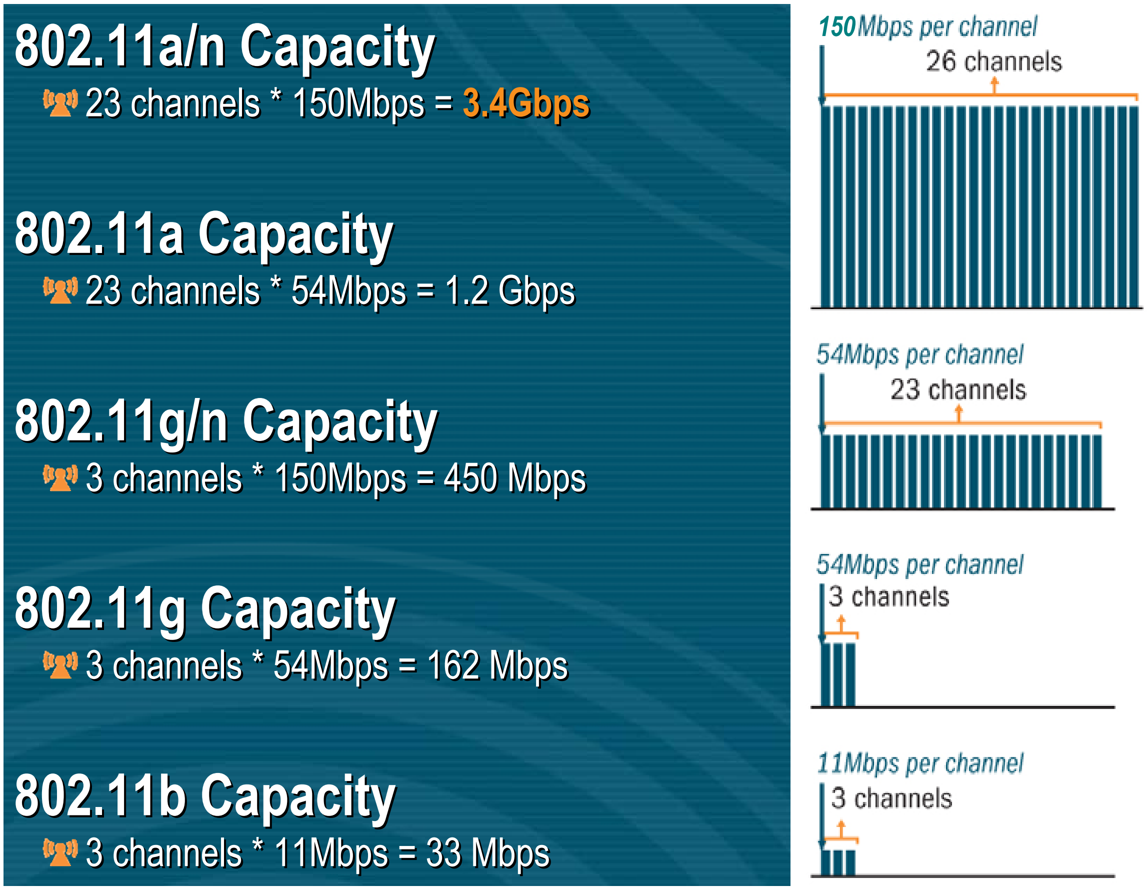

Choose New Base Encoding + Modulation
BPSK (6.5)
QPSK (13, 19.5)
QAM-16 (26, 39)
QAM-64 (58.5, 65)
x
Optionally Multiply by 2, 3, 4 for the Number of Additional Spatial Streams
x
Optionally Multiply By 2.077 to Bond Two 20MHz Channels
x
Optionally Multiply by 1.11 for Shorter Guard Interval to Increase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

Figure 27. Computing 802.11n Data Rates

802.11n Capacity

802.11n offers major increases in capacity over previous 802.11 standards, as shown in Figure 28. Note that this chart shows figures for 802.11n (with one spatial stream and channel bonding).



802.11a/n Capacity

23 channels * 150Mbps = 3.4Gbps

802.11a Capacity

23 channels * 54Mbps = 1.2 Gbps

802.11g/n Capacity

3 channels * 150Mbps = 450 Mbps

802.11g Capacity

3 channels * 54Mbps = 162 Mbps

802.11b Capacity

3 channels * 11Mbps = 33 Mbps

Figure 28. 802.11n Increases Capacity

Failover Planning

This section discusses failover protection at the unit and port levels.

Port Failover Protection

To ensure that service is continued in the event of a port failure, you can utilize the Gigabit 1 and Gigabit 2 ports simultaneously.

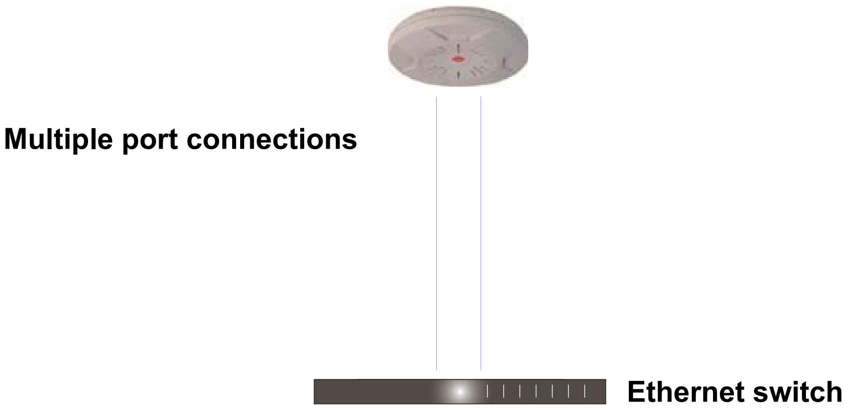


Figure 29. Port Failover Protection

In addition, the Array has full failover protection between the Gigabit 1 and Gigabit 2 Ethernet ports (see following table).

Interface	Bridges Data?	Bridges Management Traffic?	Fails Over To:	IP address
Fast Ethernet	No	Yes	None	DHCP or static
Gigabit 1	Yes	Yes	Gigabit 2	DHCP or static
Gigabit 2	Yes	Yes	Gigabit 1	Assumes the IP address of Gigabit 1

The Wi-Fi Array Gigabit Ethernet ports actually support a number of modes:

- 802.3ad Link Aggregation

- Load Balancing
- Broadcast
- Link Backup
- Bridged
- Mirrored

For more details on Gigabit port modes and their configuration, please see "Network Interface Ports" on page 184.

Switch Failover Protection

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

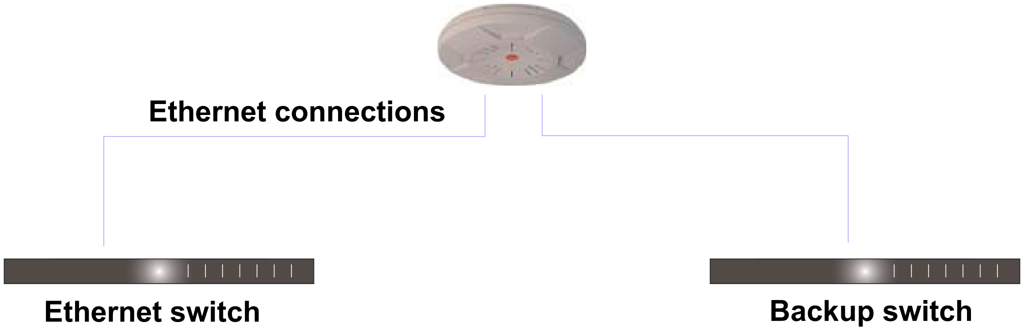


Figure 30. Switch Failover Protection

Gigabit Ethernet connections must be on the same subnet.

See Also

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

Power Planning

All XN Series Array models and XS16/12/8/4 Arrays support Power over Gigabit Ethernet (PoGE) with an integrated splitter. AC power is also supported on all XN Arrays and some versions of the XS8, XS12, and XS16.

This section discusses the AC and PoGE power options.

AC Power

The AC power option requires a direct connection between the Array and a dedicated AC power outlet. The power cord is provided with the unit.

Power over Gigabit Ethernet

To deliver power to the Array, you may use the optional XP1 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 5 on page 13.

Specific models of the Array are compatible with specific PoGE modules. For details, please see **"Power over Gigabit Ethernet Compatibility Matrix" on page 414.**

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

See Also

Coverage and Capacity Planning
Deployment Examples
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 210 and the Security section of "Frequently Asked Questions" on page 398.

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 Wi-Fi 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 Wi-Fi Array supports 1,000 ACL entries.

Meeting PCI DSS Standards

The Payment Card Industry (PCI) Data Security Standard (DSS) was developed by major credit card companies. It lays out a set of requirements that must be met in order to provide adequate security for sensitive data. The the Wi-Fi Array may be configured to satisfy PCI DSS standards. For details, please see Appendix D: Implementing PCI DSS.

Meeting FIPS Standards

The Federal Information Processing Standard (FIPS) Publication 140-2 establishes a computer security standard used to accredit cryptographic modules. The standard is a joint effort by the U.S. and Canadian governments. To implement Level 2 security requirements of FIPS Level 2 on the Wi-Fi Array, see Appendix E: Implementing FIPS Security.

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 73 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 31. 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.

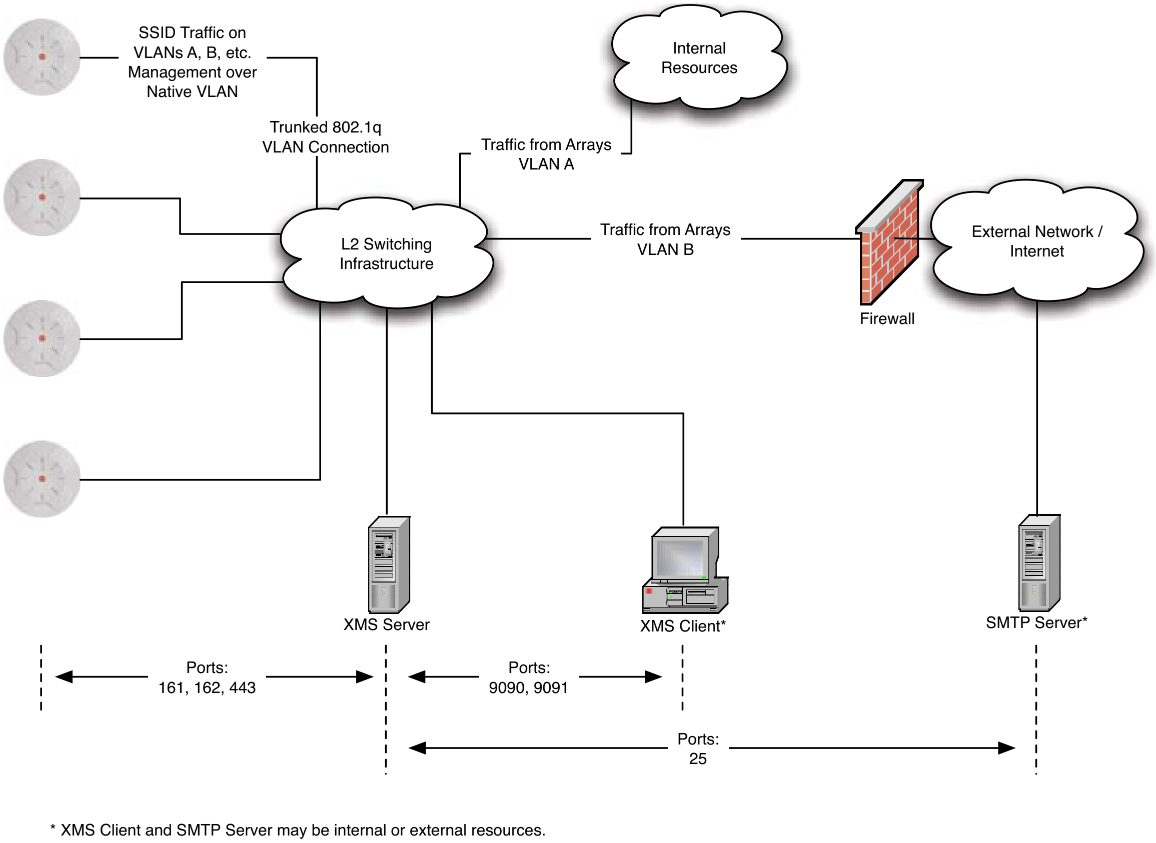

SSID Traffic on VLANs A, B, etc. Management over Native VLAN
Trunked 802.1q VLAN Connection
Internal Resources
Traffic from Arrays VLAN A
L2 Switching Infrastructure
Traffic from Arrays VLAN B
Firewall
External Network / Internet
XMS Server
XMS Client*
SMTP Server*
Ports: 161, 162, 443
Ports: 9090, 9091
Ports: 25
* XMS Client and SMTP Server may be internal or external resources.

Figure 31. 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			
20 tcp 21 udp	FTP	Client	Yes
22 tcp	SSH	Client	Yes
23 tcp	Telnet	Client	Yes
25 tcp	SMTP	Mail Server	No
69 tcp	TFTP	TFTP Server	No
161 tcp/udp	SNMP	XMS Server	No
162 tcp/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

Port	Application	Peer	Configurable
XMS			
25 tcp	SMTP	Mail Server	Yes
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
* 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 (XM-3300) or your own server. The XMS is used for managing large Wi-Fi 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 32). WDS features include:

- One to three IAPs may be used to form a single WDS link, yielding up to 900 Mbps bandwidth per link (up to 162 Mbps for XS model Arrays). 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.

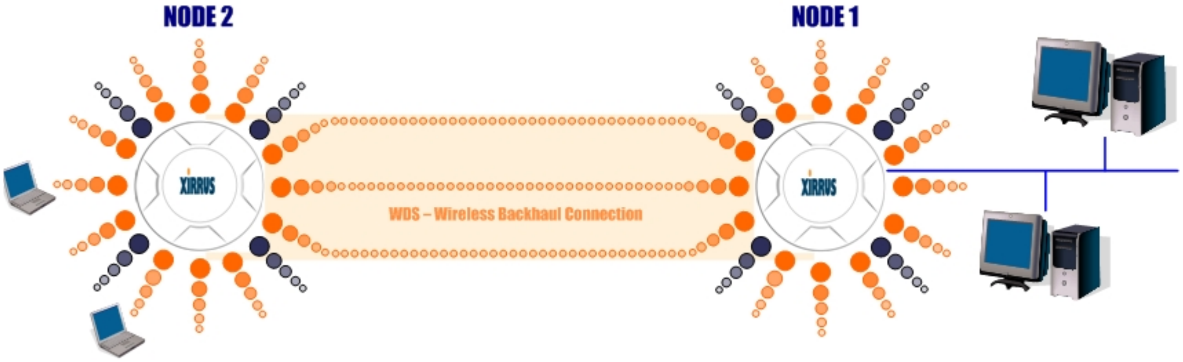


Figure 32. WDS Link

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

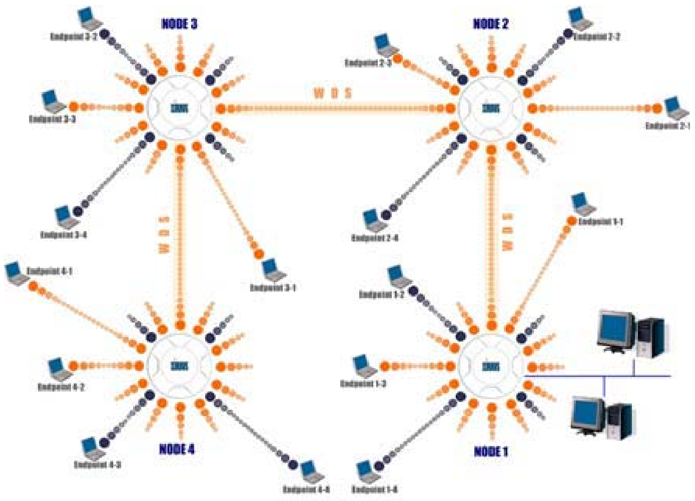


Figure 33. A Multiple Hop WDS Connection

- Multiple WDS links can provide link redundancy (failover capability - see Figure 34). A network protocol (Spanning Tree Protocol—STP) prevents Arrays from forming network loops.

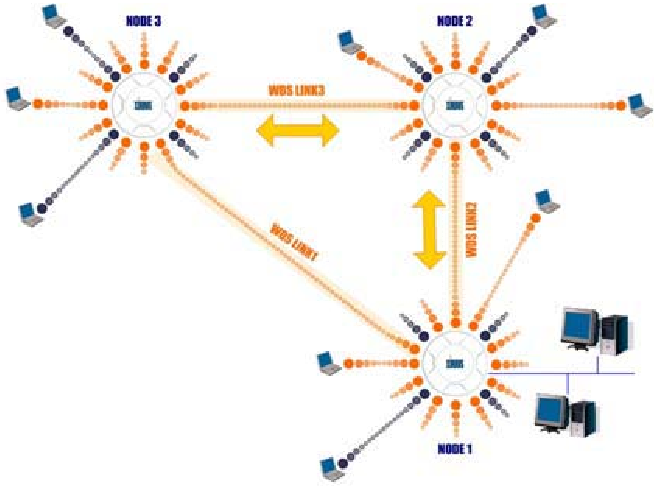


Figure 34. WDS Failover Protection

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 285. 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 Wi-Fi Arrays	
	One or Two	Three or More
Power	AC (some Array models) Power over Gigabit Ethernet	AC (some Array models) 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
Deployment Examples
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 Wi-Fi Array successfully. Review this flowchart before attempting to install the unit on a customer's network.

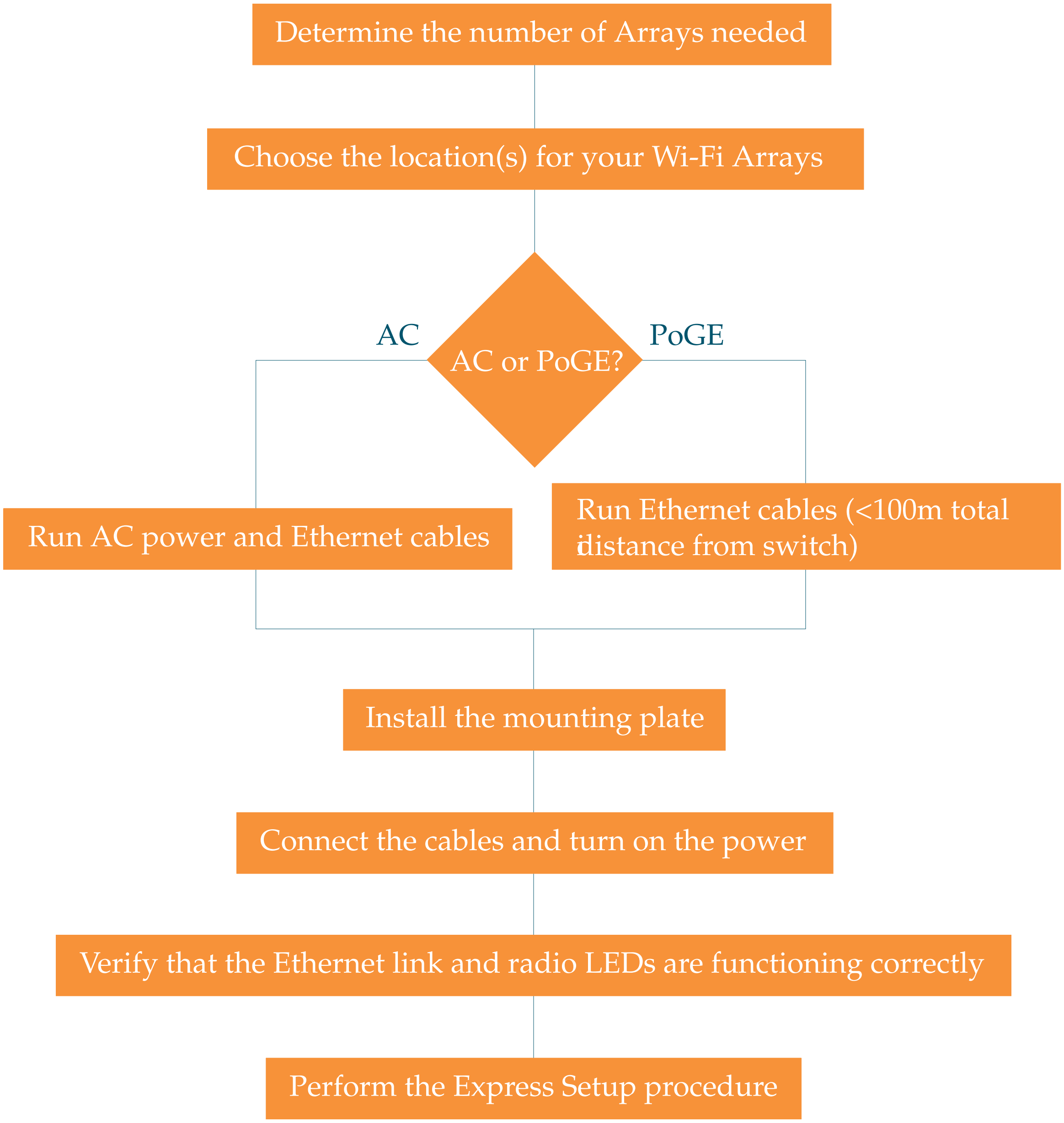

Determine the number of Arrays needed
Choose the location(s) for your Wi-Fi Arrays
AC
AC or PoGE?
PoGE
Run AC power and Ethernet cables
Run Ethernet cables (<100m total distance from switch)
Install the mounting plate
Connect the cables and turn on the power
Verify that the Ethernet link and radio LEDs are functioning correctly
Perform the Express Setup procedure

Figure 35. Installation Workflow

See Also

Coverage and Capacity Planning
Deployment Examples
Common Deployment Options
Failover Planning
Installation Prerequisites
Planning Your Installation
Power Planning
Wi-Fi Array Product Overview
Product Specifications—XN16, XN12, and XN8
Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700
Product Specifications—XS4/XS-3500
Security Planning

Unpacking the Wi-Fi Array

When you unpack your Wi-Fi Array, you will find the following items in the carton:

Item	Quantity
Xirrus Wi-Fi Array	1
AC power cord (for AC-equipped models)	1
Console cable	1
Mounting plate	1
Mounting screws	4
Tile grid mounting clamps	4
Clamp nuts	4
Mounting template	1

Item	Quantity
CD-ROM containing: This User's Guide in PDF format End User License Agreement (EULA) README file	1
Quick Install Guide	1
Registration Card	1

See Also

Installation Prerequisites

Installation Workflow

Installing Your Wi-Fi Array

This section provides instructions for completing a physical installation of your Xirrus Wi-Fi 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 Wi-Fi 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. For wall mount instructions, go to "Mounting Array on a Wall (All models except 4-port Arrays)" on page 96.

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

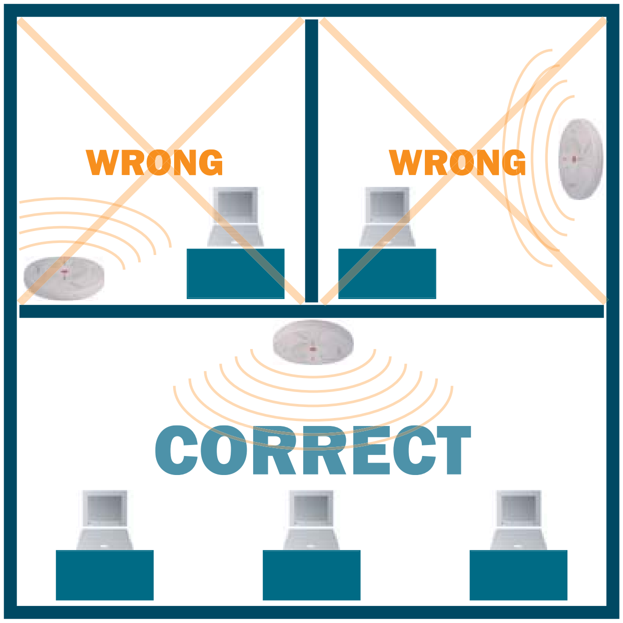


Figure 36. Array Placement

Wiring Considerations

If you are using the Xirrus Power over Gigabit Ethernet modules (PoGE) to distribute power, see "Power over Gigabit Ethernet (PoGE) (Optional)" on page 13. If you prefer to use AC power and you have an Array that supports AC, an AC power outlet must be available to the Array.

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

Power

One of the following options:

- No power cable is required if using PoGE modules.
- Dedicated AC power if PoGE is not in use. A UL-approved cord is shipped with all AC-equipped Arrays. You must use a UL-approved cord if using AC power.

Network

- Gigabit 1—If using PoGE modules, the total of all Cat 5e or Cat 6 cable segments from the Gigabit Ethernet switch to the Array 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 2 (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.

! *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, "Port Failover Protection" on page 67.*

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 336.

See Also

Failover Planning
Installation Prerequisites
Installation Workflow
Mounting the Wi-Fi Array on a Wall (XS4 and XS-3500)
Mounting Array on a Wall (All models except 4-port Arrays)
Mounting the Array on a Ceiling
Power over Gigabit Ethernet (PoGE) (Optional)
Unpacking the Wi-Fi Array

Mounting the Array on a Ceiling

Most offices have drop-down acoustical ceiling tiles set into a standard grid. The Wi-Fi Array has been designed to enable mounting to a tiled ceiling via a mounting plate and clamps that attach to the grid. Once the mounting plate is attached, the Array simply rotates onto the plate (similar to a smoke detector). Once the unit is mounted it can be removed and re-attached easily, without the need for tools or modifications to the original installation.

This section assumes that you are mounting the Array to a tiled ceiling. If your ceiling is not tiled, the mounting plate can be attached directly to the ceiling with the screws and anchors provided (without using the tile grid mounting clamps).

Attaching the T-Bar Clips to the Template

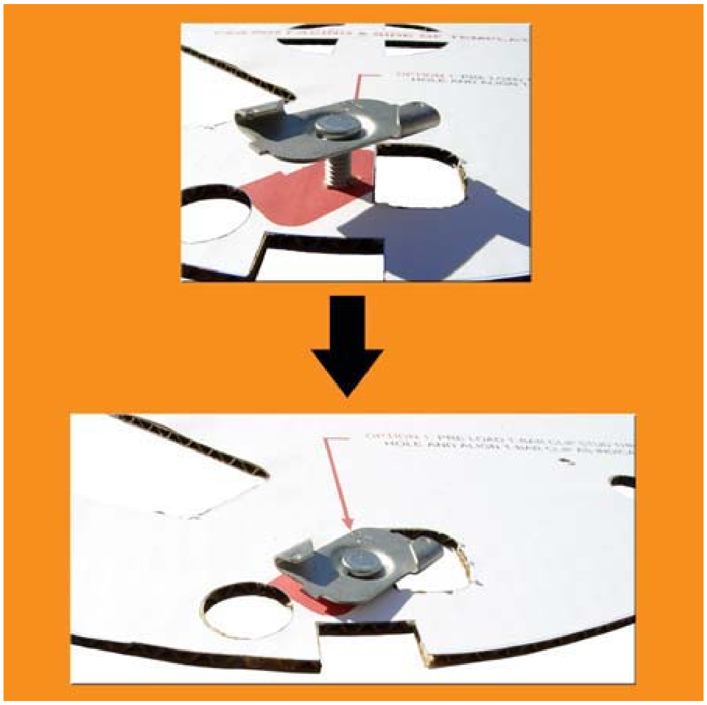


Figure 37. Attaching the T-Bar Clips to the Template

The T-bar clips create four mounting points on the ceiling tile grid for the Array mounting plate. Use the mounting template (provided) to find the correct location for all four clamps by pre-loading the 4 T-bar clips through the holes in the mounting template. Twist the clips until they are correctly aligned with the markings on the template.

Secure the T-Bar Clips to the Ceiling Support Grid

The mounting template should be oriented so that the Array's **abg(n)2** omni-directional monitoring IAP (radio) is pointing in the direction of the least required wireless signal coverage—for example, a nearby exterior wall or entrance.

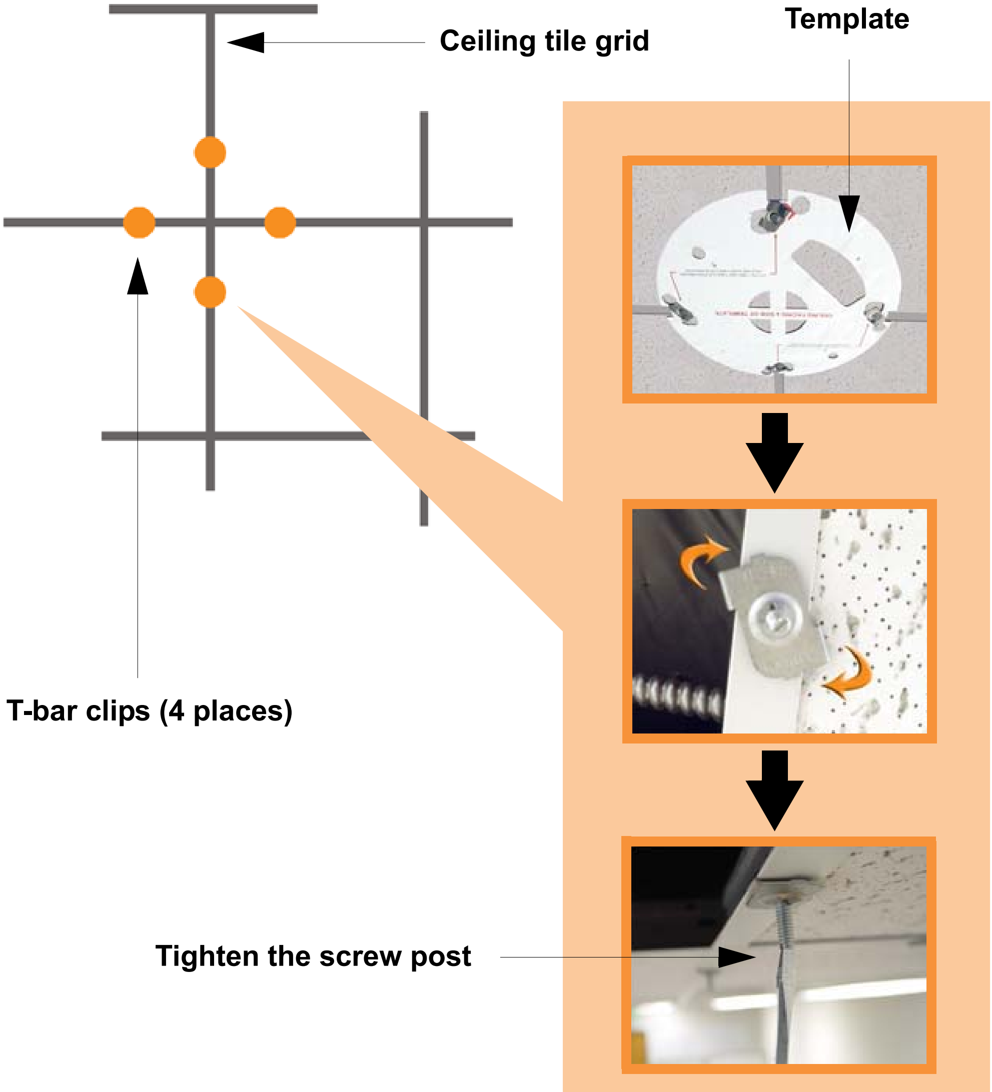


Figure 38. Attaching the T-Bar Clips to the Ceiling Grid

Use the mounting template to find the correct location for all four T-bar clips, then twist the clips onto the metal ceiling support grid (*Figure 38*). Tighten the screw posts to 10-12 lbf.ft (1.38-1.66 kgf.m). *Do not overtighten the screw posts*. Disengage the template from the four screw posts and remove the template from the ceiling.

Installing the Mounting Plate

Locate the mounting plate on the four screw posts. Secure the plate to the four clamps using the nuts provided. Tighten the nuts to 10-12 lbf.ft (1.38-1.66 kgf.m), but *do not overtighten*.

Cut an access hole for the cables in the ceiling tile.

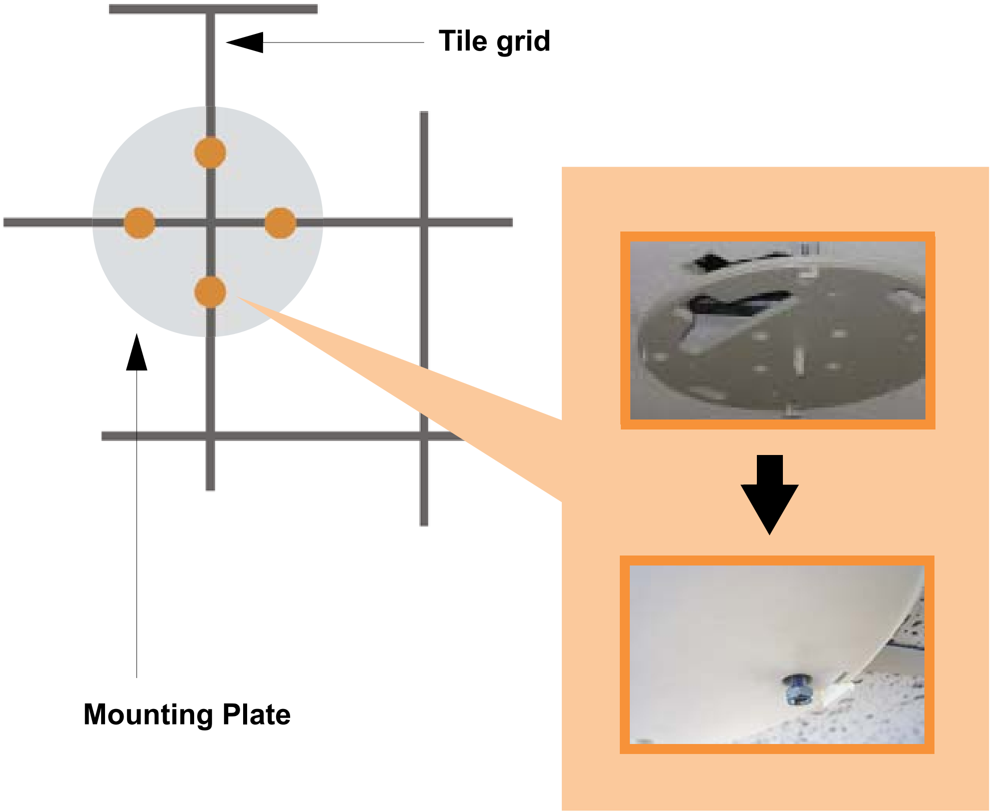


Figure 39. Installing the Mounting Plate

Connecting the Cables—AC Option

This section is for Array models that have a separate AC input. If supplying AC to the Array directly (not using PoGE), refer to Figure 40 to connect cables. Otherwise, skip to Connecting the Cables—PoGE Option.

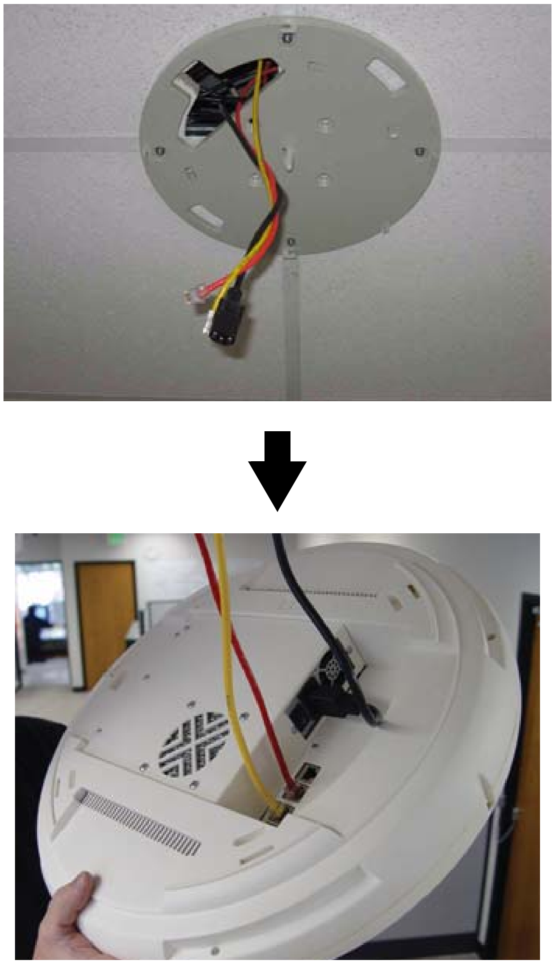


Figure 40. Connecting the Cables

Feed the power and Ethernet cables through the access hole in the tile and the mounting plate, then connect the cables to the Array. See also, "Wiring Considerations" on page 84.

- AC power cord—connect to AC source and AC socket on Array.
- Gigabit1 (mandatory)—the Array's primary data and management port.

- Gigabit2 (optional)—may be used for load balancing, fail-over, mirroring, or increasing link speed to the wired network.
- Fast Ethernet (optional)—for a management-only connection to the Array.
- Serial cable (optional)—for connecting directly with the Array using CLI.

Connecting the Cables—PoGE Option

For the XS8, XS12, or XS16, use the procedure below and refer to Figure 41. For the XS4, see "Connecting the Cables—AC Option" on page 89. All of these Array models have an integrated splitter, so an external splitter is not needed.

For the XS8, XS12, or XS16:

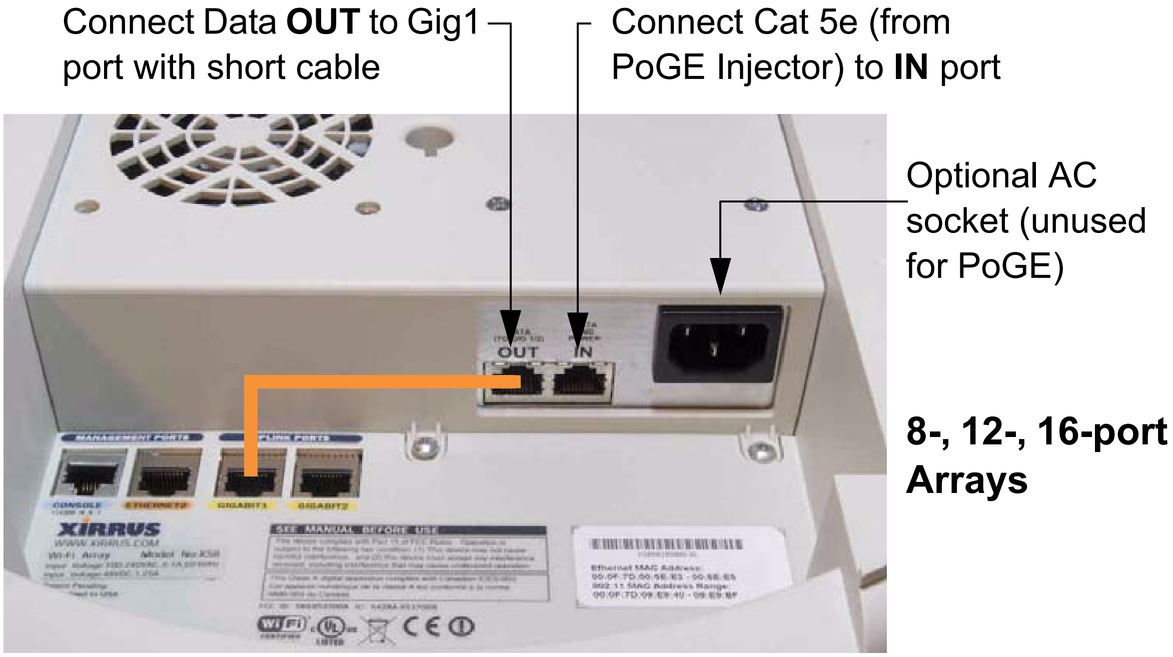

Connect Data **OUT** to Gig1 port with short cable
Connect Cat 5e (from PoGE Injector) to **IN** port
Optional AC socket (unused for PoGE)
8-, 12-, 16-port Arrays
OUT
IN
XIRRUS

Figure 41. Connecting the Cables (PoGE—XS8/XS12/XS16)

- Feed the Ethernet cable(s) through the access hole in the ceiling tile and the mounting plate.
- Connect the Cat 5e or Cat 6 data cable coming from the PoGE injector to the Array's Data and Power **IN** port as shown in Figure 41.

Do not connect the cable from the injector directly to a Gigabit port! It must be connected to the **IN** *port (towards the right in Figure 41).*

- Connect the supplied short orange Cat 5e data cable from the Array's Data **OUT** port to Gigabit1, as shown. Connect any additional Ethernet and serial cables as required.

For the XS4:

Feed the PoGE cable through the access hole in the ceiling tile and the mounting plate, then connect the cable to the Gigabit1 port on the XS4 Array. The Gigabit1 port is the data and management connection to the Array. A splitter is integrated with this port.

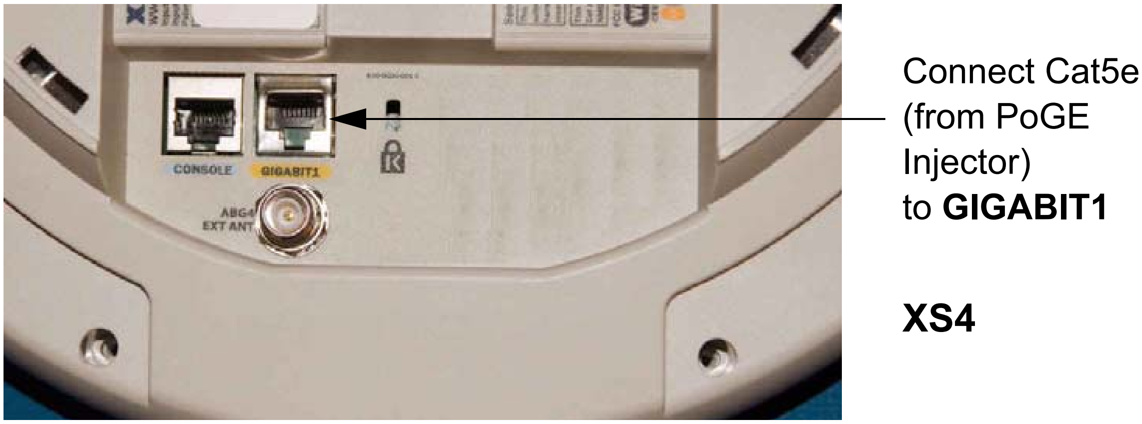


Figure 42. Connecting the Cable (PoGE—XS4)

Attaching the Array to the Mounting Plate

Before attaching the Array to the mounting plate, verify that it is powering up. The Ethernet link LED lights up and the radio LEDs on the front of the unit will illuminate in rotation, indicating that the Wi-Fi Array software is loading and the unit is functioning correctly.

Mounting all models except XS-3900/XS-3700

Align the Array with the key post on the mounting plate, then turn the Array to the right to lock the unit into place at the 4 lugs—similar to a smoke detector.

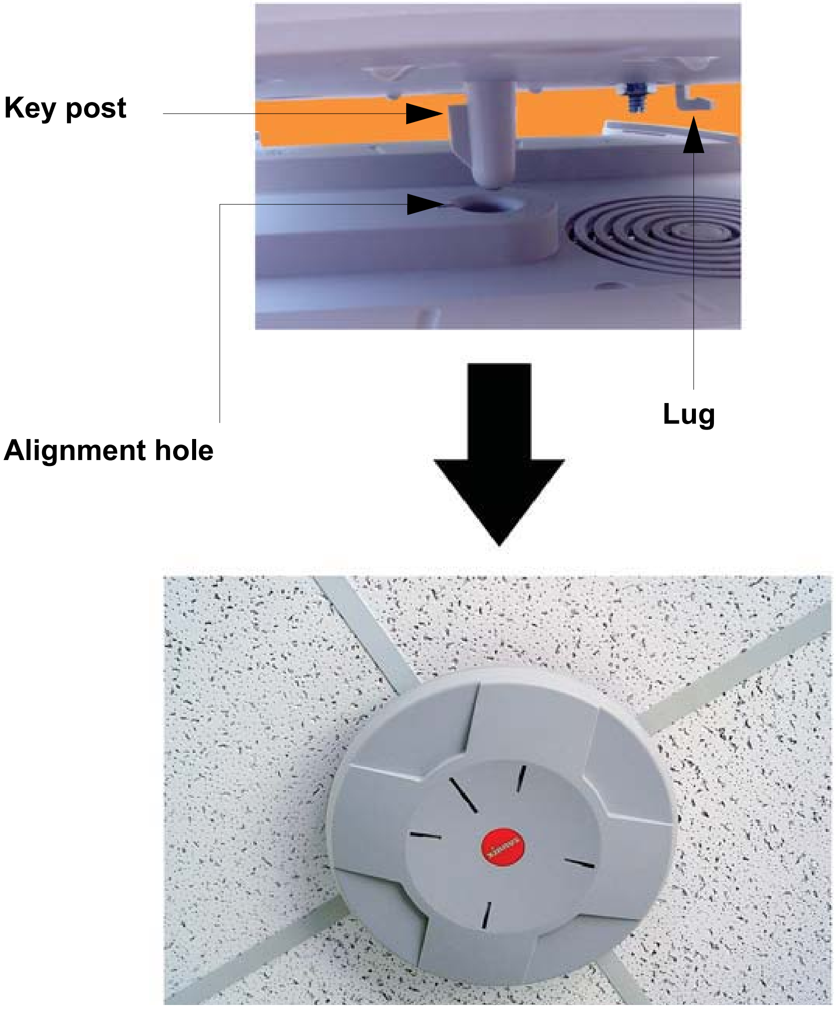


Figure 43. Attaching the Unit (XS4 shown)

See Also

Installation Workflow

Installing Your Wi-Fi Array

Mounting the Wi-Fi Array on a Wall (XS4 and XS-3500)

Mounting Array on a Wall (All models except 4-port Arrays)

Securing the Array

Mounting the XS-3900/XS-3700

Align the port recess on the Array with the access hole in the mounting plate, then connect the Array with the lugs on the mounting plate (4 places) and turn the Array clockwise to lock the unit into place (similar to a smoke detector).

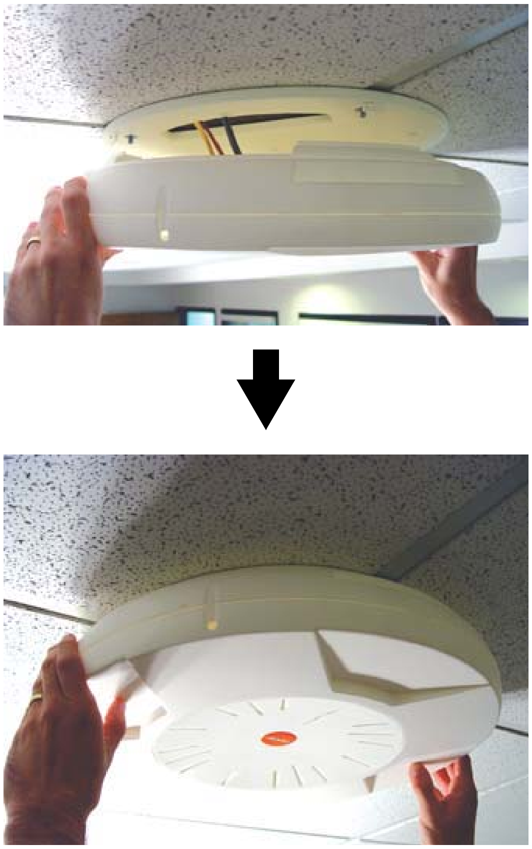


Figure 44. Attaching the Unit (XS-3900)

Securing the Array

For added security, there is a locking bracket incorporated into the mounting plate, which will accept a small luggage-style padlock (if desired). There is also a Kensington lock slot located near the Ethernet ports. In addition, the mounting plate incorporates a positive locking tab that prevents the unit from being inadvertently released.

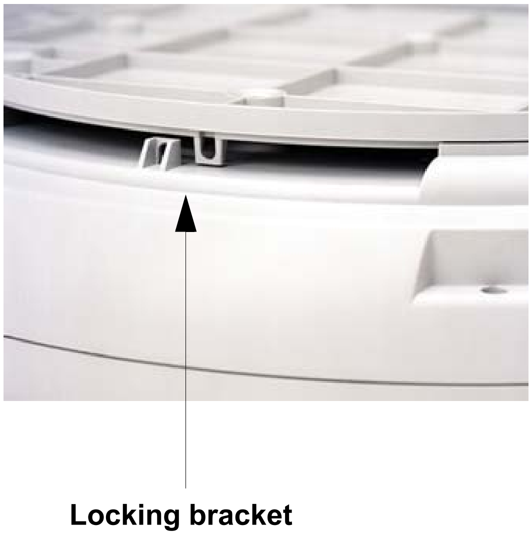


Figure 45. Securing the Array

Now that the Array is physically installed, you must run the Express Setup procedure from the unit's Web Management Interface to enable the radios and establish initial system configuration settings. Go to "Powering Up the Wi-Fi Array" on page 107.

See Also

Installation Workflow

Installing Your Wi-Fi Array

Mounting the Wi-Fi Array on a Wall (XS4 and XS-3500)

Mounting Array on a Wall (All models except 4-port Arrays)

Mounting the Array on a Ceiling

Powering Up the Wi-Fi Array

Dismounting the Array

To dismount the XS-3700/3900

To dismount the Array, place your fingers so as to increase the space between the Array and the mounting plate at the positions indicated by the decals on the mounting plate—these are aligned with IAPs (radios) abg(n)1 and abg(n)3, as indicated on the clock-face of the Array.

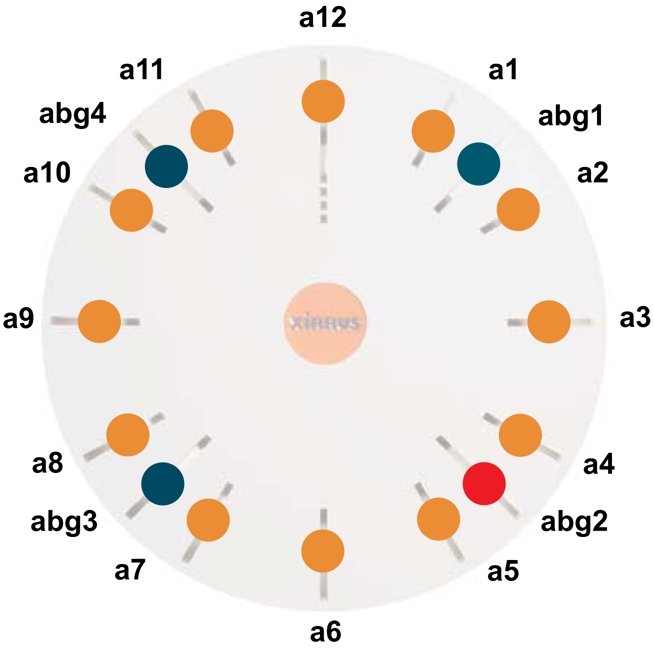


Figure 46. IAP Positions (XS16 shown)

To dismount any other Array model

For all Array models other than the XS-3700/3900, 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.

See Also

Installation Workflow

Installing Your Wi-Fi Array

Mounting the Wi-Fi Array on a Wall (XS4 and XS-3500)

Mounting Array on a Wall (All models except 4-port Arrays)

Mounting the Array on a Ceiling

Mounting Array on a Wall (All models except 4-port Arrays)

This procedure is applicable to the Wi-Fi Array’s 16-radio models, 12-radio models, and 8-radio models. If you are mounting a 4-radio model, go to “Mounting the Wi-Fi Array on a Wall (XS4 and XS-3500)” on page 101.

The wall mounting assembly kit is used to mount the Wi-Fi Array (except for 4-port models) on a wall, instead of the traditional ceiling mount—if mounting the Array on the ceiling is impractical at your location.

Kit Contents (Wall Mount Assembly)

The wall mount assembly kit includes the following items:

- 5 x SNAPTOGGLE™ toggle bolts (for attaching the wall bracket to the wall)
- 4 x 1/4 inch bolt assemblies (for attaching the mounting plate to the wall bracket)
- Wall Mounting Bracket

Tools Required

- Power drill
- 1/2 inch (13mm) drill bit
- Cross head screwdriver
- 1/4 inch nut wrench
- Pencil
- Level

Mark the Wall Position

1. Use the Wall Mounting Bracket as a template and mark the locations on the wall for the mounting holes.

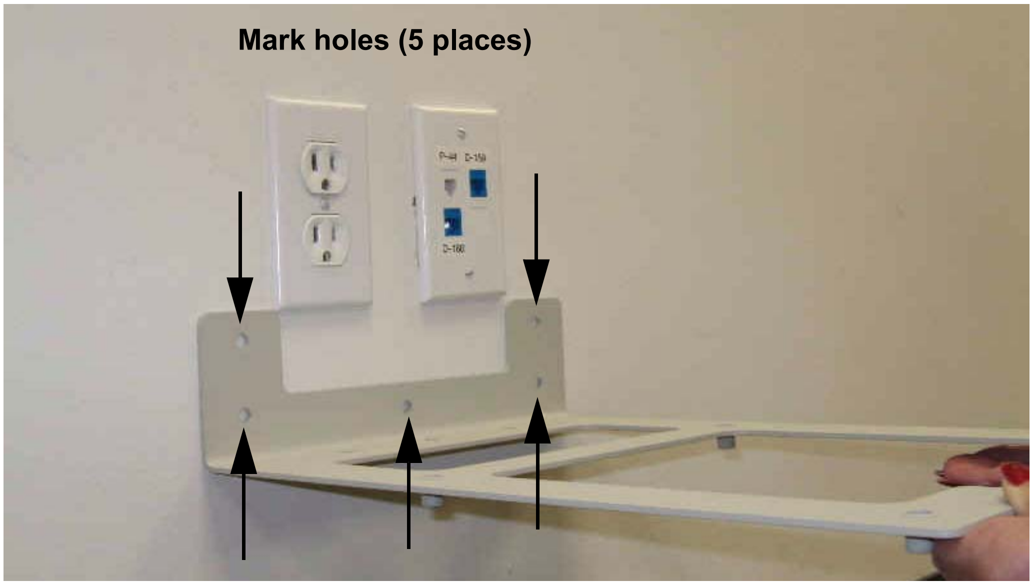


Figure 47. Wall Mount—Marking the Holes

When marking the holes, ensure that the mounting plate is level—you may need assistance.

The bracket must be secured to the wall in 5 places, using the 2 holes at the top and the 3 holes at the bottom (5 toggle bolts are provided).

Install the SNAPTOGGLE™ Toggle Bolts

2. At the locations you marked in Step 1, drill a 1/2 inch (13mm) hole (there must be a minimum clearance behind the wall of 1 7/8 inches—48mm).

3. (Refer to Figure 48, graphic **A**) Hold the metal channel flat alongside the plastic straps and slide the channel through the hole.

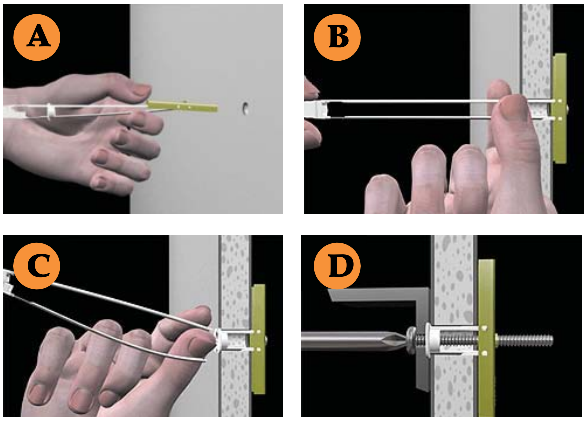


Figure 48. Installing the Toggle Bolts

4. (Refer to Figure 48, graphic **B**) Hold the strap handle between your thumb and forefinger and pull towards you until the metal channel rests flush behind the wall.

   Using your other hand, now slide the plastic cap along the straps until the flange of the cap is flush with wall.

   The straps provide a one-way ratcheting mechanism (similar to a cable tie). Ensure that the toggle bolt assembly is oriented correctly (as shown) before sliding the plastic cap along the straps.

5. (Refer to Figure 48, graphic **C**) Break the straps at the wall, flush with the flange of the cap. The straps can be broken by pushing them from side-to-side and simply snapping them off.

   Figure 48, Graphic **D** shows a cutaway example of how the toggle bolt is used to secure an item to the wall (in our case, the item is the Wall Mounting Bracket—secured to the wall with 5 toggle bolts.

   Do not attach the Wall Mounting Bracket to the wall at this time.

Attach the Mounting Plate to the Wall Mounting Bracket

6. Secure the Wi-Fi Array's mounting plate to the Wall Mounting Bracket, in 4 places. Tighten the bolts to a torque of 10–12 lbf.ft (1.38–1.66 kgf.m).

   Do not overtighten the bolts.

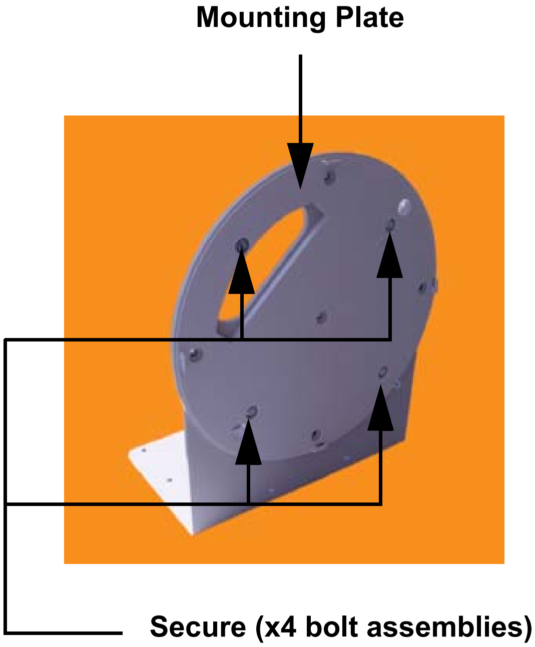


Figure 49. Attaching the Wall Mounting Plate

Attach the Wall Mounting Bracket/Plate Assembly to the Wall

7. Secure the Wall Mounting Bracket (with attached Mounting Plate) to the wall at the 5 toggle bolt anchors you created in Steps 1 through 5—using all 5 places.

Mount the Array

8. Mount the Wi-Fi Array to the Wall Mounting Bracket in the same way that you would mount the Array to a ceiling mount (the procedure is identical). See "Attaching the Array to the Mounting Plate" on page 92 or "Mounting the XS-3900/XS-3700" on page 93.

Figure 50 shows the orientation of the Wi-Fi Array when mounted on a wall. It is not intended to show a fully installed Array.

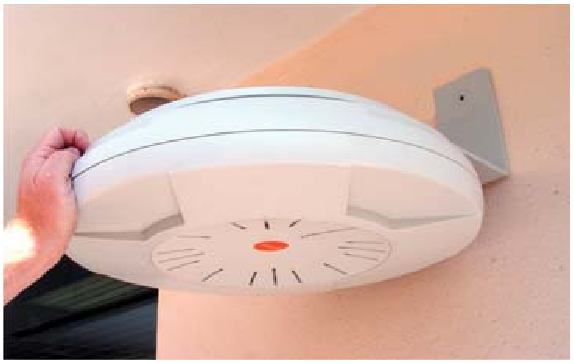


Figure 50. Mounting the Array on a Wall

See Also

Installation Workflow

Installing Your Wi-Fi Array

Mounting the Wi-Fi Array on a Wall (XS4 and XS-3500)

Mounting the Array on a Ceiling

Securing the Array

Mounting the Wi-Fi Array on a Wall (XS4 and XS-3500)

This procedure is applicable to the 4 radio models of the Wi-Fi Array (XS4 and XS-3500). If you are mounting a 16-, 12-, or 8-radio model, go to "Mounting Array on a Wall (All models except 4-port Arrays)" on page 96.

The wall mounting assembly kit is used to mount a 4-port Wi-Fi Array on a wall, instead of the traditional ceiling mount—where mounting the Array on the ceiling may be impractical at your location.

Kit Contents (Wall Mount Assembly)

The wall mount assembly kit includes the following items:

- 5 x SNAPTOGGLE™ toggle bolts (for attaching the wall bracket to the wall)
- 4 x 1/4 inch bolt assemblies (for attaching the mounting plate to the wall bracket)
- Wall Mounting Bracket

Tools Required

- Power drill
- 1/2 inch (13mm) drill bit
- Cross head screwdriver
- 1/4 inch nut wrench
- Pencil
- Level

Mark the Wall Position

1. Use the Wall Mounting Bracket as a template and mark the locations on the wall for the mounting holes.

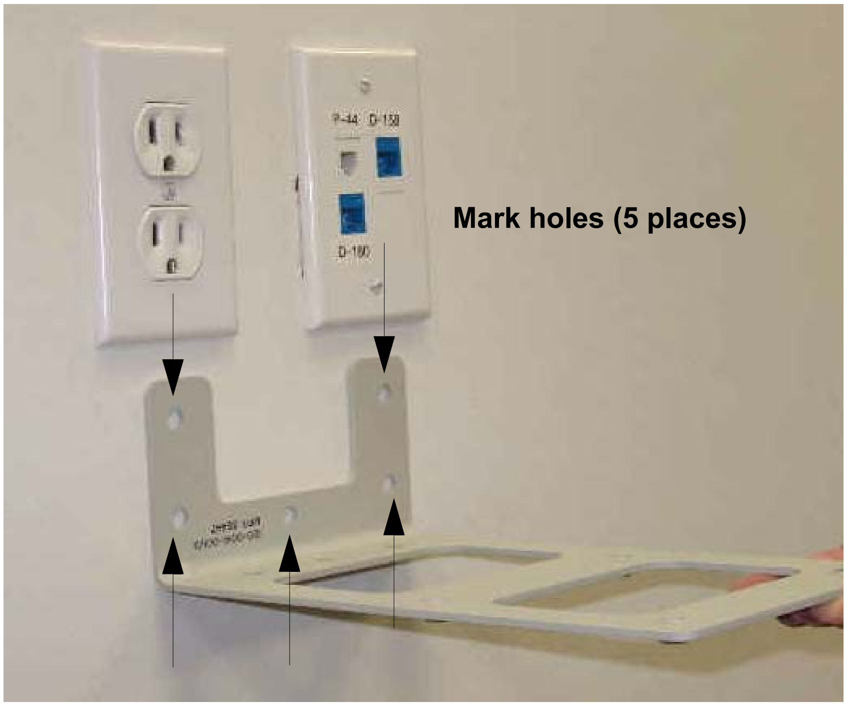


Figure 51. Wall Mount—Marking the Holes

The bracket must be secured to the wall in 5 places, using the top 2 holes and the bottom 3 holes (5 toggle bolts are provided).

When marking the holes, ensure that the mounting plate is level—you may need assistance.

Install the SNAPTOGGLE™ Toggle Bolts

2. At the locations you marked in Step 1, drill a 1/2 inch (13mm) hole (there must be a minimum clearance behind the wall of 1 7/8 inches—48mm).

3. (Refer to Figure 52, graphic **A**) Hold the metal channel flat alongside the plastic straps and slide the channel through the hole.

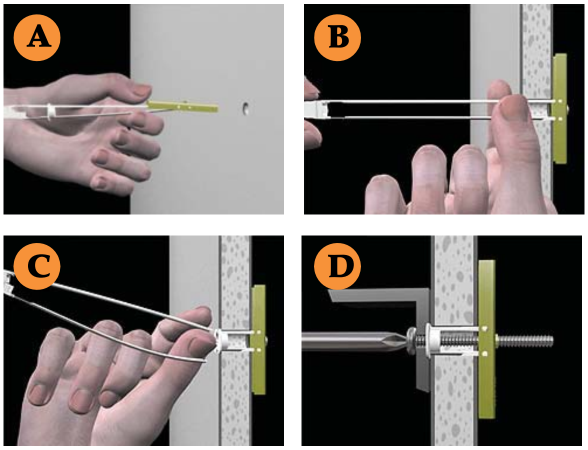


Figure 52. Installing the Toggle Bolts

4. (Refer to Figure 52, graphic **B**) Hold the strap handle between your thumb and forefinger and pull towards you until the metal channel rests flush behind the wall.

   Using your other hand, now slide the plastic cap along the straps until the flange of the cap is flush with wall.

   The straps provide a one-way ratcheting mechanism (similar to a cable tie). Ensure that the toggle bolt assembly is oriented correctly (as shown) before sliding the plastic cap along the straps.

5. (Refer to Figure 52, graphic **C**) Break the straps at the wall, flush with the flange of the cap. The straps can be broken by pushing them from side-to-side and simply snapping them off.

   Figure 52, Graphic **D** shows a cutaway example of how the toggle bolt is used to secure an item to the wall (in our case, the item is the Wall Mounting Bracket—secured to the wall with 5 toggle bolts).

   Do not attach the Wall Mounting Bracket to the wall at this time.

Attach the Mounting Plate to the Wall Mounting Bracket

6. Secure the Wi-Fi Array’s mounting plate to the Wall Mounting Bracket, in 4 places.

   Tighten the bolts to a torque of 10–12 ft-lb (1.38–1.66 kg.m).

   Do not overtighten the bolts.

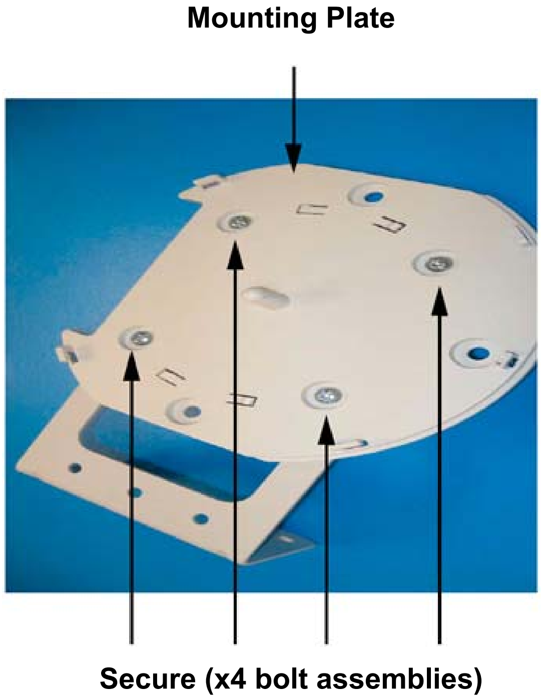


Figure 53. Attaching the Array Mounting Plate

Attach the Wall Mounting Bracket/Plate Assembly to the Wall

7. Secure the Wall Mounting Bracket (with attached Mounting Plate) to the wall at the 5 toggle bolt anchors you created in Steps 2 through 5—using all 5 places.

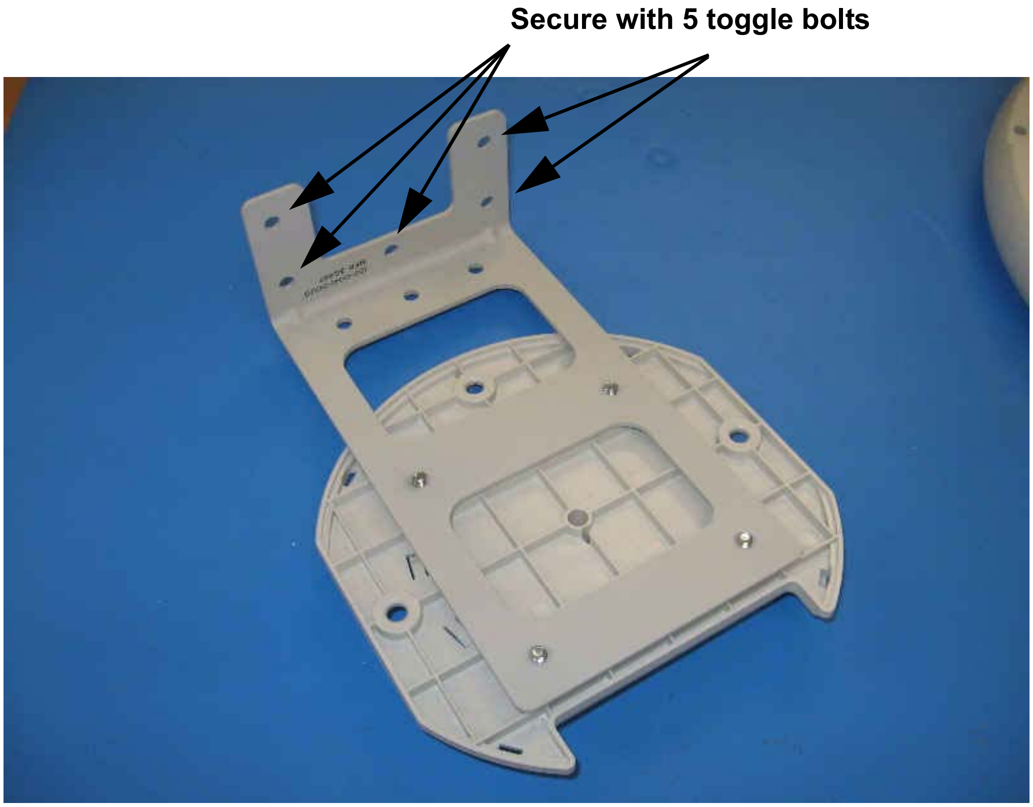


Figure 54. Attaching the Wall Mounting Bracket to the Wall

Mount the Array

8. Mount the Wi-Fi Array to the Wall Mounting Bracket by positioning the key post (on the underside of the mounting bracket) into the key receptacle on the underside of the Array.

   When the key post is properly located, gently turn the Array in a clockwise direction to secure the Array to the mounting plate.

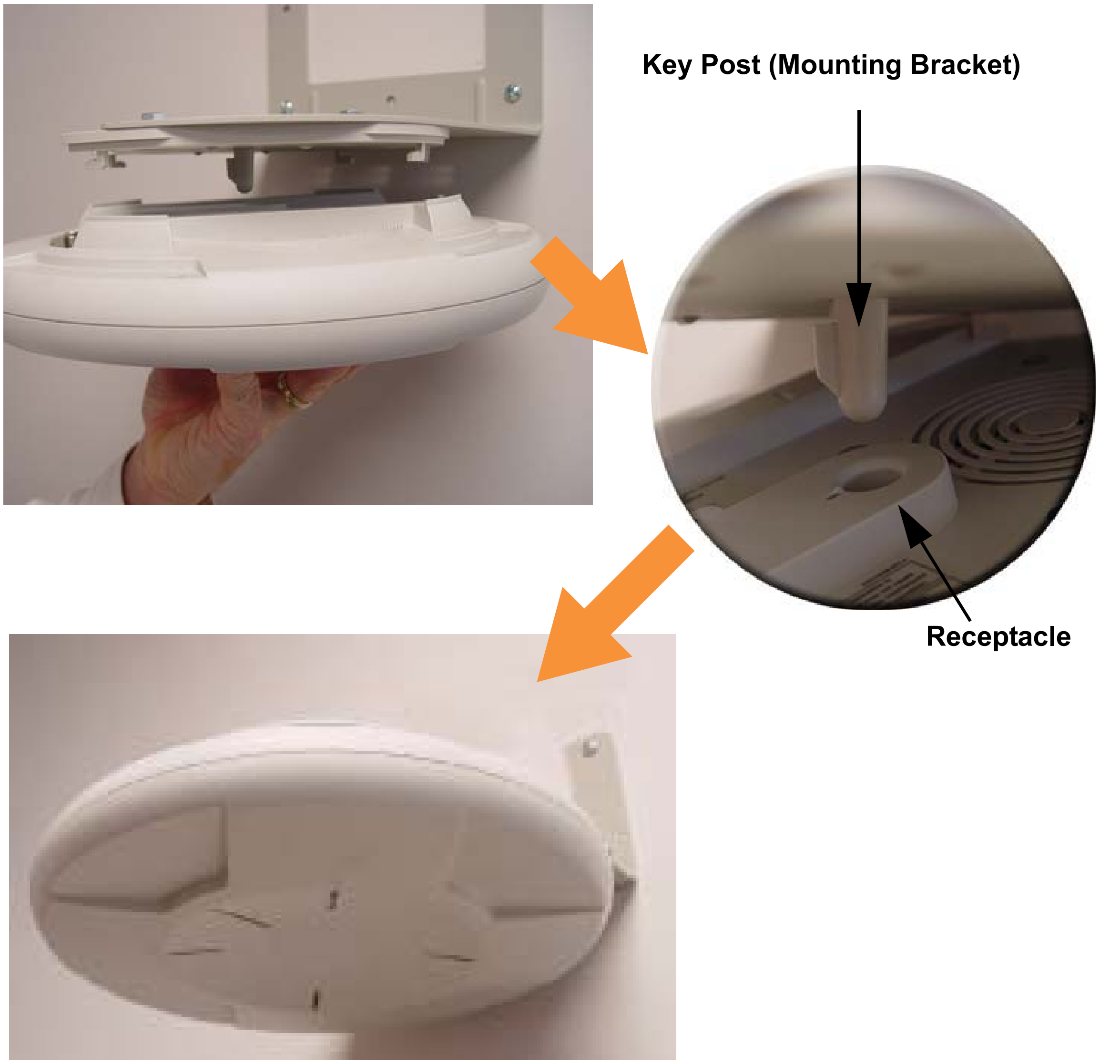


Figure 55. Mounting the Array on a Wall

Removing the Array

To remove the Array from the Wall Mount Assembly, simply apply a little upward pressure to the Array, then gently turn the Array in a counterclockwise direction to release the unit from the bracket.

See Also

Installation Workflow
Installing Your Wi-Fi Array
Mounting Array on a Wall (All models except 4-port Arrays)
Mounting the Array on a Ceiling
Securing the Array

Powering Up the Wi-Fi 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.

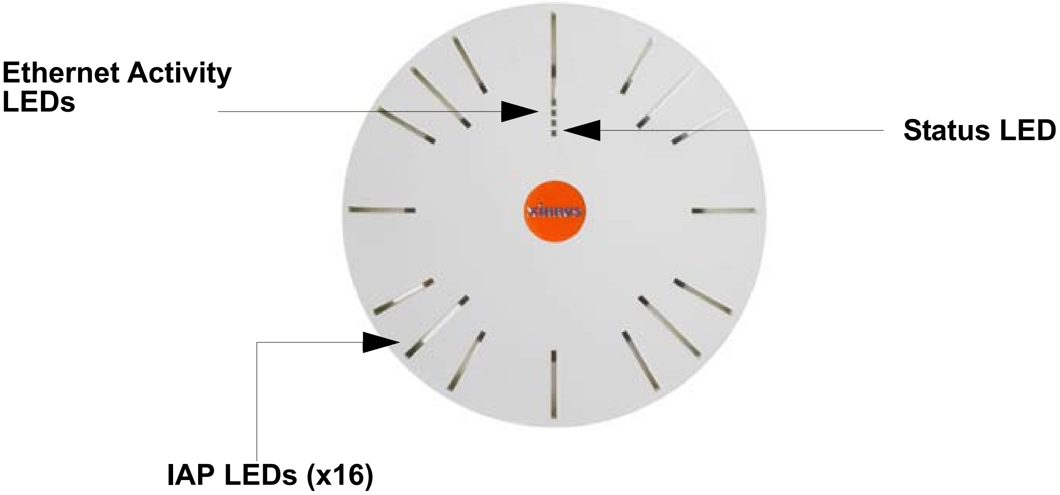


Figure 56. LED Locations (XS-3900)

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 283.

Array LED Operating Sequences

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

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 RED	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 GREEN	ON for IAPs that are up, and OFF for IAPs that are down

LED Operation when Array is Running

The normal LED operation when the Array is running is as follows:

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	IAP **abg(n)2** 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 Wi-Fi Array

Establishing Communication with the Array

The Array can be configured through the Command Line Interface (CLI) or the graphical Web Management Interface (WMI). You can use the CLI via the serial management port, the Fast Ethernet port, or either of the Gigabit Ethernet ports. You can use the WMI via any of the Array's Ethernet ports.

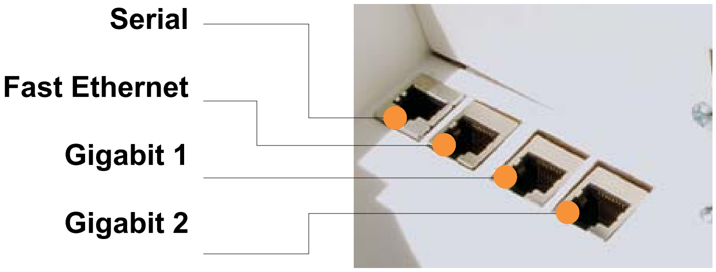


Figure 57. Network Interface Ports

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, the Fast Ethernet port will default to an IP address of 10.0.1.1 and both Gigabit Ethernet ports will default to 10.0.2.1. If the Array is connected to a network that provides DHCP addresses, the IP address can be determined by the following two methods:

1. Examine the DHCP tables on the server and find the addresses assigned to the Array (Xirrus MAC addresses begin with 000F7D).
2. Query the Array using the CLI via the serial port. Use the **show ethernet** command to view the IP addresses assigned to each port.

Logging In

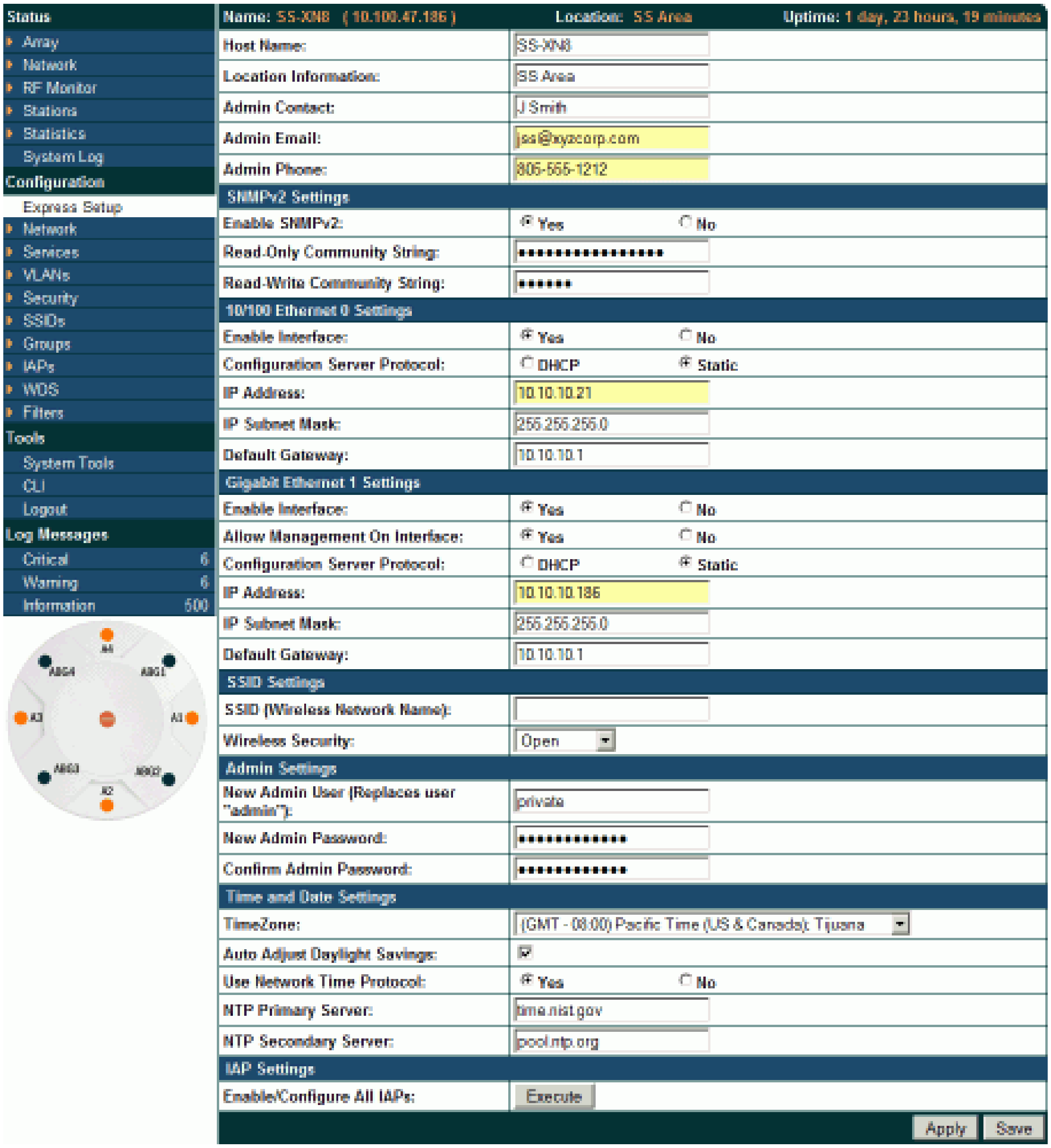
When logging in to the Array, use the default user name and password—the default user name is **admin**, and the default password is **admin**.

See Also

Installation Workflow
Performing the Express Setup Procedure
Powering Up the Wi-Fi Array

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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 1 day, 23 hours, 19 minutes

Host Name:	SS-XN8	
Location Information:	SS Area	
Admin Contact:	J Smith	
Admin Email:	jss@xyzcorp.com	
Admin Phone:	805-555-1212	
SNMPv2 Settings		
Enable SNMPv2:	● Yes	○ No
Read-Only Community String:	••••••••••••••••	
Read-Write Community String:	••••••	
10/100 Ethernet 0 Settings		
Enable Interface:	● Yes	○ No
Configuration Server Protocol:	○ DHCP	● Static
IP Address:	10.10.10.21	
IP Subnet Mask:	255.255.255.0	
Default Gateway:	10.10.10.1	
Gigabit Ethernet 1 Settings		
Enable Interface:	● Yes	○ No
Allow Management On Interface:	● Yes	○ No
Configuration Server Protocol:	○ DHCP	● Static
IP Address:	10.10.10.186	
IP Subnet Mask:	255.255.255.0	
Default Gateway:	10.10.10.1	
SSID Settings		
SSID (Wireless Network Name):		
Wireless Security:	Open	
Admin Settings		
New Admin User (Replaces user "admin"):	private	
New Admin Password:	•••••••••••••	
Confirm Admin Password:	•••••••••••••	
Time and Date Settings		
TimeZone:	(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 Secondary Server:	pool.ntp.org	
IAP Settings		
Enable/Configure All IAPs:	Execute	

Figure 58. 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. 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 200.

7. Configure the **Fast Ethernet** (10/100 Megabit), **Gigabit 1** and **Gigabit 2** 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.

   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 information:

- **IP 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.
- **IP 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.

8. **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 398.

   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 210.

c. **Wireless Key/Passphrase**: Depending on the wireless security scheme you selected, enter a unique WEP key or WPA passphrase.

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

9. **Admin Settings:** This section allows you to change the default password for the Array. Note that the Array also offers the option of authenticating administrators using a RADIUS server (see "Admin Management" on page 215).

   a. **New Admin Password**: If desired, enter a new administration password for managing this Array. Choose a password that is not obvious, and one that you can remember. If you forget your password, you must reset the Array to its factory defaults so that the password is reset to **admin** (its default setting).

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

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

    b. **Use Network Time Protocol**: Check this box if you want to use an NTP server to synchronize the Array's clock. This ensures that Syslog time-stamping is maintained across all units. Without an NTP server assigned (no universal clock), each Array will use its own internal clock and stamp times accordingly, which may result in discrepancies. 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.

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

    d. **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.

    e. **Set 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).

    f. **Set 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).

    g. **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).

11. **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 59)

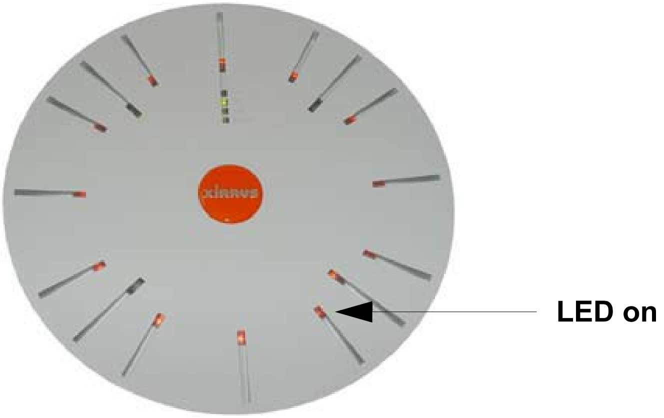


Figure 59. LEDs are Switched On

12. Click on the **Apply** button to apply the new settings to this session
13. Click on the **Save** button to save your changes (otherwise your new settings will not take effect).

    This ends the Express Setup procedure.

See Also

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

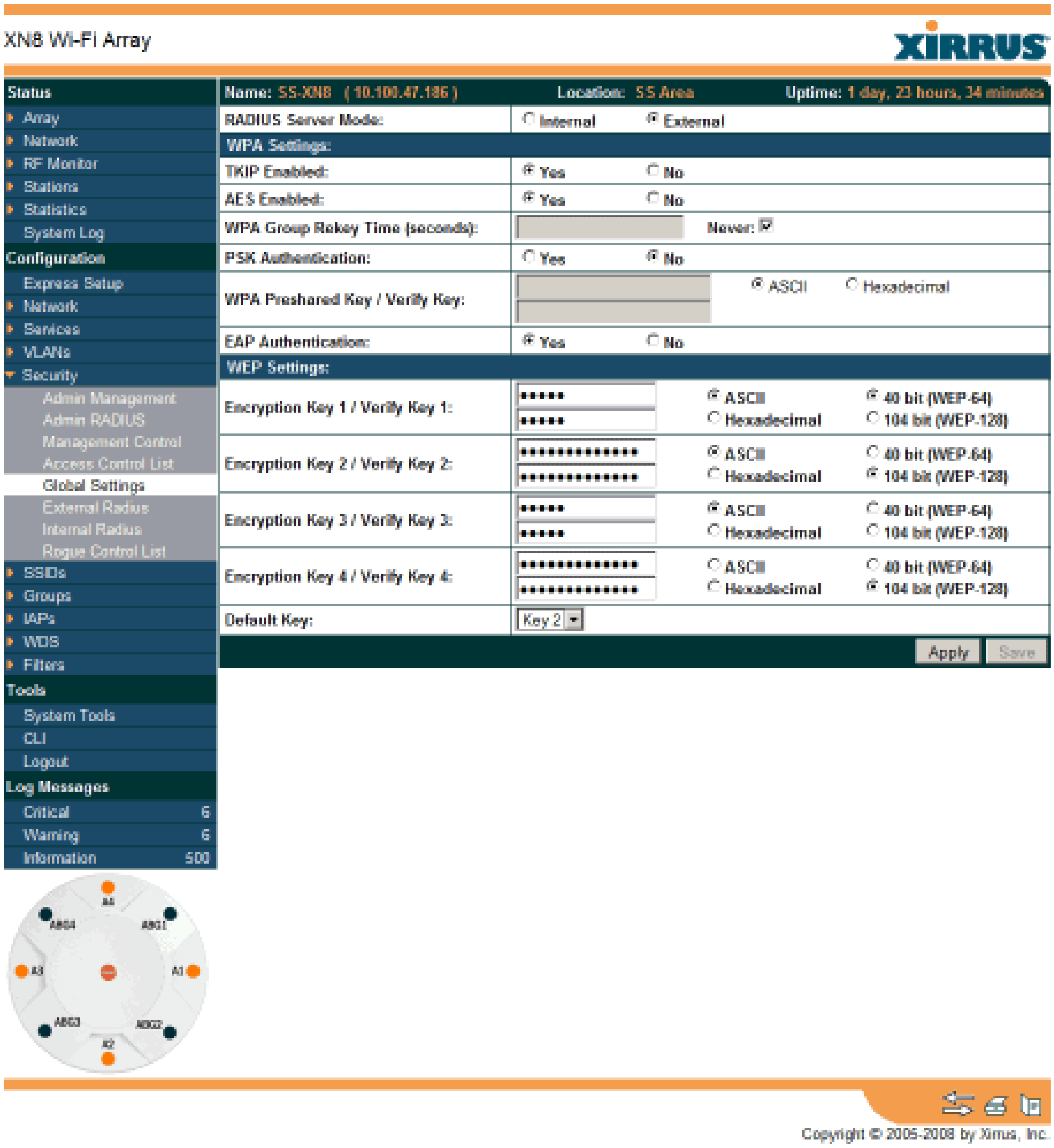
The Web Management Interface

This topic provides an overview of the Xirrus Wi-Fi 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 Wi-Fi Array. It allows you to configure the product to suit your individual requirements and ensure that the unit functions efficiently and effectively.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 1 day, 23 hours, 34 minutes

RADIUS Server Mode:	○ Internal	● External	
WPA Settings:			
TKIP Enabled:	● Yes	○ No	
AES Enabled:	● Yes	○ No	
WPA Group Rekey Time (seconds):		Never: ☑	
PSK Authentication:	○ Yes	● No	
WPA Preshared Key / Verify Key:		● ASCII	○ Hexadecimal
EAP Authentication:	● Yes	○ No	
WEP Settings:			
Encryption Key 1 / Verify Key 1:	••••• •••••	● ASCII ○ Hexadecimal	● 40 bit (WEP-64) ○ 104 bit (WEP-128)
Encryption Key 2 / Verify Key 2:	••••••••••••• •••••••••••••	● ASCII ○ Hexadecimal	○ 40 bit (WEP-64) ● 104 bit (WEP-128)
Encryption Key 3 / Verify Key 3:	••••• •••••	● ASCII ○ Hexadecimal	○ 40 bit (WEP-64) ○ 104 bit (WEP-128)
Encryption Key 4 / Verify Key 4:	••••••••••••• •••••••••••••	○ ASCII ○ Hexadecimal	○ 40 bit (WEP-64) ● 104 bit (WEP-128)
Default Key:	Key 2 ▾		

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Figure 60. Web Management Interface

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
- RF Monitor Windows
  - IAPs
  - Spectrum Analyzer
  - Intrusion Detection
- Station Status Windows
  - Stations
  - Location Map
  - RSSI
  - Signal-to-Noise Ratio (SNR)
  - Noise Floor
  - Max by IAP

Configuration Windows

- Express Setup
- Network
  - Network Interfaces
  - DNS Settings
  - CDP Settings

Configuration Windows (cont'd)

- Services
  - Time Settings (NTP)
  - NetFlow
  - System Log
  - SNMP
  - DHCP Server
- VLANs
  - VLAN Management
- Security
  - Admin Management
  - Admin RADIUS
  - Management Control
  - Access Control List
  - Global Settings
  - External Radius
  - Internal Radius
  - Rogue Control List
- SSIDs
  - SSID Management
- Groups
  - Group Management
- IAPs
  - IAP Settings
  - Global Settings (IAP)
  - Global Settings .11a
  - Global Settings .11bg
  - Global Settings .11n
  - Advanced RF Settings
  - LED Settings
- WDS
  - WDS Client Links
- Filters
  - Filter Lists
  - Filter Management

Statistics Windows

- IAP Statistics Summary
- Per-IAP Statistics
- Network Statistics
- VLAN Statistics
- WDS Statistics
- Filter Statistics
- Station Statistics
- Per-Station Statistics

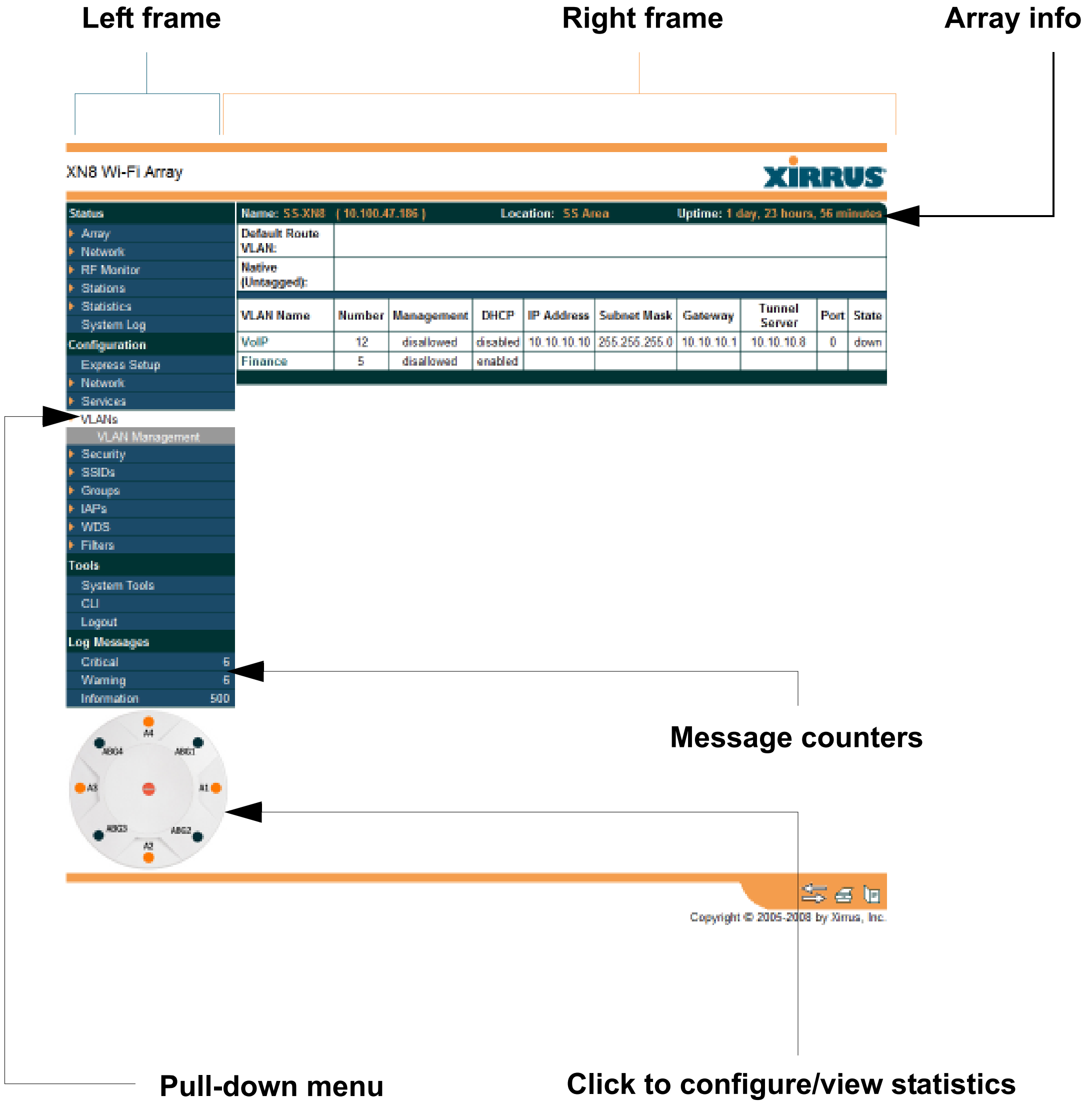
System Log Window

Tool Windows

- System Tools
- CLI
- Logout

User Interface

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.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 1 day, 23 hours, 56 minutes

Default Route VLAN:

Native (Untagged):

VLAN Name	Number	Management	DHCP	IP Address	Subnet Mask	Gateway	Tunnel Server	Port	State
VoIP	12	disallowed	disabled	10.10.10.10	255.255.255.0	10.10.10.1	10.10.10.8	0	down
Finance	5	disallowed	enabled						

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Figure 61. WMI: Frames

The left frame contains three main elements:

- Configuration menu organized by function (for example, radio interfaces, security, etc.). Click the heading to display a summary of its current configuration, as well as an associated pull-down menu.
- 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.
- 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.

The right frame displays the status information or configuration parameters for the Wi-Fi 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.

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.

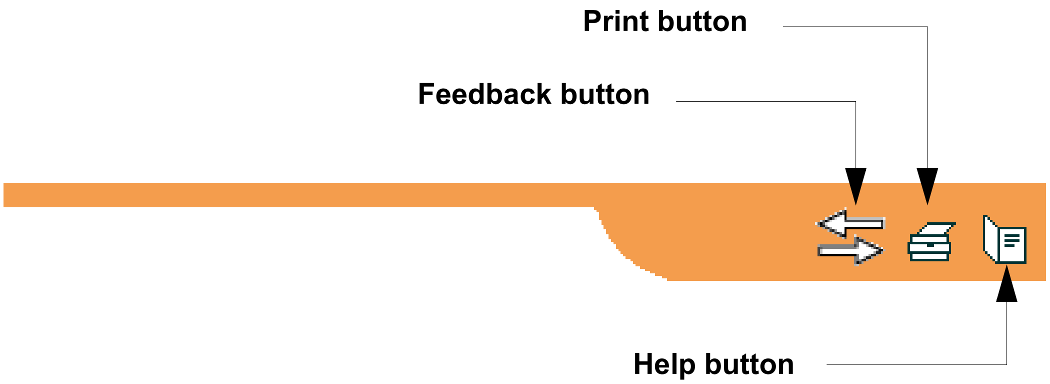
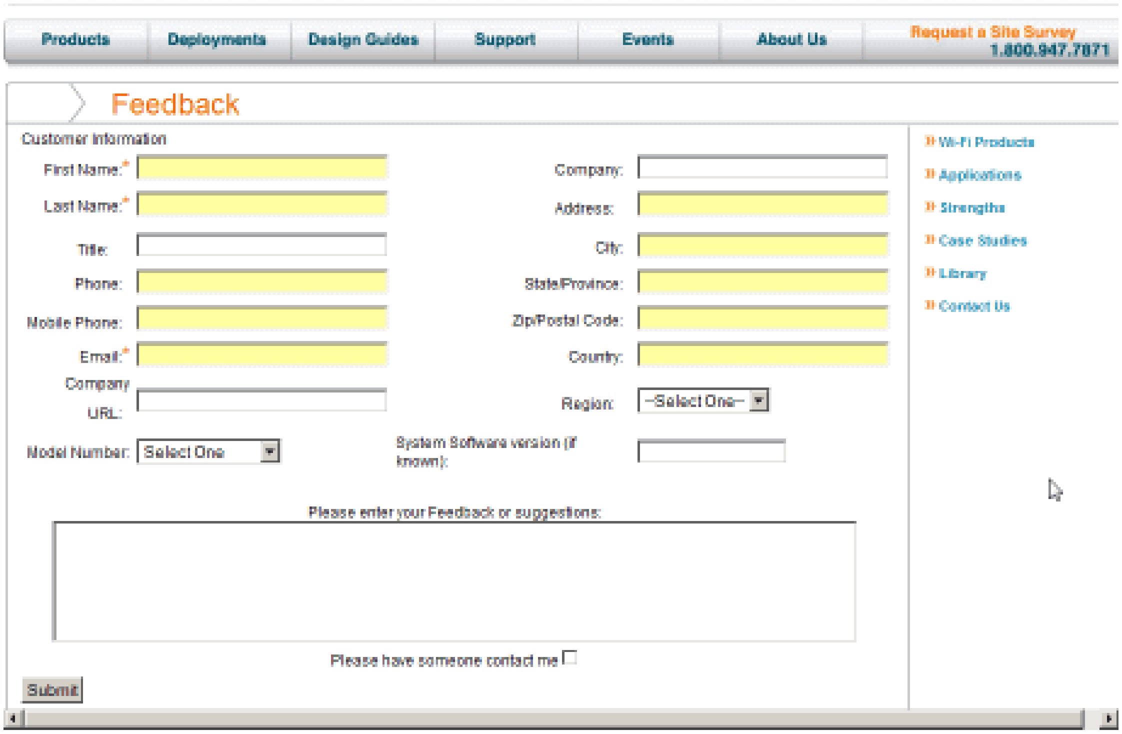


Figure 62. WMI: Utility Buttons

- Click on the **Feedback** button to generate a Web page that allows you to submit your comments to Xirrus, Inc. You can also access the feedback page at http://www.xirrus.com/public/feedback/. Refer to Figure 63 on page 125 to see a sample of the feedback form.
- 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.



Feedback

Customer Information

First Name:*		Company:	
Last Name:*		Address:	
Title:		City:	
Phone:		State/Province:	
Mobile Phone:		Zip/Postal Code:	
Email:*		Country:	
Company URL:		Region:	--Select One--
Model Number:	Select One	System Software version (if known):	

Please enter your Feedback or suggestions:

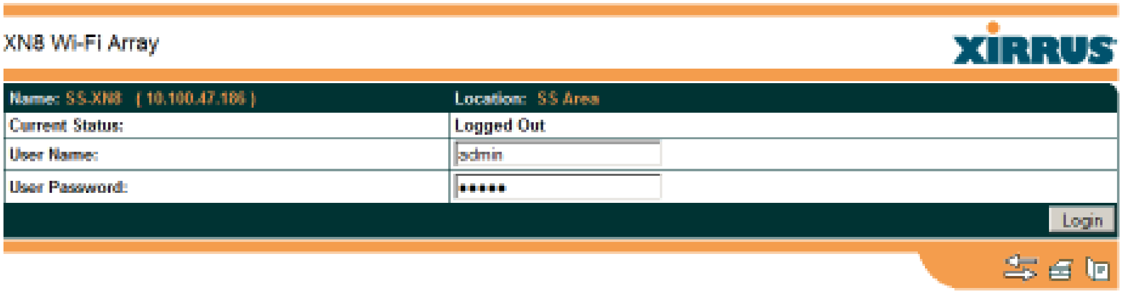
Please have someone contact me □

Figure 63. Feedback Form

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. Connect to the Wi-Fi Array via its default IP address (10.0.2.1 for both Gigabit 1 and Gigabit 2 Ethernet ports) or via a DHCP assigned IP address.
3. To log in to the Array's Web Management Interface, enter **admin** when prompted for a user name and password.



XN8 Wi-Fi Array

Name: SS-XN8 (10.100.47.186)	Location: SS Area
Current Status:	Logged Out
User Name:	admin
User Password:	•••••

Figure 64. Logging In to the Wi-Fi Array

Applying Configuration Changes

When you have defined all your settings in any WMI configuration window, you must click on the **Apply** button for the changes to take effect in the current session, or click on the **Save** button to apply changes to this session and write your changes, so they will be preserved after a reboot.

See Also

Key Features and Benefits
Wi-Fi Array Product Overview

Viewing Status on the Wi-Fi 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 127**
- **"Network Status Windows" on page 133**
- **"RF Monitor Windows" on page 142**
- **"Station Status Windows" on page 150**
- **"Statistics Windows" on page 165**
- **"System Log Window" on page 173**

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

- **"Configuring the Wi-Fi Array" on page 175**
- **"Using Tools on the Wi-Fi Array" on page 295**

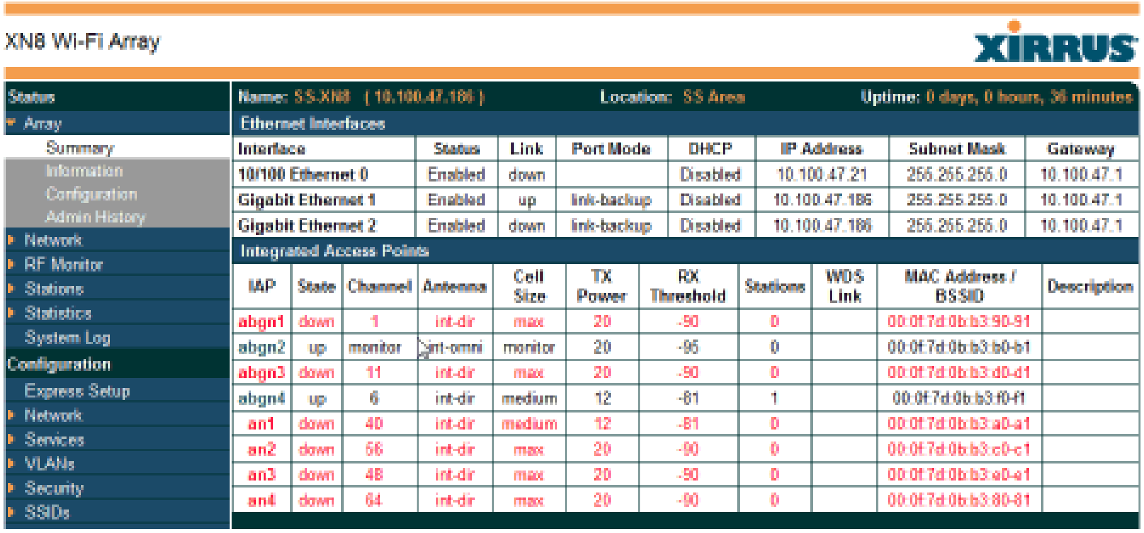
Array Status Windows

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 Wi-Fi 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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 36 minutes

Ethernet Interfaces

Interface	Status	Link	Port Mode	DHCP	IP Address	Subnet Mask	Gateway
10/100 Ethernet 0	Enabled	down		Disabled	10.100.47.21	255.255.255.0	10.100.47.1
Gigabit Ethernet 1	Enabled	up	link-backup	Disabled	10.100.47.186	255.255.255.0	10.100.47.1
Gigabit Ethernet 2	Enabled	down	link-backup	Disabled	10.100.47.186	255.255.255.0	10.100.47.1

Integrated Access Points

IAP	State	Channel	Antenna	Cell Size	TX Power	RX Threshold	Stations	WDS Link	MAC Address / BSSID	Description
abgn1	down	1	int-dir	max	20	-90	0		00:0f:7d:0b:b3:90-91	
abgn2	up	monitor	int-omni	monitor	20	-95	0		00:0f:7d:0b:b3:b0-b1	
abgn3	down	11	int-dir	max	20	-90	0		00:0f:7d:0b:b3:d0-d1	
abgn4	up	6	int-dir	medium	12	-81	1		00:0f:7d:0b:b3:f0-f1	
an1	down	40	int-dir	medium	12	-81	0		00:0f:7d:0b:b3:a0-a1	
an2	down	56	int-dir	max	20	-90	0		00:0f:7d:0b:b3:c0-c1	
an3	down	48	int-dir	max	20	-90	0		00:0f:7d:0b:b3:e0-e1	
an4	down	64	int-dir	max	20	-90	0		00:0f:7d:0b:b3:80-81	

Figure 65. 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 Interfaces Section**

  This section provides information about network interface devices. To make configuration changes to these devices, go to "Network Interfaces" on page 183.

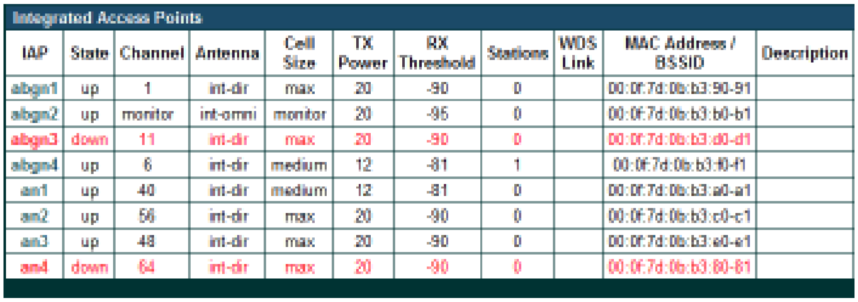
  - **Interface**: Lists the network interfaces that are available on the Array (10/100 Ethernet 0, Gigabit Ethernet 1 and Gigabit Ethernet 2).

- **Status**: Shows the current state of each interface, either enabled or disabled.
- **Link**: Shows whether the link on this interface is up or down.
- **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.

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 (16 IAPs for the XN16, XS16, or XS-3900, 12 IAPs for the XN12, or XS12, 8 IAPs for the XN8, XS8, or XS-3700, and 4 IAPs for the XN4, XS4 or XS-3500). To make configuration changes to these IAPs, go to “IAP Settings” on page 255.

- **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 66 shows an example where IAP **a3** is down.



Integrated Access Points

IAP	State	Channel	Antenna	Cell Size	TX Power	RX Threshold	Stations	WDS Link	MAC Address / BSSID	Description
abgn1	up	1	int-dir	max	20	-90	0		00:0f:7d:0b:b3:90-91	
abgn2	up	monitor	int-omni	monitor	20	-95	0		00:0f:7d:0b:b3:b0-b1	
abgn3	down	11	int-dir	max	20	-90	0		00:0f:7d:0b:b3:d0-d1	
abgn4	up	6	int-dir	medium	12	-81	1		00:0f:7d:0b:b3:f0-f1	
an1	up	40	int-dir	medium	12	-81	0		00:0f:7d:0b:b3:a0-a1	
an2	up	56	int-dir	max	20	-90	0		00:0f:7d:0b:b3:c0-c1	
an3	up	48	int-dir	max	20	-90	0		00:0f:7d:0b:b3:e0-e1	
an4	down	64	int-dir	max	20	-90	0		00:0f:7d:0b:b3:80-81	

Figure 66. 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 255.
- **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 255. 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 50.

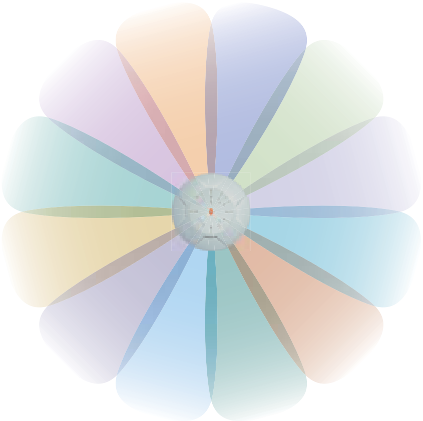


Figure 67. IAP Cells

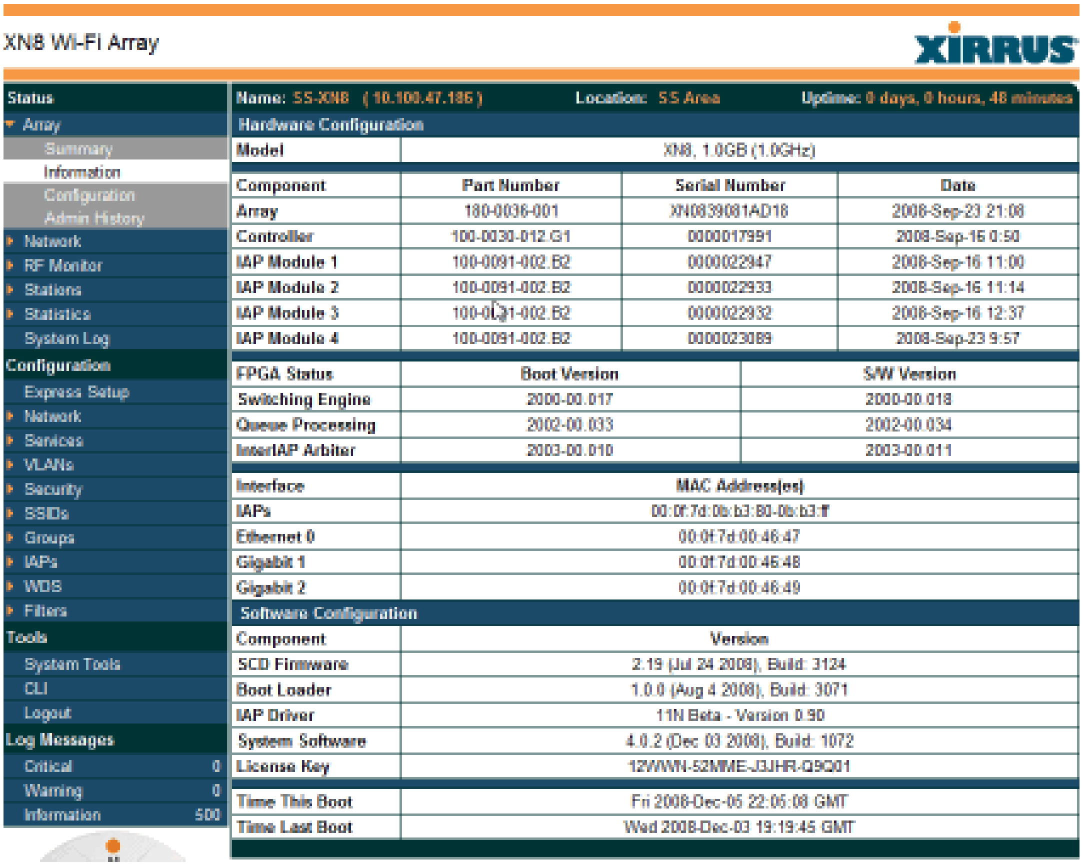
- **Tx Power**: Shows the transit power for each IAP.
- **Rx Threshold**: Shows the receive threshold for each IAP.
- **Stations**: Informs you how many client stations are currently associated with each IAP. All Arrays can handle up to 64 concurrent users per individual IAP, thus 16-port models can handle 1024 users per Array.
- **WDS Link**: The WDS Link on this radio (if any). See "WDS" on page 285.
- **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, the serial numbers assigned to each module, and MAC addresses.

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.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 48 minutes

Hardware Configuration

Model	XN8, 1.0GB (1.0GHz)

Component	Part Number	Serial Number	Date
Array	180-0036-001	XN0839081AD18	2008-Sep-23 21:08
Controller	100-0030-012.G1	0000017991	2008-Sep-16 0:50
IAP Module 1	100-0091-002.B2	0000022947	2008-Sep-16 11:00
IAP Module 2	100-0091-002.B2	0000022933	2008-Sep-16 11:14
IAP Module 3	100-0[illegible]1-002.B2	0000022932	2008-Sep-16 12:37
IAP Module 4	100-0091-002.B2	0000023089	2008-Sep-23 9:57

FPGA Status	Boot Version	S/W Version
Switching Engine	2000-00.017	2000-00.018
Queue Processing	2002-00.033	2002-00.034
InterIAP Arbiter	2003-00.010	2003-00.011

Interface	MAC Address(es)
IAPs	00:0f:7d:0b:b3:80-0b:b3:ff
Ethernet 0	00:0f:7d:00:46:47
Gigabit 1	00:0f:7d:00:46:48
Gigabit 2	00:0f:7d:00:46:49

Software Configuration

Component	Version
SCD Firmware	2.19 (Jul 24 2008), Build: 3124
Boot Loader	1.0.0 (Aug 4 2008), Build: 3071
IAP Driver	11N Beta - Version 0.90
System Software	4.0.2 (Dec 03 2008), Build: 1072
License Key	12WWN-52MME-J3JHR-Q9Q01

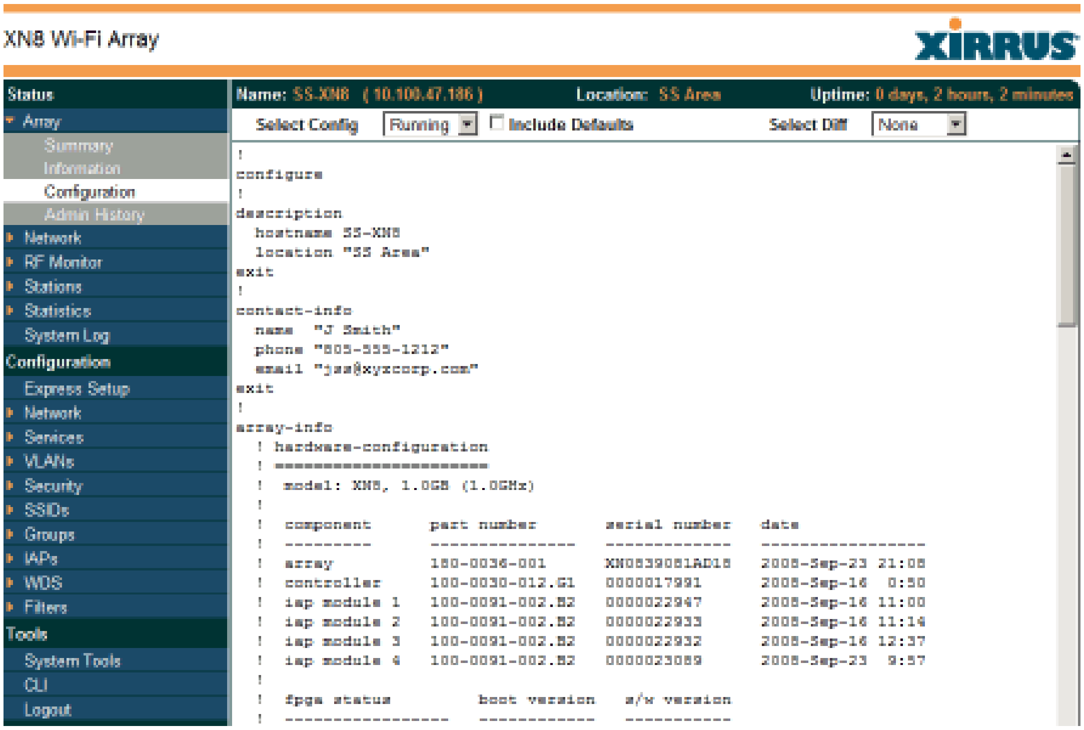
Time This Boot	Fri 2008-Dec-05 22:05:08 GMT
Time Last Boot	Wed 2008-Dec-03 19:19:45 GMT

Figure 68. Array Information

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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 2 hours, 2 minutes

Select Config Running ☐ Include Defaults Select Diff None

```
!
configure
!
description
  hostname SS-XN8
  location "SS Area"
exit
!
contact-info
  name  "J Smith"
  phone "805-555-1212"
  email "jss@xyzcorp.com"
exit
!
array-info
  ! hardware-configuration
  ! ======================
  !  model: XN8, 1.0GB (1.0GHz)
  !
  !  component      part number       serial number   date
  !  ---------      ---------------   -------------   ----------------
  !  array          180-0036-001      XN0839081AD18   2008-Sep-23 21:08
  !  controller     100-0030-012.G1   0000017991      2008-Sep-16  0:50
  !  iap module 1   100-0091-002.B2   0000022947      2008-Sep-16 11:00
  !  iap module 2   100-0091-002.B2   0000022933      2008-Sep-16 11:14
  !  iap module 3   100-0091-002.B2   0000022932      2008-Sep-16 12:37
  !  iap module 4   100-0091-002.B2   0000023089      2008-Sep-23  9:57
  !
  !  fpga status         boot version   s/w version
  !  ----------------    ------------   -----------
```

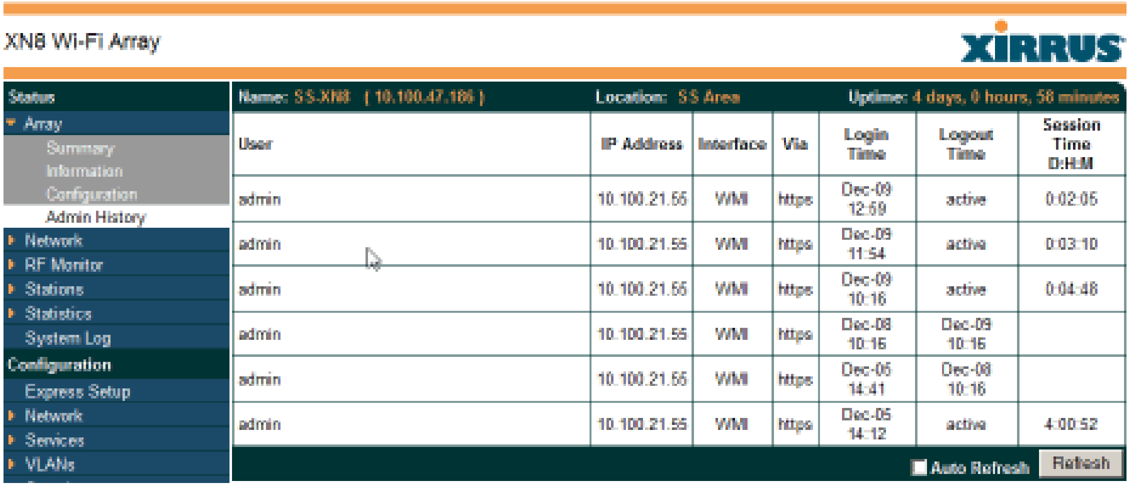
Figure 69. Show Configuration

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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 0 hours, 58 minutes

User	IP Address	Interface	Via	Login Time	Logout Time	Session Time D:H:M
admin	10.100.21.55	WMI	https	Dec-09 12:59	active	0:02:05
admin	10.100.21.55	WMI	https	Dec-09 11:54	active	0:03:10
admin	10.100.21.55	WMI	https	Dec-09 10:16	active	0:04:48
admin	10.100.21.55	WMI	https	Dec-08 10:16	Dec-09 10:16	
admin	10.100.21.55	WMI	https	Dec-05 14:41	Dec-08 10:16	
admin	10.100.21.55	WMI	https	Dec-05 14:12	active	4:00:52

Figure 70. Admin Login History

Network Status Windows

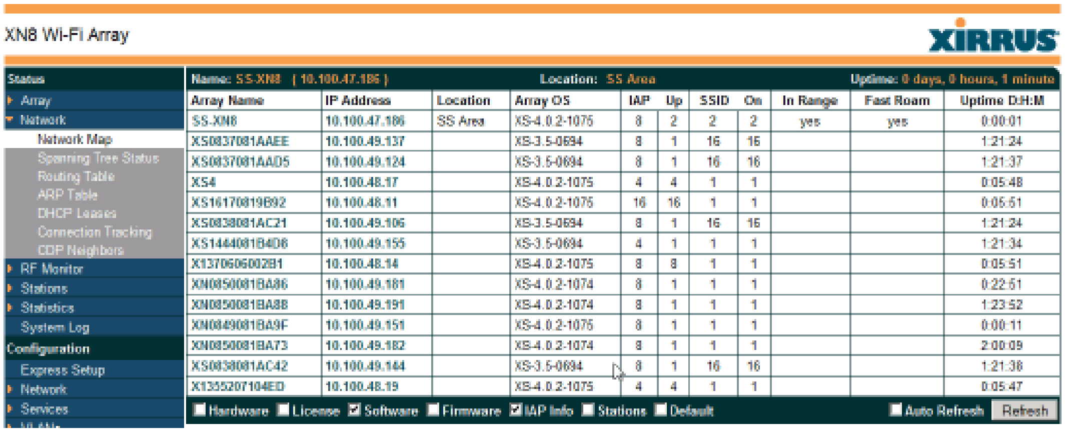
The following Network Status windows are available:

- **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 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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 1 minute

Array Name	IP Address	Location	Array OS	IAP	Up	SSID	On	In Range	Fast Roam	Uptime D:H:M
SS-XN8	10.100.47.186	SS Area	XS-4.0.2-1075	8	2	2	2	yes	yes	0:00:01
XS0837081AAEE	10.100.49.137		XS-3.5-0694	8	1	16	16			1:21:24
XS0837081AAD5	10.100.49.124		XS-3.5-0694	8	1	16	16			1:21:37
XS4	10.100.48.17		XS-4.0.2-1075	4	4	1	1			0:05:48
XS16170819B92	10.100.48.11		XS-4.0.2-1075	16	16	1	1			0:05:51
XS0838081AC21	10.100.49.106		XS-3.5-0694	8	1	16	16			1:21:24
XS1444081B4D8	10.100.49.155		XS-3.5-0694	4	1	1	1			1:21:34
X137060600281	10.100.48.14		XS-4.0.2-1075	8	8	1	1			0:05:51
XN0850081BA86	10.100.49.181		XS-4.0.2-1074	8	1	1	1			0:22:51
XN0850081BA88	10.100.49.191		XS-4.0.2-1074	8	1	1	1			1:23:52
XN0849081BA9F	10.100.49.151		XS-4.0.2-1075	8	1	1	1			0:00:11
XN0850081BA73	10.100.49.182		XS-4.0.2-1074	8	1	1	1			2:00:09
XS0838081AC42	10.100.49.144		XS-3.5-0694	8	1	16	16			1:21:38
X1355207104ED	10.100.48.19		XS-4.0.2-1075	4	4	1	1			0:05:47

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

Figure 71. Network Map

The Network Map has a number of options at the bottom 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 176.
- **Location**: The location assigned to the Array. To establish the location information, go to "Express Setup" on page 176.
- **Array OS**: The software version running on the Array.

- **IP Address**: The Array's IP address. 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 176.
- **IAP**: The number of IAPs on the Array.
- **IAPs Up**: Informs you how many IAPs are currently up and running. To enable or disable all IAPs, go to "Express Setup" on page 176. To enable or disable individual IAPs, go to "IAP Settings" on page 255.
- **SSIDs**: Informs you how many SSIDs have been assigned for the Array. To assign an SSID, go to "SSID Management" on page 240.
- **SSID On**: Informs you how many SSIDs are enabled. To enable or disable SSIDs, go to "SSID Management" on page 240.
- **In Range**: Informs you whether the Array is within wireless range of another Wi-Fi 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 260.
- **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 (XN16, XS-4, etc.), plus the amount of RAM memory and the speed of the processor.
- **Serial**: Displays the serial number of each Array.

License

- **License Key**: 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 151.

  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.

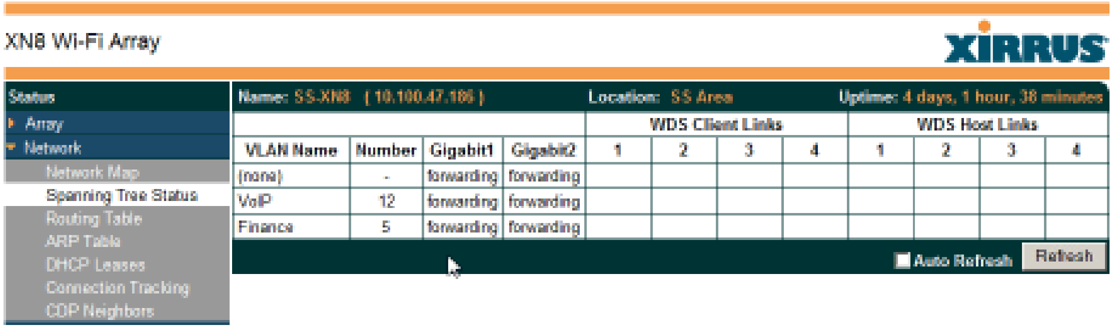
Default

- 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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 1 hour, 38 minutes

				WDS Client Links				WDS Host Links			
VLAN Name	Number	Gigabit1	Gigabit2	1	2	3	4	1	2	3	4
(none)	-	forwarding	forwarding								
VoIP	12	forwarding	forwarding								
Finance	5	forwarding	forwarding								

Figure 72. Spanning Tree Status

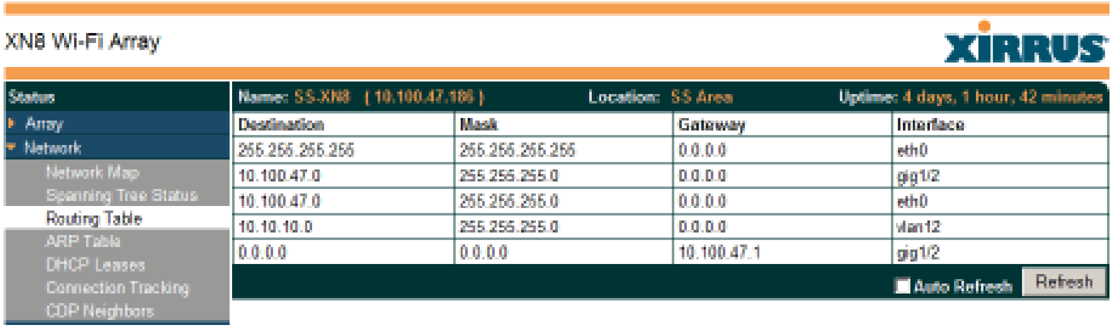
This window shows the spanning tree status (forwarding or blocked) for path segments that terminate on the gigabit ports and WDS links of this Array. You may sort the rows based on the **VLAN Name** or **Number** columns by clicking the column header. Click **Refresh** to update the information at any 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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 1 hour, 42 minutes

Destination	Mask	Gateway	Interface
255.255.255.255	255.255.255.255	0.0.0.0	eth0
10.100.47.0	255.255.255.0	0.0.0.0	gig1/2
10.100.47.0	255.255.255.0	0.0.0.0	eth0
10.10.10.0	255.255.255.0	0.0.0.0	vlan12
0.0.0.0	0.0.0.0	10.100.47.1	gig1/2

Figure 73. Routing Table

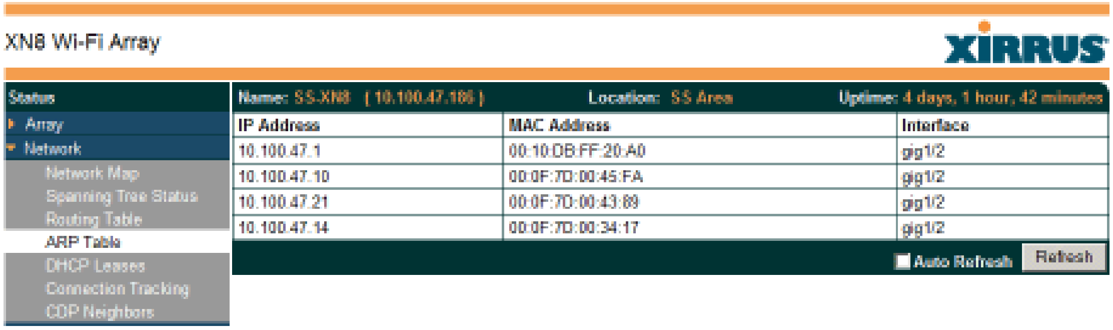
See Also

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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 1 hour, 42 minutes

IP Address	MAC Address	Interface
10.100.47.1	00:10:DB:FF:20:A0	gig1/2
10.100.47.10	00:0F:7D:00:45:FA	gig1/2
10.100.47.21	00:0F:7D:00:43:89	gig1/2
10.100.47.14	00:0F:7D:00:34:17	gig1/2

Figure 74. ARP Table

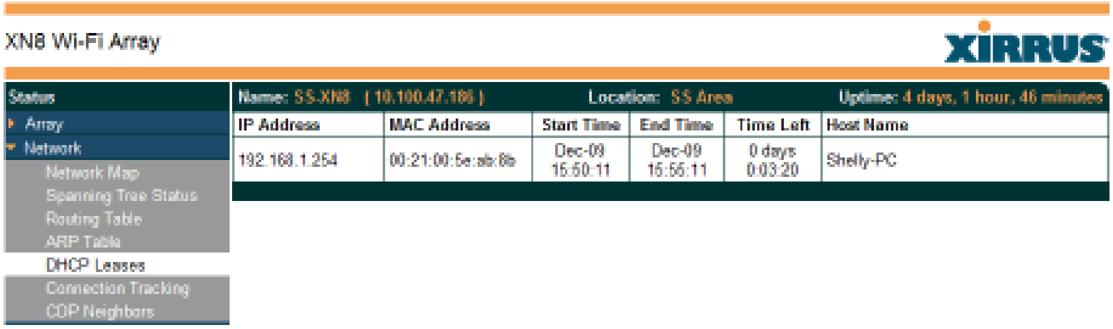
See Also

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.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 1 hour, 46 minutes

IP Address	MAC Address	Start Time	End Time	Time Left	Host Name
192.168.1.254	00:21:00:5e:ab:8b	Dec-09 15:50:11	Dec-09 15:55:11	0 days 0:03:20	Shelly-PC

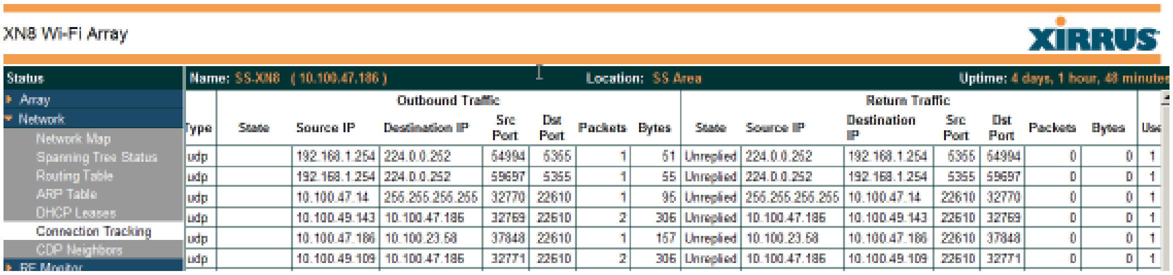
Figure 75. DHCP Leases

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.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 1 hour, 48 minutes

	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	Use
udp		192.168.1.254	224.0.0.252	54994	5355	1	51	Unreplied	224.0.0.252	192.168.1.254	5355	54994	0	0	1
udp		192.168.1.254	224.0.0.252	59697	5355	1	55	Unreplied	224.0.0.252	192.168.1.254	5355	59697	0	0	1
udp		10.100.47.14	255.255.255.255	32770	22610	1	95	Unreplied	255.255.255.255	10.100.47.14	22610	32770	0	0	1
udp		10.100.49.143	10.100.47.186	32769	22610	2	306	Unreplied	10.100.47.186	10.100.49.143	22610	32769	0	0	1
udp		10.100.47.186	10.100.23.58	37848	22610	1	157	Unreplied	10.100.23.58	10.100.47.186	22610	37848	0	0	1
udp		10.100.49.109	10.100.47.186	32771	22610	2	306	Unreplied	10.100.47.186	10.100.49.109	22610	32771	0	0	1

Figure 76. Connection Tracking

Click the **Show Netbios** checkbox at the bottom of the page to display NetBIOS name information for the source and destination location of the connection. The Netbios columns will replace traffic statistics columns.

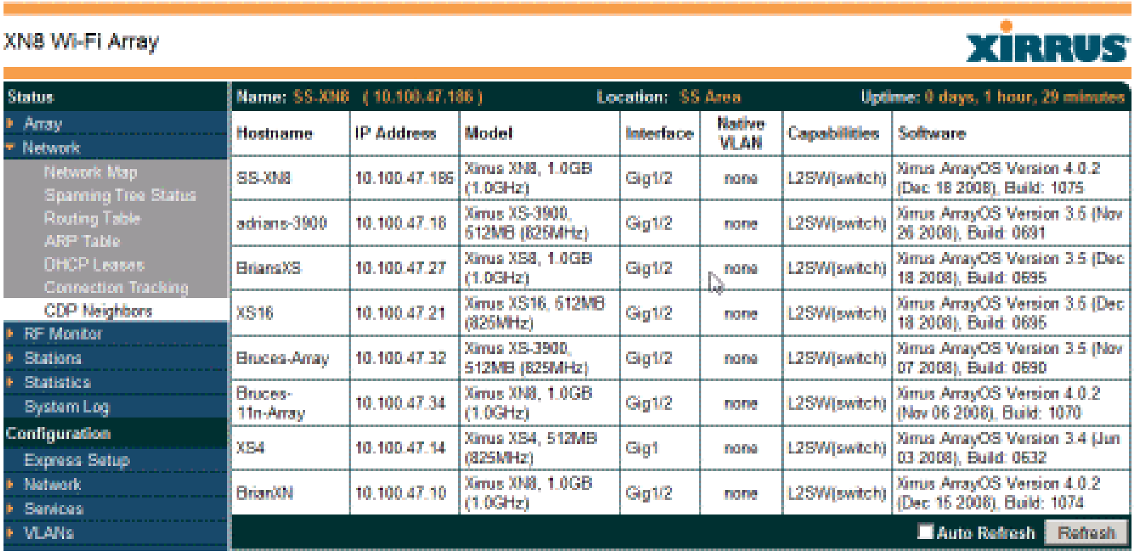
You may sort the rows based on any column that has an active column header, indicated when the mouse pointer changes to the hand icon 👆. Click **Refresh** to update the information at any time. Click **Auto Refresh** to instruct the Array to refresh this window automatically.

See Also

Filters

CDP Neighbors

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



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 1 hour, 29 minutes

Hostname	IP Address	Model	Interface	Native VLAN	Capabilities	Software
SS-XN8	10.100.47.186	Xirrus XN8, 1.0GB (1.0GHz)	Gig1/2	none	L2SW(switch)	Xirrus ArrayOS Version 4.0.2 (Dec 18 2008), Build: 1075
adrians-3900	10.100.47.18	Xirrus XS-3900, 512MB (825MHz)	Gig1/2	none	L2SW(switch)	Xirrus ArrayOS Version 3.5 (Nov 26 2008), Build: 0691
BriansXS	10.100.47.27	Xirrus XS8, 1.0GB (1.0GHz)	Gig1/2	none	L2SW(switch)	Xirrus ArrayOS Version 3.5 (Dec 18 2008), Build: 0695
XS16	10.100.47.21	Xirrus XS16, 512MB (825MHz)	Gig1/2	none	L2SW(switch)	Xirrus ArrayOS Version 3.5 (Dec 18 2008), Build: 0695
Bruces-Array	10.100.47.32	Xirrus XS-3900, 512MB (825MHz)	Gig1/2	none	L2SW(switch)	Xirrus ArrayOS Version 3.5 (Nov 07 2008), Build: 0690
Bruces-11n-Array	10.100.47.34	Xirrus XN8, 1.0GB (1.0GHz)	Gig1/2	none	L2SW(switch)	Xirrus ArrayOS Version 4.0.2 (Nov 06 2008), Build: 1070
XS4	10.100.47.14	Xirrus XS4, 512MB (825MHz)	Gig1	none	L2SW(switch)	Xirrus ArrayOS Version 3.4 (Jun 03 2008), Build: 0632
BrianXN	10.100.47.10	Xirrus XN8, 1.0GB (1.0GHz)	Gig1/2	none	L2SW(switch)	Xirrus ArrayOS Version 4.0.2 (Dec 15 2008), Build: 1074

Figure 77. CDP Neighbors

CDP must be enabled on the Array in order to gather and display this information. See "CDP Settings" on page 191.

RF Monitor Windows

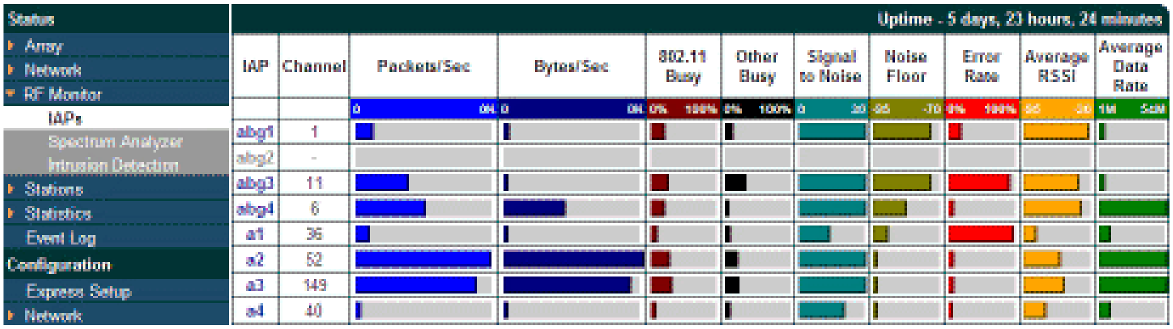
Every Wi-Fi Array includes an integrated RF spectrum analyzer as a standard feature. The spectrum analyzer allows you to characterize the RF environment by monitoring throughput, signal, noise, errors, and interference levels continually per channel. This capability uses the built-in threat-sensor radio **abg(n)2**. 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.

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.



Uptime - 5 days, 23 hours, 24 minutes

IAP	Channel	Packets/Sec	Bytes/Sec	802.11 Busy	Other Busy	Signal to Noise	Noise Floor	Error Rate	Average RSSI	Average Data Rate
		0 6K	0 6K	0% 100%	0% 100%	0 30	-95 -70	0% 100%	-95 -30	1M 54M
abg1	1									
abg2	-									
abg3	11									
abg4	6									
a1	36									
a2	52									
a3	149									
a4	40									

Figure 78. RF Monitor—IAPs

Figure 78 presents the data as a graphical display, enabled by selecting the **Graph** checkbox on the lower left. If this option is not selected, data is presented as a numerical table. 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

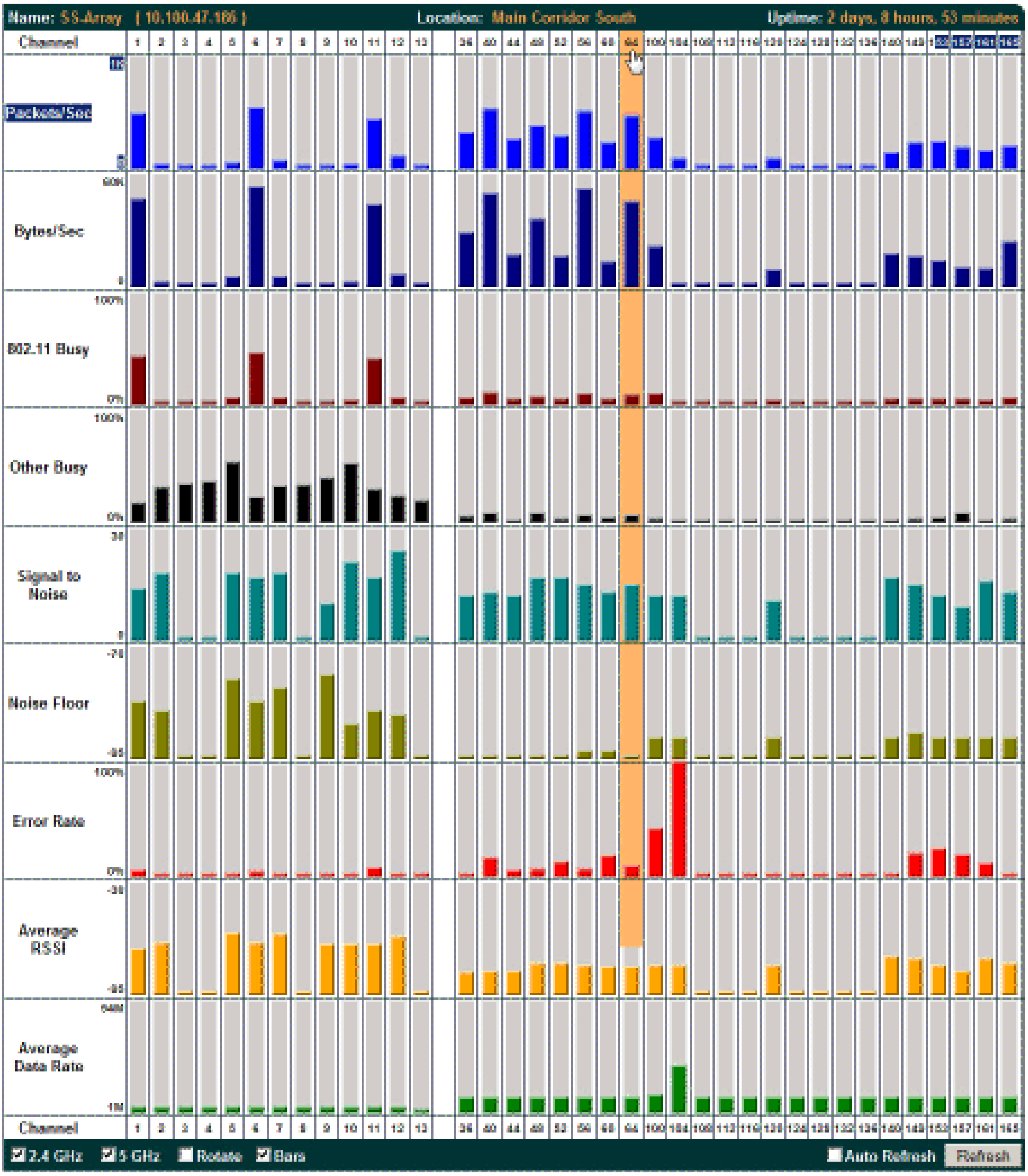
*The RF measurements for this feature are obtained by IAP **abg(n)2**, which **must** be set to **monitor** mode for any data to be available. See "IAP Settings" on page 255.*

Spectrum analysis on Wi-Fi Arrays is a distributed capability that automatically covers the entire Wi-Fi 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 **abg(n)2** 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 abg(n)2 radio is in a listen-only mode, scanning across all Wi-Fi 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 79 (the default presentation), or horizontally as bar graphs or numerical RF measurements. The measurements displayed are explained in "Spectrum Analyzer Measurements" on page 146.

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.

Click Channel number to highlight



Name: SS-Array (10.100.47.186) Location: Main Corridor South Uptime: 2 days, 8 hours, 53 minutes

☑ 2.4 GHz ☑ 5 GHz □ Rotate ☑ Bars □ Auto Refresh Refresh

Select Display Options

Figure 79. 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 (both is the default). 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 Wi-Fi packets per second on the channel, both valid and errored packets.
- **Bytes/Sec:** Total number of Wi-Fi 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.

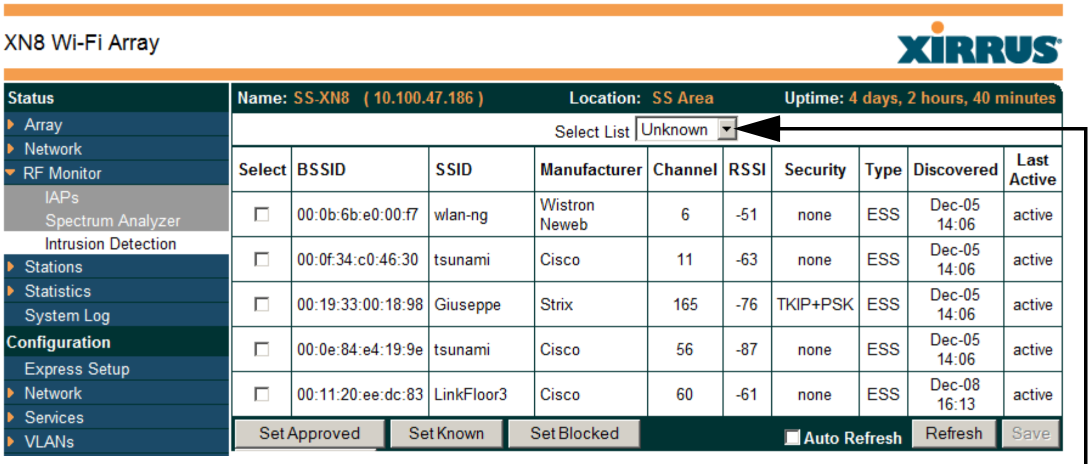
  The total busy time (802.11 Busy plus Other Busy) will never total more than 100%. The remaining time (100% minus total busy time) is quiet time—the time that no activity was seen on the channel.

- **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 Wi-Fi 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 category you select from the drop-down list at the top—either Unknown, Known or Approved. This includes ad hoc access points (station-to-station connections). You can sort the results based on the following parameters by clicking the desired column header:

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



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 2 hours, 40 minutes

Select List Unknown

Select	BSSID	SSID	Manufacturer	Channel	RSSI	Security	Type	Discovered	Last Active
□	00:0b:6b:e0:00:f7	wlan-ng	Wistron Neweb	6	-51	none	ESS	Dec-05 14:06	active
□	00:0f:34:c0:46:30	tsunami	Cisco	11	-63	none	ESS	Dec-05 14:06	active
□	00:19:33:00:18:98	Giuseppe	Strix	165	-76	TKIP+PSK	ESS	Dec-05 14:06	active
□	00:0e:84:e4:19:9e	tsunami	Cisco	56	-87	none	ESS	Dec-05 14:06	active
□	00:11:20:ee:dc:83	LinkFloor3	Cisco	60	-61	none	ESS	Dec-08 16:13	active

Select the type of AP to display

Figure 80. Intrusion Detection/Rogue AP List

The Intrusion Detection window provides the easiest method for designating rogue APs as Known. Approved, or Unknown. Choose one or more APs using the checkbox in the **Select** column, then set whether they are Approved, Known, or Unknown using the buttons on the lower left.

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

Station Status Windows

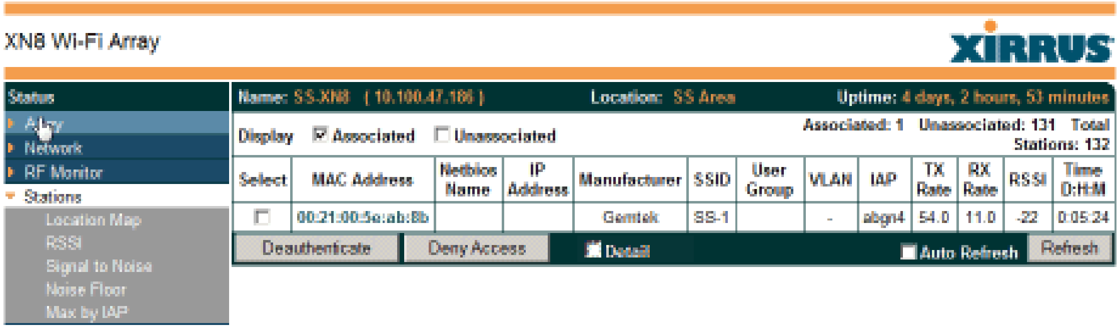
The following Station Status windows are available:

- **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.

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 not associated, or both, by selecting the appropriate checkboxes above the list. The list shows the MAC address of each station, its NetBIOS name, its IP address, its manufacturer, 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 the **Detail** checkbox at the bottom of the window to show a number of additional columns, including security settings used by the connection, the channel and band used, and additional RF measurements.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 2 hours, 53 minutes

Display ☑ Associated □ Unassociated Associated: 1 Unassociated: 131 Total Stations: 132

Select	MAC Address	Netbios Name	IP Address	Manufacturer	SSID	User Group	VLAN	IAP	TX Rate	RX Rate	RSSI	Time D:H:M
□	00:21:00:5e:ab:8b			Gemtek	SS-1		-	abgn4	54.0	11.0	-22	0:05:24

Figure 81. 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 223 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

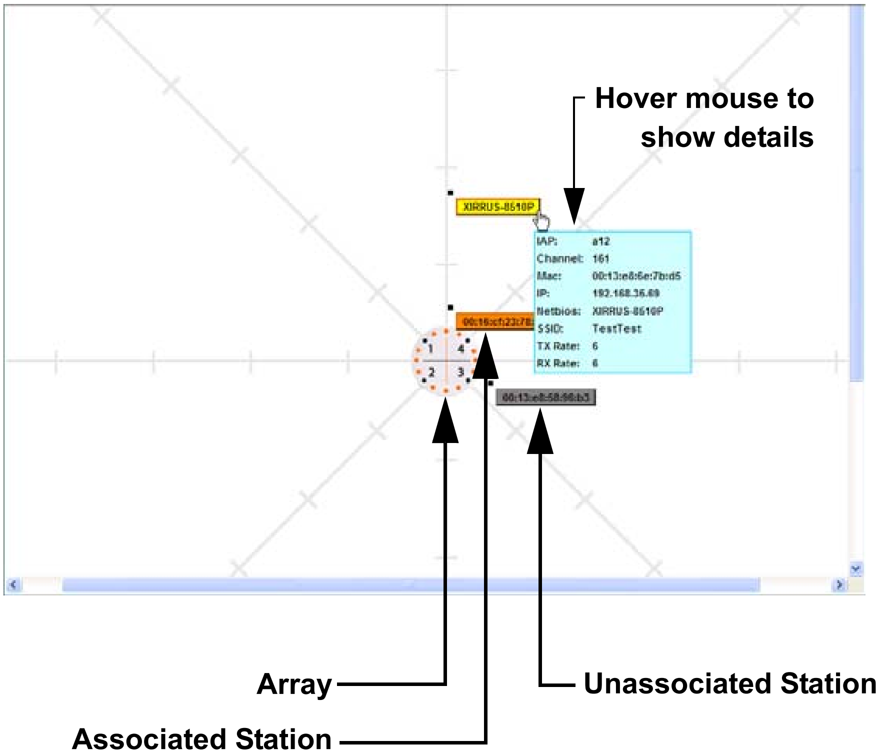
Access Control List

Station Status Windows

Location Map

The Location Map shows the approximate locations of stations relative to this Array. You may display stations associated to this Array, unassociated stations (shown in gray), or both. The station count is shown on the left, above the map. You may also choose to display 5 GHz stations (shown in orange) or 2.4 GHz stations (shown in green), or both.

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 **abg(n)1** to **abg(n)4** are a mirror image of the way they are typically drawn when looking at the face of the Array. Radios **abg(n)1** to **abg(n)4** are marked (**1** to **4**) on the map to show the orientation of the Array.



IAP: a12
Channel: 161
Mac: 00:13:e8:6e:7b:d5
IP: 192.168.36.69
Netbios: XIRRUS-8510P
SSID: TestTest
TX Rate: 6
RX Rate: 6

Hover mouse to show details

Array

Associated Station

Unassociated Station

Figure 82. Location Map

A station is identified by its NetBIOS name if known, or else by its IP or MAC address. Hover the mouse over a station to show detailed information. 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. Click it again for normal display. 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.

Controls and items displayed on the Location Map window

The controls for the Location Map are all at the bottom of the window and take up a fair amount of width. If some of the controls shown in Figure 83 are not visible, resize your browser window to be wider until all of the controls appear.

Also, 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.

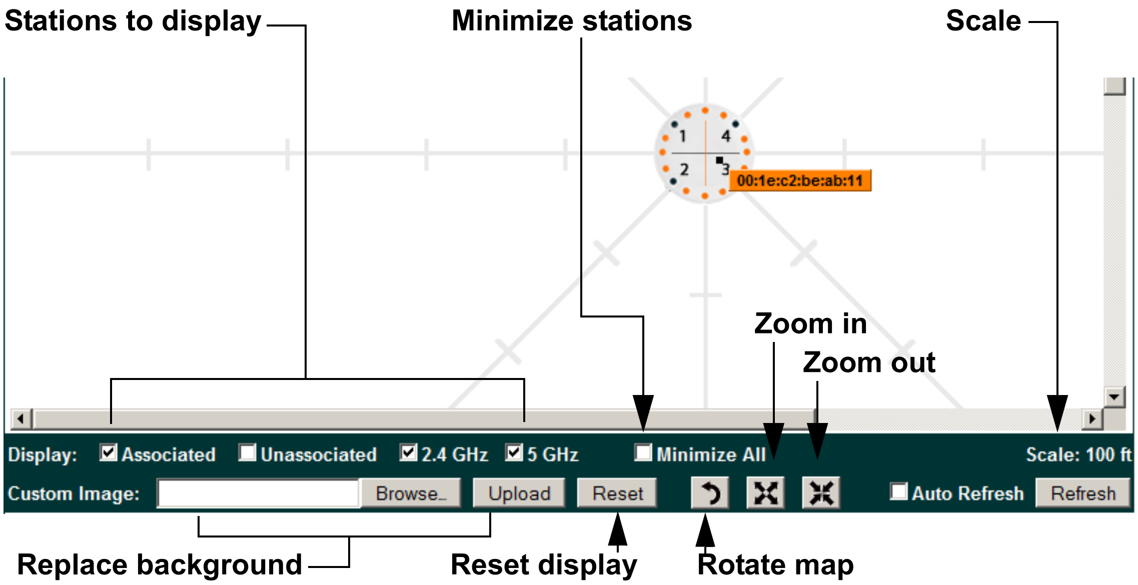
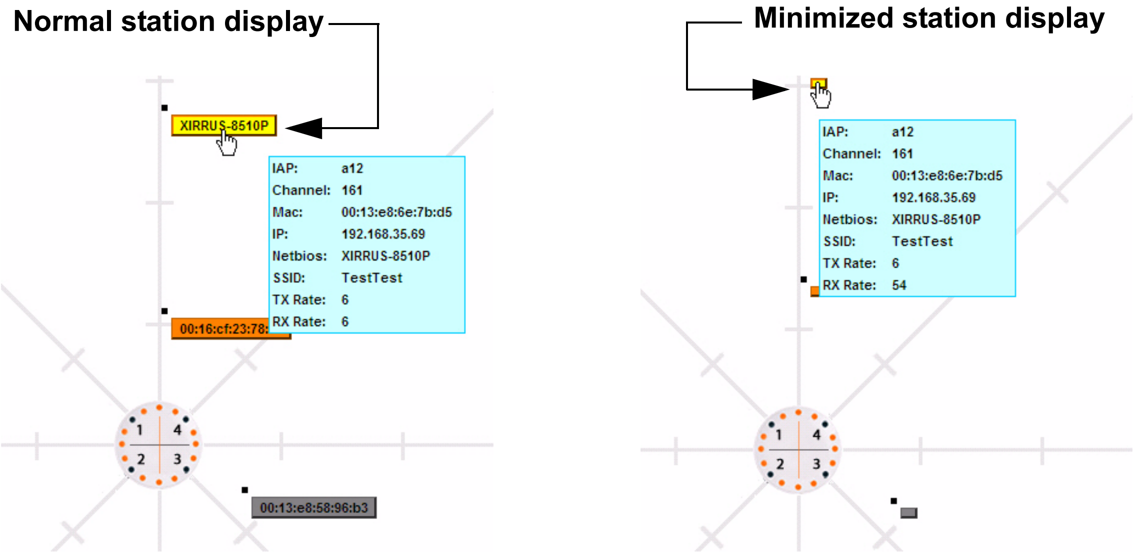

Stations to display
Minimize stations
Scale
1
4
2
3
00:1e:c2:be:ab:11
Zoom in
Zoom out
Display: ☑ Associated □ Unassociated ☑ 2.4 GHz ☑ 5 GHz □ Minimize All Scale: 100 ft
Custom Image: Browse... Upload Reset □ Auto Refresh Refresh
Replace background
Reset display
Rotate map

Figure 83. 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 802.11bg(n) stations, or 802.11a(n) stations, or both.
- **Minimize All**: All stations are shown by default with their NetBIOS name or IP or MAC address. If the map is too cluttered, you can reduce the display for each station to a small rectangle. You may still display

detailed information for the station by hovering over it. To enlarge all rectangles, clear the Minimize All checkbox.


Normal station display

IAP: a12
Channel: 161
Mac: 00:13:e8:6e:7b:d5
IP: 192.168.35.69
Netbios: XIRRUS-8510P
SSID: TestTest
TX Rate: 6
RX Rate: 6

Minimized station display

IAP: a12
Channel: 161
Mac: 00:13:e8:6e:7b:d5
IP: 192.168.35.69
Netbios: XIRRUS-8510P
SSID: TestTest
TX Rate: 6
RX Rate: 54

Figure 84. Minimizing stations

- **Scale**: This view-only value shows the approximate distance represented by each hashmark on the default map background. Scale is the rightmost of the items displayed in the control area - you may need to scroll to the right edge to see it.
- **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 156.
- **Upload**: After browsing to the desired custom image, click the **Upload** button to install it. The map will be redisplayed with your new background. No hash marks 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** on the bottom right is updated with the new scale for the map.
- **Reduce**: Click this button to reduce (zoom out on) the map. The displayed **Scale** on the bottom right is updated with the new scale for the map
- **Auto Refresh:** Instructs the Array to refresh this window automatically.
- **Refresh:** Updates the stations displayed.

See Also

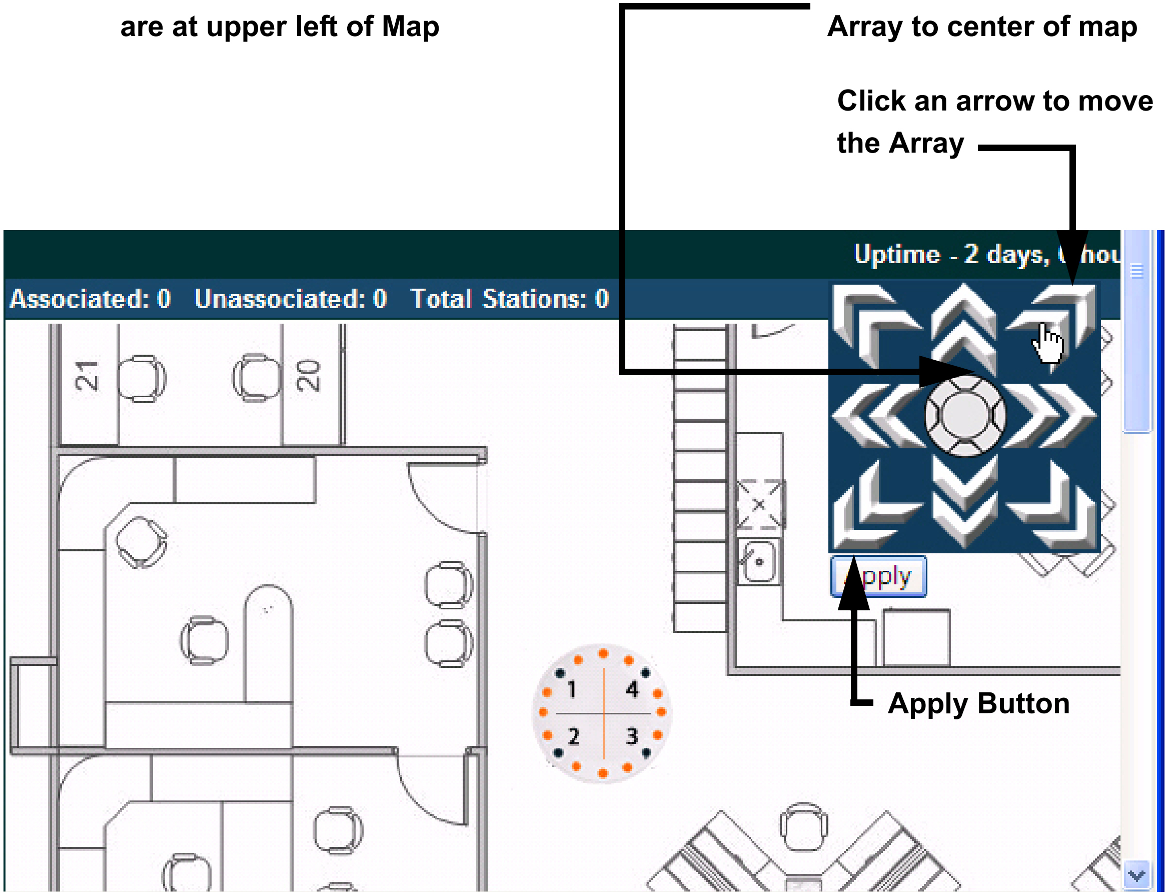
Access Control List

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 154), you should move the display of the Array on your map to correspond with its actual location at your site. The Location Map window provides a special set of controls for moving the location of the Array. These controls are displayed on the upper right corner of the map (Figure 85). The location controls only appear when you are using a custom image for your background. You will not see them if you are using the default map background.

To move the Array on the map in a particular direction, click an arrow for the desired direction on the location controls. The inner arrows move the Array by small steps; the outer arrows move it by larger steps. The arrows only work when you position the mouse directly over them—make sure you see the hand icon 👆. If you need to return the Array to the center of the map, click the center of the location controls. When you are done, click the **Apply** button to save the new Array location, as well as the enlarge/reduce/rotate settings. These location settings will persist for the duration of the current WMI session, but not after a reboot (but the custom image will still be used after rebooting—whether or not you click **Apply**).



Array Location Controls are at upper left of Map

Click here to move Array to center of map

Click an arrow to move the Array

Apply Button

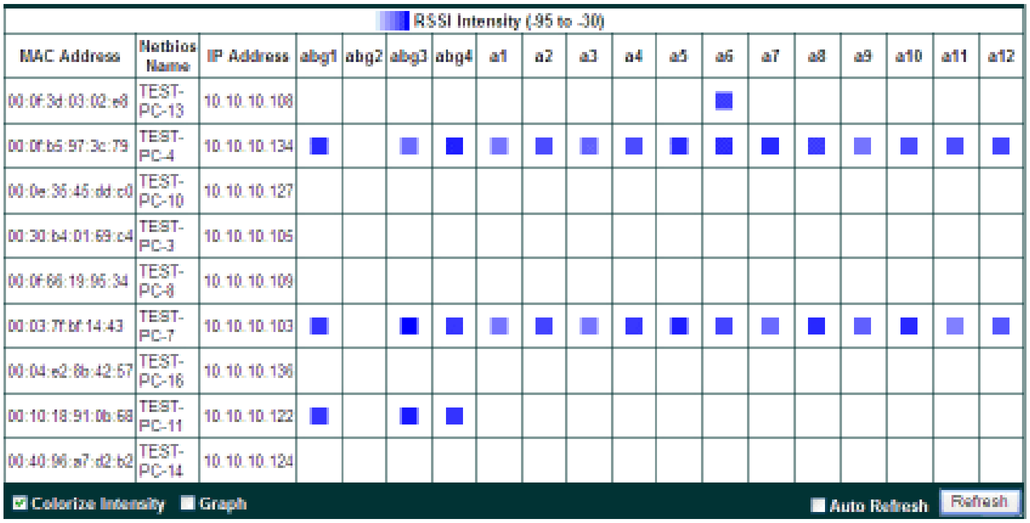
Uptime - 2 days, (hou

Associated: 0 Unassociated: 0 Total Stations: 0

Figure 85. Setting Array location on a Custom Image

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.

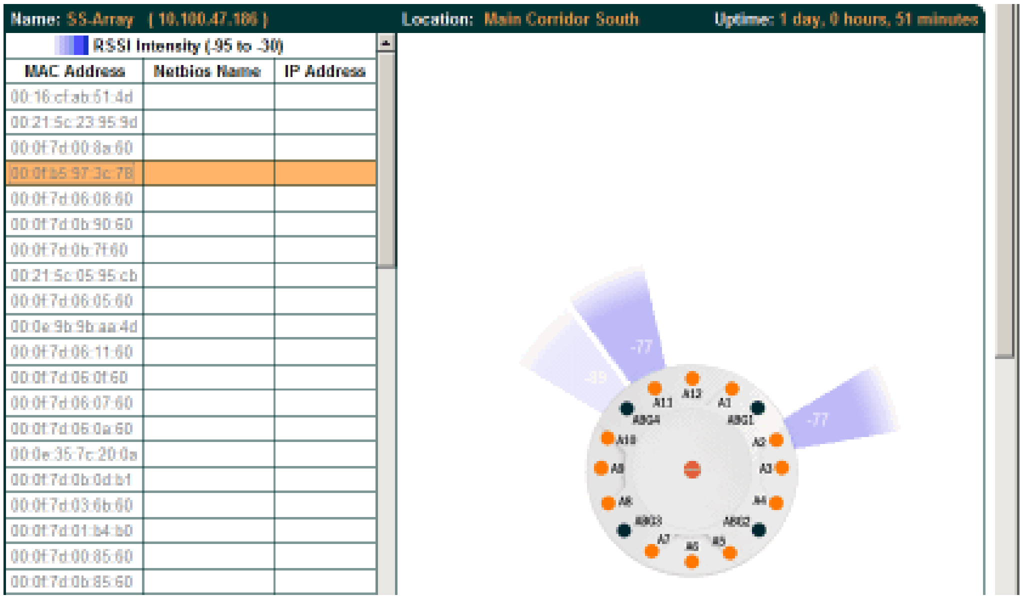


RSSI Intensity (-95 to -30)

MAC Address	Netbios Name	IP Address	abg1	abg2	abg3	abg4	a1	a2	a3	a4	a5	a6	a7	a8	a9	a10	a11	a12
00:0f:3d:03:02:e8	TEST-PC-13	10.10.10.108										■						
00:0f:b5:97:3c:79	TEST-PC-4	10.10.10.134	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■
00:0e:35:45:dd:c0	TEST-PC-10	10.10.10.127																
00:30:b4:01:69:c4	TEST-PC-3	10.10.10.105																
00:0f:66:19:95:34	TEST-PC-8	10.10.10.109																
00:03:7f:bf:14:43	TEST-PC-7	10.10.10.103	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■
00:04:e2:8b:42:57	TEST-PC-16	10.10.10.136																
00:10:18:91:0b:68	TEST-PC-11	10.10.10.122	■		■	■												
00:40:96:a7:d2:b2	TEST-PC-14	10.10.10.124																

Figure 86. 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 86) If you select **Graph**, then the RSSI is shown on a representation of the Array, either colorized or numerically based on your selection. (Figure 87) The stations are listed to the left of the Array—click on a station to show its RSSI values on the Array.



Name: SS-Array (10.100.47.186) Location: Main Corridor South Uptime: 1 day, 0 hours, 51 minutes

RSSI Intensity (-95 to -30)

MAC Address	Netbios Name	IP Address
00:16:cf:ab:51:4d		
00:21:5c:23:95:9d		
00:0f:7d:00:8a:60		
00:0f:b5:97:3c:78		
00:0f:7d:06:08:60		
00:0f:7d:0b:90:60		
00:0f:7d:0b:7f:60		
00:21:5c:05:95:cb		
00:0f:7d:06:05:60		
00:0e:9b:9b:aa:4d		
00:0f:7d:06:11:60		
00:0f:7d:06:0f:60		
00:0f:7d:06:07:60		
00:0f:7d:06:0a:60		
00:0e:35:7c:20:0a		
00:0f:7d:0b:0d:b1		
00:0f:7d:03:6b:60		
00:0f:7d:01:b4:b0		
00:0f:7d:00:85:60		
00:0f:7d:0b:85:60		

Figure 87. 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.

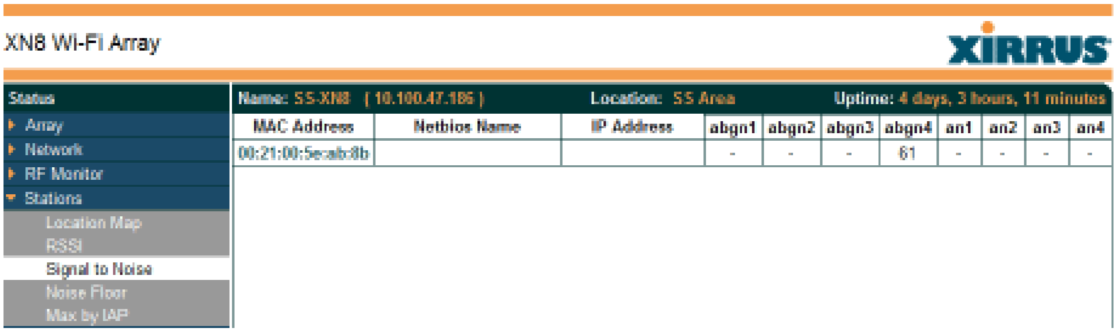
See Also

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.



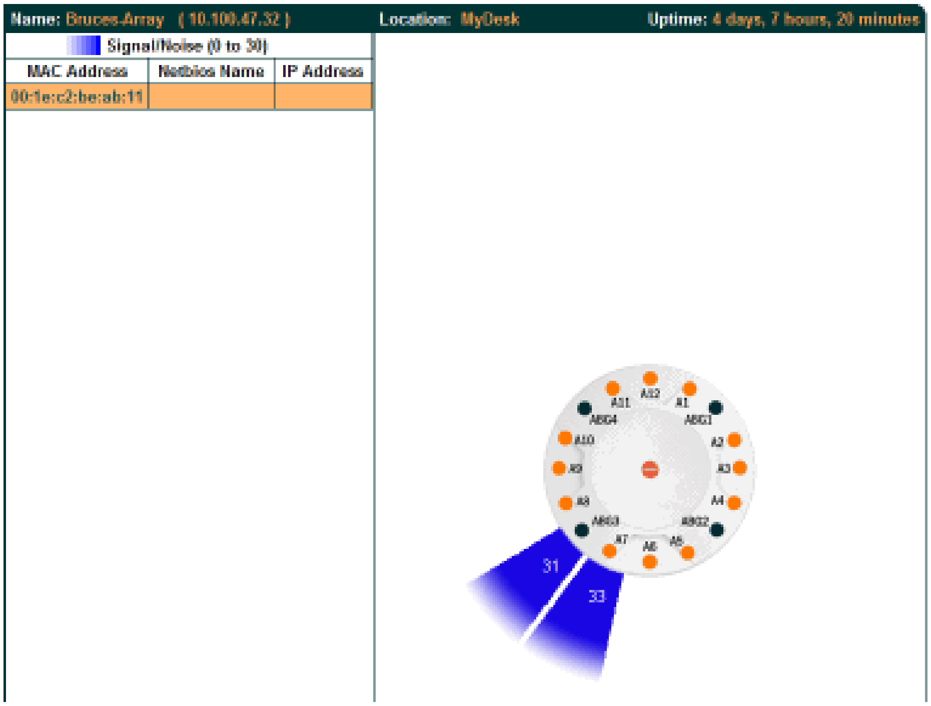
Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 3 hours, 11 minutes

MAC Address	Netbios Name	IP Address	abgn1	abgn2	abgn3	abgn4	an1	an2	an3	an4
00:21:00:5e:ab:8b			-	-	-	61	-	-	-	-

Figure 88. 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 88) You may display the relative value using color if you select **Colorize Intensity**, with the highest SNR indicated by the most intense color. (Figure 89) 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.



Name: Bruces-Array (10.100.47.32) Location: MyDesk Uptime: 4 days, 7 hours, 20 minutes

Signal/Noise (0 to 30)

MAC Address	Netbios Name	IP Address
00:1e:c2:be:ab:11		

Figure 89. 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.

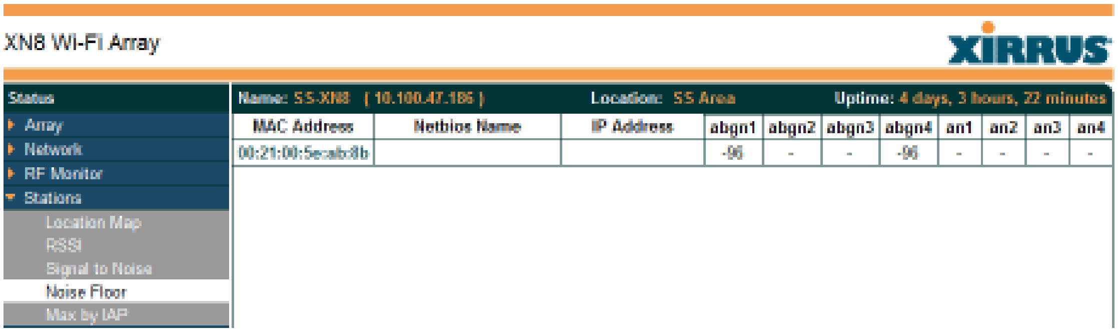
See Also

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.



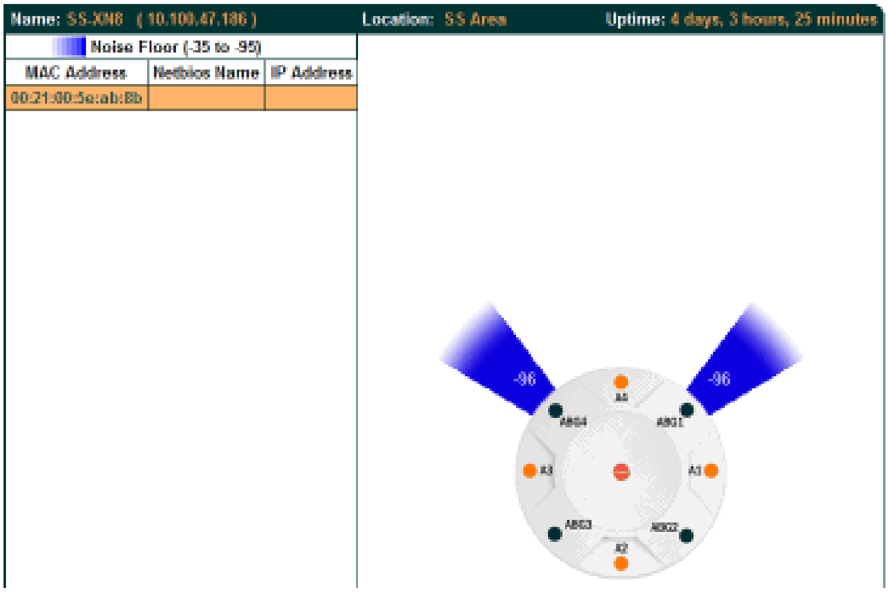
Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 3 hours, 22 minutes

MAC Address	Netbios Name	IP Address	abgn1	abgn2	abgn3	abgn4	an1	an2	an3	an4
00:21:00:5e:ab:8b			-96	-	-	-96	-	-	-	-

Figure 90. 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 90) 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 91) The stations are listed to the left of the Array—click on a station to show its values on the Array.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 3 hours, 25 minutes

Noise Floor (-35 to -95)

MAC Address	Netbios Name	IP Address
00:21:00:5e:ab:8b		

Figure 91. 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.

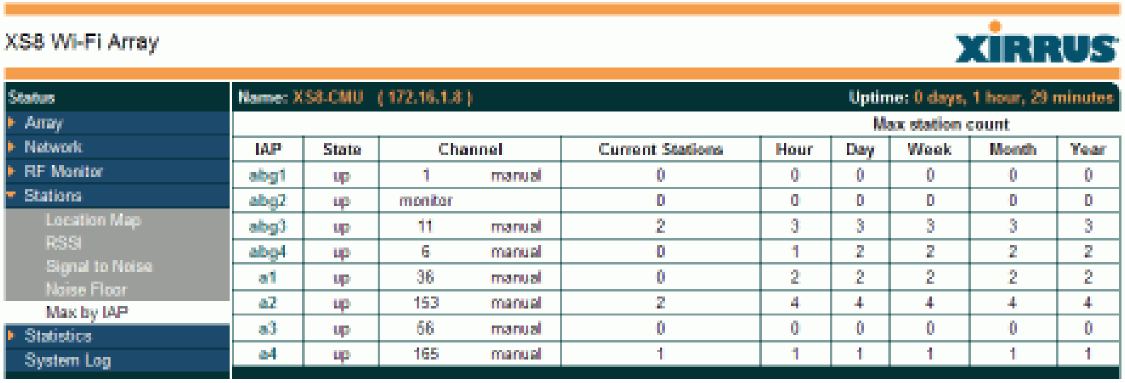
See Also

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.



Name: XS8-CMU (172.16.1.8)

Uptime: 0 days, 1 hour, 29 minutes

				Max station count				
IAP	State	Channel	Current Stations	Hour	Day	Week	Month	Year
abg1	up	1 manual	0	0	0	0	0	0
abg2	up	monitor	0	0	0	0	0	0
abg3	up	11 manual	2	3	3	3	3	3
abg4	up	6 manual	0	1	2	2	2	2
a1	up	36 manual	0	2	2	2	2	2
a2	up	153 manual	2	4	4	4	4	4
a3	up	56 manual	0	0	0	0	0	0
a4	up	165 manual	1	1	1	1	1	1

Figure 92. 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

Statistics Windows

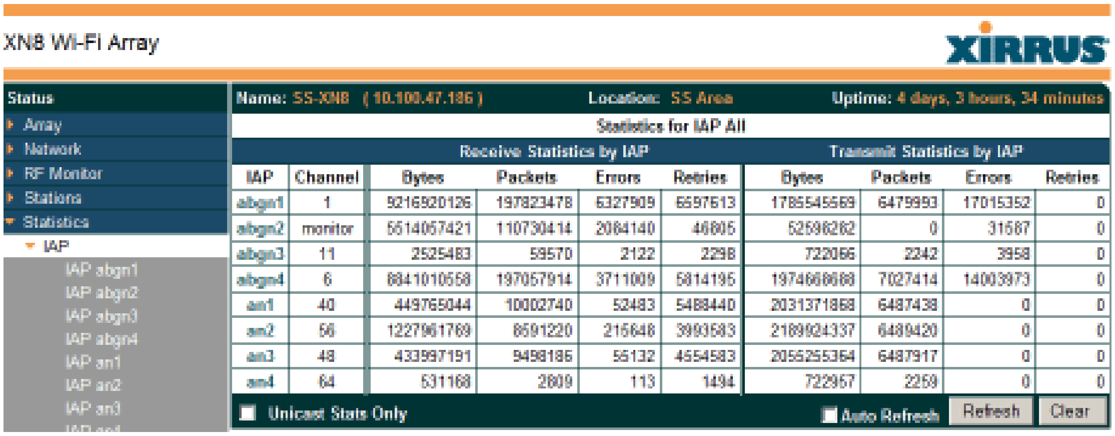
The following Array Statistics windows are available:

- **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 166. 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.

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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 3 hours, 34 minutes

Statistics for IAP All

		Receive Statistics by IAP				Transmit Statistics by IAP			
IAP	Channel	Bytes	Packets	Errors	Retries	Bytes	Packets	Errors	Retries
abgn1	1	9216920126	197823478	6327909	6597613	1785545569	6479993	17015352	0
abgn2	monitor	5514057421	110730414	2084140	46805	52598282	0	31587	0
abgn3	11	2525483	59570	2122	2298	722066	2242	3958	0
abgn4	6	8841010558	197057914	3711009	5814195	1974668688	7027414	14003973	0
an1	40	449765044	10002740	52483	5488440	2031371868	6487438	0	0
an2	56	1227961769	8591220	215648	3993583	2189924337	6489420	0	0
an3	48	433997191	9498186	55132	4554583	2055255364	6487917	0	0
an4	64	531168	2809	113	1494	722967	2259	0	0

☐ Unicast Stats Only ☐ Auto Refresh Refresh Clear

Figure 93. IAP Statistics Summary Page

See Also

System Log Window

Global Settings (IAP)

Global Settings .11a

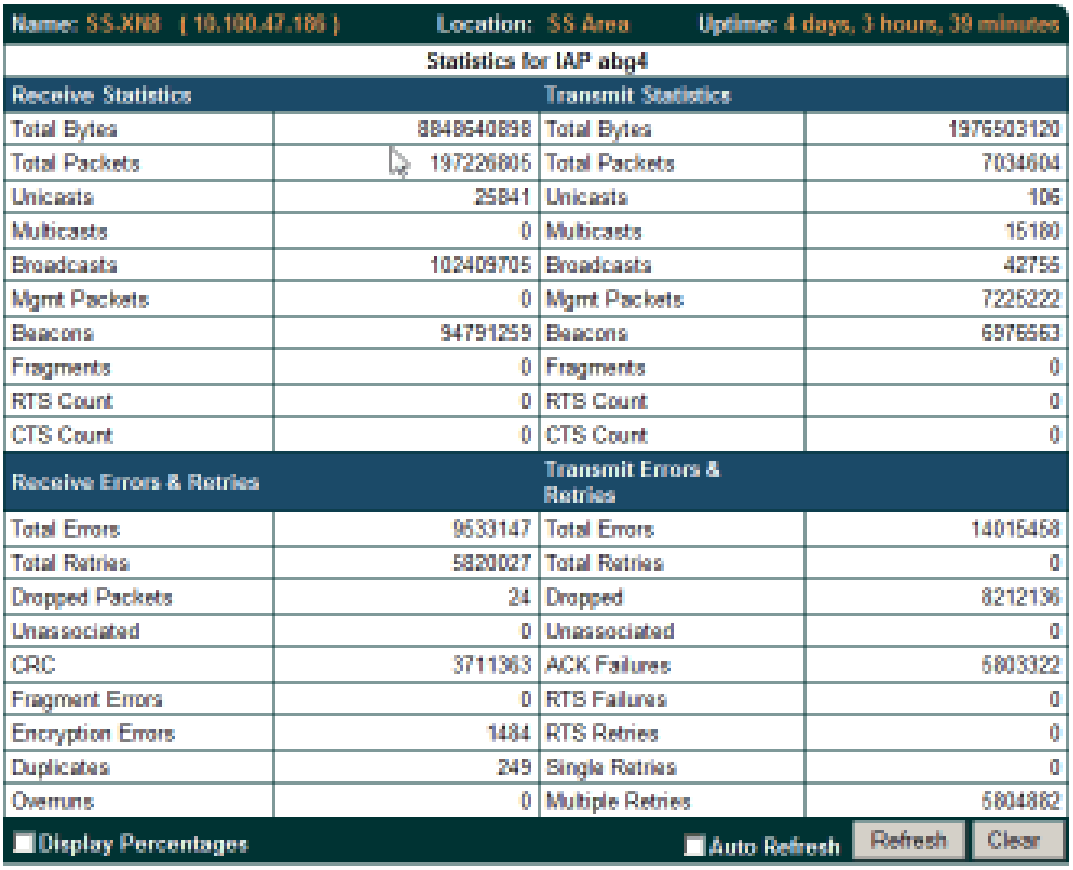
Global Settings .11bg

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 165. 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 123.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 3 hours, 39 minutes

Statistics for IAP abg4

Receive Statistics		Transmit Statistics	
Total Bytes	8848640898	Total Bytes	1976503120
Total Packets	197226805	Total Packets	7034604
Unicasts	25841	Unicasts	106
Multicasts	0	Multicasts	15180
Broadcasts	102409705	Broadcasts	42755
Mgmt Packets	0	Mgmt Packets	7225222
Beacons	94791259	Beacons	6976563
Fragments	0	Fragments	0
RTS Count	0	RTS Count	0
CTS Count	0	CTS Count	0
Receive Errors & Retries		**Transmit Errors & Retries**	
Total Errors	9533147	Total Errors	14015458
Total Retries	5820027	Total Retries	0
Dropped Packets	24	Dropped	8212136
Unassociated	0	Unassociated	0
CRC	3711363	ACK Failures	5803322
Fragment Errors	0	RTS Failures	0
Encryption Errors	1484	RTS Retries	0
Duplicates	249	Single Retries	0
Overruns	0	Multiple Retries	5804882

Figure 94. Individual IAP Statistics Page (for IAP abg(n)1)

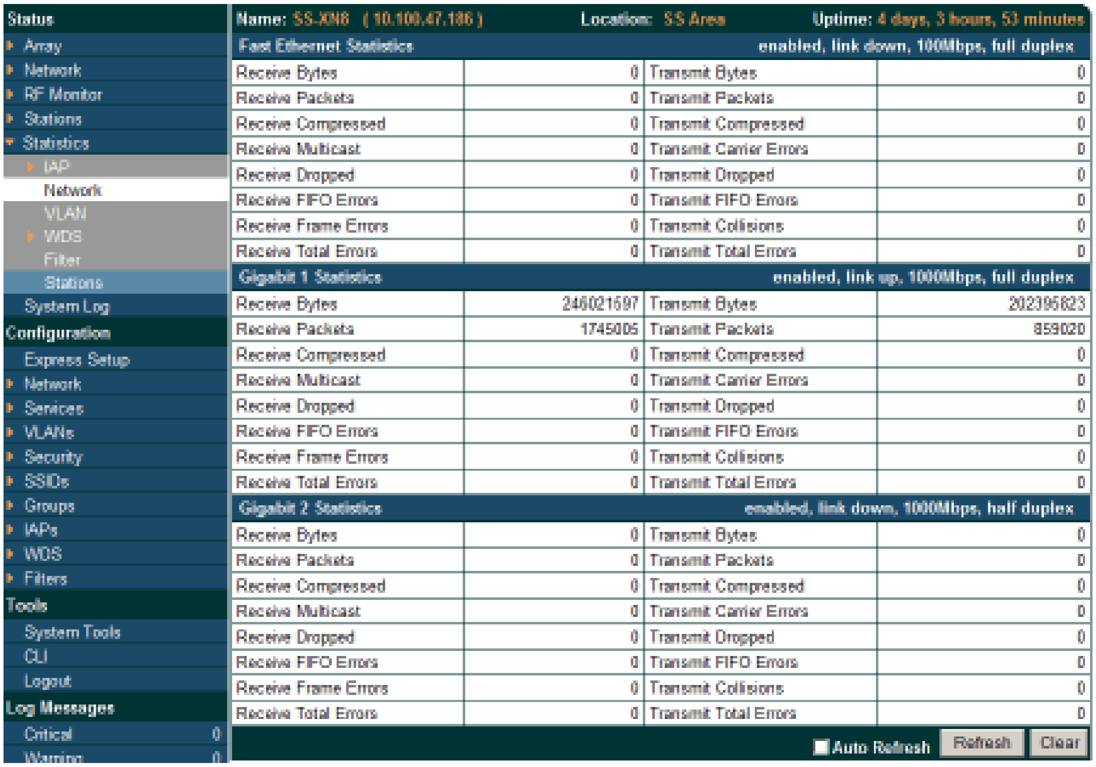
You can **Refresh** the data (update the window with the latest information) or **Clear** the data (reset all content to zero and begin counting again) at any time by clicking on the appropriate button. You can also click in the **Auto Refresh** check box to instruct the Array to refresh this window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

See Also

System Log Window
Global Settings (IAP)
Global Settings .11a
Global Settings .11bg
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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 3 hours, 53 minutes

Fast Ethernet Statistics		enabled, link down, 100Mbps, full duplex	
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
Gigabit 1 Statistics		**enabled, link up, 1000Mbps, full duplex**	
Receive Bytes	246021597	Transmit Bytes	202395823
Receive Packets	1745005	Transmit Packets	859020
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
Gigabit 2 Statistics		**enabled, link down, 1000Mbps, half duplex**	
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

Figure 95. Network Statistics

See Also

DHCP Server

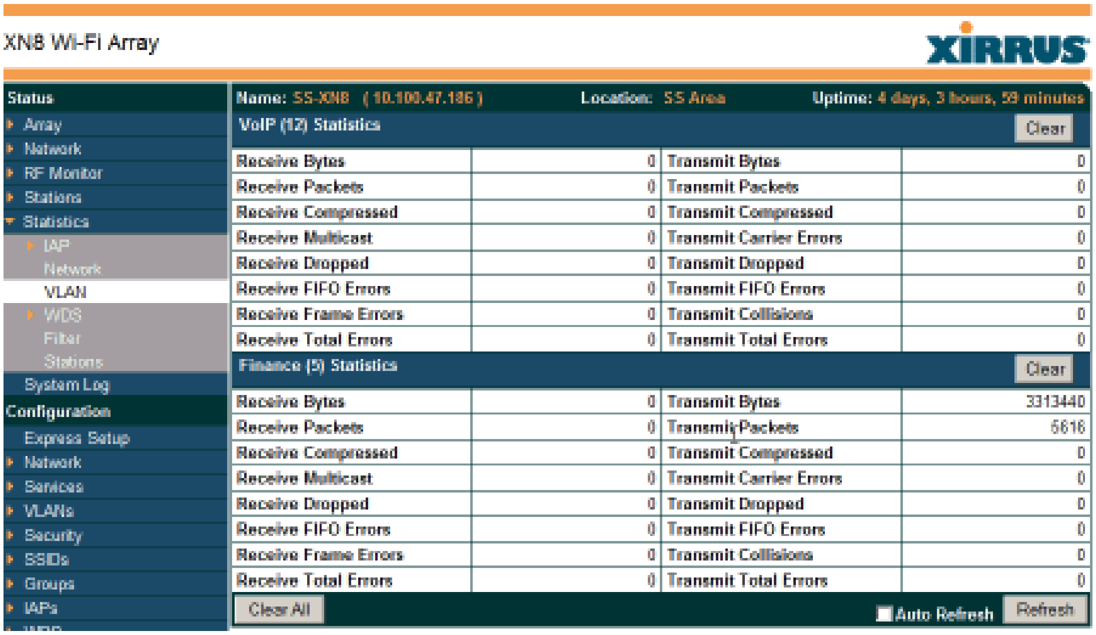
DNS Settings

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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 3 hours, 59 minutes

VoIP (12) 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

Finance (5) Statistics

Receive Bytes	0	Transmit Bytes	3313440
Receive Packets	0	Transmit Packets	5616
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

Figure 96. VLAN Statistics

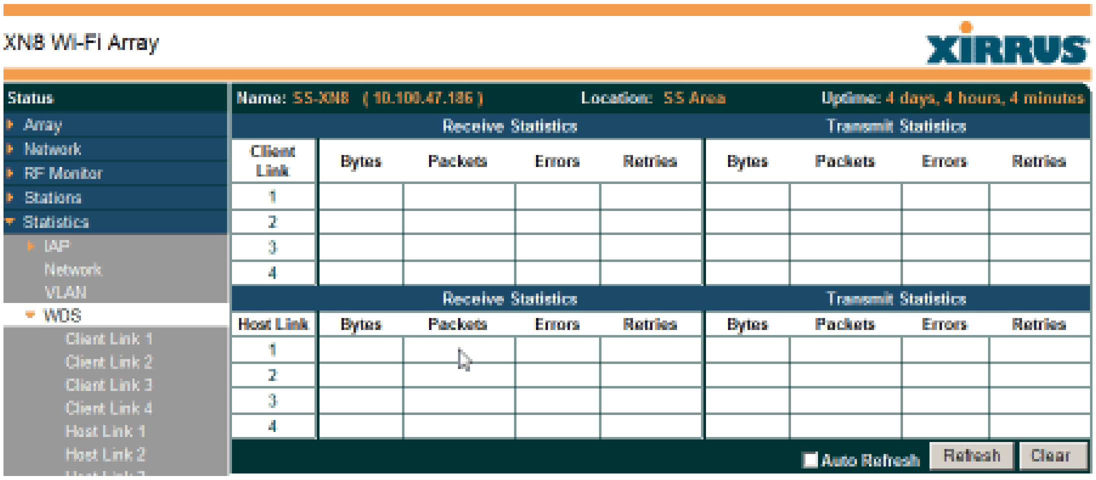
See Also

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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 4 hours, 4 minutes

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

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

☐ Auto Refresh

Figure 97. WDS Statistics

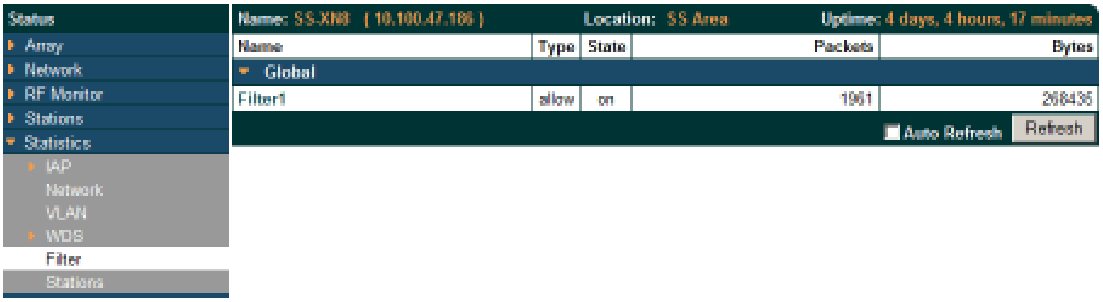
See Also

SSID Management

WDS

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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 4 days, 4 hours, 17 minutes

Name	Type	State	Packets	Bytes
Global				
Filter1	allow	on	1961	268436

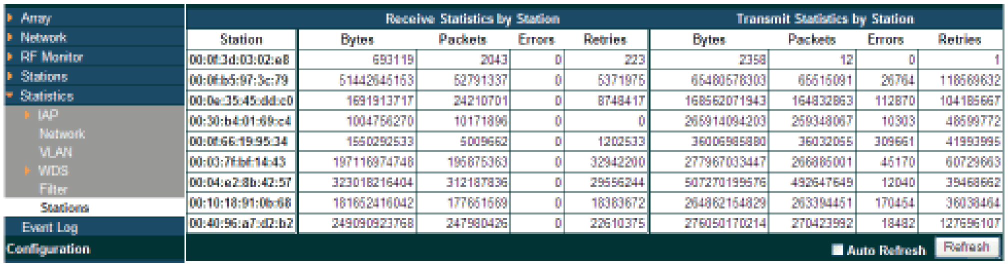
Figure 98. Filter Statistics

See Also

Filters

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 172.



	Receive Statistics by Station				Transmit Statistics by Station			
Station	Bytes	Packets	Errors	Retries	Bytes	Packets	Errors	Retries
00:0f:3d:03:02:e8	693119	2043	0	223	2358	12	0	1
00:0f:b5:97:3c:79	51442645163	52791337	0	5371975	65480578303	65516091	26764	118569632
00:0e:35:45:dd:c0	1691913717	24210701	0	8748417	168562071943	164832863	112870	104185667
00:30:b4:01:69:c4	1004756270	10171896	0	0	265914094203	259348067	10303	48599772
00:0f:66:19:95:34	1550292533	5009662	0	1202533	36006985880	36032055	309661	41993995
00:03:7f:bf:14:43	197116974748	195875363	0	32942200	277967033447	266885001	45170	60729663
00:04:e2:8b:42:57	323018216404	312187836	0	29556244	507270199576	492647649	12040	39468662
00:10:18:91:0b:68	181652416042	177651569	0	18383672	264862164829	263394451	170454	36038464
00:40:96:a7:d2:b2	249090923768	247980426	0	22610375	276050170214	270423992	18482	127696107

Figure 99. 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

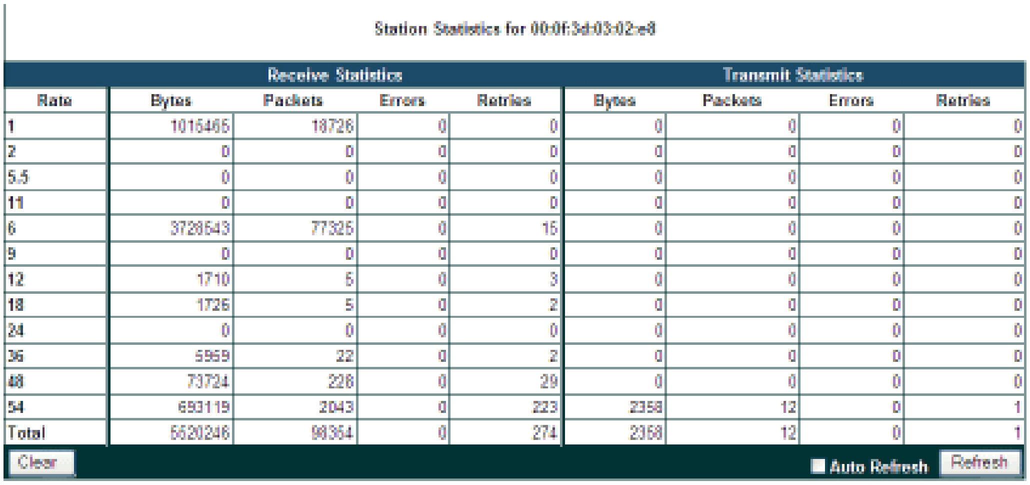
Per-Station Statistics

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 171.

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.



Station Statistics for 00:0f:3d:03:02:e8

	Receive Statistics				Transmit Statistics			
Rate	Bytes	Packets	Errors	Retries	Bytes	Packets	Errors	Retries
1	1016465	18726	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
5.5	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
6	3728543	77325	0	15	0	0	0	0
9	0	0	0	0	0	0	0	0
12	1710	5	0	3	0	0	0	0
18	1726	5	0	2	0	0	0	0
24	0	0	0	0	0	0	0	0
36	5959	22	0	2	0	0	0	0
48	73724	228	0	29	0	0	0	0
54	693119	2043	0	223	2358	12	0	1
Total	5520246	98364	0	274	2358	12	0	1

Figure 100. Individual Station Statistics Page

See Also

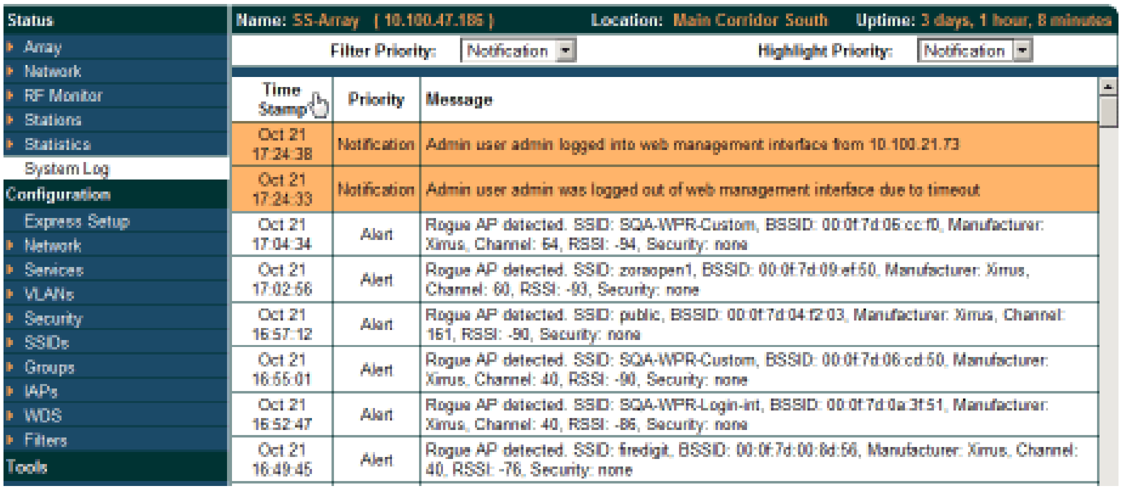
Station Statistics

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 the Debug level but use **Filter Priority** to display only messages at the Information level and above.



Name: SS-Array (10.100.47.186) Location: Main Corridor South Uptime: 3 days, 1 hour, 8 minutes

Filter Priority: Notification Highlight Priority: Notification

Time Stamp	Priority	Message
Oct 21 17:24:38	Notification	Admin user admin logged into web management interface from 10.100.21.73
Oct 21 17:24:33	Notification	Admin user admin was logged out of web management interface due to timeout
Oct 21 17:04:34	Alert	Rogue AP detected. SSID: SQA-WPR-Custom, BSSID: 00:0f:7d:06:cc:f0, Manufacturer: Xirrus, Channel: 64, RSSI: -94, Security: none
Oct 21 17:02:56	Alert	Rogue AP detected. SSID: zoraopen1, BSSID: 00:0f:7d:09:ef:50, Manufacturer: Xirrus, Channel: 60, RSSI: -93, Security: none
Oct 21 16:57:12	Alert	Rogue AP detected. SSID: public, BSSID: 00:0f:7d:04:f2:03, Manufacturer: Xirrus, Channel: 161, RSSI: -90, Security: none
Oct 21 16:55:01	Alert	Rogue AP detected. SSID: SQA-WPR-Custom, BSSID: 00:0f:7d:06:cd:50, Manufacturer: Xirrus, Channel: 40, RSSI: -90, Security: none
Oct 21 16:52:47	Alert	Rogue AP detected. SSID: SQA-WPR-Login-int, BSSID: 00:0f:7d:0a:3f:51, Manufacturer: Xirrus, Channel: 40, RSSI: -86, Security: none
Oct 21 16:49:45	Alert	Rogue AP detected. SSID: firedigit, BSSID: 00:0f:7d:00:8d:56, Manufacturer: Xirrus, Channel: 40, RSSI: -76, Security: none

Figure 101. System Log

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 Log** button to delete all messages. You can also click in the **Auto Refresh** check box to instruct the Array to refresh this window automatically.

Configuring the Wi-Fi 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 176**
- **"Network" on page 182**
- **"Services" on page 193**
- **"VLANs" on page 205**
- **"Security" on page 209**
- **"SSIDs" on page 235**
- **"Groups" on page 247**
- **"IAPs" on page 253**
- **"WDS" on page 285**
- **"Filters" on page 289**

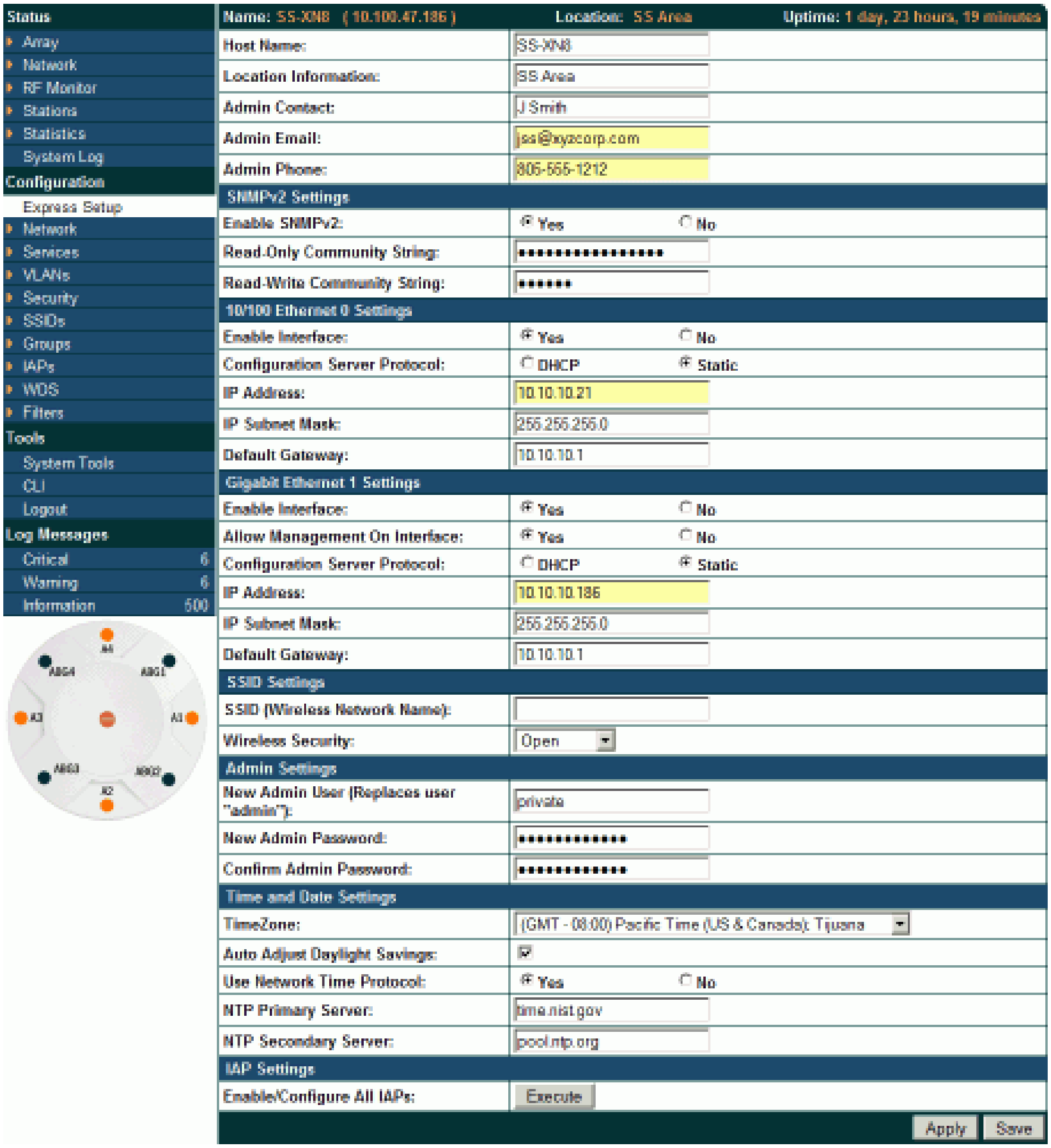
After making changes to the configuration settings of an Array you must click on the **Save** button at the bottom of the configuration window, otherwise the changes you make will not be applied the next time the Array is rebooted. Click the **Apply** button if you want the changes applied to the current configuration, without making them permanent.

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 Wi-Fi Array" on page 127**
- **"Using Tools on the Wi-Fi Array" on page 295**

Express Setup

The Express Setup procedure allows you to establish global configuration settings that will enable basic Array functionality. Any changes you make in this window will affect all radios. When finished, click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 1 day, 23 hours, 19 minutes

Host Name:	SS-XN8	
Location Information:	SS Area	
Admin Contact:	J Smith	
Admin Email:	jss@xyzcorp.com	
Admin Phone:	805-555-1212	
SNMPv2 Settings		
Enable SNMPv2:	● Yes	○ No
Read-Only Community String:	●●●●●●●●●●●●●●●●	
Read-Write Community String:	●●●●●●	
10/100 Ethernet 0 Settings		
Enable Interface:	● Yes	○ No
Configuration Server Protocol:	○ DHCP	● Static
IP Address:	10.10.10.21	
IP Subnet Mask:	255.255.255.0	
Default Gateway:	10.10.10.1	
Gigabit Ethernet 1 Settings		
Enable Interface:	● Yes	○ No
Allow Management On Interface:	● Yes	○ No
Configuration Server Protocol:	○ DHCP	● Static
IP Address:	10.10.10.186	
IP Subnet Mask:	255.255.255.0	
Default Gateway:	10.10.10.1	
SSID Settings		
SSID (Wireless Network Name):		
Wireless Security:	Open	
Admin Settings		
New Admin User (Replaces user "admin"):	private	
New Admin Password:	●●●●●●●●●●●●●	
Confirm Admin Password:	●●●●●●●●●●●●●	
Time and Date Settings		
TimeZone:	(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 Secondary Server:	pool.ntp.org	
IAP Settings		
Enable/Configure All IAPs:	Execute	

Figure 102. WMI: 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. Configure **SNMP**: Select whether to **Enable** SNMP on the Array, and set the SNMP community strings. The factory default value for the **SNMP Read-Only Community String** is **xirrus_read_only**. The factory default value for the **SNMP 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**.

7. Configure the **10/100 Ethernet 0** (10/100 Mb) and **Gigabit Ethernet 1** network interface settings. Note that the and Gigabit Ethernet 2 port is not configured on this page. If you need to make changes to Gigabit 2, please see "Network Interfaces" on page 183.

   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**: This option is available only on the Gigabit 1 and Gigabit 2 interfaces—the 10/100 Ethernet port is also known as the Management Port, and management is **always** enabled on this port. Choose **Yes** to allow management of the Array via this Gigabit interface, or choose **No** to deny all management privileges for this interface.

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 information:

   - **IP 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.
   - **IP 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.

8. **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 398.

   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 210.

c. **Wireless Key/Passphrase**: Depending on the wireless security scheme you selected, enter a unique WEP key or WPA passphrase.

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

9. **Admin Settings:** This section allows you to change the default admin username and password for the Array.

a. **New Admin User (Replace Default)**: Enter the name of a new administrator user account. 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). The default **admin** user is deleted. Note that the Array also offers the option of authenticating administrators using a RADIUS server (see "Admin Management" on page 215)).

b. **New Admin Password**: If desired, enter a new administration password for managing this Array. Choose a password that is not obvious, and one that you can remember. If you forget your password, you must reset the Array to its factory defaults so that the password is reset to **admin** (its default setting).

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

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

    b. **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).

    c. **Use Network Time Protocol**: Check this box if you want to use an NTP server to synchronize the Array's clock. This ensures that Syslog time-stamping is maintained across all units. Without an NTP server assigned (no universal clock), each Array will use its own internal clock and stamp times accordingly, which may result in discrepancies. 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.

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

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.

f. **Set 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).

g. **Set 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).

11. **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.

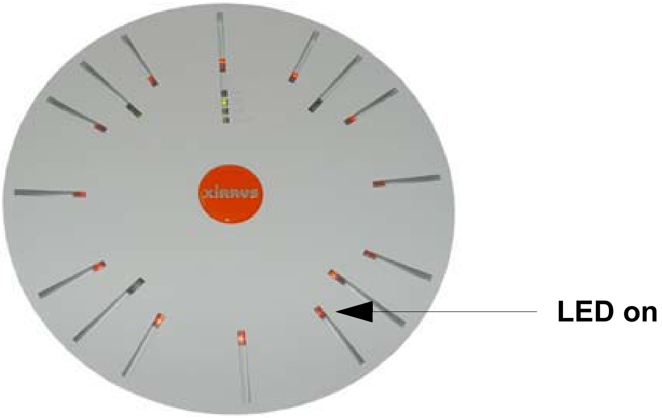
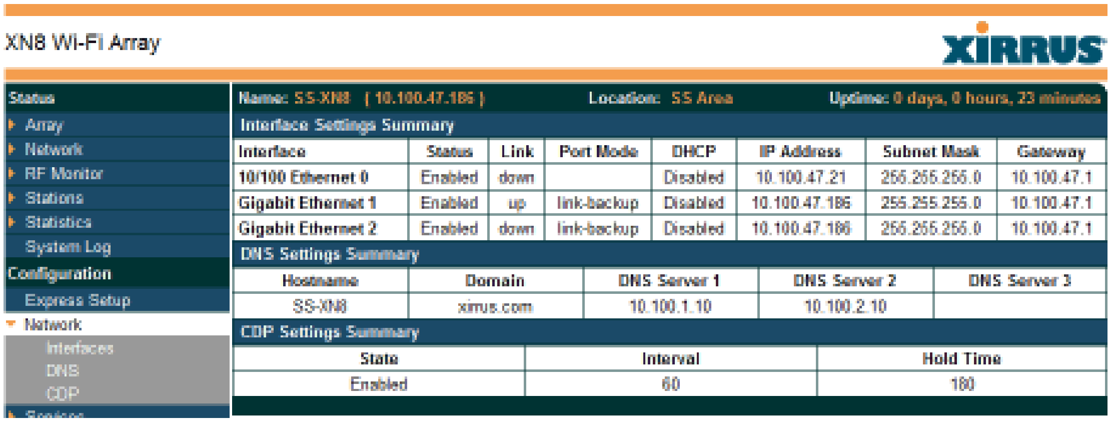


Figure 103. LEDs are Switched On

12. Click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

Network

This is a status-only window that provides a snapshot of the configuration settings currently established for the 10/100 Ethernet 0 interface and the Gigabit 1 and Gigabit 2 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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 23 minutes

Interface Settings Summary

Interface	Status	Link	Port Mode	DHCP	IP Address	Subnet Mask	Gateway
10/100 Ethernet 0	Enabled	down		Disabled	10.100.47.21	255.255.255.0	10.100.47.1
Gigabit Ethernet 1	Enabled	up	link-backup	Disabled	10.100.47.186	255.255.255.0	10.100.47.1
Gigabit Ethernet 2	Enabled	down	link-backup	Disabled	10.100.47.186	255.255.255.0	10.100.47.1

DNS Settings Summary

Hostname	Domain	DNS Server 1	DNS Server 2	DNS Server 3
SS-XN8	xirrus.com	10.100.1.10	10.100.2.10	

CDP Settings Summary

State	Interval	Hold Time
Enabled	60	180

Figure 104. Network Interfaces

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

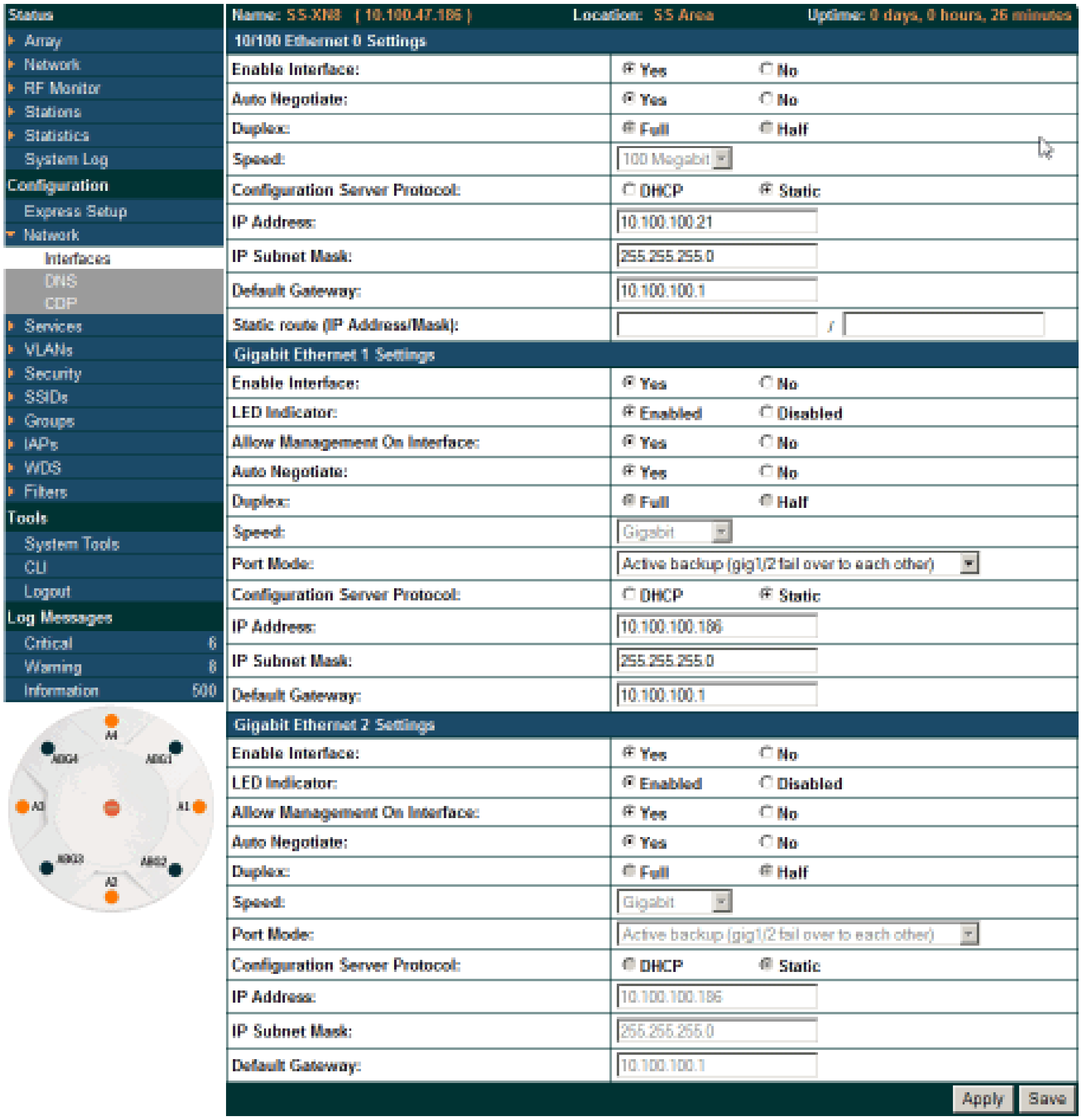
- **"Network Interfaces" on page 183**
- **"DNS Settings" on page 190**
- **"CDP Settings" on page 191**

See Also

DNS Settings
Network Interfaces
Network Status Windows
Spanning Tree Status
Network Statistics

Network Interfaces

This window allows you to establish configuration settings for the 10/100 Fast Ethernet interface and the Gigabit 1 and Gigabit 2 interfaces.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 26 minutes

10/100 Ethernet 0 Settings

Enable Interface:	● Yes	○ No
Auto Negotiate:	● Yes	○ No
Duplex:	● Full	○ Half
Speed:	100 Megabit	
Configuration Server Protocol:	○ DHCP	● Static
IP Address:	10.100.100.21	
IP Subnet Mask:	255.255.255.0	
Default Gateway:	10.100.100.1	
Static route (IP Address/Mask):	/	

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
Speed:	Gigabit	
Port Mode:	Active backup (gig1/2 fail over to each other)	
Configuration Server Protocol:	○ DHCP	● Static
IP Address:	10.100.100.186	
IP Subnet Mask:	255.255.255.0	
Default Gateway:	10.100.100.1	

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
Speed:	Gigabit	
Port Mode:	Active backup (gig1/2 fail over to each other)	
Configuration Server Protocol:	○ DHCP	● Static
IP Address:	10.100.100.186	
IP Subnet Mask:	255.255.255.0	
Default Gateway:	10.100.100.1	

Figure 105. Network Settings

Gigabit 2 settings will "mirror" Gigabit 1 settings (except for MAC addresses) and cannot be configured separately.

When finished making changes, click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent. When the status of an Ethernet or Gigabit port changes, a Syslog entry is created describing the change.

Network Interface Ports

The following diagram shows the location of each network interface port on the underside of the Array.

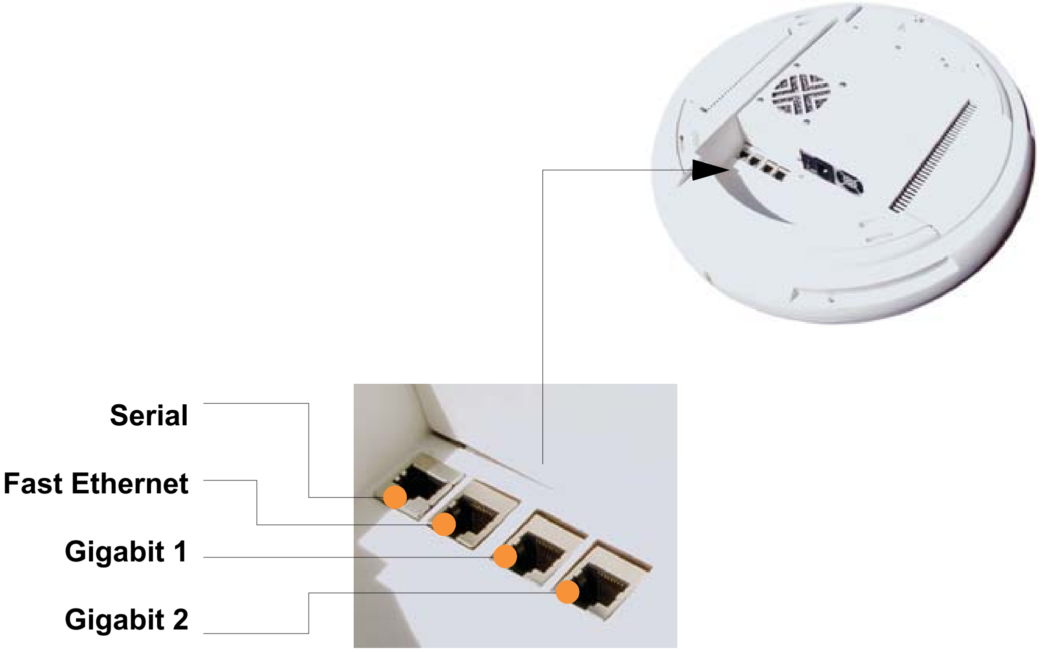


Figure 106. Network Interface Ports

Procedure for Configuring the Network Interfaces

Configure the **Fast Ethernet** and **Gigabit 1** network interfaces (some **Gigabit 2** settings cannot be configured separately and will mirror **Gigabit 1**). The fields for each of these interfaces are the same, and include:

1. **Enable Interface:** Choose Yes to enable this network interface (Fast Ethernet, Gigabit 1 or Gigabit 2), 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. 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).

    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. **Speed**: If the Auto-Negotiate feature is disabled, you must manually choose the desired data transmission speed from the pull-down list. If configuring the Fast Ethernet interface the options are **10 Megabit** or **100 Megabit**. If configuring the Gigabit 1 or Gigabit 2 interfaces the options are **100 Megabit** or **Gigabit**.

5. **Port mode:** Select the desired behavior for the gigabit Ethernet ports from the following options. For a more detailed discussion of the use of the Gigabit ports and the options below, please see the *Xirrus Gigabit Ethernet Port Modes Application Note* in the Xirrus Library.

a. **Active Backup (gig1/gig2 failover to each other)**—This mode provides fault tolerance and is the default mode. Gigabit 1 acts as the primary link. Gigabit2 is the backup link and is passive. Gigabit2 assumes the IP properties of Gigabit1. If Gigabit 1 fails the Array automatically fails over to Gigabit2. When a failover occurs in this mode, Gigabit2 issues gratuitous ARPs to allow it to substitute for Gigabit1 at Layer 3 as well as Layer 2. See Figure 107 (a).

b. **Aggregate Traffic from gig1 & gig2 using 802.3ad**—The Array sends network traffic across both gigabit ports to increase link speed to the network. Both ports act as a single logical interface (trunk), using a load balancing algorithm to balance traffic across the ports. The destination IP address of a packet is used to determine its outgoing adapter. For non-IP traffic (such as ARP), the last byte of the destination MAC address is used to do the calculation. The network switch must also support 802.3ad. If a port fails, the trunk degrades gracefully—the other port still transmits. See Figure 107 (b).

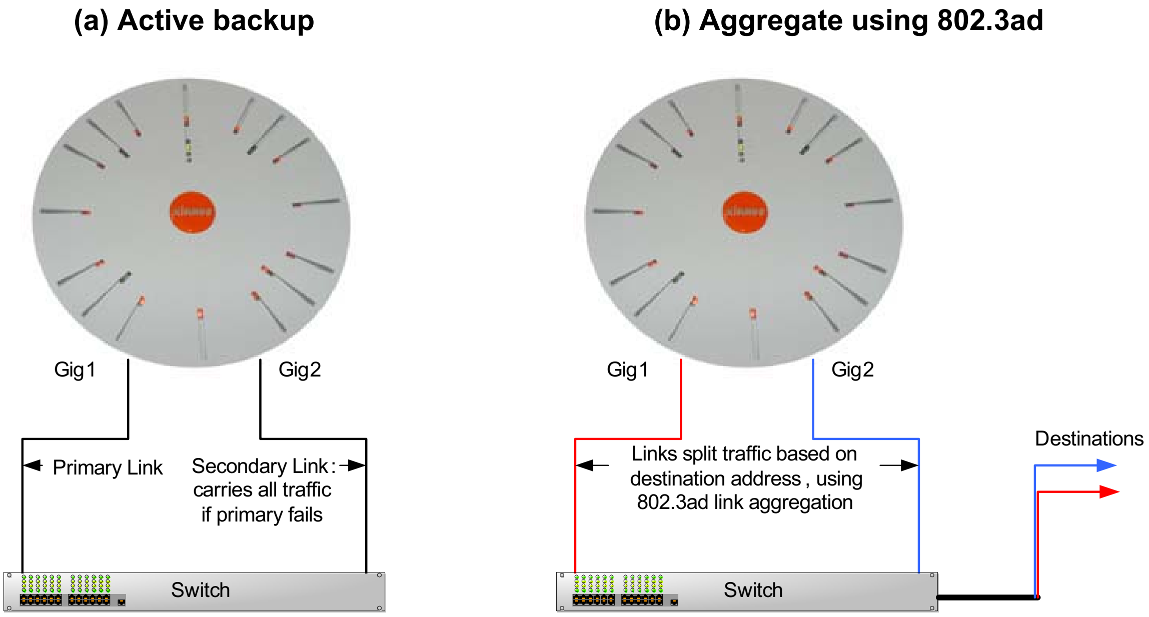

(a) Active backup
(b) Aggregate using 802.3ad
Gig1
Gig2
Primary Link
Secondary Link: carries all traffic if primary fails
Switch
Gig1
Gig2
Links split traffic based on destination address, using 802.3ad link aggregation
Switch
Destinations

Figure 107. Port Modes (a-b)

c. **Bridge traffic between gig1 & gig2**—Traffic received on Gigabit1 is transmitted by Gigabit2; similarly, traffic received on Gigabit2 is transmitted by Gigabit1. This allows the Array to act as a wired bridge and allows Arrays to be daisy-chained and still maintain wired connectivity. See Figure 108 (c).

d. **Transmit Traffic on both gig1 & gig2**—Transmits incoming traffic on both Gigabit1 and Gigabit2. Any traffic received on Gigabit1 or Gigabit2 is sent to the onboard processor. This mode provides fault tolerance. See Figure 108 (d).

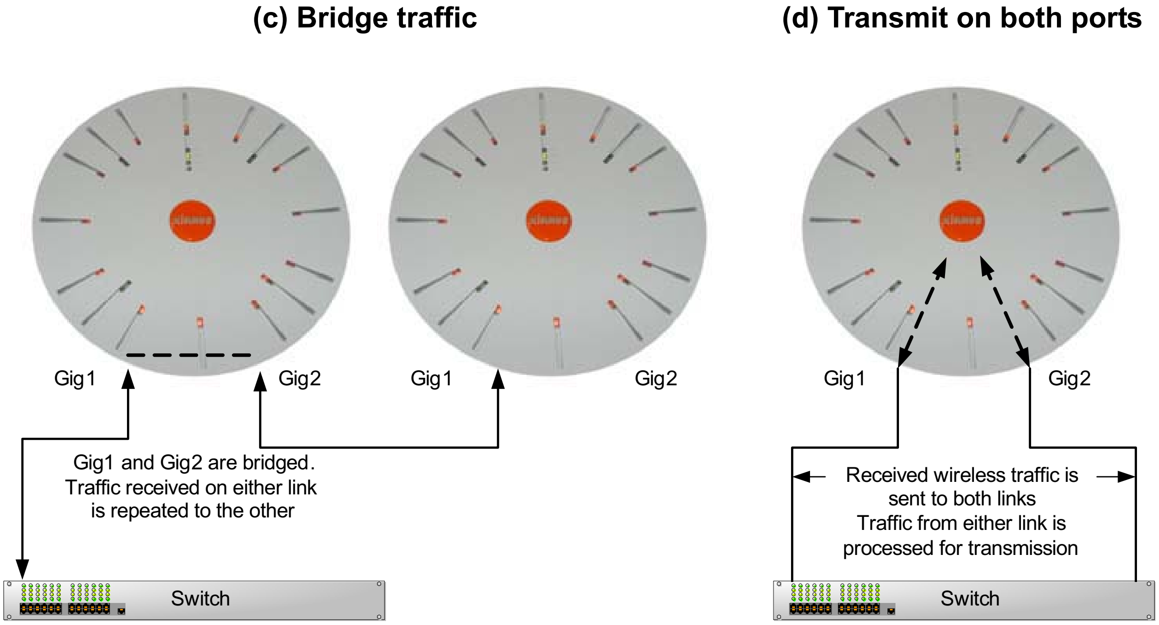
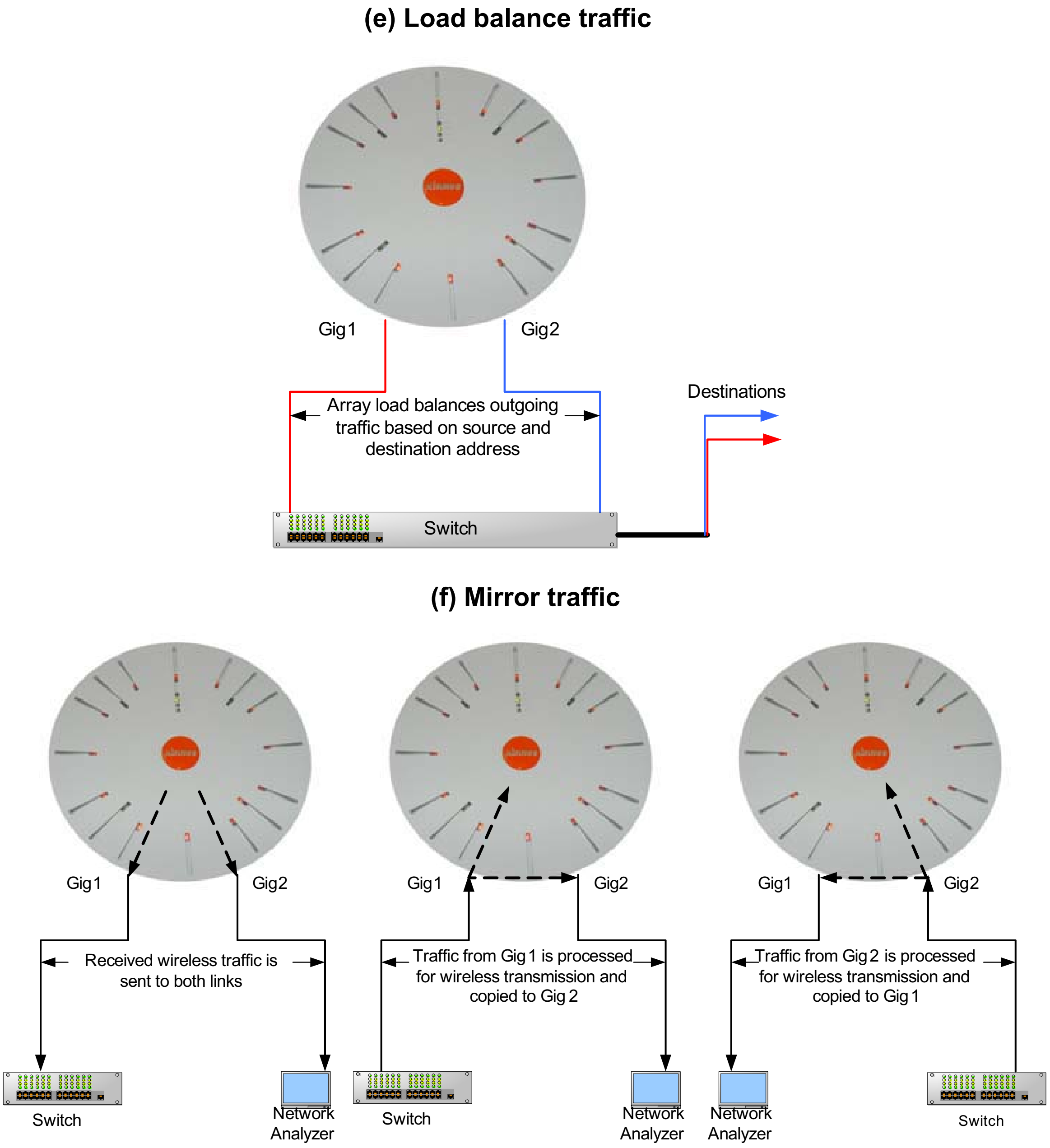

(c) Bridge traffic
(d) Transmit on both ports
Gig1
Gig2
Gig1
Gig2
Gig1
Gig2
Gig1 and Gig2 are bridged.
Traffic received on either link
is repeated to the other
Received wireless traffic is
sent to both links
Traffic from either link is
processed for transmission
Switch
Switch

Figure 108. Port Modes (c-d)

e. **Load balance traffic between gig1 & gig2**—This option provides trunking, similar to option (b)**—Aggregate Traffic from gig1 & gig2 using 802.3ad**, but 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 109 (e).



(e) Load balance traffic

Gig1
Gig2
Array load balances outgoing traffic based on source and destination address
Destinations
Switch

(f) Mirror traffic

Gig1
Gig2
Received wireless traffic is sent to both links
Switch
Network Analyzer
Gig1
Gig2
Traffic from Gig1 is processed for wireless transmission and copied to Gig2
Switch
Network Analyzer
Gig1
Gig2
Traffic from Gig2 is processed for wireless transmission and copied to Gig1
Network Analyzer
Switch

Figure 109. Port Modes (e-f)

f. **Mirror traffic on both gig1 & gig2**—all traffic received on the Array is transmitted out both Gigabit1 and Gigabit2. All traffic received on Gigabit1 is passed on to the onboard processor as well as out Gigabit2. All traffic received on Gigabit2 is passed on to the onboard processor as well as out Gigabit1. This allows a network analyzer to be plugged into one port to capture traffic for troubleshooting, while the other port provides network connectivity for data traffic. See Figure 109 (f).

6. **Configuration Server Protocol**: 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. **IP 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. **IP 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 transmit data to other networks.

7. **Static Route (IP Address/Mask)**: (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.

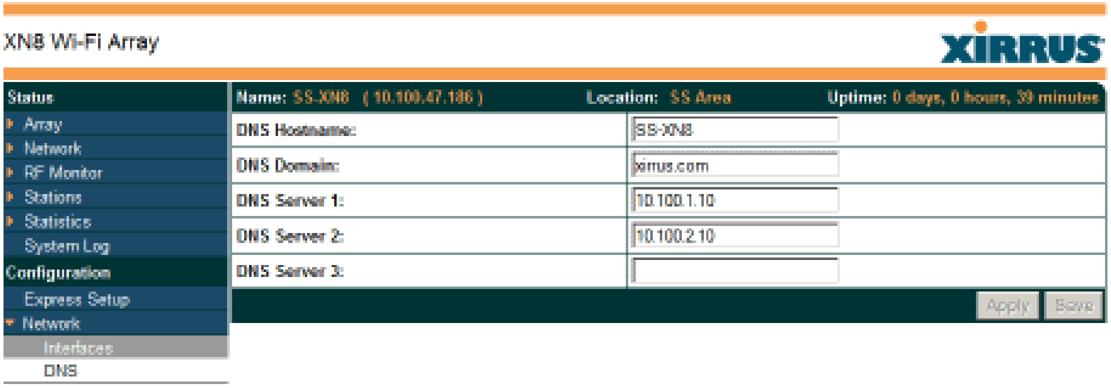
8. When done configuring all interfaces as desired, click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

See Also

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. 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 203. When finished, click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 39 minutes

DNS Hostname:	SS-XN8
DNS Domain:	xirrus.com
DNS Server 1:	10.100.1.10
DNS Server 2:	10.100.2.10
DNS Server 3:	

Figure 110. 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. Click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

See Also

DHCP Server

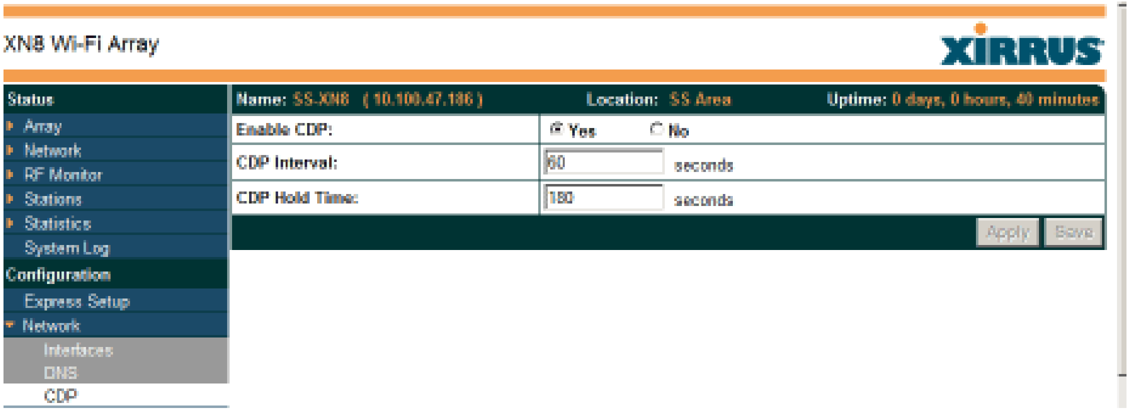
Network

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. Wi-Fi Arrays can both advertise their presence by sending CDP announcements, and gather and display information sent by neighbors (see "CDP Neighbors" on page 141).

This window allows you to establish your CDP settings. When finished, click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 40 minutes

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

Figure 111. 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

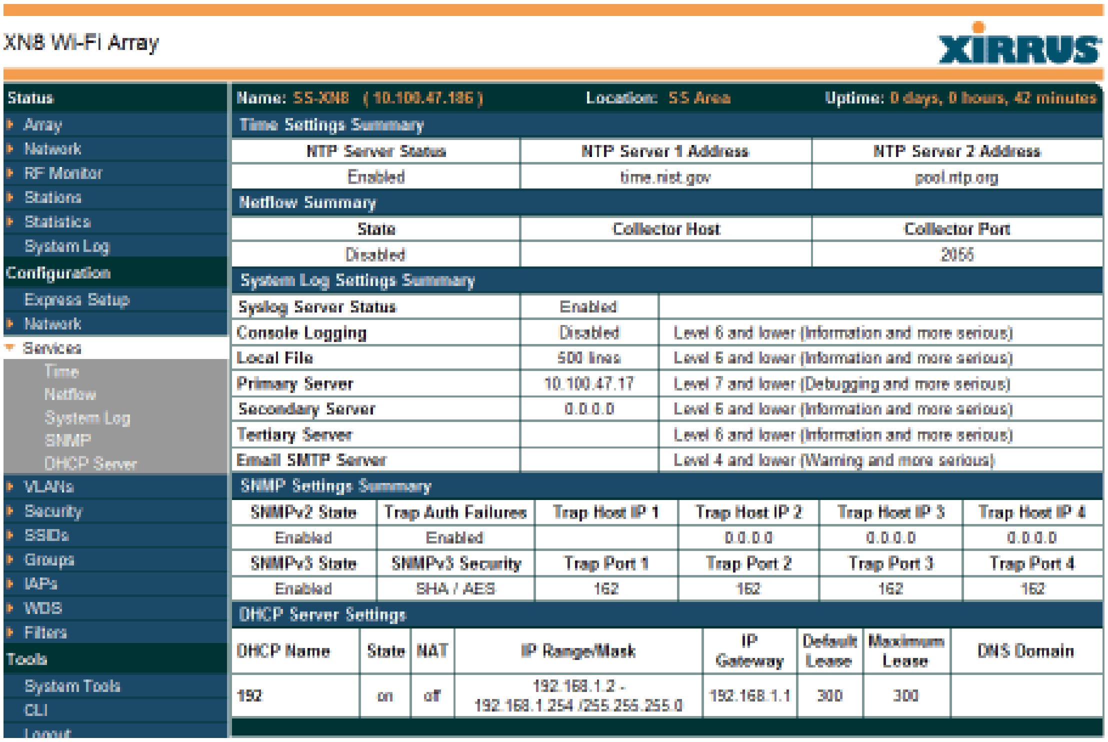
Network

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: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 42 minutes

Time Settings Summary

NTP Server Status	NTP Server 1 Address	NTP Server 2 Address
Enabled	time.nist.gov	pool.ntp.org

Netflow Summary

State	Collector Host	Collector Port
Disabled		2055

System Log Settings Summary

Syslog Server Status	Enabled	
Console Logging	Disabled	Level 6 and lower (Information and more serious)
Local File	500 lines	Level 6 and lower (Information and more serious)
Primary Server	10.100.47.17	Level 7 and lower (Debugging and more serious)
Secondary Server	0.0.0.0	Level 6 and lower (Information and more serious)
Tertiary Server		Level 6 and lower (Information and more serious)
Email SMTP Server		Level 4 and lower (Warning and more serious)

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		0.0.0.0	0.0.0.0	0.0.0.0
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
192	on	off	192.168.1.2 - 192.168.1.254 /255.255.255.0	192.168.1.1	300	300	

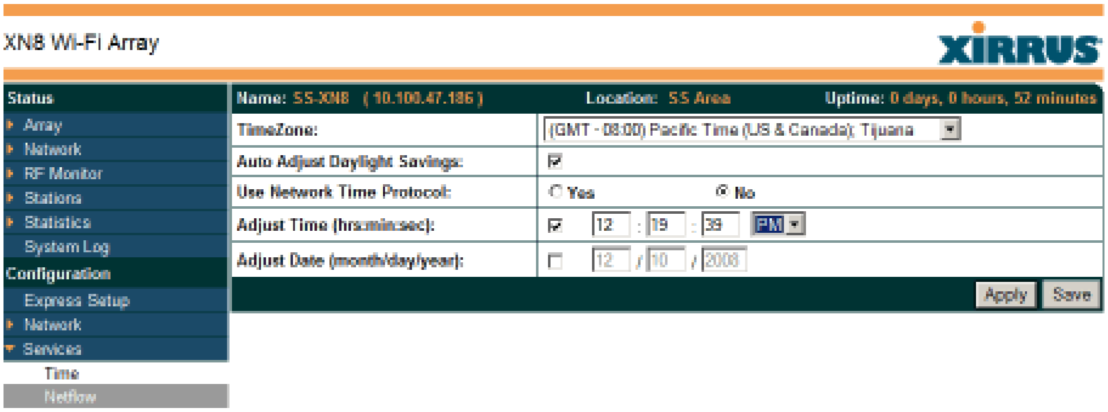
Figure 112. Services

The following sections discuss configuring services on the Array:

- "Time Settings (NTP)" on page 194
- "NetFlow" on page 196
- "System Log" on page 197
- "SNMP" on page 200
- "DHCP Server" on page 203

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. Synchronizing the Array's clock with an NTP server ensures that Syslog time-stamping is maintained across all units.



XN8 Wi-Fi Array

Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 52 minutes

TimeZone:	(GMT - 08:00) Pacific Time (US & Canada); Tijuana
Auto Adjust Daylight Savings:	☑
Use Network Time Protocol:	○ Yes ● No
Adjust Time (hrs:min:sec):	☑ 12 : 19 : 39 PM
Adjust Date (month/day/year):	□ 12 / 10 / 2008

Figure 113. Time Settings (Manual Time)

Procedure for Managing the Time Settings

1. **Time Zone:** Select the time zone you want to use (normally your local time zone) from the pull-down list.

2. **Auto Adjust Daylight Savings**: Check this box if you want the system to adjust for daylight savings automatically, otherwise leave this box unchecked (default).

3. **Use Network Time Protocol:** select whether to set time manually or use NTP to manage system time.

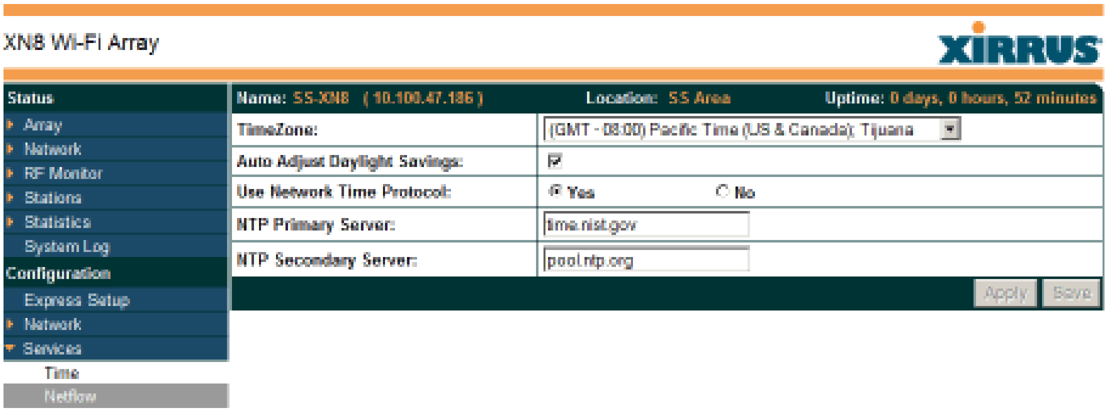
4. **Setting Time Manually**

   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, 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).

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, 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).

5. **Using an NTP Server**

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



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 0 hours, 52 minutes

TimeZone:	(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 Secondary Server:	pool.ntp.org

Figure 114. Time Settings (NTP Time Enabled)

b. **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.

6. Click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

See Also

Services

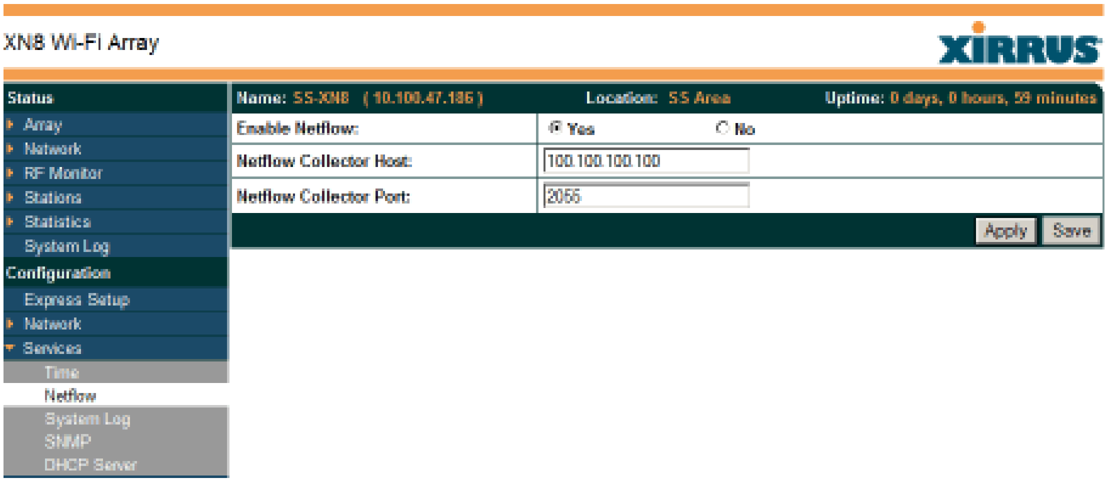
SNMP

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.

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.



Name: SS-XN8 (10.100.47.186)   Location: SS Area   Uptime: 0 days, 0 hours, 59 minutes

Enable Netflow:	● Yes ○ No
Netflow Collector Host:	100.100.100.100
Netflow Collector Port:	2055

Figure 115. NetFlow

Procedure for Configuring NetFlow

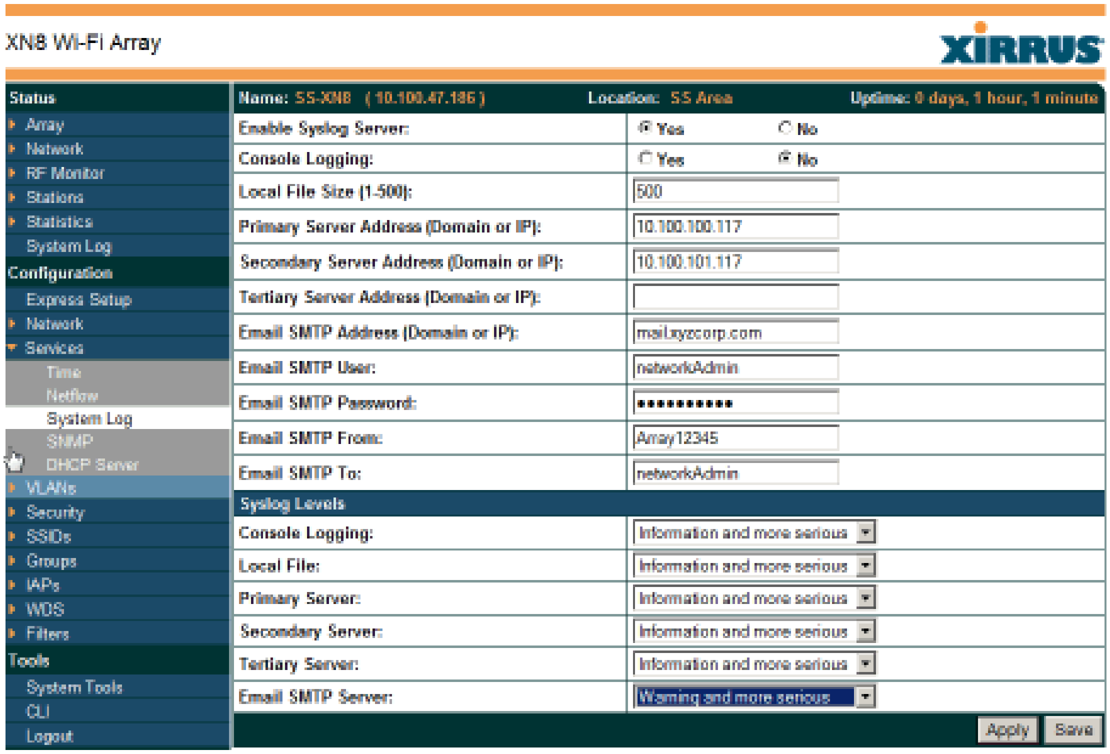
1. **Enable NetFlow:** Choose **Yes** to enable NetFlow functionality, or choose **No** to disable this feature.

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.

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 of the servers and for email notification—the Syslog service will send Syslog messages that are at the selected severity or above to the defined Syslog servers and email address.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 1 hour, 1 minute

Enable Syslog Server:	● Yes ○ No
Console Logging:	○ Yes ● No
Local File Size (1-500):	500
Primary Server Address (Domain or IP):	10.100.100.117
Secondary Server Address (Domain or IP):	10.100.101.117
Tertiary Server Address (Domain or IP):	
Email SMTP Address (Domain or IP):	mail.xyzcorp.com
Email SMTP User:	networkAdmin
Email SMTP Password:	••••••••••
Email SMTP From:	Array12345
Email SMTP To:	networkAdmin
Syslog Levels	
Console Logging:	Information and more serious
Local File:	Information and more serious
Primary Server:	Information and more serious
Secondary Server:	Information and more serious
Tertiary Server:	Information and more serious
Email SMTP Server:	Warning and more serious

Figure 116. 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 7 below).

3. **Local File Size** (1-500): 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 500.

4. **Primary Server Address (Domain or IP)**: If you enabled Syslog, enter the domain name or IP address of the primary Syslog server.

5. **Secondary/Tertiary Server Address (Domain or IP)**: If you enabled Syslog, you may enter the domain name or IP address of one or two additional Syslog servers to which messages will also be sent. (Optional)

6. **Email Notification**: 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 SMTP Address (Domain or IP)**: The domain name 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.

   b. **Email SMTP User/Email SMTP Password**: Specify a user name and password for logging in to an account on the mail server designated in Step a.

   c. **Email SMTP From**: Specify the "From" email address to be displayed in the email.

   d. **Email SMTP To**: Specify the entire email address of the recipient of the email notification.

7. **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.

8. Click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

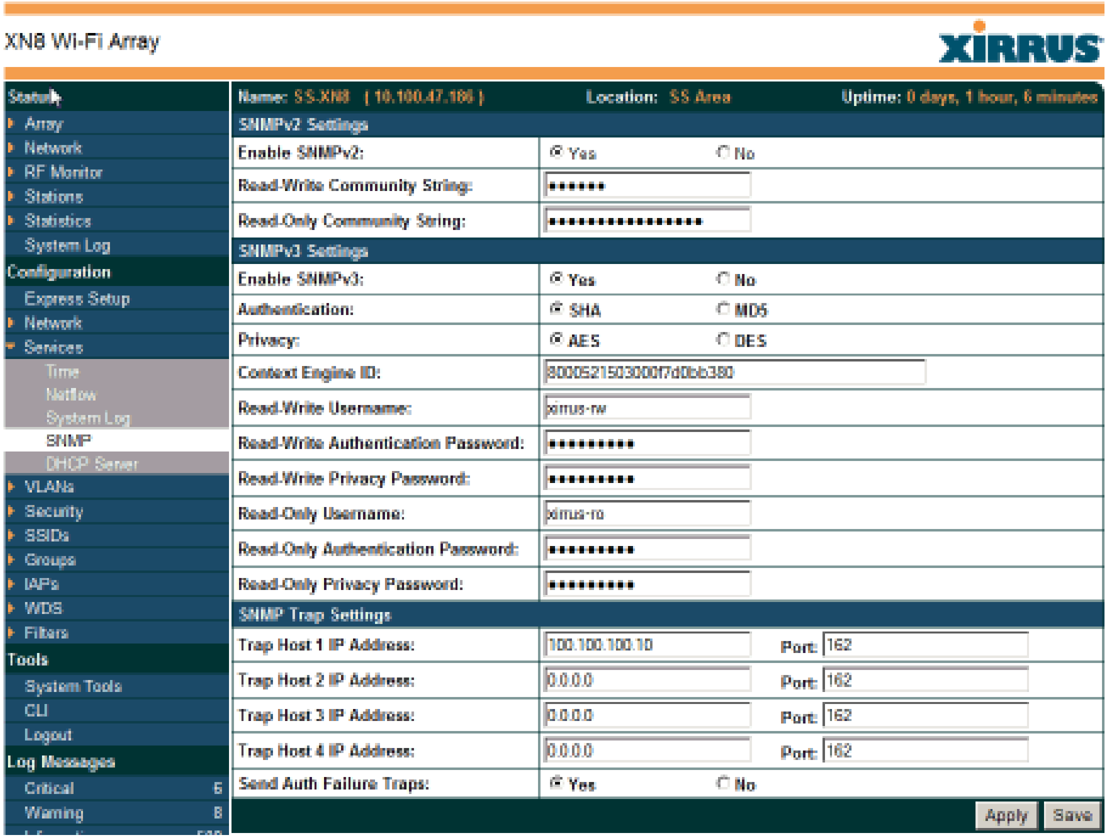
See Also

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 v2 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. If you enable both, be aware that data and keys are not encrypted when SNMPv2 is used.

> ***NOTE:*** *If you are managing your Arrays with XMS (the Xirrus Management System), it is very important to use SNMP v2 and the correct* ***Read-Write Community String*** *for proper operation of XMS with the Array. Both XMS and the Array must have the same value for this string.*



Name: SS.XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 1 hour, 6 minutes

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:	8000521503000f7d0bb380	
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:	100.100.100.10	Port: 162
Trap Host 2 IP Address:	0.0.0.0	Port: 162
Trap Host 3 IP Address:	0.0.0.0	Port: 162
Trap Host 4 IP Address:	0.0.0.0	Port: 162
Send Auth Failure Traps:	● Yes	○ No

Figure 117. SNMP

Procedure for Configuring SNMP

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**.

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**.

14. **SNMP Trap Host IP Address**: Enter the **IP Address** or domain name, 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.

15. **Send Auth Failure Traps**: Choose **Yes** to log authentication failure traps or **No** to disable this feature.

16. Click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

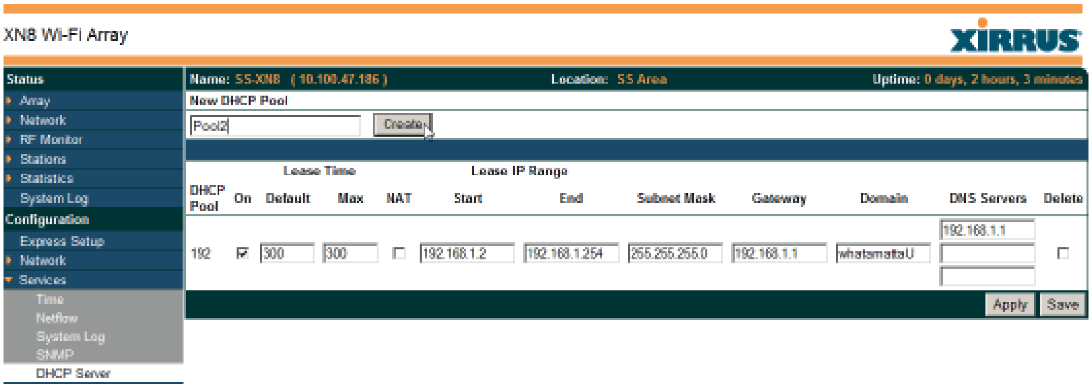
See Also

Services
System Log
Time Settings (NTP)

DHCP Server

This window allows you to create, modify and delete DHCP (Dynamic Host Configuration Protocol) pools and enable or disable DHCP server functionality. 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 enable the DHCP server, you need to define the DHCP lease time (default and maximum) and establish the IP address range that the DHCP server can use.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 2 hours, 3 minutes

New DHCP Pool

Pool2

		Lease Time			Lease IP Range						
DHCP Pool	On	Default	Max	NAT	Start	End	Subnet Mask	Gateway	Domain	DNS Servers	Delete
192	☑	300	300	□	192.168.1.2	192.168.1.254	255.255.255.0	192.168.1.1	whatamattaU	192.168.1.1	□

Figure 118. DHCP 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 also, "DNS Settings" on page 190.

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 190.

12. Click **Apply** to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

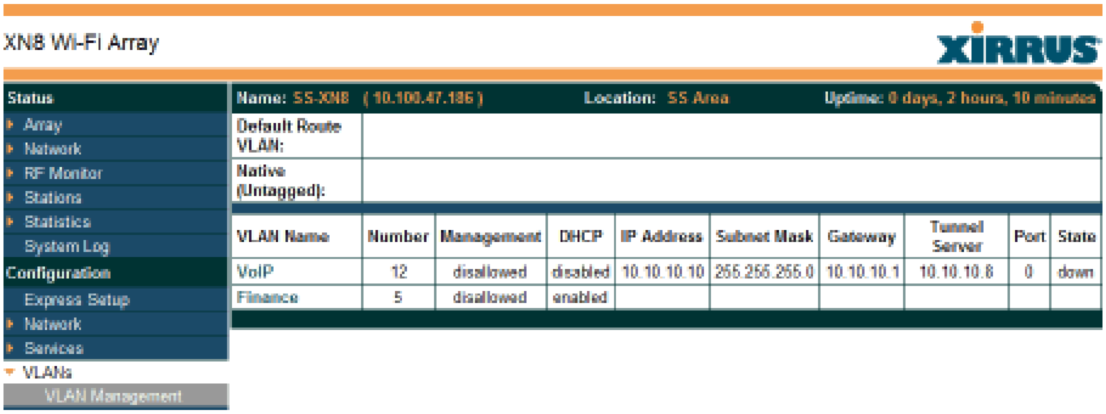
See Also

DHCP Leases
DNS Settings
Network Map

VLANs

This is a status-only window that allows you to review the current status of assigned VLANs. A VLAN (Virtual LAN) is comprised of a group of devices that communicate as a single network, even though they are physically located on different LAN segments. Because VLANs are based on logical rather than physical connections, they are extremely flexible. A device that is moved to another location can remain on the same VLAN without any hardware reconfiguration.

In addition to listing all VLANs, this window shows your settings for the Default Route VLAN and the Native (Untagged) VLAN (Step 1 page 207).



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 2 hours, 10 minutes

Default Route VLAN:

Native (Untagged):

VLAN Name	Number	Management	DHCP	IP Address	Subnet Mask	Gateway	Tunnel Server	Port	State
VoIP	12	disallowed	disabled	10.10.10.10	255.255.255.0	10.10.10.1	10.10.10.8	0	down
Finance	5	disallowed	enabled						

Figure 119. VLANs

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

Understanding Virtual Tunnels

Xirrus Arrays support Layer 2 tunneling with Virtual Tunnels. 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.

The Array has low overhead and latency for virtual tunnel connections, with high resilience. The Array performs all encryption and decryption in hardware, maintaining wire-rate encryption performance on the tunnel.

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 10 on page 208.

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

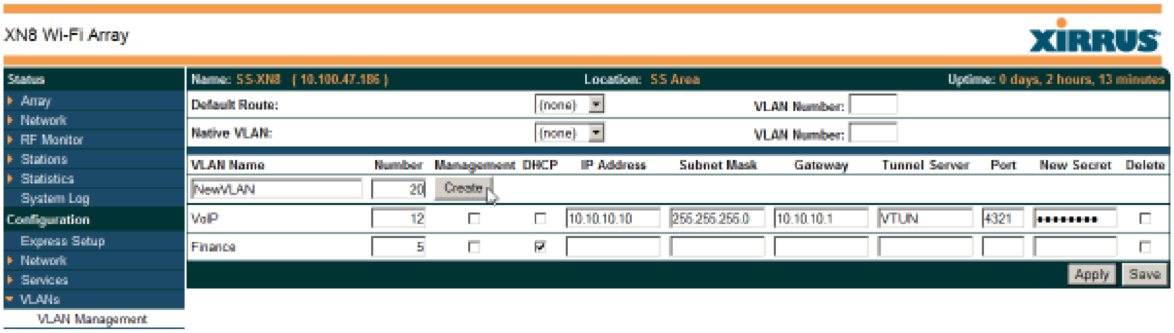
Client-Server Interaction

The Array is a client of the Virtual Tunnel Server. When you specify a VTS for a 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 Wi-Fi, 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.



Name: SS-XN8 (10.100.47.186)   Location: SS Area   Uptime: 0 days, 2 hours, 13 minutes

Default Route: (none)   VLAN Number:

Native VLAN: (none)   VLAN Number:

VLAN Name	Number	Management	DHCP	IP Address	Subnet Mask	Gateway	Tunnel Server	Port	New Secret	Delete
NewVLAN	20	Create								
VoIP	12	□	□	10.10.10.10	255.255.255.0	10.10.10.1	VTUN	4321	•••••••••	□
Finance	5	□	☑							□

Figure 120. VLAN Management

The Wi-Fi 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 81 on page 151)

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 allows you to choose a default VLAN route from the pull-down list. When you click **Apply** the VLAN you choose will appear in the corresponding VLAN Number field. The IP Gateway must be established for this function to work.

2. **Native VLAN**: This option allows you to choose the Native VLAN from the pull-down list. When you click **Apply** the VLAN you choose will appear in the corresponding VLAN Number field.

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. **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.

7. **IP Address**: If the DHCP option is disabled, enter a valid IP address for this VLAN association.

8. **Subnet Mask**: If the DHCP option is disabled, enter the subnet mask IP address for this VLAN association.

9. **Gateway**: If the DHCP option is disabled, enter the IP gateway address for this VLAN association.

10. **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 205.

11. **Port**: If this VLAN is to be tunneled, enter the port number of the tunnel server.

12. **New Secret**: Enter the password expected by the tunnel server.

13. **Delete**: To delete the selected VLAN, simply click the **Delete** button to remove the VLAN from the list.

14. Click **Apply** to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

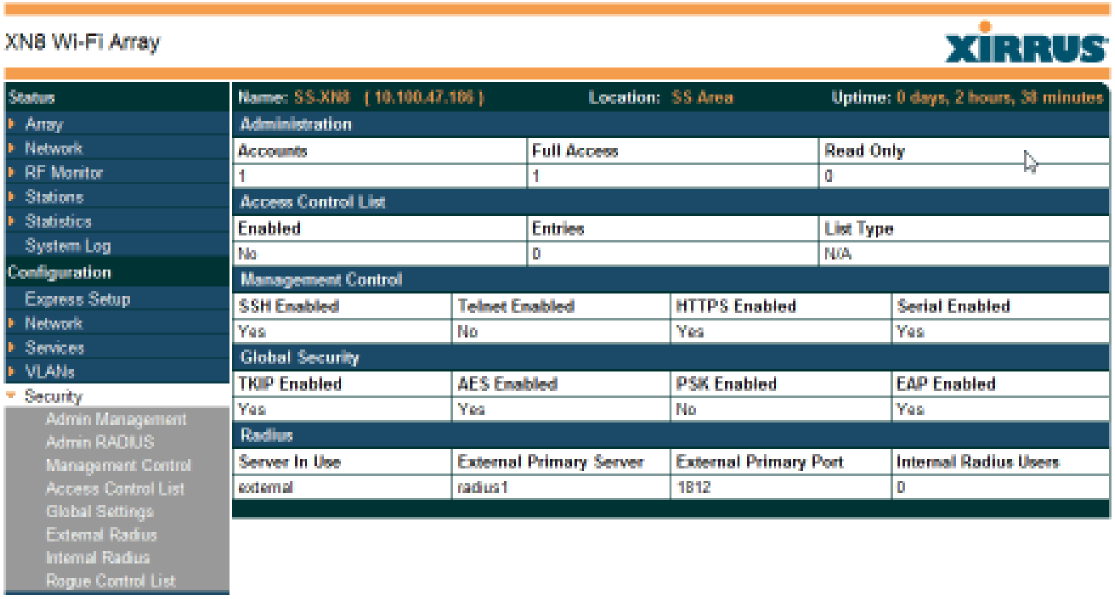
See Also

VLAN Statistics

VLANs

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.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 2 hours, 38 minutes

Administration

Accounts	Full Access	Read Only
1	1	0

Access Control List

Enabled	Entries	List Type
No	0	N/A

Management Control

SSH Enabled	Telnet Enabled	HTTPS Enabled	Serial Enabled
Yes	No	Yes	Yes

Global Security

TKIP Enabled	AES Enabled	PSK Enabled	EAP Enabled
Yes	Yes	No	Yes

Radius

Server In Use	External Primary Server	External Primary Port	Internal Radius Users
external	radius1	1812	0

Figure 121. Security

For additional information about wireless network security, refer to:

- “Security Planning” on page 70
- “Understanding Security” on page 210
- The Security section of “Frequently Asked Questions” on page 398.

For information about secure use of the WMI, refer to:

- “Certificates and Connecting Securely to the WMI” on page 213

Security settings are configured with the following windows:

- “Admin Management” on page 215

- “Admin RADIUS” on page 216
- “Management Control” on page 219
- “Access Control List” on page 223
- “Global Settings” on page 225
- “External Radius” on page 228
- “Internal Radius” on page 231
- “Rogue Control List” on page 233

Understanding Security

The Xirrus Wi-Fi 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). See also, “See Also” on page 126. 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 Wi-Fi 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 240). 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 225).

- **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 Wi-Fi 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 Wi-Fi Array will accept up to 1,000 ACL entries.
- **PCI DSS or FIPS 140-2 Security**—to implement the requirements of these security standards on the Wi-Fi Array, please see Appendix D: Implementing PCI DSS or Appendix E: Implementing FIPS Security.

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.

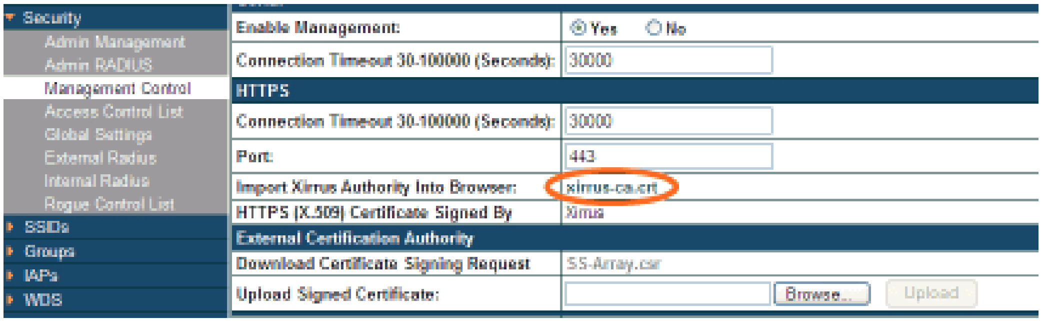
Certificate Authorities (CAs) are entities that digitally sign certificates, using their own certificates (for example, VeriSign is a well-known CA). When the Array presents its certificate to the client's browser, the browser looks up the CA that signed the certificate to decide whether to trust it. 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

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)



Enable Management:	● Yes ○ No
Connection Timeout 30-100000 (Seconds):	30000
HTTPS	
Connection Timeout 30-100000 (Seconds):	30000
Port:	443
Import Xirrus Authority Into Browser:	xirrus-ca.crt
HTTPS (X.509) Certificate Signed By	Xirrus
External Certification Authority	
Download Certificate Signing Request	SS-Array.csr
Upload Signed Certificate:	

Figure 122. Import Xirrus Certificate Authority

By clicking and opening this file, you can follow your browser's instructions and import the Xirrus CA into your CA cache (see page 221 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

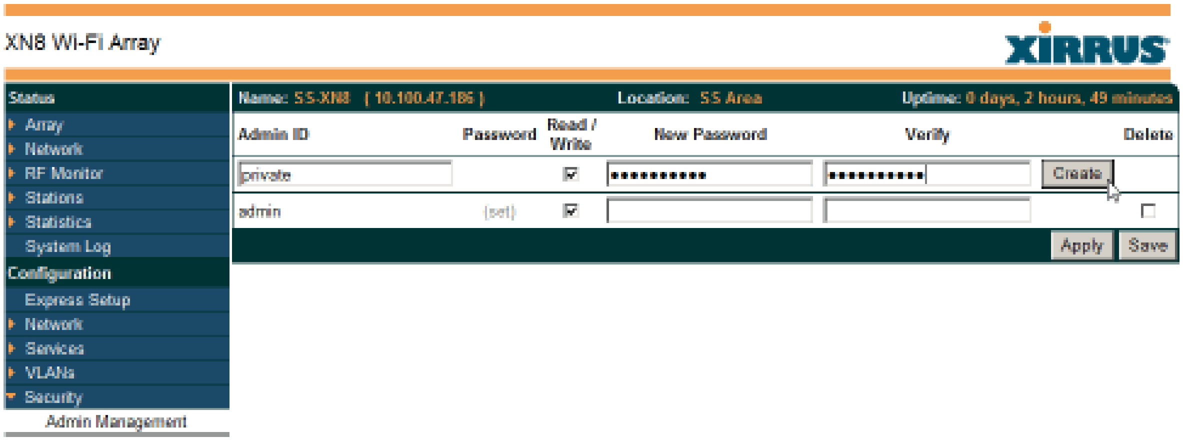
If you prefer, you may install a certificate on your Array signed by an outside CA.

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 222 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** button to save your changes.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 2 hours, 49 minutes

Admin ID	Password	Read / Write	New Password	Verify		Delete
private		☑	●●●●●●●●●●●	●●●●●●●●●●●	Create	
admin	(set)	☑				□

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. For special characters that may be used, see "See Also" on page 126.

2. **Read/Write**: Choose **Read/Write** if you want to give this administrator ID full read/write privileges, or choose **Read** to restrict this user to read only status. In the read only mode, administrators cannot save changes to configurations.

3. **User Password**: Enter a password for this ID. The length of the password must be between 5 and 50 characters, inclusive. For special characters that may be used, see "See Also" on page 126.

4. **Verify Password**: 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 **Apply** to apply modified settings to this session, or click **Save** to apply your changes and make them permanent.

See Also

External Radius
Global Settings (IAP)
Internal Radius
Management Control
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:

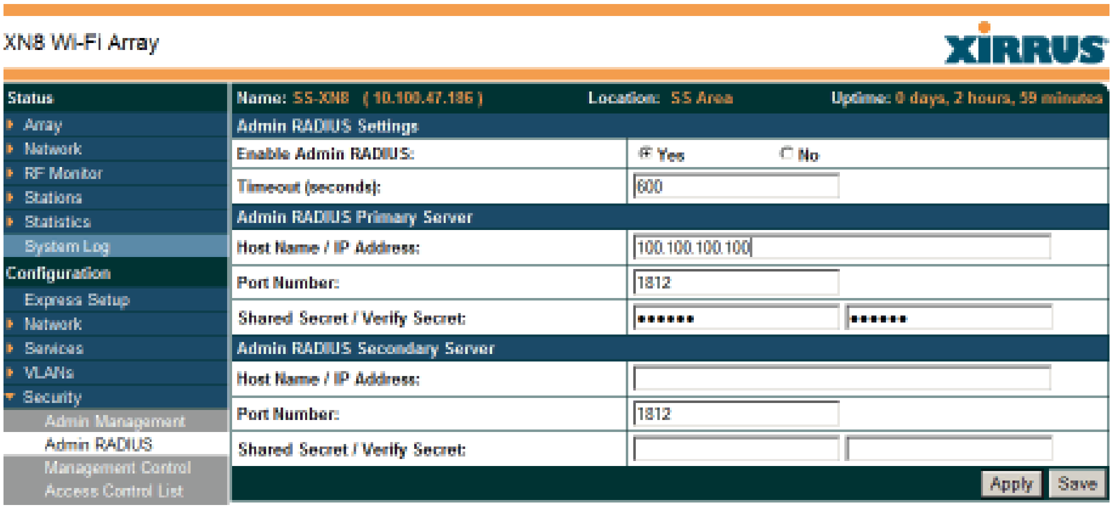
- Centralized control of administrator accounts.
- Less effort—you don't have to set up user names and passwords on each Array; just enter them once on the RADIUS server and then all of the Arrays can pull from the RADIUS server.
- Enforced policies—you may set password rules (e.g., passwords must contain 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 **Service-Type** attribute (Attribute 6). To grant read-write permission, configure the RADIUS server to send back the Service-Type attribute with a value of **Administrative**. To grant read-only permission, the RADIUS server should send the Service-Type attribute with a value of **NAS Prompt**.

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. For special characters that may be used, see "See Also" on page 126.



Name: SS-XN8 (10.100.47.186)   Location: SS Area   Uptime: 0 days, 2 hours, 59 minutes

Admin RADIUS Settings

Enable Admin RADIUS:	● Yes ○ No
Timeout (seconds):	600

Admin RADIUS Primary Server

Host Name / IP Address:	100.100.100.100	
Port Number:	1812	
Shared Secret / Verify Secret:	••••••	••••••

Admin RADIUS Secondary Server

Host Name / IP Address:		
Port Number:	1812	
Shared Secret / Verify Secret:		

Figure 124. 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. When finished, click on the **Save** button to save your changes.

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. **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).

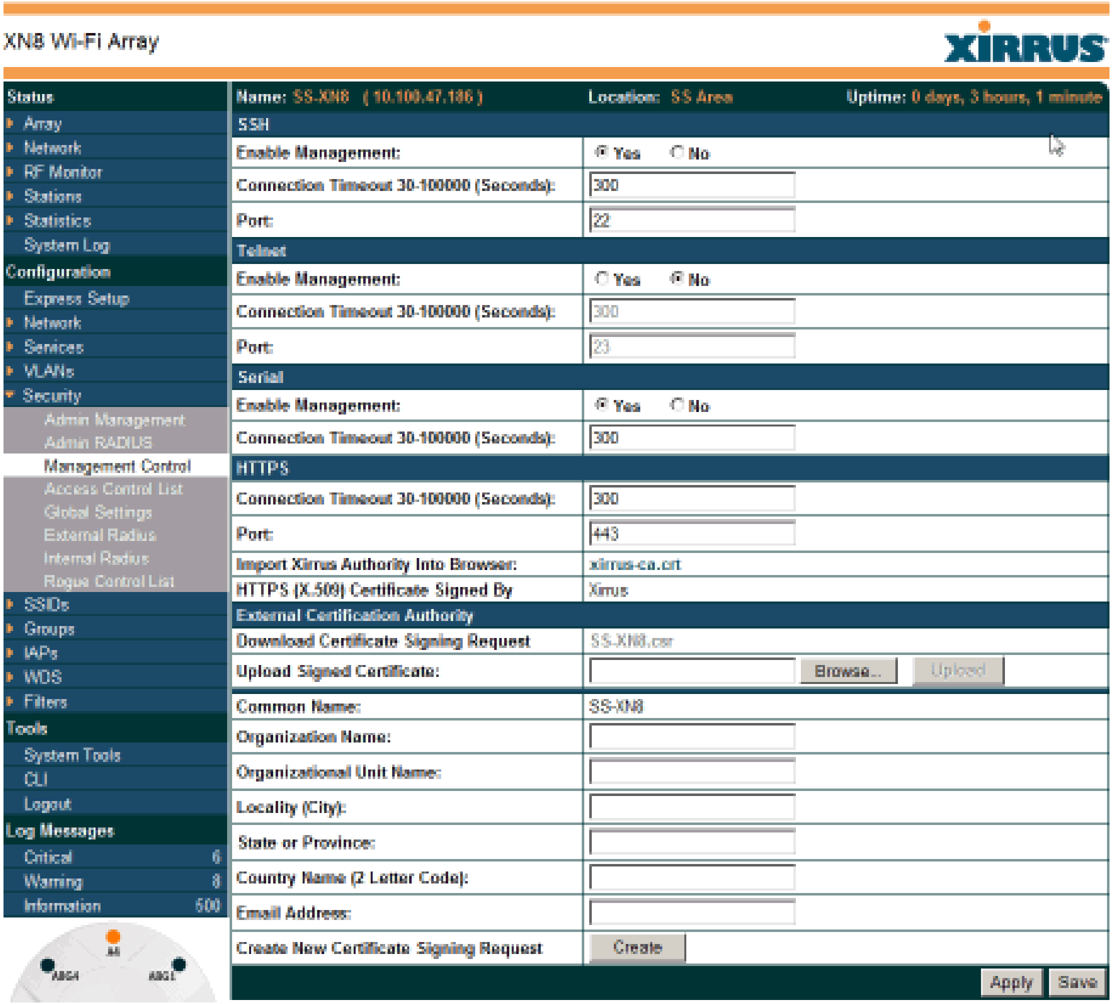
   a. **Host Name / IP Address**: Enter the IP address or domain name of this RADIUS server.

   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 the Array management interfaces to be enabled and disabled and their inactivity time-outs set. The supported range is 300 (default) to 100,000 seconds.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 3 hours, 1 minute

SSH	
Enable Management:	● Yes ○ No
Connection Timeout 30-100000 (Seconds):	300
Port:	22
Telnet	
Enable Management:	○ Yes ● No
Connection Timeout 30-100000 (Seconds):	300
Port:	23
Serial	
Enable Management:	● Yes ○ No
Connection Timeout 30-100000 (Seconds):	300
HTTPS	
Connection Timeout 30-100000 (Seconds):	300
Port:	443
Import Xirrus Authority Into Browser:	xirrus-ca.crt
HTTPS (X.509) Certificate Signed By	Xirrus
External Certification Authority	
Download Certificate Signing Request	SS-XN8.csr
Upload Signed Certificate:	
Common Name:	SS-XN8
Organization Name:	
Organizational Unit Name:	
Locality (City):	
State or Province:	
Country Name (2 Letter Code):	
Email Address:	
Create New Certificate Signing Request	

Figure 125. Management Control

Procedure for Configuring Management Control

1. **SSH:**

    a. **Enable Management**: Choose **Yes** to enable management of the Array over a Secure Shell (SSH-2) connection, or **No** 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.

2. **Telnet:**

   a. **Enable Management**: Choose **Yes** to enable Array management over a Telnet connection, or **No** 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.

3. **Serial**

   a. **Enable Management**: Choose **Yes** to enable management of the Array via a serial connection, or choose **No** 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.

4. **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.

   c. **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 213). 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.

   d. **HTTPS (X.509) Certificate Signed By**: This read-only field shows the signing authority for the current certificate.

5. **External Certification Authority**

   This Step and Step 6 allow you to obtain a certificate from an external authority and install it on an Array. "Using an External Certificate Authority" on page 214 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 6 to create a request for a certificate.
   - Use Step 5a 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 5b.

   External Certification Authority has the following fields:

   a. **Download Certificate Signing Request**: After creating a certificate signing request (.csr file—Step 6), 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.

6. **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 5 above to use this request.

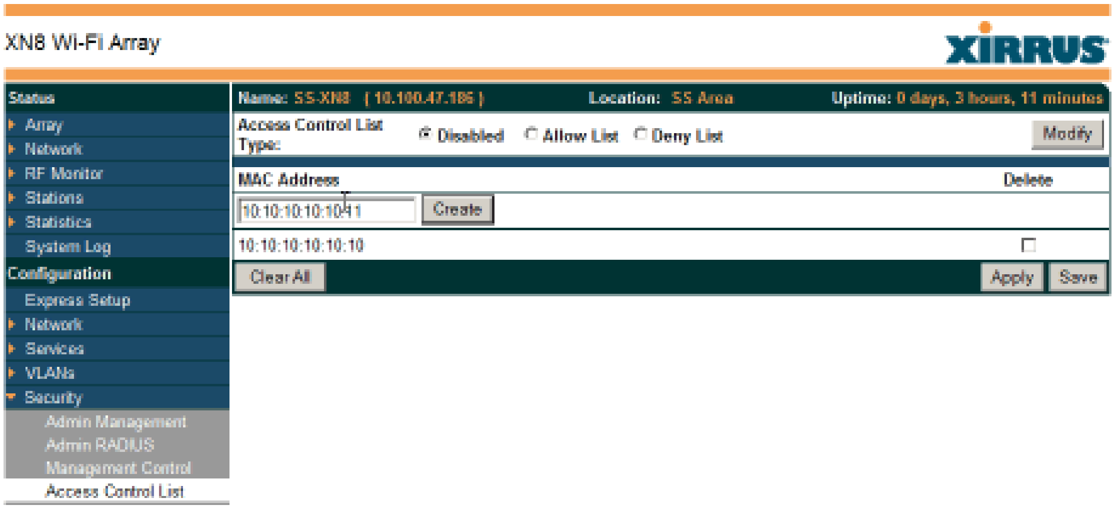
7. Click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

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 create new station access lists, delete existing lists, and add/remove MAC addresses. When finished, click on the **Save** button to save your changes.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 3 hours, 11 minutes

Access Control List Type: ● Disabled ○ Allow List ○ Deny List

MAC Address	Delete
10:10:10:10:10:11	
10:10:10:10:10:10	□

Figure 126. Access Control List

Procedure for Configuring Access Control Lists

1. **Access Control List Type:** Select **Disabled** to disable the Access Control List, or select the Access Control List type—either **Allow List** or **Deny List**. Then click Apply to apply your changes.

   - **Allow List**: Only allows these MAC addresses to associate to the Array.
   - **Deny List**: Allows all MAC addresses except the addresses defined in this list.

     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 **Create** button. The MAC address is added to the ACL.

3. **Delete**: You can delete selected MAC addresses from this list by checking their **Delete** buttons, then clicking **Apply** or **Save**.

4. Click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

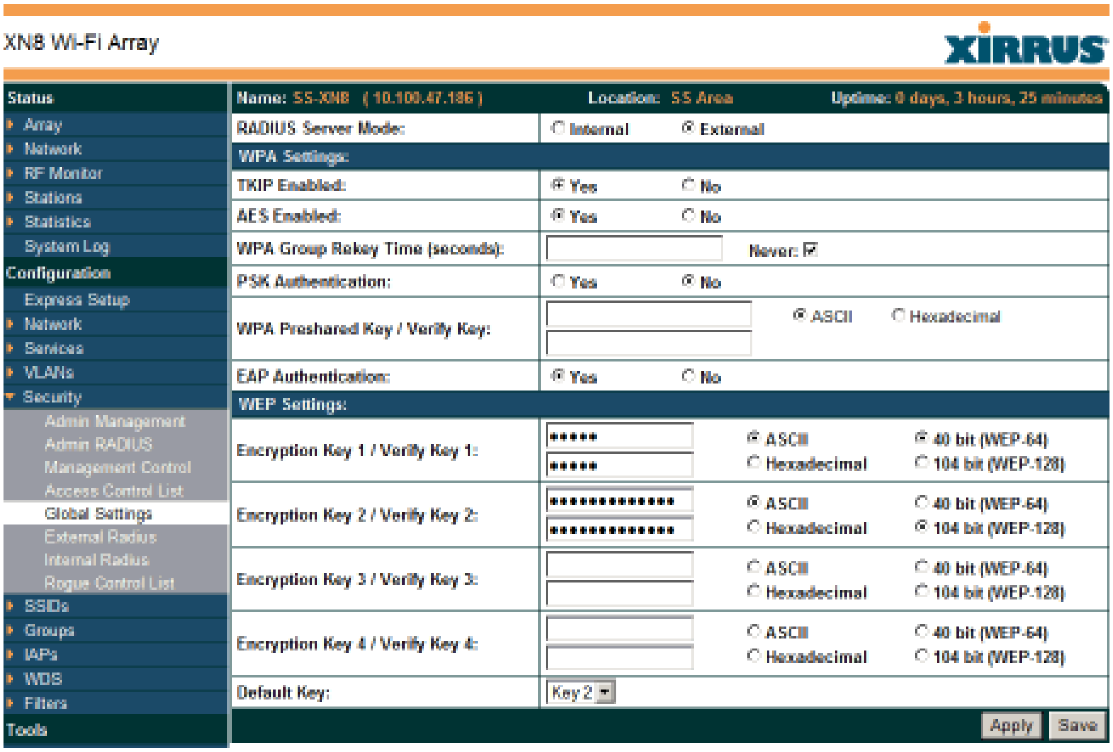
See Also

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 on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

For additional information about wireless network security, refer to "Security Planning" on page 70 and "Understanding Security" on page 210.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 3 hours, 25 minutes

RADIUS Server Mode:	○ Internal ● External	
WPA Settings:		
TKIP Enabled:	● Yes ○ No	
AES Enabled:	● Yes ○ No	
WPA Group Rekey Time (seconds):		Never: ☑
PSK Authentication:	○ Yes ● No	
WPA Preshared Key / Verify Key:		● ASCII ○ Hexadecimal
EAP Authentication:	● Yes ○ No	
WEP Settings:		
Encryption Key 1 / Verify Key 1:	***** *****	● ASCII ○ Hexadecimal ● 40 bit (WEP-64) ○ 104 bit (WEP-128)
Encryption Key 2 / Verify Key 2:	************* *************	● ASCII ○ Hexadecimal ○ 40 bit (WEP-64) ● 104 bit (WEP-128)
Encryption Key 3 / Verify Key 3:		○ ASCII ○ Hexadecimal ○ 40 bit (WEP-64) ○ 104 bit (WEP-128)
Encryption Key 4 / Verify Key 4:		○ ASCII ○ Hexadecimal ○ 40 bit (WEP-64) ○ 104 bit (WEP-128)
Default Key:	Key 2	

Figure 127. 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 228 and "Internal Radius" on page 231.

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.
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. **PSK Authentication**: Choose **Yes** to enable PSK (Pre-Shared Key) authentication, or choose **No** to disable PSK.
6. **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.
7. **EAP Authentication**: Choose **Yes** to enable EAP (Extensible Authentication Protocol) or choose **No** to disable EAP.

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).

8. **Key Mode / Length**: If you enabled WEP, choose the mode (either ASCII or Hex) and the desired key length (either 40 or 104) from the pull-down lists.

   Encryption Key 1 / Verify Key 1: Enter an encryption key of the length and type selected (to the right of the key fields):

   - 10 hex/5 ASCII characters for 40 bits (WEP-64)
   - 26 hex/13 ASCII characters for 104 bits (WEP-128)

   Re-enter the key to verify that you typed it correctly. Hexadecimal characters are defined as ABCDEF and 0-9. For ASCII mode, you may include special characters, except for the double quote symbol (“).

9. **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.

10. **Default Key**: Choose which key you want to assign as the default key. Make your selection from the pull-down list.

11. Click on the **Apply** button to apply the new settings to this session, or click **Save** to apply your changes and make them permanent.

    After configuring network security, the configuration must be applied to an SSID for the new functionality to take effect.

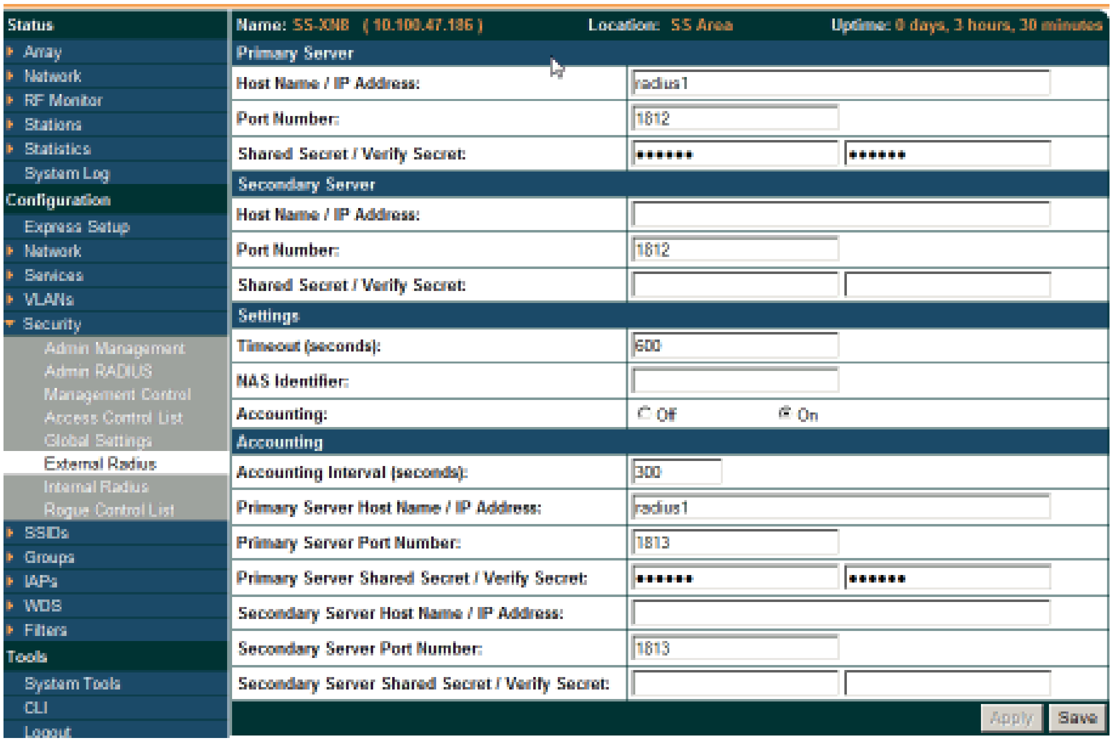
See Also

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 225.



Name: SS-XN8 (10.100.47.186) Location: SS Area Uptime: 0 days, 3 hours, 30 minutes

Primary Server		
Host Name / IP Address:	radius1	
Port Number:	1812	
Shared Secret / Verify Secret:	••••••	••••••
Secondary Server		
Host Name / IP Address:		
Port Number:	1812	
Shared Secret / Verify Secret:		
Settings		
Timeout (seconds):	600	
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:		
Secondary Server Port Number:	1813	
Secondary Server Shared Secret / Verify Secret:		

Figure 128. External RADIUS Server

If you want to include user group membership in the RADIUS account information for users, see “Understanding Groups” on page 247. User groups allow you to easily apply a uniform configuration to a user on the Array.

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. **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. **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. **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