



Wi-Fi Arrays

December 2, 2008



Wi-Fi Array™

XN16, XN12, XN8, XN4

XS16, XS12, XS8, XS4

XS-3900, XS-3700, XS-3500

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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” on page 2.**
- **“About this User’s Guide” on page 4.**
- **“Why Choose the Xirrus Wi-Fi Array?” on page 7.**
- **“Wi-Fi Array Product Overview” on page 8.**
- **“Key Features and Benefits” on page 16.**
- **“Product Specifications—XN16, XN12, and XN8” on page 20.**
- **“Product Specifications—XS16/XS-3900, XS12, and XS8/XS-3700” on page 34.**
- **“Product Specifications—XS4/XS-3500” on page 39.**

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.



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 802.11a radios are named **a1** to **a12** (for 16-port models). The 802.11a/b/g radios are named **abg1** to **abg4**. The XN series of Arrays also have two types of radios—the 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**. 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 Security Standards**
Discusses meeting security standards with the Array, including FIPS and PCI DSS.
- **Appendix E: Notices**
Contains the legal notices, licencing, 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 download 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

Feature	XN16	XN12	XN8	XN4
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

Feature	XS16, XS-3900	XS12	XS8, XS-3700	XS4, XS-3500
Wi-Fi bandwidth	864	864	432	216
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:

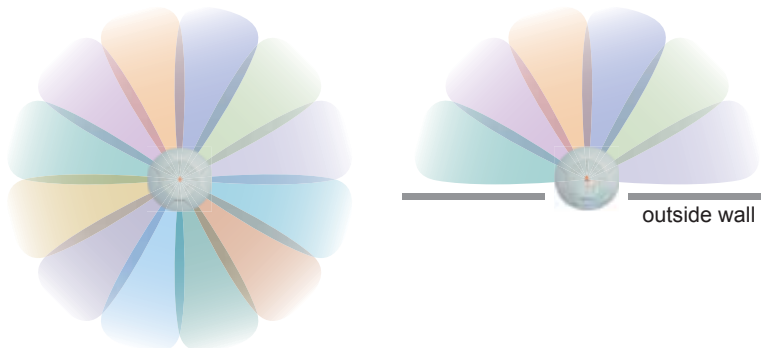


Figure 4. Wireless Coverage Patterns

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 close proximity to each unit.

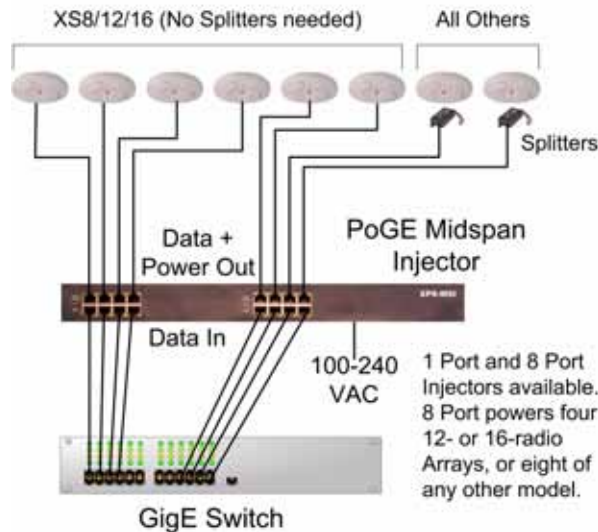


Figure 5. XP8 - Power over Ethernet Usage

Specific models of the Array are compatible with specific PoGE modules. For details, please see “**Power over Gigabit Ethernet Compatibility Matrix**” on **page 416**.

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.



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—XS4/XS-3500

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

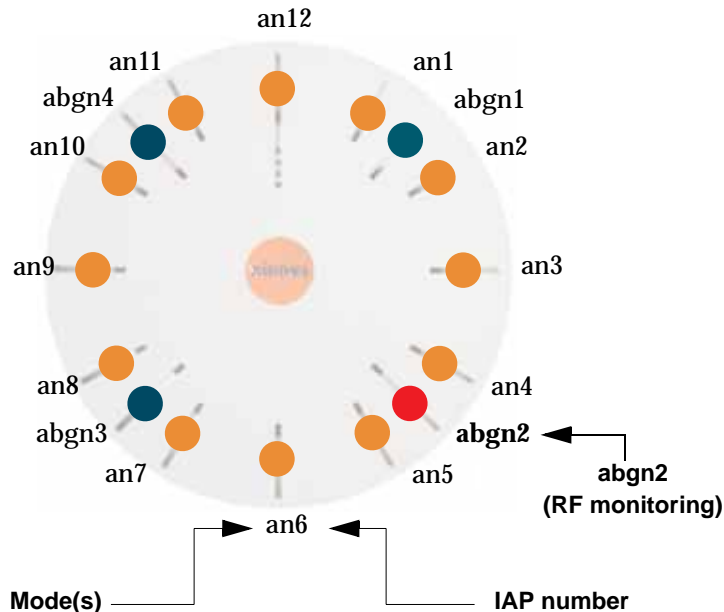


Figure 7. Layout of IAPs (XN16)

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 in the 802.11a/n mode in the 5 GHz band, and four operate in the 802.11a/b/g/n mode, providing backwards compatibility with 802.11b and 802.11g in the 2.4 GHz band.

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

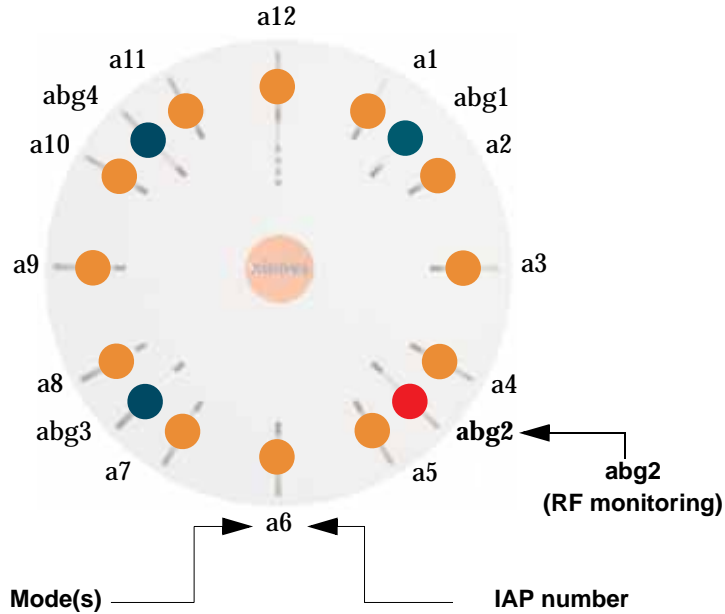


Figure 8. Naming of IAPs (XS16)

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.

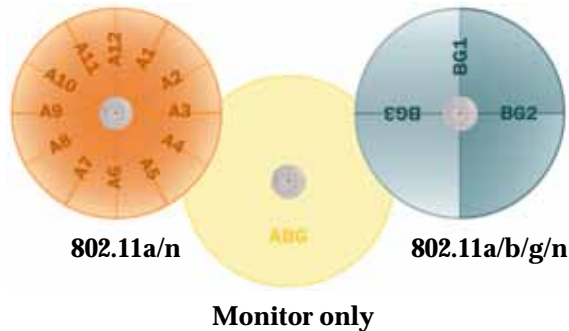


Figure 9. Coverage Schemes

- **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 (XN16/XN12/XN8) 1 GB RAM (XN16/XN12/XN8) 1 GB system flash
Integrated Switch	2.1 Gbps integrated wireless switch
Chassis	Lockable mounting plate, Kensington lock slot

Element	Specifications
<p>Electrical</p>	<p>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: 100W XN12: 90W XN8: 75W All Models: For PoGE, see “Power over Gigabit Ethernet Compatibility Matrix” on page 416.</p>
<p>Interfaces</p>	<p>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</p>
<p>Networking</p>	<p>DHCP client, DHCP server (multiple DHCP pools), DNS Client, NTP client, NAT</p>

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 v1, 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
<p>Security</p>	<p>Wireless Encryption Line speed, hardware-accelerated encryption modes: WPA TKIP WPA2 AES WEP 40/64 WEP 104/128</p> <p>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)</p> <p>Firewall: Integrated stateful-inspection, rules-based firewall</p> <p>IDS/IPS: Integrates with Xirrus XDM Intrusion Detection/Prevention System for real-time wireless security protection</p> <p>Rogue AP detection and blocking: Integrated Rogue AP detection and alerting via dedicated internal RF Threat Sensor. Rogue AP can be shielded</p> <p>Integrated RADIUS Server: Integrated 802.1x Authentication Server supporting EAP-PEAP</p>

Element	Specifications
Security (continued)	Time of Day Access: Specify when SSID access is allowed 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 802.11b/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 24 integrated antennas Spectrum Analyzer: 1 integrated into Array

Element	Specifications
<p>Wireless (continued)</p>	<p>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)</p> <p>Channel Selection: Manual and Automatic</p> <p>802.11a/n Antennas Integrated 6dBi, sectorized</p> <p>802.11b/g/n Antennas Integrated 3dBi, sectorized</p> <p>Wi-Fi Monitoring: 1 Integrated Access Point can be set as a dedicated Wi-Fi Threat Sensor 2 dBi 360° omni-directional antenna</p> <p>802.11a/b/g/n External Antenna Connectors: 3 RP-TNC connectors</p>
<p>Performance</p>	<p>Client Load Balancing Automatic load balancing between system radios</p>

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. Spectralink (Polycom) VIEW - operation with Spectralink Wi-Fi phones. Our certification 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 xxxx

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?

xxxxx

Product Specifications—XN4 xxxx

Element	Specifications
Number of Users	Maximum of 64 associated users per radio XN4: 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: 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 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: 60 W For PoGE, see “Power over Gigabit Ethernet Compatibility Matrix” on page 416.

Element	Specifications
Interfaces	<p>Serial Console Port: 1 x RS232 – RJ45 connector, for local configuration</p> <p>Ethernet Interfaces: 1 x Gigabit 100/1000 Mbps uplink port</p> <p>Status LEDs: System status, Ethernet, Radio</p>
Networking	DHCP client, DHCP server (multiple DHCP pools), DNS Client, NTP client, NAT
Management	<p>Xirrus Management System (XMS)—Layer 3 Element Management System</p> <p>HTTPS Web Management Interface (WMI)</p> <p>CLI via SSHv2, Telnet, local serial Console</p> <p>Enable/disable management for any interface</p> <p>Read-write and read-only admin accounts may be authenticated via RADIUS</p> <p>SNMP v1, v2c, v3</p> <p>Configuration Files—text-based files may be imported, exported, or compared</p> <p>NetFlow—IP flow information (traffic statistics may be sent to an external Collector)</p> <p>FTP, TFTP</p> <p>Syslog reporting for alerts/alarms—messages may be stored on internal Syslog server or sent to up to three external syslog servers.</p> <p>Cisco Discovery Protocol (CDP)—obtain protocol addresses and platform information for neighboring devices</p>

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

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

Element	Specifications
<p>Security (continued)</p>	<p>Time of Day Access: Specify when SSID access is allowed</p> <p>Station-Station Blocking: Station-to-Station traffic blocking option</p>
<p>Wireless</p>	<p>Wireless Standards: 802.11a 802.11b 802.11d 802.11g 802.11e 802.11h 802.11i 802.11j 802.11n</p> <p>Number of Radios: XN4: 4 x 802.11a/b/g/n radios 12 integrated antennas</p> <p>Spectrum Analyzer: 1 integrated into Array</p>

Element	Specifications
Wireless (continued)	<p>Frequency Bands:</p> <ul style="list-style-type: none"> 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) <p>Channel Selection:</p> <p>Manual and Automatic</p> <p>802.11a/n Antennas</p> <p>Integrated 6dBi, sectorized</p> <p>802.11b/g/n Antennas</p> <p>Integrated 3dBi, sectorized</p> <p>Wi-Fi Monitoring:</p> <ul style="list-style-type: none"> 1 Integrated Access Point can be set as a dedicated Wi-Fi Threat Sensor 2 dBi 360° omni-directional antenna <p>802.11a/b/g/n External Antenna Connectors:</p> <ul style="list-style-type: none"> 1 RP-TNC connector
Performance	<p>Client Load Balancing</p> <p>Automatic load balancing between system radios</p>

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

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	<p>Serial: 1 x RS232 – RJ45 connector</p> <p>Ethernet Interfaces: 2 x Gigabit 100/1000 Mbps w/failover 1 x Fast Ethernet 10/100 Mbps</p> <p>Status LEDs: System status, Ethernet, Radio</p>
Electrical	<p>XS16/XS12/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</p> <p>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.</p> <p>All Models: For PoGE, see “Power over Gigabit Ethernet Compatibility Matrix” on page 416.</p>
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	<p>Client Load Balancing Automatic load balancing between system radios</p> <p>Quality of Service: 802.1p wired traffic prioritization Wireless packet prioritization MAP CoS to TCID Fair queuing of downstream traffic</p>
Security	<p>Wireless Security: WEP 40bit/128bit encryption WPA and WPA2 with TKIP and AES encryption Rogue AP detection, with alerts and classification</p> <p>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)</p>

Element	Specifications
<p>Wireless</p>	<p>Number of Radios:</p> <p>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.</p> <p>XS12: 8 x 802.11a radios 4 x 802.11a/b/g radios</p> <p>XS8/XS-3700: 4 x 802.11a radios 4 x 802.11a/b/g radios</p> <p>Wireless Standards: 802.11a/b/g and g-only mode 802.11e, 802.11i</p> <p>Channel Selection: Manual and Automatic</p> <p>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)</p> <p>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</p>

Element	Specifications
Wireless (continued)	<p>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</p> <p>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</p> <p>Radio Approvals: FCC (United States) and EN 301.893 (Europe)</p>
Management	Web-based HTTPS SNMP v2, v3 CLI via SSHv2 or Telnet FTP TFTP Serial Xirrus Management System (XMS) Syslog reporting for alerts/alarms
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	<p>Wi-Fi Alliance: 802.11a/b/g, WPA, WPA2, and extended EAP types. Our certifications may be viewed here.</p> <p>Spectralink (Polycom) VIEW - operation with Spectralink Wi-Fi phones. Our certification may be viewed here.</p> <p>Federal Information Processing Standard (FIPS) Publication 140 -2, Level 2.</p>
Warranty	One year (hardware and software)

See Also

- Key Features and Benefits
- Wi-Fi Array Product Overview
- Product Specifications—XN4 xxxx
- 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	<p>Diameter: 12.58 inches (31.95 cm)</p> <p>Height: 2.58 inches (6.55 cm)</p> <p>Weight: 4lbs (1.81 kg)</p>

Element	Specifications
Environmental	<p>Operating Temperature: -10°C to 50°C 0% to 90% relative humidity (non-condensing)</p> <p>Storage Temperature: -20°C to 60°C 5% to 95% relative humidity (non-condensing)</p>
System	<p>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</p>
Electrical	<p>XS4: Each Array supports both AC and PoGE AC Input Power: 90-265VAC at 47-63Hz</p> <p>XS-3500: AC Input Power: 90-265VAC at 47-63Hz Input Power (DC version): 48VDC</p> <p>All Models: Power over Gigabit Ethernet (PoGE): all 4-port models work with all Xirrus PoGE modules, splitter required, 48VDC</p> <p>See “Power over Gigabit Ethernet Compatibility Matrix” on page 416.</p>

Element	Specifications
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 v2, 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
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

Element	Specifications
Security	<p>Wireless Security:</p> <ul style="list-style-type: none"> WEP 40bit/128bit encryption WPA and WPA2 with TKIP and AES encryption Rogue AP detection, with alerts and classification <p>User and System Authentication:</p> <ul style="list-style-type: none"> 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
<p>Wireless</p>	<p>Number of Radios: 4 x 802.11a/b/g radios</p> <p>Wireless Standards: 802.11a/b/g and g-only mode 802.11e, 802.11i</p> <p>Channel Selection: Manual and Automatic</p> <p>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)</p> <p>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</p> <p>Radio Approvals: FCC (United States) and EN 301.893 (Europe)</p>
<p>Compliance</p>	<p>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</p>

Element	Specifications
Certifications	<p> Wi-Fi Alliance: 802.11a/b/g, WPA, WPA2, and extended EAP types. Our certifications may be viewed here. </p> <p> Spectralink (Polycom) VIEW - operation with Spectralink Wi-Fi phones. Our certification may be viewed here. </p> <p> Federal Information Processing Standard (FIPS) Publication 140 -2, Level 2. </p>
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 xxxx

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” on page 45.**
- **“Planning Your Installation” on page 48.**
- **“Installation Workflow” on page 80.**
- **“Unpacking the Wi-Fi Array” on page 81.**
- **“Installing Your Wi-Fi Array” on page 83.**
- **“Powering Up the Wi-Fi Array” on page 107.**
- **“Establishing Communication with the Array” on page 110.**
- **“Performing the Express Setup Procedure” on page 112.**

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 416.**

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
- “Deployment Summary” 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 sectorized 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.

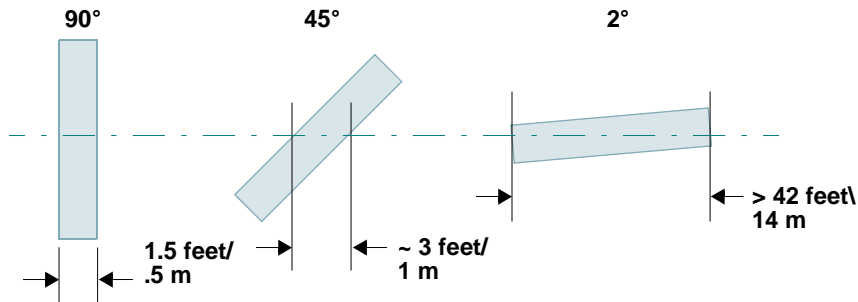


Figure 10. Wall Thickness Considerations

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](#)

[Deployment Summary](#)

[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.

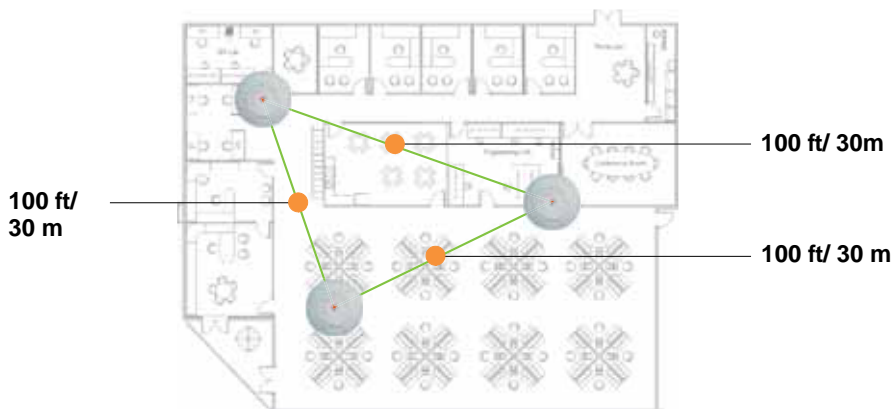


Figure 11. Unit Placement

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.

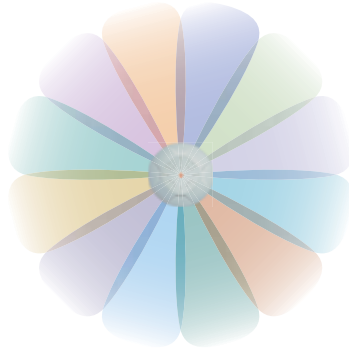


Figure 12. Full (Normal) Coverage

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.

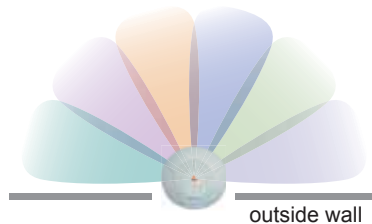


Figure 13. Adjusting RF Patterns

Custom Coverage

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

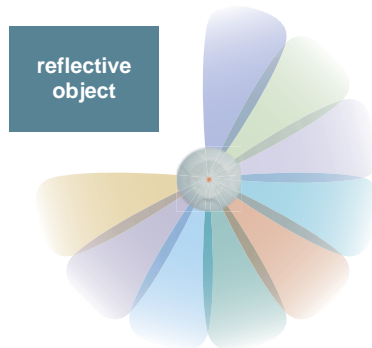


Figure 14. Custom Coverage

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.

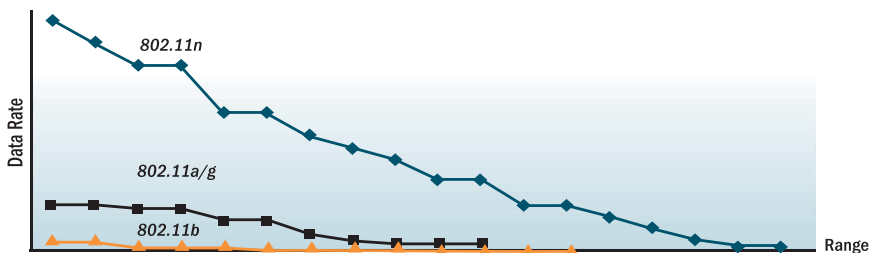


Figure 15. Connection Rate vs. Distance

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 has a smaller range than the larger Arrays.

Fine Tuning Cell Sizes

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

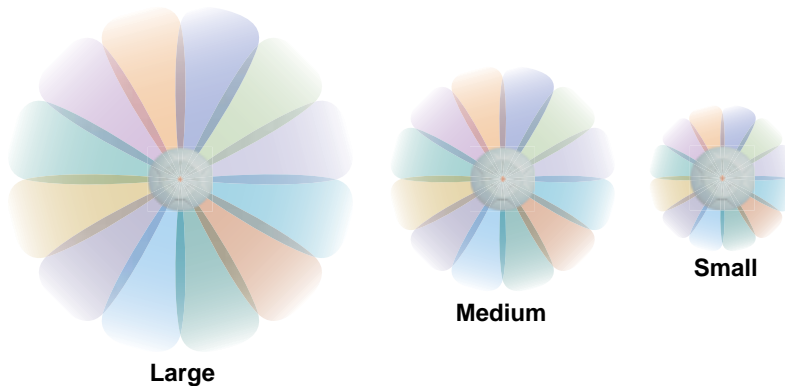


Figure 16. Transmit Power

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 close 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.

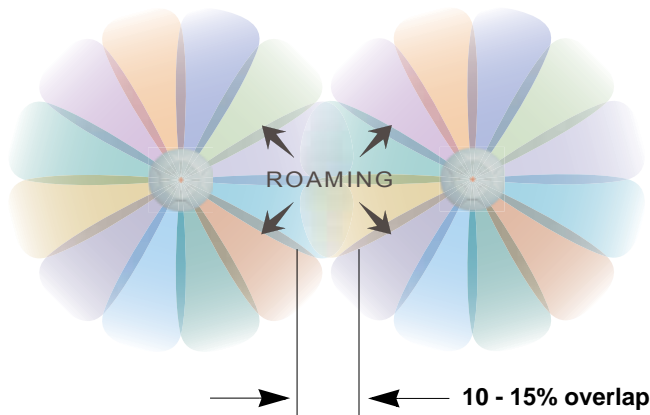


Figure 17. Overlapping Cells

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.

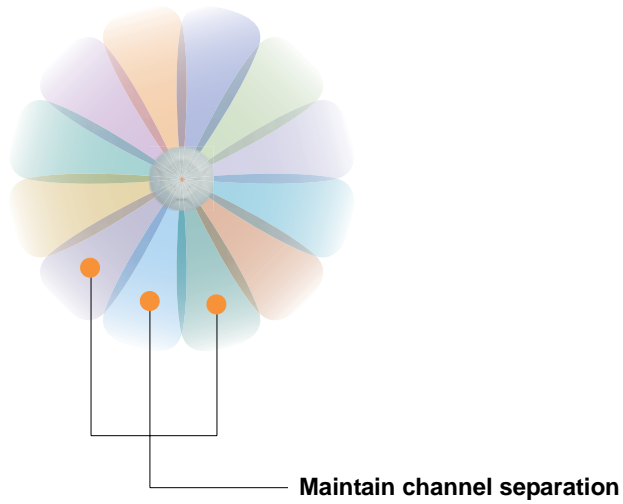


Figure 18. Allocating Channels Manually

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).

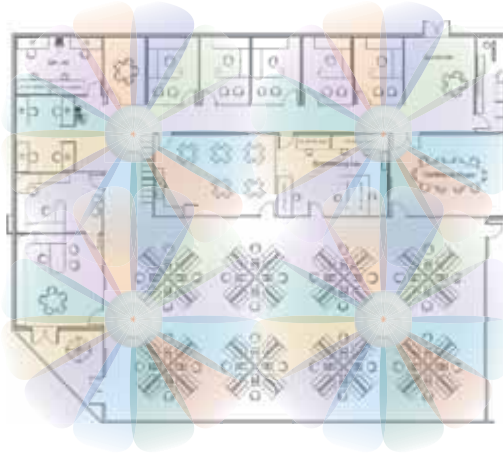


Figure 19. Deployment Scenario (54 Mbps)—Per Sector

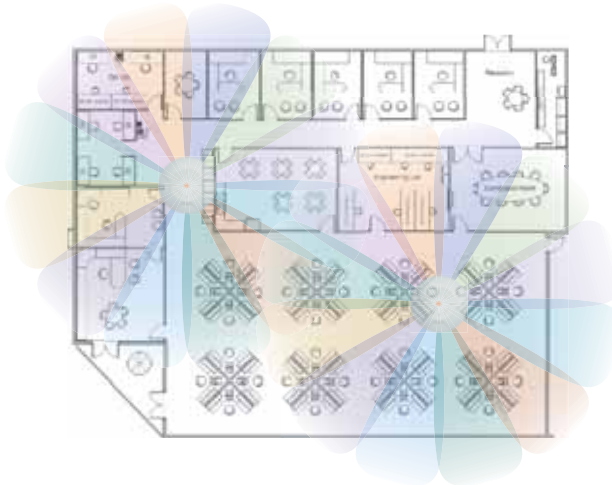


Figure 20. Deployment Scenario (36 Mbps)—Per Sector



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 61
- “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)

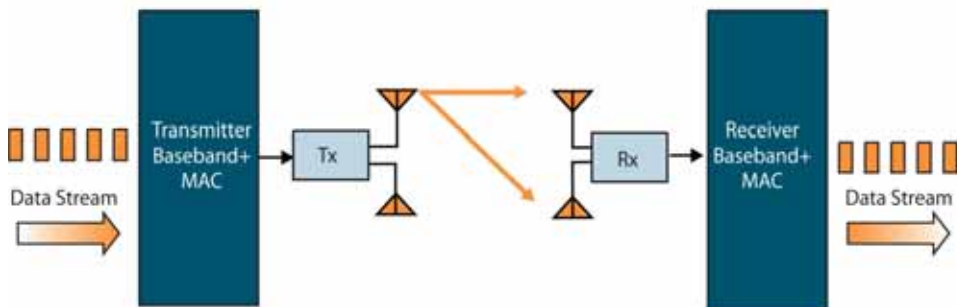


Figure 22. Classic 802.11 Signal Transmission

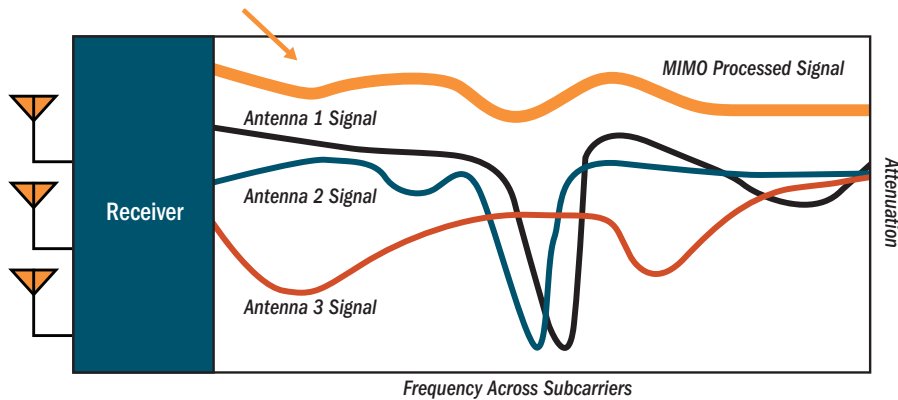


Figure 23. MIMO Signal Processing

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.

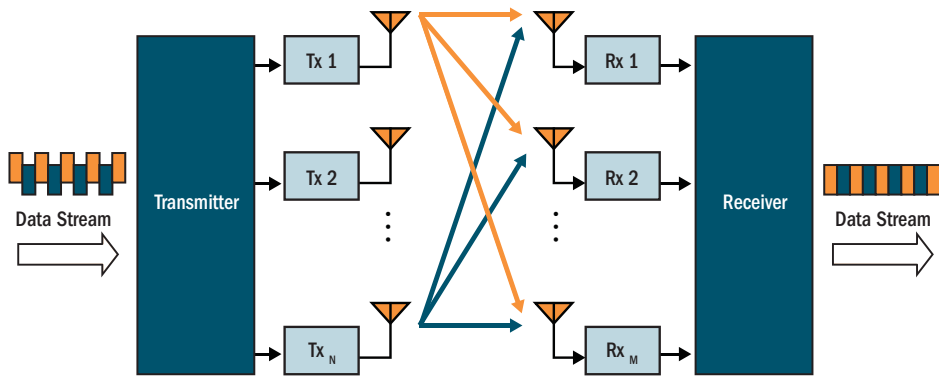


Figure 24. Spatial Multiplexing

Spatial multiplexing can double, triple, or quadruple the data rate, depending on the number of transmit antennas used. You can configure the number of chains (i.e., streams) separately for transmitting and receiving. Up to three chains may be configured separately for transmitting and receiving. We recommend that you set both TX Chains and RX Chains to 3 (see “Global Settings .11n” on page 273). These are the default values.

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 254.

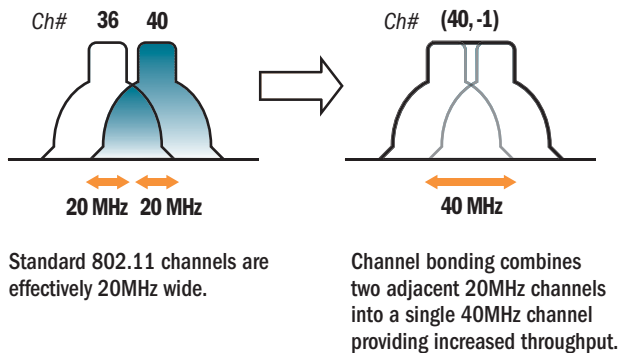


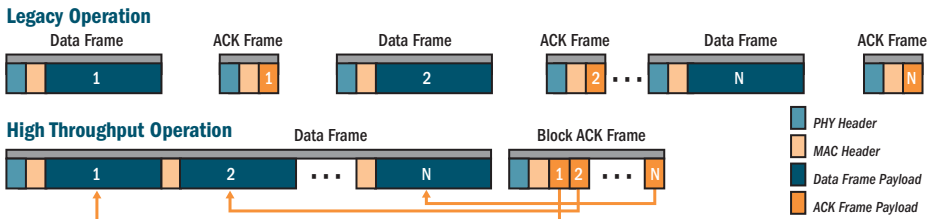
Figure 25. Channel Bonding

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.

Frame Aggregation



RIFS Usage (Reduced Inter-Frame Spacing)

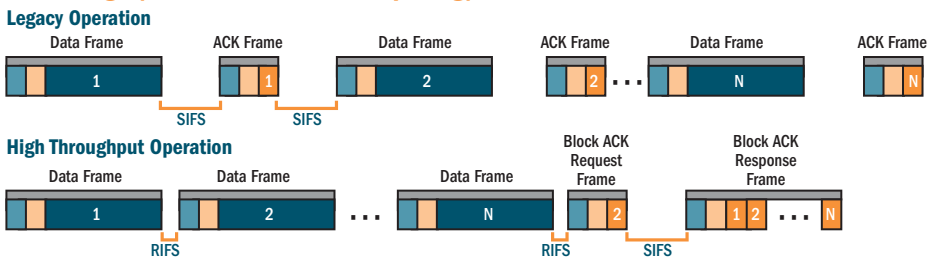


Figure 26. MAC Throughput Improvements

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

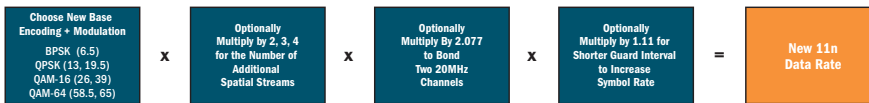
inappropriate environment, the signal quality will suffer and throughput will decrease. See “Global Settings .11n” on page 273 to configure the guard interval.

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.



Expected 802.11n Data Rates

802.11a 802.11g Rates	Expected First Generation Device Data Rates					
	One Spatial Stream			Two Spatial Streams		
	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 two spatial streams, but no channel bonding). Maximum values for the XN16, for example, will be the same as those shown in the figure, except for the 802.11a capacity—since there are only 16 IAPs, the maximum capacity would be $16 * 54$ Mbps if all IAPs are used as 802.11a radios.

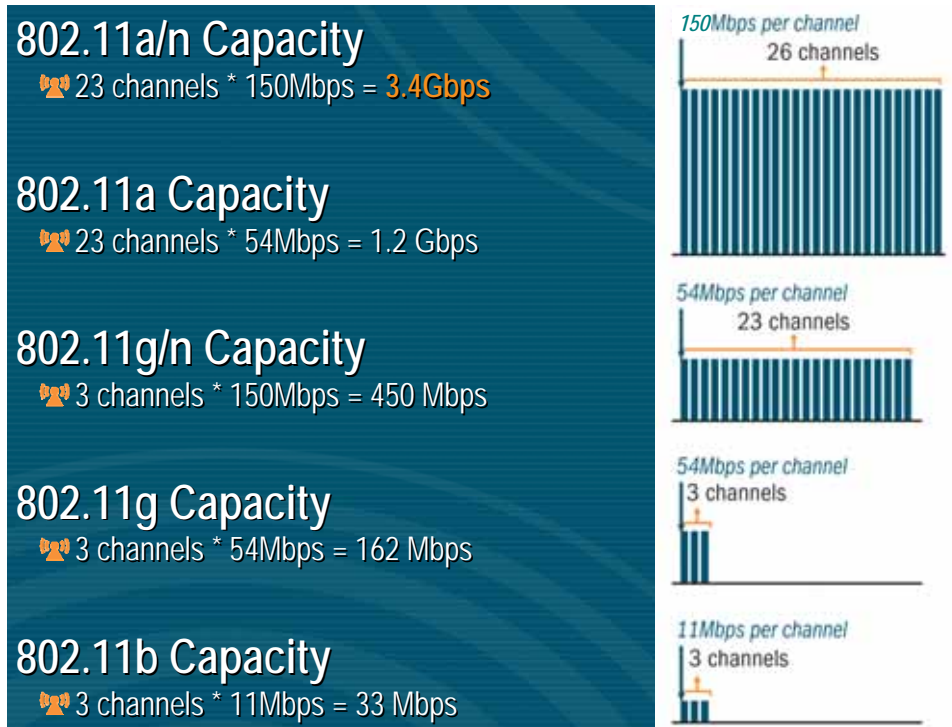


Figure 28. 802.11n Capacity

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.

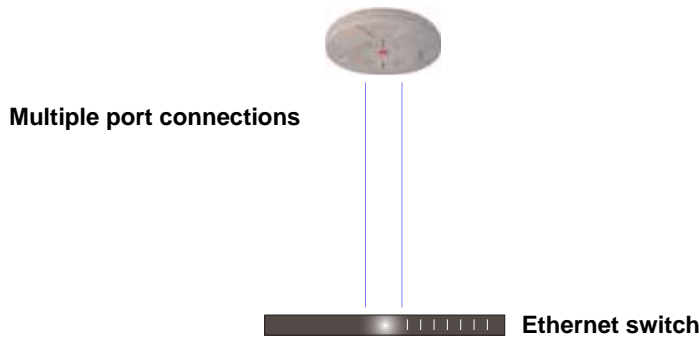


Figure 29. Port Failover Protection

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 182.

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).

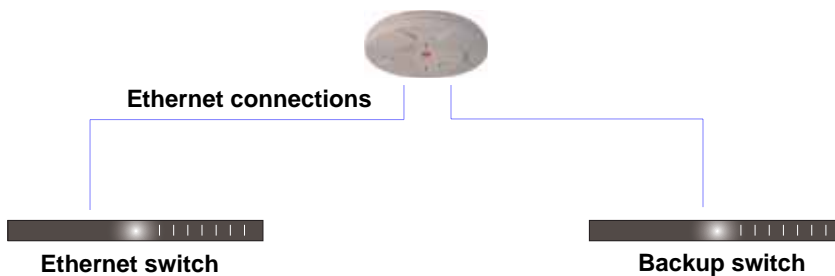


Figure 30. Switch Failover Protection



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 12](#).

Specific models of the Array are compatible with specific PoGE modules. For details, please see “[Power over Gigabit Ethernet Compatibility Matrix](#)” on [page 416](#).



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 208 and the [Security](#) section of “[Frequently Asked Questions](#)” on page 400.

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 Security Standards](#).

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 D: Implementing Security Standards](#).

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.

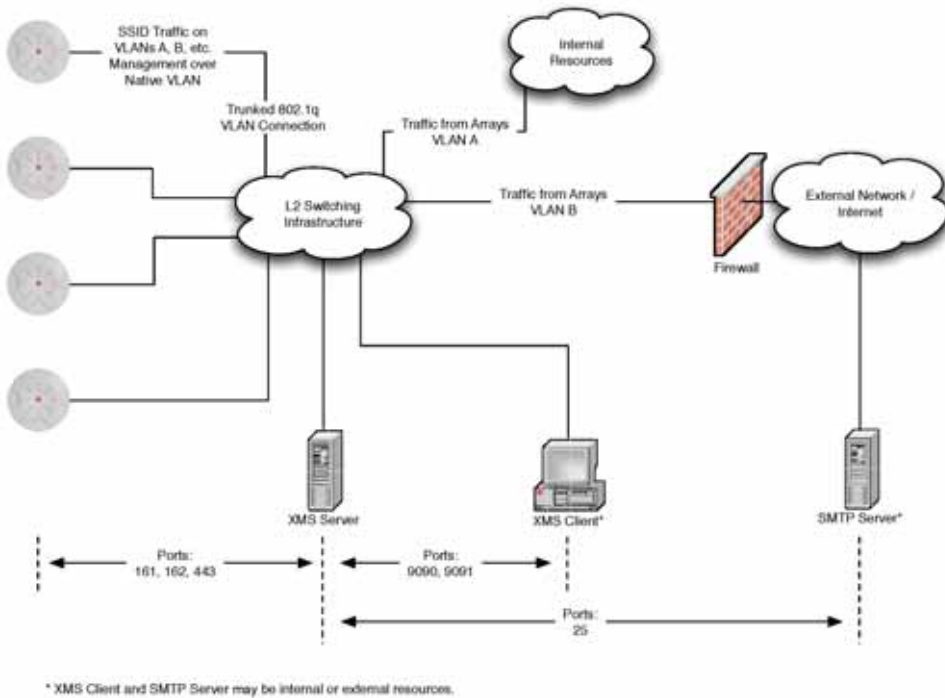


Figure 31. Port Requirements for XMS

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 WDS link, yielding up to 162 Mbps bandwidth per link. Up to 4 WDS links may be defined per Array.
- Automatic IAP Load Balancing
- Clients can still 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.

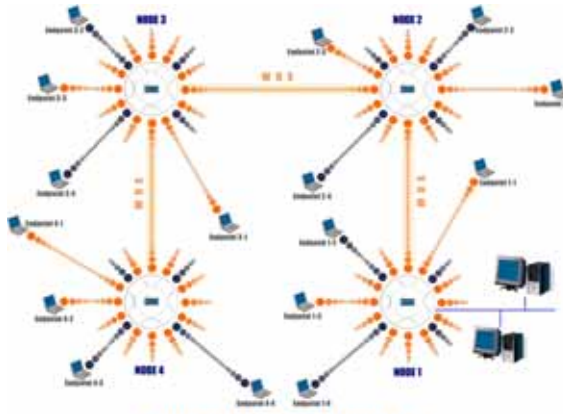


Figure 33. A Multiple Hop WDS Connection

- 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.

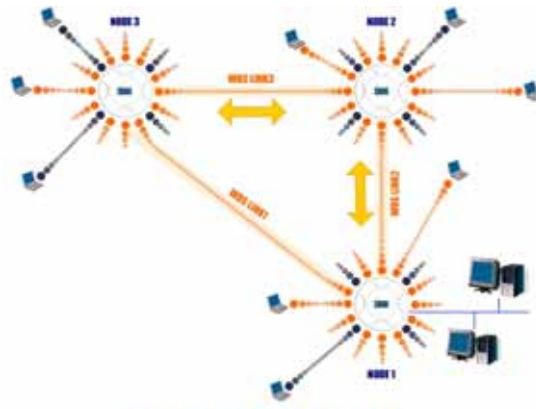


Figure 34. WDS Failover Protection

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.

Deployment Summary

The following table summarizes your deployment options.

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.

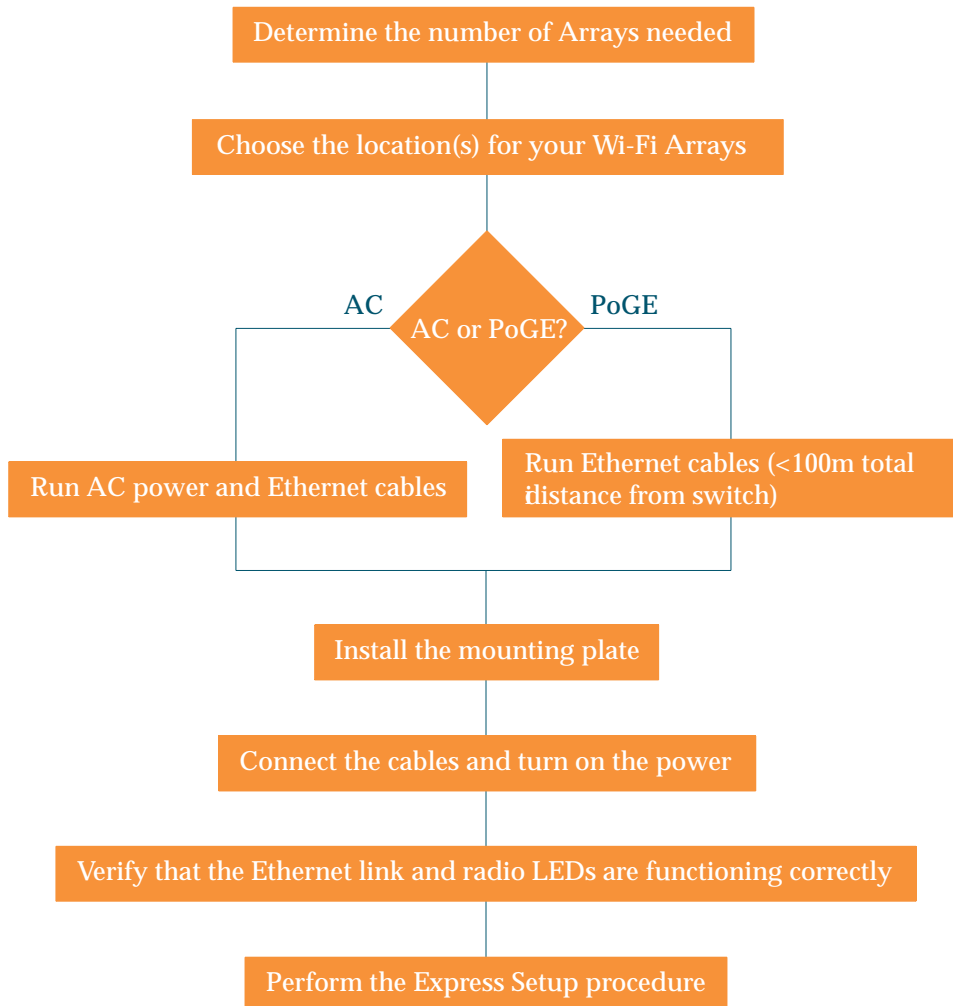


Figure 35. Installation Workflow

See Also

- Coverage and Capacity Planning
- Deployment Examples
- Deployment Summary
- 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).

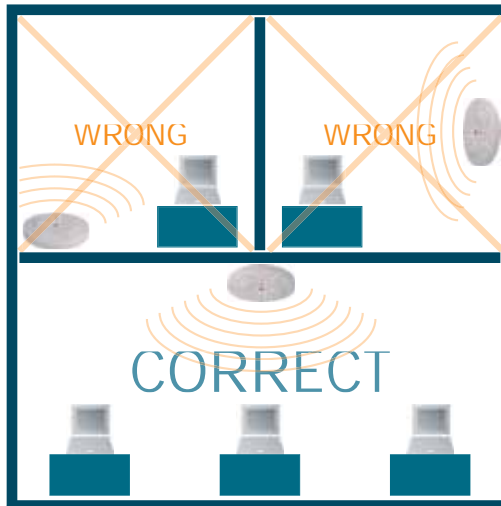


Figure 36. Array Placement

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 12](#). 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

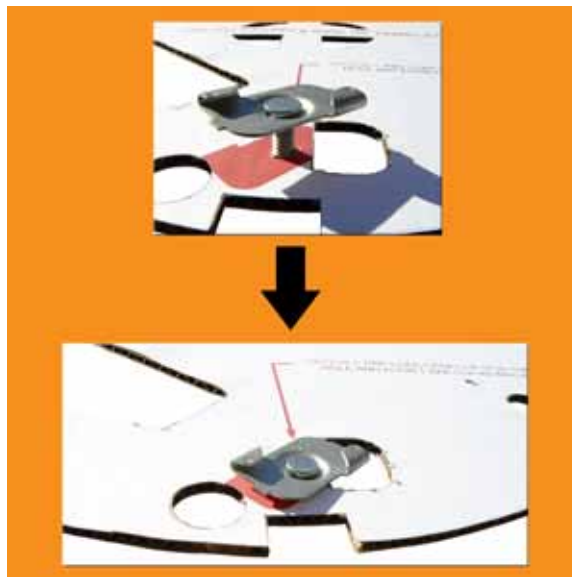


Figure 37. Attaching the T-Bar Clips to the Template

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.

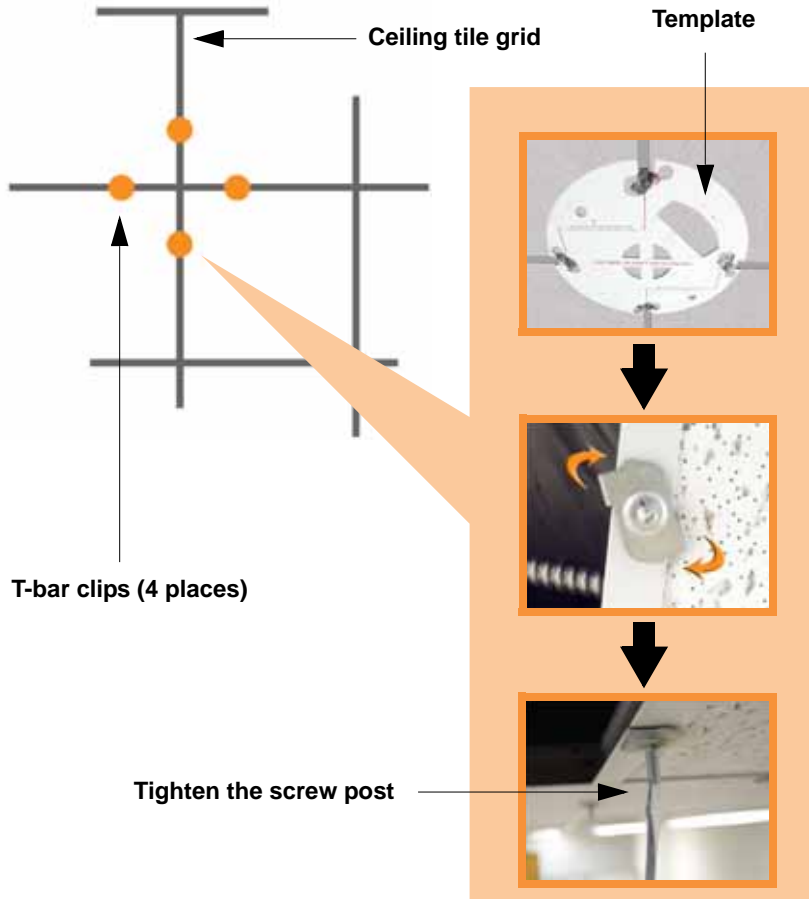


Figure 38. Attaching the T-Bar Clips to the Ceiling Grid

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.

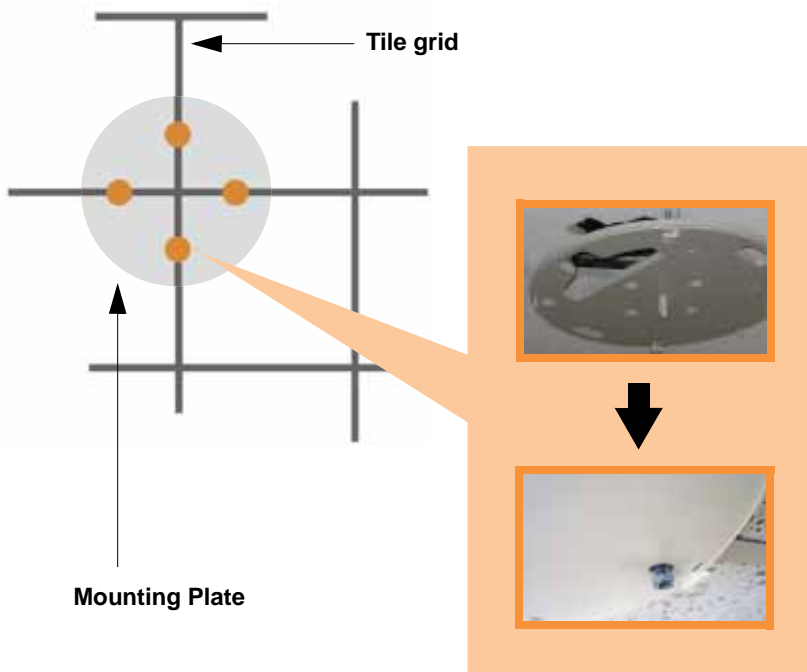


Figure 39. Installing the Mounting Plate

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:

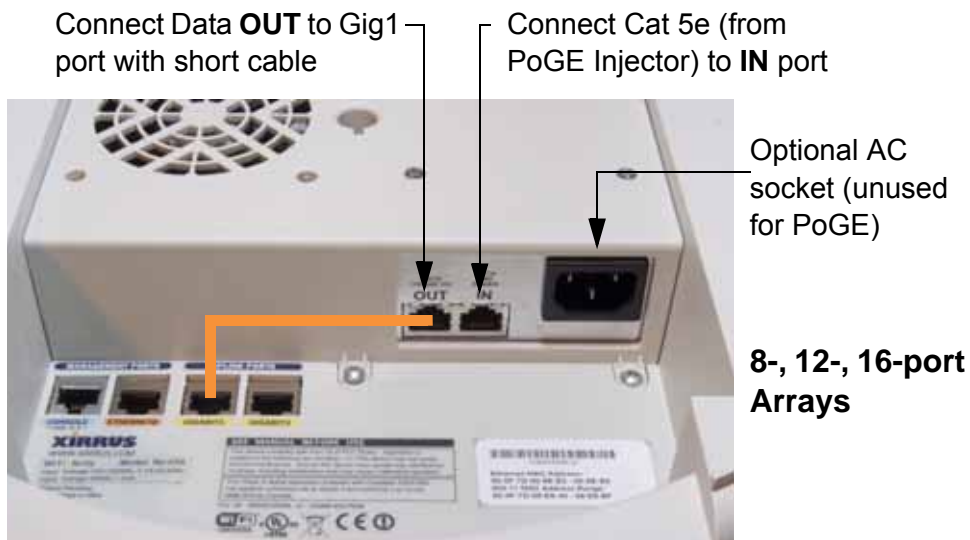


Figure 41. Connecting the Cables (PoGE—XS8/XS12/XS16)

- 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](#).

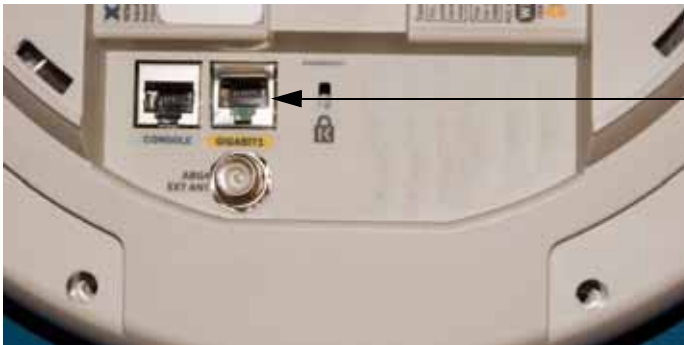


Do not connect the cable from the injector directly to a Gigabit port! It must be connected to the IN port (towards the right in Figure 41).

- Connect the supplied 6” 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.



Connect Cat5e
(from PoGE
Injector)
to **GIGABIT1**

XS4

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.

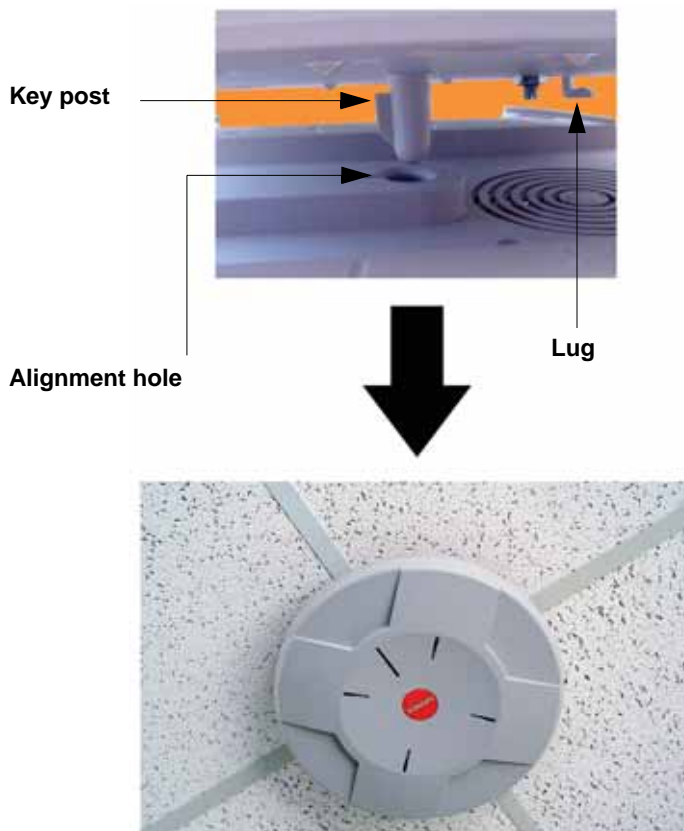


Figure 43. Attaching the Unit (XS4 shown)

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

Attaching 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.



Locking bracket

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 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.

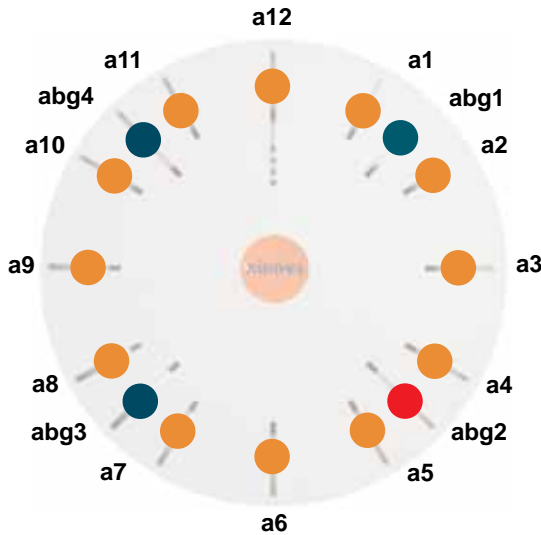


Figure 46. IAP Positions (XS16 shown)

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
- Securing the Array

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.

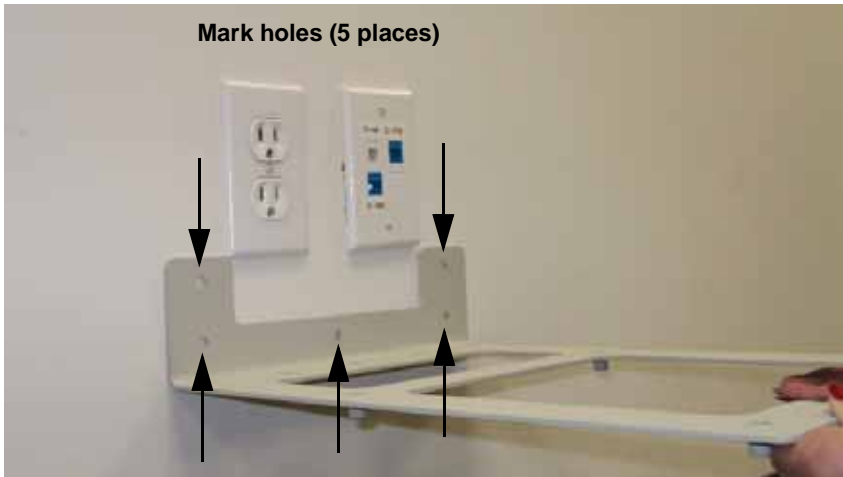


Figure 47. Wall Mount—Marking the Holes

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.

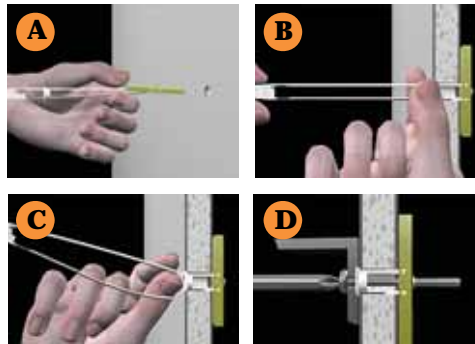


Figure 48. Installing the Toggle Bolts

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.

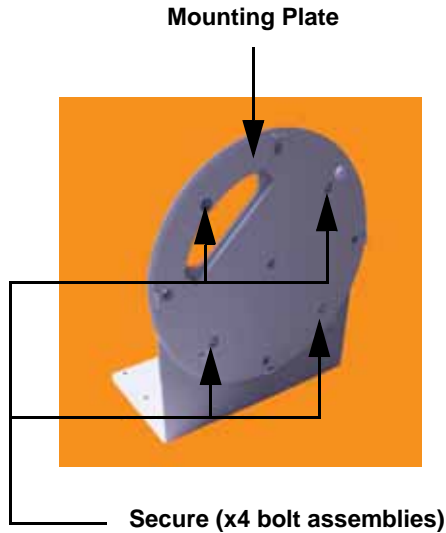


Figure 49. Attaching the Wall Mounting Plate

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 “Attaching 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.

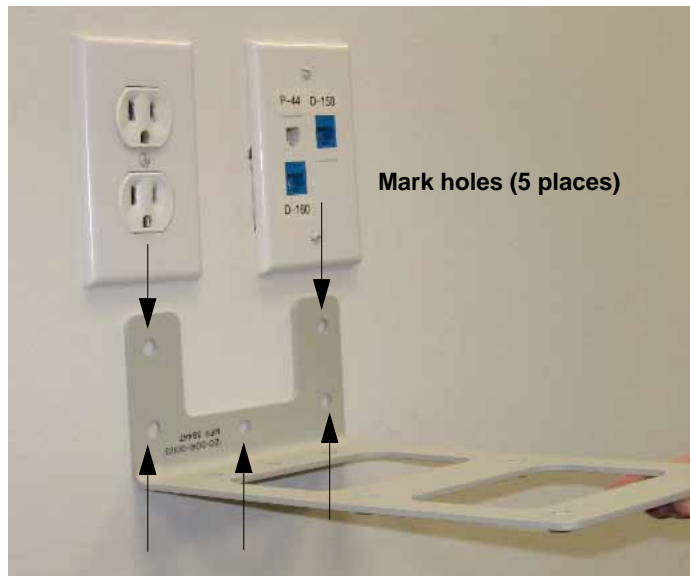


Figure 51. Wall Mount—Marking the Holes

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.

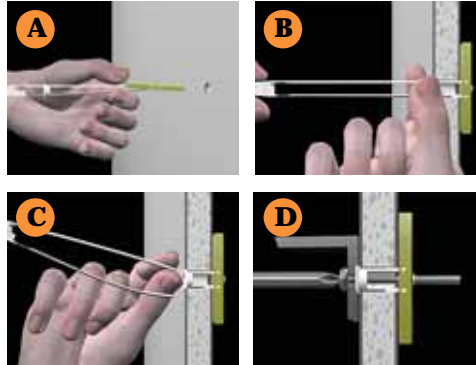


Figure 52. Installing the Toggle Bolts

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.

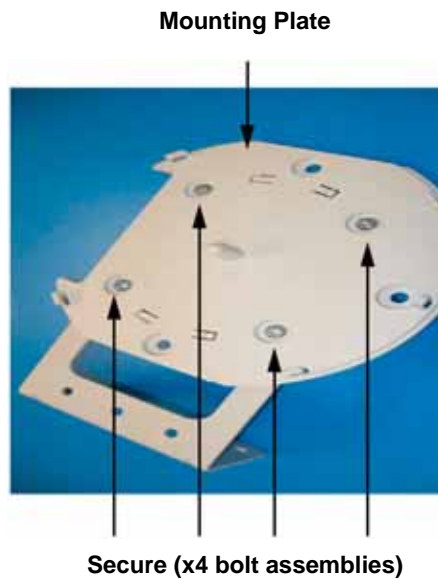


Figure 53. Attaching the Array Mounting Plate

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