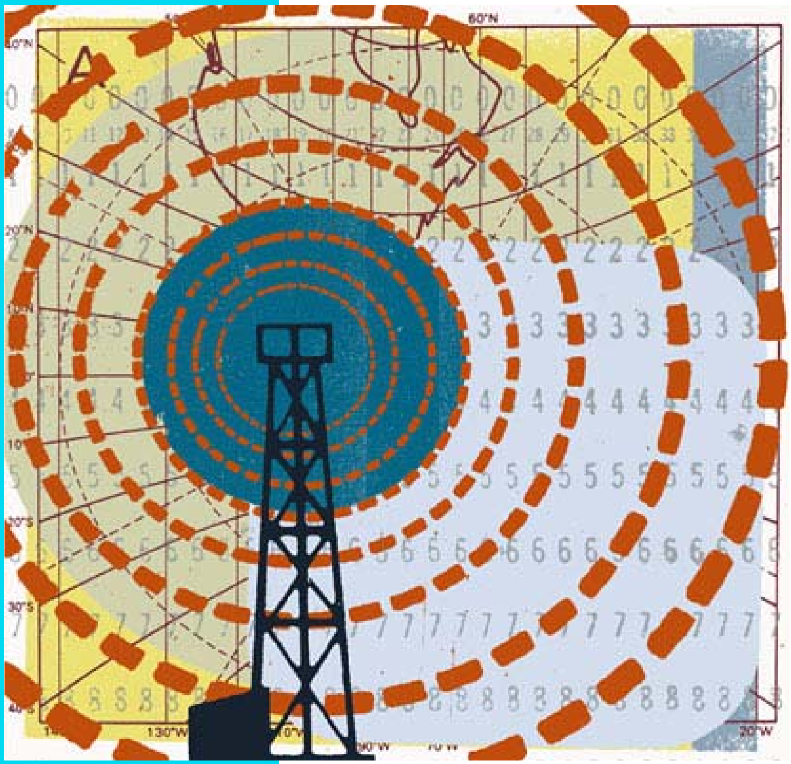
SkyPilot Network Administration



SkyPilot™ NETWORKS

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About This Guide

This document contains guidelines for performing operations, administration, and maintenance tasks for SkyPilot™ network deployments. Topics discussed include using SkyProvision™ to provision SkyPilot devices, using SkyControl™ to monitor a SkyPilot network, and troubleshooting.

This chapter explains what's in this guide and how it's organized.

Chapter Highlights

- Audience and purpose
- How this guide is organized
- Conventions used in this guide

Audience and Purpose

This guide is intended for administrators who are responsible for managing a SkyPilot network. It explains ongoing operations, administration, and maintenance tasks, such as provisioning SkyPilot devices, customizing a SkyPilot network, and monitoring SkyPilot network status.

This guide assumes administrator-level knowledge of IP networks, basic knowledge of wireless networking, and a familiarity with the information in *Getting Started with the SkyPilot Network*. Additionally, the procedures assume that SkyPilot devices have already been successfully installed according to the procedures in their installation guides. (Complete SkyPilot documentation is available on the SkyPilot website at www.skypilot.com/support/.)

How This Guide Is Organized

This guide is organized as follows:

- Chapter 1, "Introduction," describes the SkyPilot Networks hardware and software components, as well as the operations, administration, and maintenance tasks that you can perform.
- Chapter 2, "Operations," describes how to provision SkyPilot devices (either manually or automatically) and provides guidelines for configuring SkyPilot devices.
- Chapter 3, "Administration," describes routine management tasks, such as managing software and customers, configuring security, and creating reports, and directs you to the corresponding detailed procedures.
- Chapter 4, "Maintenance," describes techniques for maintaining your SkyPilot network, as well as solutions to common troubleshooting issues.

- Appendix A, “General SkyPilot EMS Reference,” provides detailed instructions for SkyPilot network management and monitoring functions that aren’t specific to SkyProvision or SkyControl, such as security configuration and alarm monitoring.
- Appendix B, “SkyProvision Reference,” provides detailed instructions for configuring provisioning parameters for automatically provisioned devices, and for performing administrative functions for your SkyPilot network.
- Appendix C, “Google Earth EMS Reference,” provides instructions for preparing network profiles for viewing in Google Earth.
- Appendix D, “SkyControl Reference,” provides detailed instructions for SkyPilot network administrative and maintenance functions.
- Appendix E, “Configuring a Firewall for SkyPilot Operations,” tells you which ports to open for data traffic from SkyPilot devices if your server is behind a firewall.
- Appendix F, “Access Point Command-Line Interface,” provides instructions for accessing an access point’s Linux command shell.

Conventions Used in This Guide

This section describes the text and syntax conventions used in this guide.

Text Conventions

This guide uses the following text conventions:

- *Italic* is used to introduce new terms.
- **Bold** is used to indicate what you click in a graphical user interface (for example, commands names). In examples showing user interaction with the command-line interface, bold is used to indicate user input as opposed to command output.
- A `monospace` font is used for code elements (variable names, data values, function names, and so forth), command lines, scripts, and source code listings. It is also used to indicate text to enter in a graphical user interface.
- *`Italic-monospace`* is used for replaceable elements and placeholders within code listings.

Syntax Conventions

This guide uses the following conventions when showing syntax:

- Angle brackets, "<" and ">", enclose mandatory elements. You must enter these elements. For example:

  ```
  ping <IP-address>
  ```

- Square brackets, "[" and "]", enclose optional elements. You can omit these elements. For example:

  ```
  show filter [filter-table-number]
  ```

  Square brackets are also used to show the current value of parameters in the output of some commands.

- A vertical bar, "|", separates choices. For example:

  ```
  show bridge [cache | port]
  ```

Contents

About This Guide v

Audience and Purpose vi
How This Guide Is Organized vi
Conventions Used in This Guide vii

Chapter 1 Introduction 1

System Overview 2
About Operations, Administration, and Maintenance 5

Chapter 2 Operations 9

Provisioning Overview 10
Provisioning Parameters Overview 15
Required Provisioning Parameters 17
Optional Provisioning Parameters 23
General Provisioning Guidelines 53
Automatic Provisioning 53
Manual Provisioning 58

Chapter 3 Administration 63

Managing Software Images 64
Managing Customers 67
Managing Access Control Lists 68
About Network Security 69
About Reports and Statistics 70

Chapter 4 Maintenance 73

Monitoring a Network’s Topology with SkyControl 74
Monitoring Events and Alarms 75
Monitoring Link States 76
Managing IP Addresses 77
Using Utilities 79
Troubleshooting 79

Appendix A General SkyPilot EMS Reference. 101

Using SkyPilot EMS (Java Client) 102
Managing Network Security 108
Configuring Traps 109
Configuring Performance Thresholds 110
Configuring Events. 112

Configuring Alarms 113

Appendix B SkyProvision Reference 115
Using SkyProvision 116
SkyPilot EMS Web Client 116
Searching for Provisioning Objects 124
Configuring Domains 124
Configuring Software Images 125
Configuring Access Point Profiles 126
Configuring Node Profiles 133
Configuring Nodes 138
Configuring VLANs 141
Configuring Proxy Proxy ARP 142
Configuring Customers 145
Configuring SNMP Parameters 146
Configuring Access Control Lists 149
Configuring QoS 150
Configuring Web Servers 150

Appendix C Google Earth EMS Reference 151
Starting Google Earth EMS 153
Downloading icons 155
Creating and viewing network profiles 156

Appendix D SkyControl Reference 169
Using SkyControl 170
Viewing Your SkyPilot Network 182
Configuring SkyControl's SNMP Queries 185
Configuring Data Collection Tasks 187
Configuring Threshold Alarms 189
Using Reports 190
Viewing Statistics 192

Appendix E Configuring a Firewall for SkyPilot Operations 195

Appendix F Access Point Command-Line Interface 197
Checking VLAN Status 197
Accessing the Interface 197

1

Introduction

After becoming familiar with the SkyPilot Networks solution and deploying your SkyPilot network (as described in *Getting Started with the SkyPilot Network*), you'll need to perform operations, administration, and maintenance (OAM) tasks to increase performance, stability, and reliability. This chapter describes these tasks and the tools you use to perform them.

Chapter Highlights

- System overview
- About operations, administration, and maintenance (OAM)

System Overview

SkyPilot Networks delivers a wireless, end-to-end broadband solution that seamlessly supports high-capacity, high-coverage networks. Designed for managed-access networks and service providers, the SkyPilot network takes broadband wireless the last mile with a cost-effective, robust infrastructure solution.

SkyPilot gives carriers an opportunity to expand rapidly into new markets and extend their offerings to include VoIP and high-bandwidth applications such as video and location-based services.

The SkyPilot solution offers a "tipping point" for converting dial-up customers to broadband and will help drive the growth of neighborhood "hotspots," offering ubiquitous wireless connectivity to local communities.

The auto-discovery and rapid provisioning features of a SkyPilot wireless mesh network can greatly reduce deployment and maintenance costs. Multiple topology options and network scalability create intriguing options for rapidly expanding a metro Wi-Fi customer base.

Hardware Components

A SkyPilot network includes the following physical components:

- **SkyGateway™**—Operates as a base station for your wireless network. It provides an interface between wired infrastructure and a wireless network of subscribers who enjoy secure, high-speed access to the Internet or wide area networks.

  A SkyPilot wireless network requires at least one SkyGateway for operation. If desired, you can add additional SkyGateways to increase network capacity or provide redundancy. The SkyGateway typically resides at a location that offers easy access to wired infrastructure—usually a POP or data center. For optimal performance, the SkyGateway should be installed on an elevated site, such as a cell tower or the top of a tall building.

NOTE There must be at least one functioning SkyGateway in your SkyPilot network before any other devices (SkyExtenders or SkyConnectors) can form communications links.

- **SkyExtender™**—Functions as a repeater and extends the wireless range of a SkyGateway. SkyExtenders are optional equipment; by adding them to your network, you can expand your coverage area and provide redundancy through SkyPilot's mesh networking features. SkyExtenders offer a cost-effective way to add capacity and balance network loads.

  A SkyExtender's Ethernet interface can supply local subscriber service (creating a direct connection to the wireless network via the SkyExtender's Ethernet port) in addition to wirelessly forwarding data on behalf of other end users.

  For optimal performance, SkyExtenders should be installed on an elevated, fixed location, such as a roof, tower, or utility pole.

- **SkyExtender DualBand**—Combines the features of a SkyExtender with a high-powered 802.11b/g access point that allows service providers and municipalities to offer standard Wi-Fi services over great distances, for targeted hot zones or dense, ubiquitous coverage patterns.

- **SkyExtender TriBand**—Combines the features of a SkyExtender DualBand with an additional radio, which is accessible through a second access point operating in parallel with the 2.4 GHz access point. The second access point leverages the 4.9 GHz Public Safety band, using 802.11a communication protocol. Each access point uses a single antenna, and these antennas have similar coverage patterns, providing a cost-effective solution for municipal networks.

IMPORTANT From here on in this guide, all references to "SkyExtender" refer to the SkyExtender, the SkyExtender DualBand, *and* the SkyExtender TriBand, unless otherwise noted.

- **SkyConnector™**—Links your subscribers to the SkyPilot wireless network. An Ethernet interface on the SkyConnector enables connecting to the subscribers' computers or a local area network (via a switch or router).

  For flexibility of installation, SkyPilot offers two versions of the SkyConnector:

  - **Outdoor**—Designed for installation by the service provider, the outdoor version of the SkyConnector attaches to an external structure such as eaves, a roof, or a pole. In general, the outdoor SkyConnector provides greater range than the indoor unit.
  - **Indoor**—A plug-and-play network device that a subscriber can easily install without technical assistance. Advise subscribers to place the SkyConnector in a location with an optimal sight line to the SkyGateway or a SkyExtender—for example, on a windowsill or in a window frame.

Software Components

The software components of a SkyPilot system are:

- **SkyProvision™**—A server-based application that automates device provisioning by enabling devices to get their configuration information from the SkyPilot EMS server. SkyProvision is also used for updating network node firmware and for setting device and system configuration options.

  SkyProvision functions are accessed using the EMS Java client or the EMS Web client. For installation information, refer to *SkyPilot EMS Installation*.

- **SkyControl™**—An SNMP management system for real-time SkyPilot device monitoring and management. This software provides a graphical view of your network topology with at-a-glance updates on topology, routing, and performance.

  SkyControl functions are accessed using the EMS Java client. For installation information, refer to *SkyPilot EMS Installation*.

- **Third-party applications**—Provided as part of the SkyPilot EMS server installation. The server package includes open-source versions of FTP, HTTP, and DHCP servers plus an open-source database for storing device configuration information. For more information about these third-party applications, refer to *SkyPilot EMS Installation*.

- **SkyPilot command-line interface**—A text-based interactive application built into all SkyPilot devices. This interface enables you to manually provision a device, retrieve information about the device's status, and perform real-time logging.

  NOTE This interface is typically referred to as the "command-line interface" (without the preceding "SkyPilot").

- **SkyPilot Web interface**—A Web-based application built into all SkyPilot devices. This tool provides much the same functionality as the SkyPilot command-line interface in an easy to use graphical interface.

  NOTE This interface is typically referred to as the "Web interface" (without the preceding "SkyPilot").

- **Access point command-line interface**—The Linux command shell interface of DualBand and TriBand access points. This interface enables you to execute standard Linux commands to configure and retrieve access point settings directly (versus through the SkyPilot Web interface). This interface is intended for SkyPilot use only.

For more information about how to use the software components, see "OAM Tools and Resources" on page 7.

About Operations, Administration, and Maintenance

After deploying your SkyPilot network, you will need to perform *operations, administration, and maintenance (OAM)* tasks to optimize performance and uptime. *Operations* refer to ongoing provisioning and customizing activities. *Administration* involves routine management tasks, such as managing software and customers, configuring security, and creating reports. *Maintenance* encompasses system monitoring, address management, and troubleshooting strategies.

OAM Tasks

A SkyPilot network administrator is usually responsible for the tasks described in Table 1-1.

Table 1-1. OAM Tasks

Task	Refer to
Provisioning SkyPilot devices	“Provisioning Overview” on page 10
Managing devices’ firmware	“Managing Software Images” on page 64
Creating reports	“About Reports and Statistics” on page 70
Monitoring system status	“Monitoring a Network’s Topology with SkyControl” on page 74 “Monitoring Events and Alarms” on page 75 “Monitoring Link States” on page 76
Troubleshooting	“Troubleshooting” on page 79

OAM Tools and Resources

Table 1-2 describes the tools and resources related to performing OAM tasks.

Table 1-2. OAM Tools and Resources

Tool or resource	Description
SkyProvision	SkyProvision is a component of SkyPilot EMS (Element Management System) that automates device provisioning by enabling devices to get their configuration information from the EMS server. Using SkyProvision, you create configuration profiles that are distributed to devices across the wireless mesh network. For more information, see “Automatic Provisioning” on page 53.
SkyControl	SkyControl is an SNMP management system for real-time SkyPilot device monitoring and management. This software provides a graphical view of your network topology with at-a-glance updates on topology, routing, and performance. Like SkyProvision, SkyControl is a component of SkyPilot EMS. For more information, see “Monitoring a Network’s Topology with SkyControl” on page 74.
Command-line interface	A comprehensive command-line interface is built into all SkyPilot devices to enable you to manually provision a device, retrieve information about the device’s status, and perform real-time logging. For more information, see “Command-Line Interface Provisioning” on page 61.
Web interface	A comprehensive Web-based application is built into all SkyPilot devices to provide much the same functionality of the command-line interface in an easy to use graphical interface. For more information, see “Web Interface Provisioning” on page 61.

2

Operations

SkyPilot operations tasks include ongoing provisioning and customizing activities. This chapter describes how to provision SkyPilot devices (either manually or automatically) and provides guidelines for configuring SkyPilot devices.

Chapter Highlights

- Provisioning overview
- Provisioning parameters overview
- Required provisioning parameters
- Optional provisioning parameters
- General provisioning guidelines
- Automatic provisioning
- Manual provisioning

Provisioning Overview

Provisioning is the process of customer authorization and service configuration. When a SkyPilot device is provisioned, it authenticates itself on the network and downloads a configuration file containing customer-specific settings, such as firmware images and Quality of Service rate limits. This device provisioning is independent of end-user provisioning, but it can be used to assist with end-user provisioning by serving IP addresses via DHCP to user equipment such as personal computers and home routers.

Table 2-1 summarizes the steps required to provision a SkyPilot device.

Table 2-1. Device Provisioning Steps

	Step	Refer to
1	Decide whether to configure the device for manual or automatic provisioning.	"Choosing a Device Provisioning Mode" on page 10
2	Provision the device.	Either of the following: ● "Manual Provisioning" on page 58 ● "Automatic Provisioning" on page 53

Choosing a Device Provisioning Mode

SkyPilot offers a choice of two device provisioning modes:

- **Automatic**—Allows unattended configuration of SkyPilot devices from a central SkyPilot EMS server at your network operations center (NOC). Automatic provisioning requires more initial setup time than manual provisioning, but it greatly simplifies network administration as your network grows.
- **Manual**—Allows device configuration with the minimum settings required for a wireless link. Configuration settings are entered through the command-line interface or Web interface and are stored in flash memory; manually provisioned devices do not depend on a SkyPilot EMS server for configuration. Manual provisioning is a logical choice if you're installing a test network or rolling out a small-scale installation that's not expected to expand.

Provisioning Mode and Device Operations

The provisioning mode you choose for devices (automatic or manual) affects the procedure that the devices use to come online.

Figures 2-1 and 2-2 illustrate the steps taken by devices—both manually and automatically provisioned—from power-on through the formation of network links.

- Figure 2-1 shows the steps taken by a SkyGateway up to the point at which the device begins sending hello beacons, which other SkyPilot devices can use to form links on the wireless network.
- Figure 2-2 shows the steps taken by SkyExtenders and SkyConnectors up to the point at which the device starts forming links with other devices on the wireless network.

Figure 2-1. SkyGateway power-on and link formation

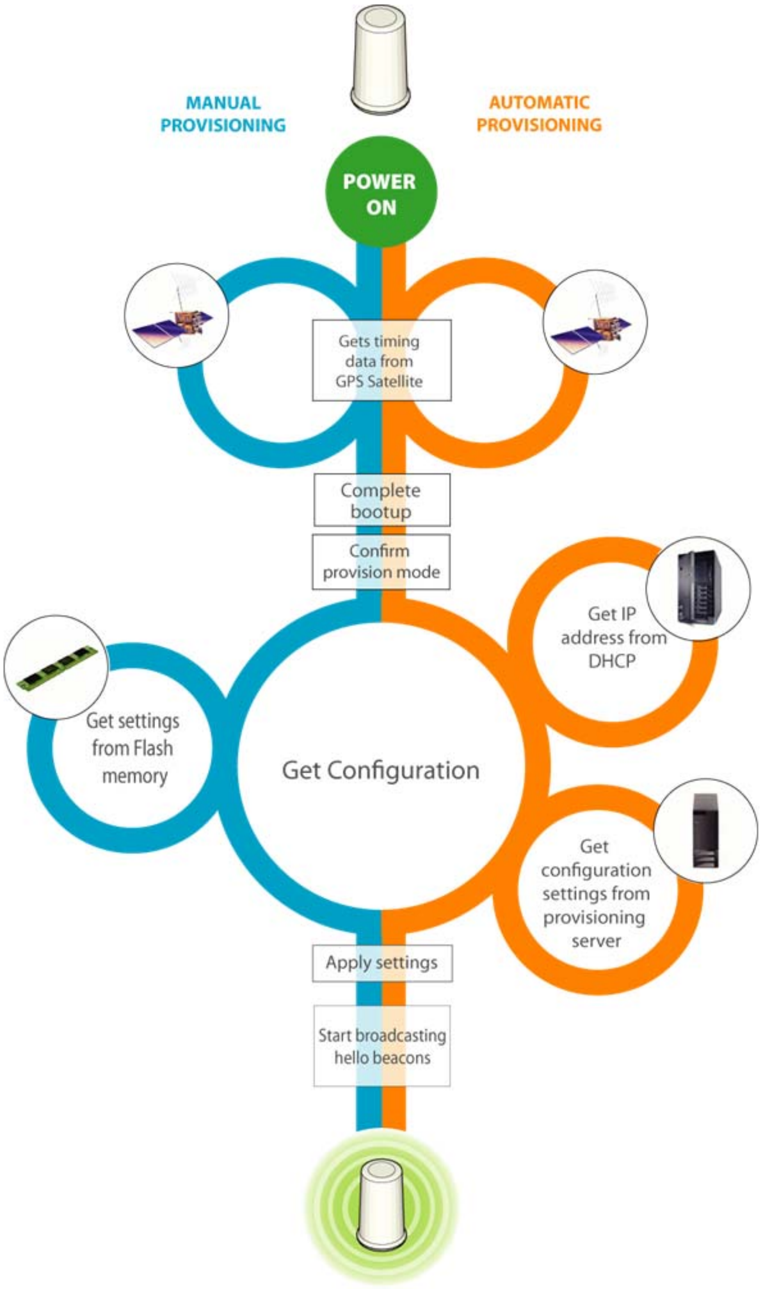

MANUAL PROVISIONING
AUTOMATIC PROVISIONING
POWER ON
Gets timing data from GPS Satellite
Complete bootup
Confirm provision mode
Get IP address from DHCP
Get settings from Flash memory
Get Configuration
Get configuration settings from provisioning server
Apply settings
Start broadcasting hello beacons

Figure 2-2. SkyConnector/SkyExtender power-on, link formation (Page 1 of 2)

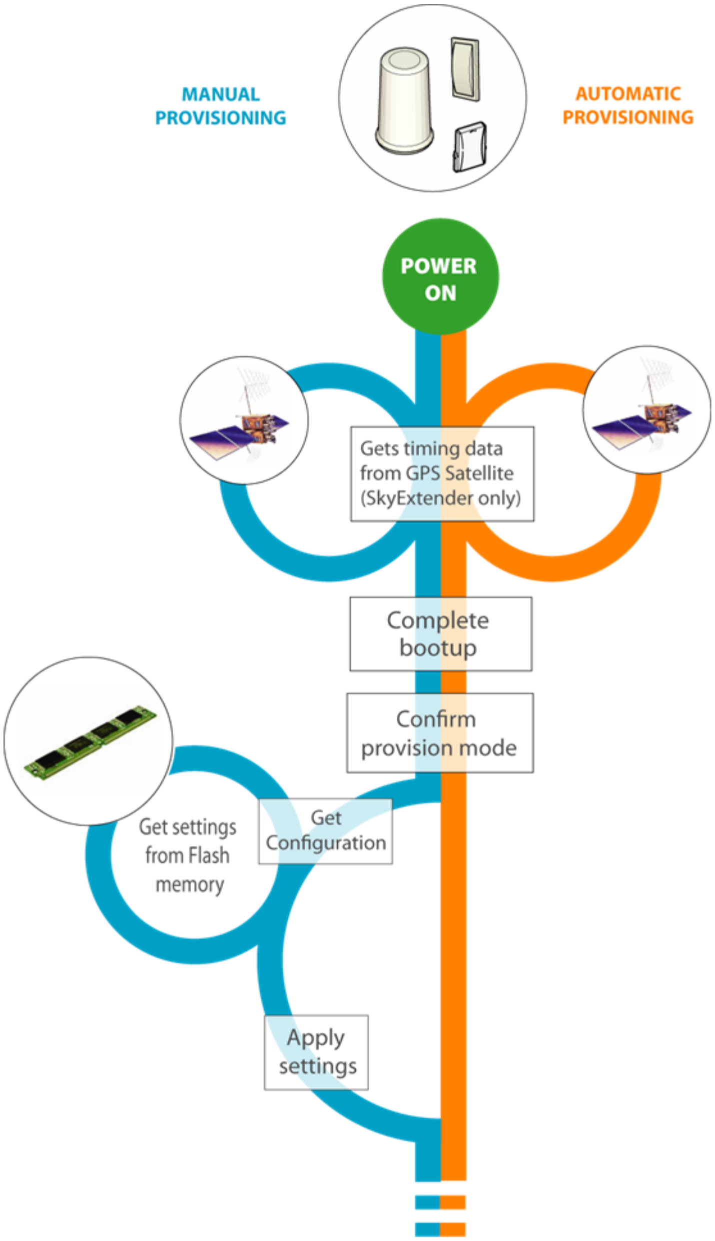
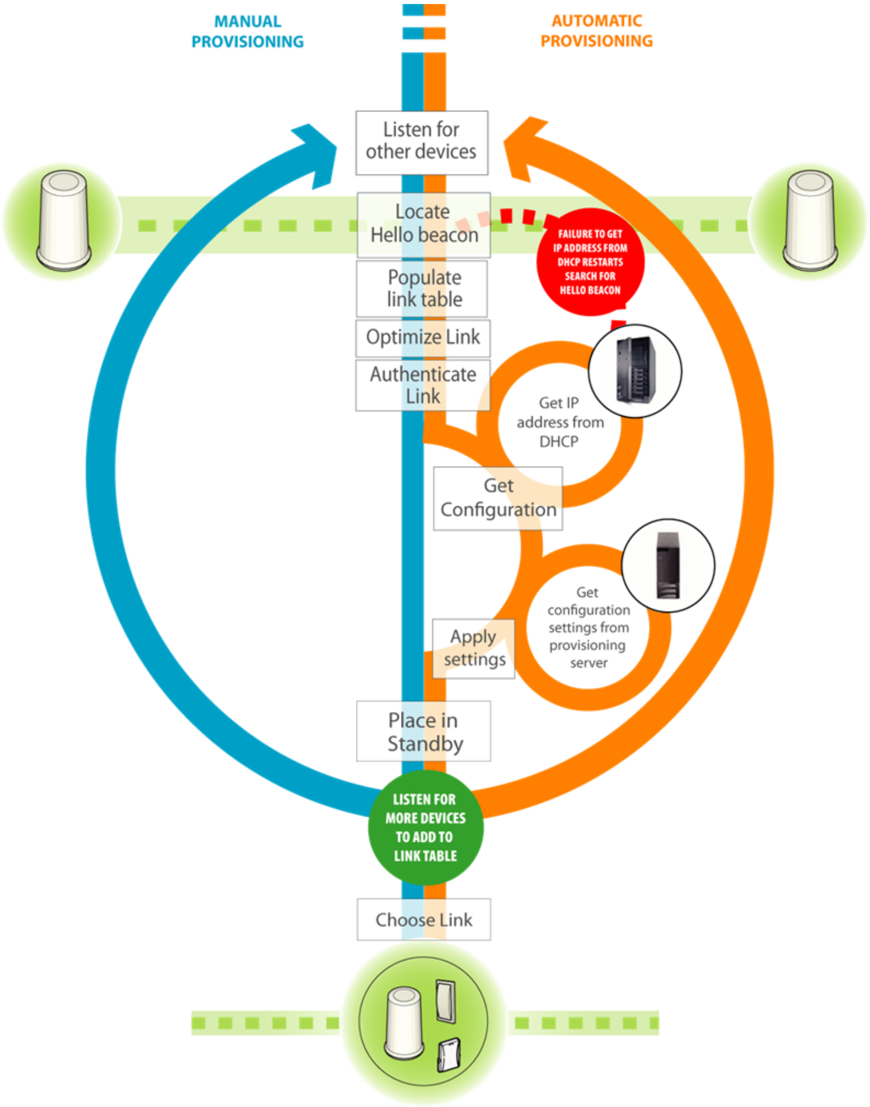


Figure 2-2. SkyConnector/SkyExtender power-on, link formation (Page 2 of 2)



Hybrid Network Provisioning

If necessary, you can set up a *hybrid network*—a SkyPilot network in which different devices use different device provisioning modes. Although a hybrid network will operate normally, individual devices will behave differently depending on their provisioning mode:

- Automatically provisioned devices will establish network links only when SkyProvision is available to provide configuration information from an EMS server.
- Manually provisioned devices will form network links according to configuration settings stored in flash memory.

There is no requirement that all devices be configured the same way (automatic provisioning or any method of manual provisioning). For example, you could use the command-line interface to manually provision and test individual nodes before adding them to your network.

Provisioning Parameters Overview

Table 2-2 lists the provisioning parameters (as they would be specified from the command line for manually provisioned devices) and shows whether they're required or optional, as well as how they can be set: on manually provisioned devices, from the command-line interface or Web interface, and/or on automatically provisioned devices via SkyProvision (both Java and Web clients).

Table 2-2. Provisioning Parameters (Page 1 of 2)

Parameter	**Req.**	**Opt.**	**CLI**	**Web Interface**	**Sky-Prov.** [‡]
access point [#]		4		4	4
acl		4	4	4	4
auto		4	4		
buzzer		4	4		4
classifier		4	4	4	4
domain	4		4		4
eth	4 [†]		4	4	4
filter		4	4	4	4
freq	4		4	4	4
ip	4 [†]		4	4	4
manual		4	4		
netkey	4 [†]		4		
parent		4	4		4
password		4	4		4
power		4	4		4

[#] Access point settings are not itemized in this table; they are configured through the Web interface or EMS client.

[†] Depends on system configuration.

[‡] All parameters that can be set with SkyProvision are set indirectly via node profile settings that are then assigned to specific devices.

Table 2-2. Provisioning Parameters (Page 2 of 2)

Parameter	Req.	Opt.	CLI	Web Interface	Sky-Prov. [‡]
`radar`		4	4		4
`snmp`		4	4	4	4
`timezone`		4	4		4
`trafficrate`		4	4	4	4
`vlan`	4 [†]		4	4	4
`web`		4	4		4

[#] Access point settings are not itemized in this table; they are configured through the Web interface or EMS client.

[†] Depends on system configuration.

[‡] All parameters that can be set with SkyProvision are set indirectly via node profile settings that are then assigned to specific devices.

Required Provisioning Parameters

Regardless of which provisioning mode you configure for a SkyGateway, the device must have the frequency and domain parameters set before it can be operational, as described in the next two sections.

In addition, if you're planning to operate a SkyPilot device as a manually provisioned device, you must change its provisioning mode from the default (automatic) to manual.

Depending on your deployment, you may need to configure additional provisioning parameters:

- If virtual local area networks (VLANs) are being used in the wired network to which the SkyGateway will connect, you may need to configure the management VLAN parameters for the SkyGateway. See "Virtual Local Area Networks (VLANs)" on page 20.

- If the SkyPilot device's Ethernet interface is configured to autonegotiate but the device fails to negotiate Ethernet connectivity (possibly because the device doesn't support autonegotiation), you may need to configure the Ethernet interface for a fixed speed and duplexity. See "Ethernet Interface" on page 22.
- If the network is using a nonstandard netkey (that is, anything other than the default netkey, `SkyPilot Network, Inc.`), you need to set the device's netkey to match the other devices. Refer to the `set netkey` command, described in the *SkyPilot Command-Line Interface Reference*. (The netkey can't be changed using SkyProvision or the Web interface.)
- Although not required by SkyPilot devices in order to forward end-user data, you should configure the IP address information so that you can access and manage the device itself. See "Managing IP Addresses" on page 77.

Frequency

In order for devices within a SkyPilot network to form links, they must operate on the same frequency. You can configure a variety of frequency settings, including the primary (preferred) frequency, multiple allowed frequencies, and the dwell time a device waits on its primary frequency before attempting to use a frequency from its Allow list to achieve successful communications with network nodes. Which frequencies you can set depends on the device:

- For a SkyGateway, you can set the frequency over which it will be broadcasting. (This is the primary frequency; the Allow list is ignored.)
- For SkyExtenders and SkyConnectors, you can set the primary frequency, as well as the range of frequencies that the device is allowed to use in its hunting. SkyExtenders and SkyConnectors dwell on the primary frequency longer than frequencies in their Allow list.

For automatically provisioned devices, you modify the frequency settings in the node profile that's assigned to the device (see "Access Point SkyAccess Profile Elements" on page 132).

For manually provisioned devices, you set the frequency by using the `set prov freq` command, described in the *SkyPilot Command-Line Interface Reference*.

Domains

A single domain can be defined to encompass your entire SkyPilot network, including all its nodes. Or domains can be used to segregate a network into two or more smaller networks, where each smaller network has the same characteristics as the larger network: one or more SkyGateways, any number of SkyConnectors (including none), and any number of SkyExtenders (including none).

A SkyConnector or SkyExtender can be configured to belong to a single domain or all domains (the default). If configured for only a single domain, it can use any of the SkyGateways within its domain, and it will choose the one with the lowest *cost route*, taking into account the current link quality in both directions (upstream and downstream), as well as the link quality further along the route to the ultimate destination. The SkyConnector/SkyExtender cannot, however, form links with SkyGateways outside its domain even if those SkyGateways are operating at a frequency in the device's Allow list. Conversely, if the SkyConnector/SkyExtender belongs to all domains, it can join any device operating on an allowed frequency, regardless of that device's domain.

Typical domain configuration activities include:

- Creating a domain for each SkyGateway and then load-balancing the SkyConnectors across multiple SkyGateways (domains). In addition to performance considerations, load balancing enables you to offer differentiated services. For example, a smaller number of business users could be assigned to one SkyGateway, while a larger number of residential users could be allocated to a second SkyGateway.
- Establishing domains with multiple SkyGateways that provide redundancy. In this case, the SkyConnectors will select a SkyGateway based on cost route. If a SkyGateway goes offline, the SkyConnectors using that SkyGateway automatically select another SkyGateway within the same domain.

For automatically provisioned devices, you use the Domain Maintenance function within SkyProvision to add, modify, and delete domains (see "Configuring

Domains" on page 124), and then you apply the domains to node profiles (see "Access Point SkyAccess Profile Elements" on page 132).

For manually provisioned devices, you set the domain by using the `set prov domain` command, described in the *SkyPilot Command-Line Interface Reference*.

Virtual Local Area Networks (VLANs)

Virtual local area networks (VLANs) are portions of a network that are configured as logical topologies defined by software, connected to the same physical network infrastructure. Devices on separate VLANs of a network behave as if they're on physically separated networks. VLANs function by logically segmenting the network into different broadcast domains so that packets are switched only between ports that are designated for the same VLAN.

By enabling the following capabilities, VLANs offer significant benefits, such as efficient bandwidth use, flexibility, performance, and security:

- Restricting the dissemination of broadcast and node-to-node traffic, thereby reducing the burden of extraneous network traffic.
- Using standard router-based security measures (since all packets traveling between VLANs must also pass through a router).
- Segregating and switching ISP traffic. Wholesale operators can offer end users a choice of any provider instead of only the provider operating a particular network. In such cases, each SkyConnector would be assigned to a single ISP. Additionally, end-user data can be separated by assigning VLANs to each SkyExtender or SkyConnector's Ethernet interface.
- Isolating management traffic from user traffic. You can configure a management VLAN, independent of a VLAN for end users. Management traffic is thereby segmented and secure.

There are two types of VLAN:

- **Management VLAN**—Used to tag and strip data with a configured VLAN ID as the data enters or exits the management interface of a device. In a SkyPilot network, you configure the management VLAN only on the SkyGateway, which then automatically propagates the VLAN configuration throughout the network.

  You must manually configure the SkyGateway VLAN because the VLAN tag can affect whether the SkyGateway's management traffic can reach a provisioning server (the EMS server).

- **Data VLAN**—Used to tag and strip data with a configured VLAN ID as the data enters or exits the Ethernet interface of SkyExtenders and SkyConnectors. The VLAN tag is added on a per-SkyExtender and per-SkyConnector basis.

The Ethernet interface of a SkyConnector or (non-DualBand) SkyExtender can be configured to either a single VLAN or no VLAN. If it's configured to a VLAN, all user Ethernet traffic transmitted upstream by the SkyConnector or SkyExtender is tagged with the configured VLAN ID. However, this VLAN tag is stripped from all Ethernet packets sent from a local SkyConnector or SkyExtender 10/100bT Ethernet interface. (Packets forwarded by the SkyGateway and SkyExtenders retain the VLAN tag.)

Data VLANs should not be configured on the SkyExtender portion of a DualBand or TriBand. Instead, VLANs can be configured on the access point's WLAN. (See "Access Point SSID Profiles" on page 42.)

TIP To avoid time-consuming troubleshooting, remember that once a SkyConnector or SkyExtender is configured to a VLAN, any packets received through their 10/100bT ports that contain a different VLAN tag are dropped. (In contrast, if a SkyConnector or SkyExtender is not configured to a VLAN, any tagged packets are forwarded unchanged.)

For automatically provisioned devices, you use SkyProvision to add, modify, and delete VLANs (see "Configuring VLANs" on page 141).

For a manually provisioned device, you configure its VLAN by using the command-line interface command (refer to the `set prov vlan` command, described in the *SkyPilot Command-Line Interface Reference*) or its Web interface counterpart (refer to the *SkyPilot Web Interface Reference*).

Ethernet Interface

A node's 10/100bT Ethernet interface can be enabled or disabled; in addition its physical settings can be configured for autonegotiation or set to full or half duplex, and its speed can be set to 100 or 10.

NOTE This section does not apply to SkyExtender DualBands, which don't have an Ethernet interface.

For SkyExtender-only applications (that is, where there is no subscriber interface), if you do not plan to connect any devices to a SkyExtender's Ethernet interface, you may want to disable the Ethernet interface for security reasons.

For SkyConnector-only or combined applications (where a SkyExtender forms wireless links to SkyConnectors and serves a local customer via the SkyExtender's Ethernet interface), you can selectively enable or disable the Ethernet interface to control subscriber access.

For automatically provisioned devices, you use the Node Profile function within SkyProvision to create profiles with the desired Ethernet interface status (see "Access Point SkyAccess Profile Elements" on page 132), and then you apply the node profiles to specific nodes (see "Configuring Nodes" on page 138).

For manually provisioned devices, you set the Ethernet interface status by using the command-line interface command (refer to the `set eth` command, described in the *SkyPilot Command-Line Interface Reference*) or its Web interface counterpart (refer to the *SkyPilot Web Interface Reference*).

Optional Provisioning Parameters

As shown in Table 2-2 on page 16, most of the provisioning parameters are optional—that is, you don't have to set them in order for your SkyPilot network devices to be operational. However, to fully utilize and customize SkyPilot functions such as reporting, you'll typically set many of the provisioning parameters discussed in these sections:

- "Radar Detection" on page 23
- "SNMP" on page 25
- "Time Zones" on page 26
- "Quality of Service (QoS)" on page 27
- "Filtering" on page 31
- If SkyExtender DualBand/TriBand devices are being used, you may need to configure their access points, including (possibly) the access points' default WPA-shared key, `publicpublic`. See "Access Points" on page 37.

You can find information about the remaining optional parameters listed in Table 2-2 in the applicable reference appendices and guides:

- Appendix B, "SkyProvision Reference"
- Appendix D, "SkyControl Reference"
- *SkyPilot Command-Line Interface Reference*
- *SkyPilot Web Interface Reference*

Radar Detection

SkyPilot devices can be configured to detect radar transmission within their reception range and take appropriate action if radar is detected. You configure SkyGateways explicitly, which then propagate the setting to SkyExtenders and SkyConnectors as links are formed.

Available configuration settings are:

- **Default**—Depends on the region (identified by a communications governing body) for which this device is manufactured:
  - FCC (US): default = Disable
  - ETSI (EU): default = Enable-shutdown
  - AUS-ACA (Australia): default = Disable
  - Public Safety (US/Latin America Public Safety): default = Disable
- **Disable**—Disables radar transmission detection.
- **Enable-shutdown**—Enables radar transmission detection, and takes appropriate action, depending on device type, when radar is detected:
  - SkyGateways sever all links and then begin operating on the lowest frequency in the Allow list on which there's been no radar detected, enabling links to reform on the network. The SkyGateway stays on the new channel indefinitely or until radar is detected.
  - SkyExtenders and SkyConnectors sever all links on the current operating frequency and begin searching on all other allowed frequencies for 30 minutes. If links are found on other frequencies, the device remains on that frequency until the links are severed or the device is restarted (even after the 30 minutes are up).
- **Enable-ignore**—Enables radar transmission detection, and logs a message whenever radar is detected.

For automatically provisioned SkyGateways, you use the Node Profile function within SkyProvision to create profiles with the desired radar detection settings (see "Access Point SkyAccess Profile Elements" on page 132), and then you apply the node profiles to specific nodes (see "Configuring Nodes" on page 138).

For manually provisioned SkyGateways, you configure radar detection by using the command-line interface command (refer to the `set radar` command, described in the *SkyPilot Command-Line Interface Reference*) or its Web interface counterpart (refer to the *SkyPilot Web Interface Reference*).

SNMP

SNMP (Simple Network Management Protocol) is a standard for gathering statistical data about network traffic and the behavior of network components. SNMP uses management information bases (MIBs), which define what information is available from any manageable network device.

SNMP is an application-layer protocol designed to facilitate the exchange of management information between network devices. By using SNMP-transported data (such as packets per second and network error rates), administrators can manage network performance, find and solve network problems, and plan for network growth.

IMPORTANT Although you can disable SNMP for a device, it's highly recommended that you do not. If you disable SNMP for any device, your monitoring capabilities with SkyControl will be limited, providing an incomplete picture of your SkyPilot network.

SNMP Community Strings

A *community string* functions as an identifier (similar to a user ID) that enables access through an SNMP agent to network information or *objects* defined within a device's MIB. The community string is transmitted with all SNMP requests to a device. If the community string is correct (that is, if it matches the configured value), the device responds with the requested information; otherwise, the device simply discards the request and does not respond. There are two types of community strings for SNMP-capable devices (and both are configurable):

- **Read-only**—Enables a remote device to retrieve information from an SNMP-capable device. The read-only community string's default value is `public`. The read-only string is also referred to as an SNMP *get*.
- **Read-write**—Allows a remote device to retrieve information from or modify settings on an SNMP-capable device. The read-write community string's default value is `private`. The read-write string is also referred to as an SNMP *set*.

SNMP Trap Receivers

SNMP trap receivers instruct a node where to send SNMP traps. To avoid a negative impact on performance, SkyPilot recommends a maximum of 10 trap receivers.

Applying SNMP Settings

You can create custom SNMP community strings and trap receivers; for details, see "Configuring SNMP Parameters" on page 146.

For automatically provisioned devices, you use the Node Profile function within SkyProvision to create profiles with the desired default or custom SNMP settings (see "Access Point SkyAccess Profile Elements" on page 132), and then you apply the node profiles to specific nodes (see "Configuring Nodes" on page 138).

For manually provisioned devices, you configure SNMP by using the command-line interface command (refer to the `set snmp` command, described in the *SkyPilot Command-Line Interface Reference*) or its Web interface counterpart (refer to the *SkyPilot Web Interface Reference*).

Time Zones

You can specify an NTP (Network Time Protocol) server IP address and set the GMT offset for accurate time. The NTP server provides the time to NTP clients (SkyPilot nodes). When a SkyPilot node starts up, it has a default date and time of January 1, 1970, 00:00:00 GMT. Using an NTP server, the node adjusts its time to be synchronized with the NTP server, which is usually UTC (Coordinated Universal Time) or GMT.

SkyPilot equipment does not display the correct time until an NTP server is specified. You must specify an NTP server in your DHCP configuration file and set the time zone during provisioning (by setting the time zone in an automatically provisioned node's node profile, or by using command-line interface or Web interface manual provisioning).

Quality of Service (QoS)

To maintain high QoS, the SkyPilot network implements a variety of controls:

- **Ingress rate control**—The SkyPilot system offers support for operator-configured maximum data rates in both directions: downstream (traffic going to a subscriber) and upstream (traffic coming from a subscriber). The SkyGateway controls the maximum downstream rate on a per-subscriber basis, while the individual subscriber nodes control the maximum upstream rate. This policing and shaping of traffic at the ingress points of the network controls access to critical bandwidth resources and minimizes the QoS mechanisms needed for traffic routed through the mesh network.
- **Scheduling fairness**—To manage any shared-access system (including broadband wireless) economically, a network operator must be able to oversubscribe user data rates relative to the overall bandwidth of the system. Therefore, there will likely be times when the overall demand is higher than the available bandwidth. SkyGateway supports per-subscriber queuing in the downstream direction, with queue control based on the configured maximum downstream rate for each subscriber. These mechanisms ensure that each user receives a proportionate share of available bandwidth during oversubscribed periods.
- **Prioritization**—SkyPilot software architecture allows for prioritization of data based on protocol type, IP address, or other differentiators. This provides a means of prioritizing the transmission of VoIP packets and any other type of data.
- **Traffic rate controls**—You can set traffic levels based on subscription rates. For example, you could create a gold level for fastest service and a silver level for slower service. The traffic levels are achieved by rate limiting. In oversubscription conditions the data rates from subscribers may be reduced proportionately. That is, a user with a 1 Mbps configured rate could be reduced to 500 Kbps while a configured rate of 500 Kbps is reduced to 250 Kbps.
- **QoS classifiers**—These are used to classify traffic according to the types of packets that will be directed to a subscriber's high-priority queue, for both upstream and downstream traffic. All other traffic will be directed to the subscriber's standard (low-priority) queue.

  For any given subscriber, this classification mechanism ensures that all queued high-priority packets are transferred before any queued low-priority packets.

However, the system as a whole transfers packets based on traffic rate control and fairness criteria, thus ensuring that the low-priority packets of one subscriber will continue to flow even when high-priority packets are queued for another subscriber.

NOTE You're not required to configure traffic rate controls or QoS classifiers. By default (that is, with no QoS classifiers applied), there is no restriction on the maximum throughput, and no traffic priorities or classifications are observed.

Configuring QoS

For automatically provisioned devices, you use the QoS functions within SkyProvision (see "Configuring QoS" on page 150).

For manually provisioned devices, you configure QoS by using command-line interface commands (refer to the `set trafficrate` and `set classifier` commands, described in the *SkyPilot Command-Line Interface Reference*) or their Web interface counterparts (refer to the *SkyPilot Web Interface Reference*).

Traffic Rate Controls

Table 2-3 lists the elements that describe traffic rate controls.

Table 2-3. Traffic Rate Controls (Page 1 of 2)

Element	Description
Name	Name of the traffic rate control profile (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Upstream Rate	(No effect on SkyGateways) Number from 64 to 10000, specifying upstream traffic rate (relative to the device using the profile) in kilobits per second; 0 to specify no traffic rate limit.
Downstream Rate	(No effect on SkyGateways) Number from 64 to 10000, specifying downstream traffic rate (relative to the device using the profile) in kilobits per second; 0 to specify no traffic rate limit.

Table 2-3. Traffic Rate Controls (Page 2 of 2)

Element	Description
Broadcast Rate	(SkyGateways only) Number from 64 to 10000, specifying the maximum downstream broadcast and multicast data rate in kilobits per second; 0 to specify no broadcast rate limit.
Date Created	(Read-only) Date and time this traffic rate control record was created.
Date Modified	(Read-only) Date and time this traffic rate control record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

QoS Classifiers

Table 2-4 lists the elements that describe QoS classifiers.

Table 2-4. QoS Classifiers (Page 1 of 3)

Element	Description
Name	Name of the QoS classifier (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
IP TOS Low	Along with **IP TOS High** and **IP TOS Mask**, matching parameters for the IP TOS (Type of Service) byte range and mask. An IP packet with IP TOS byte value `ip-tos` is considered a match if: `tos-low <= (ip-tos AND tos-mask) <= tos-high` If any of these fields is omitted, comparison of the IP packet TOS byte for this entry is irrelevant.
IP TOS High	See **IP TOS Low** above.
IP TOS Mask	See **IP TOS Low** above.
IP Protocol	Protocol name, selected from the provided list.

Table 2-4. QoS Classifiers (Page 2 of 3)

Element	Description
IP Protocol Number	(Read-only unless Other is selected as the **IP Protocol**) Protocol number. For the list of protocol type numbers, refer to the following IEEE Web page: http://standards.ieee.org/regauth/ethertype/eth.txt.
IP Source Address	Maximum of 12 digits in dotted notation.
IP Source Mask	Maximum of 15 digits in dotted notation.
IP Destination Address	Maximum of 12 digits in dotted notation.
IP Destination Mask	Maximum of 15 digits in dotted notation.
TCP/UDP Source Port Start	Starting value for the source port as a number from 1 to 65535. The combination of IP address and port must be unique within all configured QoS classifiers.
TCP/UDP Source Port End	Ending value for the source port as a number from 1 to 65535. The combination of IP address and port must be unique within all configured QoS classifiers.
TCP/UDP Destination Port Start	Starting value for the destination port as a number from 1 to 65535. The combination of IP address and port must be unique within all configured QoS classifiers.
TCP/UDP Destination Port End	Ending value for the destination port as a number from 1 to 65535. The combination of IP address and port must be unique within all configured QoS classifiers.
Source MAC Address	Maximum of 12 digits in dotted notation.
Source MAC Address Mask	Maximum of 15 digits in dotted notation.
Destination MAC Address	Maximum of 12 digits in dotted notation.
Destination MAC Address Mask	Maximum of 15 digits in dotted notation.

Table 2-4. QoS Classifiers (Page 3 of 3)

Element	Description
Ether Type	Protocol of the traffic to filter, selected from the provided list.
Ether Type Number	(Read-only unless Other is selected as the **Ether Type**) Protocol number. For the list of protocol type numbers, refer to the following EEEE Web page: http://standards.ieee.org/regauth/ethertype/eth.txt
IEEE 802.1P User Priority Low	Lower limit of the range of the 801.1p flag in the TCP/IP header for which packets are forwarded instead of dropped, selected from provided list.
IEEE 802.1P User Priority High	Upper limit of the range of the 801.1p flag in the TCP/IP header for which packets are forwarded instead of dropped, selected from provided list.
Mesh Queue Priority	(Read-only) Priority level for mesh queue. Assigns priorities to packets that match the priority queue setting. Ranges from 1-High to 3-Low.
Date Created	(Read-only) Date and time this QoS classifier record was created.
Date Modified	(Read-only) Date and time this QoS classifier record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Filtering

Filters are used to control the transfer of user data packets through a SkyPilot network. The filtering actions are performed on data packets received over the SkyPilot device's 10/100bT Ethernet interface. Four protocol fields can be configured. Filtering to allow or deny packets is applied separately to these protocol fields. If multiple filters are defined for a given protocol field, the filters are performed in the order in which they're listed in the SkyProvision display (for devices in automatic provisioning mode) or in command-line interface output (for devices in manual provisioning mode). The default filter is always applied last.

Unlike access control lists, which examine data *destined* for a given SkyPilot node, filters are used to filter *all data passing through* a given node.

You can configure filters for the following protocol fields:

- **Ethernet Type**—Limits the traffic through a node to data of a specific protocol type. EtherType values include the following (refer to the IEEE Web page, http://standards.ieee.org/regauth/ethertype/eth.txt, for the current complete list):

`0x0800`	IPv4
`0x0806`	RP
`0x809b`	AppleTalk over Ethernet
`0x8137`	IPX
`0x8191`	NetBIOS/NetBEUI
`0x86dd`	IPv6

- **IP Protocol**—Limits the traffic through a node to IP data of a specific subprotocol type. Subprotocol types include:

`0x01`	ICMP
`0x02`	IGMP
`0x06`	TCP
`0x11`	UDP
`0x73`	L2TP

- **IP Address**—Limits the traffic through a node to data with specified source and/or destination IP addresses.

- **Port**—Limits the traffic through a node to data with a specified port number, which generally identifies a subprotocol type. Valid port numbers include:

`137-139`	NetBIOS
`161-162`	SNMP
`67`	DHCP Client
`68`	DHCP Server

Configuring Filters

For automatically provisioned devices, you configure filters by using SkyProvision and selecting **Enable** in the **Filter** field of the node's node profile. You must also set the permission to **Allow** in the corresponding **Filter** field of the node's node profile. (For more information, see "Access Point SkyAccess Profile Elements" on page 132.)

For manually provisioned devices, you configure filters by using the command-line interface command (refer to the `set filter` command, described in the *SkyPilot Command-Line Interface Reference*) or its Web interface counterpart (refer to the *SkyPilot Web Interface Reference*).

EtherType Filters

Table 2-5 lists the elements that describe EtherType filter records.

Table 2-5. EtherType Filters

Element	**Description**
Name	Name of the EtherType filter (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Protocol	EtherType protocol name allowed by this filter, selected from the provided list.
EtherType	(Read-only unless Other is selected as the **Protocol**) EtherType value in hexadecimal. For the list of protocol type numbers, refer to the following IEEE Web page: http://standards.ieee.org/regauth/ethertype/eth.txt.
Permission	(Default = **Allow**) Setting to allow or deny filtering of data that matches this filter's criteria.
Date Created	(Read-only) Date and time this filter record was created.
Date Modified	(Read-only) Date and time this filter record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

IP Protocol Filters

Table 2-6 lists the elements that describe IP protocol filter records.

Table 2-6. IP Protocol Filters

Element	Description
Name	Name of the IP protocol filter (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Protocol	IP subprotocol allowed by this filter, selected from the provided list.
Protocol Number	(Read-only unless Other is selected as the **Protocol**) Number of this filter's protocol. For the list of protocol numbers, refer to the following IEEE Web page: http://www.iana.org/assignments/protocol-numbers.
Permission	(Default = **Allow**) Setting to allow or deny filtering of data that matches this filter's criteria.
Date Created	(Read-only) Date and time this filter record was created.
Date Modified	(Read-only) Date and time this filter record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

IP Address Filters

Table 2-7 lists the elements that describe IP address filter records.

Table 2-7. IP Address Filters

Element	Description
Name	Name of the IP address filter (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
IP Address	IP address to compare to a packet's source or destination address to determine how this filter is applied; up to 12 digits in dotted notation.
Subnet Mask	Subnet mask used of the IP address group to compare to a packet's source or destination address to determine how this filter is applied; up to 12 digits in dotted notation.
Type	Packet data to which the **IP Address** and **Subnet Mask** fields are compared, specified as one of the following: ● **Destination**—Packet destination address ● **Source**—Packet destination address ● **ARP**—Source IP address of an ARP request or response
Permission	(Default = **Allow**) Setting to allow or deny filtering of data that matches this filter's criteria.
Date Created	(Read-only) Date and time this filter record was created.
Date Modified	(Read-only) Date and time this filter record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Port Filters

Table 2-8 lists the elements that describe port filter records.

Table 2-8. Port Filters

Element	Description
Name	Name of the port filter (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Port	Port number to compare to a packet's source or destination port to determine how this filter is applied; a number from 1 to 65535.
Protocol	(Default = **TCP**) Protocol allowed by this filter, selected from the provided list.
Type	What the filter's **Port** value is compared to, specified as follows: ● **Destination**—Data packet's destination port ● **Source**—Data packet's protocol source port
Permission	(Default = **Allow**) Setting to allow or deny filtering of data that matches this filter's criteria.
Date Created	(Read-only) Date and time this filter record was created.
Date Modified	(Read-only) Date and time this filter record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Access Points

SkyExtender DualBand/TriBand devices and SkyAccess DualBand devices incorporate access points, which enable 802.11 network device communication. Automatically provisioned DualBands and TriBands are assigned access point profiles, which in turn are assigned an assortment of profiles as attributes, as described in the following sections.

Wireless Local Area Networks

For every access point, you can define 16 distinct WLANs, which offers significant benefits such as efficient bandwidth use, flexibility, performance, and security. WLANs offer these benefits by enabling the following capabilities:

- Restricting the dissemination of broadcast and node-to-node traffic, thereby reducing the burden of extraneous network traffic.
- Using standard router-based security measures.
- Segregating and switching ISP traffic. Wholesale operators can offer end users a choice of any provider instead of only the provider operating a particular network. In such cases, each WLAN would be assigned to a single ISP.
- Isolating management traffic from user traffic. You can configure a management WLAN, independent of a WLAN for end users. Management traffic is thereby segmented and secure.

Most WLAN deployments use one of two common types of WLAN configuration:

- **Open**—Allows anyone with Wi-Fi capability to connect to the wireless network via the SkyExtender DualBand/TriBand access point. An open WLAN does not authenticate users at the network layer, nor does it depend on authentication by a backend system.

  An open configuration raises obvious security concerns. The lack of encryption makes the network vulnerable to unauthorized access and malicious actions (including denial-of-service attacks).

  You can provide backend authentication at the application layer through a *captive portal* mechanism operating outside your wireless mesh network. A captive portal forces all HTTP traffic from an unauthenticated user to a login Web page and blocks the traffic until the user successfully logs in. (For more information about captive portal mechanisms, refer to the following Web page: http://en.wikipedia.org/wiki/Captive_portal.)

An additional disadvantage of open configurations is that users must begin each session from a Web browser before they can use other Internet applications, such as `email`, `ssh`, `ftp`, and chat clients.

- **Protected**—A Wi-Fi Protected Access (WPA) network, which uses standards-based client authentication and encryption. Users may be authenticated via a Radius server (which you'll need to implement using a third-party solution).

  WPA uses the IEEE 802.11b/g and IETF EAP protocols to give users a secure connection with both the access point and the Radius server, allowing the exchange of credentials (`username@domain` and `password`) and keys for encrypting all traffic between the client and the access point—even after authentication.

  WPA encryption is by WEP, with the addition of keys that are unique to each session and client. This additional keying mechanism eliminates the security problems of the original WEP. You can use AES encryption with the DualBand/TriBand for even stronger encryption capabilities.

  (The access point's default WPA-shared key is `publicpublic`).

  WPA-shared key, `publicpublic`. For more information about WPA, refer to the following Web page: http://en.wikipedia.org/wiki/Wi-Fi_Protected_Access.

  If you plan to configure a DualBand/TriBand access point for WPA operating without a pre-shared key, you must configure a Radius server (see "Access Point Radius Server Profiles" on page 40).

Configuring Access Points

For automatically provisioned devices, you modify the settings in the access point profiles that are assigned to the device (see "Configuring Access Point Profiles" on page 127).

For manually provisioned devices, you configure access points by using the Web interface (refer to the *SkyPilot Web Interface Reference*).

Access Point Security Profiles

Table 2-9 lists the elements that describe access point security profiles.

Table 2-9. Access Point Security Profile Elements (Page 1 of 2)

Element	Description
Name	Name of the access point security profile (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Max Remote Login Sessions	(Optional) Maximum number of simultaneous remote Telnet or `ssh` sessions allowed, or 0 to specify unlimited sessions.
Max Remote Login Timeout	(Optional) Number of minutes a Telnet or `ssh` session stays connected without activity, or 0 to never time out.
Telnet Server	Enables or disables the Telnet server for remote access to the access point's command line.
Admin Telnet Password	(Optional) Password and user name for logging in to the Telnet server.
Peer to Peer	Enables or disables peer-to-peer (blocks Layer 2 broadcast and ARP traffic between wireless clients). Typically you'll disable peer-to-peer in a public network if you want to prevent users from "sniffing" traffic or creating accidental "network neighborhoods" at the Ethernet or VLAN level. A private enterprise network may want to enable peer-to-peer to allow shared LAN services such as file sharing.
Management From Wireless Clients	Enables or disables wireless client access to the access point's Web interface; if the check box is not selected, access is disabled (and the Web interface will be accessible only through the SkyPilot wireless mesh network).
Syslog	Enables or disables system logging to a remote syslog server.
Syslog Server	(Available only if **Syslog** is enabled) Syslog server's IP address; maximum of 12 digits in dotted notation.
Syslog Port	(Available only if **Syslog** is enabled; default = 514) Port for syslog server access.

Table 2-9. Access Point Security Profile Elements (Page 2 of 2)

Element	Description
Date Created	(Read-only) Date and time this access point security profile record was created.
Date Modified	(Read-only) Date and time this access point security profile record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Access Point Radius Server Profiles

If you plan to configure a DualBand/TriBand access point for WPA with password authentication (instead of using pre-shared keys) you must configure a Radius server with the following:

- The IP address and shared secret of the access point.
- EAP-PEAP/MSCHAPv2 and EAP-TTLS/PAP, or MSCHAPv2 (not EAP-TLS) suitable for WPA. (Your Radius supplier can provide instructions.)
- A Users database with user names and passwords. (You may also need to identify a proxy Radius if you're delegating some domains to other service providers.)

Table 2-10 lists the elements that describe access point Radius server profiles.

Table 2-10. Access Point Radius Server Profile Elements (Page 1 of 2)

Element	Description
Name	Name of the access point Radius server profile (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Primary Host	Primary Radius server's IP address; maximum of 12 digits in dotted notation.
Primary Shared Secret	Shared secret string as specified in the primary Radius server's client configuration.

Table 2-10. Access Point Radius Server Profile Elements (Page 2 of 2)

Element	Description
Primary Authentication Port	(Default = 1812) TCP/UDP port for primary Radius server authentication services; must match the port number configured for authentication on the primary Radius server.
Primary Accounting Port	(Default = 1813) TCP/UDP port for primary Radius server accounting services; must match the port number configured for accounting services on the primary Radius server.
Secondary Host	(Optional) Same as **Primary Host** above, but for the secondary Radius server.
Secondary Shared Secret	(Available only if **Secondary Host** is configured) Same as **Primary Shared Secret** above, but for the secondary Radius server.
Secondary Authentication Port	(Available only if **Secondary Host** is configured) Same as **Primary Authentication Port** above, but for the secondary Radius server.
Secondary Accounting Port	(Available only if **Secondary Host** is configured) Same as **Primary Accounting Port** above, but for the secondary Radius server.
Date Created	(Read-only) Date and time this access point Radius server profile record was created.
Date Modified	(Read-only) Date and time this access point Radius server profile record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Access Point SSID Profiles

To accommodate the access point WLANs (see “Wireless Local Area Networks” on page 37), each DualBand has 32 MAC addresses assigned to it, and each TriBand has 64 MAC addresses. The MAC address of the SkyExtender’s 5 GHz radio (as seen from the SkyGateway) is printed on the label affixed to the bottom of the DualBand. MAC addresses are allocated as follows:

- DualBand 2.4 GHz/TriBand 4.9 GHz access point is 1 less than the MAC address of the 5 GHz radio.
- TriBand 2.4 GHz access point is 33 less than the MAC address of the 5 GHz radio minus 31.
- DualBand 2.4 GHz WLAN BSSIDs begin with the MAC address of the 5 GHz radio minus 31.

  For example, if the MAC address of a DualBand is 000ADB01319F (hexadecimal), the reserved addresses start at 000ADB013180.
- TriBand 2.4 GHz WLAN BSSIDs begin with the MAC address of the 5 GHz radio minus 63:
- TriBand 4.9 GHz WLAN BSSIDs begin with the MAC address of the 5 GHz radio minus 31.

  For example, if the MAC address of a TriBand is 000ADB017A3F (hexadecimal), the 2.4 GHz access point’s MAC address is 000ADB017A1E, and the reserved addresses for the 2.4 GHz WLAN BSSIDs start at 000adb017a00. The 4.9 GHz access point’s MAC address is 000ADB017A20, and the 4.9 GHz WLAN BSSIDs start at 000ADB017A20.

Table 2-11 lists the elements that describe access point SSID profiles.

Table 2-11. Access Point SSID Profile Elements (Page 1 of 4)

Element	Description
SSID	Name of the access point SSID profile (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
VLAN ID	(Default = 0) Data VLAN ID mapped to this SSID, or 0 to indicate no VLAN assignment. **NOTE** If you're configuring this SSID for 802.1x or WPA, a Radius server can override the default VLAN setting on a per-user basis.
Broadcast SSID	Enables or disables access point broadcasting of the SSID to 802.11 clients (making the SSID visible to users). If Broadcast SSID is disabled, users can still associate with this SSID if they know the SSID and can configure their client software to connect to the SSID. Typically, you'll want to enable SSID broadcasting.
Prioritization	Quality of Service (QoS) level. The access point doesn't enforce the selected QoS level; it simply sets the 802.1p tag for the selected level on all traffic that enters the SSID. QoS choices correspond to 802.1p user priorities as follows: ● **Normal** = 0 ● **High** = 6
SSID Status	Enables or disables this SSID. If SSID Status disabled, the SSID can still be fully configured, but the access point will not announce or respond to connection requests or other traffic directed to the SSID.

Table 2-11. Access Point SSID Profile Elements (Page 2 of 4)

Element	Description
Security Policy	Encryption and/or authentication scheme used by this SSID: ● **None**—Open network (no authentication or encryption). ● **WEP**—Static WEP; no authentication, shared WEP key, no key rotation, and WEP encryption. Static WEP is easily cracked, and should not be used in production environments. ● **802.1x**—802.1x/EAP authentication via dynamic WEP. The WEP key is unique per session and is automatically changed at a periodic rate via Radius reauthentication. This is the preferred choice for older clients that do not support WPA. ● **WPA-TKIP**—802.1x/EAP authentication via TKIP (Temporal Key Integrity Protocol), a hardened version of the older WEP standard. The key is updated automatically and transparently with DES or AES encryption. This option provides higher security than WEP or 802.1x but requires users to have a WPA client (which is built into recent versions of Windows XP, Mac OS X, and Linux). WPA-TKIP can be configured to use Radius authentication or a pre-shared key. ● **WPA-AES:CCMP**—Complete 802.11i (WPA2) standard, replacing WEP/DES and TKIP with a specific mode of the Advanced Encryption Standard (AES): the Counter Mode with Cipher Block Chaining-Message Authentication Code (CBC–MAC) Protocol (CCMP). CCMP provides both data confidentiality (encryption) and data integrity. This is the highest security option you can choose, but some legacy 802.11 clients may not support it.
WEP Key Size	(Available only if WEP is selected as the **Security Policy**) Key size to use for this network's encryption: 40 bits or 104 bits (also known as 64-bit or 128-bit, respectively). 104 bits is preferred unless the SSID clients are unable to accept that setting.
WEP Allow Shared Key	(Available only if WEP is selected as the **Security Policy**) Enables or disables use of a pre-shared key.
WEP Encryption Key	(Available only if WEP is selected as the **Security Policy**) Text string that functions as a password; up to 255 printable characters.

Table 2-11. Access Point SSID Profile Elements (Page 3 of 4)

Element	Description
802.1x Key Size	(Available only if 802.1x is selected as the **Security Policy**) Key size to use for this network's encryption: 40 bits or 104 bits (also known as 64-bit or 128-bit, respectively). 104 bits is preferred unless the SSID clients are unable to accept that setting.
802.1x Rekeying Period	(Available only if 802.1x is selected as the **Security Policy**) Number of seconds between dynamic key updates. For maximum protection, enter 300 seconds (5 minutes) or less. Don't use too small a value; rekeying requires about a second to complete, so too frequent rekeying can increase downtime.
WPA Pre-Shared Key	(Available only if WPA-TKIP or WPA-AES:CCMP is selected as the **Security Policy**) Enables or disables use of a pre-shared key.
WPA Passphrase	(Available only if WPA-TKIP or WPA-AES:CCMP is selected as the **Security Policy**) Text string that functions as a password; up to 255 printable characters.
DHCP Server Type	Type of DHCP used by this SSID: ● **None**—IP addresses can be supplied by a central DHCP server elsewhere on the network (typical setting). ● **Relay**—DHCP requests on this SSID will be forwarded to the specified DHCP server. ● **Server**—The access point acts as a DHCP server on the SSID.
DHCP Server IP Address	(Available only if Relay is selected as the **DHCP Server Type**) IP address of the authoritative DHCP server for a network.
DHCP IP Start Range	(Available only if Server is selected as the **DHCP Server Type**) Starting address for the IP address pool supplied by the DHCP server; for example, 192.168.10.100.
DHCP IP End Range	(Available only if Server is selected as the **DHCP Server Type**) Ending address for the IP address pool supplied by the DHCP server; for example, 192.168.10.254.
DHCP Subnet Mask	(Available only if Server is selected as the **DHCP Server Type**) Subnet mask for this network segment; for example, 255.255.255.0.

Table 2-11. Access Point SSID Profile Elements (Page 4 of 4)

Element	Description
DHCP Gateway	(Available only if Server is selected as the **DHCP Server Type**) IP address of the default gateway/router for this network segment.
DHCP DNS 1	(Available only if Server is selected as the **DHCP Server Type**) IP address of the primary DNS resolver for this network.
DHCP DNS 2	(Available only if Server is selected as the **DHCP Server Type**) IP address of the secondary DNS resolver for this network.
DHCP DNS 3	(Available only if Server is selected as the **DHCP Server Type**) IP address of the tertiary DNS resolver for this network.
DHCP Domain	(Available only if Server is selected as the **DHCP Server Type**) Default domain name for this network.
DHCP Lease Time	(Available only if Server is selected as the **DHCP Server Type**) Number of seconds each DHCP lease remains valid before renewal is necessary.
Date Created	(Read-only) Date and time this access point SSID profile record was created.
Date Modified	(Read-only) Date and time this access point SSID profile record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Wi-Fi Multimedia AP Profiles

To ensure Quality of Service on SkyAccess access point WLANs (see "Wireless Local Area Networks" on page 37), SkyPilot Networks EMS supports the creation of Wi-Fi Multimedia AP profiles that let you provision limits on multimedia bandwidth use on your access points.

Table 2-12 lists the elements that describe Wi-Fi Multimedia AP profiles.

Table 2-12. Wi-Fi Multimedia AP Profile Elements (Page 1 of 3)

Element	Description
Name	Name of the Wi-Fi Multimedia AP profile (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Voice CWMin	A Contention Window (CW) value that species the minimum amount of time an endpoint must wait before attempting to transmit a voice packet.
Voice CWMax	A Contention Window (CW) value that species the maximum amount of time an endpoint must wait before attempting to transmit a voice packet.
Voice AIFS	Arbitrary InterFrame Space (AIFS) value that can improve voice performance under heavy loads.
Voice TxopLimit	A Transmission Opportunity (Txop) value that specifies the channel holding times of contending stations in the presence of delay-sensitive voice traffic.
Voice ACM	Enable or disable the use of an ACM wrapper filter to activate audio compression.
Voice ACK-POLICY	Enable or disable return of an acknowledge packet for every voice packet received. Enabling provides a more reliable transmission, but increases traffic load.
Video CWMin	A Contention Window (CW) value that species the minimum amount of time an endpoint must wait before attempting to transmit a video packet.
Video CWMax	A Contention Window (CW) value that species the maximum amount of time an endpoint must wait before attempting to transmit a video packet.

Table 2-12. Wi-Fi Multimedia AP Profile Elements (Page 2 of 3)

Element	Description
Video AIFS	Arbitrary InterFrame Space (AIFS) value that can improve video performance under heavy loads.
Video TxopLimit	A Transmission Opportunity (Txop) value that specifies the channel holding times of contending stations in the presence of delay-sensitive video traffic.
Video ACM	Enable or disable the use of a ACM wrapper filter to activate video compression.
Video ACK-POLICY	Enable or disable return of an acknowledge packet for every video packet received. Enabling provides a more reliable transmission, but increases traffic load.
Background CWMin	A Contention Window (CW) value that species the minimum amount of time an endpoint must wait before attempting to transmit a background packet.
Background CWMax	A Contention Window (CW) value that species the maximum amount of time an endpoint must wait before attempting to transmit a background packet.
Background AIFS	Arbitrary InterFrame Space (AIFS) value that can improve background transfer performance under heavy loads.
Background TxopLimit	A Transmission Opportunity (Txop) value that specifies the channel holding times of contending stations in the presence of delay-sensitive background traffic
Background ACM	Enable or disable the use of an ACM wrapper filter to activate background data compression.
Background ACK-POLICY	Enable or disable return of an acknowledge packet for every background data packet received. Enabling provides a more reliable transmission, but increases traffic load.
Best Effort CWMin	A Contention Window (CW) value that species the minimum amount of time an endpoint must wait before attempting to transmit a best effort packet.
Best Effort CWMax	A Contention Window (CW) value that species the maximum amount of time an endpoint must wait before attempting to transmit a best effort packet.

Table 2-12. Wi-Fi Multimedia AP Profile Elements (Page 3 of 3)

Element	Description
Best Effort AIFS	Arbitrary InterFrame Space (AIFS) value that can improve best effort transfer performance under heavy loads.
Best Effort TxopLimit	A Transmission Opportunity (Txop) value that specifies the channel holding times of contending stations in the presence of delay-sensitive best effort traffic.
Best Effort ACM	Enable or disable the use of an ACM wrapper filter to activate best effort data compression.
Best Effort ACK-POLICY	Enable or disable return of an acknowledge packet for every best effort data packet received. Enabling provides a more reliable transmission, but increases traffic load.
Date Created	(Read-only) Date and time this Wi-Fi Multimedia AP profile record was created.
Date Modified	(Read-only) Date and time this Wi-Fi Multimedia AP profile record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Wi-Fi Multimedia STA Profiles

To ensure Quality of Service for wireless clients connected to SkyAccess access point WLANs (see “Wireless Local Area Networks” on page 37), SkyPilot Networks EMS supports the creation of Wi-Fi STA profiles that allow you to provision parameters for multimedia bandwidth use by wireless client devices.

Table 2-13 lists the elements that describe Wi-Fi Multimedia AP profiles.

Table 2-13. Wi-Fi Multimedia STA Profile Elements (Page 1 of 3)

Element	Description
Name	Name of the Wi-Fi Multimedia STA profile (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Voice CWMin	A Contention Window (CW) value that species the minimum amount of time an endpoint must wait before attempting to transmit a voice packet.
Voice CWMax	A Contention Window (CW) value that species the maximum amount of time an endpoint must wait before attempting to transmit a voice packet.
Voice AIFS	Arbitrary InterFrame Space (AIFS) value that can improve voice performance under heavy loads.
Voice TxopLimit	A Transmission Opportunity (Txop) value that specifies the channel holding times of contending stations in the presence of delay-sensitive voice traffic.
Voice ACM	Enable or disable the use of an ACM wrapper filter to activate audio compression.
Voice ACK-POLICY	Enable or disable return of an acknowledge packet for every voice packet received. Enabling provides a more reliable transmission, but increases traffic load.
Video CWMin	A Contention Window (CW) value that species the minimum amount of time an endpoint must wait before attempting to transmit a video packet.
Video CWMax	A Contention Window (CW) value that species the maximum amount of time an endpoint must wait before attempting to transmit a video packet.

Table 2-13. Wi-Fi Multimedia STA Profile Elements (Page 2 of 3)

Element	Description
Video AIFS	Arbitrary InterFrame Space (AIFS) value that can improve video performance under heavy loads.
Video TxopLimit	A Transmission Opportunity (Txop) value that specifies the channel holding times of contending stations in the presence of delay-sensitive video traffic.
Video ACM	Enable or disable the use of a ACM wrapper filter to activate video compression.
Video ACK-POLICY	Enable or disable return of an acknowledge packet for every video packet received. Enabling provides a more reliable transmission, but increases traffic load.
Background CWMin	A Contention Window (CW) value that species the minimum amount of time an endpoint must wait before attempting to transmit a background packet.
Background CWMax	A Contention Window (CW) value that species the maximum amount of time an endpoint must wait before attempting to transmit a background packet.
Background AIFS	Arbitrary InterFrame Space (AIFS) value that can improve background transfer performance under heavy loads.
Background TxopLimit	A Transmission Opportunity (Txop) value that specifies the channel holding times of contending stations in the presence of delay-sensitive background traffic
Background ACM	Enable or disable the use of an ACM wrapper filter to activate background data compression.
Background ACK-POLICY	Enable or disable return of an acknowledge packet for every background data packet received. Enabling provides a more reliable transmission, but increases traffic load.
Best Effort CWMin	A Contention Window (CW) value that species the minimum amount of time an endpoint must wait before attempting to transmit a best effort packet.
Best Effort CWMax	A Contention Window (CW) value that species the maximum amount of time an endpoint must wait before attempting to transmit a best effort packet.

Table 2-13. Wi-Fi Multimedia STA Profile Elements (Page 3 of 3)

Element	Description
Best Effort AIFS	Arbitrary InterFrame Space (AIFS) value that can improve best effort transfer performance under heavy loads.
Best Effort TxopLimit	A Transmission Opportunity (Txop) value that specifies the channel holding times of contending stations in the presence of delay-sensitive best effort traffic.
Best Effort ACM	Enable or disable the use of an ACM wrapper filter to activate best effort data compression.
Best Effort ACK-POLICY	Enable or disable return of an acknowledge packet for every best effort data packet received. Enabling provides a more reliable transmission, but increases traffic load.
Date Created	(Read-only) Date and time this Wi-Fi Multimedia AP profile record was created.
Date Modified	(Read-only) Date and time this Wi-Fi Multimedia AP profile record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

General Provisioning Guidelines

Some requirements are independent of the provisioning mode you choose. To ensure that network devices form effective links, always follow these guidelines:

- Set the domain of SkyExtenders and SkyConnectors to match the domain assigned to the SkyGateway, or to all domains.
- To allow devices to establish network links more quickly, make sure that the primary frequency of SkyExtenders and SkyConnectors is the same as the primary frequency assigned to the SkyGateway.
- Avoid adding unused frequencies to a device's Allow list.
- Make sure that the *netkeys* (shared network keys) match on all devices attempting for form links. All SkyPilot devices ship with a same default public netkey: `SkyPilot Network, Inc.`

Automatic Provisioning

Automatically provisioned SkyPilot nodes use the parameters configured through SkyProvision (a graphical interface that's part of SkyPilot EMS). The parameter settings are stored in a SkyPilot server's database and are retrieved by devices upon completion of the devices' startup (for SkyGateway) or formation of links (for SkyExtenders and SkyConnectors). Once the device receives its configuration information from the server, the device is available to participate in the SkyPilot network.

Automatically Provisioning All Network Devices

Table 2-14 summarizes the steps required to automatically provision all devices on a network. Although SkyPilot devices can be provisioned in any order, by following this sequence you can ensure that devices are able to form links as soon as they come online.

Table 2-14. Automatically Provisioning All Network Devices (Page 1 of 2)

	Step	Refer to
1	For new SkyPilot network deployments, custom-install the operating system software on the SkyPilot EMS server.	The appropriate installation manual: ● *SkyPilot OS Installation: Red Hat Linux 9.0* ● *SkyPilot OS Installation: Fedora Core 2 and 4* ● *SkyPilot OS Installation: Red Hat Enterprise Linux ES 3 and 4*
2	For new SkyPilot network deployments, install the server component of SkyPilot EMS, and then install the client component of SkyPilot EMS on any appropriate computer.	*SkyPilot EMS Installation*
3	For new SkyGateways, set up the DHCP server and, if the provisioning server is behind a firewall, open ports for data traffic between the server and SkyPilot devices.	"Adding Devices to the DHCP Configuration File" on page 77 "Configuring a Firewall for SkyPilot Operations" on page 195
4	Provision the SkyGateway(s).	"Automatically Provisioning a Device" on page 55
5	For new SkyGateways, complete the installation and power it on.	*SkyGateway/SkyExtender Installation and Setup*
6	(Optional) Log in to the SkyGateway and configure the management VLAN.	"Configuring VLANs" on page 141
7	Provision the SkyExtender(s).	"Automatically Provisioning a Device" on page 55

Table 2-14. Automatically Provisioning All Network Devices (Page 2 of 2)

	Step	Refer to
8	For DualBands and TriBands, provision the access point(s).	For information about access point settings, refer to *SkyPilot Network Administration*. For configuration procedures, refer to the *SkyPilot Web Interface Reference*
9	For new SkyExtenders, install the device and power it on.	*SkyGateway/SkyExtender Installation and Setup*
10	Provision the SkyConnector(s).	"Automatically Provisioning a Device" on page 55
11	For new SkyConnectors, install the device and power it on.	The appropriate installation manual: ● *SkyConnector Indoor Installation* ● *SkyConnector Outdoor Installation*

Automatically Provisioning a Device

SkyPilot automatic device provisioning is a modular process whereby you use SkyProvision to add specific configuration parameter building blocks to the provisioning server's database. Then you create a *profile*—a collection of configuration parameters that can be assigned to multiple devices that require the same parameter settings. This enables you to easily change a parameter setting for every device that uses a common profile, just by changing the parameter setting once in that profile. After a profile is changed, every device inherits the change the next time the device requests its configuration.

Automatically provisioned devices receive their configuration from the provisioning server (the EMS server) in the following situations:

- Every time the device attempts to form a link
- Every time the device reroutes
- At an interval previously configured within the device's configuration file
- When the `reload` command is entered from the command line
- When an SNMP write occurs on the device's MIB `reload` variable

Table 2-15 describes the necessary steps to using SkyProvision to configure a SkyPilot device for automatic provisioning.

Table 2-15. Automatically Provisioning a SkyPilot Device (Page 1 of 2)

Step	Description	Refer to
1	Make sure the most current software images are available in the EMS provisioning server's `/var/ftp/pub/images` directory.	
2	Start the EMS Web or Java client.	● "Logging in to the EMS Web Client" on page 117 ● "Starting the EMS Java Client" on page 102
3	Choose the software image the provisioning server will use to configure the new device.	"Managing Software Images" on page 64
4	For SkyGateways, assign a domain. If no domain exists, create one. For other devices, specify a domain for the device that's consistent with the domain assigned to the SkyGateway operating as a hub for the wireless mesh network.	"Configuring Domains" on page 124
5	(Optional) Configure a data VLAN to which the device can be assigned. (Management VLANs are configured through a SkyGateway's command-line interface.)	"Configuring VLANs" on page 141

Table 2-15. Automatically Provisioning a SkyPilot Device (Page 2 of 2)

Step	Description	Refer to
6	For DualBands/TriBands, confirm that appropriate access point profiles exist (including component security profiles). If profiles don't exist, create them in the following order: ● Access point security profile ● (For protected access networks, not open access networks) Access point Radius profile ● Access point SSID profile ● Access point profile(s)	"Configuring Access Point Profiles" on page 127
7	Confirm that an appropriate node profile exists for the device. If no appropriate profile exists, create one.	"Access Point SkyAccess Profile Elements" on page 132
8	Add a node to the network for the device, assigning to it the appropriate node profile and attributes.	"Configuring Nodes" on page 138
9	Verify that the newly configured device has been successfully added as a node on the mesh network.	"Viewing Your SkyPilot Network" on page 182
10	(Optional) Set device polling intervals and other provisioning parameters.	● Appendix B, "SkyProvision Reference" ● Appendix D, "SkyControl Reference"

This table describes only those SkyProvision functions that are necessary for enabling a device for automatic provisioning; you can perform many additional functions using SkyProvision (see "Optional Provisioning Parameters" on page 23).

Manual Provisioning

Manually provisioned SkyPilot nodes use parameters configured through the command-line interface or Web interface. The nodes store the parameter settings in flash memory, where they remain available for recall when the device starts up. Once the device starts up, it is operationally ready.

Assuming no security changes have been made that would affect the ability of SkyPilot devices to proceed (such as netkey values or domain IDs), all SkyPilot devices will discover and establish links with the wireless network without any required commands, even in manual provisioning mode. However, the following are exceptions that may require manual intervention on the part of the operator:

- The SkyGateway must be configured with a primary transmit frequency, which it will use to transmit data and establish links.
- If your deployment uses a management VLAN, the VLAN must be manually configured on the SkyGateway. This is necessary because a VLAN ID could affect whether SkyPilot management traffic passes through the wired network to which the SkyGateway is connected through its Ethernet interface.
- If VLANs have been configured for end-user data in the wired network to which the SkyGateway is connected through its Ethernet interface, VLANs must be configured on all SkyExtender and SkyConnector devices in order for end-user data to be appropriately tagged, sent, and received.
- If netkeys have been changed on connected devices, the new netkey must be manually configured on any device trying to join that network. This is necessary because the netkey is the basis for determining whether a link is trusted, which would make it impossible to rely on automated provisioning to supply this parameter. If default netkeys are used, no change is necessary.

The remaining configuration settings are optional; they’re not required to be set in order for a device to join the network and pass end-user data. Changes made during manual provisioning are stored in flash memory, and therefore do not take effect until the device is restarted.

Manual Provisioning Procedure

Table 2-16 summarizes the steps required to manually provision a device.

Table 2-16. Manually Provisioning a Device (Page 1 of 2)

	Step	Refer to
1	Decide whether to provision the device by using the command-line interface or the Web interface. (For DualBand/TriBand access points, you must use the Web interface.)	“Choosing a Manual Provisioning Method” on page 60
2	If the device is not already installed in a SkyPilot network, prepare the device for installation by installing the necessary cabling and readying the device for service.	The appropriate installation manual: ● *SkyGateway/SkyExtender Installation and Setup* ● *SkyConnector Indoor Installation* ● *SkyConnector Outdoor Installation*
3	Power on the device.	
4	Connect a computer to the device and access the command-line interface or the Web interface. (For DualBands/TriBands, this step refers to the SkyExtender portion of the device.)	*SkyPilot Command-Line Interface Reference* *SkyPilot Web Interface Reference*
5	Provision the device, making sure to set at least the minimum provisioning parameters. (For DualBands/TriBands, this step refers to the SkyExtender portion of the device.)	“Required Provisioning Parameters” on page 17 and either of the following: ● *SkyPilot Command-Line Interface Reference* ● *SkyPilot Web Interface Reference*

Table 2-16. Manually Provisioning a Device (Page 2 of 2)

	Step	Refer to
6	For DualBands/TriBands, reboot the device, connect a computer to the device's 2.4 GHz access point, and provision the access point.	*SkyPilot Web Interface Reference*
7	For TriBands, connect a computer to the 4.9 GHz access point and provision it.	*SkyPilot Web Interface Reference*
8	Power off the device.	
9	If the device is not already installed in a SkyPilot network, complete the installation.	The appropriate installation manual: ● *SkyGateway/SkyExtender Installation and Setup* ● *SkyConnector Indoor Installation* ● *SkyConnector Outdoor Installation*
10	Power on the device.	

Choosing a Manual Provisioning Method

As described in more detail in the sections that follow, there are two methods of performing manual provisioning:

- **Command-line interface**—A set of command-line commands for SkyPilot devices' configuration options (except DualBand/TriBand access points).
- **Web interface**—A Web-based interface that provides configuration options for all SkyPilot devices.

Command-Line Interface Provisioning

For manual provisioning, all SkyPilot devices (except the access point portion of DualBands/TriBands) provide a command-line interface that allows you to interact with the equipment through typed commands.

You can access the command-line interface by connecting a PC or laptop to the device's Ethernet interface (except for DualBands, which don't have an Ethernet interface) and using Telnet to start a communications session. The SkyGateway and SkyExtender also include a serial port for connecting to a console via a serial cable.

TIP The `set prov` command provides a convenient method for setting all the basic provisioning parameters for a device. This command queries you for all the provisioning parameters so that you don't need to set each parameter individually. For more information, refer to the description of the `set prov` command in the *SkyPilot Command-Line Interface Reference*.

For details about accessing and using the command-line interface and a full description of the command-line interface commands, refer to the *SkyPilot Command-Line Interface Reference*.

Web Interface Provisioning

The Web interface provides two levels of access:

- **View-only level**—Provides access to a single Web page displaying the current operating status of a SkyPilot device.
- **Administrator level**—Provides password-protected access to multiple pages of content and a mechanism for modifying the configuration of the monitored SkyPilot device.

The Web interface provides access to a manually provisioned DualBand/TriBand access point as well as an easy alternative to the command-line interface for an administrator to use to monitor and manage SkyPilot devices.

For details about accessing and using the Web interface and a full description of its functions, refer to the *SkyPilot Web Interface Reference*.

3

Administration

SkyPilot network administration involves routine management tasks, such as managing software and customers, configuring security, and creating reports. This chapter describes these management tasks and directs you to the corresponding detailed procedures.

Chapter Highlights

- Managing software images
- Managing customers
- Managing access control lists
- About network security
- About reports and statistics

Managing Software Images

Every SkyPilot device has two partitions (A and B) for storing software in flash memory. At any given time, one partition (either A or B) is designated the active partition, and the other partition is designated the backup partition.

Correspondingly, every SkyPilot device has two software images embedded in flash memory:

- **Active image**—The software image stored in the partition currently designated the active partition. This image is used by a device when it starts up.
- **Backup image**—The software image stored in the partition currently designated the backup partition. This image is used by a device if the active image becomes unbootable (as explained below).

When a new software image is downloaded to a given partition, the image previously in that partition is overwritten.

If you use SkyProvision to manage the software images, you simply specify the name of the desired software image, and SkyProvision takes care of downloading it to the proper partition and managing which partition is designated the active partition.

If you're manually managing the software images, you'll specify which partition a software image is downloaded into and then designate which partition to make the active one (which implicitly designates the corresponding image as the active image).

The device assigns every image a state:

- **Accepted**—Either the image is known to be good (the device has successfully formed links) or its state has been manually set to `accepted` (via the `set activeimage` command, described in the *SkyPilot Command-Line Interface Reference*).
- **Trial**—The image has been successfully downloaded but has not yet been used to form links.

- **Unbootable**—The image either was partially downloaded or was determined during startup to be corrupt. (You can't manually accept an unbootable image.)

Nodes on a SkyPilot network are able to interoperate using different software versions within the same major version release. For example:

- Software versions 1.0.0 to 1.0.2p2 are all compatible with each other.
- Software versions 1.1 through 1.1p2 are all compatible with each other.
- Software versions 1.2 through 1.2p3 are all compatible with each other.

SkyPilot nodes use anonymous FTP to download new software images. The FTP server therefore becomes the central repository of software images.

Configuring Software

For automatically provisioned devices, you use the Software Maintenance screen within SkyProvision to browse and select software images from the FTP repository (see "Configuring Software Images" on page 126) and then assign the image to a node profile. (For more information about node profiles, see "Access Point SkyAccess Profile Elements" on page 132.) You can also schedule a future software version change by using the Software Schedule screen in SkyProvision.

For manually provisioned devices, you configure a device's software by using the command-line interface commands (refer to the `ftpimage` and `set activeimage` commands, described in the *SkyPilot Command-Line Interface Reference*) or their Web interface counterparts (refer to the *SkyPilot Web Interface Reference*).

Software Maintenance Elements

Table 3-1 lists the elements that describe software maintenance records.

Table 3-1. Software Maintenance Elements

Element	Description
Filename	Software image file name, selected from a provided list that includes every SkyPilot software image in the EMS server's `/var/ftp/pub/images` directory.
Date Created	(Read-only) Date and time this software maintenance record was created.
Date Modified	(Read-only) Date and time this software maintenance record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Software Schedule Elements

Table 3-1 lists the elements that describe software schedule records.

Table 3-2. Software Schedule Elements (Page 1 of 2)

Element	Description
Name	Name of the software schedule record (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Schedule Date	Date on which the specified software will be downloaded, selected by clicking **Calendar**.
Status	Activates or inactivates the scheduled software download.
Node Profile	(Optional) Node profile(s) to which this software schedule is assigned; moved between the **Select Node Profile** and **Selected Node Profile** lists by using the desired direction's move button (**>>** or **<<**).

Table 3-2. Software Schedule Elements (Page 2 of 2)

Element	Description
Date Created	(Read-only) Date and time this software schedule record was created.
Date Modified	(Read-only) Date and time this software schedule record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Managing Customers

Customers are individual subscribers, as well as companies with users of their own. Multiple automatically provisioned SkyPilot nodes can be assigned to any given customer (although each node can be assigned to *only a single* customer). You can perform searches for existing customers based on any combination of customer information, including customer name, company name, or customer address or phone number. In addition to adding, modifying, and deleting customers, by modifying a customer profile you can assign nodes to customers and remove such assignments.

To manage customer records, you use the Customer Maintenance function within SkyProvision (see “Configuring Proxy Proxy ARP” on page 142).

Managing Access Control Lists

Access control lists (ACLs) enhance system security by controlling access to the local management interface on a SkyPilot node port—for example, restricting access to a given node to a specified set of management stations.

ACLs also can limit the number of management stations permitted to gain Telnet access to a given node port. Management stations that are denied Telnet access can still use SNMP to monitor a node's status.

Unlike filters, which filter *all data passing through* a given SkyPilot node, ACLs examine data *destined* for a given node.

By default (that is, if you do not configure ACLs), there are no restrictions to accessing SkyPilot devices. To avoid a negative impact on performance, SkyPilot recommends limiting the number of ACLs you configure to eight.

Configuring ACLs

For automatically provisioned devices, you use the Access Control List function within SkyProvision (see "Configuring Access Control Lists" on page 149).

For a manually provisioned device, you configure its ACL by using the command-line interface command (refer to the `set acl` command, described in the *SkyPilot Command-Line Interface Reference*) or its Web interface counterpart (refer to the *SkyPilot Web Interface Reference*).

ACL Elements

Table 3-3 lists the elements that describe ACL records.

Table 3-3. ACL Elements

Element	Description
Name	Name of the ACL list (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
IP Address	IP address from which this ACL allows access; up to 12 digits in dotted notation.
Subnet Mask	Subnet mask used to allow a group of IP addresses to access a node; up to 12 digits in dotted notation.
Port	Destination port through which access is granted; a number from 1 to 65535.
Protocol	(Default = **TCP**) Protocol allowed by this ACL, selected from a provided list.
Date Created	(Read-only) Date and time this ACL record was created.
Date Modified	(Read-only) Date and time this ACL record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

About Network Security

The SkyPilot Security Manager provides a complete set of network security functions, including the capability to set up user profiles, to assign users to security groups, and to configure which EMS functions users or groups can access.

For information about using the SkyPilot Security Manager, see "Managing Network Security" on page 108.

About Reports and Statistics

You can use several closely related methods to view current and historical SkyPilot device data. You can view the following:

- **Reports**—Samples of collected data that are grouped into meaningful and informative data sets presented in tabular format. Reports can be useful in evaluating a particular device's performance.

  With SkyControl you can generate reports using data collected for the SkyPilot MIB objects (see the next section). You can configure report parameters such as the included objects, frequency of data collection, and report format. SkyPilot EMS automatically builds any reports you configure, and you can view them at any time.

  NOTE Reports put less of a performance load on the EMS server than similar statistics functions, and so should be used whenever possible.

  For procedures to configure, view, and purge reports, see "Using Reports" on page 190.

- **Current statistics**—A snapshot (that gets updated in real time) of MIB objects selected from previously configured data collection tasks (see "Data Collection Tasks" on page 71). Current statistics can be viewed in a variety of graphical formats.

- **Collected statistics**—A historical data view of MIB objects selected from previously configured data collection tasks (see "Data Collection Tasks" on page 71). Collected statistics can be viewed in a variety of graphical formats.

About the SkyPilot MIB

The SkyPilot MIB contains objects that have been configured to enable data collection through collection tasks (both default and user-configured), as described in this section. The collected information is used by SkyControl's reporting and system statistics functions.

The SkyPilot MIB is also the source of information for SkyPilot alarms (through SNMP trap and performance threshold mechanisms).

For the current MIB object definitions, refer to the `spMib.txt` file, located in the `/usr/local/skypilot/EMS/client/mibs` directory.

WARNING Do not change the `spMib.txt` file. If you change this file and load it into a MIB browser, the SkyPilot nodes' SNMP operations will not work properly, and SkyControl will not be able to perform its monitoring functions.

Data Collection Tasks

Data collection tasks collect data from the SkyPilot MIB for a specific device, at defined intervals, for defined periods of time. The collected information is stored on the EMS server, in its database.

When you add a device to your network, SkyPilot EMS automatically creates the following data collection tasks for the device:

- `Status_Poll`—Collects the device's status. The default polling interval is 60 seconds, and you can change this interval from 1 second to hundreds of days. You'll gain network accuracy the smaller you make the interval, but values less than 60 seconds can have an adverse effect on EMS performance.
- `Statistics`—Collects an array of statistics for the device. The default polling interval is 120 seconds, and you can change this interval from 1 second to hundreds of days. You'll gain accuracy the smaller you make the interval, but values less than 120 seconds can have an adverse effect on EMS performance.

To modify the default data collection tasks or to configure custom tasks, you use the device's Configure Task function within SkyControl (see "Configuring Data Collection Tasks" on page 187).

TIP If you know you're not going to need a data collection task's statistics for a while, you can stop it from running, which decreases the EMS server's load and may improve performance. You can stop and start either of the device's default data collection tasks as well as any custom tasks you've configured.

4

Maintenance

SkyPilot maintenance tasks include developing monitoring and troubleshooting strategies. This chapter describes techniques for maintaining your SkyPilot network, as well as solutions to common troubleshooting issues.

Chapter Highlights

- Monitoring a network's topology with SkyControl
- Monitoring events and alarms
- Monitoring link states
- Managing IP addresses
- Using utilities
- Troubleshooting

Monitoring a Network's Topology with SkyControl

SkyControl is SkyPilot's customized SNMP management system for real-time monitoring and management of automatically provisioned devices. One of SkyControl's unique features is that it provides a graphical view of your network topology (including all network nodes and links) with at-a-glance updates on topology, routing, and performance.

SkyControl's SNMP implementation includes:

- Default community strings—`public` (read-only) and `private` (read-write)
- Support for the following standard MIBs:
  - MIB II
  - Ether-Like
  - Bridge
- The private/enterprise SkyPilot MIB, which offers information about the following SkyPilot hardware components and software elements:
  - Nodes—status, uptime, software/hardware version, and more
  - Links—state, RSSI, modulation, antenna, and more
  - Routing tables—forwarding, routing, MAC, and more
  - ACLs (access control lists)
  - Filters

Monitoring Events and Alarms

SkyPilot EMS includes comprehensive event and monitoring functions. SNMP traps cause events, which in turn cause alarms based on default conditions and custom-defined performance thresholds.

You can configure alarm levels, set up email notifications, generate reports, and more. By monitoring alarms, you can take appropriate corrective action, as well as prevent major network disruptions.

There are three types of SkyPilot alarm:

- **Polling alarm**—The EMS server automatically polls every SkyPilot network device, and can therefore report the following:
    - Agent down
    - Agent unreachable
    - IP conflict
- **SNMP trap alarm**—An event reported by a device when it detects a value change of a MIB object that's been configured to generate traps. The SkyPilot EMS includes a large set of preconfigured traps, and you can customize and create additional traps corresponding to any MIB OID (organization ID); see "Configuring Traps" on page 109.

  In order for SNMP trap alarms to be generated, you need to configure the following:

    - The corresponding EMS trap receivers (see "Configuring SNMP Parameters" on page 146)
    - The community string for notification, which must match the device's hardcoded default community string, `public` (see "Configuring SNMP Parameters" on page 146)
    - The device's SNMP community string and trap receiver attributes (select the device's node profile and associate the desired attributes as described in "Node Profile Operations" on page 138)

- **Threshold alarm**—An event triggered by SkyPilot EMS when it detects that a MIB object's value crosses a preconfigured threshold. For more information, see "Configuring Threshold Alarms" on page 189.

For details about configuring, viewing, and annotating events and alarms, see "Configuring Events" on page 112 and "Configuring Alarms" on page 113.

Monitoring Link States

By monitoring link states in your SkyPilot network, you can troubleshoot a variety of provisioning and operational problems.

Table 4-1 describes the possible link states.

Table 4-1. Link States (Page 1 of 2)

State	Description	Firmware version
act mgmt	The link is to a child node and is active.	All
act path	The link is the next hop to the gateway and is active.	All
standby	The link is in standby state and is available for failover.	1.0.0 to 1.0.2p2
standby-o	The link is in standby state and has been optimized.	1.1 and later
standby-h	The link is in standby state but has not yet been optimized.	1.1 and later
inactive	The link is currently inactive; there is no longer a connection.	All
non-opt	The link is currently being optimized.	All
pre-auth	The link is being authorized and provisioned.	All
auth fail	Authentication has failed (usually caused by incorrect netkeys).	All

Table 4-1. Link States (Page 2 of 2)

State	Description	Firmware version
prov fail	Provisioning has failed due to DHCP failure or provisioning server failure.	All
parent	A hello beacon has been received from a child node, and the connection is initiating.	All
child	A hello beacon has been received from a parent node, and the connection is initiating.	All

Managing IP Addresses

All SkyPilot devices ship with the default IP address 192.168.0.2, accessible only from the Ethernet interface. A SkyGateway replaces this default when it receives a new address through DHCP or if it's explicitly configured with a static IP address. However, SkyExtenders and SkyConnectors continue to keep this default IP address available in addition to any IP address received through DHCP or static configuration.

Adding Devices to the DHCP Configuration File

To enable automatic assignment of a fixed IP address to a SkyPilot device, you must add the device to your DHCP server's configuration by modifying the DHCP configuration file.

To add a device to the DHCP server configuration:

1 Connect to the DHCP server using an SSH client, and log in as `root`.

2 Using any text editor, open the DHCP configuration file, `dhcpd.conf` (typically located in the `/etc` directory).

3 Using an existing entry as a model, add a new host entry for the device you plan to install, paying particular attention to the new node's Ethernet MAC address.

Your entry must be enclosed in the main subnet declaration where the TFTP, HTTP, and NTP server addresses are defined; if your entry is outside the subnet, it will not include (inherit) the required TFTP, HTTP, and NTP server addresses.

Entries look similar to the following:

```
host cpe0135 {
              hardware ethernet 00:0A:DB:00:01:35;
              fixed-address 192.168.6.118;
              option host-name "cpe0135";
             }
```

During SkyPilot EMS installation, default options that are inherited by all subsequent entries (such as the example above and your new entry) are added at the beginning of the DHCP configuration file.

4 Save your changes and close the file.

5 Refresh the DHCP server by entering the following command:

```
skypilot_dhcp_refresh
```

The response should look similar to the following:

```
Shutting down dhcpd:                       [  OK  ]
Starting dhcpd:                            [  OK  ]
```

6 Verify that the DHCP server restarts successfully.

You should see `OK` in the command output (as shown in the example in step **5**), and you can monitor the startup messages (by using the `tail -f /var/log/messages` command) and watch for the `Start up of dhcpd successful` message.

Monitoring DHCP Activity

You can monitor the DHCP activity on your SkyPilot network by entering the following command at a SkyPilot EMS terminal window:

```
tail -f /var/log/messages
```

To end DHCP monitoring, press CTRL+C.

The DHCP leases file, `dhcpd.leases`, is located in the `/var/lib/dhcp/` directory, and can be viewed using `more/vi/less`.

Using Utilities

SkyPilot devices include a number of built-in utilities to help with your troubleshooting and maintenance tasks, as described in the following list:

- **Ping**—Layer 3 ping utility
- **Node test**—Two-way link layer ping test
- **Reboot**—Device reboot
- **Traceroute**—Path trace from the local node through the mesh network to the SkyGateway

These utilities are available through the similarly named command-line command (as described in the *SkyPilot Command-Line Interface Reference*) or through the Web interface (refer to the *SkyPilot Web Interface Reference*).

Troubleshooting

This section presents procedures for troubleshooting problems of various kinds, including startup and connectivity, with a SkyPilot device. Each procedure is presented in a table set up like this (with varying numbers of steps and substeps).

1	You'll be told to check for something as described in what follows:	
a	Here there will be a description of an action to take to accomplish the check.	Here you'll see paragraphs describing what to do next, depending on the outcome of the action you took. The following open-lock symbol is shown when you've solved the problem: 🔓 If advised to contact SkyPilot customer support, you can do so by email (support@skypilot.com) or by telephone at (408) 764-8000.

For additional troubleshooting information, refer to the appropriate device documentation or to the SkyPilot website at www.skypilot.com/support/.

This section makes numerous references to commands that are available through the command-line interface; for details, refer to the *SkyPilot Command-Line Interface Reference*.

The specific troubleshooting procedures are described in the following sections:

- “Power-On Problems” (the next section)
- “Ethernet Connectivity Problems” on page 82
- “IP Connectivity Problems” on page 83
- “SkyGateway Transmission Problems” on page 87
- “Link Failure Problems” on page 89

Power-On Problems

Use the following procedure to troubleshoot the failure of a SkyPilot device to power on. This procedure applies to any SkyPilot device and to either provisioning mode (manual or automatic).

Table 4-2. Power-On Troubleshooting (Page 1 of 2)

1	Check whether the device is getting power:	
a	Verify that the device is plugged into an AC power supply.	If plugged in, go to substep **b**. If not plugged in, plug in and restart. 🔓
b	Test your power source with a voltage meter.	If power is available, go to step **2**. If power is not available, try an alternate power source and restart. 🔓
2	Check whether the power injector is OK:	
	Check whether the red light on the power injector is lit.	If the red light is lit, go to step **3**. If the red light is not lit, replace the power injector and restart. 🔓

Table 4-2. Power-On Troubleshooting (Page 2 of 2)

3	Check whether the device is properly cabled:	
	Verify that the device is connected to the power injector with a straight-through cable.	If the correct cable is being used, go to step **4**. If the wrong cable is connecting the device, replace it with the correct cable and restart. 🔓
4	Check whether the cable is defective:	
	Use a cable tester to check the cable.	If the cable is not defective, go to step **5**. If the cable is defective, replace it and restart. 🔓
5	Check whether the cable is plugged into the correct port:	
	On a SkyGateway or SkyExtender, confirm that the cable is plugged into the horizontal powered Ethernet interface and not the vertical serial port.	If the cable is plugged into the serial port, attach it to the powered Ethernet interface and restart. 🔓 If the cable is connected to the correct port on a SkyGateway or SkyExtender, or if the device is a SkyConnector, contact SkyPilot customer support.

Ethernet Connectivity Problems

Use the following procedure to address problems that a SkyPilot device can have in making Ethernet connections. This procedure applies to any SkyPilot device and to either provisioning mode (manual or automatic).

Table 4-3. Ethernet Connectivity (Page 1 of 2)

1	Check whether the SkyPilot device is connected with the proper cables:	
	Verify the use of the following CAT5 twisted-pair cables: ● Straight-through cable between power injector and the device ● For SkyExtenders and SkyGateways: straight-through cable between power injector and an Ethernet switch or hub ● For SkyExtenders and SkyGateways: crossover cable between power injector and computer	If the correct cables are being used, go to step **2**. If an incorrect cable is being used, replace it and restart.
2	Check whether any of the cables are defective:	
	Use a cable tester to check each cable connected to the device.	If none of the cables are defective, go to step **3**. If a cable is defective, replace it and restart.
3	Check whether Ethernet is enabled on all network devices connected to the SkyPilot device:	
	Confirm that Ethernet is enabled on all equipment connected to the SkyPilot device you're troubleshooting.	If the Ethernet is enabled on all devices, go to step **4**.

Table 4-3. Ethernet Connectivity (Page 2 of 2)

4	Check whether all of the connected devices are able to autonegotiate an Ethernet connection:	
a	Confirm that each network device is able to autonegotiate an Ethernet connection.	If all network device settings are correct go to substep **b**. If the settings for any device are incorrect, modify its configuration and restart the device. 🔓
b	To check the SkyPilot device, use the `show eth` command to view its current settings.	If the settings for the SkyPilot device are incorrect, use the `set eth` command to modify the Ethernet configuration, and then restart the device. 🔓 If the device settings are correct and the problem persists, contact SkyPilot customer support.

IP Connectivity Problems

The primary causes of IP connectivity problems with SkyPilot devices are a failure to acquire a GPS signal (in the case of a SkyGateway or SkyExtender), the location of a device on the wrong subnet, and conflicts with VLAN management solutions.

This section addresses device problems related to IP connectivity. It includes the following subsections:

- “Manually Provisioned SkyGateway IP Connectivity Problems” (the next section)
- “Automatically Provisioned SkyGateway IP Connectivity Problems” on page 85
- “SkyExtender and SkyConnector IP Connectivity Problems” on page 86 (applies to both manual and automatic provisioning)

Manually Provisioned SkyGateway IP Connectivity Problems

Use the following procedure to troubleshoot IP connectivity problems with a manually provisioned SkyGateway.

Table 4-4. Manually Provisioned SkyGateway Connectivity

1	Check whether the SkyGateway is able to acquire a GPS signal:	
	Log in to the SkyGateway via the serial port and observe the output at startup to verify the acquisition of a GPS signal. Refer to "Accessing the Command-Line Interface" in the *SkyPilot Command-Line Interface Reference* for instructions on accessing the command-line interface of a SkyPilot device.	If the output confirms that the SkyGateway is receiving a GPS signal, go to step **2**. If the SkyGateway is failing to acquire a signal, move it to an alternate location and restart. 🔓
2	Check whether the SkyGateway is on the correct subnet:	
	Use the `show prov` command to verify that the SkyGateway is configured with the desired IP address.	If the command output shows the correct IP address, go to step **3**. If the output shows an incorrect IP address, use the `set ip` command to assign the correct IP address, and then restart the SkyGateway. 🔓
3	Check whether VLAN settings are preventing access to the SkyGateway:	
	Use the `show vlan` command to check whether a management VLAN is configured on the SkyGateway.	If the SkyGateway has been incorrectly configured with a management VLAN, modify (or remove) the VLAN with the `set vlan` command and restart. 🔓

Automatically Provisioned SkyGateway IP Connectivity Problems

Use this procedure to troubleshoot IP connectivity problems with a SkyGateway that's provisioned automatically from the EMS server.

Table 4-5. Automatically Provisioned SkyGateway Connectivity

1	Check whether the SkyGateway is able to acquire a GPS signal:	
	Log in to the SkyGateway via the serial port and observe the output at startup to verify the acquisition of a GPS signal. Refer to "Accessing the Command-Line Interface" in the *SkyPilot Command-Line Interface Reference* for instructions on accessing the command-line interface of a SkyPilot device.	If the output confirms that the SkyGateway is receiving a GPS signal, go to step **2**. If the SkyGateway is failing to acquire a signal, move it to an alternate location and restart. 🔓
2	Check whether VLAN settings are preventing access to the SkyGateway:	
	If a management VLAN is present, it might be preventing local access to the SkyGateway from the network. Use the `show vlan` command to check whether a management VLAN is configured on the SkyGateway.	If the SkyGateway has been incorrectly configured with a management VLAN, modify (or remove) the VLAN with the `set vlan` command and retest. 🔓 If the VLAN settings are correct and the problem persists, contact SkyPilot customer support.
3	Check whether the SkyGateway is on the correct subnet:	
	Use the `show dhcp` command to verify that the SkyGateway received an IP address from DHCP. (A SkyGateway does not have a default IP address.)	If the command output shows that the SkyGateway did not get an IP address from DHCP or that it received an incorrect IP address, modify the configuration on the DHCP server and retest. 🔓 If the output shows that the SkyGateway has received an IP address from DHCP, contact SkyPilot customer support.

SkyExtender and SkyConnector IP Connectivity Problems

Use this procedure to troubleshoot IP connectivity problems with a SkyExtender or SkyConnector (applies to both automatically and manually provisioned devices).

Table 4-6. SkyExtender and SkyConnector Connectivity (Page 1 of 2)

1	(SkyExtender only) Check whether the device is able to acquire a GPS signal:	
	Log in to the SkyExtender via the serial port and observe the output at startup to verify the acquisition of a GPS signal. Refer to "Accessing the Command-Line Interface" in the *SkyPilot Command-Line Interface Reference* for instructions on accessing the command-line interface of a SkyPilot device.	If the output confirms that the SkyExtender is receiving a GPS signal, go to step **2**. If the SkyExtender is failing to acquire a signal, move it to an alternate location and retest. 🔓
2	Check whether the computer is on the correct subnet:	
	To communicate over the LAN, the computer must be on the same subnet as the SkyPilot device. Both SkyExtenders and SkyConnectors use the IP address 192.168.0.2. Open the network settings panel of the computer to confirm that it's using these settings: ● IP address: 192.168.0.2 ● Subnet mask: 255.255.255.0	If the computer's network settings are correct, go to step **3**. If the computer's network settings are incorrect, apply the correct settings and retest. 🔓

Table 4-6. SkyExtender and SkyConnector Connectivity (Page 2 of 2)

3	Check whether VLAN settings are preventing access to the device:	
a	If a management VLAN is present on the SkyGateway, it will prevent local network access to a SkyExtender or SkyConnector after the device forms a link with the SkyGateway. On the SkyGateway, use the `show vlan` command to check whether a management VLAN is configured for that device.	If the SkyGateway has not been configured with a management VLAN, go to substep **b**. If the SkyGateway has been configured with a management VLAN, modify (or remove) the VLAN with the `set vlan` command and retest. 🔓
b	If a data VLAN is present on the SkyExtender or SkyConnector, it will prevent local network access to the device. For a SkyExtender, log in to the device via the serial port; for a SkyConnector, log in via Telnet across the wireless network. Then use the `show vlan` command to check whether a data VLAN has been enabled on the device.	If the command output indicates that a data VLAN is present on the device, use the `set vlan` command to remove the VLAN, and then retest. 🔓 If the output does not indicate that a data VLAN is present and the problem persists, contact SkyPilot customer support.

SkyGateway Transmission Problems

Use the procedures in this section to troubleshoot SkyGateway devices with wireless transmission problems. There are two subsections, one for each type of provisioning:

- "Manually Provisioned SkyGateway Transmission Problems" (the next section)
- "Automatically Provisioned SkyGateway Transmission Problems" on page 88

Manually Provisioned SkyGateway Transmission Problems

Use this procedure to troubleshoot wireless transmission problems with a manually provisioned SkyGateway (which immediately begins transmitting network signals upon completing startup).

Table 4-7. Manually Provisioned SkyGateway Transmission

●	Check whether the SkyGateway is in manual provisioning mode:	
	Log in to the SkyGateway via the serial port and use the `show prov` command to confirm that the SkyGateway was placed in manual provisioning mode.	If the command output indicates that the device is not in manual provisioning mode, use the `set prov manual` command to set that mode, and then restart the SkyGateway. (After a SkyGateway is placed in manual provisioning mode, restarting it is necessary to activate the mode.) 🔓 If the SkyGateway is in manual provisioning mode but is unable to transmit signals, contact SkyPilot customer support.

Automatically Provisioned SkyGateway Transmission Problems

Use this procedure to troubleshoot wireless transmission problems with a SkyGateway that's set up for automatic provisioning.

Table 4-8. Automatically Provisioned SkyGateway Transmission (Page 1 of 2)

1	Check whether the SkyGateway is getting its IP settings from DHCP:	
	Log in to the SkyGateway via the serial port and use the `show dhcp` command to confirm that the SkyGateway received the correct IP settings, including IP address, subnet mask, default gateway, HTTP server (SkyProvision), and FTP server (SkyProvision).	If the command shows that the device received the correct IP settings, go to step **2**. If the device did not receive IP settings from DHCP or has incorrect settings, modify the configuration on the DHCP server and retest. 🔓

Table 4-8. Automatically Provisioned SkyGateway Transmission (Page 2 of 2)

2	Check whether the SkyGateway received a configuration file with correct settings:	
	A SkyGateway set up for automatic provisioning receives its configuration from the SkyProvision server. Use the `show config` command to confirm that the device received correct configuration information, including the desired frequency and domain. If no settings are present, the SkyGateway did not receive a configuration file. You can also review the contents of the `/var/log/messages` file on the SkyProvision server to verify that the SkyGateway is requesting a configuration and, if so, that SkyProvision is responding to the request.	If the command output indicates that the SkyGateway is not getting its configuration from SkyProvision or that it received incorrect settings, first confirm that the SkyProvision server is running. If it is, modify the configuration settings for the SkyGateway and retest. 🔓 If the output indicates that the SkyGateway is getting the correct configuration settings from the SkyProvision server, contact SkyPilot customer support.

Link Failure Problems

This section describes steps for troubleshooting all SkyPilot devices having problems forming links that allow network communications. By branching off to different subsections where applicable, this troubleshooting procedure applies to both manually provisioned devices and devices set up for automatic provisioning through SkyProvision.

Failing to Form Links (General)

To troubleshoot problems that any SkyPilot device (whether provisioned manually or automatically) may have in forming links that allow it to connect with other devices on the wireless network, begin with the following steps.

Table 4-9. Link Formation Troubleshooting (General) (Page 1 of 5)

1	Check whether the device is listening on the desired frequency:	
a	Initially, a SkyPilot device scans for frequencies that are on its list of primary frequency or allowed frequencies. Use the `show prov freq` command on the device to verify that the desired frequency is on the list. (You can also use this command on the SkyGateway to check the frequency.)	If the command output indicates that the desired frequency is on the list of primary or allowed frequencies, go to substep **b**. If the desired frequency is not on the list, use the `set freq` command to specify the desired frequency as the device's primary frequency, and then restart. 🔓
b	Use the `set log hello 3` and (Telnet only) `debug on` commands to observe frequency hunting in real time. The log will tell you whether the device is switching to the desired frequency. Note that after attempting each allowed frequency twice, the device opens up to all frequencies.	If the log confirms that the device is switching to the desired frequency, go to step **2**. If the log does not show the device switching to the desired frequency, use the `set freq` command to specify the desired frequency as the primary frequency, and then restart. 🔓
2	Check whether the device is detecting signals from other devices:	
a	Use the `show link` command to find out whether the device is also receiving hello packets from a SkyGateway or SkyExtenders.	If the command output indicates that the device is not hearing a SkyGateway or any SkyExtenders, go to substep **b**. If the output confirms that the device is hearing a SkyGateway or one or more SkyExtenders, go to step **3**.

Table 4-9. Link Formation Troubleshooting (General) (Page 2 of 5)

b	Use the `set log hello 3` and (Telnet only) `debug on` commands to observe frequency hunting in real time. The log will tell you whether the device is receiving hello packets from other devices when it switches to the desired frequency.	If the log indicates that the device is switching to the desired frequency but failing to receive hello packets, go to substep **c**. If the log confirms that the device is switching to the desired frequency and also receiving hello packets from other devices, go to step **3**.
c	Adjust the device mount for improved signal reception and display the log again as in substep **b**.	If the log indicates that the device is still not receiving hello packets, try additional mounting points. If the device still fails to receive hello packets, go to substep **d**. If the log confirms that the device is now receiving hello packets, secure the mount and restart the device. 🔓
d	Move the device to an alternate site with proven coverage (for example, next to a connected device) and display the log again as in substep **b**.	If the log confirms that the device is now receiving hello packets, add an intermediary SkyExtender to improve signal coverage at the device's original location. 🔓 If the log indicates that output is significantly less than shown by other devices operating at this location, contact SkyPilot customer support.
3	Check whether the device is failing to start optimization:	
a	Use the `show link` command to see if the MAC addresses heard by the device are remaining inactive. Look for evidence of link states that have changed from `inactive` to `non-opt` (non-optimized).	If the command output fails to show inactive links that have changed to the `non-opt` state, go to substep **b**. If the output shows `non-opt` states, the device is starting link optimization. Go to step **4**.
b	Use the `set log link 3` and (Telnet only) `debug on` commands to observe link state changes in real time. Look for link states that change from `inactive` to `non-opt`.	If the log fails to show `inactive` links changing to `non-opt` links, go to substep **c**. If the log shows `inactive` links changing to `non-opt` links, the device is starting link optimization. Go to step **4**.

Table 4-9. Link Formation Troubleshooting (General) (Page 3 of 5)

c	Use the `show link opt` command to view a table displaying average RSSI and the number of hello packets the device is hearing. (The device will not attempt to optimize a link until it hears 5 packets.) An RSSI value of less than 10 on the optimal antenna pair indicates a weak signal. An RSSI value of 20 or greater is preferred.	If the table shows a low RSSI value (less than 10), the signal is probably too weak for the device to attempt optimization. Go to substep **d**. If the table indicates a threshold RSSI value (10 or greater), the signal should be strong enough for the device to attempt optimization. The problem is likely related to local radio interference, which can reduce the number of packets the device can hear. Monitor the area for sources of interference and retest. 🔓
d	Adjust the device mount for improved signal reception and display the table again as in substep **c**.	If the table shows RSSI values less than 10, try additional mount adjustments. If the device continues to display RSSI values less than 10, go to substep **e**. If the table shows that RSSI is now 10 or greater, secure the mount and restart the device. 🔓
e	Move the device to an alternate site with demonstrated signal coverage (for example, next to a connected device) and display the table again as in substep **c**.	If the table shows RSSI values of 10 or greater, add an intermediary SkyExtender to improve signal coverage at the device's original location. 🔓 If the table indicates that output is significantly lower than shown by other SkyPilot devices operating at this location, contact SkyPilot customer support.
4	Check whether the device is failing to complete link optimization:	
a	Use the `show link` command to see if the MAC addresses heard by the device have ever reached the `pre-auth` (pre-authorized) state, which indicates optimized links.	If the command output does not show `pre-auth` states, go to substep **b**. If the output shows `pre-auth` states, the device is able to optimize links. Go to step **5**.
b	Use the `set log link 3` and (Telnet only) `debug on` command to observe link state changes in real time. Look for link states that change from `non-opt` to `pre-auth`.	If the log fails to show `non-opt` links changing to `pre-auth` links, go to substep **c**. If the log shows `non-opt` links changing to `pre-auth` links, the device is successfully optimizing links. Go to step **5**.

Table 4-9. Link Formation Troubleshooting (General) (Page 4 of 5)

c	Use the `show link opt` command to view a table displaying average RSSI and the number of hello packets the device is hearing. (The device will not complete optimization of a link until it hears 5 packets.) An RSSI value of less than 10 on the optimal antenna pair indicates a weak signal. An RSSI value of 20 or greater is preferred.	If the table shows a low RSSI value (less than 10), the signal is probably too weak for the device to attempt optimization. Go to substep **d**. If the table indicates a threshold RSSI value (10 or greater), the signal should be strong enough for the device to complete optimization. The problem is likely related to local radio noise that's interfering with SkyPilot signals. (Local radio interference on either side of a link can reduce the number of packets a device can hear, and prevent it from completing optimization.) Monitor the area for sources of interference and retest. 🔓
d	Adjust the device mount for improved signal reception and display the table again as in substep **c**.	If the table shows RSSI values remaining below 10, try additional mount adjustments. If the device continues to display RSSI values less than 10, go to substep **e**. If the table shows that RSSI is now 10 or greater, secure the mount and restart the device. 🔓
e	Move the device to an alternate site with demonstrated signal coverage (for example, next to a connected device) and display the table again as in substep **c**.	If the table shows RSSI values of 10 or greater, add an intermediary SkyExtender to improve signal coverage at the device's original location. 🔓 If the table indicates that output is significantly lower than shown by other SkyPilot devices operating at this location, contact SkyPilot customer support.
5	Check whether the device is authenticating links:	
a	Use the `show link` command to see if the MAC addresses heard by the device have ever reached the `standby` state, which indicates authorized links. If authentication failures prevent link states from reaching `standby`, the states will return to `auth-fail` and `inactive`.	If the command output does not show `standby` states, go to substep **b**. If the output shows `standby` states, the device is successfully forming links and is probably looking for alternates. Once the device exhausts attempts to form more links, it will choose an optimal `standby` link as the active path and come online. 🔓

Table 4-9. Link Formation Troubleshooting (General) (Page 5 of 5)

b	Use the `set log link 3` and (Telnet only) `debug on` commands to observe link state changes in real time. Look for link states that change from `pre-auth` to `standby`.	If the log fails to show `pre-auth` links changing to `standby` links, go to substep **c**. If the log shows `pre-auth` links changing to `standby` links, the device is successfully forming links and is probably looking for alternates. Once the device exhausts attempts to form more links, it will choose an optimal `standby` link as the active path and come online. 🔓
c	Use the `set log auth 3` and (Telnet only) `debug on` commands to observe authentication events in real time. Look for reports of authentication failure due to timeouts or mismatched netkeys.	If the log reports any failure to authenticate due to timeouts or mismatched netkeys, go to substep **d**. If the log reports successful authentication, the problem may be with provisioning. Go to step **6**.
d	Use the `verifykey` command to confirm the presence of a SkyPilot public/private key pair for the device.	If a public/private key pair exists, go to substep **e**. If no keys exists, contact SkyPilot to obtain a public/private key pair. 🔓
e	Use the `show netkey` command to confirm that the hashed equivalent of the netkey is identical to the value on all other connected devices. Mismatched keys will cause authentication to fail.	If the netkeys do not match, use the `set netkey` command to modify the public key so that it matches the key used by other devices on the network. Restart the device. 🔓 If the netkeys match and the device continues to report authentication failures, contact SkyPilot customer support.
6	Continue this procedure with the steps in the next section for manually provisioned devices, or with the steps in "Failing to Form Links (Automatic Provisioning)" on page 96 for automatically provisioned devices.	

Failing to Form Links (Manual Provisioning)

The following steps continue the general procedure in the preceding subsection to address problems that manually provisioned SkyPilot devices may have in forming links that allow it to connect with other devices on the wireless network. Be sure to first perform the steps in that subsection ("Failing to Form Links (General)" on page 90).

Table 4-10. Link Formation Troubleshooting (Manual Prov.) (Page 1 of 2)

7	Check whether the problem is related to a conflict due to configuration:	
a	Use the `show link` command to see if the MAC addresses heard by the device have ever reached the `standby` state. If authentication is successful but link states fail to change from `pre-auth` to `standby`, they will return to `prov-fail` and eventually go back to `inactive`.	If the command output does not show `standby` states, go to substep **b**. If the output shows `standby` states, the device is successfully forming links and is probably looking for alternates. Once the device exhausts attempts to form more links, it will choose an optimal `standby` link as the active path and come online. 🔓
b	Use the `set log link 3` and (Telnet only) `debug on` commands to observe link state changes in real time. Look for link states that change from `pre-auth` to `standby`.	If the log fails to show `pre-auth` links changing to `standby` links, go to substep **c**. If the log shows `pre-auth` links changing to `standby` links, the device is successfully forming links and is probably looking for alternates. Once the device exhausts attempts to form more links, it will choose an optimal `standby` link as the active path and come online. 🔓

Table 4-10. Link Formation Troubleshooting (Manual Prov.) (Page 2 of 2)

c	If the SkyGateway's configuration parameters do not match the frequency or domain settings of the SkyGateway or SkyExtender it's using to form links, devices will sever the links before connections can be made. Use the `show prov` command to confirm that the SkyGateway's configuration settings for frequency and/or domain match the frequency and/or domain it's trying to use.	If the command output shows mismatched configuration information, modify the configuration to allow the SkyGateway's frequency and/or domain and retest. 🔓 If the provisioning information matches the SkyGateway's frequency and/or domain and the device is still reporting provisioning failures, contact SkyPilot customer support.

Failing to Form Links (Automatic Provisioning)

The following steps continue the general procedure in the subsection "Failing to Form Links (General)," on page 90, to address problems that an automatically provisioned SkyPilot device may have in forming links that allow it to connect with other devices on the wireless network. Be sure to first perform the steps in the earlier subsection.

Table 4-11. Link Formation Troubleshooting (Automatic Prov.) (Page 1 of 4)

8	Check whether the device is failing to receive a configuration due to problems related to DHCP:	
a	Use the `show link` command to see if the MAC addresses heard by the device have ever reached the `standby` state, which indicates successful provisioning. If authentication is successful but link states fail to change from `pre-auth` to `standby`, they will return to `prov-fail` and eventually go back to `inactive`.	If the command output does not show `standby` states, go to substep **b**. If the output shows `standby` states, the device is successfully forming links and is probably looking for alternates. Once the device exhausts attempts to form more links, it will choose an optimal `standby` link as the active path and come online. 🔓

Table 4-11. Link Formation Troubleshooting (Automatic Prov.) (Page 2 of 4)

b	Use the `set log link 3` and (Telnet only) `debug on` commands to observe link state changes in real time. Look for link states that change from `pre-auth` to `standby`.	If the log fails to show `pre-auth` links changing to `standby` links, go to substep **c**. If the log shows `pre-auth` links changing to `standby` links, the device is successfully forming links and is probably looking for alternates. Once the device exhausts attempts to form more links, it will choose an optimal `standby` link as the active path and come online. 🔓
c	An incorrect DHCP configuration will prevent the device from obtaining its configuration from the provisioning server. Use the `show dhcp` command to verify that the device is getting an IP address and other configuration information from the DHCP server.	If the command output indicates that the device received an IP address from the DHCP server, go to step **9**. If the command output indicates that the device is not getting an IP address from the DHCP server, or that it's receiving incorrect information from the DHCP server, edit the DHCP content to include the correct information, and restart. 🔓 If the provisioning information matches the SkyGateway's frequency and/or domain and the device is still reporting provisioning failures, contact SkyPilot customer support.
d	Use the `set log prov 3` and (Telnet only) `debug on` commands to observe provisioning events in real time. Monitor the DHCP server log to confirm that the device successfully made its request, and check the server's response. Note that if you're using the ISC DHCP server, you can monitor server output in real time by monitoring the `/var/log/messages` file.	If the log indicates that the device received an IP address from the DHCP server, go to step **9**. If the log indicates that the device is not getting an IP address and other configuration information from the DHCP server, or that it's receiving incorrect information from the DHCP server, edit the DHCP content to include the correct information, and restart. 🔓

Table 4-11. Link Formation Troubleshooting (Automatic Prov.) (Page 3 of 4)

9	Check whether the problem is related to unsuccessful provisioning:	
a	Use the `show link` command to see if the MAC addresses heard by the device have ever reached the `standby` state, which indicates successful provisioning. If authentication is successful but link states fail to change from `pre-auth` to `standby`, they will return to `prov-fail` and eventually go back to `inactive`.	If the command output does not show `standby` states, go to substep **b**. If the output shows `standby` states, the device is successfully forming links and is probably looking for alternates. Once the device exhausts attempts to form more links, it will choose an optimal `standby` link as the active path and come online. 🔓
b	Use the `set log link 3` and (Telnet only) `debug on` commands to observe link state changes in real time. Look for link states that change from `pre-auth` to `standby`.	If the log fails to show `pre-auth` links changing to `standby` links, go to substep **c**. If the log shows `pre-auth` links changing to `standby` links, the device is successfully forming links and is probably looking for alternates. Once the device exhausts attempts to form more links, it will choose an optimal `standby` link as the active path and come online. 🔓

Table 4-11. Link Formation Troubleshooting (Automatic Prov.) (Page 4 of 4)

c	If the device's configuration parameters do not match the frequency and/or domain settings of the SkyGateway or SkyExtender it's using to form links, devices will sever the links before connections can be made. Use the `show config` command to confirm that the device has completed provisioning, and to view configuration parameters.	If the command output does not show configuration parameters, SkyProvision may have no record of the SkyGateway. Go to substep **d**. If the output shows mismatched configuration information, modify the configuration to allow the SkyGateway's frequency or domain, and restart. 🔓
d	Use the `set log prov 3` and (Telnet only) `debug on` commands to observe provisioning events in real time. Look for reports of failure to download the device's configuration file, or rejection of a link's domain or frequency based on the contents of the device configuration. Note that you can verify that SkyProvision is offering a configuration file by monitoring the `/var/log/messages` file, which contains a log of SkyProvision configuration transactions.	If the log reports failures related to the domain and frequency values stored in the device's configuration file, edit the settings to include the correct values, and restart the device. 🔓 If the log does not report any offering of a configuration file, verify that the device's information has been correctly added into SkyProvision, and restart. 🔓 If you confirm that the provisioning server is sending the correct configuration file to the device but the device continues to report that the file was not offered or that the device continues to sever links, contact SkyPilot customer support.

A

General SkyPilot EMS Reference

SkyPilot EMS enables you to perform management and monitoring functions such as security configuration and alarm monitoring. This appendix provides detailed instructions for those functions.

Appendix Highlights

- Using SkyPilot EMS (Java client)
- Managing network security
- Configuring traps
- Configuring performance thresholds
- Configuring events
- Configuring alarms

Using SkyPilot EMS (Java Client)

SkyPilot EMS comprises applications from SkyPilot and third parties that enable the automatic configuration and remote management of devices on the SkyPilot network.

Starting the EMS Java Client

You can run multiple EMS Java clients on a single or multiple machines.

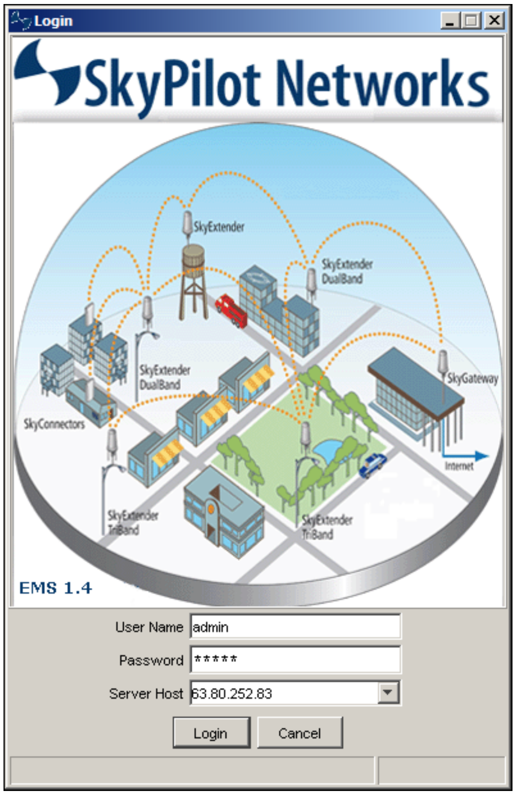
NOTE In addition to the following procedure, you may be able to start the EMS Java client by using the **Start** menu or desktop shortcuts that may have been set up during installation.

To start the SkyPilot EMS Java client:

1. Execute the SkyPilot EMS client startup script, `SkyPilot\EMS\bin\startemsclient.bat` (for Windows systems) or `/usr/local/skypilot/EMS/bin/startsemsclient.sh` (for Linux systems).

   The Login window is displayed (Figure A-1).

Figure A-1. SkyPilot EMS Login window



User Name admin

Password *****

Server Host 63.80.252.83

2 Enter your user name and password. The default user name is `admin`, and the default password is also `admin`.

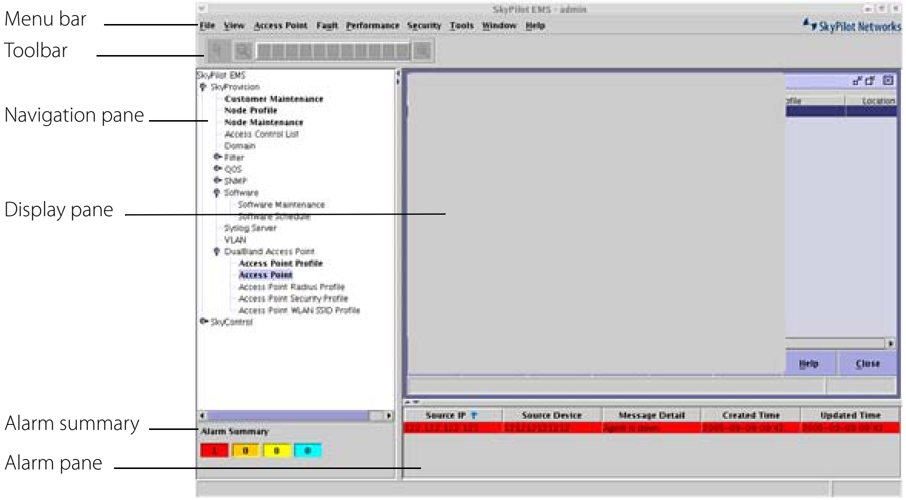
3 Click **Login**.

The SkyPilot EMS Java client interface is displayed (see the next section).

The SkyPilot EMS Java Client Interface

Figure A-2 illustrates the SkyPilot EMS Java client interface.

Figure A-2. SkyPilot EMS Java client interface



Source IP	Source Device	Message Detail	Created Time	Updated Time
[illegible]	[illegible]	Agent is down	[illegible]	[illegible]

The various parts of the interface are as follows:

- **Menu bar**—Contains menus of commands that allow you to set global network configuration items, as well as manage the windows in the display pane.
- **Navigation pane**—Contains a Windows Explorer–like hierarchical display of the SkyPilot tools: SkyProvision and SkyControl.
- **Display pane**—Shows the interface for the SkyPilot OAM tool selected in the navigation pane. Multiple windows can be shown at one time in the display pane.
- **Toolbar**—Contains context-sensitive buttons used to manipulate objects in the display pane, such as to lock a node's position in a SkyControl domain display. The toolbar buttons are enabled only when they're applicable to the display pane's active window.
- **Alarm summary**—Shows the number of active alarms for each alarm type: critical, major, minor, and warning.
- **Alarm pane**—Lists all active alarms.

Stopping the EMS Java Client

You can stop the EMS Java client at any time without affecting your SkyPilot network operations.

To stop the EMS Java Client:

1 From the menu bar, choose **File ‰ Exit**.

SkyProvision displays a Quit Confirmation message.

2 Click **Yes**.

Using the Menus

The EMS Java client menu bar contains menus of commands that allow you to set global network configuration items, as well as manage the windows in the display pane.

File Menu

The **File** menu lets you log out and return to the Login window (by choosing **File ‰ Exit**) or end a SkyPilot EMS Java client session (by choosing **File ‰ Exit**).

View Menu

The **View** menu enables you to refresh the EMS Java client display (by choosing **View ‰ Refresh**).

Object Menu

The **Object** menu changes its title and commands depending on which tool and function you've selected in the navigation pane. For example, expanding the **SkyProvision** tree in the navigation pane and clicking **Customer Maintenance** causes the **Object** menu title to change to **Customer Maintenance**; similarly, clicking **VLAN** in the **SkyProvision** tree causes the **Object** menu title to change to **VLAN**.

Fault Menu

The **Fault** menu provides access to alarm maintenance, event log, and trap functions. See “Configuring Traps” on page 109, “Configuring Events” on page 112, and “Configuring Alarms” on page 113.

Performance Menu

The **Performance** menu provides access to global data collection and report configuration functions. See “About Reports and Statistics” on page 70.

Security Menu

The **Security** menu enables you to manage network security (by choosing **Security ‰ Security Manager**). See “Managing Network Security” on page 108.

Tools Menu

The **Tools** menu offers the following choices:

- **Look & Feel**—To change the display pane appearance.
- **MIB Browser**—To access the SkyPilot MIB, along with any other MIBs you’ve installed. (This function requires prior installation of SkyControl, as well as the appropriate SkyPilot EMS license.)
- **Telnet**—To open a Telnet connection from your computer to any SkyPilot device through a serial connection.
- **MAC Address Report**—To create a report listing all MAC addresses that are missing from node maintenance or SkyControl.
- **Alarm Color Settings**—To change the colors used to indicate alarm severity in the alarm summary and alarm pane.
- **Link Status Settings**—To change the color and line style used to show link status in SkyControl network displays.
- **Change Password**—To change the password corresponding to the current SkyPilot EMS Java client session’s user name.

Window Menu

The **Window** menu provides standard Windows-based display options:

- **Cascade**—To show all open display pane windows cascaded.
- **Tile Horizontal**—To show all open display pane windows, tiled horizontally (each sized to the display pane's current width).
- **Tile Vertical**—To show all open display pane windows, tiled vertically (each sized to the display pane's current height).
- **Minimize All**—To minimize all open display pane windows.
- **Close All**—To close all open display pane windows.
- ***EMS-window***—To make ***EMS-window*** the active display pane window.

Help Menu

The **Help** menu provides version and copyright information about the SkyPilot EMS client (choose **Help ‰ About**).

NOTE Context-sensitive help information is available for every SkyProvision function. Click the **Help** action button from any display pane window (see "SkyProvision Display Pane" on page 120).

Managing Network Security

SkyPilot EMS provides a complete set of network security functions, including the capability to set up user profiles, to assign users to security groups, and to configure which EMS functions users or groups can access.

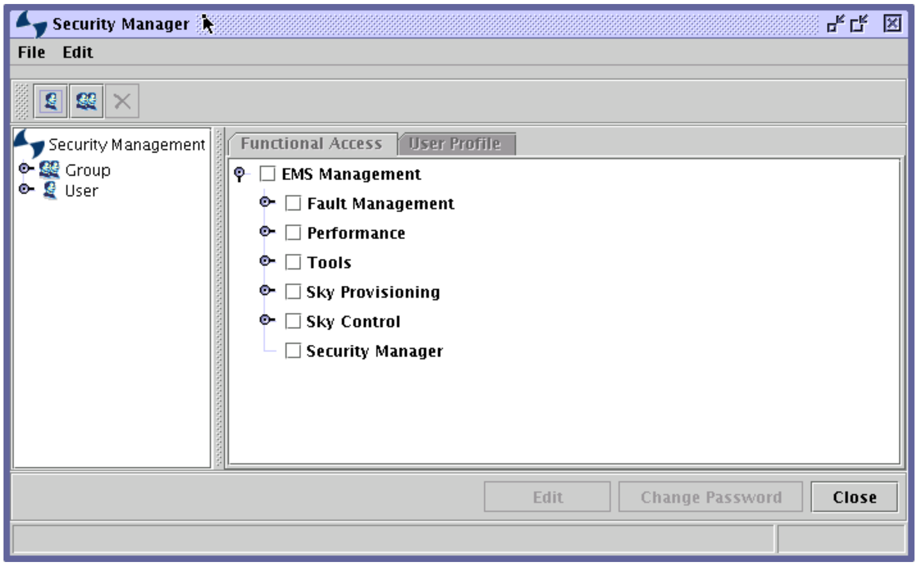
NOTE The network security functions are accessible from the EMS Java client, but not the EMS Web client.

To access the security functions:

1 From the SkyPilot EMS Java client menu bar, choose **Security ‰ Security Manager**.

SkyPilot EMS displays the Security Manager screen (Figure A-3).

Figure A-3. Security Manager screen



2 Add, modify, or delete users or groups as desired.

3 Click **Close**.

Configuring Traps

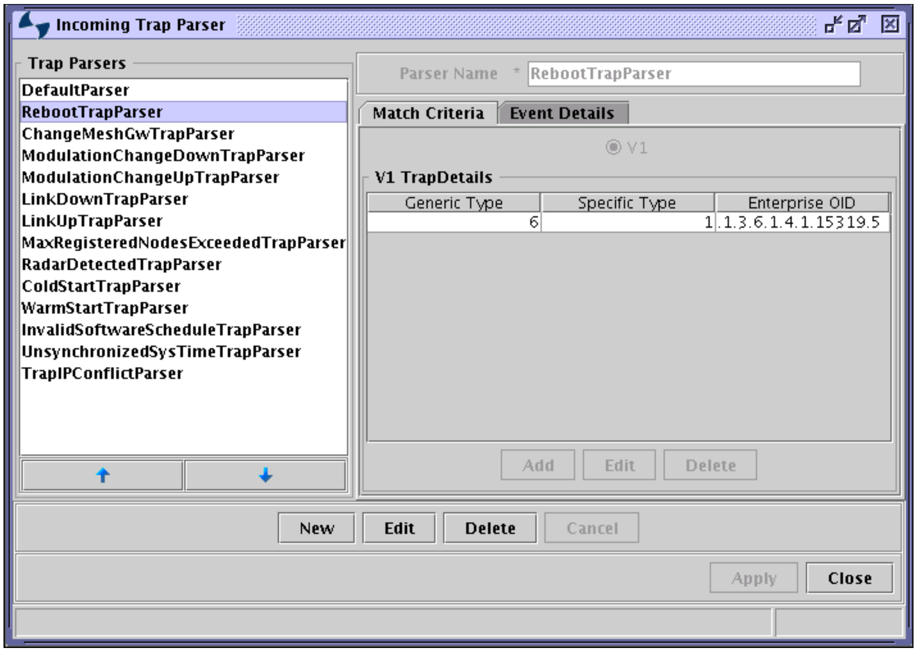
You can modify trap descriptions, messages, and associated severity for both preconfigured and custom traps by using the EMS trap parser.

To access the EMS trap parser:

1 From the SkyPilot EMS Java client menu bar, choose **Fault ‰ Parser ‰ Trap Parser**.

SkyPilot EMS displays the Incoming Trap Parser screen (Figure A-4).

Figure A-4. Incoming Trap Parser screen



DefaultParser
RebootTrapParser
ChangeMeshGwTrapParser
ModulationChangeDownTrapParser
ModulationChangeUpTrapParser
LinkDownTrapParser
LinkUpTrapParser
MaxRegisteredNodesExceededTrapParser
RadarDetectedTrapParser
ColdStartTrapParser
WarmStartTrapParser
InvalidSoftwareScheduleTrapParser
UnsynchronizedSysTimeTrapParser
TrapIPConflictParser

Parser Name * RebootTrapParser

Generic Type	Specific Type	Enterprise OID
6	1	.1.3.6.1.4.1.15319.5

2 Perform the desired operation:

- To add a trap—Click **New**; click **Add**; enter a known MIB OID or choose **Browse** to select the OID from the MIB browser, and click **OK**; from the **Event Details** tab, set the elements using the desired token (`$source`, `$community`, or `$uptime`); enter the parser name; and click **Apply**.
- To modify a trap—Select the desired trap in the Trap Parsers list and click **Edit**; then edit the desired elements and click **Apply**.
- To delete a trap—Select the desired trap in the Trap Parsers list and click **Delete**; then click **Yes**.

3 Click **Close**.

Configuring Performance Thresholds

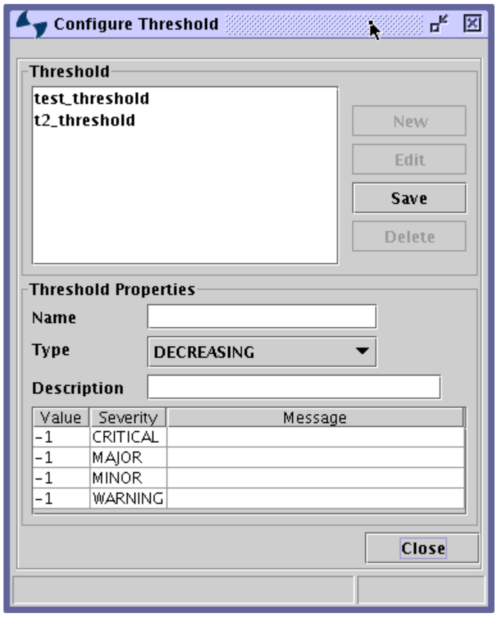
Performance thresholds are severity level profiles that can be associated with MIB objects for which data collection tasks are configured and alarms are generated. So, for example, you can specify that when a MIB object’s value crosses a threshold level, a threshold event will be generated and a corresponding alarm is created.

Performance Threshold Operations

1 From the SkyPilot EMS menu bar, choose **Performance ‰ Configure Threshold**.

SkyPilot EMS displays the Configure Threshold screen (Figure A-5).

Figure A-5. Configure Threshold screen



test_threshold
t2_threshold

Name

Type DECREASING

Description

Value	Severity	Message
-1	CRITICAL	
-1	MAJOR	
-1	MINOR	
-1	WARNING	

2 Click the name of the threshold whose settings you want to modify, and then click **Edit**.

SkyPilot EMS displays the threshold's properties in the bottom part of the Configure Threshold screen (Figure A-5). Table A-1 lists the elements that describe performance thresholds.

Table A-1. Performance Threshold Elements

Element	Description
Name	Name of the threshold (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyControl.
Type	(Default = **Decreasing**) Direction of threshold object value change to monitor: **Decreasing** or **Increasing**.
Description	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.
Enable	Enables or disables the performance threshold for the corresponding alarm severity.
Value	Value at which the corresponding alarm is triggered.
Message	Free-form text of up to 255 characters to display for the corresponding alarm trigger.

3 Edit the threshold elements and click **Save**.

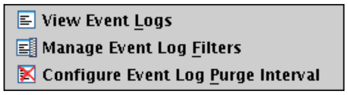
Focus returns to the Configure Threshold screen.

4 Click **Close**.

Configuring Events

You can view, save, and print event logs, create event filters, and configure event log purging from the **Event Logs** submenu of the EMS Java client **Fault** menu.

Figure A-6. EMS Event Logs submenu

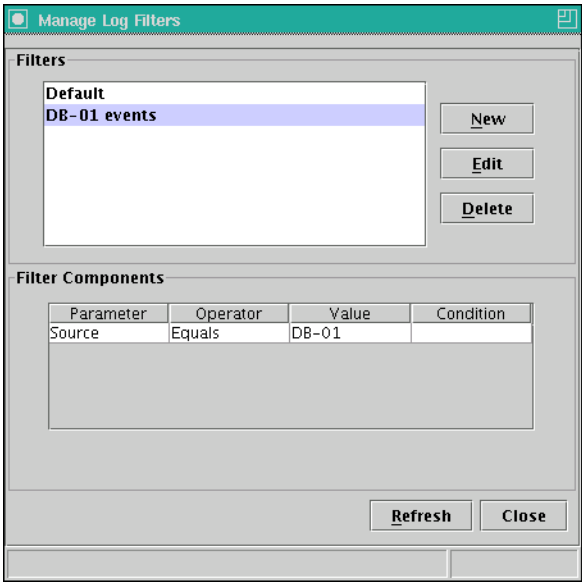


Of particular interest are the following operations:

- Refreshing event logs display—The View Logs display (shown by choosing **Fault ‰ Event Logs ‰ View Event Logs** from the EMS Java client menu bar) is a static snapshot of the event log as it exists when you first display it. To refresh the display, select **View ‰ Refresh** from the View Logs toolbar or click the View Logs display's **Refresh** button, .

- Managing log filters—From the Manage Log Filters display (Figure A-7, shown by choosing **Fault ‰ Event Logs ‰ Manage Event Log Filters** from the EMS Java client menu bar), you can add, modify, or delete filters that you can use to view and print a defined subset of all events—for example, a filter to display only events with a particular device name.

  Figure A-7. Manage Log Filters display



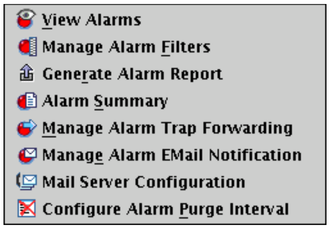
Default
DB-01 events

Parameter	Operator	Value	Condition
Source	Equals	DB-01	

Configuring Alarms

You can manage alarms, create alarm filters, and configure alarm forwarding and notification email from the **Alarms** submenu of the EMS Java client **Fault** menu.

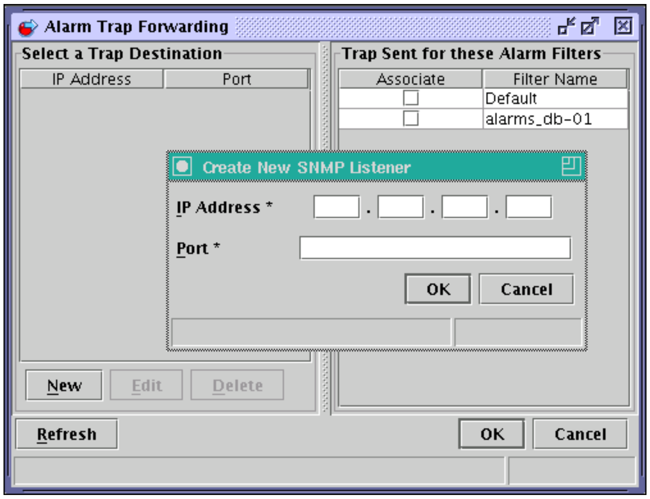
Figure A-8. EMS Alarms submenu


View Alarms
Manage Alarm Filters
Generate Alarm Report
Alarm Summary
Manage Alarm Trap Forwarding
Manage Alarm EMail Notification
Mail Server Configuration
Configure Alarm Purge Interval

Of particular interest are the following operations:

- Viewing related events—From the alarms display (which is shown by choosing **Fault ‰ Alarms ‰ View Alarms** from the EMS Java client menu bar), you can display the list of related events for any single alarm by double-clicking anywhere in the alarm line's text.
- Alarm trap forwarding—You can add, modify, and delete SNMP listeners for alarm traps through the display shown in Figure A-9 (choose **Fault ‰ Alarms ‰ Manage Alarm Trap Forwarding** from the EMS Java client menu bar).

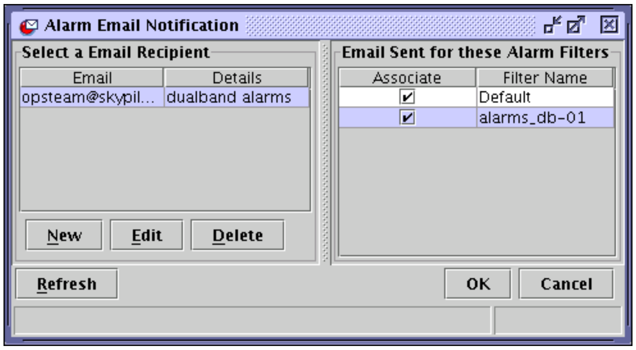
Figure A-9. Adding an SNMP listener for alarm trap forwarding



Associate	Filter Name
□	Default
□	alarms_db-01

- Setting up email notifications—You can configure email notification to automatically send email for selected alarms to selected recipients, by configuring a mail server (choose **Fault ‰ Alarms ‰ Mail Server Configuration** from the EMS menu bar) and managing the email notifications through the display shown in Figure A-10 (choose **Fault ‰ Alarms ‰ Manage Alarm Trap EMail Notification** from the EMS Java client menu bar).

Figure A-10. Alarm EMail Notification display



Select a Email Recipient

Email	Details
opsteam@skypil...	dualband alarms

Email Sent for these Alarm Filters

Associate	Filter Name
☑	Default
☑	alarms_db-01

B

SkyProvision Reference

SkyProvision enables you to configure provisioning parameters for automatically provisioned devices and to perform administrative functions for your SkyPilot network. This appendix provides detailed instructions for using those provisioning and administrative functions through the SkyPilot EMS Java client.

Appendix Highlights

- Using SkyProvision
- SkyPilot EMS Web client
- Searching for provisioning objects
- Configuring domains
- Configuring software images
- Configuring access point profiles
- Configuring node profiles
- Configuring nodes
- Configuring VLANs
- Configuring customers
- Configuring SNMP parameters
- Configuring access control lists
- Configuring QoS
- Configuring Web servers

Using SkyProvision

SkyProvision is a server-based application that automates device provisioning by enabling devices to get their configuration information from the SkyPilot EMS server.

IMPORTANT Although this appendix describes accessing SkyProvision from the EMS Java client, you can also access SkyProvision from the EMS Web client. The two clients provide identical functionality, except that the Web client's node profile functions don't provide a direct **Detail** viewing option. For information about accessing SkyProvision through the EMS Web client, see the next section.

SkyPilot EMS Web Client

The EMS Web client is a Web-based application that is built into the EMS server and can be accessed through a Web browser. This tool provides much the same functionality as the SkyProvision portion of the EMS Java client, with the following benefits:

- Quicker response
- No separate installation steps

The following section describes how to log into the EMS Web client. For detailed information about the provisioning process and device configuration settings and options, refer to the applicable sections of this document.

Logging in to the EMS Web Client

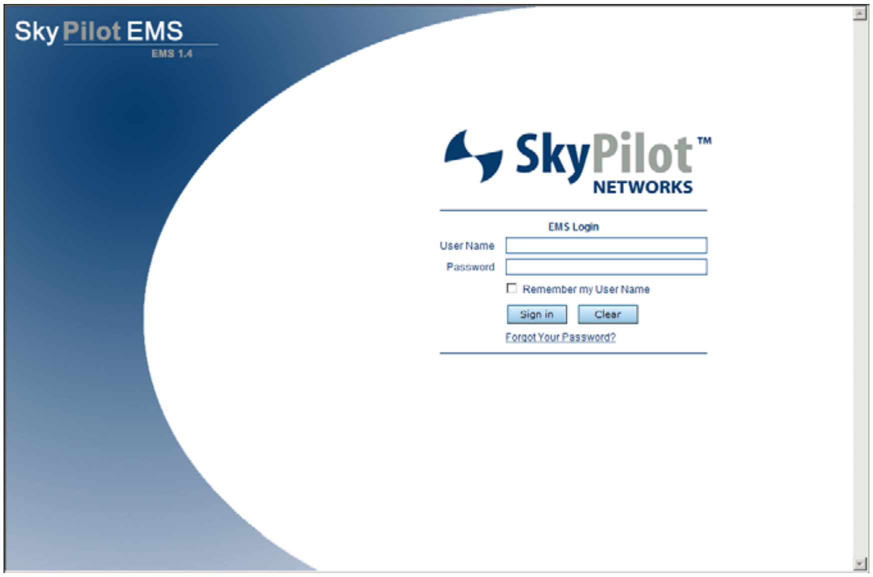
To use the EMS Web client to provision SkyPilot devices, you must be able to access the EMS server via a Web browser. You'll need a user name and password in addition to the EMS server's IP address.

To log in to the EMS Web client:

1 Open a Web browser and enter the URL for the SkyPilot EMS server's client login page: the server's IP address or host name, preceded by `http://` (for example, `http://192.168.1.228`).

The Web client displays a login screen (Figure B-1).

Figure B-1. EMS Web client login screen



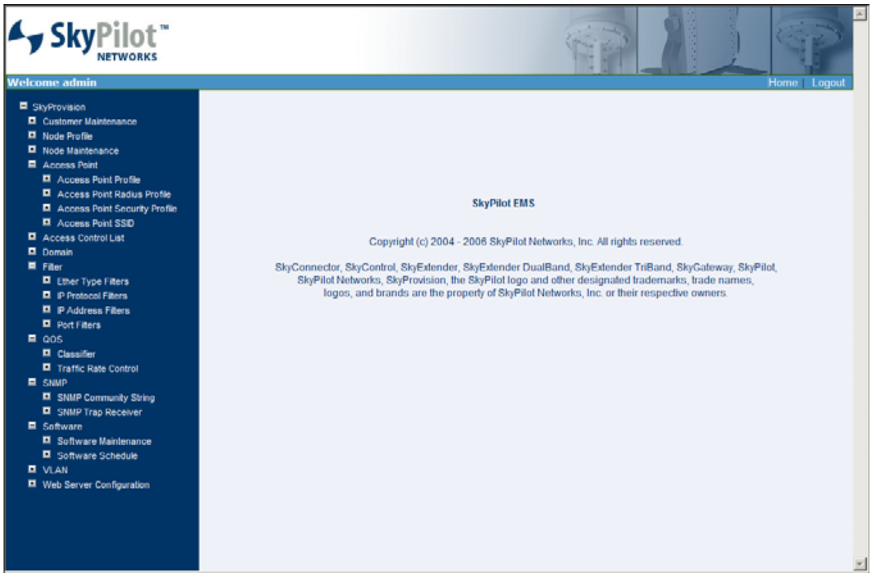
2 Enter the user name and password. The default user name is `admin`, and the default password is also `admin`. Optionally, click **Remember my User Name** to enable this option.

3 Click **Sign in**.

The Web client displays its Welcome screen (Figure B-2). There's also a navigation pane on the left, which contains a Windows Explorer–like hierarchy for navigating around in the Web client.

NOTE After 30 minutes of inactivity, the EMS Web client session expires, at which point you'll need to repeat the login procedure to continue using SkyPilot EMS.

Figure B-2. Welcome screen



SkyPilot EMS

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Starting SkyProvision (Java Client)

If SkyControl is already active, you don't need to start another EMS Java client session; both SkyProvision and SkyControl can be run within a single client session.

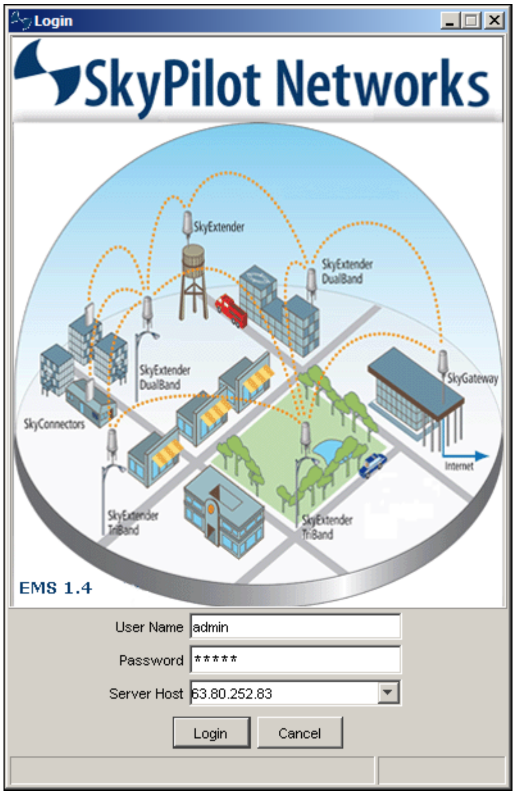
NOTE In addition to the following procedure, you may be able to start the EMS Java client by using the **Start** menu or desktop shortcuts that may have been set up during installation.

To access SkyProvision:

1 Execute the SkyPilot EMS Java client startup script, `SkyPilot\EMS\bin\startemsclient.bat` (for Windows systems) or `/usr/local/skypilot/EMS/bin/startsemsclient.sh` (for Linux systems).

The Login window (Figure B-3) is displayed.

Figure B-3. SkyPilot EMS Java client Login window



User Name admin

Password *****

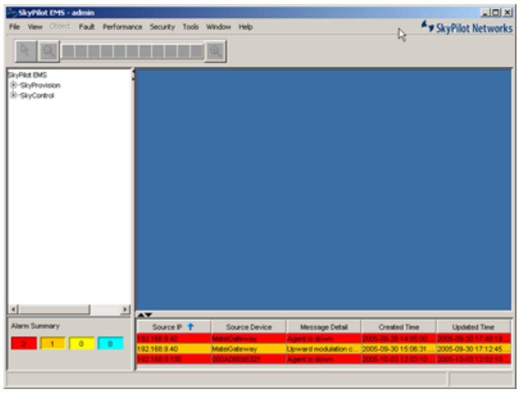
Server Host 63.80.252.83

2 Enter your user name and password. The default user name is `admin`, and the default password is also `admin`.

3 Click **Login**.

The SkyPilot EMS Java client interface is displayed (Figure B-4).

Figure B-4. SkyPilot EMS Java client interface



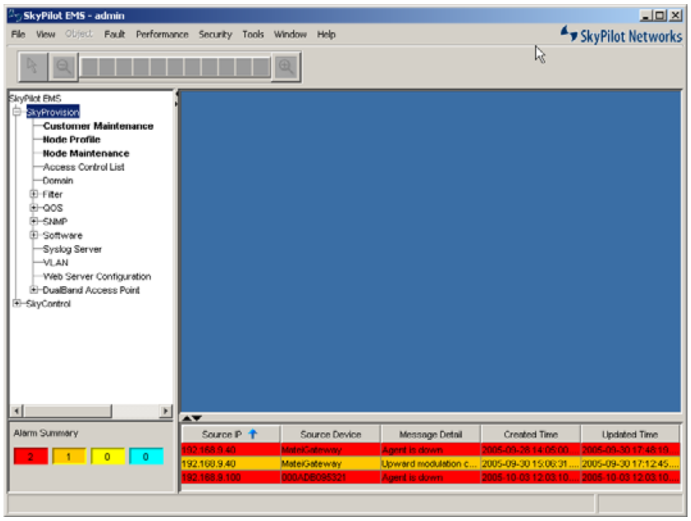
Source IP	Source Device	Message Detail	Created Time	Updated Time
192.168.9.40	MateiGateway	Agent is down	2005-09-28 14:05:00...	2005-09-30 17:48:19...
192.168.9.40	MateiGateway	Upward modulation c...	2005-09-30 15:06:31...	2005-09-30 17:12:45...
192.168.9.100	000ADB095321	Agent is down	2005-10-03 12:03:10...	2005-10-03 12:03:10...

For information about the SkyPilot EMS Java client interface elements, see "The SkyPilot EMS Java Client Interface" on page 104.

4 Click **SkyProvision** in the navigation pane.

The **SkyProvision** item in the navigation pane expands to show the entire set of provisioning functions.

Figure B-5. SkyProvision functions in the navigation pane

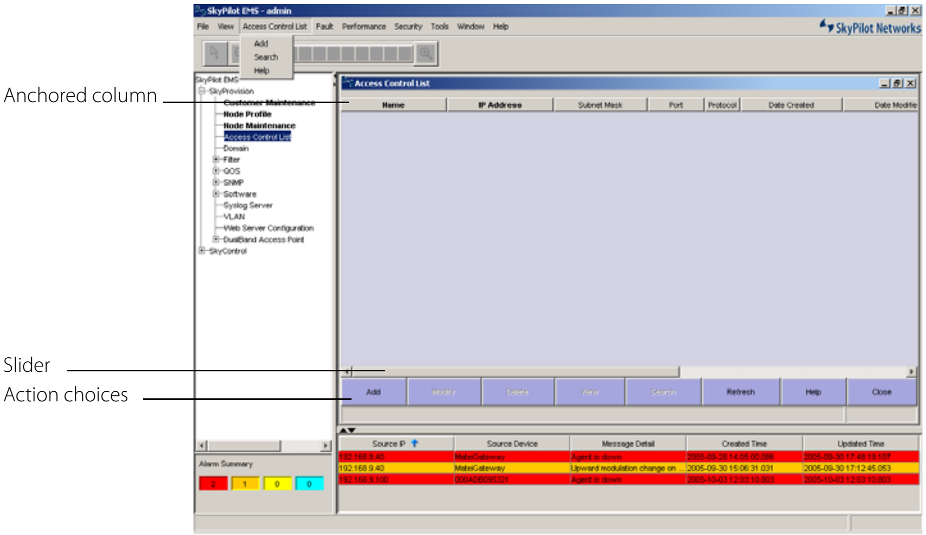


Source IP	Source Device	Message Detail	Created Time	Updated Time
192.168.9.40	MateiGateway	Agent is down	2005-09-28 14:05:00....	2005-09-30 17:48:19....
192.168.9.40	MateiGateway	Upward modulation c...	2005-09-30 15:06:31	2005-09-30 17:12:45....
192.168.9.100	000ADB095321	Agent is down	2005-10-03 12:03:10....	2005-10-03 12:03:10....

SkyProvision Display Pane

Figure B-6 illustrates the SkyProvision display pane.

Figure B-6. SkyProvision display pane



Source IP	Source Device	Message Detail	Created Time	Updated Time
192.168.9.40	MateiGateway	Agent is down	2005-09-28 14:06:00.088	2005-09-30 17:48:19.107
192.168.9.40	MateiGateway	Upward modulation change on ...	2005-09-30 15:06:31.031	2005-09-30 17:12:45.053
192.168.9.100	000ADB095321	Agent is down	2005-10-03 12:03:10.803	2005-10-03 12:03:10.803

The various parts of the interface are as follows:

- **Anchored columns**—Columns that are not resizeable and that do not move when you use the slider or arrows at the bottom of the display. Names of anchored columns are indicated by bold text in the display pane.
- **Slider**—The bar between the arrows just below the display. Use the slider to move the non-anchored columns to the right and left so that you can see all the information.
- **Action buttons**—Context-sensitive buttons, such as **Add**, **Refresh**, **Help**, and **Close**, that let you quickly perform common actions without using the menu commands.

Typical Configuration Operations

There is a pattern to the way configuration operations are performed in SkyProvision and how they're described in the rest of this appendix. This section explains the pattern; subsequent sections discuss the various configuration operations in a concise way that provides any extra information you'll need to know once you've become familiar with the pattern.

Configuring Section

Each main provisioning topic begins with a **Configuring** section that introduces what you'll learn to configure—for example, "Configuring Domains" and "Access Point SkyAccess Profile Elements."

Elements Section

The first subsection within a **Configuring** section is typically an **Elements** section that presents a table listing the elements related to the applicable configuration—for example, "Domain Elements" presenting a table that lists elements such as **Name** for the domain name, **Domain** for the domain ID, and so on. There may be multiple **Elements** sections for closely related items. Alternatively, you may be directed to an **Elements** section located elsewhere in this document.

Operations Section

Next, the **Operations** section uses a concise tabular presentation to show the configuration operations and how to perform them, similar to Table B-1 for domains.

Table B-1. SkyProvision Configuration Operations Example Table

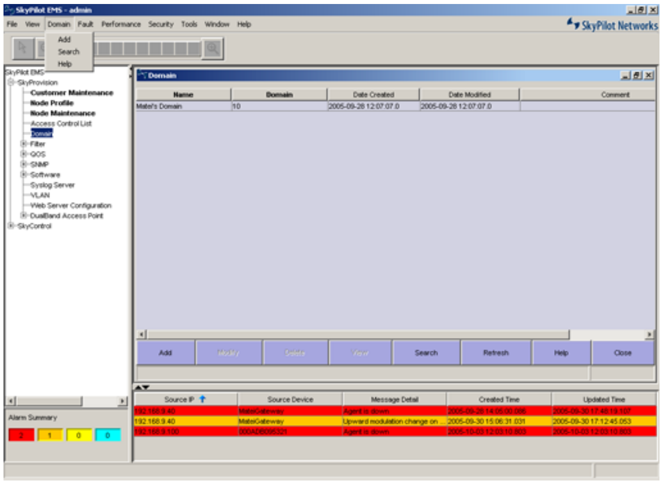
	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Domain** (double-click)
2	Add	Menu bar	**Domain ‰ Add**
	Modify	Display pane	Domain name (right-click) ‰ **Modify**
	Delete	Display pane	Domain name (right-click) ‰ **Delete**

To use one of these tables, first look in the **Operation** column to find the operation you want to perform. If there are any lower-numbered steps, perform their actions first, and then perform the desired operation's actions. For example, if you wanted to modify a domain, you'd perform the action for step 1 in Table B-1 and then the action for the Modify operation in step 2. Spelled out in full, the procedure to modify a domain would be as follows:

1. If the Domain screen is not already showing in the display pane, expand the **SkyProvision** tree in the navigation pane and then double-click **Domain** under it.

   SkyProvision displays the Domain screen (Figure B-7).

Figure B-7. Domain screen



Name	Domain	Date Created	Date Modified	Comment
Matei's Domain	10	2005-09-28 12:07:07.0	2005-09-28 12:07:07.0	

Source IP	Source Device	Message Detail	Created Time	Updated Time
192.168.9.40	MateiGateway	Agent is down	2005-09-28 14:05:00.086	2005-09-30 17:48:19.107
192.168.9.40	MateiGateway	Upward modulation change on ...	2005-09-30 15:06:31.031	2005-09-30 17:12:45.053
192.168.9.100	000ADB095321	Agent is down	2005-10-03 12:03:10.803	2005-10-03 12:03:10.803

2 In the display pane, right-click the name of the domain you want to modify and choose **Modify**.

3 Edit the domain elements.

4 Click **OK**.

You can see from Table B-1 that the actions you'd take to delete a domain would be very similar to those in the procedure just described, as would the actions for adding a domain (though in that case you'd use the menu bar instead of the navigation pane).

Note that where a configuration procedure includes choosing a command from a menu, you may be able to do so not only with the mouse but also with a keyboard shortcut, with an action choice button below the display area of the display pane, or from the navigation pane by double-clicking the desired item in the expanded **SkyProvision** tree and selecting an item from the resulting screen in the display pane.

Regardless of what you're configuring, the operations will follow a similar pattern to what's shown in Table B-1, and where there are variations the table will use the same notational conventions as in Table B-1.

Searching for Provisioning Objects

You can search any set of provisioning records for an existing configuration item such as a device or profile, which can be helpful if you have many records of a particular type. For example, your network may have hundreds of nodes, and finding the one you want to modify in the display pane may be difficult; but if you know any of the node's element values, such as its name, node type, or frequency, you can use the search function to find just those nodes that match your search criteria.

To search for provisioning objects:

1. Expand the **SkyProvision** tree, expand the object tree if necessary, right-click the desired object, and choose **Search**.
2. Select how you want to match items: **any** or **all**.
3. From the left pull-down menu, select the element to search for, and from the right pull-down menu, select the search criterion; then enter your search text.
4. Optionally, click **More Rules** and enter an additional set of search fields.
5. Click **Search**.

   The results are displayed.

Configuring Domains

A single domain can be defined to encompass your entire SkyPilot network, including all its nodes. Or domains can be used to segregate a network into two or more smaller networks, each of which has the same characteristics as a larger SkyPilot network. For more information about domains, see "Domains" on page 19.

Domain Elements

Table B-2 lists the elements that describe domains.

Table B-2. Domain Elements

Element	Description
Name	Name of the domain (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Domain #	Identification number from 1 to 10000 used by all nodes within a given domain.
Date Created	(Read-only) Date and time this domain record was created.
Date Modified	(Read-only) Date and time this domain record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Domain Operations

Table B-3 lists the operations you can perform to configure domains.

Table B-3. Domain Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Domain** (double-click)
2	Add	Menu bar	**Domain ‰ Add**
	Modify	Display pane	Domain name (right-click) ‰ **Modify**
	Delete	Display pane	Domain name (right-click) ‰ **Delete**

Configuring Software Images

SkyProvision allows you to manage software updates on your SkyPilot devices. (For information about software images, see “Managing Software Images” on page 64.)

Software Image Operations

Table B-4 lists the operations you can perform to configure software images.

Table B-4. Software Image Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Software ‰ Software Maintenance** (double-click)
2	Add	Menu bar	**Software Maintenance ‰ Add**
	Modify [†]	Display pane	Software image name (right-click) ‰ **Modify**
	Delete	Display pane	Software image name (right-click) ‰ **Delete**

[†] The only element you can modify is the comment.

Software Schedule Operations

Table B-5 lists the operations you can perform to configure software schedules.

Table B-5. Software Schedule Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Software ‰ Software Schedule** (double-click)
2	Add	Menu bar	**Software Schedule ‰ Add**
	Modify	Display pane	Software schedule name (right-click) ‰ **Modify**
	Delete	Display pane	Software schedule name (right-click) ‰ **Delete**

Configuring Access Point Profiles

Access point profiles are used to save settings that define a SkyExtender DualBand/TriBand access point and that can be applied to multiple generic, DualBand, and TriBand node profiles. Access point profiles are composed of the following profiles: access point SkyAccess, access point security, access point Radius (for protected networks), access point SSID, Wi-Fi multimedia AP, and Wi-Fi multimedia STA.

For general access point information, see “Access Points” on page 37.

Access Point Security Profile Operations

Table B-6 lists the operations you can perform to configure access point security profiles.

Table B-6. Access Point Security Profile Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Access Point ‰ Access Point Security Profile** (double-click)
2	Add	Menu bar	**Access Point Security Profile ‰ Add**
	Modify	Display pane	Profile name (right-click) ‰ **Modify**
	Delete	Display pane	Profile name (right-click) ‰ **Delete**

For element information, see “Access Point Security Profiles” on page 39.

Access Point Radius Profile Operations

Table B-7 lists the operations you can perform to configure access point Radius profiles.

Table B-7. Access Point Radius Profile Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Access Point ‰ Access Point Radius Profile** (double-click)
2	Add	Menu bar	**Access Point Radius Profile ‰ Add**
	Modify	Display pane	Profile name (right-click) ‰ **Modify**
	Delete	Display pane	Profile name (right-click) ‰ **Delete**

For element information, see See “Access Point Radius Server Profiles” on page 40.

Access Point SSID Profile Operations

Table B-8 lists the operations you can perform to configure access point SSID profiles.

Table B-8. Access Point SSID Profile Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Access Point ‰ Access Point SSID Profile** (double-click)
2	Add	Menu bar	**Access Point SSID Profile ‰ Add**
	Modify	Display pane	Profile name (right-click) ‰ **Modify**
	Delete	Display pane	Profile name (right-click) ‰ **Delete**

For element information, see See “Access Point SSID Profiles” on page 42.

Access Point Profile Operations

Table B-9 lists the operations you can perform to configure access point profiles.

Table B-9. Access Point Profile Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Access Point ‰ Access Point Profile** (double-click)
2	Add	Menu bar	**Access Point Profile ‰ Add**
	Modify	Display pane	Access point node profile name (right-click) ‰ **Modify**
	Associate attributes	Display pane	Click access point profile name; click **Attributes**; click desired attribute tabs and **Apply** access point profile attribute elements
	Delete	Display pane	Access point profile name (right-click) ‰ **Delete**

Access Point Profile Elements

Table B-10 lists the elements that describe access point profiles.

Table B-10. Access Point Profiles (Page 1 of 2)

Element	Description
Name	Name of the access point profile (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Software	Name of the software image to store in the node's memory and to use as its active running software; selected from a provided list. If the selected image is different from what is currently stored in the node's backup partition, the node will automatically download the selected image, overwriting what is currently in the backup flash partition.
Frequency Band	Frequency of antenna attached to this access point; selected from provided list. This setting limits the available **Channel** options.

Table B-10. Access Point Profiles (Page 2 of 2)

Element	Description
Channel	Radio frequency channel for access point operation; selected from a provided list. In the US, 11 channels are available, but only three of them do not overlap: 1, 6, and 11. Set the channel to one of the three nonoverlapping channels unless you plan to implement special channel reuse patterns.
Radio Policy	Type of clients with which the access point communicates: mix of 802.11b/g or 802.11b only. Typically, you'll want the 802.11b/g mix.
Dual Antenna Diversity	(Available only if 2.4 is selected for **Frequency Band**) Enables or disables antenna diversity (which allows the access point's radio driver to select the antenna with the best signal reception).
Transmit Power	Access point's transmit power, selected from a provided list.
Access Point Radius Profile	(Optional) Access point Radius profile to be used by nodes that are assigned this access point profile.
Access Point Security Profile	Access point security profile to be used by nodes that are assigned this access point profile.
Date Created	(Read-only) Date and time this access point profile record was created.
Date Modified	(Read-only) Date and time this access point profile record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Access Point Profile Attribute Elements

Table B-11 lists the elements that describe access point profile attributes. These elements enable you to associate preconfigured options, such as WLANs, with existing access point profiles.

Table B-11. Access Point Profile Attribute Elements

Element	Refer to
WLAN SSID	"Access Point SSID Profiles" on page 42
SNMP	"Configuring SNMP Parameters" on page 146

Access Point SkyAccess Profile Operations

Table B-9 lists the operations you can perform to configure access point profiles for SkyAccess DualBands.

Table B-12. Access Point SkyAccess Profile Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Access Point ‰ Access Point SkyAccess Profile** (double-click)
2	Add	Menu bar	**Access Point SkyAccess Profile ‰ Add**
	Modify	Display pane	Access point node profile name (right-click) ‰ **Modify**
	Associate attributes	Display pane	Click access point profile name; click **Attributes**; click desired attribute tabs and **Apply** access point profile attribute elements
	Delete	Display pane	Access point profile name (right-click) ‰ **Delete**

Access Point SkyAccess Profile Elements

Table B-10 lists the elements that describe access point SkyAccess profiles.

Table B-13. Access Point SkyAccess Profiles (Page 1 of 2)

Element	Description
Name	Name of the access point SkyAccess profile (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Radio Policy	Type of clients with which the access point communicates: 802.11b, 802.11g, or a mix of 802.11b/g. Typically, you'll want the 802.11b/g mix.
Auto Channel Selection	Enable of disable automatic selection of a radio frequency channel.
Frequency	Frequency of antenna attached to this access point; selected from provided list. This setting limits the available **Channel** options.
Channel	Radio frequency channel for access point operation; selected from a provided list. In the US, 11 channels are available, but only three of them do not overlap: 1, 6, and 11. Set the channel to one of the three nonoverlapping channels unless you plan to implement special channel reuse patterns.
Transmit Power	Access point's transmit power, selected from a provided list.
Max data rate	Rate of data transfer allowed for SkyAccess DualBand access point.
Beacon interval	Interval (ins seconds) at which the SkyAccess DualBand access point announces itself to the network.
WMM Status	Enables or disables status checking for Wi-Fi multimedia transfer.
WMM AP Profile	A profile for access point Quality of Service; selected from a provided list.
WMM STA Profile	A profile for wireless client Quality of Service; selected from a provided list.

Table B-13. Access Point SkyAccess Profiles (Page 2 of 2)

Element	Description
Peer-to-peer	Enable or disable peer-to-peer communications through the access point.
Management from Wireless Clients	Enable or disable management of SkyAccess DualBand access point from a wireless client.
Radius Profile	(Optional) Radius profile to be used by nodes that are assigned this access point profile.
Date Created	(Read-only) Date and time this access point profile record was created.
Date Modified	(Read-only) Date and time this access point profile record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Configuring Node Profiles

Node profiles are used to save settings that define a SkyPilot network node and that can be applied to multiple nodes. Using node profiles simplifies the process of configuring nodes and making subsequent changes. For example, you could create a node profile named Orangevale that contains settings common to all SkyConnectors in the Orangevale neighborhood. Then whenever you have a new SkyConnector to configure for someone living in Orangevale, you can simply assign the Orangevale profile to the new SkyConnector network node. And to make the same change to all those SkyConnector nodes, you’d need to make the change only once, to the Orangevale node profile.

When you configure a node profile, you specify the device type to which the profile can be applied: generic or a specific SkyPilot device. A generic node profile enables you to configure all possible node profile elements. Specific node types enable you to configure just those elements that apply to that device.

Node Profile Elements

Table B-14 lists the elements that describe node profiles. (The elements apply to all nodes using the given node profile).

Table B-14. Node Profile Elements (Page 1 of 4)

Element	Description
Name	Name of the node profile (unique among all such names), as a string of up to 128 alphanumeric characters. This name is not used by SkyProvision or SkyControl; it is for administrator reference only.
Node Type	(Default = **Generic**) Type of SkyPilot device to which this node profile can be applied; selected from a provided list.
Primary Software	Name of the software image to store in the node’s memory and to use as its active running software; selected from a provided list. If the selected image is different from what is currently stored in the node’s backup partition, the node will automatically download the selected image, overwriting what is currently in the backup flash partition.
Backup Software	Name of the software image to store in the node’s backup partition; selected from a provided list. For information about when and how nodes update the software in their active partition, see “Managing Software Images” on page 64.
Traffic Rate Control	Traffic rate control profile, if any, to apply to the node. In the absence of a traffic rate control, there will be no restriction on the maximum throughput. For more information about traffic rate controls, see “Quality of Service (QoS)” on page 27.
Domain	Name of the domain to which the node will belong; selected from a provided list. See “Domains” on page 19.
Timezone	Time zone setting for the node. See “Time Zones” on page 26.
Frequency Region	Identification of a range of frequencies, largely based on the geographic region in which the device will operate.
Frequency	Primary frequency at which the node will communicate over the network.

Table B-14. Node Profile Elements (Page 2 of 4)

Element	Description
Frequency Dwell Time	(Optional) Length of time, from 1 to 30 minutes, that the device will search for a signal on the primary frequency.
Access Point 2.4 GHz	(Available only if **Generic**, **SkyExtender DualBand**, or **SkyExtender TriBand** is selected as the **Node Type**) Access point profile containing settings to apply to this node's 2.4 GHz access point; selected from a provided list. (From the EMS Java client, you can click **Detail** to view the configuration settings for the selected access point profile.) For detailed information about using access point profiles, see "Configuring Access Point Profiles" on page 127.
Access Point 4.9 GHz	(Available only if **Generic** or **SkyExtender TriBand** is selected as the **Node Type**) Access point profile containing settings to apply to this node's 4.9 GHz access point; selected from a provided list. (From the EMS Java client, you can click **Detail** to view the configuration settings for the selected access point profile.) For detailed information about using access point profiles, see "Configuring Access Point Profiles" on page 127.
Ethernet	(Default = **Enabled**) Enables or disables the node's 10/100bT Ethernet interface. See "Ethernet Interface" on page 22.
SNMP	(Default = **Read-Write**) Type of community string for the node. See "Configuring SNMP Parameters" on page 146.
Password	(Optional) Password for Telnet session access to the node. Free-form text of up to 32 alphanumeric characters. In the absence of a password, the default password, `public`, will apply.
Telnet Timeout	Number of minutes a Telnet or `ssh` session stays connected without activity, or 0 to never time out
Filter	(Default = **Disabled**) Enables or disables the node's filtering. When **Disabled** is selected, the corresponding filter-related node profile fields are also disabled (dimmed). See "Filtering" on page 31.
EtherType Filter	Setting to allow or deny the node's EtherType filtering. When **Allow** is selected, any EtherType filters currently defined will be applied. See "Filtering" on page 31.

Table B-14. Node Profile Elements (Page 3 of 4)

Element	Description
IP Protocol Filter	Default setting (applied when there are no explicit filters matched) to allow or deny the node's IP protocol filtering. See "Filtering" on page 31.
IP Address Destination	Default setting (applied when there are no explicit filters matched) to allow or deny the node's IP destination address filtering. See "Filtering" on page 31.
IP Address Source	Default setting (applied when there are no explicit filters matched) to allow or deny the node's IP source address filtering. See "Filtering" on page 31.
Port Destination	Default setting (applied when there are no explicit filters matched) to allow or deny the node's port destination filtering. See "Filtering" on page 31.
Port Source	Default setting (applied when there are no explicit filters matched) to allow or deny the node's port source filtering. See "Filtering" on page 31.
ARP Source	Setting to allow or deny the node's ARP (Address Resolution Protocol).
Power Mode	(Optional) Transmit power level. Available modes are based on where the device will operate.
Radar Detection	(Optional. Default depends on the geographic region for which this device is manufactured: default for EU devices = **Enable-shutdown**; default for all other devices = **Disable**) Setting for the node's radar transmission detection and subsequent operation. See "Radar Detection" on page 23.
Buzzer Time	(Recent SkyConnectors only; optional) Number of seconds from 0 to 3600 that the buzzer sounds after the device starts up.
Web Server Configuration	Web server profile to apply to this node profile. See "Configuring Web Servers" on page 151.
Lease Time	(Optional) Number of minutes from 30 to 259200 that the device's waits before checking for configuration updates. If not set, the device will never check for configuration updates while the link is active.

Table B-14. Node Profile Elements (Page 4 of 4)

Element	Description
Date Created	(Read-only) Date and time this node profile record was created.
Date Modified	(Read-only) Date and time this node profile record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Node Profile Attribute Elements

Table B-15 lists the elements that describe node profile attributes. These elements enable you to associate a variety of preconfigured options, such as QoS classifiers, with existing node profiles.

Table B-15. Node Profile Attribute Elements

Element	Refer to
ACL	"Configuring Access Control Lists" on page 149
Classifier	"Quality of Service (QoS)" on page 27
Filters	"Filtering" on page 31
Frequency	"Frequency" on page 18
SNMP	"Configuring SNMP Parameters" on page 146
VLAN	"Configuring VLANs" on page 141
Proxy Proxy ARP	"Configuring Proxy Proxy ARP" on page 142

Node Profile Operations

Table B-16 lists the operations you can perform to configure node profiles.

Table B-16. Node Profile Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Node Profile** (double-click)
2	Add	Menu bar	**Node Profile ‰ Add**
	Modify	Display pane	Node profile name (right-click) ‰ **Modify**
	Associate attributes	Display pane	Click node profile name; click **Attributes**; click desired attribute tabs and **Apply** node profile attribute elements
	Delete	Display pane	Node profile name (right-click) ‰ **Delete**

Configuring Nodes

A SkyPilot network *node* is any SkyPilot device on the mesh network—SkyGateways, SkyExtenders, and SkyConnectors (both indoor and outdoor).

Node Elements

Table B-17 lists the elements that describe node records.

Table B-17. Node Elements (Page 1 of 3)

Element	Description
MAC Address	Unique 12-character hexadecimal hardware address for this node.
Node Type	(Default = **SkyConnector Indoor**) Type of SkyPilot device that constitutes this node; selected from a provided list.

Table B-17. Node Elements (Page 2 of 3)

Element	Description
Antenna Sectors	(SkyGateways only) Click the checkboxes to select or deselect antenna sectors for activation.
Host Name	(Optional) Unique free-form text of up to 32 alphanumeric characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.
IP Address	(Optional except for SkyGateways) IP address (including mask settings) that enables SkyControl to poll the node; up to 12 digits in dotted notation. In the absence of a setting for this element, SkyControl will poll the SkyGateways, which maintain records of every connected device's IP address. For more information about SkyControl polling, see "Viewing Your SkyPilot Network" on page 182.
Preferred Parent MAC Address	(Non-SkyGateway only) MAC address of a SkyGateway, SkyExtender, DualBand, or TriBand to use as the parent, even if it doesn't provide the best path.
Preferred Parent Host Name	(Read-only; non-SkyGateway only) Host name of a SkyGateway, SkyExtender, DualBand, or TriBand to use as the parent, even if it doesn't provide the best path.
Node Profile	Node profile containing settings to apply to this node; selected from a provided list. (From the EMS Java client, you can click **Detail** to view the configuration settings for the selected node profile). For detailed information about using node profiles, see "Access Point SkyAccess Profile Elements" on page 132.
Address 1	(Optional) Address information (such as street address) specifying where the node is physically located (for example, a user's home address where a SkyConnector outdoor device is mounted); free-form text of up to 255 alphanumeric characters.
Address 2	(Optional) Additional address information indicating where the device is physically located; free-form text of up to 255 alphanumeric characters.
City	(Optional) City where the device is physically located; free-form text of up to 128 alphanumeric characters.

Table B-17. Node Elements (Page 3 of 3)

Element	Description
State	(Optional) State or province where the device is physically located; free-form text of up to 64 alphanumeric characters.
Postal Code	(Optional) Postal code of where the device is physically located; up to 10 digits.
Country	(Optional) Country where the device is physically located; selected from a provided list.
Customer	(Optional) Customer associated with the device; selected from a provided list. (From the EMS Java client, you can click **Detail** to view the complete customer record for the selected customer.) For detailed information about using customer profiles, see "Configuring Proxy Proxy ARP" on page 142.
Date Created	(EMS Java client only; read-only) Date and time this node record was created.
Date Modified	(EMS Java client only; read-only) Date and time this node record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Node Operations

Table B-18 lists the operations you can perform to configure nodes.

Table B-18. Node Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Node Maintenance** (double-click)
2	Add	Menu bar	**Node Maintenance ‰ Add**
	Modify	Display pane	Node name (right-click) ‰ **Modify**
	Delete	Display pane	Node name (right-click) ‰ **Delete**

Configuring VLANs

Virtual local area networks (VLANs) are portions of a network that are configured as logical topologies defined by software, connected to the same physical network infrastructure. Devices on separate VLANs of a network behave as if they are on physically separated networks. VLANs function by logically segmenting the network into different broadcast domains so that packets are switched only between ports that are designated for the same VLAN. For more information, see "Virtual Local Area Networks (VLANs)" on page 20.

VLAN Elements

Table B-19 lists the elements that describe VLANs.

Table B-19. VLAN Elements

Element	Description
Name	Name of the VLAN (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
VLAN Tag	Number from 1 to 4096 used as the VLAN tag for all nodes within the given VLAN.
Date Created	(Read-only) Date and time this VLAN record was created.
Date Modified	(Read-only) Date and time this VLAN record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

VLAN Operations

Table B-20 lists the operations you can perform to configure VLANs.

Table B-20. VLAN Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ VLAN** (double-click)
2	Add	Menu bar	**VLAN ‰ Add**
	Modify	Display pane	VLAN name (right-click) ‰ **Modify**
	Delete	Display pane	VLAN name (right-click) ‰ **Delete**

Configuring Proxy Proxy ARP

Proxy Proxy ARP is a routing technique that uses the ARP protocol as an ad hoc mechanism. A multi-port networking device (for example, a router) implementing this protocol can respond to ARP requests on an interface, allowing the device to receive and forward packets addressed to the other devices. On a SkyPilot network, a Proxy Proxy ARP works with a VLAN to

Proxy Proxy ARP Elements

Table B-19 lists the elements that describe Proxy Proxy ARP Settings.

Table B-21. Proxy Proxy ARP Elements (Page 1 of 2)

Element	Description
Name	Name of the Proxy Proxy ARP (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
VLAN Name	Name of the VLAN (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Router IP Address	IP address of the router that will forward addresses.

Table B-21. Proxy Proxy ARP Elements (Page 2 of 2)

Element	Description
Subnet Mask	Used in conjunction with the network address to determine which part of the address is the network address and which part is the host address.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Proxy Proxy ARP Operations

Table B-22 lists the operations you can perform to configure Proxy Proxy ARP.

Table B-22. Proxy Proxy ARP Setting Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Proxy Proxy ARP Setting** (double-click)
2	Add	Menu bar	**Proxy Proxy ARP Setting ‰ New**
	Edit	Display pane	Proxy Proxy ARP name (right-click) ‰ **Modify**
	Delete	Display pane	Proxy Proxy ARP name (right-click) ‰ **Delete**

Proxy Proxy ARP Exclusion Elements

Table B-23 lists the elements that describe Proxy Proxy ARP Exclusion settings.

Table B-23. Proxy Proxy ARP Exclusion Elements (Page 1 of 2)

Element	Description
Proxy Proxy ARP ID	A unique ID number assigned to the Proxy Proxy ARP.
Name	Name of the Proxy Proxy ARP Exclusion (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.

Table B-23. Proxy Proxy ARP Exclusion Elements (Page 2 of 2)

Element	Description
Proxy Proxy ARP Setting	Name of the Proxy Proxy ARP (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
IP Address	IP address of the router that will forward addresses.
Subnet Mask	Used in conjunction with the network address to determine which part of the address is the network address and which part is the host address.
Date Created	(Read-only) Date and time this Proxy Proxy ARP Exclusion record was created.
Date Modified	(Read-only) Date and time this Proxy Proxy ARP Exclusion record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Proxy Proxy ARP Exclusion Operations

Table B-20 lists the operations you can perform to configure Proxy Proxy ARP.

Table B-24. Proxy Proxy ARP Exclusion Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Proxy Proxy ARP Exclusion** (double-click)
2	Add	Menu bar	**Proxy Proxy ARP Exclusion ‰ New**
	Edit	Display pane	Proxy Proxy ARP Exclusion name (right-click) ‰ **Modify**
	Delete	Display pane	Proxy Proxy ARP Exclusion name (right-click) ‰ **Delete**

Configuring Customers

SkyProvision allows you to manage customer records in your SkyPilot network database. (For information about customers, see “Managing Customers” on page 67.)

Customer Profile Elements

Table B-25 lists the elements that describe customer profiles.

Table B-25. Customer Profile Elements (Page 1 of 2)

Element	Description
First Name	Free-form text of up to 64 alphanumeric characters.
Last Name	Free-form text of up to 64 alphanumeric characters.
Address 1	Free-form text of up to 255 alphanumeric characters.
Address 2	(Optional) Free-form text of up to 255 alphanumeric characters.
City	Free-form text of up to 255 alphanumeric characters.
State/Province	Free-form text of up to 255 alphanumeric characters.
Postal Code	Free-form text of up to 255 alphanumeric characters.
Country	Selected from a provided list.
Day Phone	(Optional) Free-form text of up to 255 alphanumeric characters.
Evening Phone	(Optional) Free-form text of up to 255 alphanumeric characters.
Email	(Optional) Free-form text of up to 255 alphanumeric characters.

Table B-25. Customer Profile Elements (Page 2 of 2)

Element	Description
Date Created	(Read-only) Date and time this customer profile record was created.
Date Modified	(Read-only) Date and time this customer profile record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Customer Profile Operations

Table B-3 lists the operations you can perform to configure customer profiles.

Table B-26. Customer Profile Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Customer Maintenance** (double-click)
2	Add	Menu bar	**Customer Maintenance ‰ Add**
	Modify	Display pane	Profile name (right-click) ‰ **Modify**
	Delete	Display pane	Profile name (right-click) ‰ **Delete**

Configuring SNMP Parameters

To enable SNMP trap alarms and SkyControl monitoring of devices, you must first configure corresponding SNMP parameters—SNMP community strings and SNMP trap receivers.

Related topics include:

- For general information about SNMP, “SNMP” on page 25
- For general information about SkyControl, “Monitoring a Network’s Topology with SkyControl” on page 74

- For information about customizing SNMP trap descriptions, messages, and associated alarm severity, “Configuring Traps” on page 109
- For information about customizing SkyControl SNMP queries, “Configuring SkyControl’s SNMP Queries” on page 185

SNMP Community String Elements

Table B-27 lists the elements that describe SNMP community strings.

Table B-27. SNMP Community String Elements

Element	Description
Name	Name of the SNMP community string (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Community String	Identifier that allows access through an SNMP agent to a device’s MIB objects. Free-form text of up to 128 alphanumeric characters.
Type	(Default = **Read-Only**) Specifies type of access allowed by this community string: ● **Read-Only**—MIB object can be read but not modified. ● **Read-Write**—MIB object can be read and modified.
Date Created	(Read-only) Date and time this community string record was created.
Date Modified	(Read-only) Date and time this community string record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

SNMP Trap Receiver Elements

Table B-28 lists the elements that describe SNMP trap receivers.

Table B-28. SNMP Trap Receiver Elements

Element	Description
Name	Name of the SNMP trap receiver (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
IP Address	IP address to which any node using this trap receiver will send SNMP traps; up to 12 digits in dotted notation. The combination of IP address and port (below) must be unique (to SNMP trap receivers).
Port	(Default = **162**) Port to which any node using this trap receiver will send SNMP traps; number from 1 to 65535. The combination of IP address and port must be unique (to SNMP trap receivers).
Date Created	(Read-only) Date and time this trap receiver record was created.
Date Modified	(Read-only) Date and time this trap receiver record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

SNMP Operations

Table B-29 lists the operations you can perform to configure SNMP parameters.

Table B-29. SNMP Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ SNMP ‰ SNMP Community String** (double-click) or **SkyProvision ‰ SNMP ‰ SNMP Trap Receiver** (double-click)
2	Add	Menu bar	**SNMP Community String ‰ Add** or **SNMP Trap Receiver ‰ Add**
	Modify	Display pane	Parameter name (right-click) ‰ **Modify**
	Delete	Display pane	Parameter name (right-click) ‰ **Delete**

Configuring Access Control Lists

SkyProvision allows you to manage ACL records in your SkyPilot network database. (For information about ACLs, see "Managing Access Control Lists" on page 68.)

ACL Operations

Table B-30 lists the operations you can perform to configure ACLs.

Table B-30. ACL Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Access Control List** (double-click)
2	Add	Menu bar	**Access Control List ‰ Add**
	Modify	Display pane	ACL name (right-click) ‰ **Modify**
	Delete	Display pane	ACL name (right-click) ‰ **Delete**

Configuring QoS

QoS classifiers (which classify traffic according to the types of packets that will be directed to a subscriber's high-priority queue) and traffic filters (which control user data packet transfer through a SkyPilot network) contribute to maintaining high QoS. (For more information, see "Quality of Service (QoS)" on page 27.)

QoS Classifier Operations

Table B-31 lists the operations you can perform to configure QoS classifiers.

Table B-31. QoS Classifier Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ QOS ‰ Classifier** (double-click)
2	Add	Menu bar	**Classifier ‰ Add**
	Modify	Display pane	Classifier name (right-click) ‰ **Modify**
	Delete	Display pane	Classifier name (right-click) ‰ **Delete**

Traffic Filter Operations

Table B-32 lists the operations you can perform to configure traffic filters.

Table B-32. Traffic Filter Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Filter**, then double-click desired filter type (**EtherType Filter**, **IP Protocol Filter**, **IP Address Filter**, or **Port Filter**)
2	Add	Menu bar	From menu corresponding to desired filter type, choose **Add**.
	Modify	Display pane	Filter name (right-click) ‰ **Modify**
	Delete	Display pane	Filter name (right-click) ‰ **Delete**

Configuring Web Servers

SkyProvision allows you to configure the Web server settings on your SkyPilot devices.

Web Server Elements

Table B-33 lists the elements that describe Web servers.

Table B-33. Web Server Elements

Element	Description
Name	Name of the Web server (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyProvision.
Status	Enables or disables access to the Web server on the SkyPilot device.
Customer Access	Enables or disables view-only (non-administrator) access to the device's Web interface.
Administrator Password	Password for logging in to the Web server.
Date Created	(Read-only) Date and time this Web server record was created.
Date Modified	(Read-only) Date and time this Web server record was last modified.
Comment	(Optional) Free-form text of up to 255 characters. This is not used by SkyProvision or SkyControl; it is for administrator reference only.

Web Server Operations

Table B-34 lists the operations you can perform to configure Web servers.

Table B-34. Web Server Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyProvision ‰ Web Server** (double-click)
2	Add	Menu bar	**Add**
	Modify	Display pane	Web server name (right-click) ‰ **Modify**
	Delete	Display pane	Web server name (right-click) ‰ **Delete**

C

Google Earth EMS Reference

SkyPilot EMS now supports views of your SkyPilot Network in Google Earth through Google Earth EMS.

With Google Earth, you can visualize that physical layout of your networks and plan future expansion on the basis of real-world representations.

This appendix provides instructions for using Google Earth EMS to define network profiles for viewing in Google Earth.

Appendix Highlights

- Starting Google Earth EMS
- Downloading icons
- Changing views and creating profiles
- Submitting profiles to Google Earth

Starting Google Earth EMS

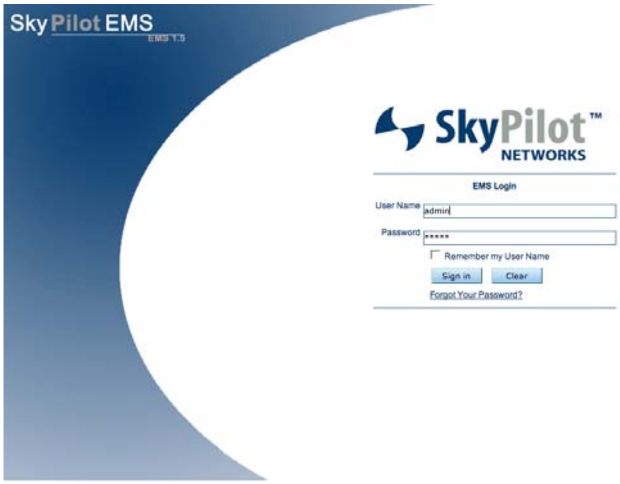
The Google Earth component is automatically included as part of your SkyPilot EMS server software installation.

To start Google Earth EMS:

1 Open a Web browser and enter the URL for the SkyPilot EMS server login page: the server's IP address or host name, preceded by `http://` (for example, `http://192.168.1.228`).

The Web client displays a login screen.

Figure C-1. EMS Web client login screen



EMS Login

User Name admin

Password *****

2 Enter the user name and password. Both the default user name and the default password are `admin`.

3 Click **Sign in**.

The Web client displays its Welcome screen.

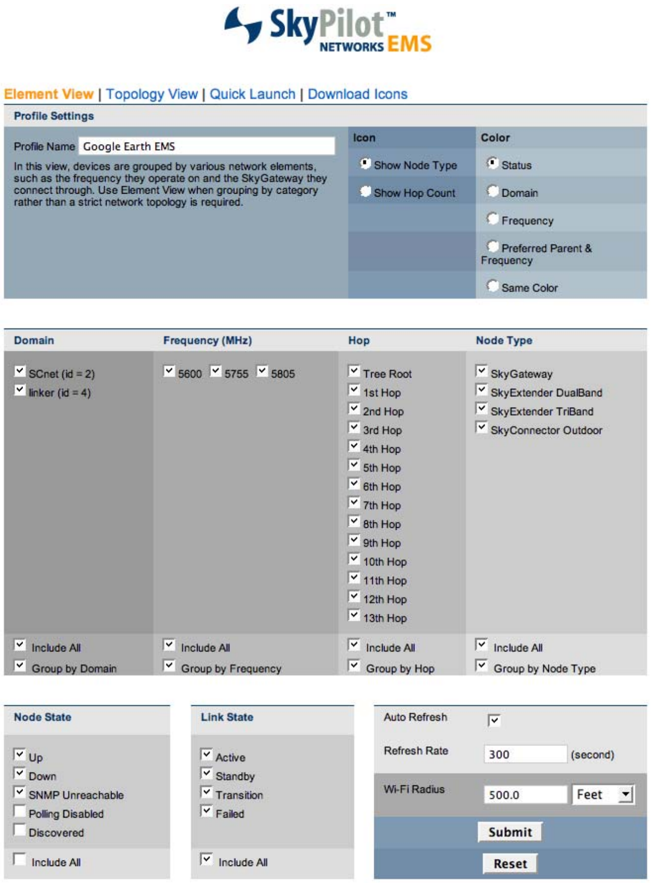
On the left, you'll see a navigation pane displaying a hierarchical menu tree for navigating two EMS applications, SkyProvision and Google Earth

4 Click **Google Earth** to display the GEMS Launchpad.

5 Click **GEMS Launchpad** to display the Google Earth EMS: Element View.

Your starting point for Google Earth EMS, the Element view is where you specify how nodes and node information will be displayed in Google Earth.

Figure C-2. Google Earth EMS: Element View


SkyPilot™ NETWORKS EMS
Element View | Topology View | Quick Launch | Download Icons
Submit
Reset

Profile Settings

Profile Name: Google Earth EMS

In this view, devices are grouped by various network elements, such as the frequency they operate on and the SkyGateway they connect through. Use Element View when grouping by category rather than a strict network topology is required.

Icon

● Show Node Type
○ Show Hop Count

Color

● Status
○ Domain
○ Frequency
○ Preferred Parent & Frequency
○ Same Color

Domain

☑ SCnet (id = 2)
☑ linker (id = 4)
☑ Include All
☑ Group by Domain

Frequency (MHz)

☑ 5600 ☑ 5755 ☑ 5805
☑ Include All
☑ Group by Frequency

Hop

☑ Tree Root
☑ 1st Hop
☑ 2nd Hop
☑ 3rd Hop
☑ 4th Hop
☑ 5th Hop
☑ 6th Hop
☑ 7th Hop
☑ 8th Hop
☑ 9th Hop
☑ 10th Hop
☑ 11th Hop
☑ 12th Hop
☑ 13th Hop
☑ Include All
☑ Group by Hop

Node Type

☑ SkyGateway
☑ SkyExtender DualBand
☑ SkyExtender TriBand
☑ SkyConnector Outdoor
☑ Include All
☑ Group by Node Type

Node State

☑ Up
☑ Down
☑ SNMP Unreachable
☐ Polling Disabled
☐ Discovered
☐ Include All

Link State

☑ Active
☑ Standby
☑ Transition
☑ Failed
☑ Include All

Auto Refresh ☑
Refresh Rate 300 (second)
Wi-Fi Radius 500.0 Feet

Navigating the Google Earth EMS page

The Google Earth EMS page provides a command banner where you can build a profile from two views (Element view and Topology view), perform a quick launch, and download icons for network nodes displayed in Google Earth.

Downloading icons

SkyPilot provides GEMS custom node icons for use with Google Earth EMS. If you want to use the icons tor represent network nodes, you must download the icons.

To download the Google Earth EMS icons:

1 Click Download Icons in the banner menu.

The Web client displays a login screen.

If the icons are not currently installed on your computer, SkyPIlot EMS will display a reminder in the message area of the Google Earth EMS asking you to install the icon package.

If you are using a Windows computer as the EMS client, you will download an installer the walks you through the installation process.

If the SkyPilot EMS client is running on a computer OS other than Windows, click **Non-Windows** to download an package of icons with a Readme file containing instructions for installing the icons on your computer.

Installing Google Earth EMS icons on a Windows-based client

To install the icon package:

1. Click Microsoft Windows in the Operating System column.

   A prompt appears, providing options for downloading the installer, **gems_icons.exe**.

2. Choose a destination and click Save.

3. Run **gems_icons.exe**.

   The Installer starts and asks you to selected the components to install.

4. Check **SkyPilot EMS 1.5 Google Earth Icons** and click Install.

   The installer copies the SkyPilot icons to the a location where they will be available to Google Earth.

5. Click **Close**.

Creating and viewing network profiles

You view SkyPilot networks in Google Earth by defining a profile and opening it in Google Earth as a "place: that you can browse and save for latter viewing.

When you submit a profile to Google Earth, EMS creates a KML file that Google Earth uses to map network node information to the physical world.

Google Earth adds the network profile to your Temporary Places folder as the subfolder with the same name as the profile.

When you click the entry, Google Earth "flies" to the physical location of the network and zooms in to a view showing the nodes you specified in the profile.

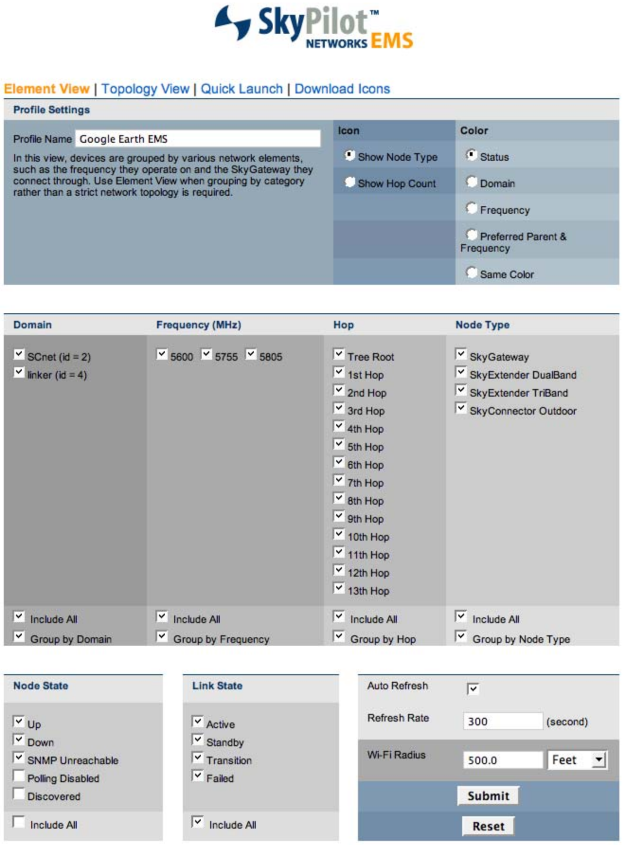
Note Newly submitted profiles appear as items in the Temporary Places folder. If you do not move these items to the My Places folder to save them, they will not be retained when you quit Google Earth.

Create a profile in Element view

Element view prepares a Google Earth view of your network based on the various elements of the network, including type of node, node state, link state, device frequency, and number of hops.

Click Element View on the command banner to open the Element View page and start creating a new profile for viewing in Google Earth.

Figure C-3. Profile Settings Element View page



Element View | Topology View | Quick Launch | Download Icons

Profile Settings

Profile Name: Google Earth EMS

In this view, devices are grouped by various network elements, such as the frequency they operate on and the SkyGateway they connect through. Use Element View when grouping by category rather than a strict network topology is required.

Icon
- ● Show Node Type
- ○ Show Hop Count

Color
- ● Status
- ○ Domain
- ○ Frequency
- ○ Preferred Parent & Frequency
- ○ Same Color

Domain
- ☑ SCnet (id = 2)
- ☑ linker (id = 4)
- ☑ Include All
- ☑ Group by Domain

Frequency (MHz)
- ☑ 5600 ☑ 5755 ☑ 5805
- ☑ Include All
- ☑ Group by Frequency

Hop
- ☑ Tree Root
- ☑ 1st Hop
- ☑ 2nd Hop
- ☑ 3rd Hop
- ☑ 4th Hop
- ☑ 5th Hop
- ☑ 6th Hop
- ☑ 7th Hop
- ☑ 8th Hop
- ☑ 9th Hop
- ☑ 10th Hop
- ☑ 11th Hop
- ☑ 12th Hop
- ☑ 13th Hop
- ☑ Include All
- ☑ Group by Hop

Node Type
- ☑ SkyGateway
- ☑ SkyExtender DualBand
- ☑ SkyExtender TriBand
- ☑ SkyConnector Outdoor
- ☑ Include All
- ☑ Group by Node Type

Node State
- ☑ Up
- ☑ Down
- ☑ SNMP Unreachable
- ☐ Polling Disabled
- ☐ Discovered
- ☐ Include All

Link State
- ☑ Active
- ☑ Standby
- ☑ Transition
- ☑ Failed
- ☑ Include All

Auto Refresh ☑

Refresh Rate 300 (second)

Wi-Fi Radius 500.0 Feet

Use the provided fields and checkboxes to specify element view options and provide a profile name.

Icon view.

Use the Icon radio buttons to specify the type of icons that will appear in Google Earth.

Click **Show Node Type** to display the network in Google Earth with node type icons. Click **Show Hop Count** to display the network in Google Earth with hop count icons.

Color

Use these radio buttons to specify the use of color in identifying different elements in Google Earth.

Domain

Click checkboxes that correspond to the domain(s) you want Google Earth to display. The domains listed correspond to the domains currently active in the SkyPilot network.

Click Check/Uncheck all to select all or none of the listed domains for viewing. Click Group by Domain to group nodes according to the domain in which they reside.

Frequency (MHz)

Click checkboxes that correspond to the frequencies of the devices you want to view in Google Earth. The frequencies assigned to the checkboxes correspond to frequences currently used in the SkyPilot network.

Click **Include All** to select all or none of the listed frequencies for viewing. Click **Group by Frequency** to group nodes by the frequency they use for network communications.

Hops

Click checkboxes that correspond to the number of "hops" you want to view in Google Earth.

Click **Include All** to select all or none of the listed hops for viewing. Click **Group by Hop** to group nodes by the number of hops they are from the network gateway.

Node type

Click checkboxes that correspond to the type of SkyPilot nodes you want to view in Google Earth--SkyGateway, SkyExtender DualBand, SkyExtender TriBand, and SkyExtender Outdoor.

Click **Include All** to select all or none of the listed node types for viewing. Click Group by Node type to group nodes by the node type.

Node state

Cick the checkboxes that correspond to the current state of SkyPilot nodes--active or inactive--you want to view in Google Earth.

Click Group by Node State to group nodes by their current state.

Link state

Cick the checkboxes that correspond to the link state of SkyPilot nodes you want to view in Google Earth--Active, Standby, Transition, or Failed.

Click Group by Link State to group nodes by their current link state.

Auto Refresh

Cick the Auto Refresh checkbox to specify auto refresh of the SkyPilot network information displayed in Google Earth--Active, Standby, Transition, or Failed.

Refresh Rate

Use the Refresh Rate field to enter frequency of refresh (in seconds).

Wi-Fi Radius

For SkyExtender DualBand and SkyExtender TriBand nodes, you can represent the radius of Wi-Fi coverage in Google Earth.

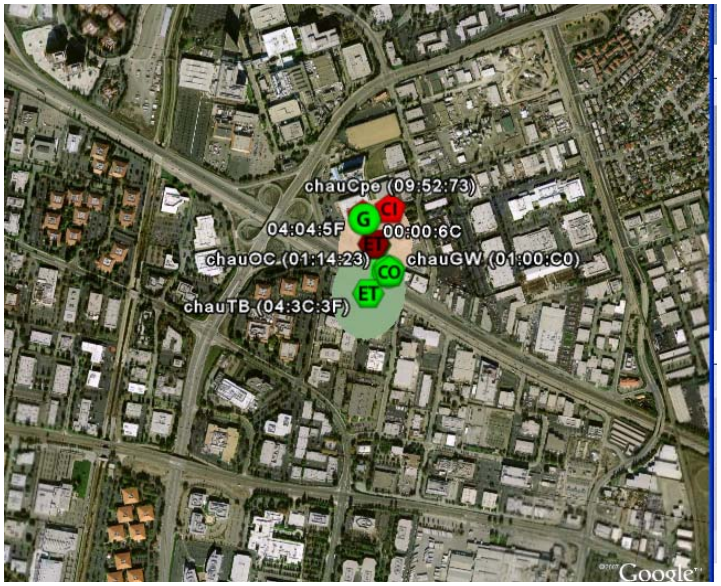
Select Feet or Meters from the Wi-Fi Radius pull down and enter a radius value in the field.

Element View in Google Earth

After setting your parameters for an Element profile, click **Submit** to open the profile in Google Earth.

Isolate the view of your network place by clicking the GEMS Network folder. Filter elements and nodes by clicking items in the subfolders.

Figure C-4. Sample SkyPilot network Place (Element view)

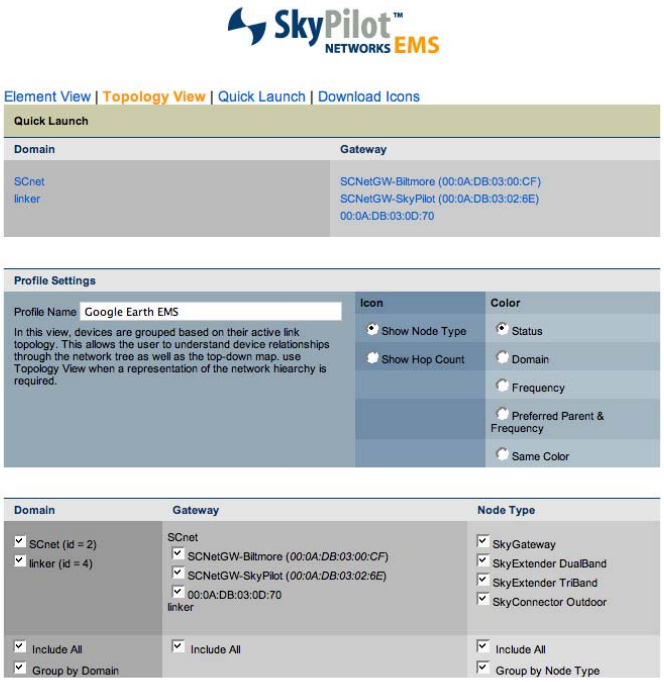


Creating a profile in Topology view

Use the Topology view to prepare a Google Earth view of your network that groups devices on the basis of their active link topology. A topology view helps you understand the relationships between the devices and is useful for viewing the network hierarchy.

Click Topology View on the command banner to open the Topology View page and start creating a new profile for viewing in Google Earth.

Figure C-5. Profile Settings Topology View page



Element View | Topology View | Quick Launch | Download Icons

Quick Launch

Domain	Gateway
SCnet linker	SCNetGW-Biltmore (00:0A:DB:03:00:CF) SCNetGW-SkyPilot (00:0A:DB:03:02:6E) 00:0A:DB:03:0D:70

Profile Settings

Profile Name Google Earth EMS	Icon	Color
In this view, devices are grouped based on their active link topology. This allows the user to understand device relationships through the network tree as well as the top-down map. use Topology View when a representation of the network hiearchy is required.	● Show Node Type	● Status
	○ Show Hop Count	○ Domain
		○ Frequency
		○ Preferred Parent & Frequency
		○ Same Color

Domain	Gateway	Node Type
☑ SCnet (id = 2) ☑ linker (id = 4)	SCnet ☑ SCNetGW-Biltmore (*00:0A:DB:03:00:CF*) ☑ SCNetGW-SkyPilot (*00:0A:DB:03:02:6E*) ☑ 00:0A:DB:03:0D:70 linker	☑ SkyGateway ☑ SkyExtender DualBand ☑ SkyExtender TriBand ☑ SkyConnector Outdoor
☑ Include All ☑ Group by Domain	☑ Include All	☑ Include All ☑ Group by Node Type

Use the provided fields and checkboxes to specify element view options and provide a profile name.

Icon view.

Use the Icon radio buttons to specify the type of icons that will appear in Google Earth.

Click **Show Node Type** to display the network in Google Earth with node type icons. Click **Show Hop Count** to display the network in Google Earth with hop count icons.

Color

Use these radio buttons to specify the use of color in identifying different elements in Google Earth.

Domain

Click checkboxes that correspond to the domain(s) you want Google Earth to display. The domains listed correspond to the domains currently active in the SkyPilot network.

Click **Include All** to select all or none of the listed domains for viewing. Click Group by Domain to group nodes according to the domain in which they reside.

Gateway

Click checkboxes that correspond to the SkyPilot SkyGateways currently available for viewing in Google Earth.

Click **Include All** to select all or none of the listed SkyGateways for viewing.

Node Type

Click checkboxes that correspond to the type of SkyPilot nodes you want to view in Google Earth--SkyGateway, SkyExtender, SkyExtender DualBand, SkyExtender TriBand, SkyConnector Indoor, SkyExtender Outdoor, and SkyAccess DualBand.

Click **Include All** to select all or none of the listed node types for viewing. Click **Group by Node Type** to group nodes by the type of device

Node State

Cick these checkboxes to set up view of the network based on the current state of SkyPilot nodes--Up, Down, SNMP Unreachable, Polling Disabled, and Discovered.

Click Group by Node State to group nodes by their current state.

Auto Refresh

Cick the Auto Refresh checkbox that specify auto refresh of the SkyPilot network information displayed in Google Earth--Active, Standby, Transition, or Failed.

Refresh Rate

Use the Refresh Rate field to enter the refresh frequency (in seconds).

Wi-Fi Radius

For SkyExtender DualBand, SkyExtender TriBand, and SkyAccess DualBand nodes, you can represent the radius of Wi-Fi coverage in Google Earth.

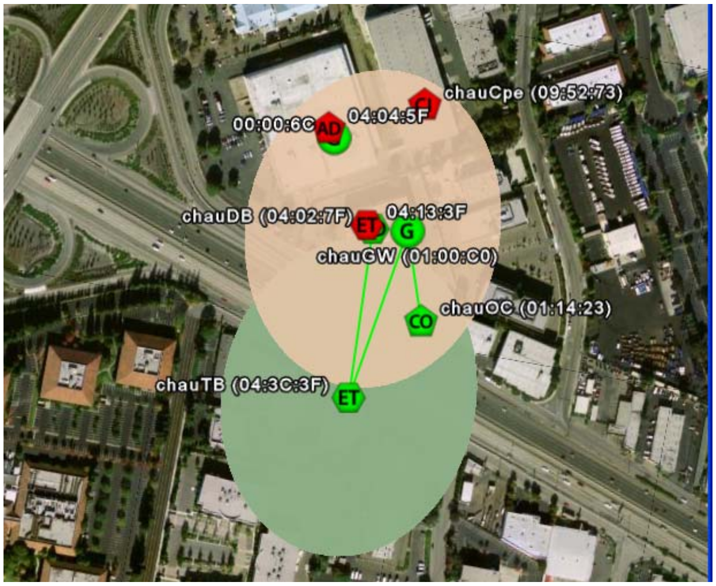
Select Feet or Meters from the Wi-Fi Radius pull down and enter a radius value in the field.

Topology view in Google Earth

After setting the parameters for a topology view, click Submit to send the profile to Google Earth.

Isolate the view of your network place by clicking the GEMS Network folder. Filter elements and nodes by selecting and de-selecting items in the GEMS Network subfolders.

Figure C-6. Sample SkyPilot network place (topology view)

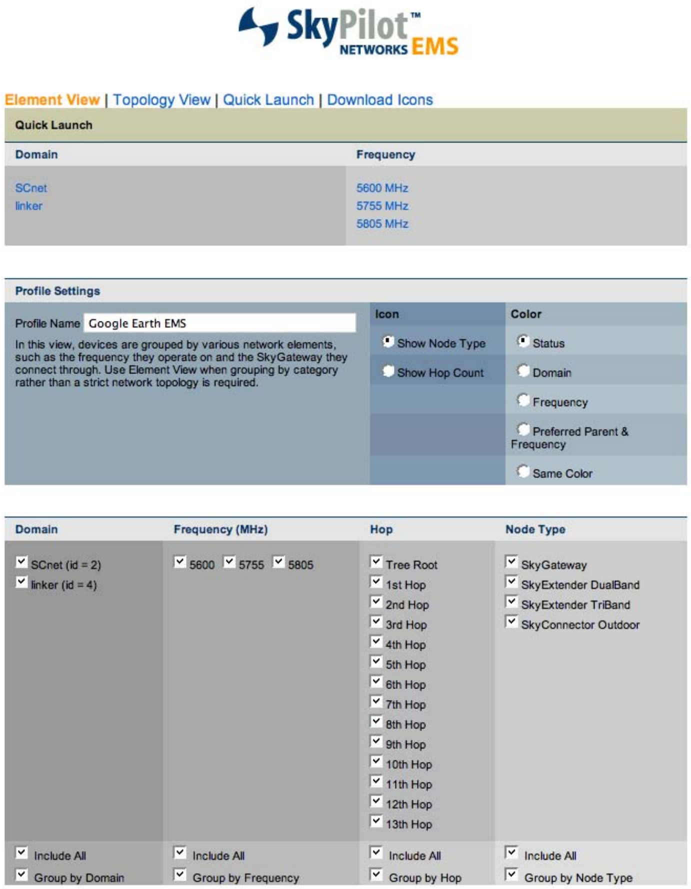


Performing a quick launch

Use the Quick Launch view to quickly prepare and submit a Google Earth view of your network based on specific network elements such as the domain or SkyGateway the serves as the network hub.

Click Quick Launch on the command banner to open the Quick Launch page and start creating a new profile for viewing in Google Earth.

Figure C-7. Profile Settings Quick Launch page



Element View | Topology View | Quick Launch | Download Icons

Quick Launch

Domain	Frequency
SCnet linker	5600 MHz 5755 MHz 5805 MHz

Profile Settings

Profile Name: Google Earth EMS

In this view, devices are grouped by various network elements, such as the frequency they operate on and the SkyGateway they connect through. Use Element View when grouping by category rather than a strict network topology is required.

Icon	Color
● Show Node Type	● Status
○ Show Hop Count	○ Domain
	○ Frequency
	○ Preferred Parent & Frequency
	○ Same Color

Domain	Frequency (MHz)	Hop	Node Type
☑ SCnet (id = 2) ☑ linker (id = 4)	☑ 5600 ☑ 5755 ☑ 5805	☑ Tree Root ☑ 1st Hop ☑ 2nd Hop ☑ 3rd Hop ☑ 4th Hop ☑ 5th Hop ☑ 6th Hop ☑ 7th Hop ☑ 8th Hop ☑ 9th Hop ☑ 10th Hop ☑ 11th Hop ☑ 12th Hop ☑ 13th Hop	☑ SkyGateway ☑ SkyExtender DualBand ☑ SkyExtender TriBand ☑ SkyConnector Outdoor
☑ Include All ☑ Group by Domain	☑ Include All ☑ Group by Frequency	☑ Include All ☑ Group by Hop	☑ Include All ☑ Group by Node Type

Links at the top of the page instantly launch a Google Earth view of the SkyPilot network based on the selected domain or SkyGateway with default parameters.

Use the provided check boxes and fields to select viewing options and provide a profile name.

Icon

Use the Icon radio buttons to specify the type of icons that will appear in Google Earth.

Click **Show Node Type** to display the network in Google Earth with node type icons. Click **Show Hop Count** to display the network in Google Earth with hop count icons.

Color

Use these radio buttons to specify the use of color in identifying different elements in Google Earth.

Domain

Click checkboxes that correspond to the domain(s) you want Google Earth to display. The domains listed correspond to the domains currently active in the SkyPilot network.

Click **Include All** to select all or none of the listed domains for viewing. Click **Group by Domain** to group nodes according to the domain in which they reside.

Frequency (MHz)

Click checkboxes that correspond to the frequencies of the devices you want to view in Google Earth. The frequencies assigned to the checkboxes correspond to frequences currently used in the SkyPilot network.

Click **Include All** to select all or none of the listed frequencies for viewing. Click **Group by Frequency** to group nodes by the frequency they use for network communications.

Hops

Click checkboxes that correspond to the number of “hops” you want to view in Google Earth.

Click **Include All** to select all or none of the listed hops for viewing. Click **Group by Hop** to group nodes by the number of hops they are from the network gateway.

Node Type

Click checkboxes that correspond to the type of SkyPilot nodes you want to view in Google Earth--SkyGateway, SkyExtender, SkyExtender DualBand, SkyExtender TriBand, SkyConnector Indoor, SkyExtender Outdoor, and SkyAccess DualBand.

Click **Include All** to select all or none of the listed node types for viewing. Click **Group by Node Type** to group nodes by the type of device

Node State

Cick these checkboxes to set up view of the network based on the current state of SkyPilot nodes--Up, Down, SNMP Unreachable, Polling Disabled, and Discovered.

Click Group by Node State to group nodes by their current state.

Auto Refresh

Cick the Auto Refresh checkbox that specify auto refresh of the SkyPilot network information displayed in Google Earth--Active, Standby, Transition, or Failed.

Refresh Rate

Use the Refresh Rate field to enter the refresh frequency (in seconds).

Wi-Fi Radius

For SkyExtender DualBand, SkyExtender TriBand, and SkyAccess DualBand nodes, you can represent the radius of Wi-Fi coverage in Google Earth.

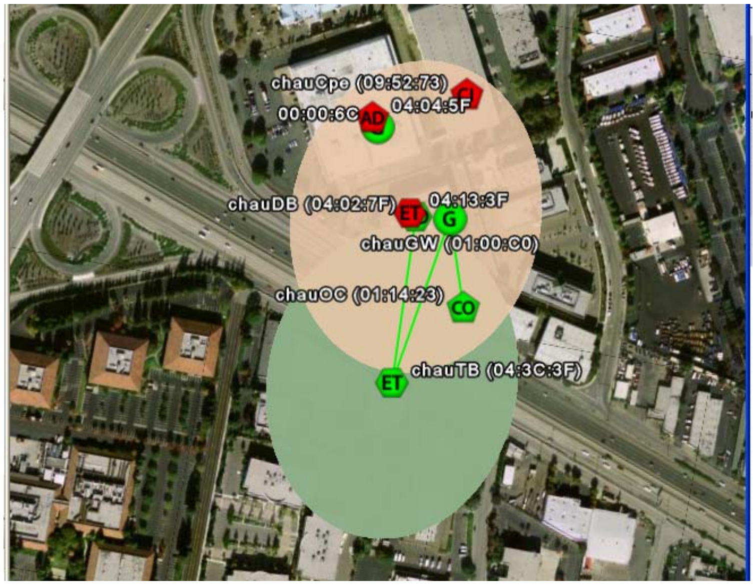
Select Feet or Meters from the Wi-Fi Radius pull down and enter a radius value in the field.

Quick launch view in Google Earth

After setting the parameters for a quick launch view, click **Submit** to send the profile to Google Earth.

Isolate the view of your network place by clicking the GEMS Network folder. Filter elements and nodes by clicking items in the folder.

Figure C-8. Sample SkyPilot network place (Quick Launch view)



D

SkyControl Reference

SkyControl enables you to perform administrative and maintenance functions for your SkyPilot network. This appendix provides detailed instructions for using those functions through the SkyPilot EMS Java client.

Appendix Highlights

- Using SkyControl
- Viewing your SkyPilot network
- Configuring SkyControl’s SNMP queries
- Configuring data collection tasks
- Configuring threshold alarms
- Using reports
- Viewing statistics

Using SkyControl

SkyControl is an SNMP management system for real-time device monitoring and management. It provides a graphical view of your network topology with at-a-glance updates on topology, routing, and performance.

Starting SkyControl

You access SkyControl from the SkyPilot EMS Java client. If SkyProvision is already active, you don't need to start another SkyPilot EMS Java client session; both SkyProvision and SkyControl can be run within a single SkyPilot EMS Java client session.

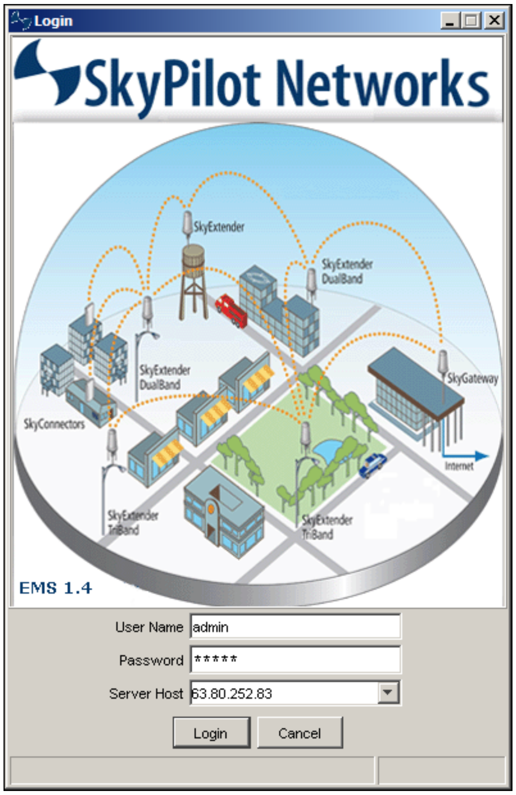
NOTE In addition to the following procedure, you may be able to start the EMS Java client by using the **Start** menu or desktop shortcuts that may have been set up during installation.

To access SkyControl:

1 Execute the SkyPilot EMS Java client startup script, `SkyPilot\EMS\bin\startemsclient.bat` (for Windows systems) or `/usr/local/skypilot/EMS/bin/startsemsclient.sh` (for Linux systems).

The Login window is displayed (Figure D-1).

Figure D-1. SkyPilot EMS Login window



User Name admin

Password *****

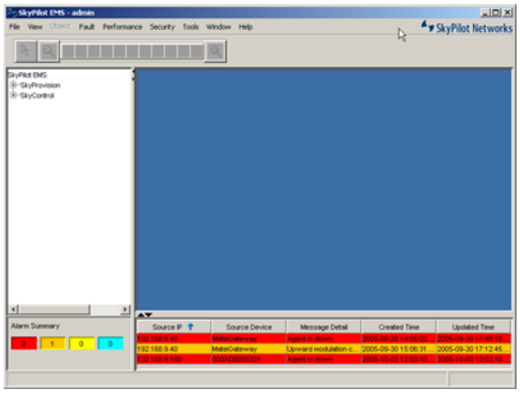
Server Host 63.80.252.83

2 Enter your user name and password.The default user name is `admin`, and the default password is also `admin`.

3 Click **Login**.

The SkyPilot EMS Java client interface is displayed.

Figure D-2. SkyPilot EMS Java client interface



Source IP	Source Device	Message Detail	Created Time	Updated Time
192.168.9.40	MateiGateway	Agent is down	2005-09-28 14:05:00 ...	2005-09-30 17:48:19 ...
192.168.9.40	MateiGateway	Upward modulation c...	2005-09-30 15:06:31 ...	2005-09-30 17:12:45 ...
192.168.9.100	000ADB095321	Agent is down	2005-10-03 12:03:10 ...	2005-10-03 12:03:10 ...

For information about the SkyPilot EMS Java client interface elements, see "The SkyPilot EMS Java Client Interface" on page 104.

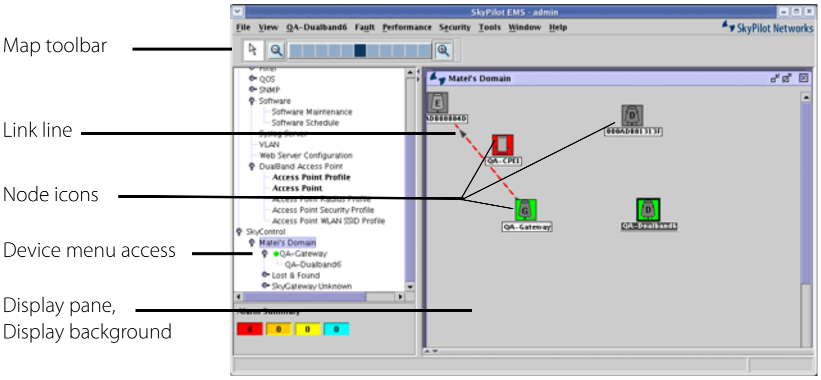
4 Click **SkyControl** in the navigation pane.

The **SkyControl** item in the navigation pane expands to show the entire list of configured domains. The **Tools** menu changes to list SkyControl tools, and the display pane changes to a blank display (which will be filled once you select domains to monitor).

SkyControl Interface

Figure D-3 illustrates the various parts of the SkyControl interface, including elements in its display pane.

Figure D-3. SkyControl interface



The various parts of the interface are as follows:

- **Map toolbar**—Toolbar that's active when a monitored domain map is shown in the display pane.
  - Use the arrow button to lock and unlock a node's position in the map display. When a node is unlocked, you can drag it to any position in the map.
  - Use the zoom level buttons to zoom in and out of the map display to any level. Use the leftmost button for maximum zoom out, the rightmost button for maximum zoom in, and the buttons in between for intermediate zoom levels. The highlighted button indicates the current zoom level.
  - Use the magnifying glass to zoom in and out of the map display by a single level.

- **Link lines**—Representations of links between nodes. Link lines are added as nodes form links with each other, which begins for each node when the node's polling starts (when the node is added if an IP address is specified, or via the device's **Poll Now** function or the device domain's **Start Polling All Devices** function, as described in Table D-2).

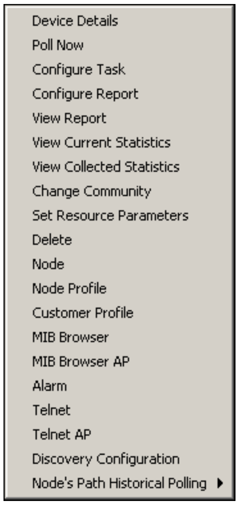
- **Node icons**—Representations of SkyPilot nodes. The icon's background color represents the current state of the node: gray indicates that there is no polling for the node; red indicates that the node is not responding and therefore is not currently an active part of the network; and green means the node is active. Table D-1 shows the icon for each type of node.

Table D-1. Node Icons

G	SkyGateway
E	SkyExtender
D	SkyExtender DualBand
T	SkyExtender TriBand
▯	SkyConnector Outdoor
▯	SkyConnector Indoor

- **Device menu access**—Right-clickable device name, which is used to access the SkyControl device menu (Figure D-4). Table D-2 provides descriptions or references to the applicable documentation section for each menu option.

Figure D-4. SkyControl device menu



Device Details
Poll Now
Configure Task
Configure Report
View Report
View Current Statistics
View Collected Statistics
Change Community
Set Resource Parameters
Delete
Node
Node Profile
Customer Profile
MIB Browser
MIB Browser AP
Alarm
Telnet
Telnet AP
Discovery Configuration
Node's Path Historical Polling

Table D-2. Device Menu Options (Page 1 of 3)

Option	Description/Reference
Device Details	Displays the device's configuration settings, polling details, Ethernet statistics, and link information. See "Viewing Detail Data" on page 183.
Poll Now	Enables an immediate single SkyControl poll of the device to update the default task statistics.
Configure Task	Displays a window in which you can add, modify, start, and stop data collection tasks. See "Configuring Data Collection Tasks" on page 187.
Configure Report	Displays a window in which you can add, modify, and delete report configurations (included objects, frequency of data collection, and report format). See "Configuring Reports" on page 190.
View Report	Displays a window in which you can select a report to view or to chart. See "Viewing Detail Data" on page 183.
View Current Statistics	Displays a window in which you can select devices, data collection tasks, objects, instances, and plotting options to create a dynamically updated graphical view of device statistics. See "Viewing Current Statistics" on page 192.

Table D-2. Device Menu Options (Page 2 of 3)

Option	Description/Reference
View Collected Statistics	Displays a window in which you can select devices, data collection tasks, objects, instances, time period, and plotting options to create a static graphical view of device statistics. See “Viewing Collected Statistics” on page 193.
Change Community	Displays a window in which you can configure the SNMP community string that SkyControl uses to poll the device. See “Configuring SkyControl’s SNMP Queries” on page 185.
Set Resource Parameters	Displays a window in which you can configure the SNMP polling timeout and retries that SkyControl uses to monitor the device. See “Configuring SkyControl’s SNMP Queries” on page 185.
Delete	Deletes the selected node. (This is a shortcut for the Node Maintenance delete function.)
Node	Displays the node’s provisioning parameters. (This is a shortcut for the Node Maintenance view function.)
Node Profile	Displays the node’s associated node profile settings. (This is a shortcut for the Node Profile view function, except that you can’t modify the node profile.)
Customer Profile	Displays the node’s associated customer profile, if any. (This is a shortcut for the Customer Profile view function, except that you can’t modify the customer profile.)
MIB Browser	Opens the MIB browser, which you can use to view the SkyPilot MIB objects associated with the current node.
MIB Browser AP	(DualBand/TriBand only; access point polling not currently implemented)
Alarm	Displays the Related Alarms window showing all current alarms for the device.
Telnet	Opens a Telnet session to the device’s command-line interface; helpful for debugging.

Table D-2. Device Menu Options (Page 3 of 3)

Option	Description/Reference
Telnet AP	(DualBand/TriBand only; port forwarding to access point's Linux command shell not currently implemented)
Discovery Configuration	Displays the Discover Configuration window where you enable or disable whether SkyControl displays nodes connected to the selected device that the device sees in its link state table, regardless of whether the connected devices are in the selected device's provisioning records.
Node's Path Historical Polling	(Non-SkyGateways only) Starts, stops, or displays the RSSI, modulation, and/or throughput data for the device's path that was active at a specified time. See "Viewing Detail Data" on page 183.

- **Display background**—Background image on which the nodes and links are shown. You can customize the background and then position the network's node icons in the correct location so that the display of the network topology accurately represents real life. For example, if you use a street map as the background and an end user's location is at the corner of Pine and Main streets, you can drag the associated SkyConnector icon directly onto the map at that corner. (For directions on customizing the display background, see "Customizing the SkyControl Display Pane" on page 179.)

Typical Configuration Operations

There is a pattern to the way configuration operations are performed in SkyControl and how they're described in the rest of this appendix. This section explains the pattern; subsequent sections discuss the various configuration operations in a concise way that provides any extra information you'll need to know once you've become familiar with the pattern.

Configuring Section

Each main topic begins with a **Configuring** section that introduces what you'll learn to configure—for example, "Configuring Data Collection Tasks" and "Configuring Threshold Alarms."

Elements Section

The first subsection within a **Configuring** section is typically an **Elements** section that presents a table listing the elements related to the applicable configuration—for example, "Data Collection Task Elements" presenting a table that lists elements such as **Name** for the data collection task name, **Frequency** for the polling frequency, and so on. There may be multiple **Elements** sections for closely related items. Alternatively, you may be directed to an **Elements** section located elsewhere in this document.

Operations Section

Next, the **Operations** section uses a concise tabular presentation to show the configuration operations and how to perform them, similar to Table D-3 for (a subset of) data collection tasks.

Table D-3. SkyControl Configuration Operations Example Table

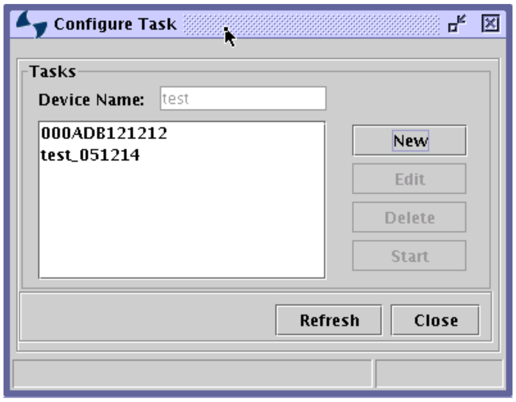
	Operation	From	Actions
1	View	Navigation pane	**SkyControl** ‰ **Domain** ‰ Device name (right-click); choose **Configure Task**
2	Add	Display pane	**New**
	Modify	Display pane	**Task name** (click) ‰ **Edit**
	Delete	Display pane	**Task name** (click) ‰ **Delete**

To use one of these tables, first look in the **Operation** column to find the operation you want to perform. If there are any lower-numbered steps, perform their actions first, and then perform the desired operation's actions. For example, if you wanted to modify a data collection task, you'd perform the action for step **1** in Table D-3 and then the action for the Modify operation in step **2**. Spelled out in full, the procedure to modify a data collection task would be as follows:

1 If the list of devices in the desired domain is not already showing in the navigation pane, expand the **SkyControl** tree in the navigation pane, expand the desired domain tree, right-click the desired device’s name, and choose **Configure Task**.

SkyControl displays the Configure Task screen.

Figure D-5. Configure Task screen



Configure Task

Tasks

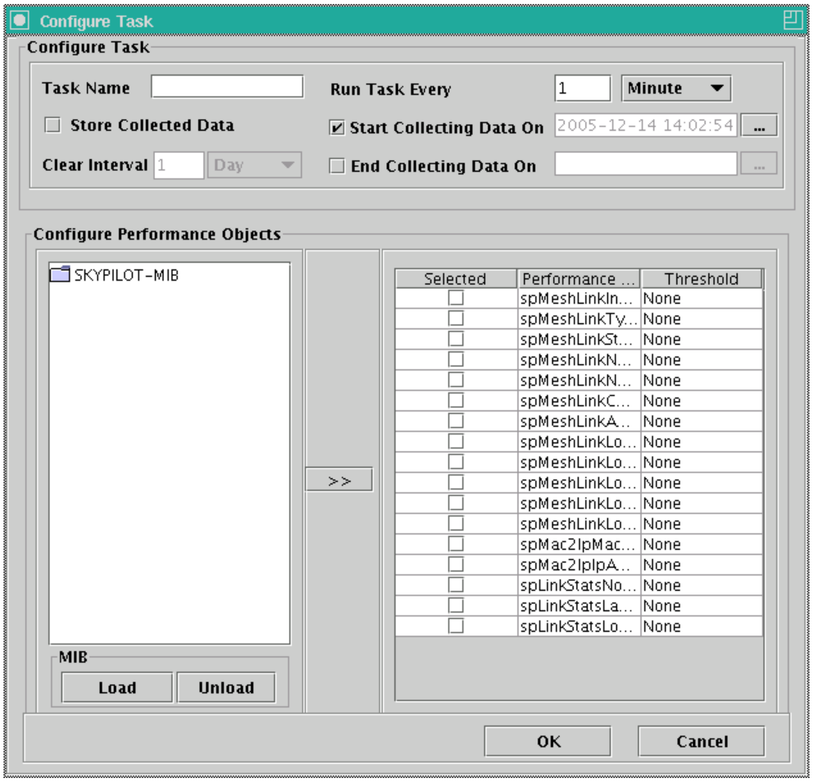
Device Name: test

000ADB121212
test_051214

2 Click the name of the task whose settings you want to modify, and then click **Edit**.

SkyControl displays the same screen as when you add a new task.

Figure D-6. Adding or modifying a data collection task



Configure Task

Configure Task

Task Name

□ Store Collected Data

Clear Interval 1 Day

Run Task Every 1 Minute

☑ Start Collecting Data On 2005-12-14 14:02:54

□ End Collecting Data On

Configure Performance Objects

SKYPILOT-MIB

Selected	Performance ...	Threshold
□	spMeshLinkIn...	None
□	spMeshLinkTy...	None
□	spMeshLinkSt...	None
□	spMeshLinkN...	None
□	spMeshLinkN...	None
□	spMeshLinkC...	None
□	spMeshLinkA...	None
□	spMeshLinkLo...	None
□	spMeshLinkLo...	None
□	spMeshLinkLo...	None
□	spMeshLinkLo...	None
□	spMeshLinkLo...	None
□	spMac2IpMac...	None
□	spMac2IpIpA...	None
□	spLinkStatsNo...	None
□	spLinkStatsLa...	None
□	spLinkStatsLo...	None

3 Edit the task elements and click **OK**.

Focus returns to the earlier Configure Task screen (Figure D-5).

4 Click **Close**.

You can see from Table D-3 that the actions you'd take to delete a data collection task would be very similar to those in the procedure just described, as would the actions for adding a data collection task.

Note that where a configuration procedure includes choosing a command from a navigation pane right-click menu, you may be able to do so not only with the mouse but also with a keyboard shortcut, from the display area of the display pane by right-clicking the desired item, or from the navigation pane by double-clicking the desired item in the expanded **SkyControl** tree and selecting an item from the resulting menu bar.

Regardless of what you're configuring, the operations will follow a similar pattern to what's shown in Table D-3, and where there are variations the table will use the same notational conventions as in Table D-3.

Customizing the SkyControl Display Pane

For each EMS Java client session (that is, each separate SkyControl instance), you can customize the display pane, including the display background, on a per-domain basis. So, for example, you could show all the links for one domain but only active links for another domain.

TIP It's important to remember which display settings you've configured; otherwise, you might spend time troubleshooting a device because it isn't appearing in a nonoperating domain's SkyControl display, only to discover that you've configured the display to show only provisioned nodes.

To customize a domain's display pane:

1 In the navigation pane of SkyPilot EMS Java client, expand the **SkyControl** tree (if it's not already expanded).

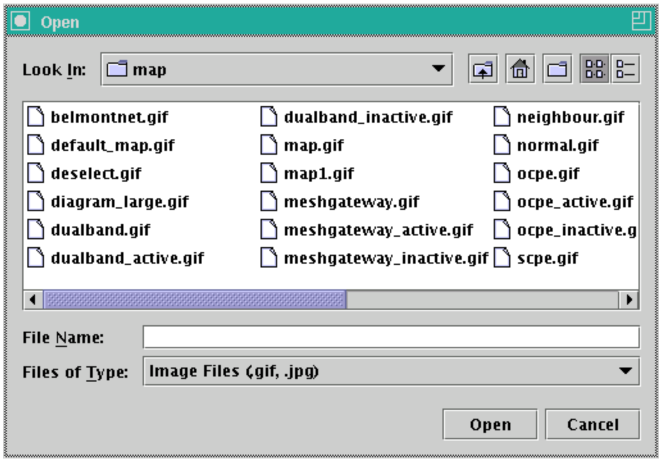
The **SkyControl** tree expands to show the complete list of configured domains.

2 If you don't want to change the display background, skip to step **4**.

To change the background, right-click the name of the domain whose background you want to customize, and choose **Change Background**.

SkyControl displays the Open screen.

Figure D-7. Open screen



Open

Look In: map

File Name:

Files of Type: Image Files (gif, .jpg)

3 Browse to the desired file, select it, and click **Open**.

SkyControl replaces the previous background with the image in the file you've opened. (If the domain isn't currently displayed, you'll see the new background the next time you view the domain.)

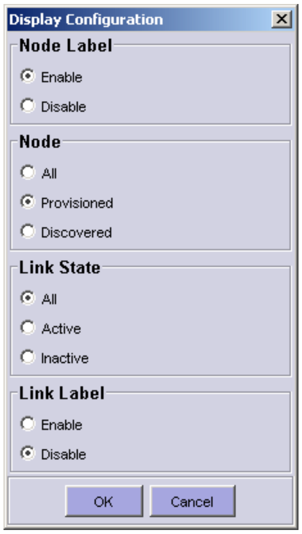
NOTE You must separately add the image to every PC on which you run the EMS Java client.

If you don't want to change which nodes and links are shown (including whether their accompanying labels are shown), you're done with this procedure. Otherwise continue with the next step.

4 To configure other display settings, right-click the name of the domain whose display you want to customize, and choose **Display Configuration**.

SkyControl displays the Display Configuration screen.

Figure D-8. Display Configuration screen



Node Label
● Enable
○ Disable

Node
○ All
● Provisioned
○ Discovered

Link State
● All
○ Active
○ Inactive

Link Label
○ Enable
● Disable

5 Select the desired options and click **OK**.

Searching for Configured Devices

You can search for any network configured device, which can be helpful if you have many devices shown in the SkyControl display. For example, your network may have hundreds of nodes, and finding the one you want examine may be difficult. But if you know the node's name, MAC address, or IP address, you can use the search function to find just those nodes that match your search criteria.

To search for configured devices:

1 Expand the **SkyControl** tree, right-click the domain containing the desired device, and choose **Search**.

2 Select how you want to search—**Name**, **MAC Address**, or **IP Address**—and enter your search criteria.

3 Click **Search**.

The domain is displayed with the desired device highlighted.

Viewing Your SkyPilot Network

SkyControl provides a graphical view of your network topology (including all network nodes and links) with at-a-glance updates on topology, routing, and performance. In addition, tabular statistics details are available for devices, links, and node path history.

Viewing Domains

You can view graphical representations of either a single domain or multiple domains at a time (one domain per window). As described in the preceding section, you can change the display configuration on a per-domain basis.

SkyControl directly polls all SkyPilot devices that are provisioned with a static IP address. In addition, it polls each SkyGateway to retrieve the list of devices connected to the SkyGateway, including their IP addresses; in this manner, devices with dynamically assigned IP addresses can be monitored by SkyControl.

IMPORTANT When a device with a dynamically assigned IP address is added to the network, SkyControl cannot poll the new node until its IP address is discovered (by polling the SkyGateway). Once the IP address is discovered, you must tell SkyControl to start polling all devices (even if SkyControl is already polling all devices) or select the device and start its default task. (If a node's IP address changes, SkyControl automatically polls the node at its new address.)

To view a domain:

1. In the navigation pane of SkyPilot EMS, expand the **SkyControl** tree (if it's not already expanded).

   The **SkyControl** tree expands to show the complete list of configured domains.

2. In the navigation pane, double-click the domain you want to view.

   SkyControl displays the domain's primary SkyGateway in the display pane. However, no other network nodes are shown until you instruct SkyControl to begin polling the SkyGateway (in the next step).

3 In the navigation pane, right-click the name of the domain you're viewing, and choose **Start Polling All Devices**.

The nodes within the domain automatically discover one another, and SkyControl automatically adds node icons to the display, as well as link lines once the links are formed.

NOTE By default, polling is on for all devices. However, if you don't need to monitor the network for some time, it's recommended that you stop the SkyControl polling in order to avoid filling the database with unneeded data.

Viewing Detail Data

You can view the following detail data for any SkyPilot device that's being monitored by SkyControl:

- A snapshot of any SkyPilot device that's included in the EMS default `statistics` data collection task, which SkyPilot EMS automatically creates for devices when they're added to the network. (To view statistics from custom data collection tasks, use the procedure described in "Viewing Current Statistics" on page 192.)
- A snapshot of any link between two network devices
- Historical path information
- Reports

To view detail data:

1 Display the domain to which the device belongs (see "Viewing Domains" on page 182).

2 Follow the instructions in Table D-4 to view the available details.

Table D-4. Viewing Details

To view	Do this
Device Details	Right-click either the corresponding node icon or the node's name in the navigation pane, and choose **Device Details**.
LInk Details	Right-click the corresponding link icon in the navigation pane, and choose **Link Details**. For the most accurate link, the polling intervals for the link's connected devices should be the same.
Node Path History	Right-click either the corresponding node icon or the node's name in the navigation pane, and choose **Node's Path Historical Polling ‰ View**. To stop and start the polling that populates the node path history, right-click either the corresponding node icon or the node's name in the navigation pane, and choose **Node's Path Historical Polling ‰ Start** or **Node's Path Historical Polling ‰ Start**, respectively. If the active path changes (that is, the device reroutes and starts sending its data to a new parent), the polling logic takes that into account, always polling the correct link.
Report	Right-click either the corresponding node icon or the node's name in the navigation pane, and choose **View Report**; from the View Report screen, select the desired report and which MIB objects to include, and click **View** or **Chart**. For more information, see "Using Reports" on page 190.

Configuring SkyControl's SNMP Queries

When you configure a device, you can configure it with specific SNMP community strings that enable SkyControl to poll the device. If no SNMP community string is configured, SkyControl uses the default read-only community string, `public`.

If you change a device's SNMP community string after the device is configured and added to the network (by changing the applicable profile for automatically provisioned devices, and by using the device's Web or command-line interface for manually provisioned devices), the node stops responding to SkyControl queries (because SkyControl is still using the original SNMP string), and SkyControl can no longer monitor the device. To reenable SkyControl monitoring, you must change the community string that SkyControl uses, as described in the next procedure.

In addition to the community string itself, you can configure the following SNMP query parameters:

- **Timeout**—How long SkyControl waits for a response to a polling request (SNMP query) before deciding that the device failed to respond.
- **Retries**—Number of times after a SkyControl polling query timeout that SkyControl repeats the polling query before deciding that the device is down. For example, if **Retries** is 3, a device is determined to be down if four consecutive SkyPilot queries time out.

You can change the SNMP query parameters as described below.

To configure SkyControl SNMP queries:

1. In the navigation pane of SkyPilot EMS, expand the **SkyControl** tree (if it's not already expanded).

   The **SkyControl** tree expands to show the complete list of configured domains.

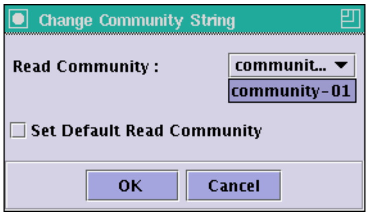
2. Expand the domain tree that contains the device for which you want to configure a data collection task (if it's not already expanded).

   The domain tree expands to show the complete list of devices in the domain.

3 To change the community string SkyControl uses to poll the device, right-click the desired device name and choose **Change Community**.

SkyControl displays the Change Community String screen (Figure D-9).

Figure D-9. Change Community String screen



Read Community : communit... ▼ community-01

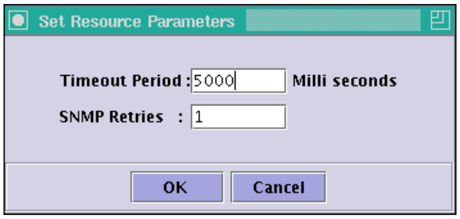
□ Set Default Read Community

Clear the **Set Default Read Community** check box, select the desired community from the drop-down list, and click **OK**.

4 To change the SNMP query parameters SkyControl uses to poll the device, right-click the desired device name and choose **Change Resource Parameters**.

SkyControl displays the Set Resource Parameters screen (Figure D-10).

Figure D-10. Set Resource Parameters screen



Timeout Period : 5000 Milli seconds

SNMP Retries : 1

Modify the desired parameters and click **OK**.

Configuring Data Collection Tasks

Data collection tasks collect data from the SkyPilot MIB for a specific device, at defined intervals, for defined periods of time. The collected information is stored on the EMS server, in its database.

NOTE After configuring a data collection task for a device, you must explicitly start the task before any of its statistics can be viewed.

Data Collection Task Elements

Table D-5 lists the elements that describe data collection tasks. (Instead of appearing on a single screen, these elements are shown on a progression of screens, much like a Data Collection Task wizard.)

Table D-5. Data Collection Task Elements (Page 1 of 2)

Element	Description
Data Collection Name	Name of the data collection task (unique among all such names), as a string of up to 64 alphanumeric characters. This name is used only within SkyControl.
Copy To Resource	(Read-only) Copies the task to other devices.
MIB	MIB browser to which you can load a MIB and select objects to poll.
Performance Objects	Object to poll; moved from the left to right list to enable selection.
Object Identifier	(Read-only) MIB object identifier selected for **MIB** element.
Display Name	Editable text displayed for the data object in reports, events, and alarm displays.
Threshold	Threshold to apply to configure this task's object as an alarm; selected from a provided list.
Reschedule Interval	Number of time intervals between data collections. The type of time interval is selected from a provided list—for example, **Minute** or **Hour**.

Table D-5. Data Collection Task Elements (Page 2 of 2)

Element	Description
Start Collecting Data From	Date and time to start running the data collection task; selected from the calendar.
End Collecting Data By	Date and time to stop running the data collection task; selected from the calendar.
Store Collected Data	Enables or disables storing the collected data.
Purge Data Older Than	Age of data to purge; interval is selected from a provided list.

Data Collection Task Operations

Table D-6 lists the operations you can perform to configure data collection tasks.

Table D-6. Data Collection Task Operations

	Operation	From	Actions
1	View	Navigation pane	**a** **SkyControl** ‰ **Domain** ‰ Device name (right-click) **b** Choose **Configure Task**
2	Add	Menu bar	**New** ‰ Data Collection Task wizard
	Copy	Display pane	**Task name** (click) ‰ **Copy**
	Stop	Display pane	**Task name** (click) ‰ **Stop**
	Modify	Display pane	**Task name** (click) ‰ **Edit**
	Delete	Display pane	**Task name** (click) ‰ **Delete**
	Start	Display pane	**Task name** (click) ‰ **Start**

Configuring Threshold Alarms

Threshold alarms are created when SkyControl interprets events according to preconfigured and custom MIB object thresholds.

Threshold Alarm Operations

Table D-7 lists the operations you can perform to configure threshold alarms.

Table D-7. Threshold Alarm Operations

	Operation	From	Actions
1	View	Navigation pane	**SkyControl ‰ Domain ‰** device name (right-click); choose **Configure Task ‰** task name Typically, the task you'll choose is `status_poll`—the default device polling task.
2	Add	Display pane	**New ‰** Select the desired threshold (or **None** to remove the alarm trigger for an event) for the Threshold element displayed by the Data Collection Task wizard.
	Modify	Display pane	**Edit ‰** Select the desired threshold (or **None** to remove the alarm trigger for an event) for the Threshold element displayed by the Data Collection Task wizard. (A task must be stopped in order to be modified.)
	Delete	Display pane	**Delete ‰** Select **None** for the threshold of the Threshold element displayed by the Data Collection Task wizard. (A task must be stopped in order for an associated threshold alarm to be deleted.)

Using Reports

With SkyControl you can generate reports using data collected for the SkyPilot MIB objects:

- First you configure report parameters such as the included objects, frequency of data collection, and report format. For more information, see the next section, “Configuring Reports.”
- Once you’ve configured a report, SkyControl automatically builds the report, which you can view any time (see “Viewing Detail Data” on page 183).
- To avoid unnecessarily filling up disk space, you should set up automatic purging of report data for each type of report (hourly, daily, weekly, and monthly). This deletes only the data, not the report configuration itself. For instructions, see “Purging Reports by Type” on page 191.

Configuring Reports

Report Elements

Table D-8 lists the elements that describe reports.

Table D-8. Report Elements (Page 1 of 2)

Element	Description
Report Name	Name of the report (unique among all such names), as a string of up to 50 alphanumeric characters. This name is used only within SkyProvision.
Type of Report	Type that reflects the time range during which data is collected and then averaged into a single report data point. The endpoint of the sampling cycle depends on the type of report: ● **Hourly**—At the stroke of the hour ● **Daily**—At midnight ● **Weekly**—On Saturday at midnight (that is, midnight between Saturday and Sunday) ● **Monthly**—On the last day of the month at midnight (that is, just before the next month begins)

Table D-8. Report Elements (Page 2 of 2)

Element	Description
Performance Objects	MIB objects that have been configured for data collection through any of the device’s data collection tasks. (See “Data Collection Tasks” on page 71.)

Report Operations

Table D-9 lists the operations you can perform to configure reports.

Table D-9. Report Operations

	Operation	From	Actions
1	View	Navigation pane	**a** **SkyControl ‰ Domain ‰** Device name (right-click) **b** Choose **Configure Report**
2	Add	Display pane	**New**
	Modify	Display pane	**Edit**
	Delete	Display pane	**Delete**

Purging Reports by Type

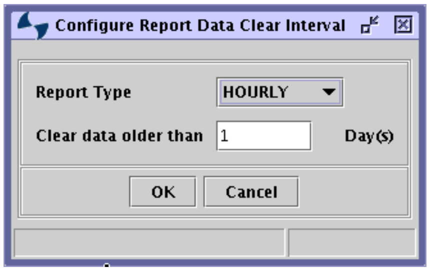
For each type of report (hourly, daily, weekly, and monthly), you can set up automatic purging of reports of that type from your system (without deleting the individual report configurations) to avoid unnecessarily filling up disk space. You can specify a different purge frequency for each type of report.

To set up report purging:

1. From the SkyPilot EMS Java client menu bar, choose **Performance ‰ Configure Report Data Clear Interval**.

   SkyPilot EMS Java client displays the screen shown in Figure D-11.

Figure D-11. Setting a report purge interval


Configure Report Data Clear Interval

Report Type: HOURLY

Clear data older than: 1 Day(s)

2 Select the report type from the provided list.

3 Enter a number to specify the age (in days) of data that you want to purge, and click **OK**.

Viewing Statistics

The following sections describe how to view both current and collected statistics.

For information about SkyPilot statistics, see “About Reports and Statistics” on page 70.

Viewing Current Statistics

You can view the current statistics for any data collection task that is not running.

To view current statistics:

1 In the navigation pane of SkyPilot EMS, expand the **SkyControl** tree (if it is not already expanded).

The navigation pane expands to show the complete list of configured domains.

2 Expand the domain tree (if it is not already expanded) that contains the device for which you want view current statistics.

The navigation pane expands to show the complete list of devices in the domain.

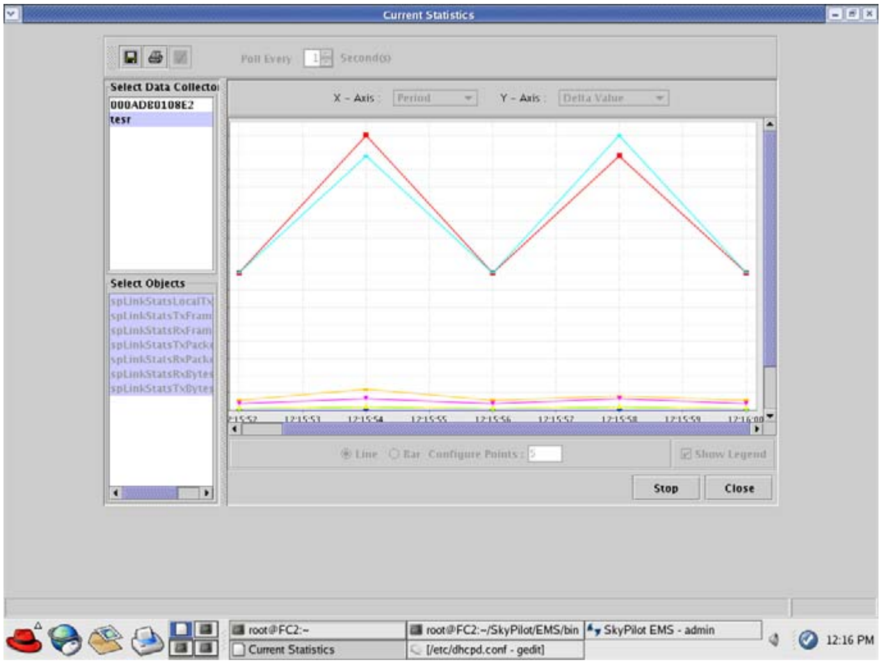
3 Right-click the desired device name and choose **View Current Statistics**.

SkyControl displays the Current Statistics screen.

4 Select the devices, data collectors, MIB objects, and instances you want to view, the desired plot type (**Line**, **Stacked Line**, **Bar**, **Stacked Bar**, or **Pie**), enter a polling interval, and click **Start**.

SkyControl displays the statistics in real time, similar to the example shown in Figure D-12.

Figure D-12. Current Statistics view



5 When you're done viewing the statistics, click **Stop** and **Close**.

Viewing Collected Statistics

You can view collected statistics for any data collection task that is not running.

To view collected statistics:

1 In the navigation pane of SkyPilot EMS, expand the SkyControl tree (if it is not already expanded).

The navigation pane expands to show the complete list of configured domains.

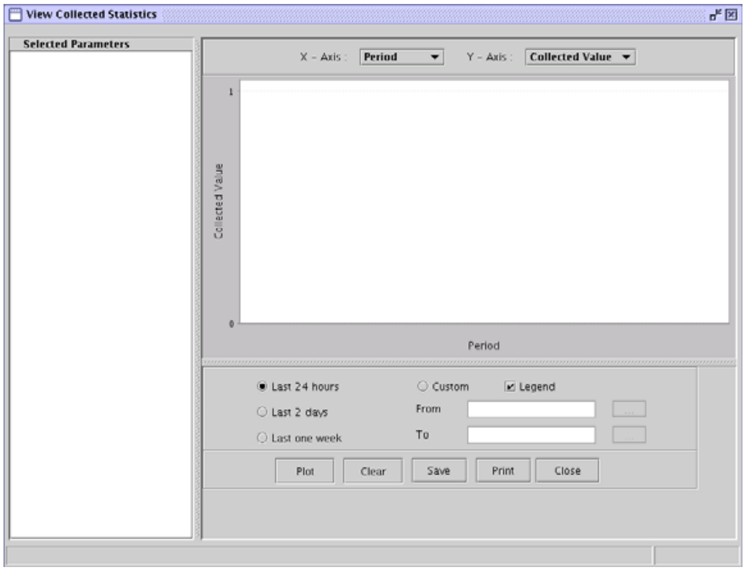
2 Expand the domain tree (if it is not already expanded) that contains the device for which you want view a report.

The navigation pane expands to show the complete list of devices in the domain.

3 Right-click the device name for which you want the report, and choose **View Collected Statistics**.

SkyControl displays the Collected Statistics screen.

Figure D-13. Collected Statistics screen



View Collected Statistics

Selected Parameters

X - Axis : Period ▾ Y - Axis : Collected Value ▾

● Last 24 hours ○ Custom ☑ Legend

○ Last 2 days From

○ Last one week To

4 Select the parameters, configure the graph elements (such as the axis settings and graph type), choose the time frame, and then click one of the following:

- **Plot**—Plots the statistics corresponding to the settings you've chosen
- **Clear**—Clears the display so you can change the settings
- **Save**—Saves the display
- **Print**—Prints the display

5 When you're done viewing the statistics, click **Close**.

E

Configuring a Firewall for SkyPilot Operations

For optimal SkyPilot operations, you should install your operating system without a firewall. However, if security concerns or other issues force you to use a firewall, you must configure the firewall to allow incoming data traffic on ports that SkyPilot clients and devices use for server communications (see Table E-1).

NOTE Each port you open reduces the overall security provided by the firewall.

Table E-1. Ports to Open

To do this	Open these ports
Allow EMS Java clients to connect to the EMS server	1098 TCP (JBoss RMI port) 1099 TCP (JBoss RMI port) 4444 TCP (JBoss RMI object port) 3306 TCP (MySQL DB port) 32007 (Notification port)
Allow EMS Web clients to connect to the EMS server	80 (HTTP server)
Allow SkyProvision to configure SkyPilot devices outside the firewall	8000 TCP (HTTP server) 20 TCP (FTP server) 21 TCP (FTP server) 67 TCP/UDP (DHCP server)
Allow SkyControl to monitor SkyPilot devices outside the firewall	161 TCP/UDP (SNMP Read) 162 UDP (SNMP Traps)

Access Point Command-Line Interface

The access point command-line interface enables SkyPilot support to debug the access point configuration through the Linux command shell. This appendix provides instructions for accessing the interface.

Checking VLAN Status

Before you can access a DualBand's or TriBand's access point command-line interface, you must first check the VLAN status.

If your SkyPilot network is configured to use a management VLAN, the access point automatically uses that VLAN for management traffic. Therefore, you'll need to access the access point from a PC that's a member of that management VLAN. Typically this means you'll need to access the Web interface from the SkyPilot EMS server or other management workstation across the SkyPilot mesh network. If you've previously configured a management SSID as a member of the management VLAN, you can use this SSID to connect directly to the access point.

Accessing the Interface

You use a Wi-Fi connection to access a DualBand or TriBand access point's command-line interface. To complete the connection, you'll need a computer that's capable of Wi-Fi communication and that's within operating range of the access point.

To gain direct Wi-Fi network access:

1. Set up your host computer's 802.11b/g interface to connect to the access point's default SSID (which is a case-sensitive string representation of the DualBand or TriBand MAC address, without the colon characters).

   The default SSID uses a Wi-Fi Protected Access–Pre-Shared Key (WPA-PSK) protection scheme that uses a public key (password) of `publicpublic` to control access. You're prompted for this key when you connect to the SSID from your computer.

2. Set an IP address for your computer's 802.11b/g interface:

   Enter the IP address 192.168.0.5 and the netmask 255.255.255.0, and apply the setting.

3. Confirm that your computer can communicate with the access point by pinging it using its default IP address: for 2.4 GHz access points, 192.168.0.3, and for 4.9 GHz access points, 192.168.0.3. (This is same IP address you use to log in directly to the access point's Web interface.)

   If the ping is successful, you're ready to debug the access point using Linux shell commands.