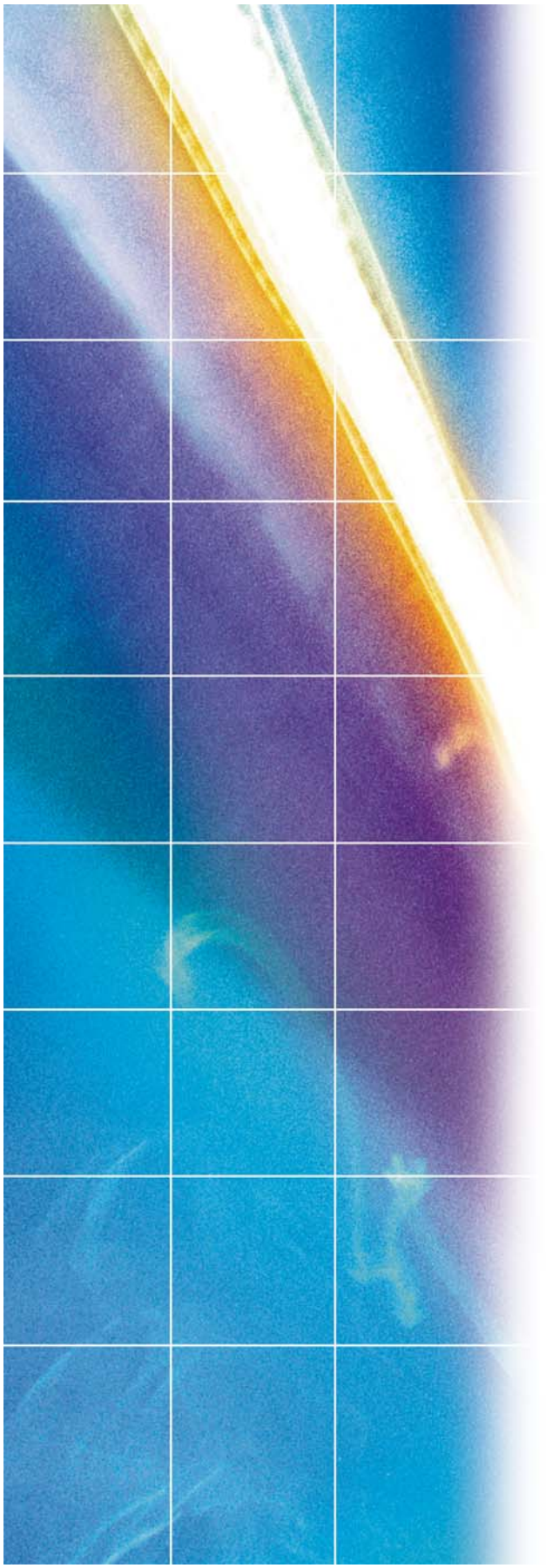

FORTRESS™ TECHNOLOGIES

Fortress Security System

Secure Wireless Bridge and Security Controller

Software GUI Guide

www.fortresstech.com

009-00035-00v5.4r1

Fortress Bridge and Controller version 5.4 Software GUI Guide [rev.1]

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If, during the warranty period, as established by the date of shipment [and in the case of resale by a Fortress Solution Provider, commencing not more than (90) days after original shipment by Fortress], the Customer finds any significant defect in materials and workmanship under normal use and operating conditions, the Customer shall notify Fortress Customer Service in accordance with the Fortress Service Policies in effect at that time which can be located on the Fortress web site: www.fortresstech.com.

EULA Addendum for Products Containing 4.4 GHz Military Band Radio(s)

This product contains one or more radios which operate in the 4.400GHz - 4.750GHz range.

This frequency range is owned and operated by the U.S. Department of Defense and its use is restricted to users with proper authorization. By accepting this agreement, user acknowledges that proper authorization to operate in this frequency has been obtained and user accepts full responsibility for any unauthorized use. User agrees to indemnify and hold harmless Fortress Technologies, Inc. from any fines, costs or expenses resulting from or associated with unauthorized use of this frequency range.

This EULA Addendum does not apply to Fortress products that do not contain 4.4 GHz radios.

Table of Contents

Chapter 1
Introduction

1.1 This Document

This user guide covers configuring, managing and monitoring any current-model Fortress Bridge (or Controller) through the Bridge GUI. It also presents the most detailed descriptions of supported network topologies and overall Bridge software functions and operation available among the full set of user guides that cover Fortress Bridges.

Fortress Bridge user guidance is intended for professional system and network administrators and assumes that its users have a level of technical expertise consistent with these roles.

Side notes throughout this document are intended to alert you to particular kinds of information, as visually indicated by their icons. Examples appear to the right of this section, in descending order of urgency.

WARNING: can cause physical injury or death and/or severely damage your equipment.

CAUTION: can corrupt your network, your data or an intended result.

NOTE: may assist you in executing the task, e.g. a convenient software feature or notice of something to keep in mind.

1.1.1 Related Documents

Fortress software user guidance, including this guide, covers all current Fortress hardware platforms.

In addition to this guide, Fortress Bridge software guides include:

- *Secure Wireless Bridge and Security Controller CLI Software Guide*
- *Secure Wireless Bridge and Security Controller Auto Config Software Guide*

Although they run the same software, there are significant differences among the various ES-series Bridges and between the ES-series and the FC-*X*, or Fortress Controller. Each Fortress hardware device is therefore covered in a platform-specific hardware guide, currently including:

- *ES820 Secure Wireless Bridge Hardware Guide*
- *ES520 Secure Wireless Bridge Hardware Guide*
- *ES440 Secure Wireless Bridge Hardware Guide*
- *ES210 Secure Wireless Bridge Hardware Guide*
- *FC-X Security Controller Hardware Guide*

Each software version of the Fortress Secure Client is covered in a separate Fortress Secure Client user guide.

1.2 Network Security Overview

Network security measures take a variety of forms; key components include:

- *Confidentiality* or *privacy* implementations prevent information from being derived from intercepted traffic.
- *Integrity* checking guards against deliberate or accidental changes to data transmitted on the network.
- *Access control* restricts network access to authenticated users and devices and defines resource availability and user permissions within the network.

1.3 Fortress Security Systems

Fortress applies a combination of established and unique methodologies to network security.

Fortress's Mobile Security Protocol (MSP) provides device authentication and strong encryption at the Media Access Control (MAC) sublayer, within the Data Link Layer (Layer 2) of the Open System Interconnection (OSI) networking model. This allows a transmission's entire contents, including IP addresses, to be encrypted.

Fortress security systems also employ and support standards- and protocols-based network security measures, including RADIUS (Remote Authentication Dial in User Service), WPA (Wi-Fi Protected Access) and WPA2, IPsec (Internet Protocol Security), and NSA (National Security Agency) Suite B[1] cryptography.

Fortress security systems can be configured to operate in full compliance with Federal Information Processing Standards (FIPS) 140-2 Security Level 2.

NOTE: New releases may still be in FIPS 140-2 Level 2-validation process. Contact your Fortress representative for the current FIPS certification status of Fortress products.

1.3.1 Fortress Bridges and Controllers

Fortress hardware devices include the ES-series of Fortress Bridges and the Fortress Controller (FC-*X*) and may be collectively referred to as *Bridges*, *Controllers* or *Controller devices*. The ES820 Bridge is also known as Fortress's *Vehicle Mesh Point*. The ES440 Bridge is also known as an *Infrastructure Mesh Point*, and the ES210 Bridge is also known as a *Tactical Mesh Point.*

1. Suite B specifies only the cryptographic algorithms to be used. Many factors determine whether a given device should be used to satisfy a particular requirement: ▪ the quality of the implementation of the cryptographic algorithm in software, firmware or hardware; ▪ operational requirements associated with U.S. Government-approved key and key-management activities; ▪ the uniqueness of the information to be protected (e.g. special intelligence, nuclear command and control, U.S.-only data); ▪ interoperability requirements, both domestic and international. The National Security Agency may evaluate Suite B products for use in protecting U.S. Government classified information on a case-by-case basis and will provide extensive design guidance to develop products suitable for protecting classified information.

The term *Bridge* is used consistently throughout user guidance to refer to both ES- and FC-series Fortress hardware devices.

Fortress Bridges provide network security by authenticating access to the bridged network and bridging encrypted wireless transmissions to the wired Local Area Network (and/or wired communication within the LAN) and by authenticating and encrypting Wireless Distribution System (WDS) links.

Fortress Bridges are variously equipped for network connectivity. When one or more radio is present, the Bridge can both provide and protect wireless connections. Fortress devices without radios act as overlay security appliances for wireless networks. All Fortress devices are equipped for wired Ethernet with varying numbers of ports.

Table 1.1 shows the various hardware configurations and capabilities of current Fortress hardware devices.

Table 1.1. Radios and Ethernet Ports in Fortress Hardware Devices

series	**Fortress model**	**# radios**	radio label	standard equipment	4.4GHz option	**# Eth ports**	Eth port HW label	Eth port SW label	takes PoE	serves PoE	fiber option	default encryption
ES	ES820	2	Radio 1	802.11a/g/n	no	2	Ethernet1	wan	no	no	no	encrypted
			Radio 2	802.11a/n	no		Ethernet2	aux	no	no	no	clear
	ES520	2	Radio 1	802.11a/g	no	9	1–8	lan1–lan8	no	yes	no	clear
			Radio 2	802.11a	yes		WAN	wan1	yes	no	no	encrypted
	ES440	4	Radio 1	802.11a/g/n	no	2	Ethernet1	wan	yes	no	no	encrypted
			Radio 2–Radio 4	802.11a/n	no		Ethernet2	aux	no	no	no	clear
	ES210	1	Radio 1	802.11a/g/n	no	2	Ethernet	aux	no	no	no	clear
							Ethernet (WAN)	wan	no	no	no	encrypted
FC	FC-***X***	0	n/a			3	Encrypted	enc	no	no	yes	encrypted
							Unencrypted	clr	no	no	yes	clear
							AUX	aux	no	no	no	clear

The ES210 is additionally equipped with a GPS (Global Positioning System) receiver and associated antenna port.

1.3.1.1 ES-Series Model Numbers

Fortress ES-series model numbers provide information about the product platform and the number and type of radio(s) it contains. Figure 1 breaks down the model number for an ES520-35 Secure Wireless Bridge.

You can find the full model number for any ES-series Bridge on the *Administration Settings* screen under *System Info*.

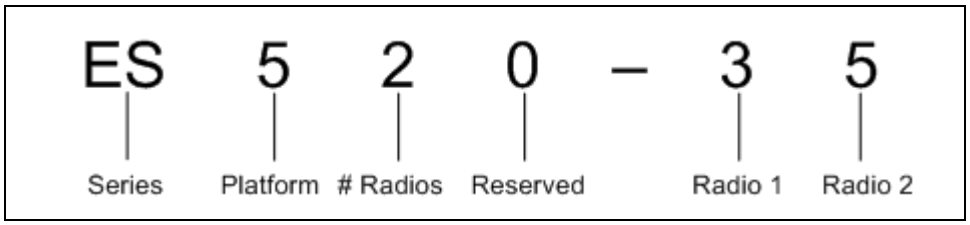


Figure 1. ES-Series Product Model Number Explication

The number of digits after the hyphen corresponds to the number of radios installed in the Bridge. The value of each digit indicates the frequency band(s) that radio supports, as shown in Table 1.2.

CAUTION: Use of 4.4 GHz radios is strictly forbidden outside of U.S. Department of Defense authority.

Table 1.2. Radio Installed and Supported Frequencies

Number	Radio Installed	Supported Frequencies
3	802.11a/g ***or*** 802.11a/g/n	2.4 GHz ***or*** 5 GHz
4	802.11 military band	4.4 GHz
5	802.11a ***or*** 802.11a/n	5 GHz

1.3.1.2 Fortress Bridge Management

Fortress Bridges can be administered through either of two native software management tools. They support SNMP (Simple Network Management Protocol) transactions, and each model chassis provides a small subset of basic user controls and visual indicators.

Bridge GUI

The graphical user interface for Fortress Bridges is a browser-based management tool that provides administration and monitoring functions in a menu- and dialog-driven format. It is accessed over the network via the Bridge's IP address. The Bridge GUI supports Microsoft® Internet Explorer and Mozilla Firefox™. Using the Bridge GUI is covered in this user guide.

Bridge CLI

The command-line interface for Fortress Bridges provides administration and monitoring functions via a command line. It is accessed over the network via a secure shell (SSH) connection to the Bridge's management interface or through a terminal connected directly to the Bridge's serial **Console** port. Using the Bridge CLI is covered in *Secure Wireless Bridge and Security Controller CLI Software Guide*.

SNMP

Fortress Bridges support monitoring through version 3 of the Simple Network Management Protocol (SNMP) Internet standard for network management. Fortress Management

Information Bases (MIBs) are included on the Bridge CD and can be downloaded from the Fortress Technologies web site: www.fortresstech.com/. Configuring SNMP through the Bridge GUI is covered in this guide; configuring it through the Bridge CLI is covered in *Secure Wireless Bridge and Security Controller CLI Software Guide*.

Chassis Indicators and Controls

Fortress Bridges are variously equipped with LED indicators and chassis controls. These are covered in each Bridge's (or Controller's) respective Hardware Guide.

1.3.2 Fortress Secure Client Software

The Fortress Secure Client employs Fortress's Multi-Factor Authentication™ and MSP to authenticate third-party client device connections and encrypt traffic between such devices and the Bridge-secured network. The Secure Client can be installed on a variety of mobile and hand-held devices.

1.4 Network Deployment Options

You can expand Fortress Bridge functionality and associated configuration options by licensing advanced features. Among these, Fortress's FastPath Mesh link management function supports optimal path selection and independent IPv6 mesh addressing and DNS (Domain Name System) distribution. FastPath Mesh networks provide higher efficiency and greater mobility than networks using STP link management, which does not require a license.

NOTE: Refer to Table 3.1 in Section 3.2 for a quick comparison of FastPath Mesh and STP networks.

Although FastPath Mesh and STP networks serve the same essential functions, the details of deploying them are not identical. Each type of network is covered separately below, with a selection of representative deployment options.

1.4.1 FastPath Mesh Network Deployments

When FastPath Mesh is licensed and selected for *Bridging Mode*, FastPath Mesh networks are automatically formed among compatibly configured Fortress Bridges. These bridging nodes are known as *Mesh Points* (MPs).

MPs connect to one another over wired or wireless interfaces that have been configured as *Core* interfaces.

NOTE: Refer to Section 3.2.1 for more on FastPath Mesh bridging and to sections 3.3.4 and 3.7 for per-port *FastPath Mesh Mode* settings for radio BSSs and Ethernet ports, respectively.

All MPs on a given FP Mesh network are *peers*. Directly connected MPs are *neighbors*.

On separate interfaces, configured as *Access* interfaces, FastPath Mesh Points can connect other devices, or *Non-Mesh Points* (NMPs), to the network and connect the mesh to a conventional hierarchical network.

Once FastPath Mesh connections are established, the FP Mesh network acts as a flat, OSI layer-2 network for the

devices it connects, routing network traffic on the fastest, most efficient path to its destination.

FastPath Mesh supports standard network DHCP (Dynamic Host Control Protocol) and DNS (Domain Name System) servers and static or dynamic IPv4 and IPv6 addressing. In addition, FastPath Mesh itself automatically generates a *Unique Local IPv6 Unicast Address* (defined in IETF RFC[2] 4193) for each MP and provides internal name resolution.

1.4.1.1 Isolated FastPath Mesh Networks

The independent RFC-4193 IPv6 mesh addressing and DNS distribution functions embedded in FastPath Mesh enable a set of Fortress Bridges to form a fully functioning FastPath Mesh network as soon as they are connected.

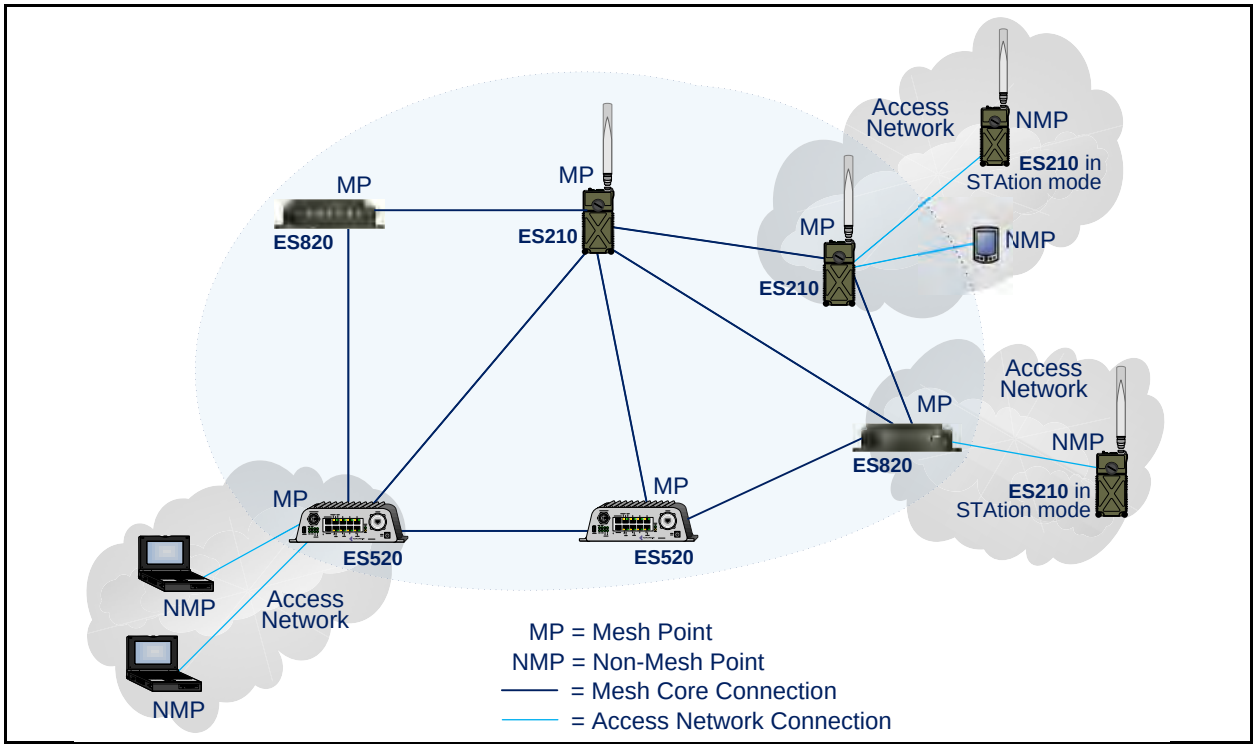


Figure 1.1. Isolated FP Mesh Network with Access Network Connections

In the case of an isolated wireless FP Mesh network, as shown in Figure 1.1, on each Bridge to be used as an MP you must, at minimum:

- License **FastPath Mesh** on the Bridge:
  on **Maintain -> Licensing**
- Select **FastPath Mesh** for *Bridging Mode*:
  on **Configure -> Administration**
- Enable the internal radio(s):
  on **Configure -> Radio Settings**

2. Internet Engineering Task Force Request for Comments

- Create a bridging BSS on (one of) the radio(s) with:
  - an *SSID* in common with the bridging BSSs on the rest of the MPs
  - a *Wireless Bridge* setting of **Enabled**

  on **Configure -> Radio Settings -> ADD BSS**
- If the current MP will connect NMPs to the network, create an Access BSS on (one of) the radio(s) with:
  - an *SSID* for NMP devices to connect to
  - a *Wireless Bridge* setting of **Disabled**

  on **Configure -> Radio Settings -> ADD BSS**

NOTE: A BSSs bridging setting also determines its FP Mesh function. With *Wireless Bridge* **Enabled**, BSSs function as Core interfaces; with *Wireless Bridge* **Disabled** they function as Access interfaces (Section 3.3.4.3).

The Bridge will force you to change the password of the preconfigured administrator account when you log in for the first time. The Bridge is not fully secure until you have also changed passwords for the two remaining preconfigured administrative accounts and the network Access ID from their defaults.

Including the RFC-4193 IPv6 address FP Mesh automatically generates, each MP can have up to sixteen IPv6 addresses. It always has a link-local address and can always have a manually configured IPv6 global address. If *IPv6 Auto Addressing* is **Enabled** (the default) and an IPv6 router is present on the network to provide routing prefixes, additional IPv6 addresses will be present. Each MP can also have a manually configured IPv4 address. Refer to Section 3.4.2 for more on IP addressing on the Bridge.

To provide virtually configuration-free DHCP and DNS services for Non-Mesh Points on the FP Mesh network, enable one (or a few) of the DHCP servers internal to the network MPs and leave all of their internal DNS servers enabled (the default). The Bridge's DNS service is used in common by IPv4 and IPv6 networks, while the Bridge provides separate, dedicated IPv4 and IPv6 DHCP servers. Refer to Section 3.6 for more on the Bridge's internal DHCP and DNS servers.

1.4.1.2 Network-Attached FastPath Mesh Networks

One or more of the Mesh Points in a FastPath Mesh network can connect the mesh to a conventional hierarchical LAN or WAN (wide are network). An MP that serves as a bridge between the FP Mesh network and a hierarchical network is a *Mesh Border Gateway* (MBG).

The MBG interface that connects to the LAN or WAN must be configured as an **Access** interface, the MBG's default gateway must be a router on the hierarchical network, and route(s) to the FastPath Mesh's subnet must be configured on the network router(s). If IPv6 network routers are configured to provide an IPv6 global prefix, the MBG will forward it to every node in the network (MPs and NMPs).

If a DHCP server internal to one of the MPs is enabled to configure the IP addresses of network NMPs, all NMPs will have the correct default gateway address and IPv6 prefix to automatically configure themselves without further manual configuration.

To create a FastPath Mesh network and attach it to a conventional hierarchical network, as shown in Figure 1.2, you must, at minimum:

- follow the steps to configure an isolated FastPath Mesh network outlined in the preceding Section 1.4.1.1.
- on each Mesh Point that will serve as an MBG:
  - configure the hierarchical network router as the MBG's default gateway: on **Configure -> Administration ->** *Network Configuration.*
  - be sure the interface that will connect to the hierarchical network is configured as an FP Mesh Access interface. *FastPath Mesh Mode* is specified for wired interfaces: on **Configure -> Ethernet Settings -> EDIT**. Wireless interfaces are automatically (and transparently) configured as Access interfaces when *Wireless Bridge* is **Disabled**: on **Configure -> Radio Settings -> ADD BSS**.
- on each router in the hierarchical network that will connect to an MBG, configure route(s) to the FP Mesh subnet.

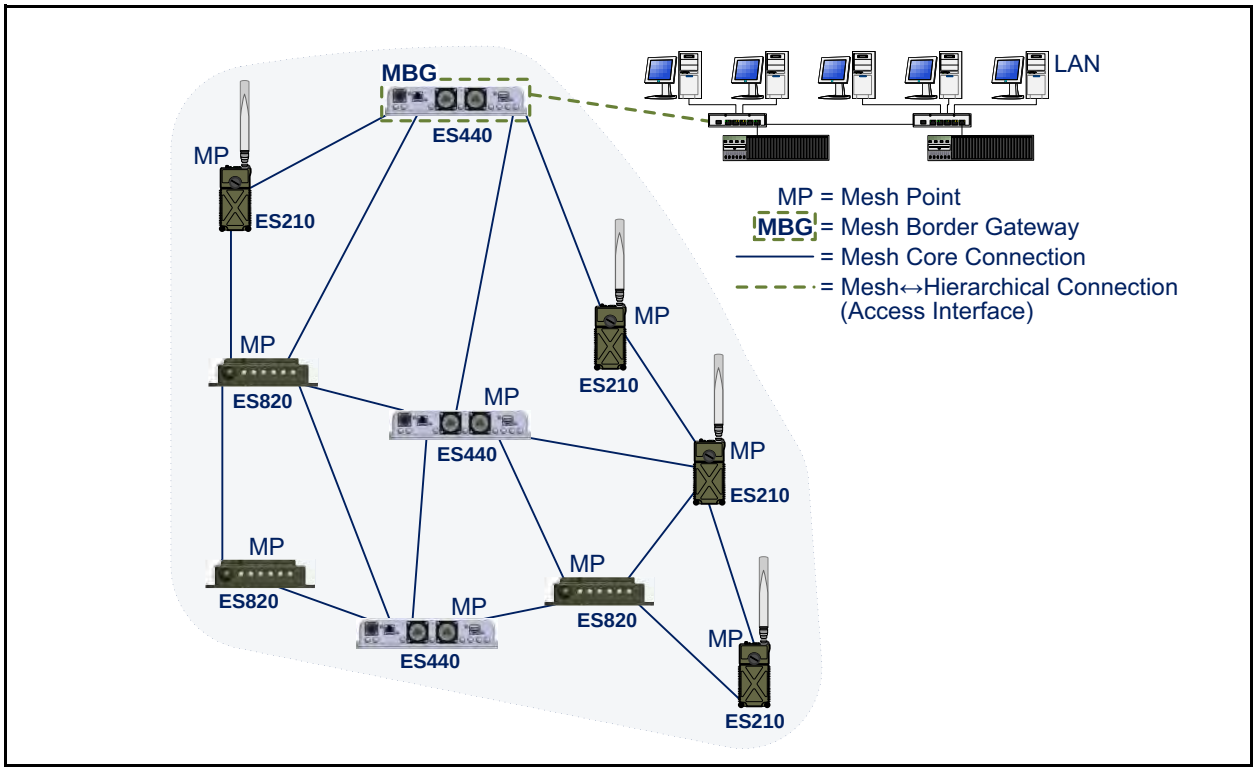


Figure 1.2. Single FP Mesh Network with a Single MBG Attachment Point

In addition to the RFC-4193 IPv6 address FP Mesh automatically generates, the MBG is provided with a global prefix by the network IPv6 router. If a DHCP server internal to one of the MPs is enabled, each IPv6 node in the network can then be reached by the public address so provided.

You can attach an FP Mesh network to a hierarchical network by more than one MBG to provide path redundancy between the mesh and the LAN or WAN. If one of the MBGs becomes unavailable, the other(s) will maintain the connection.

NOTE: There is no coordination between FP Mesh MBGs.

Regardless of the number of MBGs attached to the hierarchical network, traffic into the FP Mesh network typically flows through only one MBG. If two (or more) MBGs are used, you can manually split traffic between the two MBGs by IPv4 address ranges (10.1/16 -> MBG1, 10.2/16 -> MBG2, for example), but it will still be the case that only one MBG will send traffic to any given FP Mesh node.

1.4.1.3 Separating and Rejoining in FastPath Mesh Networks

Mesh Points in a wireless FastPath Mesh network can separate and rejoin smoothly, individually or in groups, as mobile Mesh Points move in and out of range of each other. Changes in the costs and availability of FP Mesh data paths are propagated throughout the network.

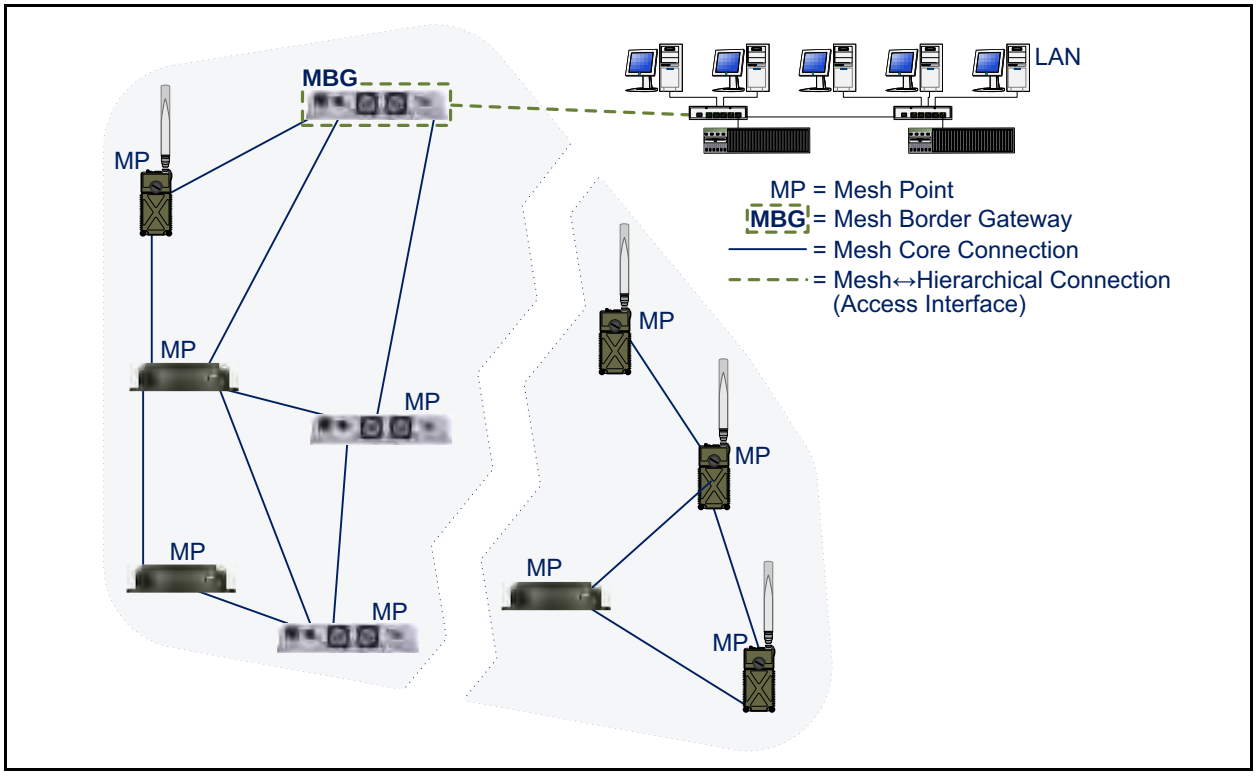


Figure 1.3. Single Separated FP Mesh Network

When a split forms in a mobile FP Mesh network attached to a hierarchical network, as shown in Figure 1.3, any nodes

separated from the MBG will be temporarily disconnected from the hierarchical network. Multiple MBGs can enable parts of the mesh temporarily separated from each other to remain connected to a hierarchical network, as long as there is an MBG present among the separated group of nodes.

1.4.1.4 Bridging Loops in FastPath Mesh Networks

Bridging loops can form only when FastPath Mesh Points are connected over both Core and Access interfaces.

In FastPath Mesh Networks with single MBG attachment points to the hierarchical network, such as those shown in Figure 1.4, simultaneous Core and Access connections are not present, and bridging loops cannot form. Although the two MBGs are connected to the same LAN by their Access interfaces, they are MPs in different FP Mesh networks and so are not also connected by Core interfaces.

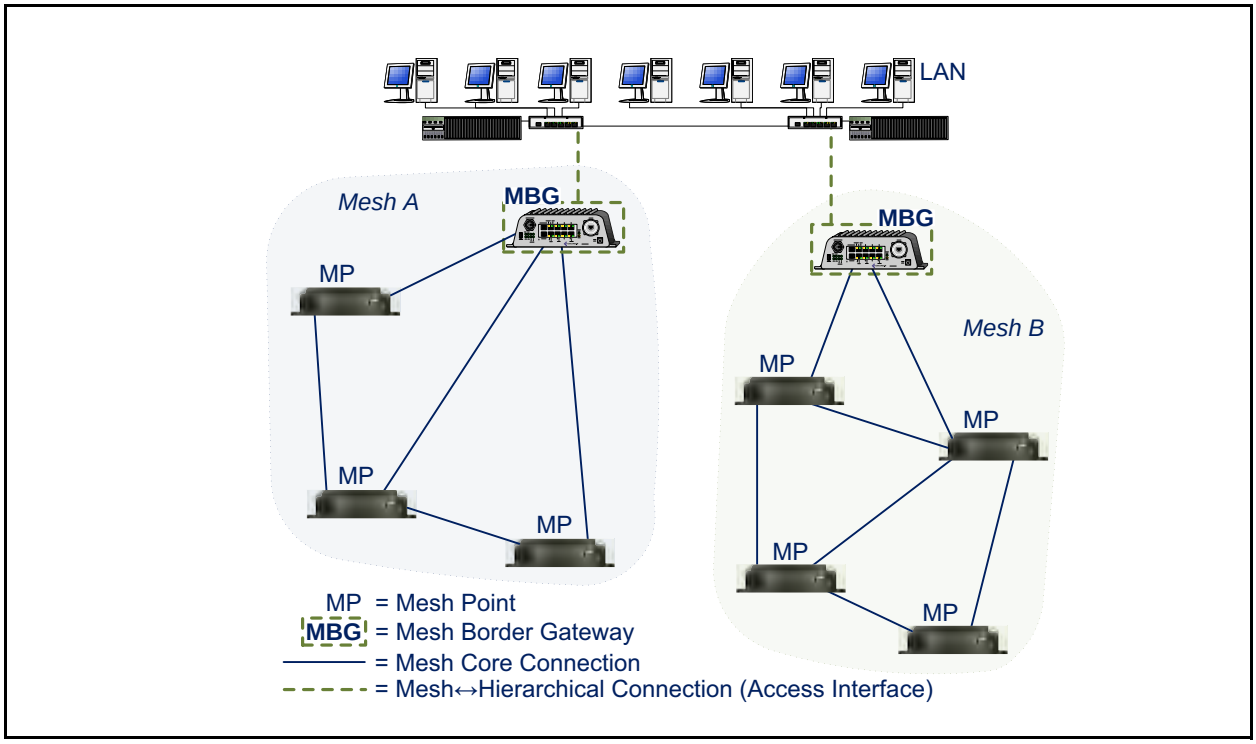


Figure 1.4. Two FP Mesh Networks, One MBG Attachment Point Each, Connected to a Single Access Network

When a FastPath Mesh network is attached to a hierarchical network by two (or more) Mesh Border Gateways, the Mesh Points serving these roles are connected to each other both by their Core interfaces and by the Access interfaces connecting them to the hierarchical network. FastPath Mesh detects and prevents the loop that would otherwise form over these connections:

- Among the many MPs that detect a loop, only the MP with the lowest MAC address will forward mesh traffic received

on the Access interfaces on which the loop has been detected.

- Only the MP so chosen as the forwarder will advertise NMPs discovered on these Access interfaces.

Because only one MBG in a given FP Mesh network will actively pass traffic to and from the hierarchical network, multiple MBGs can be present in multiple FP Mesh networks attached to the same LAN, as shown in Figure 1.5.

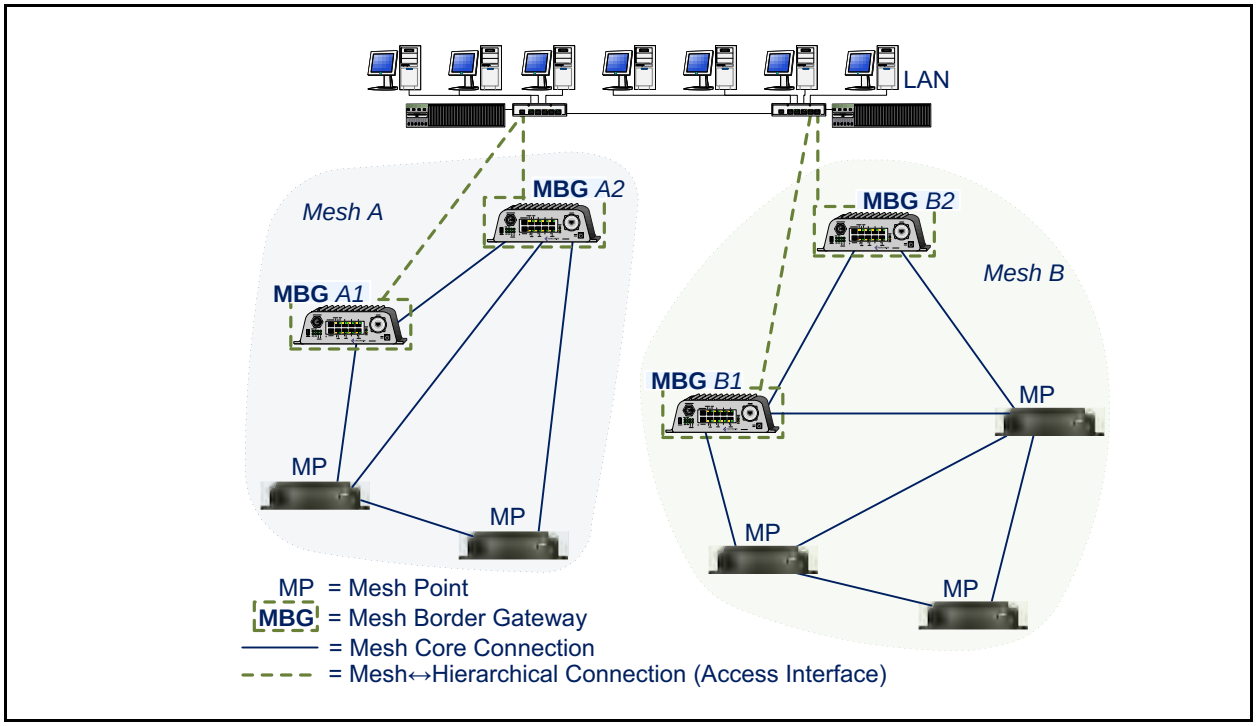


Figure 1.5. Two FP Mesh Networks, Two MBGs Each, Connected to a Single Access Network

1.4.1.5 Traffic Duplication in FastPath Mesh Networks

Although you can attach more than one FP Mesh network simultaneously to more than one LAN, configurations in which separate hierarchical networks are “bridged” by multiple FP Mesh networks will necessarily generate duplicate traffic, as shown in Figure 1.6.

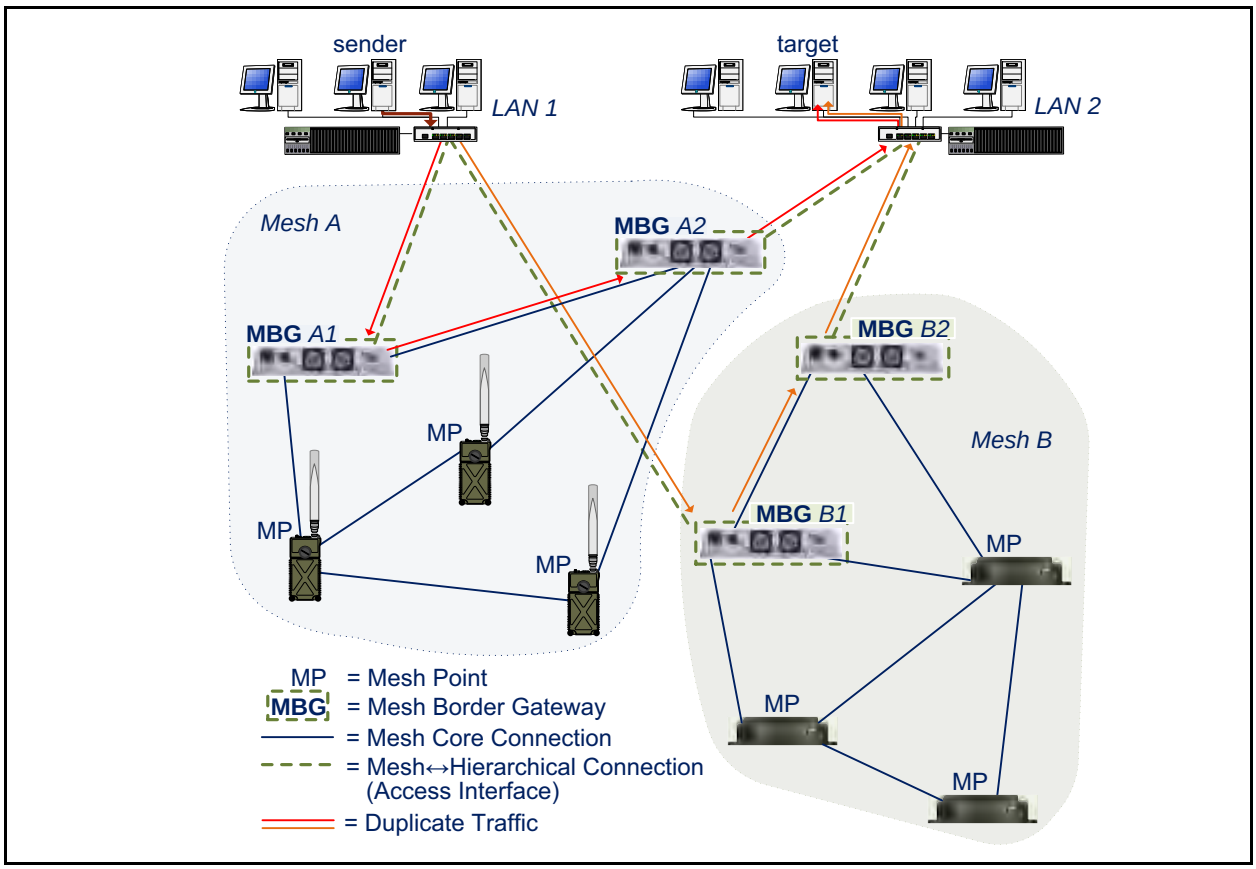


Figure 1.6. Traffic Duplication in Two FP Mesh Networks Attached to Separate Access Networks

Avoid such configurations if traffic duplication is undesirable in your environment.

1.4.2 STP Mesh Network Deployments

Fortress Bridges can be deployed in mesh networks managed by Spanning Tree Protocol without any additional features licensing.

When **STP** is selected for *Bridging Mode* (the default), the Bridge can be used as a node in an STP-managed mesh network while—on a separate BSS—also acting as an AP (access point) to WLAN client devices within range.

Bridges configured to be able to connect to one another automatically form mesh networks.

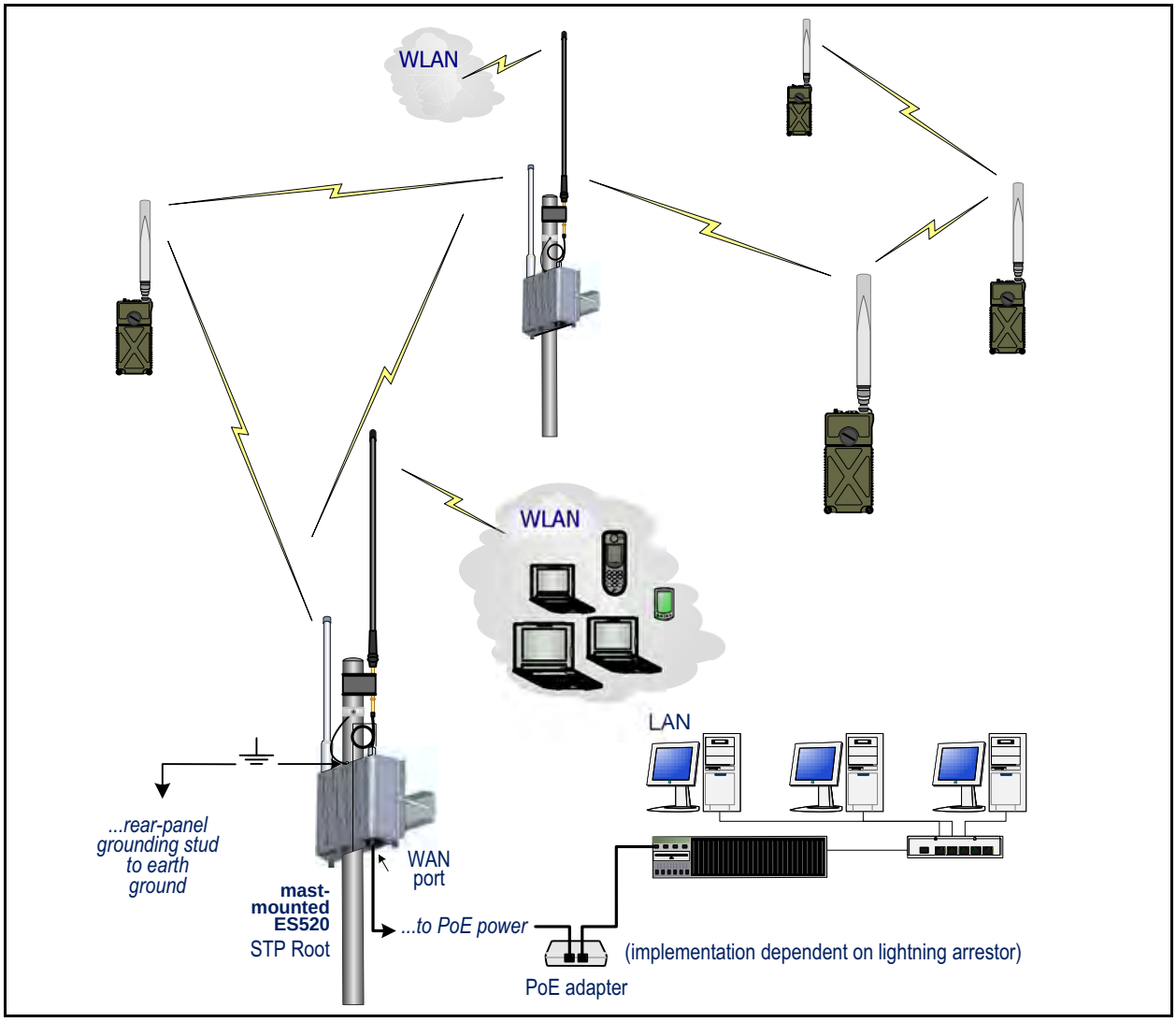


Figure 1.7. STP Mesh Network Deployment

At their default settings, the Bridge with the lowest MAC address will serve as the STP root. Alternatively, you can configure the order in which networked Bridges will assume the role of STP root, if the existing root is lost, by specifying the *Bridge Priority* order on individual Bridges in an STP network.

One or more of the linked Bridges (or network nodes) can also be configured to connect the mesh network to a LAN and/or to serve as a WLAN AP for compatibly configured wireless clients within range. Figure 1.7 shows an STP mesh network in which all connected nodes are serving as WLAN APs and the STP root node is attached to a LAN.

NOTE: Refer to Section 3.2.2 for more on STP bridging and configuring *Bridge Priority*.

1.4.3 Point-to-Point Bridging Deployments

The Bridge can be deployed as a conventional wireless Bridge to connect two separately located LANs (local area networks), for example, or to link remotely located hardware to the local network for system management and data upload, as shown in Figure 1.8).

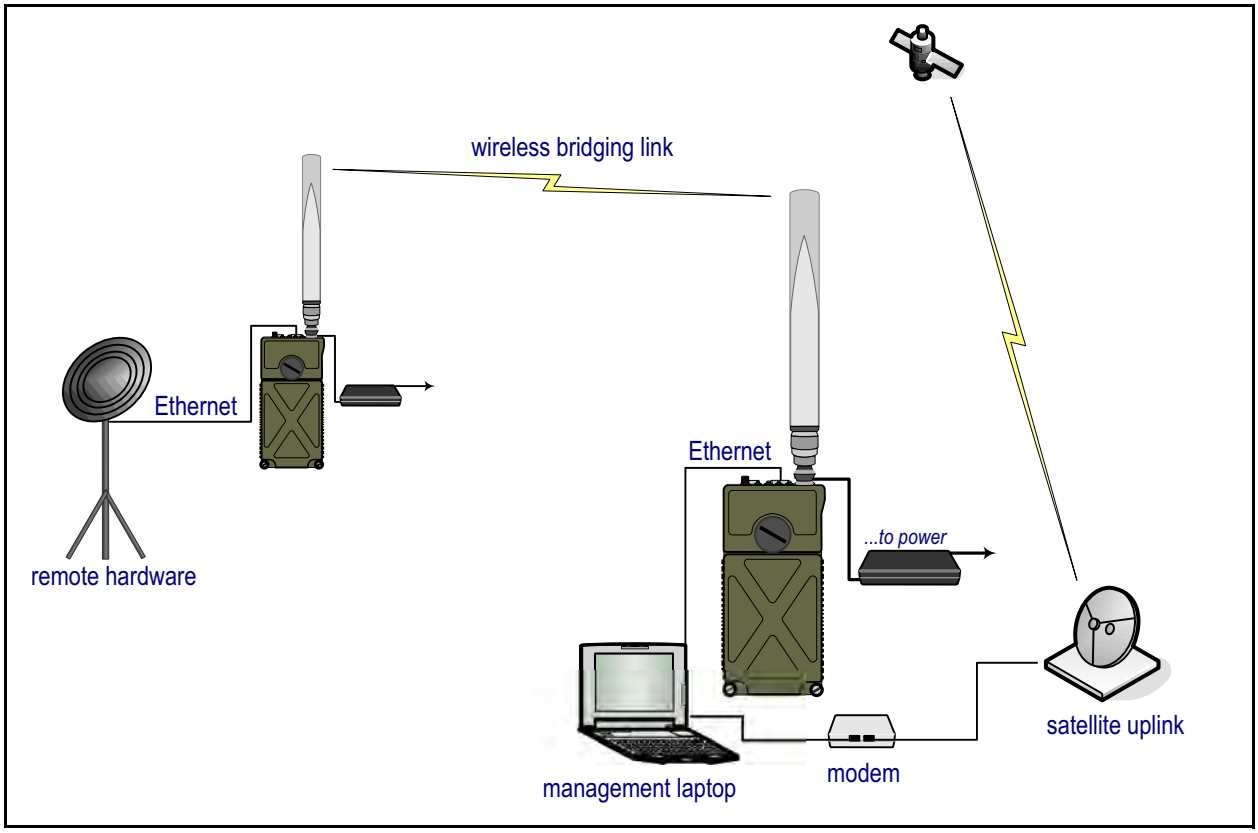


Figure 1.8. Point-to-Point Wireless Bridging Deployment

As long as the LAN or WAN to which the Bridge is connecting does not require STP to be enabled, Bridges can be deployed in point-to-point (two-node) bridging configurations without any link management (with a *Bridging Mode* setting of **Off**).

If more than two Bridges will be networked, Fortress strongly recommends using FastPath Mesh (if licensed) or STP link management.

1.4.4 Wireless Client ES210 Bridge Deployments

An ES210 Bridge can be dedicated to operate as a standard 802.11 wireless client by configuring a single station (STA) interface on its single internal radio.

ES210 Bridges operating as wireless client devices can be integrated into Bridge-secured network deployments as any WLAN client would be: connecting to the WLAN (or access network) through another Bridge acting as a network AP (or configured with an access interface).

1.5 Compatibility

The Fortress Bridge is fully compatible with WPA and WPA2 enterprise and pre-shared key modes and with Fortress Secure Client versions 2.5.6 and later.

In addition or as an alternative to the Bridge's native authentication service, the Bridge can be used with an external RADIUS server. Supported services include:

- Microsoft® Windows Server 2003 Internet Authentication Service® (IAS)
- freeRADIUS version 2.1 (open source)

Chapter 2
Bridge GUI and Administrative Access

2.1 Bridge GUI

The Fortress Secure Wireless Bridge's graphical user interface provides access to Bridge administrative and monitoring functions.

2.1.1 System Requirements

To display properly, the Bridge GUI requires a monitor resolution of at least 1024 × 768 pixels and the following (or later) browser versions:

- Microsoft® Internet Explorer 7.0
- Mozilla Firefox™ 2.0

2.1.2 Bridge GUI Security

Browser connections to the Bridge's management interface are secured via https (Hypertext Transfer Protocol Secure). GUI access can be authenticated via the self-signed X.509 digital certificate automatically generated by the Bridge for use by SSL (Secure Socket Layer) and present by default in the local certificate store. You can also import and select a different certificate for the Bridge's SSL function (refer to Section 6.2).

You can turn off GUI access to the Bridge altogether by disabling the user interface, requiring administrators to access the Bridge exclusively through the CLI (refer to Section 4.1.5). The Bridge GUI is enabled by default.

2.1.3 Logging On

You can access the Bridge GUI from any computer with access to the Bridge: any computer on one of the Bridge's clear interfaces, as well as any computer with a secure connection to an encrypted interface.

To access the Bridge GUI:

1. Open a browser and, in the address field, enter the IP address assigned to the Bridge's management interface.
2. If this is the first time an administrator has logged on to the Bridge and you agree to the terms of the license

NOTE: The default IP address is *192.168.254.254*. Default passwords for preconfigured accounts are the accounts' respective user names (refer to Section 2.2.2) and must be changed when the account is first used.

agreement, click to accept them. (Once accepted the agreement does not display.)

or

If an administrative logon banner has been configured (Section 2.2.1.9)—click to accept its terms. (There is no administrator logon banner by default.)

3 On the *Logon to Fortress Security System* screen, enter a valid *Username* and *Password*.

4 Click **LOGON**.

Figure 2.1. Bridge GUI *Logon* screen, all platforms

NOTE: Default complexity requirements force passwords to be changed on all three preconfigured accounts when the accounts are first used. If password requirements are changed to permit the defaults, first-time logons to *Maintenance* and *Logviewer* will not force password changes.

5 If prompted to do so, enter and confirm a new password for the account and click **SUBMIT**.

You will be prompted to create a new password if:

- You are logging on to the Bridge for the first time.
- The account password has expired or has been expired for non-conformance (refer to Section 2.2.1.7).
- The *User must change password:* **Yes** option is in effect for the account you are trying to log on (Section 2.2.2).

You can optionally view current password complexity requirements by clicking **Complexity Requirements** at the bottom of the *Create a new password* dialog.

If *Pass. Dictionary* is enabled (refer to Section 2.2.1.8), new passwords are checked against the list of words used by the function. You can pre-check the password against the list by clicking *Pass. Dictionary:* **CHECK PASSWORD**. The message *Not Blacklisted* will be returned if the entry passes the check; *Blacklisted!* indicates that the entry failed the check and cannot be used. By default, the password dictionary check is not in effect, and it is labeled *disabled*.

NOTE: You can view but not edit the list against which passwords are checked by clicking *Password Dictionary:* VIEW.

6 If you were prompted to create a new password, the *Logon to Fortress Security System* screen displays again: re-enter the account *Username*, enter the new *Password*, and click **LOGON**.

Two administrators with *Administrator*-level privileges (refer to Section 2.2.2.3) cannot be logged on the Bridge at the same time.

If you are trying to log on to an *Administrator*-level account when another such session is active, you will have the option of forcibly ending the active session and proceeding with the logon, or choosing **Cancel Logon** from the dropdown to preserve the first session. Click **CONTINUE** to execute your choice.

Figure 2.2. Bridge GUI *Logon* screen when the account is active, all platforms

Access configuration settings through the menu links under **Configure** on the left of all Bridge GUI screens. Monitoring functions are available under **Monitor**, maintenance and diagnostic tools under **Maintain**.

2.1.4 Using Bridge GUI Views

The Bridge GUI initially opens in *Simple View*, which displays an abbreviated set of items under the main menu headings on the left side of the page and provides a limited set of configuration settings on **Configure** screens.

To access the complete Bridge GUI, click **ADVANCED VIEW** in the upper right corner of any page. The Bridge GUI Advanced View includes additional items under the **Configure** and **Maintain** main menu headings and provides full access to configuration settings. In Advanced View, the button in the upper right corner changes to **SIMPLE VIEW**.

Figure 2.3. Bridge GUI *VIEW* buttons, all platforms

For *Administrator*-level accounts, **Advanced View**-selection is persistent over subsequent log-ons and reboots. The **Advanced View** button is absent altogether when you are logged into a *Log Viewer*-level account, where it would serve no purpose

(refer to Section 2.2.2.3 for more information on account roles and access).

On a screen common to both views, you can toggle between the two views of the screen. If you are viewing a screen exclusive to the Advanced View and you click **SIMPLE VIEW**, the Bridge GUI will return the main page for the function or, if no such page exists in Simple View, the **Monitor -> Connections** screen.

2.1.5 Accessing Bridge GUI Help

Access the table of contents for Bridge GUI help by clicking **HELP** in the upper right corner of every page. For help with the screen you are currently viewing, click **More Information** in the upper right of the screen.

2.1.6 Logging Off

To log off the Bridge GUI, click **LOGOFF**, in the upper right corner of the screen.

If you simply close the browser you have used to access the Bridge GUI, you will not be logged off completely. Although you must re-open you browser and log back on to the Bridge in order to regain access to the same account, the previous administrative session persists until it times out or, at the point of logging back in to the account, you opt to end it.

By default, the Bridge is configured to end administrative sessions after 10 minutes of inactivity, automatically logging the administrator off. You can reconfigure the global administrative *Session Idle Timeout* (refer to Section 2.2.1.4).

2.2 Administrative Accounts and Access

There are three levels of permissions for administrative accounts on the Bridge, determined by *Role* assignment:

- **Administrator** account users have unrestricted access to management functions and system information on the Bridge.
- **Maintenance** account users can view complete system and configuration information and perform a few administrative functions but cannot make configuration changes beyond changing their own passwords (Section 2.2.2.11), if permitted (the default).
- **Log Viewer** account users can view only high-level system health indicators and only those log messages unrelated to configuration changes. If permitted (the default), they can also change the password for the account.

For more detail on account privileges refer to Section 2.2.2.3.

By default, one of each administrative account type is present in the Bridge's local administrator database, with the

NOTE: The preconfigured *admin, Administrator*-level, account corresponds to the ***Crypto Officer*** role as defined by Federal Information Processing Standards (FIPS) 140-2.

predetermined user names: *admin*, *maintenance*, and *logviewer*, respectively. Administrative roles are described in greater detail in Section 2.2.2.3.

Default passwords for preconfigured accounts are the same as their user names.

The first time you log on to the *admin* account, you will be forced to enter a new password of at least 15 characters.

Administrative password requirements are global and configurable: refer to Section 2.2.1.8. The default complexity requirements will force the passwords to be changed on all three preconfigured accounts when the accounts are first used. If password requirements are changed so that the default passwords are acceptable, however, administrators logging on to the *Maintenance* and *Logviewer* accounts for the first time, will not be forced to change these account passwords from their defaults. All default passwords should nonetheless be changed in order to fully secure the Bridge's management interface.

An administrator logged on to an *Administrator*-level account can specify a number of global administrative account settings. In Advanced View, you can also add up to ten additional administrative accounts, as well as reconfigure individual account settings and delete accounts.

NOTE: Preconfigured accounts cannot be deleted.

Global administrative account settings are covered in Section 2.2.1 (below). Individual administrative account management is covered in Section 2.2.2.

NOTE: Except for *Session Idle Timeout* changes, which take effect immediately, changes to global *Logon Settings* are applied at the next administrator logon.

2.2.1 Global Administrator Settings

A number of configurable parameters apply globally to administrative accounts' logon behaviors and passwords and to administrator authentication. View the these settings through **Configuration -> Security ->** *Logon Settings*.

Figure 2.4. Simple View *Logon Settings* frame, all platforms

2.2.1.1 Maximum Failed Logon Attempts

You can configure how many times an administrator can try unsuccessfully to log on to one of the Bridge's administrative accounts before the account is subject to the Bridge's currently

configured lockout behavior. Numbers from **1** to **9** are accepted; **3** is the default.

2.2.1.2 Failed Logon Timeout

The *Failed Logon Timeout* setting specifies the number of seconds that must elapse after a failed logon attempt before the same administrator can successfully log on with valid credentials.

If an administrator enters valid credentials before the specified number of seconds have elapsed, the action is interpreted as another failed logon attempt and the timeout counter resets.

You can set *Failed Logon Timeout* from **0** (zero) to **60** seconds; a setting of **0** disables the function (no delay between logon attempts will be enforced). The default *Failed Logon Timeout* is **5** seconds.

NOTE: The lockout feature applies only to remote logon attempts. The Bridge CLI **unlock** command can always be executed via a physical connection to the **Console** port, which is never locked. Refer to the ***CLI Software Guide***.

2.2.1.3 Lockout Behavior

You can set the length of time an administrator will remain locked out after reaching the specified maximum logon attempts in *Lockout Duration*.

Alternatively, by enabling *Permanent Lockout* you can configure the Bridge to keep the account locked until you have logged on to the Bridge GUI through an *Administrator*-level account and unlocked it.

If there is no other *Administrator*-level account available, you can unlock the account only through a direct, physical connection to the Bridge's **Console** port, with the Bridge CLI's `unlock` command. Administrative access to the **Console** port is never locked. Refer to the *CLI Software Guide*.

Administrator accounts are locked when you exceed the maximum permitted number of failed logon attempts (Section 2.2.1.1) on the account. Attempts to log on fail when you supply invalid credentials and when you neglect to allow the specified period between failed attempts (Section 2.2.1.2).

Refer to Section 2.2.2.12 for instructions on unlocking an administrative account in the Bridge GUI.

2.2.1.4 Session Idle Timeout

By default, administrative sessions time out after 10 minutes of inactivity. You can disable administrative session timeouts with a *Session Idle Timeout* setting of **0** (zero) or reconfigure the timeout period in whole minutes between **1** and **60**.

NOTE: The idle timeout setting for local administrator accounts is independent of timeout settings for network users and connecting devices (Section 4.4).

2.2.1.5 Show Previous Logon

When *Show Previous Logon* is **Enabled**, the date and time the current administrator last logged on and the IP address and user interface (GUI or CLI) used to do so are displayed at the top of the first page displayed by the Bridge GUI (**Monitor -> Connections** for initial *Administrator*- or *Maintenance*-level

log-ons and **Monitor -> Event Log** when *Log Viewer* accounts first access the Bridge GUI). The feature is **Disabled** by default.

Show Previous Logon is present only in Advanced View (refer to Section 2.1.4).

2.2.1.6 Authentication Method and Failback

By default, administrative *Usernames* and passwords are authenticated by the **Local** *administrator* authentication service—a designated service running on the Bridge itself and separate from the local *user* authentication service configured on **Configure -> RADIUS Settings -> Local Server** (refer to Section 4.3.2).

NOTE: Administrators added in the external authentication service are *Learned* by the Bridge, but cannot be authenticated until their records have been opened locally for configuration (refer to Section 2.2.2.8).

Alternatively, you can reconfigure the Bridge to send administrators' logon credentials to a Remote Authentication Dial-In User Service (**RADIUS**) server, which may be any of:

- the RADIUS server internal to the current Bridge
- the RADIUS server internal to another Bridge on the network
- a third-party RADIUS server running on the network

The service(s) available are determined by the Bridge's configuration for authentication servers as determined by the settings on **Configure -> RADIUS Settings**.

When a Fortress or a third-party **RADIUS** server is used to evaluate administrator logon credentials, locally configured logon settings and password rules do not apply. Administrative logon behavior and password rules are determined by the account settings in effect on that **RADIUS** server.

When the Bridge is configured to use a third-party or Fortress **RADIUS** server and *Authentication Failback* is **Enabled**, the Bridge will use its local administrator authentication service as a backup means of authenticating administrator credentials, should the third-party or Fortress user authentication database become unavailable.

When *Authentication Failback* is disabled (the default) on a Bridge configured to use a third-party or Fortress **RADIUS** server for administrator authentication, and no such server is available, administrators cannot be authenticated and logged on to the Bridge until access to the external server is restored.

Authentication Failback is not applicable to Bridges configured with the default *Authentication Method* of **Local**.

Authentication Method and *Authentication Failback* are present only in Advanced View (refer to Section 2.1.4).

To use the local Fortress RADIUS Server to authenticate administrators:

Except for steps 7 through 11, which can be performed at any time, you ***must*** follow the steps of the procedure below in the order given.

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> RADIUS Settings** from the menu on the left.

2 Click to access the **Local Server** tab, and in the *Local Authentication Server* frame:

- In *Administrative State*, click to select **Enabled**.
- In *Administrator Auth*, click to select **Enabled**.

For help with other settings on this screen refer to Section 4.3.2.

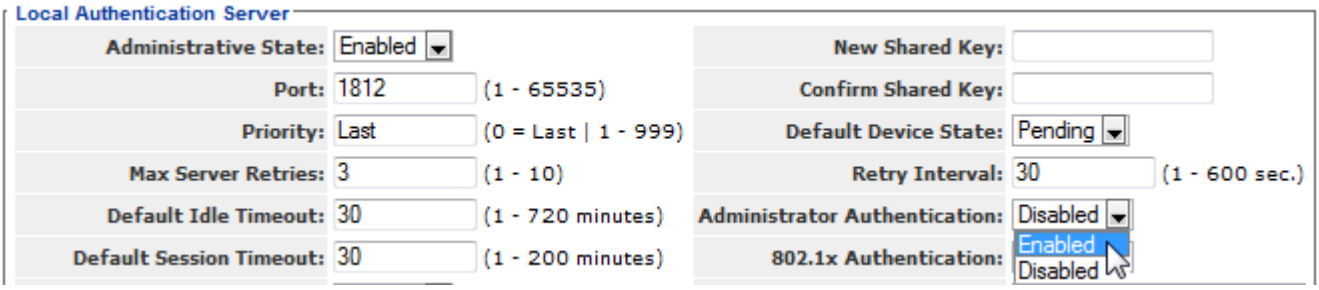


Figure 2.5. enabling local administrator authentication, all platforms

3 Click **APPLY** in the upper right of the screen.

4 Select **Configure -> Security** from the menu on the left.

5 In the *Security* screen's *Logon Settings* frame:

- In *Authentication Method*, select **RADIUS** from the dropdown.
- In *Auth Failback*, optionally click to select **Enabled**.

For help with other settings in this frame refer to the rest of this section.

CAUTION: Fortress strongly recommends selecting **Enabled** for *Auth Failback* to insure against administrative lockout in the event of network disruptions or administrator error.

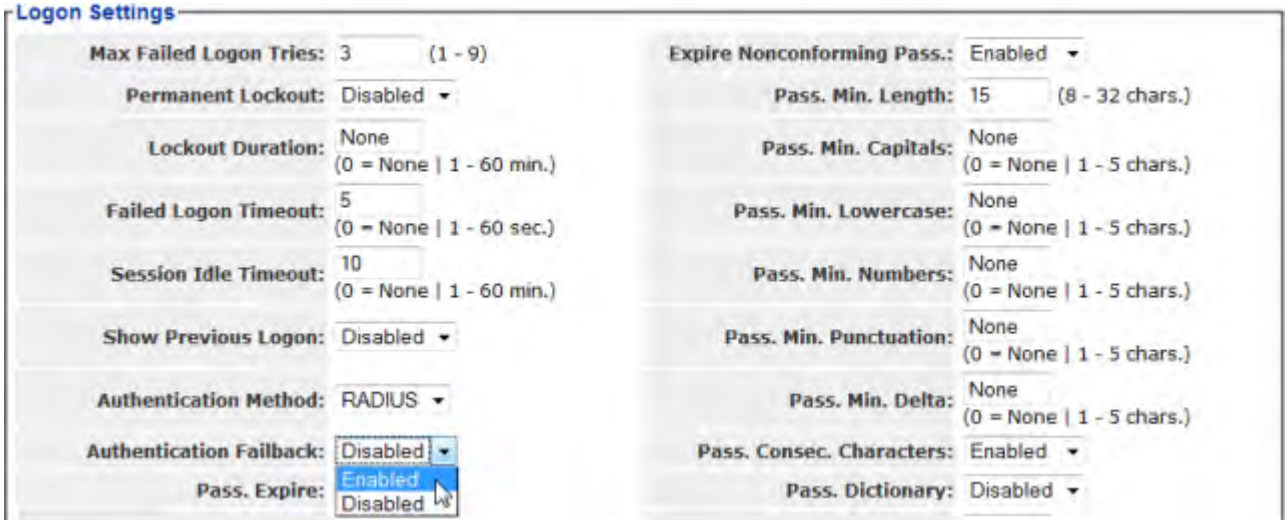


Figure 2.6. enabling administrator authentication failback, all platforms

6 Click **APPLY** in the upper right of the screen.

7 Select **Configure -> RADIUS Settings** from the menu on the left.

8 Click to access the **Local Server** tab and in the *User Entries* frame, click **NEW USER**.

9 In the *Edit Local Authentication* screen's *User Database Entry* frame:

- In *Username*, enter a user name of at least one (1) alphanumeric characters.
- In *New Password/Confirm Password*, enter a password that confirms to current password requirements (Section 2.2.1.8).
- In *Role*, select **Administrator** from the dropdown.

For help with other settings in this frame refer to Section 4.3.3.1.

Figure 2.7. creating an administrator account on the local authentication server, all platforms

10 Click **APPLY** in the upper right of the screen.

11 Repeat steps 8 through 2.7 for any additional administrators you want to configure.

To use a remote Fortress RADIUS Server to authenticate administrators:

To use a RADIUS server running on another Bridge on the network to authenticate administrators for the local Bridge, you must configure an entry for the server on the local Bridge's *Authentication Servers* page, specifying **Fortress Auth** as its *Server Type* and **Admin** as a supported *Auth Type* (refer to Section 4.3.1).

Only administrators with user accounts (configured for the *Role* of **Administrator**) on the remote Bridge will be able to authenticate through its user authentication service (refer to Section 4.3.3.1).

To use a third-party RADIUS Server to authenticate administrators:

To use a third-party RADIUS server for administrator authentication, it must be configured to use Fortress's Vendor-Specific Attributes for *Fortress-Administrative-Role* and *Fortress-Password-Expired*, provided in the `dictionary.fortress` configuration file included on the Bridge software CD and available for download at **www.fortresstech.com/support/**.

Consult your RADIUS server documentation for information on configuring the service. You must additionally configure an entry for the server on the Bridge's **Authentication Servers** list (**Configure -> RADIUS Settings-> Server List**), specifying **3rd Party RADIUS** as its *Server Type* and **Admin** as a supported *Auth Type* for the service (refer to Section 4.3.1 for more information on configuring external authentication servers for the Bridge.).

2.2.1.7 Password Expiration

You can configure the Bridge to expire administrative passwords after a specified period and to warn administrators a specified number of days before the password expires.

Password expiration (*Pass. Expire*) is **Disabled** by default.

When *Pass. Expire* is **Enabled**, you can specify a password expiration period (*Pass. Expiration*) of **1** to **365** days. The default expiration period is **60** days.

Expiration Warning

You can also configure the Bridge to warn administrators that their passwords are scheduled to expire. You can set *Pass. Expire Warning* from **0** to **365**. An expiration warning setting of **0** or a setting greater than the specified password expiration period disables the function (no password expiration warning will be issued). When a *Pass. Expire Warning* smaller than *Pass. Expiration* is set, the warning ***Your password will expire soon*** appears at the top of the first screen displayed (initially *Connections* for *Administrator*-level accounts) whenever an administrator logs on, beginning the specified number of days before administrators are forced to change their passwords. The warning does not persist after the administrator navigates away from the first page viewed. (If *Pass. Expiration* and *Pass. Expire Warning* are set to the same value, the warning will display whenever an administrator logs on.)

Nonconformance Expiration

If you change the rules for administrative passwords (refer to Section 2.2.1.8), some existing passwords may not conform to the new requirements. *Expire Nonconforming Pass.* allows you to choose whether such passwords will expire at the time the rules change (**Enabled**) or will be allowed to persist until the next scheduled expiration date (**Disabled**). By default, *Expire Nonconforming Pass.* is **Enabled**: administrators are forced to change nonconforming passwords the first time they log on after the rules for passwords have changed.

Expire Nonconforming Pass. is present only in Advanced View (refer to Section 2.1.4).

2.2.1.8 Password Requirements

The Bridge will not accept new passwords that do not meet specified requirements. If you specify new requirements that existing passwords do not meet, nonconforming passwords are treated according to the *Expire Nonconforming Passwords* setting (described in Section 2.2.1.7).

NOTE: Passwords do ***not*** need to be unique.

Configured complexity requirements apply equally to administrative passwords and to those of locally authenticated network users (Section 4.3.3.1).

You can apply up to nine rules for administrative and local user passwords:

- *Pass. Minimum Length* - Passwords must be at least the specified number of characters long. You can specify values from **8** to **32** characters. The default is **15**.
- *Pass. Minimum Capitals* - Passwords must contain at least the specified number of uppercase letters. You can specify values from **0** (zero) to **5**; a **0** value (the default) allows passwords containing no uppercase letters.
- *Pass. Minimum Lowercase* - Passwords must contain at least the specified number of lowercase letters. You can specify values from **0** (zero) to **5**; a **0** value (the default) allows passwords containing no lowercase letters.
- *Pass. Minimum Numbers* - Passwords must contain at least the specified number of numerals. You can specify values from **0** (zero) to **5**; a **0** value (the default) allows passwords containing no numerals.
- *Pass. Minimum Punctuation* - Passwords must contain at least the specified number of symbols from the set: `~ ! @ # $ % ^ & *( ) _ - + = { } [ ] | \ : ; < > , . ? /` (excludes double and single quotation marks). You can specify values from **0** (zero) to **5**; a **0** value (the default) allows passwords containing no symbols.
- *Pass. Minimum Delta* - Passwords must contain at least the specified number of changed characters, as compared to the previous password. You can specify values from **0** (zero) to **5**. A **0** value disables the check: if *Pass. History Depth* (below) is also **Disabled** (the default), the same password can be used consecutively, without any change (provided it still conforms to the rest of the rules in effect). *Pass. Minimum Delta* is disabled by default.
- *Pass. Consecutive Characters* - Passwords can/cannot contain consecutive repeated characters or consecutive characters in ascending or descending numeric or alphabetic order. When *Pass. Consecutive Characters* is **Disabled**, passwords cannot include the character pairs **98** or **ab**, for examples. When it is **Enabled** (the default), passwords can contain consecutive characters in numeric or alphabetic order.

NOTE: Pass. Mi*nimum Delta* and *Pass. History Depth* are tracked separately for each administrative account.

- *Pass. Dictionary* - Passwords can/cannot match words in the dictionary. When *Pass. Dictionary* is **Enabled**, passwords are checked against a list of English words, and the password is rejected if a match is found. When it is **Disabled** (the default), passwords can contain the words on the list.

  You can view but not edit the word list: **Configuration -> Admin Users -> EDIT|NEW USER ->** *Pass. Dictionary* **-> VIEW**.

- *Pass. History Depth* - Passwords cannot be reused until the specified number of new passwords have been created. You can specify values of **0** (zero) to **10**. A **0** value disables the check: if *Pass. Minimum Delta* (above) is also **Disabled** (the default), the same password can be used consecutively, without any change (provided it still conforms to the rest of the rules in effect). *Pass. History Depth* is disabled by default.

Password requirements settings are present only in Advanced View (refer to Section 2.1.4).

To configure global administrative account settings:

The Bridge GUI's *Logon Settings* are shown in Advanced View below.

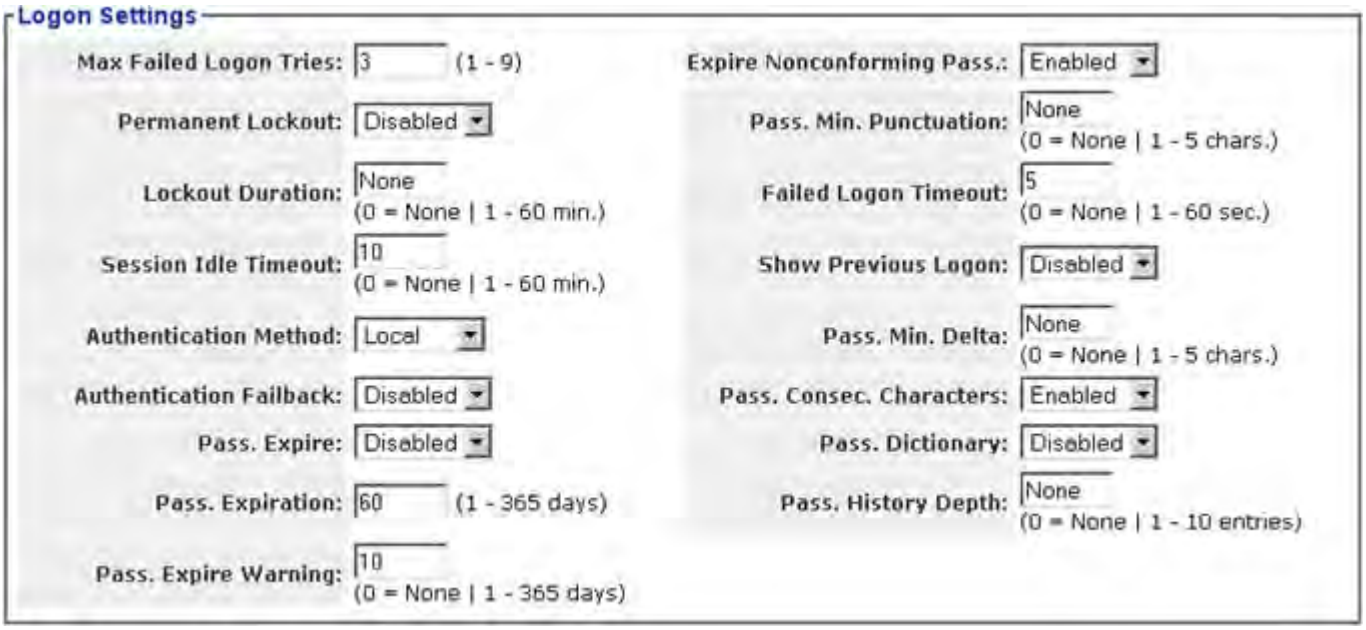


Figure 2.8. Advanced View *Logon Settings* frame, all platforms

Table 2.1 shows which *Administrator Logon* settings appear in the two GUI views.

Table 2.1. Global Administrator Logon Settings

Simple & Advanced Views	Advanced View Only
Max Failed Logon Tries	*Show Previous Logon*
Failed Logon Timeout	*Authentication Method*
Permanent Lockout	*Authentication Failback*
Lockout Duration	*Expire Nonconforming Pass.*
Session Idle Timeout	*Pass. Min. Length*
Pass. Expire	*Pass. Min. Capitals*
Pass. Expiration	*Pass. Min. Lowercase*
Pass. Expire Warning	*Pass. Min. Numbers*
	Pass. Min. Punctuation
	Pass. Min. Delta
	Pass. Consec. Characters
	Pass. Dictionary
	Pass. History Depth

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Security** from the menu on the left.
2. If you are configuring one or more Advanced View settings (see Table 2.1), click **ADVANCED VIEW** in the upper right corner of the page. (If not, skip this step.)
3. In the *Security* screen's *Logon Settings* frame, enter new values for those settings you want to configure (described in sections 2.2.1.1 through 2.2.1.8).
4. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

2.2.1.9 System Messages

The *Comment* field in the *System Messages* frame on **Configure -> Administration** is intended as a user-configured informational field. The *Comment* is displayed nowhere else.

You can configure a *Warning Banner* for display on the Bridge's administrator logon screens.

When a logon banner is present, administrators are prompted to click to accept its conditions before they are permitted to proceed with the logon.

There is no *Warning Banner* configured by default.

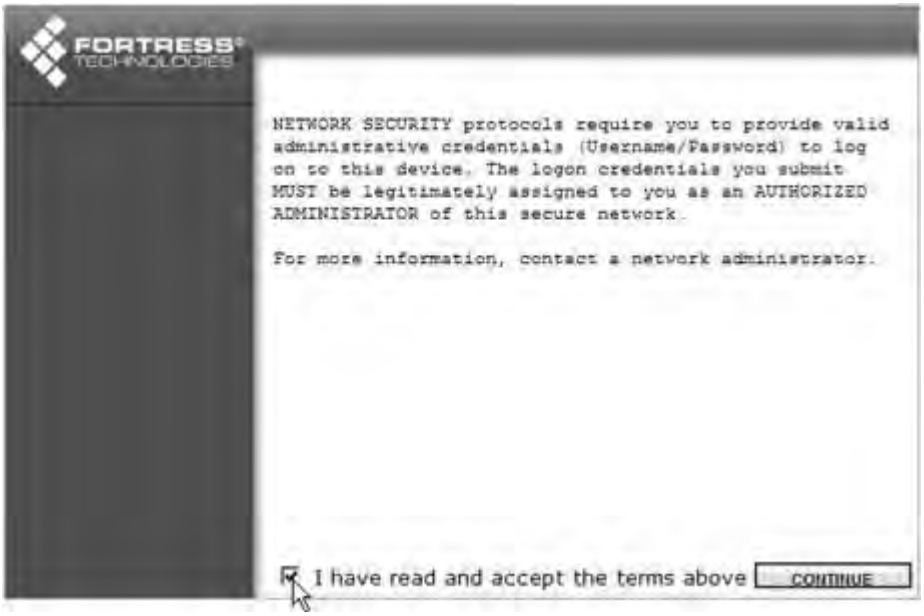


Figure 2.9. *Logon Banner* on the Bridge GUI *Logon Screen* screen, all platforms

To configure a comment or administrator logon banner:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Administration** from the menu on the left.
2. Scroll down to the *System Messages* frame and:
   - Optionally enter information into the *Comment* field.

   and/or
   - In the *Warning Banner* field enter or paste a message of up to 2000 characters or click **UPLOAD BANNER FILE** to upload text from an existing file.
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

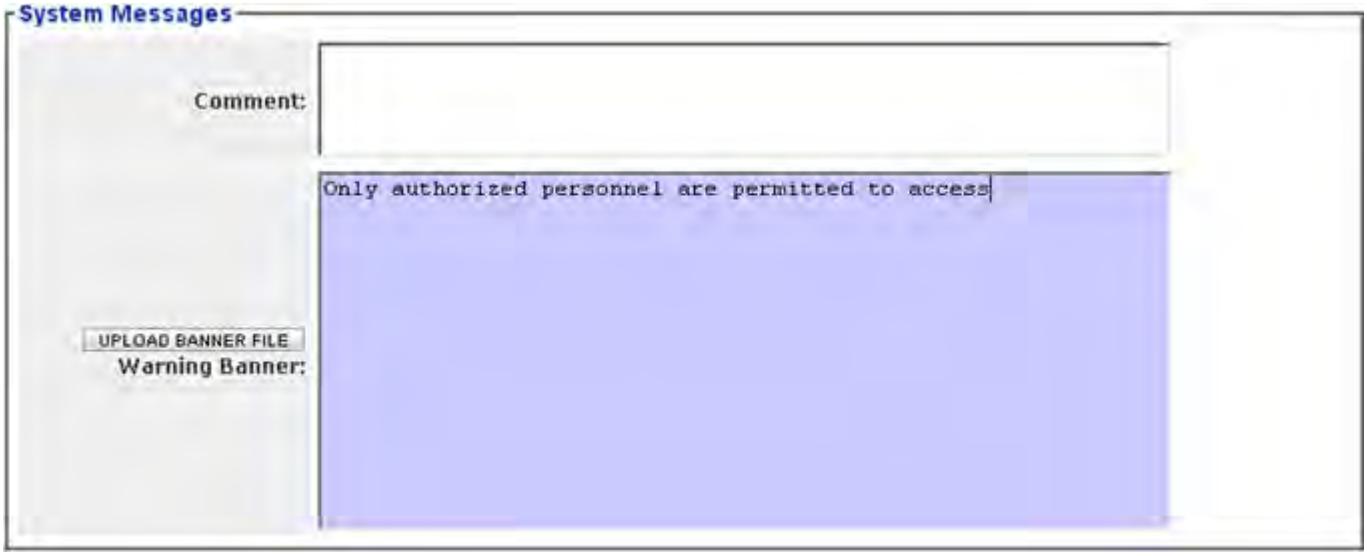


Figure 2.10. *System Messages* frame, all platforms

To eliminate an existing logon banner, delete all content from the *Warning Banner* field and **APPLY** the change.

2.2.2 Individual Administrator Accounts

Up to thirteen usable administrative accounts can be present on the Bridge's local administrator database at one time.

Three of these are preconfigured with the fixed user names: *admin*, *maintenance* and *logviewer*, reflecting the default administrative *Role* of each account. While they can be reconfigured (refer to Section 2.2.2.9), preconfigured administrative accounts cannot be deleted.

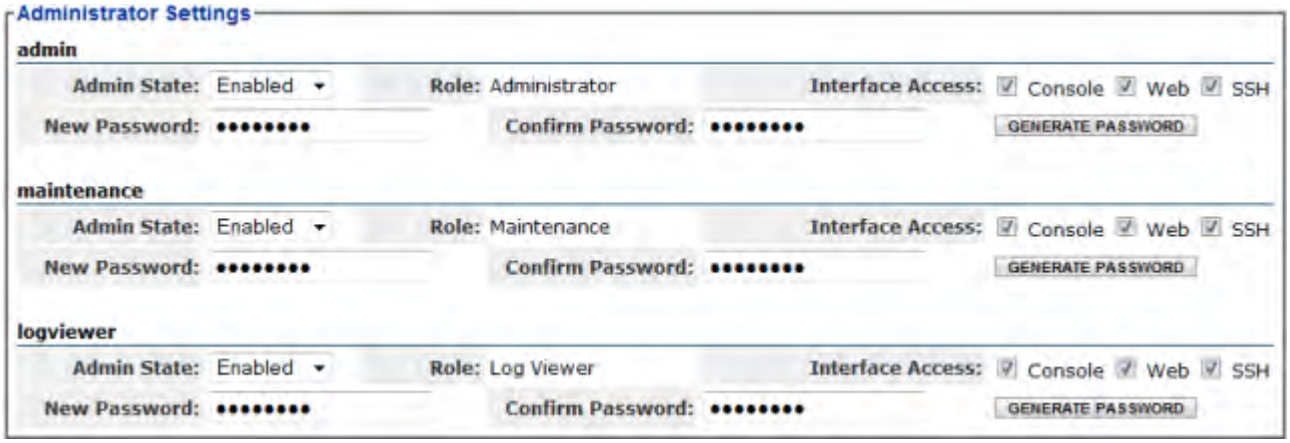


Figure 2.11. Simple View *Administrator Settings* frame, all platforms

In Advanced View, you can add up to ten additional local administrative accounts and configure additional account parameters for both pre-configured and manually created accounts.

On Bridges configured to authenticate administrators through a third-party or Fortress **RADIUS** server (refer to Section 2.2.1.6), an additional ten *Learned* administrative accounts can appear on the **Admin Users page**.

Learned administrative accounts are not immediately usable to locally authenticate administrators. In order to be usable for local authentication, accounts for *Learned* administrators must be converted to configured accounts on the local administrator database (refer to Section 2.2.2.8). *Learned* accounts converted to configured accounts are retained in the local administrator database and count toward the maximum total of thirteen configured accounts.

Although the credentials associated with a *Learned* account are initially learned by the local administrator database from an administrative account on another authentication service, the two accounts are not linked in any way after the *Learned* account has been converted to a configured account.

NOTE: In order for any account in the local administrator database to authenticate an administrator, the Bridge must be using the local administrator database for that purpose (whether it has been configured for **Local** administrator authentication or has failed back to the local administrator database (Section 2.2.1.6).

2.2.2.1 Administrator User Names

At the time a new administrative account is created, you must provide a *Username*. Once established, the *Username* associated with an administrative account cannot be changed.

Administrator user names must be unique on the Bridge. They are case sensitive, can be from 1 to 32 characters long, and can include spaces and any of the symbols in the set: `~ ! @ # $ % ^ & *( ) _ - + = { } [ ] | \ : ; < > , . ? /` (excludes double and single quotation marks).

An administrative account with a *Learned* state of *Yes* acquires the *Username* configured for the associated administrator in the third-party or Fortress **RADIUS** server (refer to Section 2.2.2.8).

You can create new administrative accounts only in Advanced View.

NOTE: In Advanced View, the *Username* for any account listed in *Administrator Settings* links to a *Detailed Statistics* dialog for the account. Refer to Section 5.2 for more information.

2.2.2.2 Account Administrative State

Preconfigured and newly added administrative accounts are **Enabled** by default. If you change an account's *Administrative State* to **Disabled**, it will no longer be usable. If the associated administrator attempts to log on to a **Disabled** account, the *Logon to Fortress Security System* screen will be returned with an error message. If you re-enable the account, the administrator will be allowed to log on normally.

At least one enabled *Administrator*-level account must be present on the Bridge at all times. You will not therefore be allowed to disable an *Administrator*-level account if it is the only such account on the Bridge.

You can create new administrative accounts and edit them only in Advanced View, but you can change the *Admin State* of preconfigured accounts in both views.

2.2.2.3 Administrative Role

An administrative account can be configured for one of three possible administrative roles:

- **Administrator** accounts provide unrestricted access to the Bridge. *Administrator*-level users can configure all functions and view all system and configuration information on the Bridge.
- **Maintenance** accounts provide view-only access to complete system and configuration information but no reconfiguration access. A maintenance administrator's execution privileges are confined to using the network diagnostic tools on **Maintain -> Network**, resetting Secure Clients and controller device sessions, rebooting the Bridge, and generating a support package.
- **Log Viewer** accounts provide view-only access to high-level system health indicators and any log messages unrelated

NOTE: *Log Viewer* and *Maintenance* administrators can change their own passwords, provided their account passwords are not locked (refer to Section 2.2.2.7).

to configuration changes. *Log Viewer*-level accounts have no execution privileges on the Bridge.

Only one *Administrator*-level account can be active on the Bridge at one time. Their limited permissions allow multiple *Maintenance*-level and *Log Viewer*-level accounts to be active on the Bridge at the same time. Only one active session per administrative account is supported, regardless of *Role*.

You can reconfigure the *Role* of any administrative account, including the preconfigured accounts.

If you downgrade the role of the *Administrator*-level account you are currently logged on through, you will be able to finish the session with full permissions. The role change takes effect when you next log on to the account.

At least one enabled *Administrator*-level account must be present on the Bridge at all times. You will not therefore be allowed to reconfigure the *Role* of an *Administrator*-level account if it is the only such account on the Bridge.

You can create administrative accounts and edit an account's *Role* only in Advanced View.

2.2.2.4 Administrator Audit Requirement

Whether and how an administrative account is subject to audit logging is configured in the *Audit* field. Three options are available at the individual account level:

- **Required** (the default) - Activity on the account will be included in the audit log.
- **Prohibited** - Activity on the account will not be included in the audit log.
- **Auto** - Account activity will be treated by the audit logging function according to the global settings in **Configuration -> Logging** (refer to Section 4.6.2).

NOTE: An individual account's *Audit* setting overrides global *Logging* settings.

You can create administrative accounts and edit an account's *Audit* setting only in Advanced View.

2.2.2.5 Administrator Full Name and Description

An administrative account does not require a *Full Name* or a *Description* to be entered for the administrator.

If you choose to use these fields, they accept up to 250 alphanumeric characters, symbols and/or spaces.

You can create and edit administrative accounts only in Advanced View.

You can create administrative accounts and edit an account's *Full Name* and *Description* only in Advanced View.

2.2.2.6 Administrator Interface Permissions

You can control which of the Bridge's management interfaces an administrative account can access.

- **Console** - The account can access the Bridge CLI through a direct, physical connection to the Bridge's **Console** port (refer to the *CLI Software Guide*).
- **Web** - The account can access the Bridge GUI through a browser connected to the Bridge's IP address (refer to Section 2.1.3).
- **SSH** - The account can access the Bridge CLI through a Secure Shell terminal session (refer to the *CLI Software Guide*).

NOTE: SSH must be enabled on the Bridge before an administrative account configured for SSH access can log on to the Bridge CLI remotely (refer to Section 4.1.6 and/or the ***CLI Software Guide***).

Interfaces are independently selectable in any combination. By default, all three are selected so that accounts can use any of them to access the Bridge. Clearing an option's checkbox will deselect it, preventing access through the deselected interface for that account. Clearing all three *Interface Permissions* checkboxes effectively disables the account.

You can create new administrative accounts only in Advanced View, but you can change interface permissions for the three preconfigured accounts in Simple View.

2.2.2.7 Administrator Passwords and Password Controls

You must configure a password for an administrative account at the time the account is created.

NOTE: Default passwords for preconfigured accounts are the same as their user names (`admin`, `maintenance`, `logviewer`) and should be changed when the Bridge is installed.

Passwords must conform to the rules in effect on the Bridge as configured in *Security* settings (refer to Section 2.2.1.8)

You can also view current password complexity requirements by clicking **More Information** in the upper right of the *Edit Admin Users* screen and then **Password Complexity Settings**.

An administrative account with a *Learned* state of *Yes* acquires the password configured for the associated administrator in the external RADIUS server (refer to Section 2.2.2.8). This password need not conform to locally configured rules.

You can create and edit administrative accounts only in Advanced View, but, as long as you are logged on to an *Administrator*-level account, you can enable/disable the three preconfigured accounts in Simple View and change their passwords and interface permissions. (Refer to Section 2.2.2.11 for information on changing passwords from lower level administrator accounts.)

Locking Passwords

By default, passwords are not locked, allowing administrators with **Maintenance** and **Log Viewer** accounts to change their own passwords (refer to Section 2.2.2.11). When **Yes** is selected for *Password is Locked*, passwords cannot be changed. If an administrator attempts to change a locked password, the *Edit Password* screen will be returned with the error message: *Password is locked against any changes*.

NOTE: Configuring an administrative account's *Role* is covered in Section 2.2.2.3.

The same message will be returned for an *Administrator*-level account if the administrator tries to change the password when the password is locked. Because *Administrator*-level accounts can change the *Password is Locked* setting for any account, it is impossible to effectively lock passwords on these accounts (although the administrator will have to select **No** for *Password is Locked* and **APPLY** the reconfiguration before changing the password).

You can lock administrative account passwords only in Advanced View.

Forcing Password Changes

You can force an administrator to change an account's password the next time s/he logs on to the account by selecting **Yes** for *User must change password*.

NOTE: Preconfigured accounts force their default passwords to be changed when the accounts are first accessed.

After the administrator has successfully changed the password and logged on, the function will reset to *User must change password:* **No**.

You cannot force a password change on an account when the account's password is locked. If both *Password is Locked* and *User must change password* are set to **Yes**, the administrator will be allowed to log on without changing the account password, and *User must change password* will reset to **No** without effect.

You can force administrative account password changes only in Advanced View.

2.2.2.8 Adding Administrative Accounts

You can create new administrative accounts from an existing *Administrator*-level account. When the Bridge is configured to use the local administrator database to authenticate administrator credentials (*Authentication Method:* **Local**, refer to Section 2.2.1.6), manual creation is the only way to add administrative accounts. (Accounts added automatically from external authentication databases are described in the second part of this section.)

For manually created accounts, you can automatically generate a random password that exceeds the requirements currently in effect (Section 2.2.1.8). Generated passwords conform to all current complexity rules and exceed the specified minimum length by four characters, unless the specified minimum is fewer than four characters short of the 32-character maximum (in which cases characters are added to total 32).

You can add administrative accounts only in Advanced View.

To add a new administrative account:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner

of the page, then **Configure -> Administration** from the menu on the left.

2 In the *Administration* screen's *Administrator Settings* frame, click **NEW USER**.

Figure 2.12. creating a new administrator account, all platforms

3 In the *Account Information* frame, enter at least a *Username* and optionally a *Full Name* and/or *Description*, and configure any additional settings for the account. (Your options are described in detail in sections 2.2.2.1through 2.2.2.6.)

4 In the *Password Controls* frame, establish a new password for the account:

- Click **GENERATE PASSWORD** to automatically generate a password that complies with the complexity requirements currently in effect (Section 2.2.1.8).

or

- Enter a *New Password* that complies with the complexity requirements currently in effect.

You can check the password against the list of words used by the Bridge's *Password Dictionary* function by clicking *Password Dictionary:* **CHECK PASSWORD**. The message *Not Blacklisted* will be returned if the entry passes the check; *Blacklisted!* indicates that the entry failed the check and cannot be used. If the *Password Dictionary* check is not in effect it is labeled *(disabled)*.

5 Record and secure the new password for future reference.

You will need the password for subsequent access to the Bridge and the network it secures.

6 Optionally, in the same frame, you can lock the password or require the administrator to change it when s/he first logs on (described in detail in Section 2.2.2.7.)

CAUTION: Make a record of the password for future access to the Bridge. After the password is applied it cannot be queried by any means.

You can optionally view current password complexity requirements by clicking **More Information** in the upper right of the *Edit Password* screen and then **Password Complexity Settings**.

7 Click **APPLY** in the upper right of the screen (or **CANCEL** the creation of the new account).

The new account will be listed, in Advanced View, in *Administrator Settings* on **Configure -> Administration**.

NOTE: You can view but not edit the list against which passwords are checked by clicking *Password Dictionary:* VIEW.

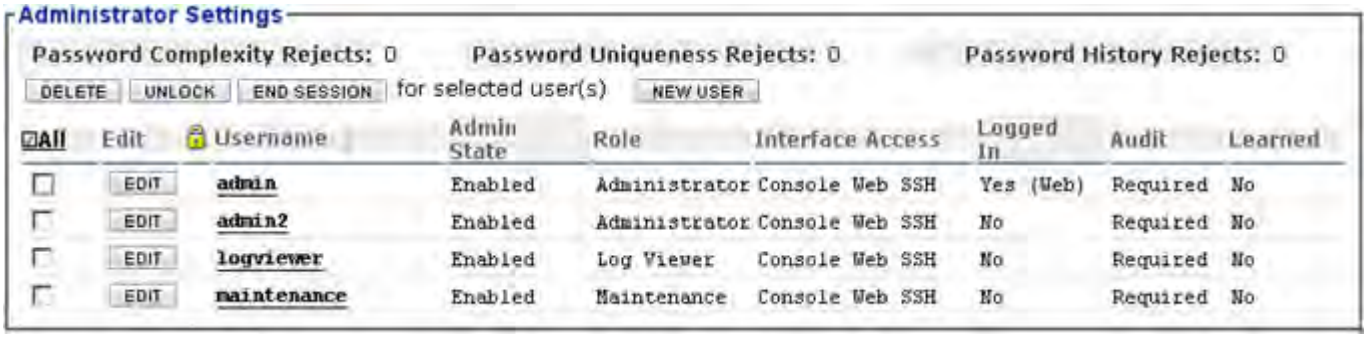


Figure 2.13. Advanced View *Administrator Settings* frame, all platforms

When the Bridge is configured to authenticate administrators through a third-party or Fortress user authentication database (*Authentication Method:* **RADIUS**), administrators who log on successfully through a user account are automatically added to the Bridge's local database of administrator accounts as *Learned* accounts. (Refer to Section 2.2.1.6 for more on administrative authentication methods.)

NOTE: Refer to Section 2.2.1.6 for details on configuring the Bridge to use a third-party or Fortress RADIUS server to authenticate administrators.

Up to ten such *Learned* accounts can be present. They appear among configured accounts on the **Admin Users page**—and in the local administrator database—with a *Learned* status of *Yes*.

Learned account credentials can be authenticated only by the third-party RADIUS server or Fortress user authentication database on which their accounts were originally configured. A *Learned* administrator cannot log on to the Bridge through the local administrator database until you convert the account to a locally configured account (as indicated by a *Learned* state of *No*).

To convert a learned account to a configured account:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Administration** from the menu on the left.

2 In the *Administrator Settings* frame, locate the record for the *Learned* (*Yes*) administrator whose account you want to convert (the *Username* will match the administrator's RADIUS-server user name), and click the **EDIT** button to the left of the record.

You need not make any changes to the account.

NOTE: Once a *Learned* account has been converted to a local configured account, it is completely independent of the account in the authentication service from which it was learned.

3 Click **APPLY** in the upper right of the screen (or **CANCEL** the conversion of the account).

The newly converted account will be listed, in Advanced View, on **Configure -> Administration** with *Learned* state of **No**, and the associated administrator will be allowed to log on (with valid credentials).

Learned user names and passwords need not meet the Bridge's configured requirements for local administrative accounts.

2.2.2.9 Editing Administrative Accounts

You can reconfigure any setting for an individual administrative account except for the *Username*.

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Administration** from the menu on the left.

2 In the *Administrator Settings* frame, click the **EDIT** button to the left of the account you want to edit.

3 On the resulting *Administration* screen, enter new values for those settings you want to configure. (Your options are described in detail in sections 2.2.2.2 through 2.2.2.7.)

4 Click **APPLY** in the upper right of the screen (or **CANCEL** your changes).

Global administrative account logon behaviors and password requirements can be edited through **Configure -> Security**, as described in Section 2.2.1.

NOTE: If an account is the only **Enabled** *Administrator*-level account present, you cannot change its *Administrative State* to **Disabled** or reconfigure its *Role*.

NOTE: Changes to the account you are currently logged onto will take effect the next time you log on.

2.2.2.10 Deleting Administrative Accounts

You can delete any account in the Advanced View *Administrator Settings* frame (**Configure -> Administration**), except for:

- the preconfigured accounts: *admin*, *logviewer* and *maintenance*
- any account, if it is the only *Administrator*-level account with an *Administrative State* of **Enabled** present on the Bridge

At least one account with the *Role* of **Administrator** (refer to Section 2.2.2.3) must always be present and enabled on the Bridge.

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Administration** from the menu on the left.

2 In the *Administrator Settings* frame, click to place a check in the box(es) to the left of the account(s) you want to eliminate.

3 Click **DELETE** in the upper left of the frame.

4 Click **OK** in the confirmation dialog (or **CANCEL** the deletion).

Figure 2.14. deleting an administrator account, all platforms

The account will be removed from the Advanced View *Administrator Settings* frame (**Configure -> Administration**).

2.2.2.11 Changing Administrative Passwords

Administrators with *Administrator*-level accounts can change the password of any account, including their own, as described in sections 2.2.2.7 and 2.2.2.9.

Provided the password is not locked (refer to Section 2.2.2.7), administrators with *Maintenance* or *Log Viewer* accounts can change their own passwords:

To change the account password from Maintenance and Log Viewer accounts:

1 Log on to the Bridge GUI through a *Maintenance*-level or *Log Viewer*-level account and select **Configure -> Administration** from the menu on the left.

2 In the *Change Your Password* frame, enter a *New Password* and re-enter it in *Confirm Password.*

NOTE: The *Change Your Password* option does not appear on the *Administration* screen when you are logged on through an *Administrator*-level account.

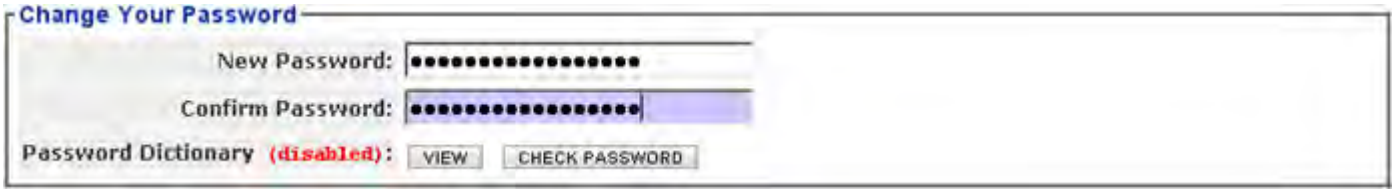


Figure 2.15. changing the password from within a *Maintenance*- or *Log Viewer*-level account, all platforms

You can optionally view current password complexity requirements by clicking **More Information** in the upper right of the *Edit Password* screen and then **Password Complexity Settings**.

You can check the password against the list of words used by the Bridge's *Password Dictionary* function (refer to Section 2.2.1.8) by clicking *Password Dictionary:* **CHECK PASSWORD**. The message *Not Blacklisted* will be returned if the entry passes the check; *Blacklisted!* indicates that the

NOTE: You can view but not edit the list against which passwords are checked by clicking *Password Dictionary:* VIEW.

entry failed the check and cannot be used. If the *Password Dictionary* check is not in effect it is labeled *(disabled)*.

3 Click **APPLY** in the upper right of the screen (or **CANCEL** the change).

Role configuration options for administrative accounts are described in detail in Section 2.2.2.3.

2.2.2.12 Unlocking Administrator Accounts

You can unlock administrator accounts in Advanced View only.

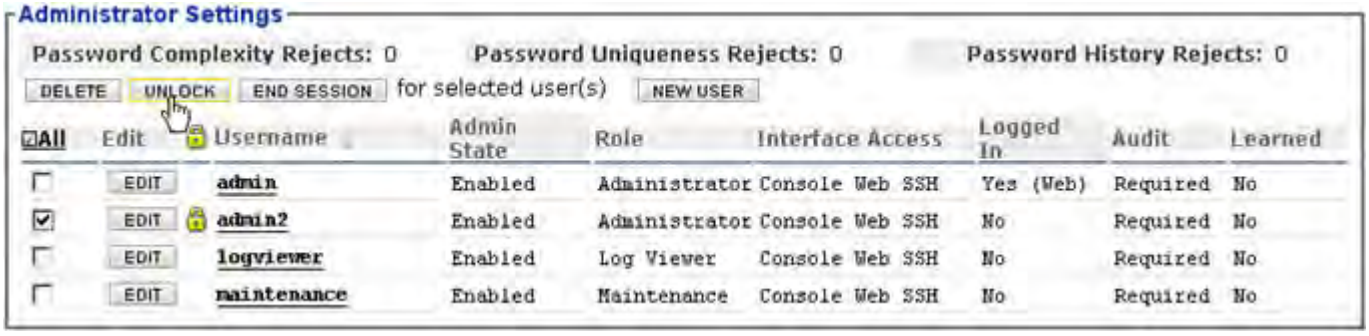


Figure 2.16. unlocking an administrator account, all platforms

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Administration** from the menu on the left.

2 In the *Administrator Settings* frame, click to place a check in the box(es) to the left of the account(s) you want to unlock.

3 Click **UNLOCK** in the upper left of the frame.

4 Click **OK** in the confirmation dialog (or **CANCEL** the action).

The account will be unlocked and the associated administrator will be able to log on normally (with valid credentials).

The *Lockout Duration* can be set from **0** (zero) to **60** minutes; a *Lockout Duration* of **0** (the default) disables the lockout function, provided that *Permanent Lockout* is **Disabled** (the default).

NOTE: If no *Administrator*-level account is available, you can unlock an account only through a direct, physical connection to the Bridge's **Console** port, with the Bridge CLI's `unlock` command (refer to the ***CLI Software Guide***).

2.2.3 Administrator IP Address Access Control

You can control remote administrative access to the Bridge by restricting the IP addresses from which administrators are permitted to log on.

When the *Admin IP Access Control Whitelist* is **Enabled**, only those IP addresses present on the list will be permitted to access the Bridge's management interface remotely.

To control remote access by specified IP addresses:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Access Control** from the menu on the left.

CAUTION: If you ignore the relevant warning, you can lock out all network access to the Bridge by having the administrator IP ACL **Enabled** when there are no IP addresses listed. You can access the Bridge in this case only by a physical connection to the Bridge's **Console** port (refer to the ***CLI Software Guide***)

2 In the resulting screen's *Admin IP Access Control Whitelist* frame, click **NEW IP**.

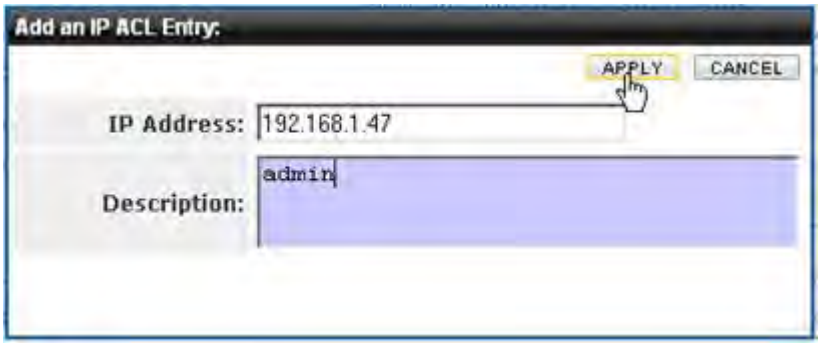


Figure 2.17. Advanced View *Add an IP ACL Entry* dialog, all platforms

3 In the resulting *Add an IP ACL Entry* dialog, enter the *IP Address* of the computer from which you are currently logged on and, optionally, a *Description* for the entry. Then click **APPLY** (or **CANCEL** the addition).

The IP address you added will be listed on the *Admin IP Access Control Whitelist*.

4 Repeat steps 2 and 3 for any additional IP addresses from which you want to permit administrative access.

5 When you have finished adding permitted IP addresses, in the *Admin IP Access Control Whitelist* frame, in *Administrative State*, click **Enabled**.

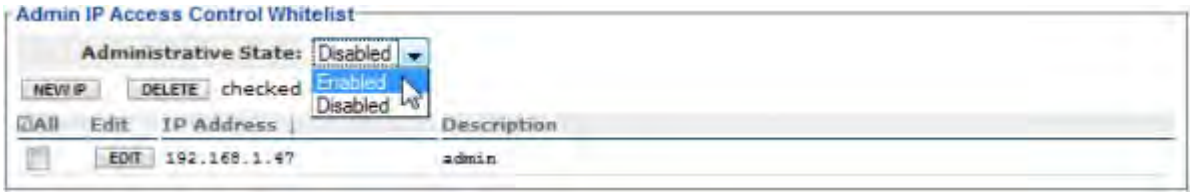


Figure 2.18. Advanced View *Admin IP Access Control Whitelist* frame, all platforms

6 Click **APPLY** on the right of the frame.

If you navigate away from the screen without clicking **APPLY**, the *Administrative State* will not be changed.

If you attempt to enable the *Admin IP Access Control Whitelist* when the IP address you are currently logged on through is not listed, a dialog warns that proceeding will lock the computer you are currently using out of the Bridge's management interface.

Figure 2.19. Advanced View current IP address lockout dialog, all platforms

CAUTION: If your current IP address is not on the administrator IP ACL when you **Enable** it or you delete your address when the list is already enabled, and you do not **Cancel** the change when prompted, your session will end and your current IP address will be blocked until it is added to the list of permitted addresses or the function is disabled.

A dialog will also warn you if you are deleting your current IP address from the list when it is already enabled (after you have cleared the usual confirmation dialog).

Unless you want to prevent management access to the Bridge from your current IP address, **Cancel** these changes.

The *Admin IP Access Control Whitelist* is **Disabled** by default, and no IP addresses are listed.

If the *Admin IP Access Control Whitelist* is **Enabled** when there are no IP addresses on the list, administrative access to the Bridge will be possible only through a direct, physical connection to the Bridge's **Console** port (refer to the *CLI Software Guide)*.

2.2.4 SNMP Administration

In the Bridge GUI Advanced View, the Fortress Bridge can be configured for monitoring through Simple Network Management Protocol (SNMP) version 3.

The Fortress Management Information Bases (MIBs) for the Bridge are included on the Bridge CD-ROM.

When SNMP v3 support is enabled, the SNMP v3 user (*FSGSnmpAdmin*) access to the Bridge is authenticated via the SHA-1 message hash algorithm as defined in RFC 2574, *User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)*, using the specified authentication passphrase. SNMP v3 privacy is secured via the Advanced Encryption Standard with a 128-bit key (AES-128), using the specified privacy passphrase.

SNMP v3 support is disabled by default.

When SNMP traps are enabled, the SNMP daemon running on the Bridge detects certain system events and sends notice of their occurrence to a server running an SNMP management application, the network management system (NMS), or *trap destination*.

SNMP traps are disabled by default, and no SNMP trap destinations are configured (refer to Section 2.2.4.2).

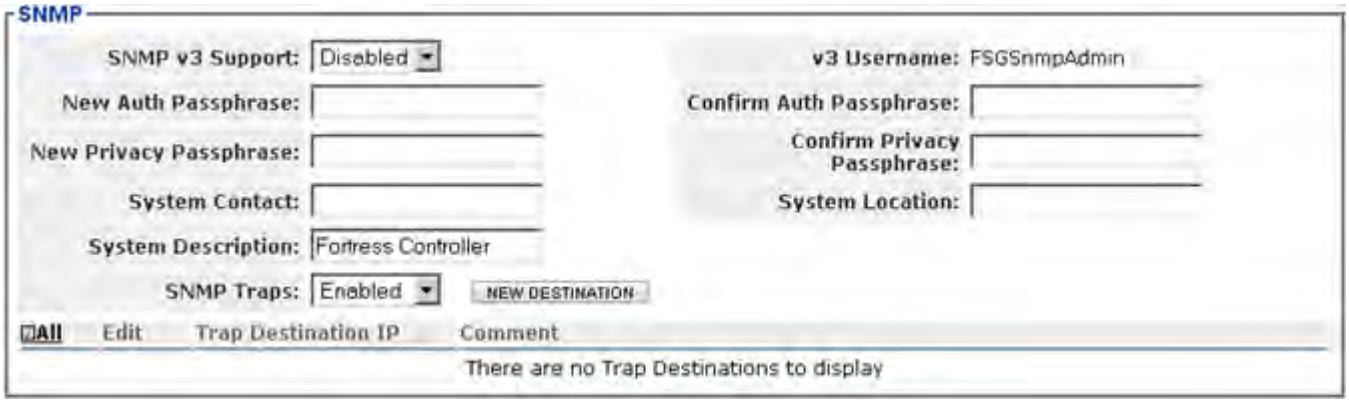


Figure 2.20. Advanced View *SNMP frame*, all platforms

The settings that configure SNMP on the Bridge include:

- *SNMP v3 Support* - enables/disables SNMP v3 user access.

  When *SNMP v3 Support* is **Enabled**, the preconfigured SNMP v3 user is permitted to access the Bridge, and new passphrases should be configured in the *SNMP v3 User* frame:

  - *Username* - identifies the v3 user, *FSGSnmpAdmin. Username* cannot be changed.
  - *New Auth Passphrase* and *Confirm Auth Passphrase* - an authentication passphrase of 10–32 alphanumeric characters (without spaces). You should change the *Auth Passphrase* from the default if you enable *SNMP v3 Support*.
  - *New Privacy Passphrase* and *Confirm Privacy Passphrase* - a passphrase of 10–32 alphanumeric characters (without spaces). You must enter a *Privacy Passphrase* if you enable *SNMP v3 Support*.

  SNMP v3 Support is **Disabled** by default. Refer to Section 2.20 for detailed instructions.

- *SNMP Traps* - enables/disables SNMP event notifications forwarded to specified trap destinations.

  When *SNMP Traps* are **Enabled**, you must configure *SNMP Trap Destinations* before traps can be sent:

  - *Trap Destination IP* - IP Address of the NMS server
  - *Comment* - optional description of the trap destination

  Refer to Section 2.2.4.2 for detailed instructions.

- *System Contact* - establishes the E-mail address for the Bridge's administrative SNMP contact.
- *System Location* - establishes a name for the location of the Bridge-secured network.
- *System Description* - provides an optional description of the Bridge-secured system.

NOTE: The default *Auth Passphrase* is **FSGSnmpAdminPwd**.

2.2.4.1 Configuring SNMP v3

If you enable *SNMP v3 Support*, you should specify and confirm a *New Auth Passphrase* and a *New Privacy Passphrase*.

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Administration** from the menu on the left.
2. Scroll down to the *SNMP* frame, and click **Enabled** for *SNMP v3 Support* to enable SNMP v3 (or disable it by clicking **Disabled**).
3. In the same frame:
   - In *New Auth Passphrase* and *Confirm Auth Passphrase*, enter an authentication passphrase of 10–32 alphanumeric characters (without spaces).

- In *New Privacy Passphrase* and *Confirm Privacy Passphrase*, enter a privacy passphrase for the user (10–32 alphanumeric characters without spaces).

4 In the same frame, optionally enter:
- an E-mail address to serve as the SNMP *System Contact*
- a description of the *System Location*
- a *System Description*

5 Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

2.2.4.2 Configuring SNMP Traps

You can create, edit and delete trap destinations regardless of whether SNMP traps are enabled.

Table 2.2. Fortress SNMP Traps

event type	event
status	the Gateway[a] has started
	the Gateway is active
	the Gateway is down
	change Access ID open window has closed
devices	a Secure Client has disconnected
	all Secure Clients have disconnected
	a Secure Client has idle timed out
	a Secure Client has roamed
connections	the partners[b] have reset
	the clients[c] have been reset
	the sessions[d] have reset

a. In SNMP traps, the Bridge is identified as a “Gateway.”
b. Partners are devices on the encrypted network
c. Clients are devices on the clear network
d. Sessions of devices on both the secure and clear networks reset.

Traps will not be sent to configured destinations when *SNMP Traps* are **Disabled** (the default).

To enable/disable SNMP traps:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Administration** from the menu on the left.

2 Scroll down to the *SNMP* frame, and click **Enabled** for *SNMP Traps* to enable traps or **Disabled** to disable them.

3 Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

To create trap destinations:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Administration** from the menu on the left.
2. Scroll down to the *SNMP* frame, and click **NEW DESTINATION**.
3. In the *Add SNMP Trap Destination* dialog*:*
   - In *Trap Destination IP:* enter the network address of an SNMP network management system.
   - In *Comment:* optionally enter a comment for display with the associated destination IP address.
4. Click **APPLY** in the upper right of the screen (or **CLOSE** the dialog to cancel your changes).

Configured traps are displayed in the *SNMP Traps* frame.

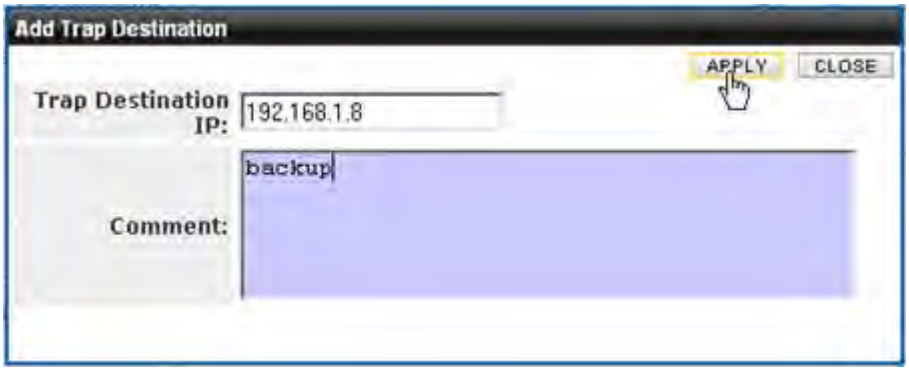


Figure 2.21. Advanced View *Add Trap Destination* dialog, all platforms

To edit a trap destination:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Administration** from the menu on the left.
2. Scroll down to the *SNMP* frame and click the **EDIT** button for the trap destination you want to change.
3. In the resulting *Edit SNMP Trap Destination* dialog*:*
   - In *Destination IP address:* enter a new address of an SNMP network management system and/or revise the optional *Comment*.
4. Click **APPLY** in the upper right of the screen (or **CLOSE** the dialog to cancel your changes).

Figure 2.22. deleting an SNMP trap, all platforms

To delete a trap destinations:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Administration** from the menu on the left.
2. Scroll down to the *SNMP* frame and:
   - If you want to delete one or more selected destinations, click to check the box(es) for those you want delete.

   or

   - If you want to delete all destinations, click **All** to place a check in all destination checkboxes.
3. Click **DELETE**.
4. Click **OK** in the confirmation dialog (or **Cancel** your deletion).

Figure 2.23. Advanced View deleting an SNMP trap confirmation dialog, all platforms

Your changes are reflected in the *SNMP Trap Destinations* frame on the main **Configuration -> SNMP** screen.

Chapter 3
Network and Radio Configuration

3.1 Network Interfaces

Multiple Bridges can be connected through their wired and/or wireless interfaces to form fixed or mobile tactical mesh networks and to bridge or extend the reach and availability of conventional hierarchical networks.

CAUTION: All Bridges in a mesh network must run the same Bridge software version.

Different models of Fortress Bridge chassis feature varying numbers of user-configurable Ethernet ports. Fortress Bridges can be additionally equipped with one to four independent internal radios supporting various capabilities defined in the IEEE (Institute of Electrical and Electronics Engineers) 802.11-2007 standard, or with no radios. On each radio internal to a Bridge, up to four independent wireless interfaces, or *Basic Service Sets* (BSSs), can be configured, up to a total of eight per Bridge.

Alternatively, an ES210 Bridge can be dedicated to act as a wireless client by configuring a single *station* (STA) interface on its single internal radio.

Compare your Bridge's model number (on the *Administration Settings* screen under *System Info*.) to Table 1.1 on page 3 to determine the number of Ethernet ports with which the Bridge you are configuring is equipped and the number and type(s) of radio(s) installed in it.

Fortress Bridge radios can connect to the radios of remote Fortress Bridges to form mesh networks and, on separate BSSs, serve as access points (APs) or access interfaces to connect compatibly configured wireless devices to a wireless LAN (WLAN) or to an FP Mesh access network.

On Bridges with more than one radio, the higher power radio(s) dedicated to the higher frequency band (5 GHz, standard equipment, or 4.4 GHz, military band) will generally be the better choice for network bridging (or backhaul) links. In Bridges with two radios (ES520 and ES820), these are Radio 2. In the four-radio ES440, Radio 2, Radio 3 and Radio 4 are all in this category.

In Fortress Bridges equipped with any number of radios, the standard-equipment Radio 1 is a dual-band 802.11a/g (or 802.11a/g/n) radio. Radio 1's 802.11g capability typically indicates its use to provide wireless access to devices within range.

You can configure the Bridge's network interfaces to meet various deployment and security requirements. Ethernet port configuration is covered in Section 3.7. Creating and configuring radio interfaces are described in Section 3.3.4 (BSS interfaces) and Section 3.3.5 (WLAN client interfaces).

3.2 Bridging Configuration

Each Bridge can maintain simultaneous network links with up to fifty other Bridges, so that up to fifty-one directly linked Fortress Bridges can be present on a given network. Many more Bridges can belong to a more widely deployed mesh network encompassing nodes linked indirectly through other nodes.

NOTE: FastPath Mesh and **STP** *Bridging Mode*s are incompatible with the Bridge's VLAN function (Section 3.9).

Networked radios must:

- use the same radio frequency band (Section 3.3.2.2)
- be set to the same channel (Section 3.3.2.3)

The BSSs that comprise the network must:

- be enabled for bridging (Section 3.3.4.3)
- be configured with the same SSID (Section 3.3.4.2)

Wireless bridging links must be formed over Fortress-secured interfaces. When a BSS's *Wireless Bridge* setting is **Enabled**, the BSS's *Fortress Security* setting is automatically fixed on **Enabled**, the *Wi-Fi Security* setting is automatically fixed on **Disabled**, and the fields are greyed out (refer to Section 3.3.4.3).

When licensed to do so, the Bridge can manage bridging links and route network traffic using Fortress's FastPath Mesh (FP Mesh) tactical mobile networking. Alternatively, Spanning Tree Protocol (STP) can be used for mesh link management without a license.

Both protocols enable the deployment of self-forming, self-healing secure networks, and both prevent bridging loops while providing path redundancy.

STP prevents network loops by selectively shutting down some mesh network links.

FastPath Mesh maintains the availability of every mesh connection and additionally provides optimal path routing of network traffic, along with independent IPv6 mesh addressing and DNS (Domain Name System) distribution functions to

support the mesh network and user controls to configure and tune it.

Table 3.1. STP Networks Compared to FastPath Mesh

function	STP	FP Mesh
self-forming	supported	supported
self-healing	supported[a]	supported
end-to-end encryption	supported	supported
all paths available at all times	not supported	supported
optimal path selection	not supported	supported
automatic IPv6 mesh addressing	not supported	supported
independent DNS and *.ftimesh.local* domain	not supported	supported
configurable network and neighbor cost weighting	not supported	supported

a. except for STP root node

Unless the network can be physically configured to eliminate any possibility of bridging loops (multiple OSI [open systems interconnection] layer-2 paths to the same device), either **FastPath Mesh** or **STP *must*** *be used* when Bridges are deployed in a mesh network.

Supported FastPath Mesh and STP network topologies are illustrated and described in detail in Chapter 1.

NOTE: FastPath Mesh and STP link management are mutually incompatible. Networked Bridges must all be configured to use the same *Bridging Mode*.

3.2.1 FastPath Mesh Bridging

Nodes on a FastPath Mesh network are of two basic types:

- *Mesh Point* (MP) - a Fortress Bridge with FastPath Mesh enabled
- *Non-Mesh Point* (NMP) - any node that is not an MP

FP Mesh nodes can connect over their Ethernet ports or radio BSSs. An FP Mesh interface must be configured for the type of connection it provides:

- MPs connect to other MPs only on *Core* interfaces.
- NMPs connect to MPs only on *Access* interfaces

A given interface can be of only one type; so MPs and NMPs cannot share an interface. Per-port *FastPath Mesh Mode* settings for radio BSSs and Ethernet ports are described in sections 3.3.4.4 and 3.7.3, respectively.

All MPs on a given FP Mesh network are *peers*. Directly connected MPs are *neighbors*.

An MP that serves as a link between the FP Mesh network and a conventional hierarchical network is a *Mesh Border Gateway* (MBG).

An FP Mesh network presents to NMPs as a flat, OSI layer-2 network, while optimizing operations to eliminate inefficiencies

inherent in layer-2 networks, including advance ARP resolution and streamlined broadcast and multicast handling to significantly reduce broadcast traffic.

FP Mesh enables each node to use all mesh network links and to route traffic on the optimal path by computing per-hop costs, based on link conditions, and end-to-end costs, based on cumulative per-hop costs. System and neighbor cost weighting are user configurable (refer to sections 3.2.1.5 and 3.2.1.6).

Any node in an FP Mesh network can be reached via:

- MAC (media access control) address, as in conventional hierarchical networks
- IPv4 address, if IPv4 is in use for the network
- any IPv6 address locally generated for or assigned to the node, including RFC-4193 and local- and global-scope addresses
- FQDN (fully qualified domain name), if servers internal to FP Mesh network MPs are providing network DHCP (Dynamic Host Control Protocol) and DNS services (refer to Section 3.6).

IPv4 Addressing and Name Resolution

IPv4 is enabled by default on the Bridge (refer to Section 3.4.2.1). Although FastPath Mesh functionality does not require IPv4, it fully supports standard IPv4 addressing for all network nodes (MPs and NMPs).

NOTE: The Fortress Bridge's internal DNS and DHCP servers are covered in Section 3.6.

The DHCP and DNS servers internal to the Fortress Bridge can be enabled on any Mesh Point. These severs provide virtually configuration-free DHCP and DNS services for Non-Mesh Points. FastPath Mesh operates best when the DNS servers internal to all network MPs are enabled (the default), and the DHCP server on one MP (or a small set of MP DHCP servers) is enabled to provide network DHCP service(s).

Third-party external DHCP and DNS servers can be used with FP Mesh but require extensive configuration. Furthermore, the recommended Fortress internal server deployment uses far fewer network resources because it does not allow DNS network broadcast queries to enter the mesh from every NMP.

Only NMPs are provided DHCP service. IPv4 addresses must be manually configured on FastPath Mesh Points (refer to Section 3.4.2.1).

IPv6 Addressing, Namespace and Name Resolution

IPv6 is always enabled on the Bridge and every MP thus has a link local IPv6 address (refer to Section 3.4.2.2). FP Mesh fully supports standard IPv6 addressing for all network nodes (MPs and NMPs), including locally assigned and local- and global-scope addresses, as well as multiple IPv6 routers and associated global prefixes.

Additionally, FastPath Mesh functionality itself provides automatic IPv6 addressing without the need for a DHCP server and name distribution within the network without the need for a DNS server.

To provide independent IPv6 addressing and facilitate optimal network traffic routing, FP Mesh generates an RFC-4193 *Unique Local IPv6 Unicast Address* (a.k.a., unique local addresses or ULAs) for every MP and supports up to sixteen IPv6-address prefixes using RFC-2461 *Neighbor Discovery*.

Figure 3.1. Advanced View *Bridging Configuration* frame, *Administration* screen, all platforms

FP Mesh Configuration Settings

Once the Bridge's radio is enabled (Section 3.3.2.1) and a bridging-enabled BSSs is created and configured on it (Section 3.3.4), the Bridge will act as a Mesh Point in a wireless FastPath Mesh network, automatically connecting to compatibly configured MPs via their automatically generated IPv6 addresses, without additional FP Mesh configuration.

Sections 3.2.1.1 through 3.2.1.7 describe the complete settings for configuring FastPath Mesh networking. The first four settings (in sections 3.2.1.1–3.2.1.4), are located in two places in the Bridge GUI:

- **Configure -> Administration ->** *Bridging Configuration*
- **Configure -> FastPath Mesh ->** *Global Settings*

Network Cost settings (Section 3.2.1.5) are present only among the FP Mesh settings on the *Administration* screen, while Neighbor Cost and Multicast Group settings (sections 3.2.1.6 and 3.2.1.7) are present only on the *FastPath Mesh* screen.

Step-by-step instructions for changing FP Mesh bridging settings appear on page 53, following the descriptive sections below.

CAUTION: Fortress-protected networks are not fully secured until all preconfigured administrative passwords and the Access ID have been changed from their defaults (sections 2.2.2.7 and 4.1.17, respectively).

3.2.1.1 FastPath Mesh Bridging Mode

The *Bridging Mode* setting enables **FastPath Mesh** and the rest of the settings that configure it, described below.

FastPath Mesh is available for selection only when the feature has been licensed on the Fortress Bridge: refer to Section 6.3.

NOTE: The *Bridge Priority* setting on **Configure -> Administration ->** *Bridging Configuration* applies only to STP bridging and is greyed out when **FastPath Mesh** is selected.

3.2.1.2 Fortress Security

For FP Mesh, you can choose to globally enable or disable end-to-end Fortress Security for the Core interface connections

between FastPath MPs. When **Enabled** (the default), traffic between MPs is subject to Fortress's Mobile Security Protocol (MSP), as configured on the Bridge itself (refer to Section 4.1).

3.2.1.3 Mobility Factor

To facilitate node mobility in the FP Mesh network, *Mobility Factor* adjusts the frequency at which the costs of data paths to neighbor nodes are sampled so that cost changes can be transmitted to the network. The higher the *Mobility Factor*, the more frequent is the cost sampling.

Enter the highest relative speed of nodes in the network, in miles per hour, as the *Mobility Factor* for all the MPs in the FP Mesh network. For example, if nodes could move at approximately 10 mph and in opposite directions, their highest relative speed is 20 mph: enter **`20`** for *Mobility Factor*.

NOTE: All MPs in the FP Mesh network should use the same mobility factor.

Set the *Mobility Factor* between **`1`** (the appropriate setting for a stationary node) and **`60`**. The default is **`30`**.

3.2.1.4 Mesh Subnet ID

When FP Mesh is enabled, a *Unique Local IPv6 Unicast Address*, as defined in RFC 4193, is generated for the Fortress Bridge Mesh Point in the format:

```
| 7 bits |1|  40 bits   |  16 bits  |          64 bits           |
+--------+-+------------+-----------+----------------------------+
| Prefix |L| Global ID  | Subnet ID |        Interface ID        |
+--------+-+------------+-----------+----------------------------+
```

- *Prefix* - `FC00::/7` identifies the address as a Local IPv6 unicast address
- *L* - `1` if the prefix is locally assigned (**`0`** value definition t.b.d.)
- *Global ID* - pseudo-randomly allocated 40-bit global identifier used to create a globally unique prefix
- *Subnet ID* - 16-bit subnet identifier
- *Interface ID* - 64-bit Interface ID

The subnet ID portion of the RFC-4193 address will facilitate network segmentation in a future release of FastPath Mesh.

3.2.1.5 Network Cost Weighting

Traffic on an FP Mesh network is routed along the least costly path to its destination. You can rebalance how the FP Mesh network computes the throughput and latency costs of available data paths by specifying new values for *a* and/or *b* in the FP Mesh cost equation:

cost = ***a*** *(1/CLS) + ***b***(Q/CLS) + ***U***

...in which:

- *CLS* - (Current Link Speed) is the time-averaged link speed, as measured in bits per second.
- *Q* - is the time-averaged current Queue depth, as measured in bits.

CAUTION: The default cost equation values are optimal for FP Mesh implementation. Ill-considered changes can easily affect network behavior adversely.

- ***U*** - is the user defined per-interface cost offset, which allows you to configure one link to be more costly than another. Any non-negative integer between **0** (zero) and **4,294,967,295** can be defined (for configuration information, refer to Section 3.3.4.4 for wireless and Section 3.7.3 for Ethernet interface controls).
- ***a*** and ***b*** - are device-wide user defined constants that correspond to throughput and latency, respectively. Any non-negative integer between **0** (zero) and **65,535** can be defined.

As a rule, a higher value of the constant *a*, *Throughput Cost Weighting*, improves overall throughput, while a higher value of *b*, *Latency Cost Weighting*, reduces latency. The default for both is **1**.

3.2.1.6 Neighbor Cost Overrides

The cost of reaching a neighbor node (another Mesh Point directly linked to the current MP) on an FP Mesh network is the cost associated with the interface used to reach the node. You can override the interface cost for a particular neighbor by specifying a fixed cost for that node.

The neighbor for which the cost override is specified should be configured with a reciprocal neighbor cost, of the same value, specified for the current MP. Asymmetric neighbor cost overrides are not recommended.

To configure a neighbor cost override, you must identify the FP Mesh interface the neighbor connects to and specify the node by any one of:

- MAC address
- IP address
  - RFC-4193 IPv6 address
  - IPv4 address
- hostname

NOTE: If more than one cost override is specified for the same neighbor by different identifiers, only the cost associated with the highest address-type on the list shown (at left) will be applied.

Specify a given neighbor's cost override by only one address identifier, in non-negative numbers between **1** and **4,294,967,295**; or specify **max**. The higher the cost value, the less likely the neighbor will be used to route network traffic. A neighbor with a cost of **max** will never be used to route traffic.

NOTE: A node is assumed to have a only one IPv6 unique local address. If different costs are configured for the same neighbor by more than one IPv6 address, applied cost is unpredictable.

You can configure Neighbor Costs for devices that are not currently neighbor MPs, or even peers. If the specified node appears as or becomes a neighbor, the configured cost will be applied.

3.2.1.7 Multicast Group Subscription

FastPath MPs automatically subscribe/unsubscribe to multicast streams on behalf of NMPs by snooping IP multicast control messages (IGMP and MLD[3]) on mesh Access interfaces.

You can also force MPs to join or leave specific multicast groups, if you need to support non-IP multicast groups or a device on an Access interface that doesn't implement IGMP/MLD, or for testing/debugging purposes.

To subscribe to a multicast group, you must identify the FP Mesh interface for the stream and specify the multicast address for the group by MAC or IP address. MPs can subscribe as multicast listeners, talkers or both (the default).

You can observe the multicast groups to which the MP is currently subscribed (whether learned or configured) on **Monitor -> Mesh Status ->** *Multicast Groups* (described in Section 5.8.5). You can observe and flush the *Multicast/Broadcast Forwarding* table on the same page.

Figure 3.2. Advanced View *FastPath Mesh Settings* screen, all platforms

3.2.1.8 Configuring FastPath Mesh Settings:

Only *Bridging Mode* can be configured in both Bridge GUI views. Other FastPath Mesh bridging settings are accessible only in Advanced View.

Basic FastPath Mesh settings are located in two places in the Bridge GUI, more advanced settings appear on only one Advanced View screen, as shown in Table 3.2.

Table 3.2. FastPath Mesh Bridging Settings

<table>
<tr><th colspan="2">Administration screen</th><th colspan="2">FastPath Mesh screen</th></tr>
<tr><td rowspan="6">Bridging Configura-tion frame</td><td colspan="2">Bridging Mode</td><td rowspan="4">Global Settings frame</td></tr>
<tr><td colspan="2">Mesh Fortress Security</td></tr>
<tr><td colspan="2">Mobility Factor</td></tr>
<tr><td colspan="2">Mesh Subnet ID</td></tr>
<tr><td>Throughput Cost Weighting</td><td>Neighbor Costs</td><td rowspan="2">individual frames</td></tr>
<tr><td>Latency Cost Weighting</td><td>Multicast Groups</td></tr>
</table>

3. Internet Group Management Protocol, Multicast Listener Discovery, Multicast Router Discovery

1. Log on to the Bridge GUI through an *Administrator*-level account.
2. If you are configuring any setting beyond *Bridging Mode*, click **ADVANCED VIEW** in the upper right corner of the page. (If not, skip this step.)
3. Navigate to a Bridge GUI screen and frame through which the setting(s) you want to configure can be accessed:
   - **Configure -> Administration ->** *Bridging Configuration*
   - **Configure -> FastPath Mesh ->** *Global Settings* or *Neighbor Costs* or *Multicast Groups*

   (Refer to Table 3.2.)
4. Enter new values for any settings you want to configure in the *Bridging Configuration* or *Global Settings* frames (described in sections 3.2.1.1 through 3.2.1.5, above), and click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).
5. To configure neighbor cost overrides:
   In the FastPath Mesh screen's *Neighbor Costs* frame:
   - If you want to specify a new MP for a cost override:
     - Click **NEW NEIGHBOR COST**.
     - In the *Add a new Neighbor Cost* dialog, specify the Core interface through which the neighbor connects (or will connect) to the current MP:
       - From the *Interface* dropdown, select a BSS currently configured on (one of) the MP's radio(s) or one of the MP's Ethernet ports.

       or

       - Leave *Interface* at the default, **New BSS**, and enter a valid *BSS Name*, as it will be (or is currently) configured on (one of) the MP's radio(s).
     - Enter an *Address* for the neighbor: its MAC or IPv4 or IPv6 address or its host name.
     - Enter the *Cost*, from **1** to **4,294,967,295**, you want to configure for the neighbor (refer to Section 3.2.1.6).
     - Click **APPLY** in the dialog (or **CANCEL** the action).

   and/or
   - If you want to change an existing cost override:
     - Click the **EDIT** button for the neighbor's entry.
     - In the *Edit a Neighbor Cost* dialog, enter a new value between **1** to **4,294,967,295** for *Cost.*
     - Click **APPLY** in the dialog (or **CANCEL** the action).
6. To subscribe to multicast groups:
   In the FastPath Mesh screen's *Multicast Groups* frame:

NOTE: You cannot change the *Interface* or *Address* for an existing *Neighbor Costs* entry. If these values have changed, delete the neighbor's entry and recreate it with the new value.

- If you want to subscribe to a new multicast group:
  - Click **NEW MULTICAST GROUP**.
  - In the *Add a Multicast Group* dialog, specify the Access interface on which the current MP will subscribe to the multicast group:
    - From the *Interface* dropdown, select a BSS currently configured on (one of) the MP's radio(s) or one of the MP's Ethernet ports.

    or

    - Leave *Interface* at the default, **New BSS**, and enter a valid *BSS Name*, as it will be (or is currently) configured on (one of) the MP's radio(s).
  - Enter a MAC or IPv4 or IPv6 *Address* for the multicast group.
  - From the *Mode* dropdown, select whether the MP is subscribing is as a multicast **Listener**, **Talker** or **Both** (refer to Section 3.2.1.7).
  - Click **APPLY** in the dialog (or **CANCEL** the action).

and/or

- If you want to change the *Mode* of an existing subscription:
  - Click the **EDIT** button for the subscription's entry.
  - In the *Edit a Multicast Group* dialog, select a new value for *Mode* (you cannot change the *Interface* or *Address*).
  - Click **APPLY** in the dialog (or **CANCEL** the action).

To delete Neighbor Costs or Multicast Groups:

You can delete a single entry or all entries in either list.

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> FastPath Mesh** from the menu on the left.
2. In the *FastPath Mesh* screen's *Neighbor Costs* or *Multicast Groups* frame:
   - If you want to delete a single entry, click to place a check in the box beside it; then the **DELETE** button above the list.

   or

   - If you want to delete all entries, click **All** to place a check in all entries' boxes; then click the **DELETE** button above the list.

The relevant list reflects the deletion(s).

3.2.2 STP Bridging

When STP is used for link management, the Fortress Bridge can connect to other Fortress Bridges to form mesh networks and, on separate BSSs, simultaneously serve as access points (APs) to connect compatibly configured wireless devices to a wireless LAN (WLAN).

STP is selected for *Bridging Mode* by default.

Bridging BSSs

BSSs enabled for wireless bridging automatically form STP mesh network connections with compatibly configured bridging BSSs on other Fortress Bridges.

On Bridges equipped with multiple radios, the radio(s) fixed on the 5 GHz 802.11a frequency band will generally be the most appropriate for the bridging function. (These include Radio 2 in the ES520 and ES820 and Radio 2, Radio 3 and Radio 4 in the ES440.) BSSs configured on these radios are therefore **Enabled** for *WDS* by default.

Access Point BSSs

Under STP link management, a BSS on which bridging is disabled is acting as a conventional wireless AP.

On Bridges equipped with multiple radios, Radio 1 is generally the better choice for the AP function, because it can be configured to use the 2.4 GHz 802.11g frequency band. By default, BSSs configured on Radio 1 are therefore **Disabled** for *WDS*.

Any wireless device within range of the Bridge's radio can connect to the Bridge-secured WLAN, if the connecting device:

- is using the same RF band and channel as the Bridge radio
- is using the same SSID as an AP BSS configured on the Bridge
- successfully meets all security requirements for connecting to that BSS, if the BSS is configured to enforce security measures

One of the Bridges in the network must act as the root switch in the STP configuration. If a given root becomes unavailable, the root role can be assumed by another Bridge in the network. The network can experience significant traffic disruption in this event, until the new STP root node has been established.

You can configure the order in which each Bridge in the network will assume the STP root role, should Bridge(s) ahead of it in the priority list become unavailable. The role of root is taken by the Bridge in the network with the lowest STP *Bridge Priority* number.

When the Bridge is in **STP** *Bridging Mode*, STP must be enabled across all devices on the Bridge-secured network.

NOTE: Settings other than *Bridge Priority* on **Configure -> Administration ->** *Bridging Configuration* apply only to FastPath Mesh bridging and are greyed out when **STP** is selected for *Bridging Mode*.

NOTE: *Fortress Security* is **Enabled** for WDS-enabled BSSs, *Wi-Fi Security* is **Disabled**, and these fields are greyed out.

Figure 3.3. Simple View *Bridging Configuration* frame, *Administration* screen, all platforms

3.2.2.1 Configuring STP Bridging:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Administration** from the menu on the left.

2 In the *Bridging Configuration* frame:

- In *Bridging Mode:* select **STP** to enable Spanning Tree Protocol.
- In *Bridge Priority:* optionally enter a new STP root numbers between **0** and **65535** are valid. The default is **49152**.

3 Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

NOTE: If networked Bridges all have the same priority number, their MAC addresses are used, lowest to highest, to establish STP root priority.

3.3 Radio Settings

Different Fortress Bridge models can be variously equipped with one to four independent internal radios supporting various 802.11 capabilities, or with no radios.

Table 3.3. Fortress Bridge Model Radios

series	basic model	# of radios	radio label	standard equipment	default band	standard model #	4.4 GHz option	4.4 GHz model #[a]
ES	**ES820**	2	Radio 1	802.11a/g/n	802.11g	ES820-35	no	*n/a*
			Radio 2	802.11a/n	802.11a		no	
	ES520	2	Radio 1	802.11a/g	802.11g	ES520-35	no	ES520-34
			Radio 2	802.11a	802.11a		yes	
	ES440	4	Radio 1	802.11a/g/n	802.11g	ES440-3555	no	*n/a*
			Radio 2–Radio 4	802.11a/n	802.11a		no	
	ES210	1	Radio 1	802.11a/g/n	802.11a	ES210-3	no	*n/a*
FC	**FC-*X***	0	*n/a*					

a. Refer to Section 1.3.1.1 for more on ES-series model numbers.

Compare your Bridge's model number (on the *Administration Settings* screen under *System Info*.) to Table 3.3 above to determine the number of and type of radio(s) with which the Bridge you are configuring is equipped. On Bridge GUI *Radio Settings* screens, configuration settings for 4.4 GHz military band radios are also identified as such.

Each radio installed in a Fortress Bridge can be configured with up to four BSSs, which can serve either as bridging interfaces networked with other Fortress Bridges or as access interfaces for connecting wireless client devices. Refer to Section 3.3.4 for details on radio BSS configuration.

Alternatively, an ES210 Bridge can be dedicated to act as a wireless client by configuring a single *station* (STA) interface on its single internal radio. Refer to Section 3.3.5 for details on radio STA configuration.

3.3.1 Advanced Global Radio Settings

Advanced Global Radio Settings apply to all radios internal to the Bridge and are available only in the Bridge GUI Advanced View.

3.3.1.1 Radio Frequency Kill

The *Kill All RF* setting turns the radio(s) installed in the Bridge off (**Enabled**) and on (**Disabled**).

The default *Kill All RF* setting is **Disabled**, in which state the Bridge receives and transmits radio frequency signals normally.

You can also enable/disable RF kill through Fortress Bridge chassis controls (refer to the Fortress *Hardware Guide* for the Bridge you are configuring).

3.3.1.2 Radio Distance Units

The increment used to set *Distance* for the Bridges' radio(s) (refer to Section 3.3.2.7) is configured globally in *Radio Units*:

- *Metric* - (the default) the *Distance* setting is configured in kilometers.
- *English* - the *Distance* setting is configured in miles.

3.3.1.3 Country of Operation

By default, the following countries and territories are available for selection:

American Samoa	Hungary	Poland
Austria	Iceland	Portugal
Belgium	Ireland	Romania
Bosnia Herzegovina	Italy	Saudi Arabia
Bulgaria	Kosovo	Serbia
Canada	Latvia	Slovakia
Croatia	Liechtenstein	Slovenia
Cyprus	Lithuania	Spain
Czech Republic	Luxembourg	Sweden
Denmark	Macedonia	Switzerland
Estonia	Malta	Turkey
Finland	Mexico	United Arab Emirates
France	Montenegro	United Kingdom
Germany	Netherlands	United States
Greece	Northern Mariana Islands	US Minor Outlying Islands
Guam	Norway	US Virgin Islands

When *Country* is licensed on the Bridge (Section 6.3), additional countries are available for selection.

To allocate bandwidth and prevent interference, radio transmission is a regulated activity, and different countries specify hardware configurations and restrict the strength of signals broadcast on particular frequencies according to different rules.

While some countries develop such regulations independently, national regulatory authorities more often adopt an established set of rules in common with other countries in the same region. Whether used in common by multiple countries or by a single country, a *regulatory domain* is distinguished by a single set of rules governing radio devices and transmissions.

In order to comply with the relevant regulatory authority, you must establish the Bridge's regulatory domain by identifying the country in which the Bridge will operate. Bridge software automatically filters the options available for individual radio settings (Section 3.3.2) according to the requirements of the relevant regulatory domain as they apply specifically to the Bridge's internal radios.

In some of the countries on the default *Country Code* list, radios using the 802.11a frequency band will have ***no*** compliant channels available unless *Advanced Radio* operation has been licensed on the Bridge. (Refer to Section 3.3.2 for more detail on radio operation with and without an *Advanced Radio* license and to Section 6.3 for licensing information.)

By default, the **United States** is selected as the Bridge's country of operation, and the rules of the Federal Communication Commission (FCC) regulatory domain dictate available radio settings in the 5 GHz 802.11a and the 2.4 GHz 802.11g frequency bands.

The 4.400 GHz–4.750 GHz frequency range is regulated by the United States Department of Defense, rather than by the FCC. ***Use of military band radios is strictly forbidden outside of U.S. military applications and authority.*** On a Bridge with one or more 4.4 GHz radios installed, **United States** is selected as the Bridge's country of operation and the setting cannot be changed.

3.3.1.4 Environment Setting

It is common for regulatory domains to restrict certain channels to indoor-only use. In order for the Bridge's radio(s) to comply with such requirements, you must specify whether the Bridge is operating **Indoors** or **Outdoors** (the default).

In many regulatory domains, including the Bridge's FCC domain, additional channels are available for selection (Section 3.3.2.3) when *Environment* is set to **Indoors**.

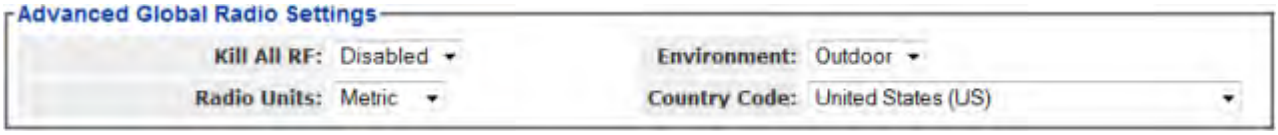


Figure 3.4. Advanced View *Advanced Global Radio Settings* frame, all radio-equipped platforms

3.3.1.5 Configuring Global Advanced Radio Settings

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Radio Settings** from the menu on the left.
2. In the *Radio Settings* screen's *Advanced Global Radio Settings* frame, use the dropdown menus to specify new values for the setting(s) you want to change (described above).
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

NOTE: You must reboot the Bridge in order for a change to *Environment* or *Country Code* to take effect.

3.3.2 Individual Radio Settings

The remaining settings that affect radio operation are configured, per radio, in the *Radio Settings* frame.

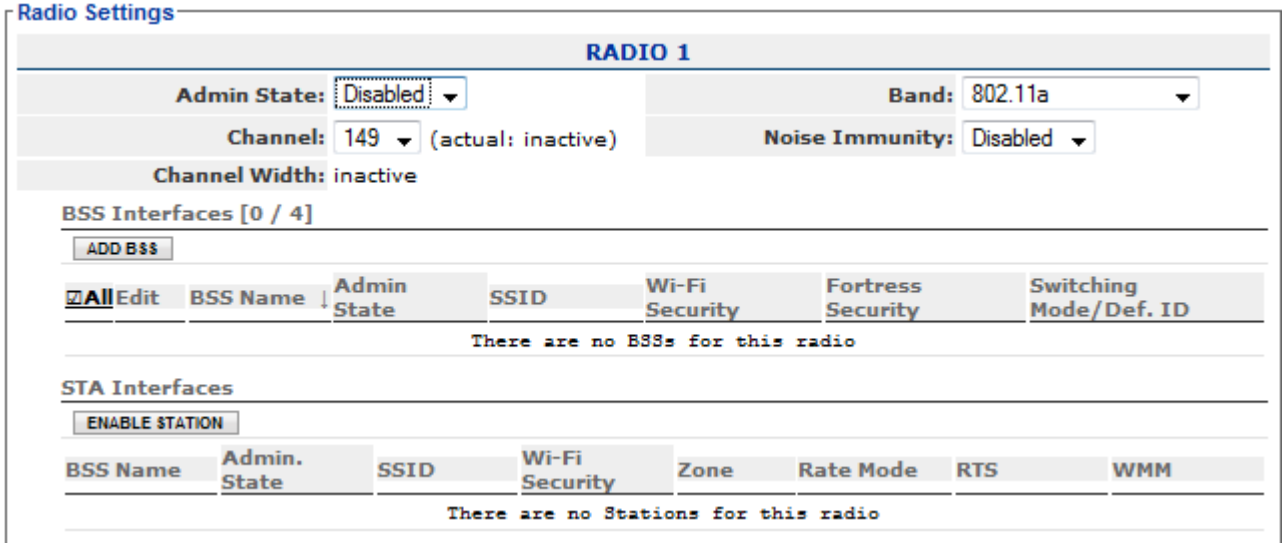


Figure 3.5. Simple View *RADIO 1 Radio Settings* frame, all radio-equipped platforms

As determined by your *Country Code* selection (under *Global Radio Settings* and described in Section 3.2), regulatory domain requirements can affect an individual radio's operational state and *Radio Band* setting as well as determine available *Channel* and *TxPower* options (refer to 3.3.2.3 and 3.3.2.6).

In addition, the Bridge uses your entries for *Network Type* and *Antenna Gain* (refer to sections 3.3.2.4 and 3.3.2.5, respectively) to calculate allowable *TxPower* settings. These settings are therefore also subject to regulatory compliance requirements.

When *Advanced Radio* operation has not been licensed on the Bridge (the default), transmission by the Bridge's 802.11a radio(s) is restricted to channels in the UNII-3/ISM[4] band of the 5 GHz bands. Outside of the United States, this restriction can cause dual-band radios to be automatically reconfigured from 802.11a to 802.11g operation and radios that can use only the 802.11a frequency band to be disabled altogether (and their configuration fields greyed out).

When *Advanced Radio* is licensed, the Bridge's 802.11a radio(s) can use additional licensed and unlicensed frequencies. Contact Fortress Technologies for additional information.

An *Advanced Radio* license permits the Bridge's 802.11a radio(s) to be used, in the 802.11a band, in any of the countries on the default *Country Code* list (Section 3.3.1.3) and in any of the additional countries in which the Bridge can be operated when *Country* is licensed.

Country Code is described in Section 3.3.1.3. Features licensing is covered in Section 6.3. Per-radio settings are described in Sections 3.3.2.1 through 3.3.2.10; step-by-step instructions for changing them follow these sections.

NOTE: If you change the *Country Code* in effect on the Bridge to a domain in which current radio settings are not permitted, the relevant value(s) will revert to default(s), and reconfiguration options will be confined to permissible values.

3.3.2.1 Radio Administrative State

The *Admin State* setting simply turns the radio on (**Enabled**) and off (**Disabled**). Bridge radios are **Disabled** by default.

Although a radio's *Admin State* always remains at its configured value, the actual operational state of the Bridge's internal radios is subject to the regulatory domain in which the Bridge is operating (refer to Section 3.3.1.3). In some cases, radios that can use only the 802.11a frequency band must be automatically disabled (their configuration fields greyed out) in order to bring the Bridge into compliance. Refer to Section 3.3.2 for more operational detail, and consult your local regulatory authority for the applicable specifications and requirements for radio devices and transmissions.

3.3.2.2 Radio Band

The *Band* setting selects both the frequency band of the radio spectrum a Bridge radio will use (for dual band radios) and whether it will use the 802.11n standard for wireless transmission/reception (for radios that support the option).

CAUTION: Radios used to form a network (Section 3.2) must use compatible transmission and reception settings.

4. Unlicensed National Information Infrastructure-3/Industrial, Scientific and Medical

5 GHz and 2.4 GHz Options

Radios installed as Radio 1 in radio-equipped Fortress Bridges (refer to Table 3.3, above) can operate in either the 5 GHz 802.11a frequency band or the 802.11g 2.4 GHz band of the radio spectrum, according to your selection in the *Band* field.

By default, a dual-band radio installed as Radio 1 in a multi-radio Bridge is configured to operate in the 2.4 GHz 802.11g band. The single dual-band radio installed in the ES210 is configured to operate in the 802.11a band by default.

In Bridges equipped with more than one radio, the additional radio(s) can function in only a single frequency band: the 5 GHz 802.11a band in standard-equipment radios, or the 4.4 GHz military band in Bridges that support this option.

CAUTION: The 4.400–4.750 GHz frequency range is regulated by the U.S. Department of Defense. Use of military band radios is strictly forbidden outside of U.S. military applications and authority.

The radio *Band* setting is among those subject to the relevant regulatory domain (Section 3.3.1.3). In some cases, in order to bring the Bridge into compliance, dual-band radios could be automatically fixed on the 802.11g band and radios fixed on the 802.11a band could be disabled altogether. Refer to Section 3.3.2 for more operational detail, and consult your local regulatory authority for the applicable specifications and requirements for radio devices and transmissions.

802.11n Options

BSSs configured on the radio(s) installed in certain Bridge models are additionally capable of 802.11n operation (refer to Table 3.3 on page 57), as defined by this recent IEEE amendment to the 802.11 standards.

NOTE: Although fully compatible with the IEEE standard, Bridge 802.11n-capable radios cannot perform MIMO (Multiple-Input Multiple-Output), or ***spatial multiplexing***, at this time.

The ES210 Bridge's *Station Mode* function (refer to Section 3.3.5) does not support 802.11n operation. You must set the ES210 radio's *Band* to **802.11a** or **802.11g** before you can add a *Station Interface* to the ES210 radio.

A Bridge radio BSS configured to use the 802.11n standard is fully interoperable with other 802.11n network devices.

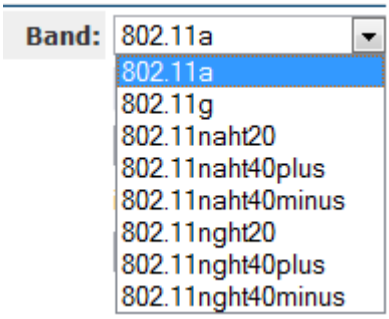


Figure 3.6. 802.11n-capable, dual-band radio *Band* options, ES210, ES440, ES820

Selecting an 802.11n option in a radio's *Band* field permits the Bridge to take advantage of radio enhancements and traffic handling efficiencies defined in the newer standard, including both 20 MHz and 40 MHz channel widths, frame aggregation

and block acknowledgement (*block ACK*), and smaller frame headers and inter-frame gaps.

On 802.11n-capable radios, there are three possible high-throughput *(ht)* 802.11n options for each frequency band supported on the radio: three for the 5 GHz *802.11na* band and three for the 2.4 GHz *802.11ng* band, when present:

- *ht20* - 802.11n - *High-Throughput 20 MHz,* the radio will use only 20 MHz channel widths, while taking advantage of the standard's traffic handling efficiencies.
- *ht40plus - High-Throughput 40 MHz plus 20 MHz,* the radio can use 40 MHz channel widths by binding the selected 20 MHz channel to the adjacent 20 MHz channel *above* it on the radio spectrum.
- *ht40minus - High-Throughput 40 MHz minus 20 MHz,* the radio can use 40 MHz channel widths by binding the selected 20 MHz channel to the adjacent 20 MHz channel *below* it on the radio spectrum.

3.3.2.3 Channel and Channel Width

The *Channel* setting selects the portion of the radio spectrum the radio will to use to transmit and receive—in order to provide wireless LAN access or to establish the initial connections in a mesh network.

The channels available for user selection are determined by the frequency band the radio uses, subject to the relevant regulatory domain rules. In most regulatory domains, certain channels in the 5 GHz frequency band are designated DFS (Dynamic Frequency Selection) channels. DFS compliance also restricts the channels available for user selection (and broadcast) on 802.11a radios.

NOTE: Consult your local regulatory authority for applicable radio device and transmission rules and for DFS channel designations.

The Bridge GUI presents only currently permissible channels for user selection, according to the currently specified *Country* of operation (Section 3.3.1.3) and *Band* (Section 3.3.2.2), excluding channels on the radio's *DFS Channel Exclusions* list (Section 3.3.3).

A dual-band radio that uses the 2.4 GHz 802.11g band by default (Radio 1 in the multiple radio ES440, ES520 and ES820 Bridges) is set to channel **1** by default.

A second internal 5 GHz 802.11a radio (Radio 2 in non-military-band ES440, ES520 and ES820) or a single dual-band radio that uses 802.11a by default (Radio 1 in the ES210) has a default channel setting of **149**. In the military-band ES440, Radio 2 is set to channel **4100** by default.

Whether they use the 5 GHz 802.11a band or the 4.4 GHz military band, Radio 3 and Radio 4 in the ES440 are set by default to unique channels.

Table 3.4 shows all channels available for selection on military band Bridge radios, with their corresponding frequencies.

Table 3.4. 4.4 GHz Military Band Radio Channels

Channel	Frequency (GHz)	Channel	Frequency (GHz)
4100	4.476	4128	4.616
4104	4.496	4132	4.636
4108	4.516	4136	4.656
4112	4.536	4140	4.676
4116	4.556	4144	4.696
4120	4.576	4148	4.716
4124	4.596		

To the right of the *Channel* field, the *Radio Settings* screen displays the view-only *actual* channel over which the radio is communicating. If the *actual* channel is different from the user-specified *Channel*, the *actual* channel was set by DFS operation. Refer to Section 3.3.3 for more detail.

The *Radio Settings* screen also displays *Channel Width* informationally, view-only.

3.3.2.4 Network Type

Whether the Bridge is a member of a multi-node, point-to-multipoint (**PtMP**) network (the default) or a two-node, point-to-point (**PtP**) network affects allowable *TxPower* settings for the Bridge's current country of operation (refer to Section 3.3.1.3). You must enter the correct value for *Network Type* in order to comply with the requirements of the applicable regulatory domain.

You can configure *Network Type* only in Advanced View.

3.3.2.5 Antenna Gain

Measured in dBi (decibels over isotropic), *Antenna Gain* is used to determine allowable *TxPower* settings for the Bridge's current country of operation (refer to Section 3.3.1.3). Consult the documentation for the antenna connected to the radio you are configuring to determine the antenna's gain.

NOTE: Antenna port labels corresponds to radio numbering: Radio 1 uses **ANT1**, and so on.

The gain of the antenna affects the distribution of the radio frequency (RF) energy it emits and is therefore subject to the requirements of the applicable regulatory domain. You must enter the correct value for *Antenna Gain* in order to comply with local regulations.

The dropdown provides selectable values from 0–50 dBi (inclusive). The default antenna gain depends on the Bridge you are configuring. In multi-radio Bridges, all radios have a default antenna gain setting of 9 dBi. The ES210 radio's default antenna gain is 5 dBi.

You can configure *Antenna Gain* only in Advanced View.

3.3.2.6 Tx Power Mode and Tx Power Settings

The default transmit power level for all radios is **Auto**, which directs the Bridge to automatically set the transmit power at the maximum allowed for the selected *Band*, *Channel*, *Network Type* and *Antenna Gain* (refer to sections 3.3.2.2 through 3.3.2.5) by the regulatory domain established in *Country Code* (Section 3.3.1.3).

Alternatively, you can specify a transmit power level for the radio. As for **Auto** power-level selection, the set of usable values for *TxPower* is a function of the Bridge's regulatory domain, in combination with its *Band*, *Channel*, *Network Type* and *Antenna Gain* settings for that radio.

The power at which radios are permitted to transmit is subject to the applicable regulatory domain. You must configure the Bridge with accurate values in order to comply with local regulations. Consult your local regulatory authority for applicable specifications and requirements for radio devices and transmissions.

In environments with a dense distribution of APs (and resulting potential for interference), it may be desirable to select a lower *Tx Power* setting than the default (**Auto**) for a radio using the 802.11g band. The **Auto** setting is otherwise appropriate for all radios.

You can configure *TxPower* only in Advanced View.

WARNING: The FCC (the Bridge's default regulatory domain) requires antennas to be professionally installed; the installer is responsible for ensuring compliance with FCC limits, including TX power restrictions.

3.3.2.7 Distance

The *Distance* setting configures the maximum distance for which a radio in a mesh network must adjust for the propagation delay of its transmissions.

Distance is set in kilometers (the default) or miles, according to the global *Radio Units* setting (Section 3.3.1.2), in increments of 1 and values from **1** to **56** km or **1** to **35** miles.

In a network deployment, the *Distance* setting on the networked radios of *all* member Bridges should be the number of kilometers (or miles) separating the two Bridges with the greatest, unbridged distance between them. In Figure 3.7, the *Distance* setting would be **3** kilometers: the longest distance in the network between two Bridges without another Bridge between them.

Propagation delay is not a concern at short range. At distances of one (kilometer or mile) and under, you should leave the setting at **1** (the default for both radios).

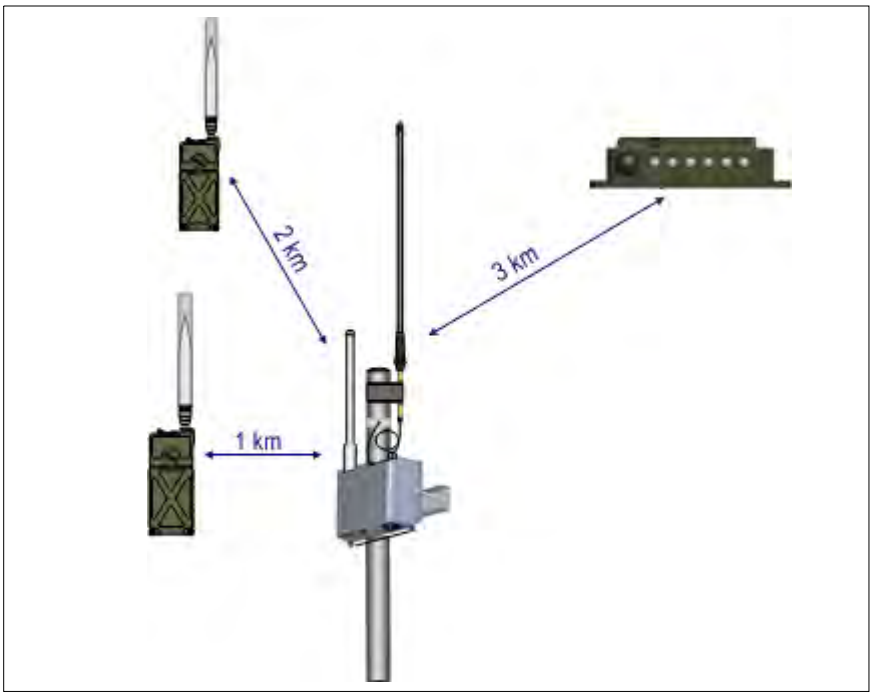


Figure 3.7. Bridge network deployment with radio *Distance* settings of 3 kilometers

You can configure *Distance* only in Advanced View.

3.3.2.8 Beacon Interval

Bridge radios transmit beacons at regular intervals to announce their presence on their network, the strength of their RF signals and, when *Advertise SSID* is enabled (Section 3.3.4.2), the SSIDs of their basic service sets (BSSs). The beacon interval is also used to count down the DTIM (Delivery Traffic Indication Message) period (refer to Section 3.3.4.8).

CAUTION: Radios using DFS channels (Section 3.3.3) ***must*** use the default *Beacon Interval* of **100** ms.

In mesh network deployments, all of the Bridges in the network must use the same *Beacon Interval*.

You can configure the number of milliseconds between beacons in whole numbers between **25** and **1000**. You cannot disable the beacon. The default *Beacon Interval* is **100** milliseconds, which is optimal for almost all network deployments and recommended for bridging operation.

A longer beacon interval conserves power and leaves more bandwidth free for data transmission, potentially improving throughput. A shorter interval provides faster, more reliable passive scanning for network nodes and devices, potentially improving mobility.

Fortress recommends retaining the *Beacon Interval* default unless operating conditions require a change.

You can configure *Beacon Interval* only in Advanced View.

3.3.2.9 Short Preamble

The short preamble is used by virtually all wireless devices currently being produced. The *Short Preamble* is therefore the most likely requirement for new network implementations and is **Enabled** by default. The setting applies only to 802.11g band operation; it is greyed out for Radio 2 and for Radio 1 when it is configured to use the 802.11a band.

When *Short Preamble* is **Disabled** connecting devices must use the long preamble, which is still in use by some older 802.11b devices. If the WLAN must support devices that use the long preamble, you must set *Short Preamble* for the radio on which the access point BSS is configured to **Disabled**.

You can configure *Short Preamble* only in Advanced View.

3.3.2.10 Noise Immunity

For radios using the **802.11a** band (Section 3.3.2.2), enabling *Noise Immunity* allows the radio to aggressively lower the receive threshold for the signal strength of connected nodes, in order to compensate for unusual levels of local interference.

Noise Immunity is **Disabled** by default, and Fortress recommends retaining the default, unless operating conditions require a change.

3.3.2.11 Configuring Individual Radio Settings:

Table 3.5 shows which *Radio Settings* appear in the two GUI views.

Table 3.5. Radio Settings

Simple & Advanced Views	Advanced View Only
Admin. State *Band* *Channel* *Noise Immunity*	*Network Type* *Beacon Interval* *Distance* *Antenna Gain* *TxPower* *Short Preamble* *Channel Exclusions*

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Radio Settings** from the menu on the left.
2. If you are configuring one or more Advanced View settings (see Table 3.5), click **ADVANCED VIEW** in the upper right corner of the page. (If not, skip this step.)
3. In the *Radio Settings* screen's *Radio Settings* frame, enter new values for those settings you want to configure (described in sections 3.3.2.1 through 3.3.2.10, above).

4 Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

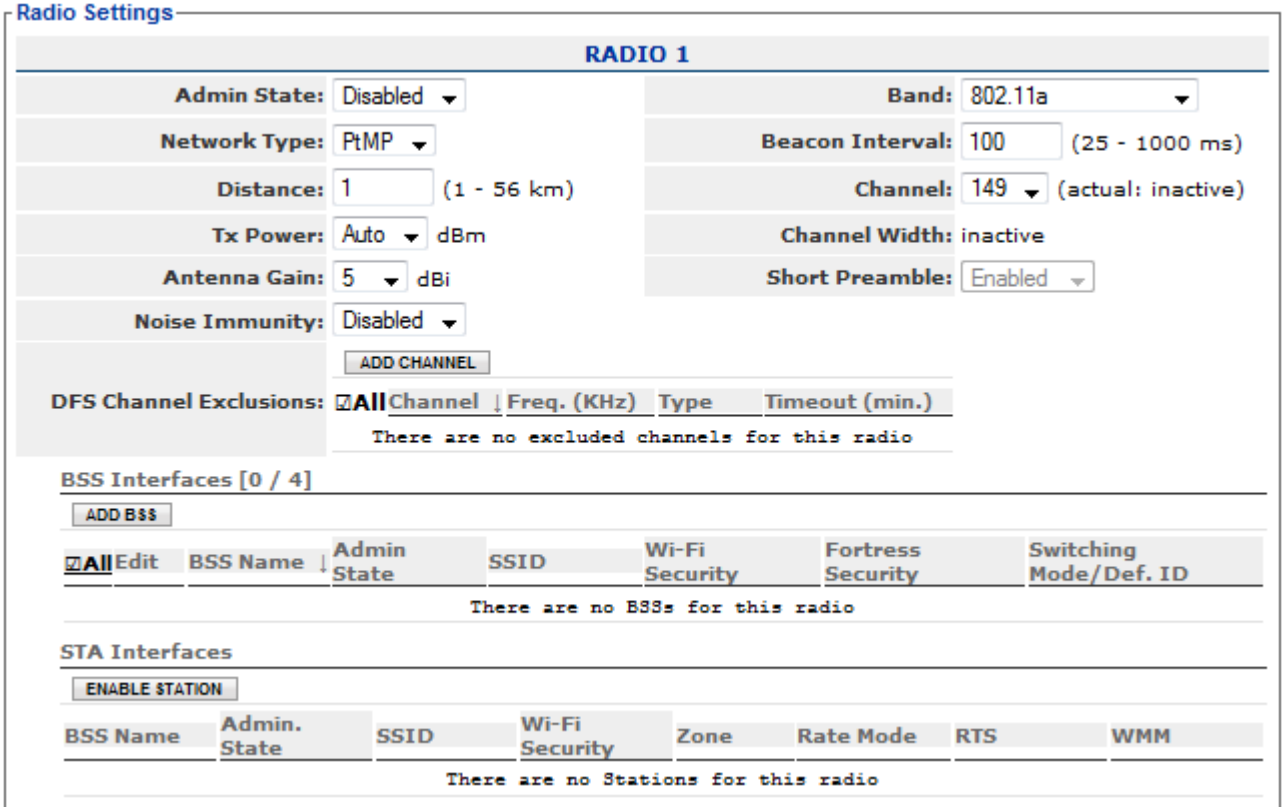


Figure 3.8. Advanced View *RADIO 1 Radio Settings* frame, all radio-equipped platforms

3.3.3 DFS Operation and Channel Exclusion

Most regulatory domains, including the Bridge's default FCC domain, require that certain channels in the 5 GHz 801.11a frequency band operate as DFS (Dynamic Frequency Selection) channels.

DFS is a radar (radio detection and ranging) avoidance protocol. Devices transmitting on a DFS channel must detect approaching radar on the channel, vacate the channel within 10 seconds of doing so, and stay off the channel for a minimum of 30 minutes thereafter.

Radios using the 2.4 GHz 802.11g frequency band or the 4.4 GHz military band are not subject to DFS.

NOTE: The Bridge's regulatory domain is determined by the specified *Country* of operation, described in Section 3.3.1.3.

3.3.3.1 DFS Operation on the Bridge

Bridge radios deployed in a mesh network must use a common channel in order to remain connected. For radios on which a *Bridging*-enabled BSSs are configured (Section 3.3.4), the *actual* channel on which the network transmits and receives will be subject to change according to the Bridge's DFS implementation.

In order to keep all network nodes connected, a network Bridge forced by DFS to change the channel on a bridging radio will

NOTE: Consult your local regulatory authority for applicable DFS channel designations.

signal the impending change and transmit the new channel number to the network, before switching its bridging radio to the new channel. Bridges receiving this transmission will do the same, until the new channel has been propagated to every Bridge in the network and all are all connected over the new channel.

If you manually change the *Channel* setting on a bridging radio (Section 3.3.2.3), the new channel will be propagated to the rest of the network in the same manner.

NOTE: Radios using DFS channels ***must*** use the default *Beacon Interval* of **100** ms (Section 3.3.2.8).

You can observe the view-only *actual* channel on **Configure -> Radio Settings**, to the right of the *Channel* setting (which persists as specified as the *actual* channel changes).

3.3.3.2 Channel Exclusion

For each enabled radio, Fortress Bridges maintain a list of channels excluded from that radio's use, Channels that are unavailable for DFS or for manual selection. Bridging radios in a mesh network maintain a global list of excluded channels by propagating their channel exclusions to all nodes.

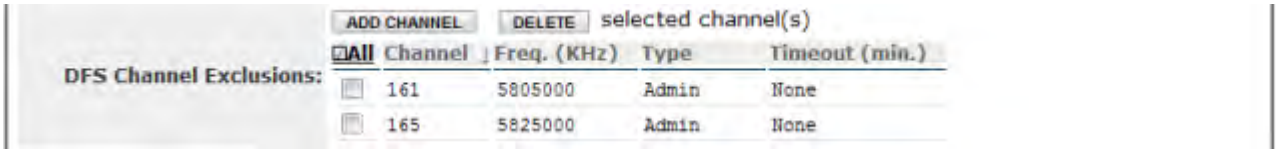


Figure 3.9. Advanced View *DFS Channel Exclusions* list, all radio-equipped platforms

Channels can be excluded in four ways:

- The channel was manually added to the radio's excluded list (see below).
- For DFS channels, a radio using the channel detected radar and had to change to a different channel. The channel on which radar was detected is excluded from use for 30 minutes, after which it will automatically become available again.
- For bridging radios, the channel was learned remotely from another node in the network. Remotely learned channel exclusions will age out a radio's excluded list if the remote Bridge stops propagating the exclusion (or drops out of the network).
- For multi-radio Bridges, the channel is in use by the other radio internal to the Bridge and so is excluded from use by the current radio.

NOTE: While there can be no radar events on 4.4 GHz military band radio, it can receive a remote channel change from a network peer.

You may want to exclude a channel from use if you are experiencing abnormal interference on the channel, for example, or in order to avoid a channel on which intermittent radar is known to take place.

You can observe the channels currently excluded from each radio's use, in Advanced View only, on the *Channel Exclusions* list on **Configure -> Radio Settings**.

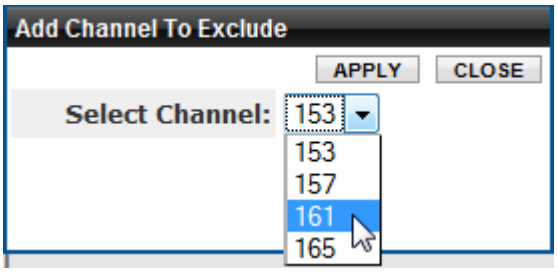


Figure 3.10. Advanced View *Add Channel To Exclude* dialog, all radio-equipped platforms

To manually add channels for exclusion:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Radio Settings** from the menu on the left.
2. In the *Radio Settings* screen's *Radio Settings* frame, above the *Channel Exclusions* list, click **ADD CHANNEL**.
3. In the *Add Channel to Exclude* dialog, choose a channel from the *Select Channel* dropdown and click **APPLY** (or **CLOSE** the dialog without adding the channel).

Delete a channel from the exclusion list by clicking to place a check in the box to the left of its entry on *Channel Exclusions* and then clicking **DELETE** at the top of the frame. Delete all channels by clicking **All** to check all their boxes and then **DELETE**.

Figure 3.11. deleting a channel exclusion, all radio-equipped platforms

You must be in Advanced View to access the *Channel Exclusions* list.

3.3.4 Radio BSS Settings

A Bridge radio can support up to four Basis Service Sets (BSSs), each with its own SSID and associated settings and serving as an independent, virtual interface.

In a Fortress FastPath Mesh network, a given BSS can either provide mesh connections to other Fortress Bridge Mesh Points or connect other wireless devices (Non-Mesh Points) to the FastPath Mesh. Refer to Section 3.2.1 for more detail.

In a mesh network under STP link management, a given BSS can either provide mesh network connections to other Fortress

NOTE: An ES210 Bridge can alternatively support a single wireless client **STA** interface. Refer to Section 3.3.5.

Bridges or serve as a WLAN access point (AP). Refer to Section 3.2.2 for more detail.

You can view the BSSs configured for each radio, under the radio's entry on **Configure -> Radio Settings**.

No BSSs are configured on Bridge radios by default. To create a BSS you need only specify a unique name (Section 3.3.4.1) and SSID (Section 3.3.4.2).

Sections 3.3.4.1 through 3.3.4.14 describe complete settings to configure Bridge radio BSSs; step-by-step instructions for changing them follow these sections.

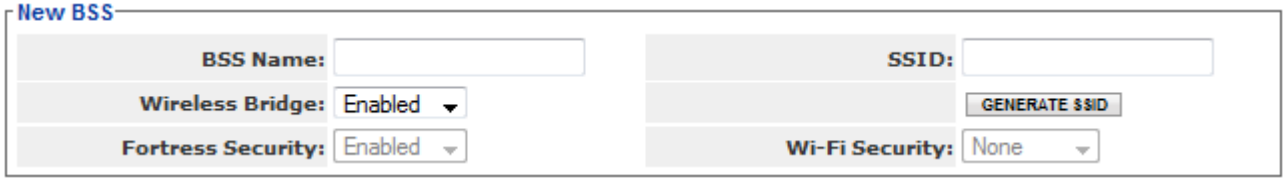


Figure 3.12. Simple View *New BSS* settings frame, all radio-equipped platforms

3.3.4.1 BSS Administrative State and Name

Admin State simply determines whether the BSS is **Disabled** or **Enabled**. Newly created BSSs are **Enabled** by default.

You can enable and disable radio BSSs only in Advanced View.

You must specify a *BSS Name*, an alphanumeric identifier of up to 254 characters and unique to the current radio, in order to create a BSS.

3.3.4.2 BSS SSID and Advertise SSID

You must specify a service set identifier in order to create a BSS. You can manually enter an *SSID* of up to 32 alphanumeric characters, or randomly generate a 16-digit ASCII string to use for the SSID.

The SSID associated with each BSS is a unique string of up to 32 characters normally included in the beacon and probe-response 802.11 management frames transmitted by access points (APs) and wireless bridges.

When they are broadcast (the default), SSIDs are used to advertise which devices can connect to the wireless network. When *Advertise SSID* is **Disabled** (see below), SSIDs function more like device passwords, limiting network access to those devices that "know" the BSSs unadvertised SSID. (Disabling *Advertise SSID* is not, however, sufficient to secure the BSS.)

When *Advertise SSID* is **Disabled**, the SSID string is deleted from the radio beacons. A setting of **Enabled**, the default, causes the SSID to be included in these packets.

You can set a BSS's *SSID* in either Bridge GUI view. You can enable/disable *Advertise SSID* only in Advanced View.

3.3.4.3 Wireless Bridge and Minimum RSS

In a Fortress FastPath Mesh network, the *Wireless Bridge* setting, in conjunction with *FastPath Mesh Mode* (below), determines whether the BSS will provide network connections to other Fortress Bridge Mesh Points (**Enabled**) or connect other Non-Mesh Points to the FastPath Mesh (**Disabled**). FastPath Mesh bridging is described in Section 3.2.1.

NOTE: When FastPath Mesh is enabled, your selection in *Wireless Bridge* automatically configures the interface's FP Mesh Mode (described below).

In a mesh network under STP link management, the *Wireless Bridge* setting determines whether the BSS will act as a wireless bridge (**Enabled**) or a conventional WLAN access point (**Disabled**). STP bridging is described in Section 3.2.2.

On the single-radio ES210, *Wireless Bridge* is **Enabled** by default for BSSs, when the radio is left on the default 5 GHz 802.11a band.

NOTE: Enabling *Wireless Bridge* for the BSS enforces a *Fortress Security* setting of **Enabled** (Section 3.3.4.13).

On Bridges with two radios, the ES520 and ES820, *Wireless Bridge* is **Disabled** by default for BSSs on Radio1, when it is left on the default 2.4 GHz 802.11g band, and **Enabled** by default for BSSs on Radio 2.

On the four-radio ES440, *Wireless Bridge* is also **Disabled** by default for BSSs on Radio1, when it is left on the default 2.4 GHz 802.11g band, and **Enabled** by default for BSSs on Radio 2, Radio 3 and Radio 4.

Once a *Wireless Bridge* value has been established for a BSS, the setting cannot be reconfigured. You must delete the BSS and recreate it with the new *Wireless Bridge* value in order to make such a change.

When *Wireless Bridge* is **Enabled**, you can also configure the minimum received signal strength that the other nodes (bridging-enabled Bridges) in range must maintain in order to remain connected to the current Bridge.

Minimum signal strength received (*Minimum RSS*) is configured in whole dBm (decibels referenced to milliwatts) from -95 to 0 dBm. The default is -80 dBm.

You can enable/disable *Wireless Bridge* in either Bridge GUI view. You can set the *Minimum RSS* only in Advanced View.

3.3.4.4 User Cost Offset and FastPath Mesh Mode

When FastPath Mesh is enabled, *User Cost Offset* allows you to weight the interface more or less heavily in the FP Mesh cost equation in order to make it less attractive than other interfaces.

Enter a non-negative integer between **`0`** (zero) and **`4,294,967,295`**. The higher the offset, the less attractive the interface. A neighbor with the maximum cost (**`4,294,967,295`**) will never be used to route traffic. The default is **`0`** (zero). Network Cost Weighting and the FP Mesh cost equation are described in Section 3.2.1.5.

Because of its dependency on the BSSs *Wireless Bridge* function, the FastPath Mesh Mode of a wireless interface on the Bridge is not among the user controls provided.

When FastPath Mesh is enabled and the BSS is configured as bridging interface (*Wireless Bridge:* **Enabled**), the BSS is automatically configured as an FP Mesh *Core* interface, allowing it to connect to other FP Mesh-enabled Fortress Mesh Points (MPs).

When FastPath Mesh is enabled and the BSS is configured as a network Access interface (*Wireless Bridge:* **Disabled**), the BSS is automatically configured as an FP Mesh *Access* interface, allowing it to connect to connect Non-Mesh Points (NMPs) to the FP Mesh network.

FastPath Mesh bridging is described in Section 3.2.1.

3.3.4.5 BSS Switching Mode and Default VLAN ID

Two settings configure the BSS's VLAN handling:

- *Default VLAN ID* - associates the BSS with a specified VLAN ID. The Bridge supports VLAN IDs **1**–**4094**. If the VLAN ID you enter is not already present on the *VLAN Active ID Table* (Section 3.9.3), it will be added. The default is **1**.
- *Switching Mode* - establishes the BSS's behavior with regard to data packet VLAN tagging:
  - **Access** - (the default) configures the interface to accept only: (1) packets that do not contain VLAN tags and (2) specialized *priority-tagged packets*, which provide support for Ethernet QoS exclusive of VLAN implementations.
  - **Trunk** - configures the interface to accept incoming packets with any VLAN tag in the VLAN ID table and to pass packets with their VLAN tagging information unchanged, including 802.1p priority tags.

NOTE: There is only one VLAN trunk per Bridge, used by all **Trunk** ports. It is defined by the Bridge's *VLAN Active ID Table* (Section 3.9.3).

Refer to Section 3.9 and to Table 3.14 for a complete description of VLAN handling on the Bridge.

To support QoS, the Bridge treats incoming priority-tagged packets (characterized by a VLAN ID of zero) as untagged packets, but marks them for sorting into QoS priority queues according to the user-priority value contained in their VLAN tags. (Refer to Section 3.8 for details on the Bridge's QoS implementation).

You can configure BSS VLAN settings only in Advanced View.

3.3.4.6 BSS G Band Only Setting

The *G Band Only* setting applies only to BSSs on radios using the 2.4 GHz frequency band (refer to Section 3.3.2.2). The

function is **Disabled** by default, at which setting the BSS accepts connections from both 802.11g and 802.11b devices.

Enabling *G Band Only* prevents 802.11b wireless devices from connecting to the BSSs. The older 802.11b is the slower of the two 2.4 GHz wireless standards and most new devices support 802.11g. Consult the connecting device's documentation to determine which standard(s) it supports.

The *G Band Only* setting does not apply to BSSs on 802.11a radios.

You can configure *G Band Only* only in Advanced View.

3.3.4.7 BSS WMM Setting

Traffic received on BSSs **Enabled** for Wi-Fi Multimedia (the default) is prioritized according to the QoS (Quality of Service) tags included in its VLAN tags, if present, or directly in its 802.11 headers, if no VLAN tags are present.

Disabling WMM disables only the priority treatment of packets received wirelessly, disregarding any priority marking in the 802.11 header. When WMM is disabled on a BSS, traffic received on the interface is treated as untagged and marked internally for *Medium* (or *Best Effort*) QoS handling. The internal marking is used if the data is transmitted out an interface that requires marking (such as another WMM-enabled BSS or an 802.1Q VLAN trunk).

Refer to Section 3.8 for more on the Bridge's WMM and QoS implementation.

NOTE: On BSSs serving as Core interfaces in a FP Mesh network (Section 3.3.4.4), Fortress recommends the WMM default of **Enabled**, to allow prioritization of FP Mesh control packets.

3.3.4.8 BSS DTIM Period

APs buffer broadcast and multicast messages for devices on the network and then send a Delivery Traffic Indication Message to "wake-up" any inactive devices and inform all network clients that the buffered messages will be sent after a specified number of beacons have been transmitted. (The beacon interval, described in Section 3.3.2.8, is configured on the *Radio Settings* screen.)

The *DTIM Period* determines the number of beacons in the countdown between transmitting the initial DTIM and sending the buffered messages. Whole values from **1** to **255**, inclusive, are accepted; the default is **1**.

A longer *DTIM Period* conserves power by permitting longer periods of inactivity for power-saving devices, but it also delays the delivery of broadcast and multicast messages. Too long a delay can cause multicast packets to go undelivered.

Because the broadcast beacon counts down the *DTIM Period*, the specified *Beacon Interval* (configured on the *Radio Settings* screen and described in Section 3.3.2.8.) also affects the DTIM function.

You can configure *DTIM Period* only in Advanced View.

3.3.4.9 BSS RTS and Fragmentation Thresholds

The *RTS Threshold* allows you to configure the maximum size of the frames the BSS sends without using the RTS/CTS protocol. Frame sizes over the specified threshold cause the BSS to first send a *Request to Send* message and then receive a *Clear to Send* message from the destination device before transmitting the frame.

The *RTS Threshold* is measured in bytes. A value of zero (**0**) disables the function (the default), or whole values between **1** and **2345** are accepted.

The smaller the *RTS Threshold*, the more RTS/CTS traffic is generated at the expense of data throughput. On large busy networks, however, RTS/CTS speeds recovery from radio interference and transmission collisions, and a relatively small *RTS Threshold* may be necessary to achieve significant improvements.

The *Frag. Threshold* allows you to configure the maximum size of the frames the BSS sends whole. Frame sizes larger than the specified threshold are broken into smaller frames before they are transmitted. An acknowledgement is sent for each frame received, and if no acknowledgement is sent the frame is retransmitted.

The *Frag. Threshold* is measured in bytes. A value of zero (**0**) disables the function (the default), or whole values between **256** and **2345** are accepted.

Fragmentation becomes an advantage in networks that are:

- experiencing collision rates higher than five percent
- subject to heavy interference or multipath distortion
- serving highly mobile network devices

A relatively small fragmentation threshold results in smaller, more numerous frames. Smaller frames reduce collisions and make for more reliable transmissions, but they also use more bandwidth. A larger fragmentation threshold results in fewer frames being transmitted and acknowledged and so can provide for faster throughput, but larger frames can also decrease the reliability with which transmissions are received.

You can configure RTS and fragmentation thresholds only in Advanced View.

3.3.4.10 BSS Unicast Rate Mode and Maximum Rate

When a BSS is configured to use a *Unicast Rate Mode* setting of **auto** (the default), the interface dynamically adjusts the bit rate at which it transmits unicast data frames—throttling between the configured *Unicast Maximum Rate* and the minimum rate—to provide the optimal data rate for the connection.

At a *Unicast Rate Mode* setting of **fixed**, the BSS will use the configured *Unicast Maximum Rate* for all unicast transmissions.

Transmission rates are set in megabits per second (Mbps). *Unicast Maximum Rate* can be set only to a value greater than or equal to the minimum rate. Usable values for *Unicast Maximum Rate* settings depend on the *Band* setting for the radio on which the BSS is configured, as indicated by the markers in Table 3.6.

NOTE: You can configure the unicast minimum rate in the Bridge CLI (refer to the ***CLI Software Guide)***. On a radio using any 802.11g band, the default is **1 Mbps**. On a radio using any 802.11a band, the default is **6 Mbps**.

Table 3.6. Usable BSS Rate Settings (in Mbps) per Radio Band Setting

	1	2	5.5	6	9	11	12	18	24	36	48	54	6.5	13	19.5	26	39	52	58.5	65
802.11a				♦	♦		♦	♦	♦	♦	♦	♦								
802.11g	♦	♦	♦			♦	♦	♦	♦	♦	♦	♦								
802.11naht				♦	♦		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
802.11nght	♦	♦	♦			♦	♦	♦	♦	♦	♦	♦		♦	♦	♦	♦	♦	♦	♦

The default *Unicast Maximum Rate* for a new BSS specifies the highest setting possible, as determined by the 802.11 standard in use by the radio on which you are configuring the BSS. The default depends on whether or not the radio is using 802.11n: On a radio with an **802.11a** or **802.11g** *Band* setting, the default *Unicast Maximum Rate* is **54 Mbps**. On a radio using any of the 802.11n settings in either frequency band, the default *Unicast Maximum Rate* is **65 Mbps**.

NOTE: Radio *Band* settings are covered in detail in Section 3.3.2.2).

You can configure *Unicast Rate Mode* and *Unicast Maximum Rate* only in Advanced View.

3.3.4.11 BSS Multicast Rate

The bit rate at which a wireless interface sends multicast frames is negotiated per connection. *Multicast Rate* sets a floor for multicast transmissions by specifying the lowest bit rate at which the BSS will send multicast frames.

CAUTION: Too high a *Multicast Rate* will limit the ability of a FastPath Mesh network to establish adjacency with neighbor MPs unable to receive multi-/broadcast packets at the specified rate (due to distance, for example).

BSSs on a radio configured by default to use the 2.4 GHz 802.11g band have a default *Multicast Rate* of **1 Mbps**, which is appropriate for a BSS using the 2.4 GHz frequency band, typically to provide wireless access to local devices. Fortress recommends leaving BSSs in the 802.11g band, including all 802.11ng options, at the default of **1**.

BSSs on a radio fixed on, or configured by default to use, the 5 GHz 802.11a band have a default *Multicast Rate* of **6 Mbps**,

which is appropriate for a BSS using the 5 GHz frequency band, typically for network bridging. Fortress recommends leaving BSSs in the 802.11a band, including all 802.11na options, at the default of **6**.

If the BSS will provide mesh network bridging in the 5 GHz 802.11a band, Fortress recommends a *Multicast Rate* of **6 Mbps**. Set a higher rate ***only*** if you are certain that all neighbor links to the BSS can consistently maintain a significantly better data rate than the new *Multicast Rate*.

3.3.4.12 BSS Description

You can optionally provide a *Description* of the BSS of up to 100 characters.

A BSS's description displays only on the Advanced View *Edit BSS* frame (**Advanced View -> Configure -> Radio Settings -> *[BSS Interfaces]* EDIT**).

You can enter a *Description* for a BSS only in Advanced View.

3.3.4.13 BSS Fortress Security Setting

Traffic on BSSs **Enabled** for *Fortress Security* is subject to Fortress's Mobile Security Protocol (MSP), as configured on the Bridge itself (refer to Section 4.1).

Fortress Security is **Enabled** on BSSs by default. When a BSS's *Wireless Bridge* setting is **Enabled** (refer to Section 3.3.4.3), its *Fortress Security* setting is automatically fixed on **Enabled** and the *Fortress Security* field is view-only.

Disabling *Fortress Security* on a BSS exempts all traffic on that BSS from Fortress's Mobile Security Protocol (MSP).

Standard Wi-Fi security protocols can be applied to the traffic on a BSS (Section 3.3.4.14, below), regardless of whether the BSS is **Enabled** or **Disabled** for *Fortress Security*.

3.3.4.14 BSS Wi-Fi Security Settings

As an alternative or in addition to *Fortress Security*, a number of well known security protocols can be applied to the BSSs created on the Bridge.

Your selection in the *Wi-Fi Security* field of the *Edit BSS* frame determines the additional fields you must configure for that setting—presented dynamically by the Bridge GUI for each possible *Wi-Fi Security* selection.

Wi-Fi Security: None

If Fortress Security is disabled on a BSS and it has a Wi-Fi Security setting of None, traffic on that BSS is unsecured.

Devices connected to an unsecured BSS send and receive all traffic in the clear.

CAUTION: An unsecured wireless interface leaves the network unsecured.

BSSs enabled for bridging (Section 3.3.4.3) must be **Enabled** for *Fortress Security*. You cannot apply *Wi-Fi Security* to bridging-enabled BSSs.

A *Wi-Fi Security* setting of **None** requires no further configuration.

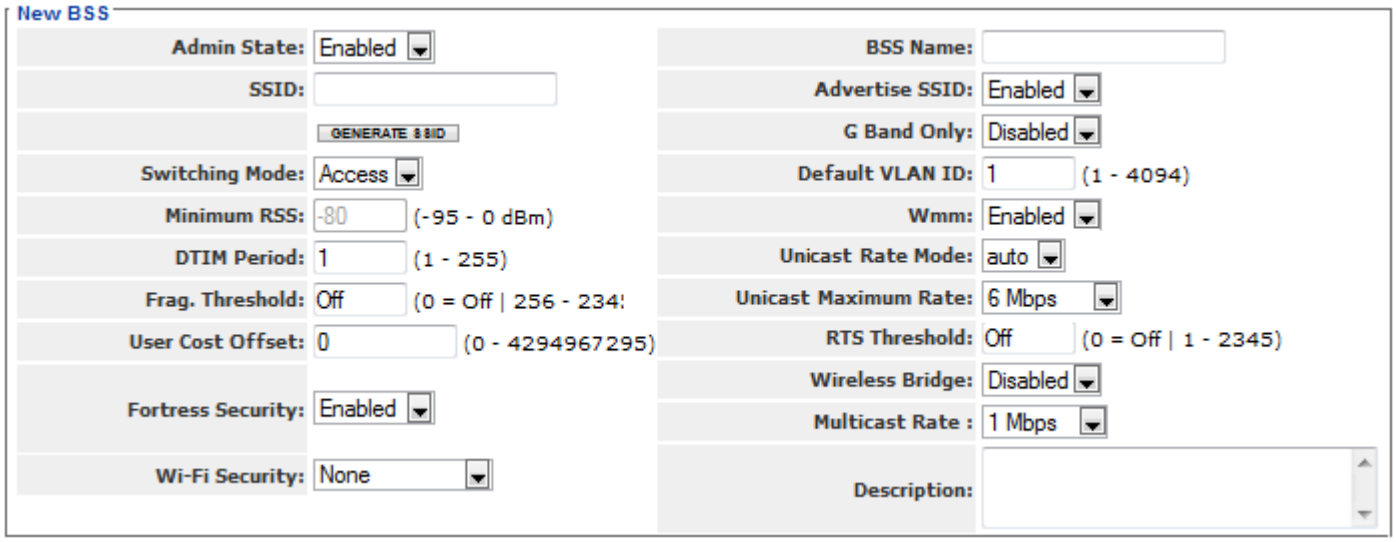


Figure 3.13. Advanced View *New BSS* settings frame, all radio-equipped platforms

WPA, WPA2 and WPA2-Mixed Security

WPA (Wi-Fi Protected Access) and WPA2 are the *enterprise* modes of WPA (as distinguished from the *pre-shared key* modes described below). You can specify that **WPA** or **WPA2** be used exclusively by the BSS, or you can configure it to be able to use either by selecting **WPA2-Mixed**.

WPA and WPA2 use EAP-TLS (Extensible Authentication Protocol-Transport Layer Security) to authenticate network connections via X.509 digital certificates. In order for the Bridge to successfully negotiate a WPA/WPA2 transaction, you must have specified a locally stored key pair and certificate for the Bridge to use to authenticate the connecting device as an EAP-TLS peer, and at least one CA (Certificate Authority) certificate must be present in the local certificate store. Refer to Section 6.2.1 for guidance on configuring an EAP-TLS key pair and digital certificate.

NOTE: Enterprise WPA and WPA2 modes require an 802.1X authentication service to be available, as part of the Bridge configuration (Section 4.3.2.7) or externally (Section 4.3.1).

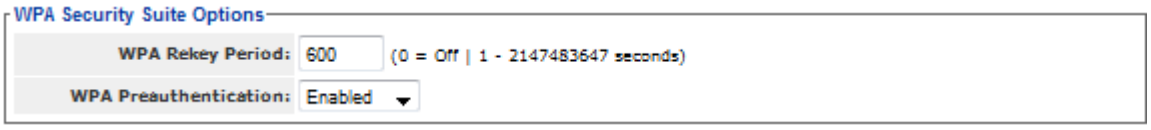


Figure 3.14. *WPA Security Suite Options* frame for WPA2 enterprise modes, all radio-equipped platforms

You can configure WPA2 security in either Bridge GUI view. WPA and WPA2-Mixed security are available for selection only in Advanced View.

On the *New/Edit BSS* screens, these additional settings apply to **WPA**, **WPA2** and **WPA2-Mixed** selections:

- *WPA Rekey Period* - specifies the interval at which new pair-wise transient keys (PTKs) are negotiated or **0** (zero), which disables the rekeying function: the interface will use the same key for the duration of each session seconds. Specify a new interval in whole seconds between **0** and **2147483647**, inclusive. No *WPA Rekey Period* is specified by default.
- *WPA Preauthentication* - to facilitate roaming between network access points, enabling *WPA Preauthentication* on the BSS permits approaching WPA2 wireless clients to authenticate on the Bridge while still connected to another network access point, while wireless clients moving away from the Bridge can remain connected while they authenticate on the next network AP. *WPA Preauthentication* is **Disabled** by default.

NOTE: *WPA Preauthentication* applies only to **wpa2** and **wpa2 mixed** enterprise mode *Wi-Fi Security* settings. It is not present when **wpa** is selected.

WPA-PSK, WPA2-PSK and WPA2-Mixed-PSK Security

WPA-PSK (Wi-Fi Protected Access) and WPA2-PSK are the *pre-shared key* modes of WPA (as distinguished from the *enterprise* modes described above). You can specify that **WPA-PSK** or **WPA2-PSK** be used exclusively by the BSS, or you can configure it to be able to use either by selecting **WPA2-Mixed-PSK**.

Pre-shared key mode differs from enterprise mode in that PSK bases initial key generation on a user-specified key or passphrase instead of through digital certificates. Like enterprise-mode, PSK mode generates encryption keys dynamically and exchange keys automatically with connected devices at user-specified intervals.

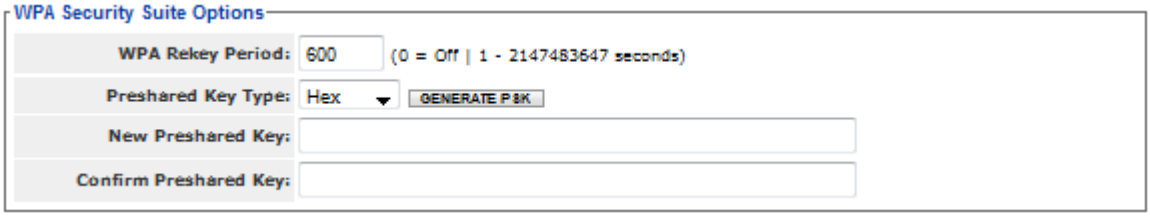


Figure 3.15. ***WPA Security Suite Options*** **frame for WPA PSK modes, all radio-equipped platforms**

On the *New/Edit BSS* screens, these additional settings apply to **WPA-PSK**, **WPA2-PSK** and **WPA2-Mixed-PSK** selections:

- *WPA Rekey Period* - specifies the interval at which new keys are negotiated. Specify a new interval in whole seconds between **1** and **2147483647**, inclusive, or **0** (zero) to permit the same key to be used for the duration of the session.
- *Preshared Key Type* - determines whether the specified key is an **ASCII** passphrase or a **Hex**adecimal key.

- *New Preshared Key* and *Confirm Preshared Key* - specify the preshared key itself, as:
  - a plaintext passphrase between 8 and 63 characters in length, when **ASCII** is selected for *Preshared Key Type*, above.
  - a 64-digit hexadecimal string, when **Hex** is selected for *Preshared Key Type*, above.

You can configure **WPA2-PSK** security in either Bridge GUI view. **WPA-PSK** and **WPA2-Mixed-PSK** security are available for selection only in Advanced View.

3.3.4.15 Configuring a Radio BSS

Table 3.7 shows which *New/Edit BSS* settings appear in the two GUI views.

Table 3.7. BSS Settings

Simple & Advanced Views	Advanced View Only
BSS Name *SSID* *Wireless Bridge* *Fortress Security* *Wi-Fi Security:* partial[a]	*Admin State* *Advertise SSID* *G Band Only* *Switching Mode* *Default VLAN ID* *Minimum RSS* *WMM* *DTIM Period* *RTS Threshold* *Frag. Threshold* *Unicast Rate Mode* *Unicast Maximum Rate* *Multicast Rate* *Description* *Wi-Fi Security:* complete

a. The complete set of Wi-Fi options (Section 3.3.4.14) is available for selection only in Advanced View. Simple View provides access to only **None**, WPA2 and WPA2-PSK options.

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Radio Settings** from the menu on the left.
2. If you are configuring one or more Advanced View settings (see Table 3.7), click **ADVANCED VIEW** in the upper right corner of the page. (If not, skip this step.)
3. In the *Radio Settings* screen's *Radio Settings* frame:
   - If you are creating a new BSS, click the **ADD BSS** button for the radio to which you want to add the BSS.

   or
   - If you are reconfiguring an existing BSS, click the **EDIT** button for the BSS you want to change.

NOTE: On the ES210 Bridge, the **ADD BSS** button is only present when the *Station Mode* function is disabled (the default; refer to Section 3.3.5.13).

4 In the *Radio Settings* screen's *New/Edit BSS* frame, enter new values for the settings you want to change (described in sections 3.3.4.1 through 3.3.4.14, above).

5 Click **APPLY** in the upper right of the screen (or **CANCEL** your changes).

3.3.5 ES210 Bridge STA Settings and Operation

Configuring a *STA Interface* on the ES210 Bridge radio causes the Bridge to act as a dedicated WLAN client device, or *station*, rather than as an AP or a wireless bridge (or FP Mesh Point).

An ES210 Bridge configured with such an interface is in *Station Mode*. Only a single *STA Interface* is permitted on a given Bridge, and when one is present, no additional wireless interface of any type can be configured.

Station Mode is supported only the ES210 Bridge.

A *STA Interface* can only bridge between a wireless AP and one or more Ethernet devices on the ES210 's clear Ethernet port(s), meaning Ethernet ports on which *Fortress Security* is **Disabled** (Section 3.7.4). In addition, no wired (Ethernet) bridging can occur when the ES210 Bridge is in *Station Mode*.

For example, on an ES210 on which the *aux* port is clear and the *wan* port is encrypted (the defaults), a typical *Station Mode* setup would use the *aux* port to connect one or more Ethernet devices. If *Fortress Security* is **Disabled** on the WAN port, it can be used in the same way. Devices on a clear Ethernet port cannot, however, communicate with devices on an encrypted Ethernet port when the Bridge is in *Station Mode*.

You can preconfigure the ES210 Bridge's *STA Interface* with the settings required to connect to a specific network. Alternatively, you can scan for available networks within range and select one to use to create the *STA Interface* for the ES210 Bridge.

The scan function for a *Station Mode* ES210 Bridge is supported through a preconfigured interface that operates transparently to Bridge GUI users to detect networks within range of the Bridge. You must enable the ES210 Bridge's *Station Mode* function before you can scan for a network or preconfigure a *STA Interface*. You must enable the radio before you can scan for a network to connect to.

NOTE: *Station Mode* does not support 802.11n radio operation. You must set the radio *Band* to **802.11a** or **802.11g** before you can add a *Station Interface* (refer to Section 3.3.2.2).

NOTE: On the ES210, the *aux* port is labeled **Ethernet** on the chassis; the *wan* port, **Ethernet (WAN)**.

NOTE: The ES210 Bridge radio can alternatively support up to four **BSS** interfaces. Refer to Section 3.3.4.

Figure 3.16. Simple View *Add Station Mode* settings frame, ES210

Refer to the relevant step-by-step instructions in Section 3.3.5.11, *Establishing an ES210 Bridge STA Interface Connection*, for preconfiguring the interface or creating it through the ES210 Bridge's scanning function.

3.3.5.1 Station Administrative State

Admin State simply determines whether the interface is **Disabled** or **Enabled**. A newly created *STA Interface* is **Enabled** by default.

3.3.5.2 Station Name and Description

In order to create a *STA Interface*, you must specify a *STA Name* of up to 254 alphanumeric characters to identify the interface in the ES210 Bridge configuration.

You can optionally provide a *Description* of the interface of up to 100 characters, only in Advanced View.

3.3.5.3 Station SSID

When you **SCAN** for wireless networks within range and choose one to which to associate, the SSID of the network you select will be automatically added as the *STA Interface SSID*.

If you are manually creating a *STA Interface* in advance of connecting to a particular network, you ***must*** specify the network SSID for the ES210 Bridge to associate to.

3.3.5.4 Station BSSID

To disable roaming among multiple APs with the same SSID, you can specify the MAC address of a single wireless AP to which the ES210 Bridge *STA Interface* is permitted to associate.

When you **SCAN** for wireless networks within range, you can automatically fill in the *BSSID* field when you choose a network to associate to by clicking on the *BSSID* displayed (instead of the *SSID*) to select it.

3.3.5.5 Station WMM

When Wi-Fi Multimedia QoS (Quality of Service) is **Enabled** on the *STA Interface*, it advertises that it is capable of WMM. If the AP that the *STA Interface* associates to is also capable of and enabled for WMM, the AP will respond to the *Station Mode* Bridge with this information and WMM will be used for the association. If the AP is not capable of and enabled for WMM, having *WMM* **Enabled** on the *STA Interface* will have no effect.

WMM is **Disabled** by default for a *STA Interface*.

If the association is made to a BSS configured on another Fortress Bridge to serve as a wireless AP (*Wireless Bridge* **Disabled**, refer to Section 3.3.4.3) and the WMM settings on both the BSS and the *STA Interface* are **Enabled**, WMM will be used for the association.

In a WMM-enabled association, packets sent from the Bridge include WMM tags that permit traffic from the Bridge to be prioritized according to the information contained in those tags.

You can configure WMM for the *STA Interface* only in Advanced View.

3.3.5.6 Station Fragmentation and RTS Thresholds

The *RTS Threshold* allows you to configure the maximum size of the frames the *STA Interface* sends without using the RTS/CTS protocol. Frame sizes over the specified threshold cause the interface to first send a *Request to Send* message and then receive a *Clear to Send* message from the destination device before transmitting the frame.

The *RTS Threshold* is measured in bytes. A value of zero (**0**) disables the function (the default), or whole values between **1** and **2345** are accepted.

The *Frag. Threshold* allows you to configure the maximum size of the frames the *STA Interface* sends whole. Frame sizes larger than the specified threshold are broken into smaller frames before they are transmitted. An acknowledgement is sent for each frame received, and if no acknowledgement is sent the frame is retransmitted.

The *Frag. Threshold* is measured in bytes. A value of zero (**0**) disables the function (the default), or whole values between **256** and **2345** are accepted.

You can configure RTS and fragmentation thresholds only in Advanced View.

3.3.5.7 Station Unicast Rate Mode and Maximum Rate

When a *STA Interface* is configured to use a *Unicast Rate Mode* setting of **auto** (the default), the interface dynamically adjusts the bit rate at which it transmits unicast data frames—throttling between the configured *Unicast Maximum Rate* and the minimum rate—to provide the optimal data rate for the connection.

At a *Unicast Rate Mode* setting of **fixed**, the interface will use the configured *Unicast Maximum Rate* for all unicast transmissions.

Transmission rates are set in megabits per second (Mbps). *Unicast Maximum Rate* can be set only to a value greater than or equal to the minimum rate. Usable values for *Unicast Maximum Rate* settings depend on the *Band* setting for the radio on which the *STA Interface* is configured, as shown in Table 3.8.

NOTE: You can configure the unicast minimum rate in the Bridge CLI (refer to the ***CLI Software Guide)***. On a radio using any 802.11g band, the default is **1 Mbps**. On a radio using any 802.11a band, the default is **6 Mbps**.

Table 3.8. Usable STA Rate Settings (in Mbps) per Radio Band Setting

	1	2	5.5	6	9	11	12	18	24	36	48	54
802.11a				♦	♦		♦	♦	♦	♦	♦	♦
802.11g	♦	♦	♦			♦	♦	♦	♦	♦	♦	♦

The default *Unicast Maximum Rate* for a new STA interface is **54 Mbps**, which specifies the highest setting possible in either frequency band.

You can configure *Unicast Rate Mode* and *Unicast Maximum Rate* only in Advanced View.

NOTE: Radio *Band* settings are covered in detail in Section 3.3.2.2).

3.3.5.8 Station Multicast Rate

The bit rate at which a wireless interface sends multicast frames is negotiated per connection. *Multicast Rate* sets a floor for multicast transmissions by specifying the lowest bit rate at which the *STA Interface* will send multicast frames.

A *STA Interface* on a radio configured by default to use the 2.4 GHz 802.11g band has a default *Multicast Rate* of **1 Mbps**, which is appropriate for an interface using the 2.4 GHz frequency band. Fortress recommends leaving a *STA Interface* in the 802.11g band at the default *Multicast Rate* of **1**.

A *STA Interface* on a radio fixed on, or configured by default to use, the 5 GHz 802.11a band has a default *Multicast Rate* of **6 Mbps**, which is appropriate for an interface using the 5 GHz frequency band. Fortress recommends leaving a *STA Interface* in the 802.11a band at the default *Multicast Rate* of **6**.

You can configure *Multicast Rate* only in Advanced View.

3.3.5.9 Station Fortress Security Status

Fortress Security is displayed view-only for the *STA Interface*. Fortress's MSP (Mobile Security Protocol) cannot be applied to the *STA Interface*, so the field will always display *Clear*.

3.3.5.10 Station Wi-Fi Security Settings

Your selection in the *Wi-Fi Security* field of the *Add Station Mode* frame determines the additional fields you must configure for that setting.

Wi-Fi Security: None

By default, no Wi-Fi security is applied to traffic on a *STA Interface*. ***Traffic on a STA Interface with a Wi-Fi Security setting of None is unsecured.***

WPA, WPA2 and WPA2-Mixed Security

WPA (Wi-Fi Protected Access) and WPA2 are the *enterprise* modes of WPA (as distinguished from the *pre-shared key* modes described below). You can specify that **WPA** or **WPA2** be used exclusively by the *STA Interface*, or you can configure it to be able to use either by selecting **WPA2-Mixed**.

WPA and WPA2 use EAP-TLS (Extensible Authentication Protocol-Transport Layer Security) to authenticate network connections via X.509 digital certificates. In order for a Bridge in station mode to successfully negotiate a WPA/WPA2 client connection, you must have specified a locally stored key pair and certificate to use to authenticate the Bridge as an EAP-TLS

NOTE: Enterprise WPA and WPA2 modes require an 802.1X authentication service to be available, as part of the Bridge configuration (Section 4.3.2.7) or externally (Section 4.3.1).

peer and at least one CA (Certificate Authority) certificate must be present in the local certificate store. Refer to Section 6.2.1 for guidance on configuring an EAP-TLS key pair and digital certificate.

On the *Add Station Mode* screen, these additional settings apply to **WPA**, **WPA2** and **WPA2-Mixed** selections:

- *Rekey Period* - specifies the interval at which new pair-wise transient keys (PTKs) are negotiated or **0** (zero), which disables the rekeying function: the interface will use the same key for the duration of each session seconds. Specify a new interval in whole seconds between **0** and **2147483647**, inclusive. No *Rekey Period* is specified by default.
- *TLS Cipher* - specifies the list of supported cipher suites, the sets of encryption and integrity algorithms, that the Bridge will send to the 802.1X authentication server:
  - **All** - the default, supports both **Legacy** and **Suite B** cipher suites (as described in the next two items)
  - **Legacy** - supports Diffie-Hellman with RSA keys (DHE-RSA-AES128-SHA and DHE-RSA-AES256-SHA)
  - **Suite B** - supports Diffie-Hellman with ECC keys (ECDHE-ECDSA-AES128-SHA and ECDHE-ECDSA-AES256-SHA)

  In EAP-TLS, the authentication server selects the cipher suite to use from the list of supported suites sent by the client device (or rejects the authentication request if none of the proposed suites are acceptable).
- *Subject Match* - optionally provides a character string to check against the subject Distinguished Name (DN) of the authentication server certificate. Each RDN (Relative Distinguished Name) in the sequence comprising the certificate DN is compared to the corresponding RDN in the string provided. Wildcard characters cannot be used.
- *Certificate Hash* - optionally provides a 64-character hash value to check against the hash value of the authentication server certificate. When the *Certificate Hash* field is empty, the default, no hash value check is performed.
- *WPA Strict Check* - optionally enables strict checking of key usage and extended key usage extensions in the authentication server certificate. Strict key usage checking is **Enabled** by default.

NOTE: Unlike Suite B *Key Establishment* (Section 4.1.3), the **Suite B** *TLS Cipher* option is available regardless of whether Suite B is licensed on the Bridge (Section 6.3).

You can configure *TLS Cipher*, *Certificate Hash*, *Subject Match* and *WPA Strict Check* only in Advanced View.

WPA-PSK, WPA2-PSK and WPA2-Mixed-PSK Security

WPA-PSK (Wi-Fi Protected Access) and WPA2-PSK are the *pre-shared key* modes of WPA (as distinguished from the *enterprise* modes described above). You can specify that **WPA-**

PSK or **WPA2-PSK** be used exclusively by the *STA Interface*, or you can configure it to be able to use either by selecting **WPA2-Mixed-PSK**.

Pre-shared key mode differs from enterprise mode in that PSK bases initial key generation on a user-specified key or passphrase instead of through digital certificates. Like enterprise-mode, PSK mode generates encryption keys dynamically and exchange keys automatically with connected devices at user-specified intervals.

On the *Add Station Mode* screen, these additional settings apply to **WPA-PSK**, **WPA2-PSK** and **WPA2-Mixed-PSK** selections:

- *Rekey Period* - specifies the interval at which new keys are negotiated. Specify a new interval in whole seconds between **1** and **2147483647**, inclusive, or **0** (zero) to permit the same key to be used for the duration of the session.
- *Key Type* - determines whether the specified key is an **ascii** passphrase or a **hex**adecimal key.
- *WPA Key* and *Confirm WPA Key* - specify the preshared key itself, as:
  - a plaintext passphrase between 8 and 63 characters in length, when **ascii** is selected for *Key Type*, above.
  - a 64-digit hexadecimal string, when **hex** is selected for *Key Type*, above.

NOTE: The *TLS Cipher, Subject Match, Certificate Hash* and *WPA Strict Check* fields do not apply (and are greyed out) when **WPA-PSK**, **WPA2-PSK** or **WPA2-Mixed-PSK** are selected.

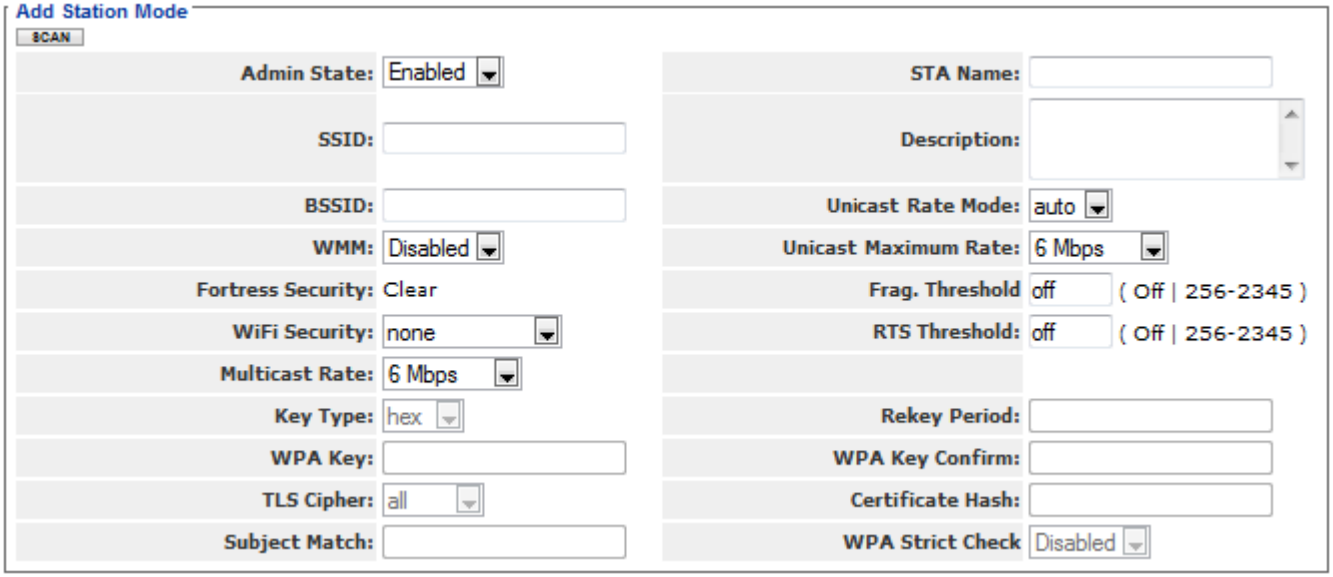


Figure 3.17. Advanced View Add *Station Mode* settings frame, ES210

3.3.5.11 Establishing an ES210 Bridge *STA Interface* Connection

Table 3.9 shows which *Add/Edit Station Mode* settings appear in the two GUI views.

Table 3.9. STA Interface Settings

Simple & Advanced Views	Advanced View Only
Admin State	*Description*
STA Name	*WMM*
SSID	*Frag. Threshold*
BSSID	*RTS Threshold*
Wi-Fi Security	*Unicast Rate Mode*
Key Type	*Unicast Maximum Rate*
Rekey Period	*Multicast Rate*
WPA Key/Key Confirm	*TLS Cipher*
	Certificate Hash
	Subject Match
	WPA Strict Check

When *Station Mode* is enabled, you can scan for available wireless networks in range and select one to connect to, or you can configure the *STA Interface* in advance to connect to a specific network.

To scan for available networks and choose one to connect to:

If the network you will be connecting to uses WPA, WPA2 or WPA2-Mixed to authenticate connecting devices, you must import a valid EAP-TLS digital certificate for the *STA Interface* before the ES210 Bridge will be permitted to connect. Refer to Section 6.2 for guidance.

If the network you will be connecting to uses WPA-PSK, WPA2-PSK or WPA2-Mixed-PSK, you will be required to enter a valid pre-shared key for the *STA Interface*, as described below, before the ES210 Bridge will be permitted to connect. Refer to WPA-PSK, WPA2-PSK and WPA2-Mixed-PSK Security in Section 3.3.5.10 for more on the pre-shared key.

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Radio Settings** from the menu on the left.
2. If you are configuring one or more Advanced View settings (see tables 3.5 and 3.9), click **ADVANCED VIEW** in the upper right corner of the page. (If not, skip this step.)
3. Preconfigure the radio on which you will create the *STA Interface* with settings that will permit it to scan for the network you want to connect to. Refer to Section 3.3 for guidance.
4. In the *Radio Settings* frame for the radio configured in Step 3, under *STA Interface*, click the **ENABLE STATION** button to display the **ADD STATION** and **DELETE STATION**.
5. Click the **ADD STATION** button.

6 In the *Radio* screen's *Add Station Mode* frame, click the **SCAN** button to detect and display available networks.

SSID	Signal Strength	BSS ID	Security Suite
alafia	21	c0:3f:0e:14:41:34	wpa2mixedpsk
crain	16	c0:3f:0e:0f:56:e8	wpa2mixedpsk
Root central	39	00:1f:f3:04:a8:6b	wpapsk
Lasso of Truth	30	00:22:3f:ad:ab:be	wpapsk
08FX05033409	7	00:18:3a:ad:15:54	none
TRENDnet	3	00:14:d1:c3:ac:73	wpa2mixedpsk

Figure 3.18. selecting a network for the *STA Interface* to connect to, ES210

7 Click to select the network you want the Bridge to connect to:

- Click the network *SSID* to capture only the network SSID and Wi-Fi security requirement.
- Click the *BSS ID* to capture both of the above and the MAC address of the network access point for the *BSSID* field on *Add Station Mode* (in order to restrict the Bridge to connecting to only that AP).

The Bridge GUI returns the *Add Station Mode* frame with settings, as described here, for the network you selected.

Add Station Mode

SCAN

Admin State:	Disabled	STA Name:	alafia
SSID:	alafia	Description:	
BSSID:	c0:3f:0e:14:41:34	Rate Mode:	auto
WMM:	Disabled	Maximum Rate:	1 Mbps
Fortress Security:	Clear	Frag. Threshold	off (Off | 256-2345)
WiFi Security:	wpa2mixedpsk	RTS Threshold:	off (Off | 256-2345)
Multicast Rate:	1 Mbps		
Key Type:	hex	Rekey Period:	60
WPA Key:	1AD962871E1990E	WPA Key Confirm:	1AD962871E1990E
TLS Cipher:	all	Certificate Hash:	
Subject Match:		WPA Strict Check	Disabled

Figure 3.19. preconfiguring the *STA Interface* to connect to a network, ES210

8 In the *Add Station Mode* frame, configure the *STA Interface* for operation:

- If the connection requires a pre-shared key for authentication, you *must* specify whether it is an **ascii** or **hex**adecimal string and enter, then re-enter, the correct key, as described under *WPA-PSK, WPA2-PSK and WPA2-Mixed-PSK Security* in Section 3.3.5.10.

or

- If the connection uses a digital signature for authentication, you can optionally configure the

additional security options described under *WPA, WPA2 and WPA2-Mixed Security* in Section 3.3.5.10.

and

- Optionally configure any additional interface settings, as described in sections 3.3.5.2 through 3.3.5.8.

9 Click **APPLY** in the upper right of the screen (or **CANCEL** the action).

To preconfigure a Station Mode ES210 Bridge to connect to a specific network:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Radio Settings** from the menu on the left.

2 If you are configuring one or more Advanced View settings (see tables 3.5 and 3.9), click **ADVANCED VIEW** in the upper right corner of the page. (If not, skip this step.)

3 Preconfigure the radio on which you will create the *STA Interface* with settings that will permit it to connect to the same network as the *STA Interface*. Refer to Section 3.3 for guidance.

4 In the *Radio Settings* frame for the radio configured in Step 3, under *STA Interface*, click the **ENABLE STATION** button to display the **ADD STATION** and **DELETE STATION** buttons.

5 Click the **ADD STATION** button.

6 In the *Radio* screen's *Add Station Mode* frame:

- Enter at least a *STA Name* (Section 3.3.5.2) and the *SSID* (Section 3.3.5.3) of the network the Bridge will be connecting to.
- Leave *Admin State* at the default of **Enabled** (Section 3.3.5.1).
- Optionally preconfigure any additional setting(s) (described in sections 3.3.5.2 through 3.3.5.10, above).

NOTE: For WPA PSK authentication, you must enter the correct key in the *WPA Key*/*WPA Key Confirm* fields, as described in Section 3.3.5.10. These fields do not apply (and are greyed out) for Enterprise WPA modes.

7 Click **APPLY** in the upper right of the screen (or **CANCEL** the action).

8 If you are using **WPA**, **WPA2** or **WPA2-Mixed** *Wi-Fi Security*, import a valid EAP-TLS digital certificate to authenticate the *STA Interface* on the network it will connect to. Refer to Section 6.2 for guidance.

9 Before connecting the *STA Interface* to the network, you must enable the radio on which the *STA Interface* is configured (Bridge radios are **Disabled** by default; refer to Section 3.3.2.1).

3.3.5.12 Editing or Deleting the ES210 Bridge *STA Interface*

An established *STA Interface* can be reconfigured or deleted.

To edit or delete the STA Interface:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Radio Settings** from the menu on the left.
2. If you are reconfiguring the existing *STA Interface*, on the *Radio* screen:
   - If you are reconfiguring one or more Advanced View settings (see Table 3.8), click **ADVANCED VIEW** in the upper right corner of the page. (If not, skip this step.)
   - Click the **EDIT STATION** button.
   - In the *Radio* screen's *Edit Station Mode* frame, enter new values for the setting(s) you want to change (described in sections 3.3.5.1 through 3.3.5.10, above).
   - Click **APPLY** in the upper right of the screen (or **CANCEL** your changes).

   or

   If you are deleting the *STA Interface*, on the *Radio* screen:
   - Click the **DELETE STATION** button.

3.3.5.13 Enabling and Disabling ES210 Bridge Station Mode

Station Mode is disabled by default, in which state the preconfigured scanning interface used for network detection is disabled. You must enable the function before you can manually configure a *STA Interface* or scan for a network.

To enable or disable Station Mode:

If one or more BSSs have been configured on the ES210 Bridge radio, you must delete all BSSs before you can enable *Station Mode* (refer to Section 3.3.4).

If a *STA Interface* is present, you must delete it before you can disable *Station Mode* (refer to Section 3.3.5.12).

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Radio Settings** from the menu on the left.
2. Change the *Station Mode* state:
   - If you are enabling *Station Mode,* click the **ENABLE STATION** button.

   or

   - If you are disabling *Station Mode,* click the **DISABLE STATION** button.

Station Mode must be disabled on the ES210 Bridge radio, before you can configure a BSS on the radio (refer to Section 3.3.4).

3.4 Basic Network Settings Configuration

The basic settings that establish the Bridge's presence on the network are configured in the *Network Configuration* frame on **Configure -> Administration**, described in sections 3.4.1 and 3.4.2, below.

The Bridge's system clock and, optionally, NTP (network time protocol) configuration are set in the *Time Configuration* frame of the same screen, as described in Section 3.4.3.

The Bridge's global bridging function is also configured on **Configure -> Administration**, in the *Bridging Configuration* frame, and described in Section 3.2

The Bridge's Ethernet interfaces are also individually configurable, on **Configure -> Ethernet Settings**, as described in Section 3.7.

3.4.1 Hostname, Domain and DNS Client Settings

The Bridge's configuration settings must include a *Hostname*, which by default is based on the hardware series to which the Bridge belongs (**ES-**) and its MAC address.

You can optionally identify redundant external Domain Name System servers (*Preferred DNS* and *Alternate DNS*) for the Bridge.

In Advanced View, you can change the Bridge's default *Domain* name, **ftimesh.local**.

Bridge software itself includes a standard network DNS service, enabled by default, which uses the domain name configured here. If the Bridge cannot resolve a DNS request internally, it will forward the request to the external servers configured here.

Refer to Section 3.6.2 for additional information on the internal DNS server and additional configuration options.

When FastPath Mesh is licensed and enabled, Bridge functionality additionally includes independent name distribution within the FastPath Mesh network without the need for any DNS server, using the Bridge's configurable *Domain*.

Configure these settings on the Bridge GUI's *Network Configuration* screen.

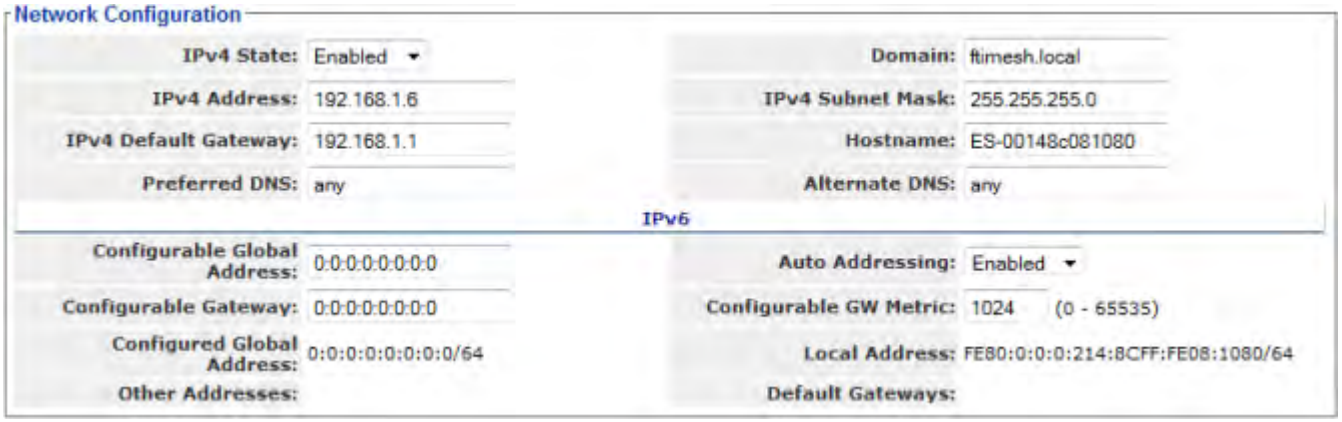


Figure 3.20. Advanced View *Network Configuration* frame, all platforms

- *Preferred DNS* and *Alternate DNS*- provide addresses of external Domain Name System servers on the network or specifies no network DNS server with **any**, which maps to an IP address of **`0.0.0.0`**, the default for both settings. Leaving both settings at their defaults (or later specifying **`0.0.0.0`** addresses for both) effectively disables the Bridge's ability to query external DNS servers.
- *Domain* - specifies the Bridge's local domain name.

NOTE: When enabled (the default), the Bridge's internal DNS service is preferred over either external server, forwarding only those DNS requests that cannot be resolved internally.

Table 3.10. Network and IPv4 Configuration Settings

Simple & Advanced Views	Advanced View Only
IPv4 State *IPv4 Address* *IPv4 Subnet Mask* *IPv4 Default Gateway* *Hostname* *Preferred DNS* *Alternate DNS*	*Domain*

To configure hostname and DNS Client settings:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Administration** from the menu on the left.
2. If you are changing the Bridge's local domain name, select **ADVANCED VIEW** in the upper right corner of the page. If not, skip this step.
3. In the *Administration* screen's *Network Configuration* frame, enter new values for the settings you want to configure (described above).
4. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

3.4.2 IP Configuration

The Bridge supports Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6).

IPv4 is enabled by default. When it is disabled, the Bridge's management IP address neither accepts or sends IPv4 packets.

IPv6 is always enabled on the Bridge, a state which is not user configurable.

3.4.2.1 IPv4 Configuration

The settings that configure Internet Protocol version 4 on the Bridge include:

- *IPv4 State* - adds the Bridge's IPv4 address—and therefore the Bridge itself—to the IPv4 network (**Enabled**) or removes the Bridge's address (and the Bridge) from the network (**Disabled**). IPv4 is **Enabled** by default.
- *IPv4 Address* - establishes an IPv4 network address for the Bridge's management interface. The default IPv4 address is *192.168.254.254*; it is normally changed during installation.
- *IPv4 Subnet Mask* - provides the correct IPv4 subnet mask for the Bridge's management interface.
- *IPv4 Default Gateway* - provides the IP address of the default IPv4 gateway for the Bridge's subnet.

In order to re-access the Bridge's management interface after changing the Bridge's IPv4 settings, you must enter the Bridge's new IP address into a new instance of your browser.

3.4.2.2 IPv6 Configuration

Internet Protocol version 6 is always enabled on the Bridge.

NOTE: Fortress's FastPath Mesh functionality includes independent IPv6 addressing, which can supply additional IPv6 ULAs (Unique Local Addresses, refer to Section 3.2.1).

You can choose to allow all IPv6 settings to be automatically configured on the Bridge, opt to manually configure the global address and IPv6 gateway/metric, or use both manually and automatically configured global addresses.

When *IPv6 Auto Addressing* is **Enabled** (the default) and there is an IPv6 router on the network configured to provide the global prefix, the Bridge will automatically configure a compatible IPv6 global address for itself, displayed under *Other Addresses.* If additional IPv6 routers are present, auto-addressing will configure additional IPv6 global addresses.

If a network IPv6 router is configured to do so, it will additionally supply its own address as one of the Bridge's IPv6 *Default Gateways*, with the appropriate *metric*. If more than one IPv6 router is present on the network and so configured, the additional routers will also appear on the list of *IPv6 Default Gateways*, with their *metric*s.

If you choose to manually configure IPv6 settings, these include:

- *Auto Addressing* - configures the Bridge to learn IPv6 global prefixes from network routers (**Enabled**, the default) or to use only a locally established global address (**Disabled**).
- *Configurable Global Address* - manually establishes an IPv6 global network address—which must be within the IPv6 global scope—for the Bridge's management interface.
- *Configurable Gateway* - manually provides the IP address of the default gateway for the Bridge's IPv6 subnet. The default gateway address must be a compatible link-local or global address (i.e., lie within the same prefix as either the global address or the link-local address).

  If no default gateway is necessary (i.e., you are configuring the Bridge for use on a private network unconnected to other OSI Layer 3 networks), you can leave *Default Gateway* at its default setting of all zeros.
- *Configurable GW Metric* - establishes the IPv6 metric, or relative routing cost, for the *Configurable Gateway*, allowing it to be assigned a preference relative to the automatically assigned default gateways.

The rest of the settings in the *IPv6* portion of the *Network Configuration* frame provide complete information about the current IPv6 configuration and are view-only (whether or not *Auto Addressing* is in effect).

- *Configured Global Address* - normally shows the manually configured IPv6 network address. There can, however, be several seconds' delay before a change in *Configurable Global Address* takes effect and is displayed in the view-only *Configured Global Address* field.
- *Local Address* - shows the Bridge's link local IPv6 network address, which is automatically generated regardless of whether *Auto Addressing* is in effect.
- *Other Addresses* - shows all automatically configured IPv6 addresses for the Bridge, including router-configured addresses and, when FP Mesh is licensed and enabled, the RFC-4193 unique local address (Section 3.2.1).

  Each displayed address of any type additionally shows the applicable IPv6 subnet prefix length following the address itself, separated by a slash (ex. */64*).
- *Default Gateways* - lists all network gateways, whether manually configured or active network IPv6 routers configured to automatically supply their addresses and metrics (shown in parentheses).

You can configure and view all IPv4 and IPv6 settings in Simple View.

Table 3.11. IPv6 Network Configuration Settings

Configurable Settings
Configurable Global Address *Auto Addressing* *Configurable Gateway* *Configurable GW Metric*
View-Only Settings
Configured Global Address/prefix length *Local Address/prefix length* *Other Addresses/prefix lengths* *Default Gateways (metrics)*

To configure IP settings:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Administration** from the menu on the left.
2. In the *Network Configuration* frame, enter new values for those settings you want to configure (described in sections 3.4.2.1 and 3.4.2.2).
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

3.4.3 System Clock and NTP Client Configuration

You should set the Bridge's internal clock at installation, regardless of whether you enable its NTP (Network Time Protocol) function.

3.4.3.1 System Date and Time Configuration

Configure the Bridge's local *System Date*, *System Time* and *Time Zone* in the *Time Configuration* frame.

System date and time settings are accessible regardless of the current Bridge GUI view.

Figure 3.21. Simple View *Time Configuration* frame, all platforms

The Bridge's internal clock is set in UTC (Universal Time Coordinated) by default. The Bridge CLI includes an option to set time on the Bridge in local time (refer to the *CLI Software Guide*); no such option is available in the Bridge GUI.

3.4.3.2 NTP Client Configuration

In Advanced View, after you have set the Bridge's internal clock to within 1000 seconds of the current time on the network, you can enable the Bridge to synchronize its clock with the time disseminated by up to three configured NTP servers.

Once the Bridge's system clock is successfully synchronized with NTP server time, NTP manages the drift between the time on the Bridge (the NTP client) and the time maintained by the NTP server(s) for the network. If the Bridge is out of sync with NTP server time, NTP automatically corrects the Bridge's system clock.

If an NTP server is configured with a shared key to authenticate NTP transactions and you specify that key on the Bridge, the Bridge will require the shared key for NTP transactions with that server. If you do not specify a key for a configured NTP server, the Bridge will synchronize its clock with that of the NTP server without shared-key authentication.

The Bridge supports up to three NTP servers.

NTP Timeout applies globally to the configured server(s). Three settings establish each NTP server individually.

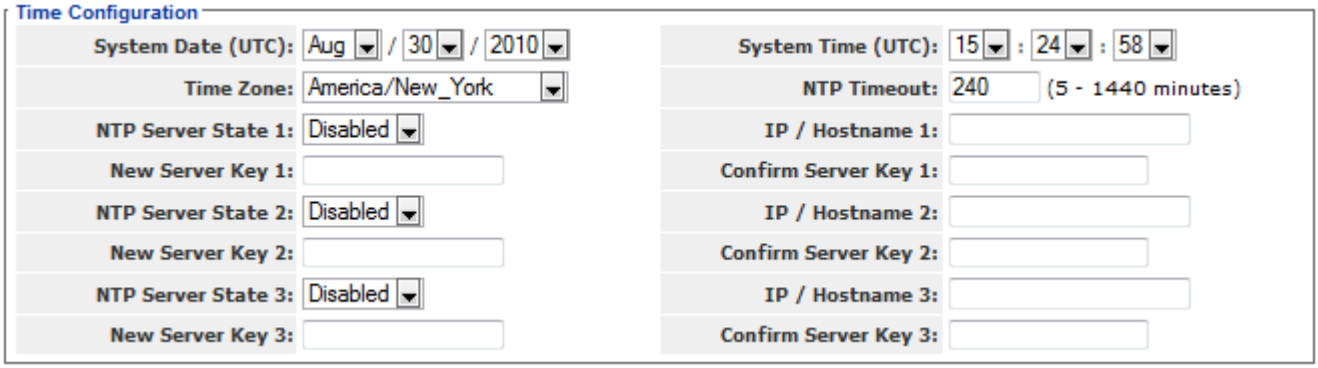


Figure 3.22. Advanced View *Time Configuration* frame, all platforms

- *NTP Timeout* - globally determines the interval, in minutes from **5** to **1440**, of silence from configured NTP servers after which you will be notified that the Bridge cannot reach any of its configured and enabled NTP servers. The default *NTP Timeout* is **240** minutes.
- *Server State 1–3* - establishes whether the NTP server (when configured) will be used (**Enabled**) to set system time on the Bridge. All three are **Disabled** by default.
- *IP /Hostname 1–3* - provides the IP address or fully qualified hostname of the NTP server.
- *New/Confirm Server Key 1–3* - provides the key in effect for the NTP server.

The Bridge's NTP client function is disabled by default, and no NTP servers are configured.

To configure system clock and NTP:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Administration** from the menu on the left.
2. If you are configuring NTP client settings, select **ADVANCED VIEW** in the upper right corner of the page. If not, skip this step.
3. In the *Administration* screen's *Time Configuration* frame, select/enter new values for the settings you want to configure (described above).
4. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

NOTE: When NTP is enabled, the values provided by the NTP server overwrite manually configured *System Date* and *Time* values.

3.5 Location or GPS Configuration

Only the ES210 Bridge is equipped with a GPS (Global Positioning System) receiver and associated antenna port. When the feature is **Enabled** (the default) and a GPS antenna connected, the ES210 uses the signals of GPS satellites in range to triangulate its exact position on the globe. It dynamically displays this information in *Location* fields and in *Topology View* details (on **Monitor -> Topology View**, refer to Section 5.4).

Figure 3.23. GPS *Location* settings frame, ES210

At the default *Admin State* of **Enabled**, you can observe current readings of the Bridge's *GPS Longitude*, *GPS Latitude* and *GPS Altitude* in the *Location* frame on **Configure -> Administration** (in the formats described below for manual entry), along with a count of *GPS Satellites* in contact with the Bridge.

On other model Fortress Bridges (or on the ES210, when the GPS function is **Disabled**), you can optionally configure fixed settings to reflect the Bridge's physical position on the globe. Coordinates entered are shown only here (and for the Bridge CLI `show location` command).

NOTE: The ES210 GPS antenna port is shown in the Fortress *ES210 Secure Wireless Bridge Hardware Guide*.

Figure 3.24. *Location* settings frame, ES440, ES520, ES820, FC-*X*

Manually establish a Bridge's *Location* with standard settings for:

- *Latitude* and *Longitude* - specify the Bridge's global coordinates in degrees, minutes and seconds, north/south or east/west in the format:

  DD:*MM*:*SS*.*ss*N/S/E/W, with no spaces

  You need only specify whole seconds. You can optionally specify the Bridge's coordinates to the 100th second.
- *Altitude* - specifies the Bridge's altitude in whole meters above sea level.

No manual *Location* is set by default.

To enable GPS or manually configure the Bridge's location:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Administration** from the menu on the left.
2. In the *Location* frame, enter new values into the *Location* settings you want to change.
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

3.6 DHCP and DNS Services

Bridge functionality includes standard, user configurable network IPv4 and IPv6 DHCP (Dynamic Host Control Protocol) and DNS (Domain Name System) services.

3.6.1 IPv4 and IPv6 DHCP Services

When the Bridge's internal DHCP servers are enabled, the Bridge provides standard DHCP services to network DHCP clients.

You can observe current DHCP leases on **Monitor -> Connections ->** *DHCP Leases* tab.

Internal DHCP services use the internal DNS server (see below) and the locally configured DNS client settings and domain name on **Configure -> Administration ->** *Network Configuration* (refer to Section 3.4.1).

The IPv4 DHCP server uses the locally configured IPv4 *Default Gateway* in the upper half of the *Network Configuration* frame (refer to Section 3.4.2.1). The IPv6 DHCP server uses the IPv6 default gateway(s) in the lower *IPv6* portion of the frame, including those established automatically and the manually configured default gateway (if present). Refer to Section 3.4.2.2 for more on IPv6 addressing.

The Bridge's internal DNS server is enabled by default, and the Bridge can be configured to use external network DNS servers, when available (refer to Section 3.4.1). If the Bridge's DNS server and DNS client functions are enabled simultaneously, and the internal DHCP service is unable to resolve a name to

an IP address, the Bridge will forward the request to up to two network DNS servers.

When FastPath Mesh is used for bridging and the FastPath Mesh network is attached to a conventional hierarchical network, internal DHCP services obtain default gateway and DNS server settings from locally configured values. In addition, the Bridge passes DHCP client IP address-to-name mapping to the independent FastPath Mesh name resolution function, permitting all nodes in the FP Mesh network to reach DHCP clients by name, as well as by IPv4 address. Refer to Section 3.2.1.1 for more on FastPath Mesh bridging.

NOTE: Fortress's FastPath Mesh functionality includes automatic RFC-4193 IPv6 addressing independent of network IPv6 DHCP services (see Section 3.2.1).

Both internal DHCP servers are **Disabled** by default.

If you enable the Bridge's internal IPv4 DHCP server, you must specify the lowest and highest IPv4 addresses in the Bridge's IPv4 DHCP address pool.

If you enable the Bridge's internal IPv6 DHCP server and leave *Auto Addressing* at its default of **Enabled**, you do not need to manually define the service's address pool. Alternatively, you can optionally disable *Auto Addressing*, and specify the pool's start and end IPv6 addresses.

Figure 3.25. Advanced View *DHCP* configuration frames, all platforms

Although address formats are different, the four basic settings that configure the Bridge's IPv4 and IPv6 DHCP services are the same:

- *Admin. State* - determines whether the Bridge will serve IP addresses to network devices (**Enabled**) or not (**Disabled**). Both DHCP services are **Disabled** by default.
- *Max. Lease Time* - determines the period of time leases issued to DHCP clients by the service are valid, in minutes between **1** and **525,600** (365 days). The default for both servers is **60** minutes.
- *IP Range Min.* and *IP Range Max.* - define the start and end IP addresses within the service's DHCP address pool:
  - For the *IPv4 DHCP* service, you must enter IPv4 addresses in the usual format when you enable the server.
  - For the *IPv6 DHCP* service:

- If *Auto Addressing* will be left at its default of **Enabled** (see below), you should leave these settings at their defaults (**::**).
- If you opt to disable *Auto Addressing*, you must enter IPv6 addresses in the usual format.

The Bridge's IPv6 DHCP server has an additional setting:

- *Auto Addressing* - configures the IPv6 DHCP server to automatically define its address pool. When *Auto Addressing* is **Enabled** (the default), the IPv6 server's manually configured *IP Range Min.* and *IP Range Max.* should remain undefined (at the default **::** setting).

To configure internal DHCP servers:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> DHCP/DNS** from the menu on the left.
2. In the frame for the type of DHCP server you are configuring, IPv4 DCHP or IPv6 DHCP, select/enter new values for the settings you want to configure (described above).
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

When Bridge DHCP servers are enabled, the fields that configure their address pools are grayed out to indicate that you cannot reconfigure the address pool while the server is running. You must disable the server to re-enable these fields for editing.

3.6.2 DNS Service

When enabled (the default), the Bridge's internal DNS server provides local network name-to-IP address resolution, for both IPv4 and IPv6 addresses.

The Bridge's domain name, **ftimesh.local** by default, is configured in Advanced View in the *Network Configuration* frame on **Configure -> Administration**.

The Bridge's DNS service learns name-to-IP address mapping for locally resolved names from any of three sources:

- user entries to the DNS Host to IP Map (see below)
- when a DHCP server is available, from DHCP requests
- when FastPath Mesh is used for bridging, from name-to-IP address mappings learned by the other Mesh Points (i.e., peer nodes) in the FP Mesh network

For manual entries, you can map a single name to multiple IP address and associate a single IP address with multiple names.

The Bridge GUI's DNS Host to IP Map shows all mappings, which you can sort by ascending or descending *Hostname* or *IP Address*. Each entry is identified by *Type*, which can be:

- *self* - a mapping for the current Bridge
- *dynamic* - a mapping supplied by a DHCP service or obtained from other Mesh Points in a FastPath Mesh network
- *static* - a manually established mapping

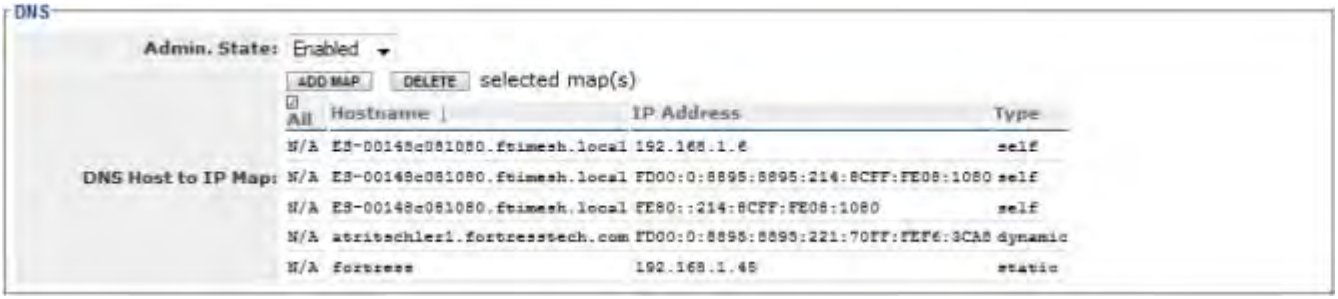


Figure 3.26. Advanced View *DNS* configuration frame, all platforms

When FastPath Mesh is used for bridging, the internal DNS service facilitates name resolution for FP Mesh network nodes and network resiliency in the absence of an external referral server. Fortress therefore recommends that the DNS service be left at its a default of **Enabled** for FastPath Mesh network deployment. Refer to Section 3.2.1.1 for more on FastPath Mesh bridging.

CAUTION: Disabling the DNS server internal to a FastPath Mesh Point can degrade FP Mesh network performance.

To configure the internal DNS server:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> DHCP/DNS** from the menu on the left.
2. In the *DNS* frame, in Admin. State, determine whether the internal service is **Enabled** (the default) or **Disabled**.
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel the change).
4. In the same frame, if you want to manually map one or more device names in the Bridge's local domain to specific IPv4 and/or IPv6 address(es):
   - Click **ADD MAP**.

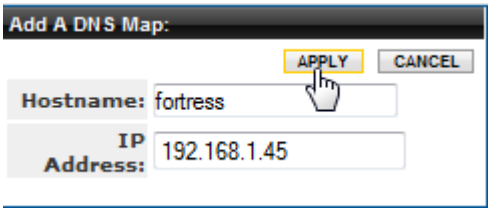


Figure 3.27. Advanced View *Add a DNS Map* dialog, all platforms

- In the resulting *Add a DNS Map* dialog, enter a network device's *Hostname* and, in *IP Address*, the IPv4 or IPv6 address you want to the name to map to.
- Click **APPLY** (or **CANCEL** the addition).
- Repeat these steps for any additional name-to-IP address associations you want to manually add to the internal DNS service.

5 In the same frame, if you want to remove manually configured name-to-IP address mappings:

- If you want to delete one or a selected group of manual mappings, click to place a check in the box beside each entry you want to delete; then the **DELETE** button above the list.

or

- If you want to delete all manual mappings, click **All** to place a check in the boxes of all manually configured entries; then click the **DELETE** button above the list.

NOTE: DNS entries learned dynamically from network DHCP services or FastPath Mesh peer nodes cannot be manually deleted.

3.7 Ethernet Interface Settings

Fortress Bridges are equipped for wired network connections with varying numbers of Ethernet ports with various optional characteristics.

Table 3.12. Fortress Bridge Model Ethernet Ports

series	Fortress model	# of Eth ports	HW label	GUI label	takes PoE	serves PoE	fiber option	default encryption
ES	ES820	2	**Ethernet1**	*wan*	no	no	no	encrypted
			Ethernet2	*aux*	no	no	no	clear
	ES520	9	**WAN**	*wan1*	yes	no	no	encrypted
			1–8	*lan1–lan8*	no	yes	no	clear
	ES440	2	**Ethernet1**	*wan*	yes	no	no	encrypted
			Ethernet2	*aux*	no	no	no	clear
	ES210	2	**Ethernet (WAN)**	*wan*	no	no	no	encrypted
			Ethernet	*aux*	no	no	no	clear
FC	FC-***X***	3	**Encrypted**	*enc*	no	no	yes	encrypted
			Unencrypted	*clr*	no	no	yes	clear
			AUX	*aux*	no	no	no	clear

Compare your Bridge's model number (on the *Administration Settings* screen under *System Info*.) to Table 3.12 above to determine the number of Ethernet ports with which the Bridge you are configuring is equipped, how they are labeled on the

chassis and in the GUI, and each port's default Fortress Security setting.

Bridge Ethernet ports can be configured per port, according to the requirements of your implementation. Access per-port settings through **Configure -> Ethernet Settings**.

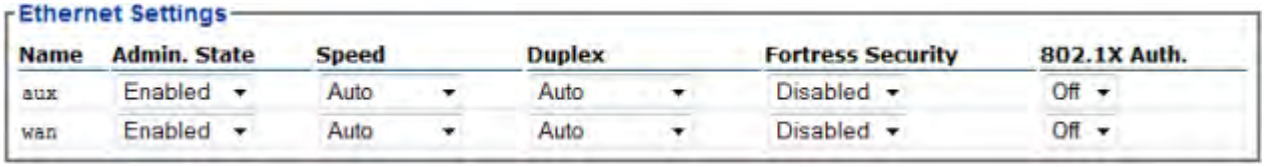


Figure 3.28. Simple View *Ethernet Settings* screen, ES210, ES440, ES820

Software labels cannot be changed. *Ethernet Settings* screens display each port's view-only *Name*.

3.7.1 Port Administrative State

Admin. State determines whether the port is **Enabled** or **Disabled**. All ports are **Enabled** by default.

3.7.2 Port Speed and Duplex Settings

Speed determines whether the port will transmit and receive data at a specified speed (**10 Mbps** or **100 Mbps**) or automatically adjust to the highest possible speed (**Auto**, the default).

Duplex determines whether the port will allow only **Full Duplex** communication, only **Half Duplex** communication, or automatically determine whether to use full or half duplex communication according to the duplex communication in use by connected devices (**Auto**, the default).

3.7.3 Port FastPath Mesh Mode and User Cost Offset

Two settings configure the port's FastPath Mesh attributes:

- *FastPath Mesh Mode* - establishes the port's role in the FP Mesh network.
  - **Core** - configures the interface to connect to other FP Mesh-enabled Fortress Mesh Points (MPs)
  - **Access** - configures the interface to connect Non-Mesh Points (NMPs) to the FP Mesh network.
- *User Cost Offset* - allows you to weight the port more heavily in the FP Mesh cost equation in order to make it less attractive relative to other interfaces. Enter a non-negative integer between **0** (zero) and **4,294,967,295**. The higher the offset, the less attractive the interface. A neighbor with the maximum cost (**4,294,967,295**) will never be used to route traffic. The default is **0** (zero). Network Cost Weighting and the FP Mesh cost equation are described in Section 3.2.1.5.

FastPath Mesh bridging is described in Section 3.2.1.

NOTE: Core can only be selected for *FastPath Mesh Mode* when the *Fortress Security* selection for the port (Section 3.7.4) matches that of the FP Mesh network overall (Section 3.2.1.2). Normally, *Fortress Security* should be **Enabled** for both.

Figure 3.29. Advanced View *Ethernet Port Settings* screen, *wan* port, ES210, ES440, ES820

3.7.4 Port Fortress Security

When *Fortress Security* is **Enabled** on a port, traffic on that port is subject to Fortress's Mobile Security Protocol (MSP), as configured on the Bridge itself (refer to Section 4.1). Such a port is also known as an *encrypted port*.

When *Fortress Security* is **Disabled**, traffic on the port is exempt from Fortress's MSP.

If *Cleartext Traffic* is **Enabled** on the Bridge (Section 4.1.10), configured cleartext devices (Section 4.5.3) are exempt from MSP and permitted to pass clear text on the Bridge's encrypted ports.

Refer to Table 3.12, above, to determine the default *Fortress Security* settings for a given Bridge model's Ethernet ports.

NOTE: The current *Cleartext* traffic setting is shown in the upper left of all Bridge GUI screens.

3.7.5 Port 802.1X Authentication

Enabling *802.1X Auth.* requires that devices connecting to the port are 802.1X supplicants successfully authenticated by the 802.1X service configured on or for the Bridge (**Enabled**) or allows non-802.1X authenticated devices to connect (**Disabled**). 802.1X is disabled on all ports by default. (Refer to Section 4.3 to configure an 802.1X server for the Bridge.)

3.7.6 Port Default VLAN ID and Port Switching Mode

Two settings configure the port's VLAN handling:

- *Default VLAN ID* associates the port with the specified VLAN ID. The Bridge supports VLAN IDs **1**–**4094**. If the VLAN ID you enter is not already present on the *VLAN Active ID Table* (Section 3.9.3), it will be added. The default is **1**.
- *Switching Mode* establishes the port's behavior with regard to data packet VLAN tagging.
  - **Access** - (the default) configures the port to accept only: (1) packets that do not contain VLAN tags and (2) specialized *priority-tagged packets*, which provide support for Ethernet QoS exclusive of VLAN implementations.

- **Trunk** - configures the port to accept incoming packets with any VLAN tag in the VLAN ID table and to send packets with their VLAN tagging information unchanged, including 802.1p priority tags, provided that the port's QoS override function is disabled (see *QoS*, below).

NOTE: There is only one VLAN trunk per Bridge, used by all **Trunk** ports. It is defined by the Bridge's *VLAN Active ID Table* (Section 3.9.3).

Refer to Section 3.9 and to Table 3.14 for a complete description of VLAN handling on the Bridge.

To support QoS, the Bridge treats incoming priority-tagged packets (characterized by a VLAN ID of zero) as untagged packets, but marks them for sorting into QoS priority queues according to the user-priority value contained in their VLAN tags. (Refer to Section 3.8 for details on the Bridge's QoS implementation).

You can configure VLAN port settings only in Advanced View.

3.7.7 Port QoS Setting

QoS enables/disables the port's Quality of Service override feature. When enabled, the port's QoS function forces all traffic on the port into the specified QoS priority queue and adds a priority marking for that queue to each packet. Bridge priority markings replace any 802.1p Quality of Service (QoS) tags included in the packets.

If a packet received on the port is transmitted wirelessly, the Bridge uses the priority marking to determine its WMM (Wi-Fi Multimedia) priority level. If the packet egresses over an Ethernet port with a VLAN *Switching Mode* of **Trunk** (described above), the Bridge priority marking is inserted into the packet's VLAN tag for QoS processing. (Ethernet ports with a *Switching Mode* of **Access** do not send VLAN tags and so cannot include priority tags.)

By default, the QoS override is set to **None** on all ports, which disables the function. Alternatively, you can choose to associate all traffic on the port with the Bridge's **Low**, **Medium**, **High** or **Critical** priority queue. (Refer to Section 3.8 for more information on QoS priority queues.)

You can configure QoS settings only in Advanced View.

3.7.8 Port Power over Ethernet

Only the ES520 Bridge can act as Power over Ethernet Power Sourcing Equipment (PoE PSE), and only via the eight ports of its internal LAN switch, labeled *lan1–lan8* in the Bridge GUI.

NOTE: The ES520 can supply a maximum 36 Watts of PoE overall and up to 16 W per vertically stacked port-pair, to connected PDs. (Refer to the ***ES520 Hardware Guide*** for details.)

The *PSE* setting determines whether the port will serve PoE to connected Powered Devices (PDs). *PSE* is **Disabled** by default. It must be **Enabled** on every port through which you want to supply PSE, i.e., on all ports connected to PDs.

Ethernet devices that do not support PoE, or non-Powered Devices, can use a *PSE*-enabled port with no effect on such devices or on PSE operation.

If you are powering a PoE Class 3 or Class 0 device on a given port, you may want to leave *PSE* **Disabled** on the port above/below it. Vertically stacked ports share a fuse that can bear only a single PoE Class 0/3 device. Plugging a PoE powered device into the remaining port in the pair will trip the shared fuse, when *PSE* is **Enabled** on that port (and the overall maximum PoE supply would not be exceeded by the addition).

PSE connection capacities and limitations are described in full in Fortress's *ES520 Secure Wireless Bridge Hardware Guide*.

Figure 3.30. Advanced View *Ethernet Port Settings* screen, *lan* port, ES520

Table 3.13 shows which *Ethernet Settings* appear in the two GUI views.

Table 3.13. Ethernet Port Settings

Simple & Advanced Views	Advanced View Only
Admin. State *Speed* *Duplex* *Fortress Security* *802.1X Auth.*	*Switching Mode* *Default VLAN ID* *QoS* *PSE*

3.7.9 Configuring Ethernet Ports

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Ethernet Settings** from the menu on the left.
2. If you are configuring one or more Advanced View settings (see Table 3.13), click **ADVANCED VIEW** in the upper right corner of the page and then the **EDIT** button for the port you want to configure.
3. In the *Ethernet Settings* frame, enter new values for those settings you want to configure, described above.
4. Click **APPLY** in the upper right of the screen (or **CANCEL** your changes).

3.8 QoS Implementation

The Bridge supports Quality of Service (QoS) expediting for wireless traffic according to the WMM® (Wi-Fi Multimedia) subset of the IEEE standard 802.11e, *QoS for Wireless LAN*, and for Ethernet traffic according to the IEEE standard 802.1p, *Traffic Class Expediting*.

The Bridge marks traffic that contains 802.1p user-priority tags with the associated QoS priority level. The default mapping of priority tags to priority queues conforms to IEEE standard 802.1D, MAC Bridges, Annex G, but is user configurable (see below). Traffic received without user-priority tags is marked for *Medium* (or *Best Effort*) QoS handling.

Ethernet QoS

On Ethernet, QoS tags are conveyed as part of the VLAN tags that can be included in packet headers. If the Bridge is configured to use VLANs, it will apply the user-priority values in the VLAN tags of the traffic it receives according to the mapping specified on **Configure -> Ethernet Settings**.

The Bridge can send 802.1p user-priority tags over Ethernet only when *VLAN Mode* is **Enabled** (Section 3.9) and only over ports with a VLAN *Switching Mode* of **Trunk** (Section 3.7.6), since these are the only conditions under which the Bridge sends VLAN-tagged packets.

When VLANs are disabled, the Bridge drops regular VLAN traffic but accepts specialized *priority-tagged packets* in order to support Ethernet QoS exclusive of a VLAN implementation. Priority-tagged packets are those which include a VLAN tag with a VLAN ID of zero (or null-value VLAN ID). The Bridge sorts this traffic into QoS priority queues according to the user-priority information contained in the VLAN tag. The Bridge cannot send priority-tagged packets.

The Bridge's per-port QoS override function (Section 3.7.7) overrides any priority tagging information in the traffic on that port, marking all traffic on the port for sorting into the specified QoS priority queue.

Wireless QoS

When enabled on the BSS, WMM Quality of Service is in effect for bridge links, the connections formed between Bridge radio BSSs with *Wireless Bridge* **Enabled** (Section 3.3.4.3).

QoS is negotiated individually for devices connecting to a WMM-enabled BSS configured to provide wireless access (Section 3.3.4). If the connecting device supports and is enabled for WMM QoS, the Bridge prioritizes traffic for the device according to its priority tags. Traffic from devices that do not send priority tags is marked for *Medium* (or *Best Effort*) QoS handling.

NOTE: To determine/configure WMM QoS capability for a given device, consult its documentation.

WMM is enabled by default on new BSSs (refer to Section 3.3.4.7).

Wireless packets can convey QoS priority tags directly in their 802.11 headers. When no VLAN tags are present, the Bridge sorts wireless traffic into QoS priority queues according to these tags. If a wireless packet also contains a VLAN tag, the Bridge applies the user-priority tag conveyed in the VLAN tag, rather than in the 802.11 header.

On ES210 Bridges in *Station Mode* (refer to Section 3.3.5), WMM is also enabled by default on new *STA Interfaces* (as described in Section 3.3.5.5).

Priority Tag-to-Queue Mapping

By default, 802.1p user-priority values are mapped to priority queues according to IEEE standard 802.1D, MAC Bridges, Annex G:

Critical - packets are delivered ahead of all other QoS levels. WMM categorizes this level of service as *Voice*. The IEEE specification recommends *Critical* QoS for traffic tagged with 802.1p user-priority values 6 and 7.

High - packets are delivered after *Critical* and ahead of lower QoS levels. WMM categorizes this level of service as *Video*. IEEE recommends *High* QoS for traffic tagged with user-priority values 4 and 5.

Medium - is *Best Effort* delivery: packets are delivered after higher QoS levels, but ahead of *Low* priority traffic. IEEE recommends *Medium* QoS for traffic tagged with user-priority values 0 (zero) and 3 and for untagged traffic.

Low - is for *Background* traffic: packets are delivered after all other QoS levels. IEEE recommends *Low* QoS for traffic tagged with user-priority values 1 and 2.

Packets received with no priority information and not subject to an Ethernet-port QoS override are sorted into the *Medium* QoS priority queue.

You can disable QoS on the Bridge by assigning all eight 802.1p tags to the same priority level.

You can configure Ethernet Quality of Service only in Advanced View

Figure 3.31. Advanced View *802.1p QoS Tag Priorities* frame, all platforms

To reconfigure QoS priority tag-to-queue mapping:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Ethernet Settings** from the menu on the left.
2. In the *Ethernet Settings* screen's *802.1p QoS Tag Priorities* frame, use the pull down menus to change how 802.1p priority tags are assigned to QoS priority queues.
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

3.9 VLANs Implementation

When *Bridging Mode* is **Off** (**STP** is selected by default, refer to Section 3.2), the Bridge supports multiple virtual local area networks (VLANs), either by transparently passing VLAN tagging information or by translating VLAN tags according to a user-defined routing map.

NOTE: VLANs are incompatible with **FastPath Mesh** and **STP** *Bridging Modes* (Section 3.2).

Each of the Bridge's Ethernet ports and each BSS configured on its radio(s) can be configured to use a specified VLAN. The VLANs configured for these interfaces are automatically added to the Bridge's table of active VLAN IDs (described below).

At its default configuration, the Bridge has a *VLAN Mode* setting of **Disabled**. The only VLAN configured on the Bridge is the native VLAN with a VLAN ID of 1. VLAN 1 is specified for all of the Bridge's interfaces by default and 1 is the sole VLAN ID configured on the *VLAN Active ID Table*.

You can configure the Bridge's VLAN mode, VLAN IDs and native VLAN.

Figure 3.32. Advanced View *VLAN Settings* frame, all platforms

3.9.1 VLAN Mode

Which VLAN mode to use is largely determined by your network configuration and its requirements. These instructions assume that you are familiar with VLAN concepts and implementation.

VLAN Mode: Disabled

The default *VLAN Mode* of the Bridge is **Disabled**, in which VLAN traffic is not passed. Packets received with VLAN tags traffic are discarded. Any per port VLAN settings are disregarded.

External switches running in port-based VLAN modes require that the Bridge use the VLAN mode **Disabled**.

VLAN Mode: Normal

In **Normal** *VLAN Mode*, the Bridge passes the VLAN tag's VLAN ID exactly as it is received, while encrypting/decrypting the rest of the data normally. The same tags are passed to and from the clear and encrypted interfaces. Per port VLAN settings are applied.

The Bridge can support up to 48 VLANs in **Normal** mode.

If the Bridge must support trunking between switches, bridging between multiple Fortress Bridges, or an access point with multiple SSIDs connected directly to the Bridge, use **Normal** mode.

As shown in Table 3.14, **Access** interfaces can receive and transmit only untagged traffic. Traffic received on an **Access** interface is tagged internally with the ingress interface's *Default VLAN ID*, and this tag is removed again at egress.

Trunk ports pass most tagged traffic with its tags unchanged, except that traffic tagged with the same VLAN ID as the ingress interface's *Default VLAN ID* is sent untagged.

Table 3.14. *Normal* Mode VLAN Handling

received traffic		**VLAN traffic handling**		
interface *Switching Mode*	**VLAN tagging**	**on ingress**	**internal**	**on egress**
Access	untagged	accept	tag w/ ingress interface *Default VLAN ID*	tag = egress interface *Default VLAN ID:* send untagged
				tag ≠ egress interface *Default VLAN ID:* drop
	tagged	drop		
Trunk	untagged	accept	tag w/ ingress interface *Default VLAN ID*	send untagged
	tag = ingress interface *Default VLAN ID*	accept	preserve tag as received	send untagged
	tag ≠ ingress interface *Default VLAN ID* and is in *VLAN Active ID Table*	accept	preserve tag as received	send tagged as received
	tag ≠ ingress interface *Default VLAN ID* and is ***not*** in *VLAN Active ID Table*	drop		

The Bridge's Ethernet port *Switching Mode* and *Default VLAN ID* settings are covered in Section 3.7.6. Configuring these setting for radio BSSs is described in Section 3.3.4.5

VLAN Mode: Translate

In **Translate** *VLAN Mode*, the Bridge alters the VLAN ID in the VLAN tag according to a *routing map* (or *translation table*) that

you configure for each VLAN that the Bridge secures. The routable VLAN IDs received on clear interfaces are translated, according to the routing map, into non-routable IDs and transmitted on an encrypted interface, and vice versa (non-routable VLAN IDs received on encrypted interfaces are translated into routable IDs and transmitted on a clear interface).

Routable VLAN IDs must therefore be part of a trunk in the clear zone, and *Non-Routable* VLAN IDs must be part of a trunk on an encrypted port. VLAN IDs that are passed within the same zone do not have to be present in the VLAN routing map.

The Bridge can support up to 24 VLANs in translate mode: each translation requires two VLAN IDs, for a maximum of 48 VLAN IDs on the VLAN translation map.

If the Bridge's encrypted and clear interfaces reside on the same OSI layer-2 switch, use **Translate** mode.

NOTE: VLAN translation occurs only on traffic received in one zone (clear or encrypted) and transmitted in the other zone. VLAN IDs passed from one interface to another within the same zone are not translated.

3.9.2 Native VLAN

The native VLAN can be used as management VLAN, allowing you to use tagged traffic to manage the Bridge.

On an interface with a VLAN *Switching Mode* of **Trunk**, you can access the Bridge's management interface only with packets tagged with the Bridge's *Native VLAN ID*. You can manage the Bridge on an interface with a VLAN *Switching Mode* of **Access** only with untagged packets and only when the interface's *Default VLAN ID* matches the Bridge's global *Native VLAN ID*.

You can reconfigure the Bridge to use a native VLAN ID other than 1 (the default), which automatically adds the new number to the Bridge's VLAN ID table (described in Section 3.9.3). If the new ID is already present on the VLAN ID table, it will simply be selected as the *Native VLAN ID*.

VLAN functions are available only in Advanced View.

To configure basic VLAN settings

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> VLAN** from the menu on the left.
2. In the *VLAN Settings* frame, enter new values for those settings you want to configure (described above).
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).
4. If you selected a *VLAN Mode* of **Normal** or **Translate**, refer to Section 3.9.3 to configure additional VLANs. For **Translate** mode, refer to Section 3.9.4 to create VLAN map records.

You cannot configure VLANs when **STP** or **FastPath Mesh** is selected as the Bridge's *Bridging Mode* (refer to Section 3.2).

3.9.3 VLAN ID Table

The VLAN IDs you use on your network, for the native VLAN and for translate-mode mapping, are stored in the *VLAN ID Table*.

The contents of the table determine the VLANs available for assignment to the Bridge's interfaces. The *VLAN ID Table* defines the VLAN trunk for the Bridge, as used by all interfaces on the Bridge configured as **Trunk** ports. It is populated through any of several operations:

NOTE: There is only one VLAN trunk per Bridge, defined by the Bridge's *VLAN Active ID Table* and used by all **Trunk** ports.

- If, in **Configure -> VLAN ->** *VLAN Settings* (sections 3.9.1 and 3.9.2), you enter a VLAN ID not already present on the VLAN ID table as the *Native VLAN ID*, the new VLAN ID is automatically added to the table.
- If, in **Configure -> VLAN ->** *VLAN Translate Map Records* (Section 3.9.4), you enter a VLAN ID not already present on the VLAN ID table as a *Routable ID* or *Non-Routable ID*, the new VLAN ID is automatically added to the table.

NOTE: VLAN IDs added automatically to the VLAN ID table will remain on the table even if the Bridge is reconfigured to no longer use them.

- If, in **Configure -> Radio Settings ->** *BSS Interfaces* **-> EDIT/ ADD BSS** or in **Configure -> Switch Settings ->** *Switchports* **-> EDIT**, you enter a *Default VLAN ID* not already present on the VLAN ID table, the new VLAN ID is automatically added to the table.

  The settings that configure VLAN handling by the Bridge's Ethernet ports are described in Section 3.7.6; VLAN settings for radio BSS interfaces are covered in Section 3.3.4.5.
- You can manually add VLAN IDs to the VLAN ID table (below).

You can configure up to 48 VLAN IDs on the Bridge, using VLAN ID numbers **1**–**4094**, inclusive. VLAN IDs **0** and **4095** are reserved for internal use.

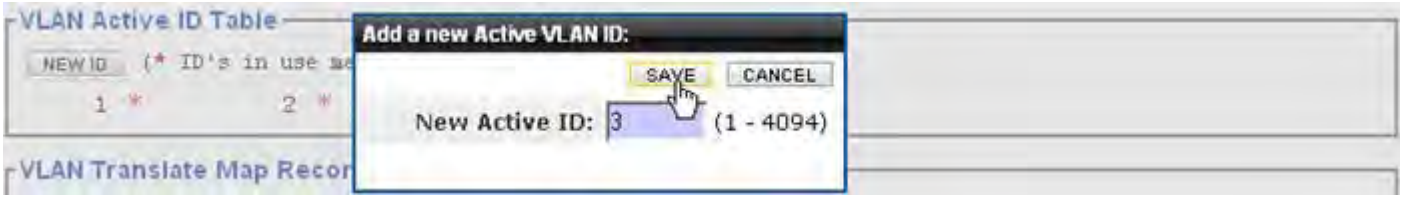


Figure 3.33. Advanced View *Add a new Active VLAN ID* dialog, all platforms

VLAN functions are available only in Advanced View.

To manually add VLAN IDs to the Bridge configuration

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> VLAN** from the menu on the left.
2. In the *VLAN Active ID Table* frame, click **NEW ID**.

3 In the resulting dialog, enter the ID number of the VLAN you want to add to the configuration and click **OK**.

The ID number of VLAN you added will be listed in the *VLAN Active ID Table*.

You cannot delete a VLAN ID from the Bridge configuration while it is in use, as indicated by a red asterisk to the right of the ID number.

The marked VLAN ID may be in use by one of the Bridge's Ethernet interfaces (Section 3.7.6), radio BSS interfaces (Section 3.3.4.5), or as the Native VLAN (Section 3.9.2); or the VLAN ID may be part of the VLAN translation map (Section 3.9.4). When you have reconfigured the Bridge so that the VLAN ID is no longer in use, you will be able to delete the VLAN ID from the configuration, as indicated by the checkbox to the right of the ID number.

To delete VLANs from the Bridge configuration

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> VLAN** from the menu on the left.

2 In the *VLAN Active ID Table*, click to check the box(es) of the VLAN(s) you want to delete (or check the boxes of all unused VLAN IDs with **ALL**).

3 Click **DELETE**.

4 Click **OK** in the confirmation dialog (or **Cancel** the deletion).

The ID numbers of VLANs you delete will be removed from the *VLAN ID Active Table*.

You cannot configure VLANs when **STP** or **FastPath Mesh** is selected as the Bridge's *Bridging Mode* (refer to Section 3.2).

3.9.4 VLAN Map Records

If you are using VLAN Translate mode (Section 3.9.1). you must create a VLAN translation map for your configuration:

To add VLAN map records to the Bridge configuration:

Figure 3.34. Advanced View *VLAN Map Record* frame, all platforms

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> VLAN** from the menu on the left.

2 In the *VLAN Translate Map Records* frame, click **NEW RECORD**.

3 On the resulting *Edit VLAN* screen, in *VLAN Map Record*:

- In *Record Name:* enter a descriptive name for the mapping record.
- In *Routable ID:* enter the routable VLAN ID for packets passed through the clear zone (to the wired LAN).
- In *Non-Routable ID:* enter the corresponding non-routable VLAN ID for packets passed through the encrypted zone (to the WLAN).

4 Click **APPLY** in the upper right of the screen (or **CANCEL** your addition).

The mapping records you create display at the bottom of the *VLAN Translate Map Records* frame on the VLAN screen.

To edit a VLAN map record

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> VLAN** from the menu on the left.

2 In the *VLAN Map Records* frame click the **EDIT** button for the record you want to change.

3 Change the settings you want to reconfigure (described above, and click **APPLY** in the upper right of the screen (or **CANCEL** your changes).

Your changes will be reflected in the record's entry at the bottom of the *VLAN Map Records* frame on the VLAN screen.

To delete VLAN map records

You can delete VLAN map records individually or all at once.

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> VLAN** from the menu on the left.

2 In the *VLAN Translate Map Records* frame:

- Click to check the box(es) of the record(s) you want to delete.

or

- Click **All** to select all map records.

3 Click **DELETE** at the top of the frame.

4 Click **OK** in the confirmation dialog (or **Cancel** the deletion).

The records you delete are removed from the *VLAN Translate Map Records* frame on the VLAN screen.

VLAN functions are available only in Advanced View, and you cannot configure VLANs when **STP** or **FastPath Mesh** is selected as the Bridge's *Bridging Mode* (refer to Section 3.2).

3.10 ES210 Bridge Serial Port Settings

The serial port on the front panel of the ES210 Bridge is configured by default to be used for **Console** port access to the Bridge CLI, as other Bridge model serial ports are used.

On the ES210 Bridge, you can reconfigure the serial port to instead connect the Bridge to an external third-party *Serial Sensor*, or another serial device.

When *Serial Sensor Settings* are **Enabled**, the serial port behaves like a serial terminal server, passing data between the specified TCP (Transmission Control Protocol) port and the device connected to the serial port. Serial data can be accessed using **`telnet ip_addr tcp_port`**, with no options.

Only one TCP connection at a time is permitted to the *Serial Sensor* TCP port. The ES210 Bridge can send data from and to the connected serial device over any of the Bridge's wired or wireless interfaces, under the security provisions configured for the interface and on the Bridge overall.

3.10.1 Configuring the Serial Port

Enabling *Serial Sensor Settings* disables the serial port for Bridge CLI access. The Bridge CLI remains accessible by a terminal emulation application over an SSH2 (Secure Shell 2) network connection, provided *SSH Access* is **Enabled** (the default; refer to Section 4.1.6).

NOTE: You must reboot the Bridge in order to change the function of the ES210 Bridge serial port.

Disabling the *Serial Sensor* function re-enables the port's Bridge CLI **Console** function and automatically returns serial port settings to the correct values for the Bridge CLI (baud rate: **`9600`**, parity: **none**, stop bits: **`1`**).

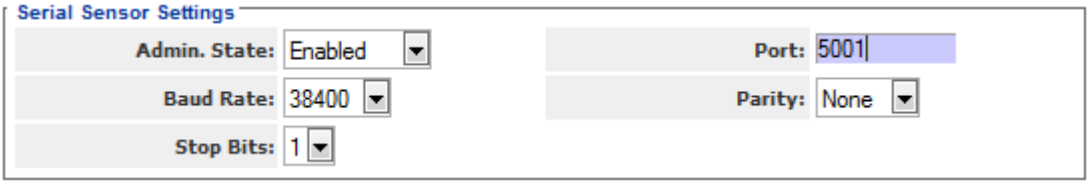


Figure 3.35. *Serial Sensor Settings* frame, ES210

Use *Serial Sensor Settings* to enable and configure the ES210 Bridge's serial port to connect to an external serial device.

- *Admin. State* - determines whether the port's *Serial Sensor* function and the rest of the configuration settings in the *Serial Sensor Settings* frame are **Enabled** or **Disabled** (the default). You must reboot the ES210 Bridge in order to change *Admin. State*, as directed below.
- *Port* - specifies the TCP port for the serial interface. Port values between **`5000`** and **`65534`** are valid; the default is port **`5001`**.
- *Baud Rate* - specifies the number of bits per second for the serial connection at **300**, **1200**, **2400**, **4800**, **9600** (the

automatic setting for the **Console** port), **19200**, or **38400** (the default when *Serial Sensor Settings* are **Enabled**).

- *Parity* - specifies whether the parity bit used for error checking results in an **Even** or **Odd** number of bits per byte or, with a setting of **None** (the default), that no parity bit should be added.
- *Stop Bits* - specifies whether the port should use a stop bit of **1** (the default) or **2**.

The serial port always uses 8 data bits per character and no hardware or software flow control.

To configure the ES210 serial port:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Serial Sensor** from the menu on the left.

2 In the *Serial Sensor Settings* frame, enter new values for those settings you want to configure (described above).

3 Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

4 If you changed the *Admin. State* in Step 2, reboot the ES210 Bridge according to the instructions in Section 6.1.2.

Restoring the ES210 Bridge's factory default configuration restores the serial port to the default Bridge CLI **Console** function.

CAUTION: Enabling the *Serial Sensor* function on the ES210 Bridge disables management access through the serial port.

3.10.2 Resetting the Serial Port

When the ES210 Bridge is enabled for and connected to an external serial device, you can manually restart the serial port's TCP session.

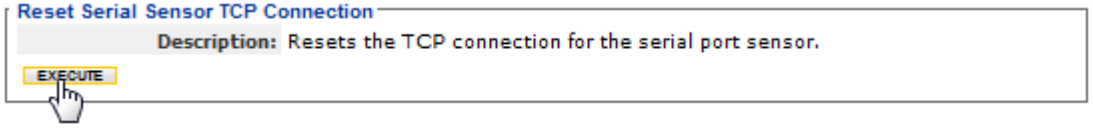


Figure 3.36. ***Reset Serial Sensor TCP Connection*** **frame, ES210**

To reset the ES210 serial port TCP session:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Serial Sensor** from the menu on the left.

2 In the *Reset Serial Sensor TCP Connection* frame, click **EXECUTE**.

Resetting the serial port has no effect when the *Serial Sensor* function is **Disabled**.

Chapter 4
Security, Access, and Auditing Configuration

4.1 Fortress Security

The *Security Settings* frame provides controls for various aspects of the Bridge's overall network security provisions: Fortress MSP (Mobile Security Protocol) functions including key establishment, data encryption and network Access ID; FIPS operation; global session timeouts; and several additional management and network access settings.

A number of Fortress *Security Settings* are available only in **ADVANCED VIEW**. Table 4.1 shows which settings are available in each view.

NOTE: Fortress MSP is not supported on an ES210 Bridge in *Station Mode* (refer to Section 3.3.5).

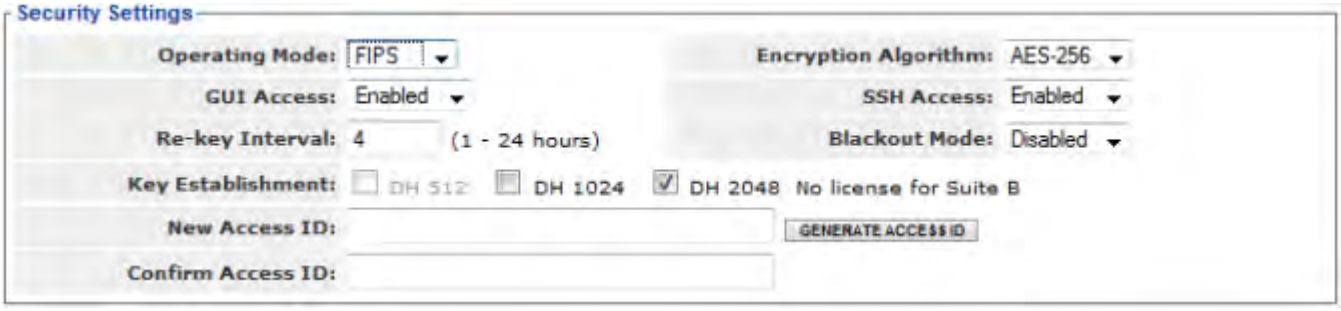


Figure 4.1. Simple View, Fortress *Security Settings* frame, all platforms

In addition, administrative password requirements and the retry, timeout and lockout parameters for administrative accounts are set on the *Security* screen, in the *Logon Settings* frame (as described in Section 2.2.1).

4.1.1 Operating Mode

The Fortress Bridge can be operated in either of two modes: *Normal* or *FIPS* (the default).

The rigidly enforced administrative requirements of *FIPS* operating mode are *required* by deployments and applications that must comply with the Federal Information Processing Standards (FIPS) for cryptographic modules. However, the high levels of security that can be implemented in *Normal* operating mode generally meet or exceed the needs of virtually

all networked environments that are not required to comply with FIPS.

As of this writing, FIPS operating mode in the current version of Bridge software is in the process of being validated as compliant with FIPS 140-2 Security Level 2. These Federal standards enforce security measures beyond those of *Normal* operating mode, the most significant of which include:

- Only a designated *Crypto Officer*, as defined by FIPS, may perform administrative functions on the Bridge and its Secure Clients. (The preconfigured *admin*, *Administrator*-level, account corresponds to the FIPS *Crypto Officer* role; refer to Section 2.2.)
- If the Bridge encounters a FIPS Error condition, it shuts down and reboots, running FIPS self-tests as a normal part of boot-up. If FIPS self-tests pass, the Bridge will return to normal operation. If FIPS self-tests fail, before any interfaces are accessible, the Bridge will again reboot. If the Bridge is unable to pass power-on self-tests, it will cycle perpetually through this reboot process. In this case, you must return the Bridge to your vendor for service or replacement.
- DH-512 and DH-1024 key establishment (Section 4.1.3) are no longer FIPS 140-2-compliant and are therefore not compatible with FIPS operating mode.

NOTE: Contact your Fortress representative for up-to-date information on the Bridge's FIPS validation status.

Regardless of the current operating mode, the Bridge can be configured to allow unencrypted data on encrypted interfaces by enabling *Cleartext Traffic* (refer to Section 4.1.10). In FIPS terminology, this indicates that the Bridge is in *Bypass Mode (BPM)*, as selectively permitted clear text can pass, along with any encrypted traffic, on encrypted interfaces (Ethernet ports or radio BSSs on which *Fortress Security* is **Enabled**).

NOTE: Only devices configured on the Bridge to pass clear text on encrypted interfaces are permitted to do so, even when *Cleartext Traffic* is enabled.

The Bridge GUI displays the current operating *Mode* and *Cleartext* traffic setting in the status fields in the upper left, above the main menu (refer to Section 5.1).

4.1.2 MSP Encryption Algorithm

The Bridge supports the strong, AES encryption standard at these user-specified key lengths:

- AES-256 (default)
- AES-192
- AES-128

All Secure Clients (and other Fortress controller devices) connecting to the Bridge must be configured to use the same encryption algorithm as the Bridge. For information on setting encryption algorithms on Fortress Secure Clients, refer to that product's user guide.

4.1.3 MSP Key Establishment

You can configure the method that the Bridge and its Secure Clients (and other connecting controller devices) use to establish data encryption keys.

In *Normal* operating mode (Section 4.1.1) the Bridge supports three Diffie-Hellman groups (DH groups) for key establishment—identified by the size of the modulus, in numbers of bits, used to generate the secret shared key:

- **DH-512** (*Normal* [non-FIPS] operating mode only)
- **DH-1024** (*Normal* [non-FIPS] operating mode only)
- **DH-2048** (default selection)

NOTE: On wireless networks, separate multicast packets are sent for each configured key group. To maximize throughput, limit the number selected.

When operating the Bridge in *FIPS* mode (Section 4.1.1), you cannot use DH-512 or DH-1024 key establishment, because the smaller Diffie-Hellman group moduli are no longer compliant with FIPS 140-2 Security Level 2.

When NSA (National Security Agency) Suite B[5] cryptography is licensed on the Bridge, an additional elliptic curve Diffie-Hellman key establishment method is available for selection: **Suite B** (specified by the NSA as compliant with the Suite B set of cryptographic algorithms). When Suite B is not licensed on the Bridge, the Bridge GUI displays a link to the features licensing page (refer to Section 6.3).

While a Secure Client can employ only one key establishment option at a time, the Bridge supports multiple key establishment selections, allowing connecting Clients to use any enabled key establishment option.

A Secure Client logging on to the Bridge must use a key establishment option enabled on the Bridge. For information on configuring key establishment on Fortress Secure Clients, refer to the Secure Client's user guide.

NOTE: Secure Client versions earlier than 3.1 support only DH-512 key establishment. If you need to support pre-3.1 Secure Client devices, you must include DH-512.

When two Fortress controller devices are connected, they will negotiate keys using the highest security option mutually supported by the devices.

When Suite B key establishment has been licensed on the Bridge, this option represents the highest available security.

Larger key moduli equate to more security for the standard Diffie-Hellman group key establishment options, as well. DH-512 is therefore the least secure DH group, and if you do not need the Bridge to support Secure Client versions earlier than 3.1 (which require DH-512), Fortress recommends more secure key establishment.

NOTE: DH-512 key establishment cannot be selected when a 32-digit Access ID (Section 4.1.17) is in effect.

Larger key moduli result in somewhat longer initial connection times.

Refer to the Suite B requirements specific to your site and implementation for guidance on Suite B.

5. Refer to Footnote 1 on page 2.

4.1.4 MSP Re-Key Interval

Fortress Bridges generate new keys at defined intervals, renegotiating dynamic keys with their Secure Clients whenever those Clients are logged on. You can specify the re-key interval, in hours, at values between 1 and 24. The default is 4.

At the default, for example, to decrypt data intercepted over a 12-hour period, a hacker would need to recover three sets of keys just from the Bridge, quickly enough to employ them before the next re-key—a highly unlikely possibility. Connecting devices' re-keying behaviors would generate additional key exchanges, and keys from the Bridge alone would not permit network access.

Every new key negotiation adds network traffic, and the increased security of shorter re-key intervals should be balanced against throughput considerations.

4.1.5 Access to the Bridge GUI

In order for the Bridge GUI to be usable, *GUI Access* must be **Enabled**. When *GUI Access* is **Disabled**, the Bridge can be managed exclusively through the Bridge CLI.

Access to the Bridge GUI is **Enabled** by default.

If you disable the Bridge GUI from within the interface, your current session will end. You must re-enable the Bridge GUI from the Bridge CLI before the former will again be accessible (refer to the *CLI Software Guide*).

4.1.6 Secure Shell Access to the Bridge CLI

In order for the Bridge CLI to be accessible via the network, Secure Shell (SSH®) must be **Enabled**. When *SSH Access* is **Disabled**, you can access the Bridge CLI exclusively through a direct connection to its **Console** port.

SSH Access is **Enabled** on the Bridge by default.

NOTE: The Bridge's command-line interface can always be accessed via a direct connection to the Bridge's serial **Console** port (refer to the ***CLI Software Guide***).

4.1.7 Blackout Mode

The *Blackout Mode* setting on the Fortress Bridge globally turns all chassis LEDs on and off.

When *Blackout Mode* is **Enabled**, none of the Bridge's LEDs will illuminate for any reason—except for a single, initial blink (green) of less than half a second, at the beginning of the boot process. When *Blackout Mode* is **Disabled** (the default), the LED indicators function normally.

You can also enable/disable blackout mode through chassis controls on some Bridge hardware models (refer to the *Hardware Guide* for the Bridge you are configuring) or through the Bridge CLI (refer to the *CLI Software Guide*).

4.1.8 FIPS Self-Test Settings

The Bridge runs a number of self-tests described in FIPS 140-2, (Federal Information Processing Standards' *Security Requirements for Cryptographic Modules*).

FIPS tests run—and self-test failures are logged—regardless of whether it is in *FIPS* or *Normal* operating mode. When the Bridge is in FIPS operating mode, it will additionally shut down and reboot upon the failure of any FIPS self-test, as required by FIPS 140-2 (refer to Section 4.1.1).

By default, FIPS tests run when they are automatically triggered or manually executed (refer to Section 6.1.7). FIPS tests are triggered regardless of FIPS settings. You cannot turn triggered FIPS testing off on the Bridge. FIPS test triggers include any security-related change to the Bridge's configuration (deleting a user, for example, or changing the re-key interval).

You can configure the Bridge to run additional FIPS tests periodically, and when periodic tests are enabled, you can configure the FIPS self-test run-interval (the default is **`86,400`** seconds, or 24 hours).

You can configure the interval at which the random number generator is reseeded (the default is **`86,400`** seconds, or 24 hours). You can also determine whether random number generator (RNG) tests are run routinely: continuous RNG tests are **Enabled** by default; when the Bridge is in FIPS operating mode they cannot be **Disabled**.

You can configure FIPS self tests only in Advanced View.

4.1.9 Encrypted Data Compression

You can configure whether or not data passed by devices on an encrypted interface on the Bridge (in the encrypted zone) is compressed. Data compression in the encrypted zone is enabled by default.

The compression settings of all Secure Clients (and other Fortress controller devices) on the Bridge-secured network must match: either enabled for all devices or disabled for all devices.

You can enable/disable data compression only in Advanced View.

4.1.10 Encrypted Interface Cleartext Traffic

By default, cleartext traffic—both received and transmitted—is blocked on a Bridge's encrypted interfaces (Ethernet ports or radio BSS on which *Fortress Security* is **Enabled**).

Encrypted-interface cleartext traffic must be enabled to support AP management rules on the Bridge and Trusted Device access to the Bridge's encrypted zone. In FIPS terminology, when clear text is enabled on the Bridge's encrypted interfaces, the Bridge is in *FIPS Bypass Mode*.

Disabling cleartext traffic on encrypted interfaces after AP management rules or Trusted Devices have been configured will not remove them from the configuration. Because these devices cannot decrypt encrypted traffic, however, the Bridge will not be able to communicate directly with them until cleartext traffic is permitted on encrypted interfaces. 802.1X devices will likewise be unable to access the Bridge-secured network when cleartext traffic on encrypted interfaces is blocked.

You can enable/disable cleartext traffic only in Advanced View.

NOTE: The current *Cleartext* traffic setting is shown in the upper left of all Bridge GUI screens (refer to Section 5.1).

4.1.11 Encrypted Interface Management Access

By enabling or disabling *Encrypted Interface Management*, you can control whether or not the Bridge's management interface can be accessed on interfaces enabled for Fortress Security (refer to sections 3.3.4.13 and 3.7.4 for wireless and Ethernet interfaces, respectively).

Encrypted Interface Management applies to any connection to an encrypted interface on the current Bridge:

- local Fortress Secure Client connections
- connections through a remote Fortress controller device
- bridging links between networked Fortress Bridges
- authorized clear devices when *Guest Management* is **Enabled** (Section 4.1.12, below)

Encrypted Interface Management is **Enabled** by default.

If *Encrypted Interface Management* is **Disabled**, you will be able to manage the Bridge only through a clear interface (or through the serial Console port).

You can enable/disable *Encrypted Interface Management* only in Advanced View.

4.1.12 Guest Management

You can control whether or not the Bridge's management interface can be accessed by authorized cleartext devices (Section 4.5.3) on encrypted interfaces on the Bridge by enabling or disabling *Guest Management*.

Guest Management is **Disabled** by default, and *Trusted Devices* are not allowed to access the Bridge's management interface.

The *Encrypted Interface Management* setting (Section 4.1.11, above) overrules *Guest Management*. When *Encrypted Interface Management* is **Disabled**, no management access is permitted

on any encrypted interface, including by configured cleartext devices, regardless of the *Guest Management* setting.

You can enable/disable *Guest Management* only in Advanced View.

4.1.13 Cached Authentication Credentials

When a device's session times out, the device is required to renegotiate encryption keys in order to reconnect to the network. When *Cached Auth. Credentials* is **Enabled** (the default), users of devices that have timed out are reauthenticated transparently, using cached user credentials. When the *Cached Auth. Credentials* is **Disabled**, such users are prompted to re-enter their usernames and passwords in order to re-establish their network connections.

You can enable/disable *Cached Auth. Credentials* only in Advanced View.

4.1.14 Fortress Beacon Interval

The Fortress Bridge transmits a key beacon at regular intervals to maintain active, secure connections to other Fortress devices on the local, Bridge-secured network. This enables immediate, secure communication between Fortress devices.

You can configure the number of seconds between Fortress beacons in whole numbers between 1 and 3000, or disable the Fortress beacon (by entering zero in the interval configuration field). The default beacon interval of 30 seconds is appropriate for most networks. Less frequent beacons (longer intervals) may be desirable where network bandwidth is in short supply.

You can configure the beacon interval only in Advanced View.

4.1.15 Global Client and Host Idle Timeouts

You can separately configure Secure Client connections to the Bridge's encrypted zone and host connections to the clear zone to be forcibly ended after a specified period of inactivity.

When local or external authentication is in effect for network users, the timeout settings configured globally on the applicable RADIUS server will override the *Client Idle Timeout* setting on the Security screen. For more detail on user timeout settings, refer to Section 4.4.

You can configure Client and host device timeouts, in minutes, from **`1`** to **`43,200`** (30 days). A setting of **`0`** (zero), disables timeouts. By default, both types of session timeout after 30 minutes of inactivity.

You can configure the Client and host device idle timeouts only in Advanced View.

NOTE: Administrator idle timeouts (Section 2.2.1.4) are separate from host and Secure Client devices idle timeout settings.

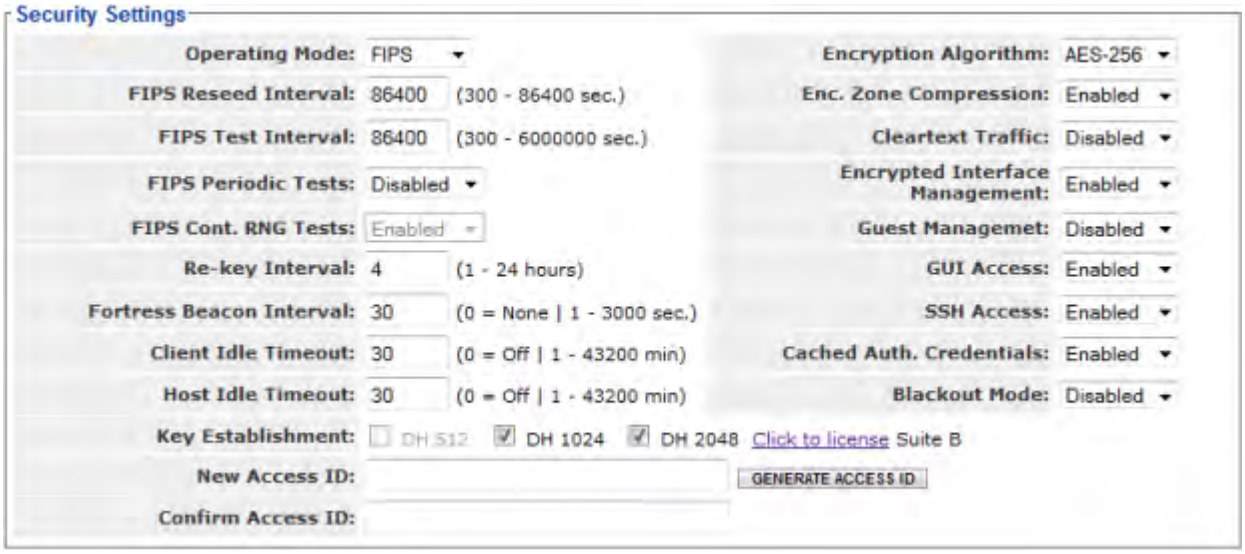


Figure 4.2. Advanced View, Fortress *Security Settings* frame, all platforms

4.1.16 Changing Basic Security Settings:

Table 4.1 shows which settings can be configured only in Advanced View.

Table 4.1. Security Settings

Simple & Advanced Views	Advanced View Only
Operating Mode	*FIPS Reseed Interval*
Encryption Algorithm	*FIPS Test Interval*
GUI Access	*FIPS Periodic Tests*
SSH Access	*FIPS Cont. RNG Tests*
Re-key Interval	*Enc. Zone Compression*
Blackout Mode	*Cleartext Traffic*
Key Establishment	*Secure Client Mgmt.*
Access ID	*Guest Management.*
	Cached Auth. Credentials
	Fortress Beacon Interval
	Client Idle Timeout
	Host Idle Timeout

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Security** from the menu on the left.
2. If you are configuring one or more Advanced View settings (see Table 4.1), click **ADVANCED VIEW** in the upper right corner of the page. (If not, skip this step.)
3. In the *Security* screen's *Security Settings* frame, enter new values for the settings you want to change (described in sections 4.1.1 through 4.1.14, above).
4. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

4.1.17 Fortress Access ID

The Access ID provides network authentication for the Fortress Security System. This 16- or 32-digit hexadecimal ID is established during installation, after which the same Access ID must be specified for all of the Bridge's Secure Clients (and other connecting Fortress controller devices).

Likewise, if you change the Bridge's Access ID, you must subsequently make the same change to all of its Secure Clients' Access IDs. For information on setting the Access ID on Secure Clients, refer to the Fortress Secure Client user guide.

You can manually enter either a 16-digit or a 32-digit hexadecimal Access ID of your own composition, or you can elect to have the Bridge randomly generate an Access ID and display the result for you to record.

NOTE: The default Access ID is represented by 16 zeros or the word, *default*. Manually entering either value returns the Bridge's Access ID to its default setting.

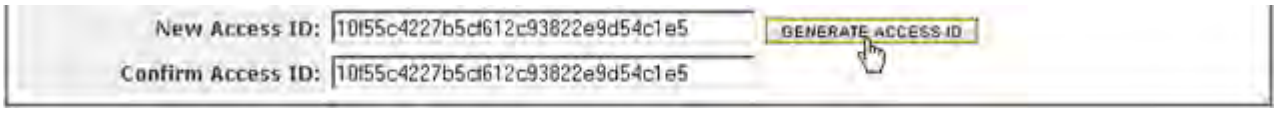


Figure 4.3. Fortress *Access ID* controls, all platforms

32-digit hexadecimal Access IDs are incompatible with DH-512 key establishment (described in Section 4.1.3). A manually entered 32-digit Access ID will not be accepted if DH-512 is selected for key establishment in the Bridge. The length of a randomly generated Access ID is determined by the key establishment selections in effect when you click the **GENERATE ACCESS ID** button: if DH-512 is selected, a 16-digit hexadecimal Access ID is generated; if DH-512 is *not* selected, a 32-digit hexadecimal Access ID is generated.

NOTE: Secure Client versions earlier than 3.1 support only 16-digit hexadecimal Access IDs.

Regardless of how you establish the Bridge's Access ID, ***you must make a record of the Access ID at the same time that you create it***. For security purposes, once you have left the screen on which you establish it, the Access ID can never again be displayed.

To change the Access ID:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Security** from the menu on the left.

2 On the *Security* screen's *Security Settings* frame:

If you want to randomly generate the Access ID to be used on the Bridge-*secured network:*

- Click **GENERATE ACCESS ID** to generate a 16-digit (when DH-512 key establishment is selected) or a 32-digit (when DH-512 is *not* selected) hexadecimal Access ID.
- Record the Access ID in a safe place. Once you have left the page on which it was generated, the Access ID can never again be displayed.

NOTE: A 32-digit Access ID cannot be configured when DH-512 key establishment (Section 4.1.3) is selected.

CAUTION: The Access ID cannot be displayed after it has been created.

or

If you want to manually enter a 16-digit or a 32-digit hexadecimal Access ID of your own composition:

- In *New Access ID* and *Confirm Access ID*, enter the 16- or 32-digit hexadecimal Access ID to be used by the Bridge and its Secure Clients.
- Record the Access ID in a safe place. Once you have left the screen on which it was initially established, the Access ID can never again be displayed.

3 Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

4.2 Internet Protocol Security

Fortress Bridges can be configured to secure private communications over public networks by implementing the IPsec protocol suite developed by the IETF (Internet Engineering Task Force) to protect data at the Network Layer (Layer 3) of the OSI model.

NOTE: Fortress's IPsec function is not yet supported on IPv6 networks.

Fortress's IPsec implementation uses:

- ISAKMP (Internet Security Association and Key Management Protocol) as defined in RFC 2408
- IKEv2 (Internet Key Exchange version 2) as defined in RFC 4306
- IPsec Tunnel Mode using ESP (Encapsulating Security Payload) as defined in RFC 4303
- Strong standards-based cryptographic algorithm suites including:
  - NSA (National Security Agency) Suite B[6]:
    - AES-128-GCM, 16B ICV[7]
    - AES-256-GCM, 16B ICV
  - Legacy AES-128-CBC (Cipher Block Chaining)

NOTE: Fortress devices do not initiate IKE v1 transactions, but will accept IKE v1 connections from legacy devices.

In IPsec Phase 1, ISAKMP is used to authenticate the initial Security Association (SA)—via digital signature or pre-shared key—and to encrypt the control channel over which IKE messages are exchanged. The Phase 1 IKE SA secures negotiation of the Phase 2 IPsec SAs over which network traffic is sent and received, according to the ESP protocol, using the specified encryption standard(s).

How IPsec is applied to traffic on the Bridge is determined by the Security Policy Database (SPD) entries configured—per interface—to apply a specified action to traffic selected by its source and destination subnets.

Once the function is enabled and configured, the Bridge functions as an IPsec gateway for the locally connected

6. Refer to Footnote 1 on page 2.
7. Advanced Encryption Standard-Galois/Counter Mode, 16-bit integrity check value

devices, using its own IP address as the IPsec peer address and conducting IKE transactions on behalf of (and transparently to) the devices it secures.

IPsec can be used alone or in conjunction with the Fortress Security settings described in Section 4.1.

4.2.1 Global IPsec Settings

IPsec is globally disabled by default. When you enable IPsec, you must also provide for at least one authentication method for ISAKMP connections:

- For IPsec peers to be authenticated via digital signature using an X.509 certificate, you must also have specified a locally stored key pair and certificate to authenticate the Bridge as an IPsec endpoint. Refer to Section 6.2.1 for guidance on creating an IPsec key pair.
- For IPsec peers to be authenticated by pre-shared keys, you must specify those keys, per peer (refer to Section 4.2.3, below).

Once IPsec is globally enabled and configured, you must specify at least one SPD entry (configured to **Apply** IPsec) on at least one Bridge interface, before the Bridge can send and receive IPsec-protected traffic (refer to Section 4.2.2).

Figure 4.4. IPsec *Global Settings* frame, all platforms

Global IPsec settings include:

- *Admin. State* - globally sets the Bridge's IPsec function to **Enabled** or **Disabled**.
- *Certificate Revocation List* - When the IPsec CRL function is **Disabled**, the default, certificates used to authenticate IPsec peers are not checked against the lists of certificates that have been revoked by their issuing authorities. When the IPsec CRL function is **Enabled**, peer certificate chains are traced back to a trusted root certificate and each certificate's serial number is checked against the contents of the issuing authority's CRL to verify that none of the certificates in the chain have been revoked, as described in RFC 3280.

- *Suites* - selects the cryptographic algorithm suite(s) that the Bridge will accept when acting as an IKE responder and will offer when acting as an IKE initiator.
  - **SuiteB 256** - AES-256-GCM, 16B ICV (default selection)
  - **SuiteB 128** - AES-128-GCM, 16B ICV (default selection)
  - **Legacy** - AES-128-CBC
- *SA Lifetime* - specifies a time- and/or data-limited lifespan at the end of which a new IKE transaction must be negotiated to establish new IPsec SAs for the connection:
  - in minutes *(mins.)* from **1** to **71,582,788** to determine how long the SA will be used before it expires, or specify **0** (zero) to impose no time limit.
  - in kilobytes *(KB)* from **1** to **4,294,967,295** to determine how much data will pass on the SA before it expires, or specify **0** (zero) to impose no data limit.

  If both fields are set to positive values, both apply, and whichever condition occurs first will cause the SA to expire. The default *SA Lifetime* is set, in minutes, at **240** (4 hours), with an *unlimited* amount of traffic permitted.

NOTE: Unlike Suite B *Key Establishment* options (Section 4.1.3), Suite B IPsec *Cryptographic Algorithm* options are available regardless of whether Suite B is licensed on the Bridge (Section 6.3).

To configure global IPsec settings:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> IPsec** from the menu on the left.
2. On the *IPsec Settings* screen's *Global Settings* frame, enter new values for the settings you want to change (described above).
3. Click **APPLY** in the upper right of the screen (or **CANCEL** your changes).

CAUTION: If you disable IPsec when the function is in use, all IKE and IPsec SAs will be immediately terminated, configured SPD entries will be disabled, and IPsec traffic will cease to be sent or received on any interface.

4.2.2 Interface Security Policy Database Entries

When IPsec is globally enabled and configured (refer to Section 4.2.1), each of the Bridge's network interfaces can be associated with up to 100 SPD entries.

An interface with one or more SPD configured for it is enabled to pass IPsec traffic. An interface with no SPD configured for it is disabled for IPsec traffic.

Each SPD entry defines the traffic to which it will apply by a specified local subnet of IP addresses—the source of outbound traffic and destination of inbound traffic. You can likewise specify a remote subnet of IP addresses to which an SPD will apply—defining traffic by its outbound destination/inbound source—as well as the IP address of the connecting device.

How traffic defined by an SPD entry will be handled is determined by the *Action* specified in the entry, as shown in Table 4.2.

Table 4.2. Configurable SPD Entry Actions

action	inbound packets	outbound packets
Apply	*must* be IPsec-protected	IPsec-encrypt and send as ESP
Bypass	must *not* be IPsec-protected	send unprotected by IPsec
Drop	drop without further processing	

Traffic on an interface that has no matching SPD definition will be handled according to whether *any* SPD entry has been configured for that interface:

- An interface with no SPD entry configured for it permits packets to pass unprotected by IPsec. Such an interface is a *red* interface, in IPsec terms, indicating the unprotected status of traffic on that interface.
- An interface with at least one SPD entry configured for it drops any packet that does not match (one of) the traffic selector(s) defined by the SPD entry(-ies) configured for that interface. In IPsec terms, such an interface is functioning as a *black* interface, indicating the secure status of any traffic passing on it.

NOTE: Devices that implement the IPsec model are sometimes referred to as ***red/black boxes***.

SPD entry settings include:

- *Policy Name* - identifies the SPD entry in the Bridge configuration.
- *Interface Name* and *BSS Name* - associates the SPD entry with a particular interface on the Bridge.

  The *Interface Name* dropdown provides a list of the Bridge's Ethernet interfaces. The *BSS Name* dropdown provides a list of BSSs currently configured on (one of) the Bridge's internal radio(s). Use only one of these dropdown lists to specify only a single Ethernet or wireless interface.

NOTE: A BSS must be already be present on a Bridge radio before it can be associated with an SPD entry.

- *Local Address* and *Local Mask* - defines the traffic to which the SPD entry will apply by the local subnet of IP addresses that will comprise the outbound source/inbound destination of that traffic.
- *Remote Address* and *Remote Mask* - defines the traffic to which the SPD entry will apply by the remote subnet of IP addresses that will comprise the inbound source/outbound destination of that traffic
- *Priority* - establishes the order in which the policy defined by the entry will be applied, from **`1`** to **`100`**, relative to other configured policies. *Priority* values must be unique. Policies with lower *Priority* numbers take precedence over those with higher *Priority* numbers.

- *Action* - determines how packets selected by the local and remote subnet parameters specified above will be handled:
  - **Drop** - drop packets without further processing (default selection)
  - **Bypass** - receive and send only packets unprotected by IPsec
  - **Apply** - receive and send only packets protected by IPsec
- *Peer Address* - if the *Action* to be applied by the SPD entry is **Apply**, you must identify the IP address of the remote device to and from which IPsec-protected traffic will be sent. If the *Action* is **Drop** or **Bypass**, no IPsec peer is expected for the SPD and you cannot enter an IP address in this field.

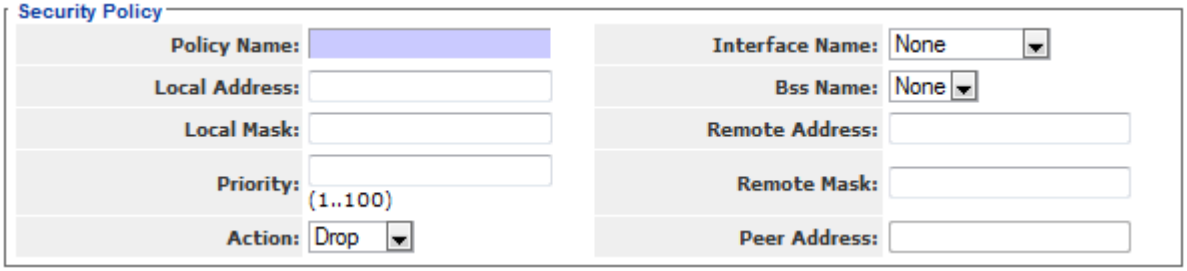


Figure 4.5. IPsec *Security Policy* Database entry frame, all platforms

To add an IPsec SPD entry to a Bridge interface:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> IPsec** from the menu on the left.
2. In the *IPsec Settings* screen's *Security Policies* frame, click **ADD SPD** and, on the resulting screen, enter valid values for the settings described above.
3. Click **APPLY** in the upper right of the screen (or **CANCEL** the addition).

The SPD entries you add are listed in the *Security Policies* frame.

To delete IPsec SPD entries:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> IPsec** from the menu on the left.
2. In the *IPsec Settings* screen's *Security Policies* frame:
   - If you want to delete a single SPD entry or selected entries, click to place a checkmark in the box(es) beside the entry(-ies) you want to eliminate.

   or

   - If you want to delete all SPD entries, click **ALL** at the top of the *Security Policies* list to check all entries.

   Click the *Security Policies* frame's **DELETE SPD** button.

Deleted SPD entries are removed from the *Security Policies* list.

4.2.3 IPsec Pre-Shared Keys

As an alternative to using a digital certificate, the identity a given IPsec peer can be authenticated by a static pre-shared key (PSK), as configured on both parties to the initial ISAKMP transaction.

PSKs on the Bridge can be specified as a string of ASCII characters or a series of hex bytes (hexadecimal pairs). Alternatively, you can generate a random key, of a specified length, expressed in hex bytes.

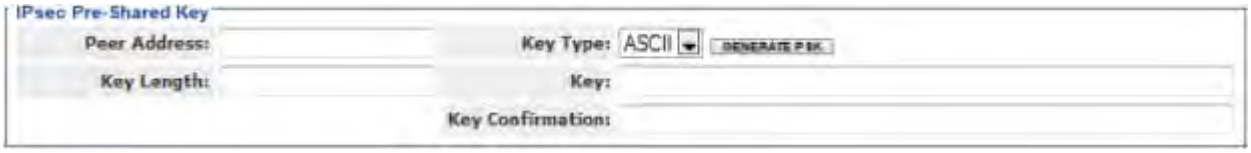


Figure 4.6. *IPsec PSK* settings frame, all platforms

To configure a PSK for an IPsec peer:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> IPsec** from the menu on the left.
2. In the *IPsec Settings* screen's *Pre-Shared Keys* frame, click **ADD PSK** and, on the resulting screen, in *Peer Address*, specify the IP address of the IPsec peer to be authenticated by the PSK.
3. On the same screen, establish the key to be used to authenticate the specified IPsec peer:
   - If you want to specify a key:
     - In *Key Type* - use the dropdown to specify whether the key you enter is an **ASCII** string or a series of **Hex** bytes.
     - In *Key* and *Key Confirmation* - enter a key in the format you specified above.

   or

   - If you want to automatically generate a random key:
     - In *Key Length* - optionally specify the number of bytes to comprise the key, from **1** to **64**. If you omit this value, the default key length is 32 bytes.
     - In *Key Type* - use the dropdown to specify whether an **ASCII** string or a series of **Hex** bytes should be generated, and click **GENERATE PSK**.
     - Record the resulting PSK. You must configure a matching key on the IPsec peer specified in Step 2.
4. Click **APPLY** in the upper right of the screen (or **CANCEL** the addition).

NOTE: The *Secret Length* parameter is ignored for manually entered PSKs.

The IP addresses of the IPsec peers for which PSKs are configured are listed in the *Pre-Shared Keys* frame.

To delete IPsec peer PSKs:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> IPsec** from the menu on the left.
2. In the *IPsec Settings* screen's *Pre-Shared Keys* frame:
   - If you want to delete the PSK for a single or selected IPsec peers, click to place a checkmark in the box(es) beside the IP address(es) of the peer(s) for which you want to delete the PSK(s).

   or

   - If you want to delete all IPsec peer PSKs, click **ALL** at the top of the *Pre-Shared Keys* list to check all IP addresses.

   Click the *Pre-Shared Keys* frame's **DELETE PSK** button.

The IP addresses of the IPsec peers whose PSKs are deleted are removed from the *Pre-Shared Keys* list.

4.2.4 IPsec Access Control List

An additional level of security can be provided in the Bridge's IPsec implementation via the IPsec ACL.

The function is enabled when at least one ACL entry is configured. It is disabled by default: no ACL entries are present.

When the IPsec access control function is enabled, the Bridge compares the Distinguished Names (DNs) contained in the X.509 digital certificates of authenticating IPsec peers against those recorded in the IPsec ACL. If no match is found, access is denied. If a match is found, access is allowed or denied according to the ACL entry's *Access* rule.

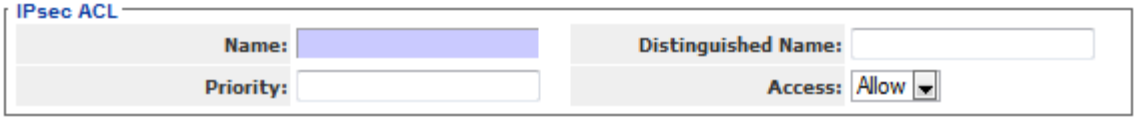


Figure 4.7. *IPsec ACL* entry frame, all platforms

You can configure up to 100 IPsec ACL entries to be applied in the specified priority. Settings include:

- *Name* - identifies the ACL entry in the Bridge configuration.
- *Distinguished Name* - specifies the DN pattern against which those in the X.509 certificates of IPsec peers will be matched. Each RDN (Relative Distinguished Name) in the sequence comprising the certificate DN is compared to the corresponding RDN specified in the IPsec ACL entry. You can use wildcard characters (*****) in the RDNs that comprise the *Distinguished Name* specified for an ACL entry.

  For example, the DN pattern:

  ```
  C=US, ST=Florida, O=*
  ```

matches the DN:
`C=US, ST=Florida, O="Fortress Technologies” OU=Engineering`

but does not match the DNs:
`C=US, ST=Florida, OU=Engineering`

`C=US, ST=Florida, L=Oldsmar, O="Fortress Technologies”`

- *Priority* - establishes the order in which the ACL entry will be applied, from **1** to **100**, relative to other configured ACL entries. *Priority* values must be unique. Entries with lower *Priority* numbers take precedence over those with higher *Priority* numbers.
- *Access* - determines whether the Bridge will **Allow** (the default) or **Deny** access to IPsec peers whose X.509 certificate DNs match the DN pattern of the entry.

To add an IPsec ACL entry:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> IPsec** from the menu on the left.
2. In the *IPsec Settings* screen's *IPsec ACLs* frame, click **ADD ACL** and, on the resulting screen, enter values for the settings described above.
3. Click **APPLY** in the upper right of the screen (or **CANCEL** the addition).

The ACL entries you add are listed in the *IPsec ACLs* frame.

To delete IPsec ACL entries:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> IPsec** from the menu on the left.
2. In the *IPsec Settings* screen's *IPsec ACLs* frame:
   - If you want to delete a single ACL entry or selected entries, click to place a checkmark in the box(es) beside the entry(-ies) you want to eliminate.

   or

   - If you want to delete all ACL entries, click **ALL** at the top of the *IPsec ACLs* list to check all entries.

   Click the *IPsec ACLs* frame's **DELETE ACL** button.

NOTE: Deleting all ACL entries disables the Bridge's IPsec ACL function.

Deleted ACL entries are removed from the *IPsec ACLs* list.

4.3 Authentication Services

The Bridge is equipped with an internal, or local, RADIUS (Remote Authentication Dial In User Service) server (Section 4.3.2). It can also be configured to use external authentication servers, both 3rd-party RADIUS servers and those of other Fortress Bridges to which the current Bridge is connected (Section 4.3.1).

Authentication is enabled on the Bridge when at least one authentication server is configured and enabled on the Bridge.

You can configure two types of authentication server for the network, depending on the network configuration:

- **Fortress Auth.** - identifies an authentication service running internally on a Fortress Bridge (either on the local Bridge or on a Fortress Bridge external to the current Bridge). A Bridge's internal authentication server is always available. Availability of external Fortress authentication servers depends on whether other Bridges configured for authentication are present on the network.
- **3rd Party RADIUS** - identifies a non-Fortress RADIUS server. The Bridge can be used with most standard RADIUS servers likely to be present on the network, including:
  - Microsoft® Internet Authentication Service (IAS) included in Windows® Server 2003
  - the open source freeRADIUS version 2.1

NOTE: If you are using an external RADIUS server, configure user timeouts in that service.

For each of the three possible authentication types (*Auth Types*) that you want the Bridge to support, you must specify at least one authentication server that supports that authentication type. *Auth Types* include:

- **User/Device Authentication** - 1) the user name and password, as supplied by the user logging in and configured locally or on an authentication server providing user authentication to the network, and 2) the unique, hexadecimal Device ID generated for each Secure Client device and used to authenticate it on a Fortress-secured network
- **802.1X** - supplicant credentials
- **Admin** - the user name and password of an administrator on the Bridge, as supplied by the administrator logging in and configured locally or on an authentication server providing administrative authentication over the network

CAUTION: Only the **Fortress Auth.** authentication server type supports both RADIUS user authentication and Fortress device authentication. **3rd Party RADIUS** servers do not support device authentication.

NOTE: Enabling 802.1X on any Ethernet port or using WPA or WPA2 BSS *Wi-Fi Security* options that do not use PSK (Section 3.3.4.14) all ***require*** that you configure an 802.1X authentication service on or for the Bridge.

Only Fortress RADIUS servers fully support all three types of authentication. Table 4.3 shows the authentication types supported by the two possible server types.

Table 4.3. Supported *Auth. Types* by Configurable Server *Type*

Authentication	Fortress Auth.	3rd Party RADIUS
User/Device	yes	user only
802.1X	yes	yes
Admin	yes	yes

In order to use a 3rd -party RADIUS server to authenticate Bridge administrators, the server must be configured to use Fortress's Vendor-Specific Attributes (*Fortress-Administrative-*

Role, *Fortress-Password-Expired*) and administrators must be configured on the server. Fortress Vendor-Specific Attributes are provided in the `dictionary.fortress` configuration file included on the Bridge software CD and are available for download at **www.fortresstech.com/support/**. Consult your external RADIUS server documentation for instructions on configuring the service

You can configure the same authentication server for more than one supported authentication type.

Even when no authentication server is configured for the Bridge, you can set global session idle timeouts for connected Secure Client and host devices connecting to the Bridge (Section 4.4).

If you are using the Bridge's internal RADIUS server, you can set local default timeout settings for authenticating Secure Client devices and users (Section 4.3.2) that will override the RADIUS-server-independent Secure Client idle timeout described above. Individual user and device timeout settings override the local defaults (Section 4.3.3).

Figure 4.8. Simple View, external *RADIUS Server* frames, all platforms

The Bridge can use up to four authentication servers at a time, although in Simple View you can configure only two. None is configured by default (as indicated by the blank *IP Address* and *Shared Key* fields in Simple View and the empty **Server List** in Advanced View).

More than one authentication server can be configured on the Bridge for purposes of redundancy. For a given authentication type, however, only the relevant server with the first priority will be used to check authentication credentials. The success or failure of a given authentication attempt is therefore determined solely by the active authentication server for that authentication type. That is, credentials are authenticated or failed by the

relevant server and failed credentials are not forwarded to any other server.

If the server with first priority for a given authentication type becomes unavailable, the next server in the priority sequence that has also been configured to support that authentication type will be used.

In Advanced View, where you can configure up to four RADIUS servers, you can specify the priority number of each. In Simple View, *RADIUS Server 1* has priority over *RADIUS Server 2*.

Advanced View also allows you to configure the maximum number of allowable authentication attempts and the retry interval for each server. These settings apply globally to all users and (if applicable) devices authenticated by that server.

4.3.1 Authentication Server Settings

External authentication servers can be added and reconfigured only through the settings described below.

Once the internal authentication server has been added to the Bridge configuration with the settings on the **Local Server** tab of the *RADIUS Settings* screen, you can reconfigure some aspects of its operation from its entry on the **Server List** or, in Simple View, in the corresponding *RADIUS Server* frame. However, the internal server can be added, and complete settings for it can be accessed, only on the **Local Server** tab, as described in Section 4.3.2.

4.3.1.1 Authentication Server State, Name, and IP Address

The *Admin State* setting determines whether the Bridge forwards authentication requests of the applicable type(s) to the server (**Enabled**) or not (**Disabled**).

You must specify a unique *Server Name* to identify an external server in the Bridge configuration. You cannot edit the *Server Name* once it is established.

You must specify the network *IP Address* of an external authentication server in order to add it to the Bridge configuration.

NOTE: The *Server Name* and *IP Address* of the internal RADIUS server (*Local Auth Sever* and *127.0.0.1,* respectively) are internally set and cannot be changed.

4.3.1.2 Authentication Server Port and Shared Key

The *Port* setting configures the UDP port to be used to communicate with the authentication server. The default authentication server port is **1812**, as assigned by the IANA (Internet Assigned Numbers Authority) for RADIUS server authentication.

Use the *New Shared Key* and *Confirm Shared Key* fields to establish the key used to authenticate the Bridge on the external authentication server.

NOTE: The server key you enter here should already be present in the authentication service configuration.

4.3.1.3 Server Type and Authentication Types

The *Server Type* setting identifies the type of authentication service running on the configured server, while *Auth Types* selections specify which type(s) of authentication credentials will be sent to the server. Refer to the description at the beginning of this section (Section 4.3) on page 133 for more detail.

4.3.1.4 Authentication Server Priority

In configurations with multiple authentication servers, *Priority* establishes the server's position in the order of redundant servers for the specified authentication type(s). Numerical values between **1** and **999** are accepted. The default value, **Last**, places the server last on the server priority list.

4.3.1.5 Authentication Server Max Retries and Retry Interval

The *Max Retries* setting determines how many times the Bridge will attempt to connect to the server before assuming it is unavailable and going on to the next relevant server on the priority list. You can configure **1** to **10** maximum connection attempts; the default is **3**. *Max Retries* is available in only Advanced View.

Retry Interval specifies how long the Bridge will wait between connection retries (above). *Retry Interval* is available only in Advanced View.

NOTE: You must enable the Bridge's internal authentication server in order to enable local authentication on the Bridge (refer to Section 4.3.2).

Figure 4.9. Advanced View, *Authentication Server* frame, all platforms

4.3.1.6 Configuring Authentication Servers

You can add external servers to the Bridge configuration through the settings described in sections 4.3.1.1 through 4.3.1.5, and you can reconfigure these settings for any RADIUS server already in the Bridge configuration. You can add the internal server to the configuration and access all of the settings associated with it only on the **Local Server** tab, in Advanced View (refer to Section 4.3.2).

Table 4.4 shows which of these settings can be configured in each Bridge GUI view.

Table 4.4. External Authentication Server Settings

Simple & Advanced Views	Advanced View Only
Admin. State *IP Address* *Server Name* *Port* *Auth Types* *Server Type* *New/Confirmed Shared Key*	*Priority* *Max Retries* *Retry Interval*

To configure a RADIUS server in Simple View:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> RADIUS Settings** from the menu on the left.
2. On the *RADIUS Settings* screen, enter new values for the *RADIUS Server 1* and/or *RADIUS Server 2* settings you want to change (described above).
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

To configure a RADIUS server in Advanced View:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> RADIUS Settings** from the menu on the left.
2. On the *RADIUS Settings* screen:
   - If you want to add a new server, click the **NEW SERVER** button in the upper left of the screen.

   or

   - If you want to edit an existing server, click the **EDIT** button to the left of its entry on the *Authentication Servers* list.
3. In the *RADIUS Settings* screen's *Authentication Server* frame, enter new values for the settings you want to change (described above).
4. Click **APPLY** in the upper right of the screen (or **CANCEL** your changes.)

4.3.2 The Local Authentication Server

Enable and configure the Bridge's internal RADIUS server and local user and device authentication, in Advanced View, on the **Local Server** tab of the *RADIUS Settings* screen.

4.3.2.1 Local Authentication Server State

The *Administrative State* setting turns the local authentication service on (**Enabled**) and off (**Disabled**, the default).

4.3.2.2 Local Authentication Server Port and Shared Key

The *Port* setting configures the port to be used to communicate with the local authentication server. The default authentication server port is **1812**, as assigned by the IANA (Internet Assigned Numbers Authority) for RADIUS server authentication.

Use the *New Shared Key* and *Confirm Shared Key* fields to establish the shared key for the Bridge's internal authentication server. The key must be 1–16 (inclusive) characters in length, and it can contain any printable character. The same key must be configured on other Fortress controller devices when they are configured to use the current Bridge's authentication server.

4.3.2.3 Local Authentication Server Priority

In configurations with multiple authentication servers, *Priority* establishes the server's position in the order of redundant servers for the specified authentication type(s). Numerical values between **1** and **999** are accepted. The default value, **Last**, places the server last on the server priority list.

4.3.2.4 Local Authentication Server Max Retries and Retry Interval

The *Max Server Retries* setting determines the maximum number of unsuccessful local authentication attempts a user or device is allowed before being locked out. You can specify whole numbers between **1** and **10**; the default is **3**.

A devices that exceeds the maximum allowable retry attempts to authenticate on the Bridge is locked out until the device's individual *Auth State Mode* is set to **Allow First**. Such a device is locked out on every Bridge in a network, and you must change the device's *Auth State Mode* on every Bridge that handles traffic from the device.

Users who exceed the maximum allowable retry attempts to log on to the Bridge-secured network are locked out until you reset their sessions. On a network of Bridges, you must reset the session on each Bridge that passes traffic for the device.

Retry Interval specifies how long the Bridge requires a user or device to wait between connection retries.

4.3.2.5 Local Authentication Server Default Idle and Session Timeouts

The *Default Idle Timeout* setting determines the amount of time a device can be idle on the network before the current session is ended and the associated Device ID and/or user credentials must be reauthenticated and keys renegotiated before the connection can be re-established. If local user authentication is in effect for the device and *Permit cached authentication credentials* is globally **Disabled** on **Configuration -> Security**

(Section 4.1.13), the user will be prompted to re-enter a valid username and password.

Set *Default Idle Timeout* in minutes, between **1** and **720**. The default is **30** minutes.

The *Default Session Timeout* - setting determines the amount of time a device can be present on the network before the current session is ended and the associated Device ID and/or user credentials must be reauthenticated and keys renegotiated before the connection can be re-established. If local user authentication is in effect for the device, the user will be prompted to re-enter a valid username and password.

Set *Default Session Timeout* in minutes, between **1** and **200**. The default is **30** minutes.

4.3.2.6 Local Authentication Server Global Device, User and Administrator Settings

The *Default Device State* setting globally determines the default connection state of devices auto-populating the device authentication screen and of devices with an individual *Auth State Mode* setting of **Defer** (the default, Section 4.3.3.2):

- **Allow** - the device will be allowed to connect (provided its individual *Auth State Mode* is **Allow First** or **Defer** and a compatible *Key Length* has been specified for the device).
- **Pending** - (the default) the connection requires administrator action: explicitly changing the device's individual *Auth State Mode* to **Allow First** (or you can explicitly **Deny All** attempted key exchanges for a device), as described on page 147.
- **Deny** - the device is not allowed on the network (provided it is not already present on the **Device Authentication** tab with an individual *Auth State Mode* of **Allow First**).

NOTE: Individual device authentication settings for devices already present on the Bridge's **Device Authentication** tab (whether you added them manually or edited their entries) override the global *Default Device State* setting on the local authentication server.

Whether device authentication is enabled and, if so, whether devices populating the device authentication database have user authentication enabled or disabled by default is determined by *Authentication Method*:

- **User auth only** - disables device authentication on the Bridge.
- **Device auth with user auth by default** - enables device authentication on the Bridge and enables user authentication by default for new devices auto-populating the **Device Authentication** tab on *Local Authentication*.
- **Device auth without user auth by default** - enables device authentication on the Bridge and disables user authentication by default for new devices.

The *Administrator Authentication* setting enables support for administrator authentication (**Enabled**) or disables it (**Disabled**, the default). Refer to Section 2.2.1.6 for more detail.

4.3.2.7 Local 802.1X Authentication Settings

The Bridge's internal RADIUS server can be configured to authenticate 802.1X supplicant credentials using two possible EAP (Extensible Authentication Protocol) types.

EAP-MD5 verifies an MD5 (Message-Digest algorithm 5) hash of each user's password, which requires a user's credentials to be present in the Bridge's local user authentication service before the local 802.1X service can authenticate that user. Refer to Section 4.3.3.1 for guidance.

NOTE: EAP-TLS provides a significantly higher level of security than **EAP-MD5**.

In order to use EAP-TLS (EAP with Transport Layer Security) public key cryptography authentication, you must import a valid EAP-TLS digital certificate for the local service and the root CA (Certificate Authority) certificate that signs the local server certificate. You must also import any root CA certificate(s) used to sign supplicant certificates, so that the local server can verify their authenticity. Refer to Section 6.2 for guidance. In addition, as noted below, three local server configuration settings apply only when **EAP-TLS** is selected for *EAP Protocols*.

- *802.1X Authentication* - turns the service on (**Enabled**) and off (**Disabled**, the default).
- *CRL Check* - for EAP-TLS only, determines whether certificates used to authenticate 802.1X supplicants are checked against the lists of certificates that have been revoked by their issuing authorities. *CRL Check* is **Disabled** by default. When the function is **Enabled**, supplicant certificate chains are traced back to a trusted root certificate and each certificate's serial number is checked against the contents of the issuing authority's CRL to verify that none of the certificates in the chain have been revoked, as described in RFC 3280. *CRL Check* does not apply to EAP-MD5 authentication.
- *Strict Check* - for EAP-TLS only, controls strict checking of key usage and extended key usage extensions in the authentication server certificate. *Strict Check* is **Enabled** by default; you can turn it off by selecting **Disabled**. *Strict Check* does not apply to EAP-MD5 authentication.
- *TLS Cipher* - for EAP-TLS only, specifies the list of supported cipher suites, or sets of encryption and integrity algorithms, that the 802.1X service will accept:
  - **All** - the default, supports both **Legacy** and **Suite B** cipher suites (below)
  - **Legacy** - supports Diffie-Hellman with RSA keys (DHE-RSA-AES128-SHA and DHE-RSA-AES256-SHA)
  - **Suite B** - supports Diffie-Hellman with ECC keys (ECDHE-ECDSA-AES128-SHA and ECDHE-ECDSA-AES256-SHA)

In EAP-TLS, the authentication server selects the cipher suite to use from the list of supported suites sent by the client device (or rejects the authentication request if none of the proposed suites are acceptable). *TLS Cipher* does not apply to EAP-MD5 authentication.

- *EAP Protocols* - specifies the EAP type(s) the Bridge can use to authenticate 802.1X supplicant credentials:
  - **EAP-MD5** - (default selection) permits the Bridge to authenticate a supplicant using an MD5 hash of the user's password.
  - **EAP-TLS** - when there is a valid EAP-TLS certificate in the Bridge's local certificate store (refer to Section 6.2), permits the Bridge to authenticate a supplicant using public key cryptography.

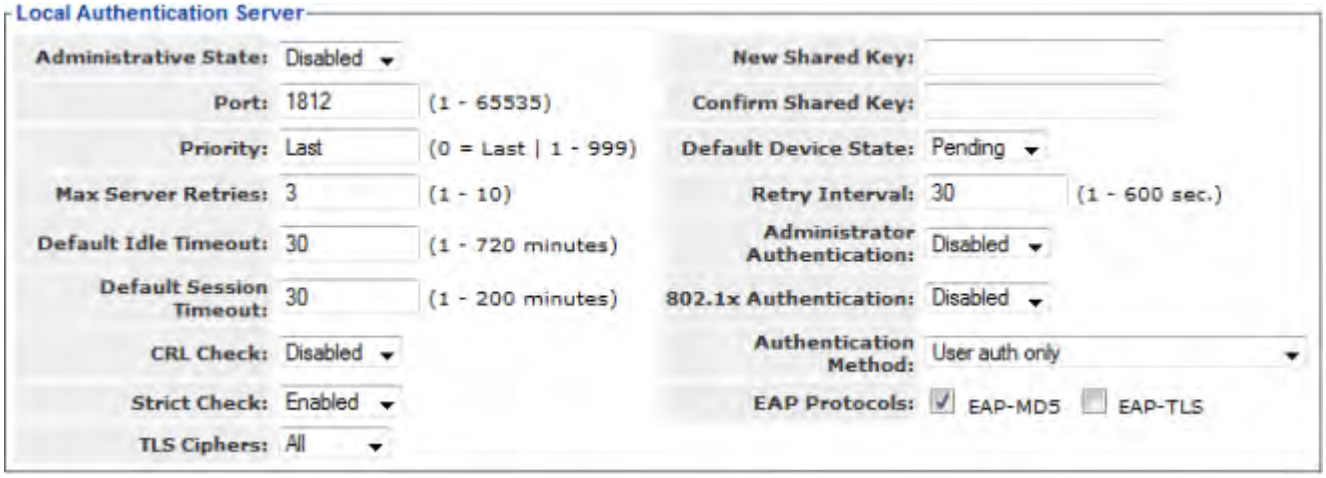


Figure 4.10. Advanced View *Local Authentication Server* tab, all platforms

4.3.2.8 Configuring the Local RADIUS Server

You can configure local authentication only in Advanced View.

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> RADIUS Settings** from the menu on the left.
2. On the *RADIUS Settings* screen, click the **Local Server** tab.
3. In the *Local Authentication Server* frame, enter new values for the settings you want to configure (described above).
4. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

4.3.3 Local User and Device Authentication

You can configure user and device authentication settings even when the Bridge's local authentication is disabled (the default). The settings will only be applied when the local RADIUS server is enabled (refer to Section 4.3.2).

NOTE: When using an external authentication server, user and (when applicable) device authentication settings are configured in the external application.

4.3.3.1 Local User Authentication Accounts

Locally authenticating users are displayed on the *User Entries* list on **Configure -> RADIUS Settings -> Local Server**.

You cannot disable local user authentication, per se, except by disabling local authentication entirely. There is, however, no requirement that you configure local users.

The users for whom you create accounts can fall into one of two categories:

- Secure Client users - are running the Fortress Secure Client on their connecting devices. They use the Bridge's local user authentication service to log on to the Bridge-secured network. Secure Client users pass only encrypted traffic on the Bridge's encrypted interfaces.
- Administrative users - use the Bridge's local user authentication service to log on to the management interface of another Fortress Bridge on the network (or of the local Bridge), when the administrative *Authentication Method* on that Bridge is set to **RADIUS**. Administrative users pass only encrypted traffic on the Bridge's encrypted interfaces.
- When an administrative user logs on to the Bridge through a local or remote Fortress *user* authentication database (as configured on the relevant **Local Server** screen), a *Learned* administrative account is created for that user in the *administrator* authentication database. You can optionally convert a *Learned* account to a local administrative account that can be used if the original user authentication service becomes unavailable (refer to Section 2.2.2.8).
- One can optionally convert the learned account(s) to local account(s) that can be used when external admin auth is disabled.
-

Default User Authentication Settings

While idle timeout and session timeout settings can be individually configured for each user, the default values for these settings are determined by the *Default Idle Timeout* and *Default Session Timeout* values configured on the local RADIUS server (refer to Section 4.3.2).

Individual User Authentication Settings

User authentication on the Fortress Bridge requires the usual settings to identify, track and manage access for each user on the Bridge-secured network.

Figure 4.11. Advanced View *User Database Entry* frame, all platforms

- *Administrative State* - determines whether user access to the account is **Enabled** (the default) or **Disabled**.
- *Username* - identifies the user on the network—from 1 to 16 alphanumeric characters—required.
- *Full Name* - associates the person, by name, with his/her user account—up to 64 alphanumeric characters, including spaces, dashes, dots and underscores—optional.
- *New/Confirm Password* - establishes the credentials the user must key in to access his/her user account—must comply with the password requirements configured in **Configure -> Security ->** *Logon Settings* (Section 2.2.1.8)—required.
- *Role* - Determines whether the user is a Secure Client user permitted access to only the Bridge-secured network (**None**) or an administrator permitted access to both the network and to the management interface of a remote or local Bridge—at the specified level of privileges (**Log Viewer**, **Maintenance**, or **Administrator**).

NOTE: Administrative roles are described in Section 2.2.2.3.

- *Idle Timeout* - sets the amount of time the user's device can be idle on the network before it must renegotiate keys with the Bridge.

  Idle Timeout is set in minutes, between **1** and **720**. If you enabled *Local Authentication* while leaving the local authentication server's *Default Idle Timeout* setting at its default, the *Idle Timeout* value in the *User Authentication Setting* frame will be **30** minutes.

- *Session Timeout* - sets the amount of time the user's device can be present on the network before the current session is ended and he/she must log back in to re-establish the connection.

  Session Timeout is set in minutes, between **1** and **200**. If you enabled *Local Authentication* while leaving the local authentication server's *Default Session Timeout* setting at its

default, the *Session Timeout* value in the *User Authentication Setting* frame will be **20** minutes.

You can add and edit locally authenticated users only in Advanced View.

To configure locally authenticated user accounts:

An existing account's *Username* cannot be changed, but you can edit any other value associated with a user account

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> RADIUS Settings** from the menu on the left.
2. On the *RADIUS Settings* screen, click the **Local Server** tab.
3. In the *User Entries* frame:
   - If you are adding a user, click **NEW USER** and enter valid values (described above) into the *User Database Entry* frame.

   or

   - If are editing an existing account, click the **EDIT** button for the account you want to reconfigure and enter new values for the settings you want to change.
4. Click **APPLY** in the upper right of the screen (or **CANCEL** the addition).

Newly created accounts are added to the *User Entries* list.

Figure 4.12. Advanced View *User Entries* frame, all platforms

To delete local user accounts:

You can delete a single user account, selected accounts, or all user accounts from the Bridge's internal RADIUS server.

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> RADIUS Settings** from the menu on the left.
2. On the *RADIUS Settings* screen, click the **Local Server** tab.
3. In the *User Entries* frame:
   - If you want to delete a single user account or selected accounts, click to place a checkmark in the box(es) beside the account(s) you want to eliminate.

   or

   - If you want to delete all local user accounts, click **ALL** at the top of the *User Entries* list to check all accounts.

Click the *User Entries* frame's **DELETE** button.

4 Click **OK** in the confirmation dialog.

Deleted accounts are removed from the *User Entries* list.

4.3.3.2 Local Device Authentication

Fortress's device authentication assigns each Fortress device, including those running the Fortress Secure Client, a unique Device ID subsequently used to authenticate the device for access to the Fortress-secured network.

The Bridge's native device authentication settings apply only to devices authenticating through the Bridge's internal authentication server.

When device authentication is enabled, the Bridge detects devices attempting to access the Bridge's encrypted zone and lists them on **Configure -> RADIUS Settings -> Local Server**, in the *Device Entries* frame.

You can also manually add devices to the Bridge's *Device Entries* list. In order to add a device manually, you must specify its MAC address and Fortress-generated Device ID.

NOTE: Device authentication is supported only by the authentication servers internal to Fortress controller devices; 3rd-party RADIUS servers do not support device authentication.

Default Device Authentication Settings

As devices auto-populate the *Device Entries* list., they are permitted or denied immediate access to the network based on the *Default Device State* setting on the (**Configure -> RADIUS**) **Local Server** tab:

- **Allow** - devices will be allowed to connect by default.
- **Pending** - (the default) connections require an administrator to change individual device authentication settings to **Allow**.
- **Deny** - devices are not allowed on the network by default.

You can also configure whether user authentication is enabled or disabled by default for auto-populating devices.

All *Local Authentication Server* settings are described in Section 4.3.2).

To enable device authentication and configure defaults:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> RADIUS Settings** from the menu on the left.

2 On the *RADIUS Settings* screen, click the **Local Server** tab.

3 In the *Local Authentication Server* frame:

- Verify that *Administrative State* is **Enabled** and that *Port* and *Shared Key* are correctly configured (Section 4.3.2).
- From the *Default Device State* dropdown choose a default state (described above) for auto-populating devices.

- In *Authentication Method*, simultaneously enable device authentication and configure the default user authentication setting, by selecting one of:
  - **Device auth with user auth by default** - enables user authentication for new devices by default.
  - **Device auth without user auth by default** - disables user authentication for new devices by default.

4 Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

Connecting devices will auto-populate the *Device Entries* list with the defaults you configured.

Individual Device Authentication Settings

When device authentication is enabled (above), connecting devices auto-populate the Bridge's *Device Entries* list, and any manually created device authentication accounts on the Bridge are applied to the devices they specify.

The Fortress Bridge tracks and manages access for devices on the Fortress-secured network through two identifiers: the device's MAC address and its Fortress-generated Device ID.

NOTE: The Device ID of the current Bridge is shown on **Configure -> Administration**, in the *System Info* frame at the top of the screen.

When a device auto-populates the *Device Entries* list, these values are detected and entered for the device. When you manually add a device, you must specify its MAC address and Device ID. Consult the relevant Fortress documentation for the device you are adding for information on determining its Fortress Device ID.

The values and settings that configure individual device authentication accounts include:

- *Administrative State* - Determines whether the device is **Enabled** (the default) or **Disabled** for network access.
- *Device ID* - a unique, 16-digit hexadecimal identifier generated for the device and used to authenticate it on the network

  Once a Fortress Device ID has been generated for a device, it is not user configurable. If you are manually adding a device, you must specify its valid, Fortress Device ID. Once established (manually or automatically), the Device ID cannot be changed.
- *MAC Address* - the device's MAC address

  If you are manually adding a device, you must specify its MAC address. Once established (manually or automatically), the MAC address cannot be changed.
- *Common Name* - accepts up to 64 alphanumeric characters by which you can identify the device.

  If a device has a hostname associated with it (the hostname of a laptop running the Fortress Secure Client,

for instance), that hostname is included for the device when it is first added to the *DEVICE AUTHENTICATION* screen. If no hostname is associated with the device, it will be added without one. You can edit an existing hostname or add one for a device that has no hostname.

- *User Auth* - configures whether the Bridge will require the device's user to authenticate before allowing the device to connect to the encrypted zone (**Enabled**) or allow the device access without user authentication (**Disabled**).
- *Auth State Mode* - configures the initial state of the device's connection to the encrypted zone:
  - **Allow First** - the device will be allowed to connect using the first key establishment method it attempts to use. Once the device is connected the Bridge will automatically detect any other key establishment methods the connecting device supports, and you can specify those you wish to allow the device to use for subsequent connections to the network. If you want the device to be able to use a supported key establishment method other than that used for the initial connection, you must manually enable it for the device.
  - **Deny All** - prevents all access to the network; all the device's attempts to exchange keys will be denied.
  - **Defer** - whether the device is allowed to connect depends upon the local authentication server's *Default Device State* setting (Section 4.3.2).
- *Authed Keys* - after a device has been added to the Bridge's device authentication database and allowed to connect, you can specify the key establishment method(s) the device will be allowed to use for subsequent connections. Available options are limited to the key establishment method(s) the device has previously used to try to connect. No *Authed Keys* are selected by default

You can add and edit locally authenticated Secure Client devices only in Advanced View.

Figure 4.13. Advanced View *Device Database Entry* frame, all platforms

To configure locally authenticated Secure Client device accounts:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner

of the page, then **Configure -> RADIUS Settings** from the menu on the left.

2 On the *RADIUS Settings* screen, click the **Local Server** tab.

3 In the *Device Entries* frame:

- If you are adding a device, click **NEW DEVICE** and enter valid values (described above) into the *Device Database Entry* frame.

or

- If you are editing an existing account, click the **EDIT** button for the account you want to reconfigure and enter new values for the settings you want to change.

4 Click **APPLY** in the upper right of the screen (or **CANCEL** the addition).

Newly created accounts are added to the *Device Entries* list.

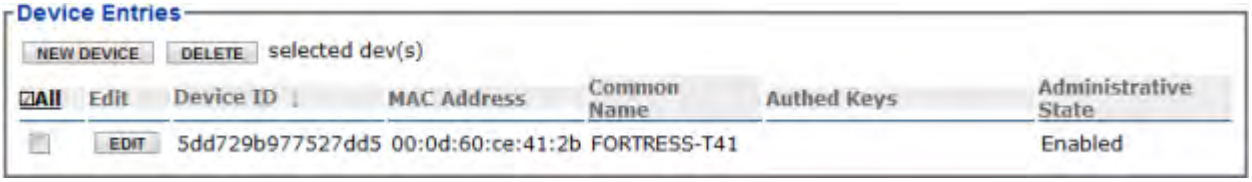


Figure 4.14. Advanced View *Device Entries* frame, all platforms

To delete Secure Client device accounts:

You can delete a single device account, selected accounts, or all device accounts from the Bridge's internal RADIUS server.

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> RADIUS Settings** from the menu on the left.

2 On the *RADIUS Settings* screen, click the **Local Server** tab.

3 In the *Device Entries* frame:

- If you want to delete a single device account or selected accounts, click to place a checkmark in the box(es) beside the account(s) you want to eliminate.

or

- If you want to delete all local device accounts, click **ALL** at the top of the *Device Entries* list to checkmark all accounts.

Click the *Device Entries* frame's **DELETE** button.

4 Click **OK** in the confirmation dialog.

Deleted accounts are removed from the *Device Entries* list.

4.4 Local Session and Idle Timeouts

When their connections to the Bridge have not passed traffic for a specified number of seconds, devices are cleared from the Bridge's database of currently connected devices. When a

device's session is idle timed out by the Bridge in this way, the device must re-establish its connection; if it is re-accessing an encrypted zone it must also reauthenticate.

Idle timeouts can be configured for two types of devices:

- *Secure Client devices* - are the devices running the Fortress Secure Client to connect to the Bridge's encrypted zone.
- *Host devices* - are devices in the Bridge's clear zone.

Host idle timeouts can be set in only one place in the Bridge GUI, only in Advanced View, on **Configure -> Security ->** *Security Settings* **->** *Host Idle Timeout* (refer to Section 4.1.15).

The Bridge GUI provides more than one configuration field for Secure Client idle timeouts, to accommodate different authentication scenarios and administrative options:

- **Configure -> Security ->** *Security Settings* **->** *Client Idle Timeout* allows you to configure global and individual Secure Client idle timeouts when local authentication is not enabled (refer to Section 4.1.15).
- **Configure -> RADIUS Settings -> Local Server->** *Default Idle Timeout* globally determines the default Secure Client timeout on the Bridge's local authentication server. When local authentication is enabled, this setting overrides the timeout configured on the *Security* screen (refer to Section 4.3.2).
- **Configure -> RADIUS Settings -> Local Server-> NEW USER/ EDIT ->** *Idle Timeout* determines the individual Secure Client's idle timeout on the Bridge's local authentication server. This setting overrides the default user timeout setting (refer to Section 4.3.3).

NOTE: Idle timeout settings for network users' connecting devices are distinct from the globally configured session idle timeout for administrators (Section 2.2.1.4).

In addition, you can set global and individual *session* timeouts for locally authenticated users on the second and third screens described above.

When FastPath Mesh is licensed and enabled, global idle timeout values for all types of devices are controlled by software, rather than by configured (or default) global values. Individual user timeout settings, however, continue to override global values, as described.

4.5 ACLs and Cleartext Devices

The first Access Control List (ACL) on **Configure -> Access Control**, *IP Access Whitelist*, applies exclusively to administrative connections to the Bridge's management interface and is covered in Section 2.2.3 with the other administrative access configuration settings.

There is also an ACL associated with the Bridge's IPsec function, which is covered in Section 4.2.4 with the other IPsec configuration settings.

The remaining access Access Control functions are covered below. These prevent, or define limits for, overall network access, whether by administrators or users.

4.5.1 MAC Address Access Control

The Bridge allows you to create and maintain an ACL of MAC (Media Access Control) addresses permitted to access the Bridge-secured network.

When the *MAC Access Whitelist* is **Enabled**, only those MAC addresses present on the list will be permitted to access the Bridge-secured network.

> **CAUTION:** If you ignore the relevant warning, you can block all network access by having the *MAC Access Whitelist* **Enabled** when there are no MAC addresses listed. Access can be restored only by reconfiguring the function via a direct physical connection to the Bridge's **Console** port.

To control network access by specified MAC addresses:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Access Control** from the menu on the left.
2. In the resulting screen's *MAC Access Whitelist* frame, click **NEW MAC**.

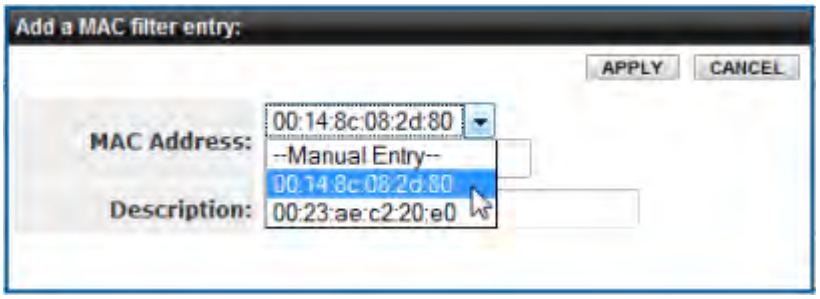


Figure 4.15. Advanced View *Add a MAC filter entry* dialog, all platforms

3. In the resulting *Add a MAC Filter Entry* dialog, select your current MAC address from the dropdown list above the *MAC Address* field (or manually enter the address) and optionally enter a *Description* for the entry. Then click **APPLY**.
4. Repeat steps 2 and 3 for any additional MAC addresses from which you want to permit network access.

   Only MAC addresses of devices currently connected to the network will be present in the dropdown list. To add a device that is not currently connected, you must leave the dropdown at its default, **Manual Entry**, and manually enter its MAC address.

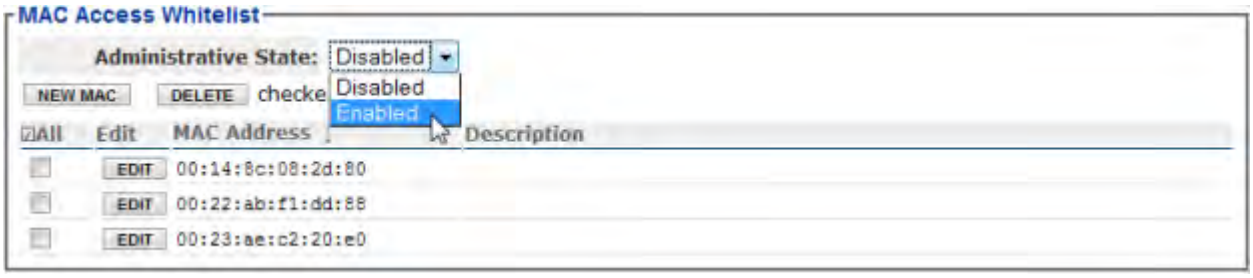


Figure 4.16. Advanced View *MAC Access Whitelist* frame, all platforms

5 When you have finished adding permitted MAC addresses, in the *MAC Access Whitelist* frame, in *Administrative State*, click **Enabled**.

6 Click **APPLY** on the right of the frame.

If you navigate away from the screen without clicking **APPLY**, the *Administrative State* will not be changed.

The MAC ACL reflects your changes.

If you attempt to enable the *MAC Access Whitelist* when the MAC address you are currently logged on through is not listed, a dialog warns that proceeding will block network access for the computer you are currently using

A dialog will also warn you if you are deleting your current MAC address from the list when the list is already enabled (after you have cleared the usual confirmation dialog).

CAUTION: If your current MAC address is not on the *MAC Access Whitelist* when you **Enable** it or you delete your address when the list is already enabled, and you do not **Cancel** the change when prompted, your session will end and your current MAC address will be blocked until it is added to the list of permitted addresses or the function is disabled.

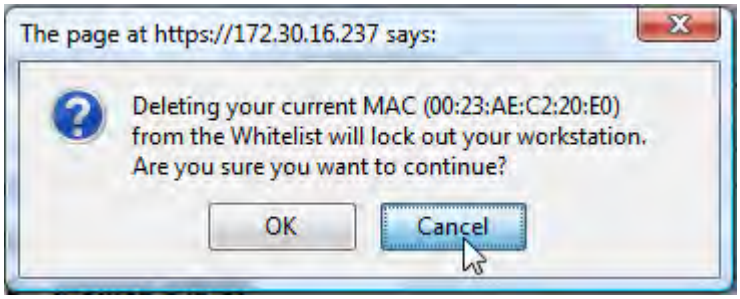


Figure 4.17. Advanced View current MAC address lockout dialog, all platforms

Unless you want to prevent network access from your current MAC address, **Cancel** these changes.

The *MAC Access Whitelist* is **Disabled** by default, and only the current Bridge's MAC address is automatically listed.

If the *MAC Access Whitelist* is **Enabled** when there are no MAC addresses on the list, all network connections will be blocked. Network access can be restored only by reconfiguring the function through a direct, physical connection to the Bridge's **Console** port.

To edit the description of an existing MAC address entry:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Access Control** from the menu on the left.
2. In the *Access Control* screen's *MAC Access Whitelist* frame, click the **EDIT** button for the entry for which you want to change the description, and in the *Edit a MAC filter entry* dialog:
   - Edit the *Description* (you cannot change the *MAC Address*).
   - Click **APPLY** in the dialog (or **CANCEL** it to cancel the action).

The MAC ACL reflects your changes.

To delete MAC addresses from the ACL:

You can delete a single device entry or all MAC addresses on the Bridge's ACL.

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Access Control** from the menu on the left.
2. In the *Access Control* screen's *MAC Access Whitelist* frame,
   - If you want to delete a single entry, click to place a check in the box beside it; then the **DELETE** button above the list.

   or
   - If you want to delete all entries, click **All** to place a check in all entries' boxes; then click the **DELETE** button above the list.
3. Click **OK** in the confirmation dialog (or **Cancel** the deletion).

The MAC ACL reflects your changes.

4.5.2 Controller Device Access Control

Fortress's device authentication assigns every Fortress controller device (Fortress Bridges and Controllers) a unique Device ID that is subsequently used to authenticate the device for access to the Fortress-secured network.

The Bridge detects other Fortress controller devices on the network, automatically populates the Controller *Access List* with these discovered devices and, by default, allows them to connect.

As controller devices auto-populate the *Authorized Controller Devices* list, they are permitted or denied immediate access to the network based on the *Default Auth State* setting in the *Controller Access List* frame:

- **Allow** - (the default) auto-populating controller devices will be allowed to connect.
- **Pending** - auto-populating controller devices require an administrator to change their individual *Auth State* settings to **Allow** before they can connect.
- **Deny** - auto-populating controller devices are not allowed to connect.

You can also manually add controller devices to the Bridge's *Authorized Controller Devices* list.

In order to add a device manually, you must specify its MAC address and Fortress-generated, 16-digit hexadecimal Device ID.

NOTE: The Bridge's Device ID and MAC address are displayed in the *System Info* frame on **Configure -> Administration**.

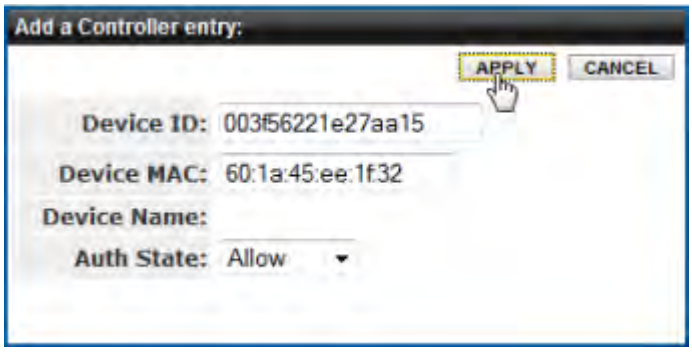


Figure 4.18. Advanced View *Add a Controller entry* dialog, all platforms

Access Control functions are available only in Advanced View.

To configure the Controller ACL:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Access Control** from the menu on the left.
2. In the *Access Control* screen's *Controller Access List* frame, select the *Default Auth State* for auto-populating (and manually configured) Controller devices (described above).
3. In the same frame:
   - If you want to add a device to the Bridge's Controller ACL:
     - Click **NEW CONTROLLER.**
     - In the *Add a Controller entry* dialog, enter the *Device ID* and the *Device MAC* address for the Controller.
     - Select the *Auth State* at which the Controller will be permitted to connect (described above).

   and/or
   - If you want to edit the entry of an existing entry:
     - Click the **EDIT** button for the entry.

- In the *Edit a Controller entry* dialog, edit the MAC address or *Auth State* (you cannot change the *Device ID*).

❖ Click **APPLY** in the dialog (or **CLOSE** it to cancel the action).

4 When you have finished adding and/or editing Controller entries, click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

The *Controller Access List* reflects your changes.

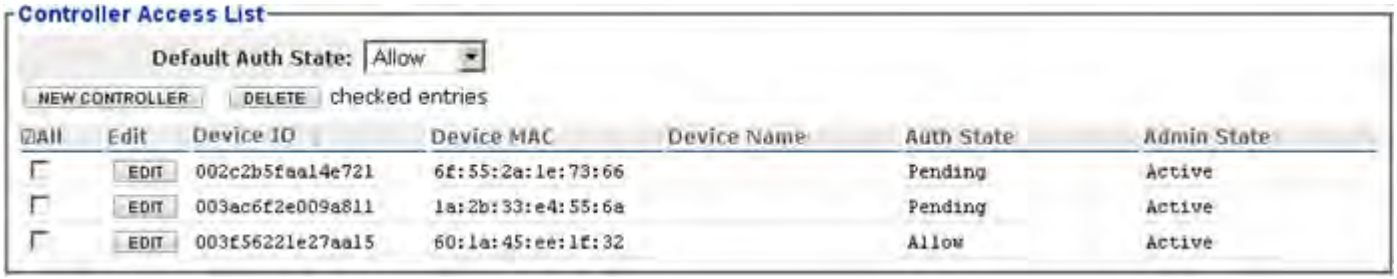


Figure 4.19. Advanced View *Controller Access List* frame, all platforms

To delete Controller devices from the ACL:

You can delete a single Controller entry or all Controller devices on the Bridge's ACL.

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Access Control** from the menu on the left.

2 In the *Access Control* screen's *Controller Access List* frame,

❖ If you want to delete a single entry, click to place a check in the box beside it; then the **DELETE** button above the list.

or

❖ If you want to delete all entries, click **All** to place a check in all entries' boxes; then click the **DELETE** button above the list.

3 Click **OK** in the confirmation dialog (or **Cancel** the deletion).

The Controller ACL reflects your changes.

4.5.3 Cleartext Device Access Control

You may want to allow certain devices to pass unencrypted data, or *clear text*, on the Bridge's encrypted interfaces. These might be wireless 3rd-party APs (access points) or Trusted Devices that require cleartext access to the encrypted zone.

Network security is maximized when:

1 the smallest possible number of cleartext devices are permitted encrypted zone access

2 the smallest effective set of accessible ports is specified for each

3 cleartext device access is enabled only when needed

Once cleartext access to encrypted interfaces has been established for a device, the Bridge uses the device's MAC address, IP address and port number to authenticate it on the network.

Configured cleartext devices will not be allowed to pass traffic in the Bridge's encrypted zone, unless *Cleartext Traffic* has been **Enabled** (on **Advanced View -> Configure -> Security ->** *Security Settings*, refer to Section 4.1.10). *Cleartext Traffic* is **Disabled** by default.

NOTE: The current *Cleartext* traffic setting is shown in the upper left of all Bridge GUI screens (refer to Section 5.1).

These settings are available regardless of specified cleartext *Device Type* (below):

- *Admin State* - determines whether the device's cleartext access to the Bridge's encrypted zone is **Enabled** or **Disabled** (the default).
- *Device Name* - establishes a descriptive name for the device. Access rules, whether for Trusted Devices or APs must be uniquely named on the Bridge.
- *MAC Address* - provides the MAC address of the device.
- *IP Address* - provides the network address of the device.
- *Device Type* - establishes the cleartext device as a wireless **Access Point** or a designated **Trusted Device**.
- **Pass All Traffic** - determines whether the Bridge will filter OSI Layer 2 traffic from the device (checkbox clear, the default) or allow all OSI Layer 2 traffic to pass to and from the device in the encrypted zone (box checked).

NOTE: STP and Cisco® Layer 2, VLAN management traffic to or from switches in the Bridge's encrypted zone ***requires*** *Pass All Traffic* to be enabled (checked).

Figure 4.20. Advanced View *Trusted Device/AP Settings* frame, all platforms

4.5.3.1 3rd-Party AP Management

Bridges equipped with one or more radios can themselves serve as wireless access points (APs), as described in Section 3.3.4.

The Bridge-secured network can additionally include 3rd-party wireless APs, which will pass network traffic normally regardless of whether you have configured the Bridge to allow administrative access to the AP.

If you want to manage a 3rd-party AP on the Bridge-secured network, you must communicate with it in clear text (the AP

having no means to decrypt/encrypt Fortress MSP traffic). To do so, you must configure cleartext access for the AP.

Cleartext access configured to permit direct communication with APs can represent a security risk: APs' MAC addresses are necessarily transmitted in clear text and could be spoofed. Fortress recommends creating and enabling cleartext device access only as required and filtering that traffic to permit only the necessary minimum network access for the device.

These settings are available only when *Device Type* (Section 4.5.3) is **Access Point**:

- *Custom Management Ports* - specifies ports by number (separate multiple entries by commas, no spaces).
- *Two-Way* - permits two-way communication for AP management (**Enabled**) or allows only one-way communication from the Bridge to the AP (**Disabled**, the default), according to the requirements of the AP. When **Trusted Device** is the selected *Device Type*, this field is greyed out.

CAUTION: To maximize network security, permit the fewest possible cleartext devices to access encrypted interfaces and to configure the smallest effective set of accessible ports for each.

Figure 4.21. Advanced View *Access Point Settings* frame, all platforms

4.5.3.2 Trusted Devices

Some wireless devices—IP phones, digital scales or printers, for example—are not equipped to run additional software such as the Fortress Secure Client.

In order to allow such a device onto the network, the Fortress Bridge must be configured to identify it as a *Trusted Device*—essentially a specialized, cleartext network device for which the narrowest possible access rules are applied.

Visitor Access through Trusted Devices

Visitors to your facilities can be granted temporary access to the WLAN by configuring Trusted Devices, with appropriate access rules, through which visitors can connect their mobile devices. Trusted Devices created to provide access to visiting mobile device are managed no differently from other Trusted Devices.

To limit visitor access to the Web, select only the **Web** group of port numbers from the checkbox options in the *Access Management Rules* frame.

Trusted Devices for visitors are managed no differently from other Trusted Devices. You should delete any Trusted Device access rule when it is no longer required.

Well Known Trusted Device Ports

Well Known TD Ports - specifies accessible groups of well known ports, grouped by function. *Well Known TD Ports* options are available only when *Device Type* (Section 4.5.3) is **Trusted Device**.

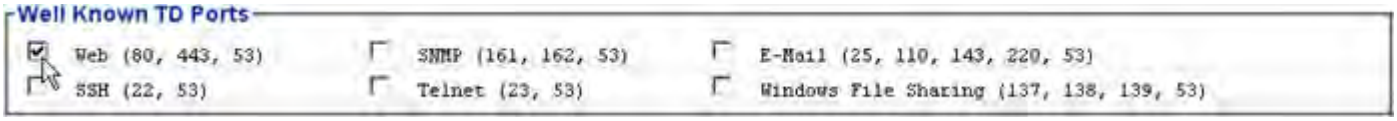


Figure 4.22. Advanced View *Well Known TD Ports* frame, all platforms

Access Control functions are available only in Advanced View.

To configure cleartext access for APs and Trusted Devices:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Access Control** from the menu on the left.

2 In the *Access Control* screen's *Controller Access List* frame, click **NEW TD/AP**, and on the resulting screen:

- On the *APs/Trusted Devices* screen, configure basic cleartext device settings in the *Trusted Device/AP Settings* frame.
- If **Access Point** was selected for *Type* in the preceding step, configure *Access Point Settings* for the device.

or

- If **Trusted Device** was selected for *Type* in the preceding step, configure *Well Known TD Ports* for the device.

3 Click **APPLY** in the upper right of the screen (or **CANCEL** your addition).

Devices for which cleartext access to the encrypted zone has been configured are displayed on the *Trusted Device/AP Access List*.

NOTE: *Cleartext Traffic* must be **Enabled** in order for any AP or Trusted Device to pass traffic on encrypted interfaces (refer to Section 4.1.10).

To edit APs and Trusted Device cleartext access:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Access Control** from the menu on the left.

2 In the *Access Control* screen's *Controller Access List* frame, click **EDIT** button beside the device entry you want to edit.

3 On the resulting screen, change those settings you want to reconfigure.

4 Click **APPLY** in the upper right of the screen (or **CANCEL** your changes).

To delete cleartext access for APs and Trusted Device:

You can delete cleartext access to the Bridge's encrypted zone for a single device or for all devices.

NOTE: Disabling or deleting cleartext access for an AP does not disable the access point: it continues to pass network traffic among devices on the encrypted network.

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Access Control** from the menu on the left.

2 In the *Access Control* screen's *Controller Access List* frame:

- If you want to delete one or more selected cleartext devices, click to check the box(es) for the cleartext device(s) you want to delete.

or

- If you want to delete all cleartext devices, click **All** to place a check in the box of every device.

3 Click **DELETE**.

4 Click **OK** in the confirmation dialog (or **Cancel** the deletion).

The cleartext device ACL reflects your changes.

4.6 Remote Audit Logging

The Bridge supports remote audit logging using the syslog standard with an external server, and you can specify a threshold severity level for the events sent to syslog.

You can also specify a number of parameters by which to separately filter administrator and connecting device activity for audit logging.

4.6.1 Enabling Audit Logging

To send audit log messages from the Bridge to an external server, you must enable the function and enable and configure the Bridge's connection to the syslog server.

NOTE: Remote logging settings do not affect which events the Bridge logs locally, in the native *Event Log* (refer to Section 5.9).

You can send logged events of every severity level to the remote server, or you can globally configure the Bridge to send a only a subset of messages, filtered by severity level, for audit logging.

Logging/Auditing functions are available only in Advanced View.

Figure 4.23. Advanced View *Global Logging Settings* frame, all platforms

To enable remote audit logging:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner

of the page, then **Configure -> Logging/Auditing** from the menu on the left.

2 In the *Logging/Auditing* screen's *Global Logging Settings* frame:

- In *Auditing* - click **Enabled** to turn audit logging on.
- In *Remote Log Storage* - click **Enabled** to direct the Bridge to use the network syslog server.
- In *Remote Log Host* - enter the IP address of the syslog server.
- In *Severity of Messages Retained* - select from the dropdown the minimum severity level for which messages will be sent to the external audit log.

  At the default setting of **Critical**, for example, the Bridge will send only those messages at the **Critical** severity level, and not those at lower levels of severity (**Warning**, **Error**, and **Informational** messages).

3 Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

Audit logging is **Enabled** by default, but the external syslog server function is **Disabled** and no *Remote Log Host* is configured.

Disable audit logging by selecting **Disabled** in *Auditing*.

4.6.2 Administrative Audit Logging

You can globally configure the way in which administrative activity on the Bridge is filtered for audit logging.

Global settings will apply to an administrative session only when the *Audit* setting for the administrator's individual account is set to **Auto** (refer to Section 2.2.2.4). At the default *Audit* setting of **Required**, all activity on an administrative account is sent to the audit log without regard to global settings.

Additionally, the settings that filter administrative events by *User Interface*, *Fortress Security* and *Interface Type* (sections 4.6.2.1 and 4.6.2.2) will apply only when the administrator is logged on from a MAC address that is not itself subject to the separately configured *MAC Auditing Settings* (Section 4.6.2.3). If an administrator logs on from a listed MAC address, the audit logging configuration for that MAC address is applied.

Finally, audit logging must be enabled and an external syslog server configured on the Bridge before events can be sent to the audit log (refer to Section 4.6.1).

NOTE: Individual administrative accounts' *Audit* settings (refer to Section 2.2.2.4) override all other audit logging settings, and the audit settings associated with a given MAC address (Section 4.6.2.3) override those in *Global Auditing Settings*.

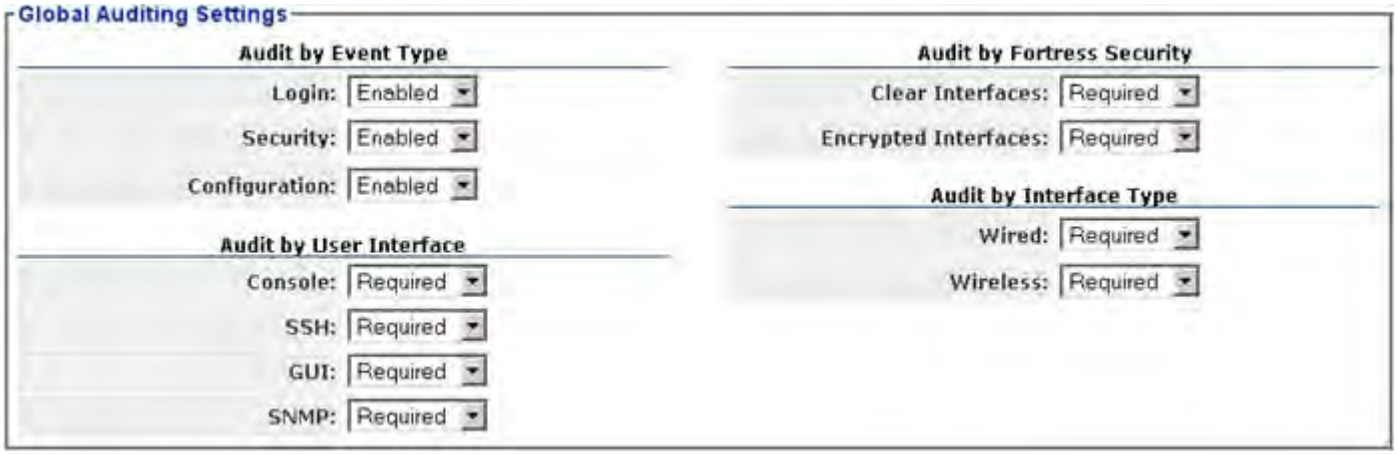


Figure 4.24. Advanced View *Global Auditing Settings* frame, radio-equipped platforms

4.6.2.1 Logging Administrative Activity by Event Type

You can specify which events can be sent to the audit log by three broad types:

- *Login* - When **Enabled**, logon activity by subject administrators can be sent to the audit log. When *Login* is **Disabled**, the logon activity of subject administrators will not be sent.
- *Security* - When **Enabled**, if *Configuration* (below) is also **Enabled**, any changes made by subject administrators to the Bridge's security settings can be sent to the audit log. When *Security* is **Disabled**, security reconfiguration by subject administrators will not be sent.
- *Configuration* - When **Enabled**, if *Security* (above) is also **Enabled**, all changes made by subject administrators to the Bridge's configuration can be sent to the audit log. If *Security* is **Disabled** when *Configuration* is **Enabled**, all changes except those to security settings can be logged. When *Configuration* is **Disabled**, Bridge reconfiguration by subject administrators will not be sent (even if *Security* logging is **Enabled**).

In addition to the conditions described at the beginning of this section (4.6.2), whether or not events of an **Enabled** type are actually sent to the audit log depends on whether the event meets the interface and Fortress security status criteria for audit logging configured in the rest of the *Global Auditing Settings* frame (below).

All three event types are **Enabled** by default.

4.6.2.2 Logging Administrative Activity by Interface and Fortress Security Status

You can filter administrative activity sent to the audit log by the kind of management interface the administrator is logged on

through and whether the interface is encrypted or clear, wired or wireless:

- *Audit by User Interface* - There are four ways an administrator can access the Bridge:
  - *Console* - a serial connection to the chassis **Console** port
  - *SSH* - a Secure Shell connection to the Bridge CLI
  - *GUI* - an HTTPS (Hypertext Transfer Protocol Secure) connection to the Bridge GUI
  - *SNMP* - Simple Network Management Protocol transactions
- *Audit by Fortress Security* - All remote management connections to the Bridge must be made on one of its *Clear Interfaces* (on which *Fortress Security* is **Disabled**) or on one of its *Encrypted Interfaces* (on which *Fortress Security* is **Enabled**).
- *Audit by Interface Type* - All remote management connections must be made through either a *Wired* interface (Ethernet port) or a *Wireless* interface, a BSS (Basic Service Set) on one of the Bridge's radios.

NOTE: The *Wireless* interface type does not apply to Bridges without radios and will not be present for those models (refer to Table 1.1 on page 3).

The Bridge handles audit event logging according to a hierarchy of categories, ordered as shown above.

Each of the interface and Fortress security status controls for audit event logging can be set to one of three behaviors:

- **Required** - events originating from that interface or from an interface with the specified Fortress security status will be logged, provided they are not **Prohibited** in a superior audit setting.
- **Prohibited** - events originating from that interface or from an interface with the specified Fortress security status will not be logged, provided they are not **Required** in a superior audit setting
- **Auto** - events originating from that interface or from an interface with the specified Fortress security status will be logged according to whether they are **Prohibited** or **Required** in a superior setting. If all applicable superior settings are at **Auto**, events will be logged according to any applicable inferior settings.

In short, events are checked against the audit settings for *User Interface*, *Fortress Security* and *Interface Type*, in that order, and logged according to the first applicable **Required** or **Prohibited** setting.

Audit logging is **Required** by default for all interfaces, regardless of user, type, or Fortress security status.

Logging/Auditing functions are available only in Advanced View.

To configure audit logging by event type, Fortress security status and interface:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Logging/Auditing** from the menu on the left.
2. In the *Logging/Auditing* screen's *Global Auditing Settings* frame, enter new values for the controls you want to configure. (Your options are described in sections 4.6.2.1 and 4.6.2.2).
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

NOTE: Changes to administrative audit logging take effect at the next administrator logon.

4.6.2.3 Logging Administrative Activity by MAC Address

You can filter administrative activity sent to the audit log by the MAC address from which it originates.

The same categories of interfaces and Fortress security status of origin used to globally configure administrative audit logging apply when you configure audit event logging by individual MAC address (refer to Section 4.6.2.2).

- *Audit by User Interface* - includes the possible administrative network interfaces: *SSH*, *GUI*, *SNMP*
- *Audit by Fortress Security* - includes *Clear Interfaces* and *Encrypted Interfaces*.
- *Audit by Interface Type* - includes *Wired* and *Wireless* interfaces.

NOTE: The *Wireless* interface type does not apply to Bridges without radios and will not be present for those models (refer to Table 1.1 on page 3).

Each control can be set to one of the same three behaviors described in Section 4.6.2.2: **Required**, **Prohibited**, **Auto**.

Events originating from the MAC address are checked against the audit settings for *User Interface*, and *Fortress Security* and *Interface Type*, in that order, and logged according to the first applicable **Required** or **Prohibited** setting.

In new MAC address entries, logging is **Required** by default for all interfaces, regardless of user, type, or Fortress security status.

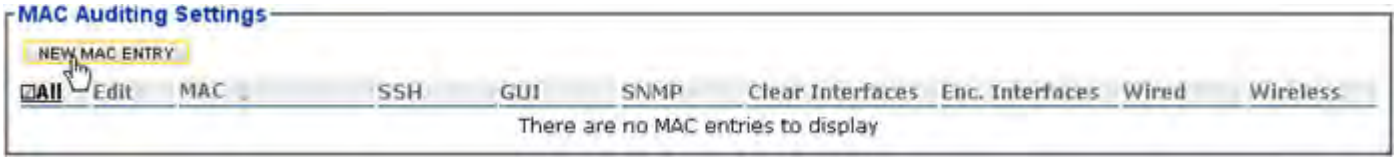


Figure 4.25. Advanced View *MAC Auditing Settings* frame, all platforms

To configure audit logging by MAC address:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Configure -> Logging/Auditing** from the menu on the left.

2 In the *Logging/Auditing* screen's *Mac Auditing Settings* frame, click **NEW MAC ENTRY**.

3 In the resulting screen's *MAC Auditing Entry* frame, enter the MAC address you want to configure for audit logging and, optionally, a description of up to 250 alphanumeric characters, symbols and/or spaces.

4 In the same frame, enter new values for the *Audit by...* controls you want to configure (described above).

5 Click **APPLY** in the upper right of the screen (or **CANCEL** the addition).

Figure 4.26. Advanced View *MAC Auditing Entry* frame, all radio-equipped platforms

You can recall the *MAC Auditing Entry* frame for a configured MAC address by clicking the **EDIT** button to the left of its entry on *MAC Auditing Settings*. You can then reconfigure audit logging for that MAC address and **APPLY** your changes.

Delete a MAC address from audit logging by clicking to place a check in the box to the left of its entry on *MAC Auditing Settings* and then clicking **DELETE** at the top of the frame. Delete all MAC addresses by clicking **All** to check all their boxes and then **DELETE**.

4.6.3 Learned Device Audit Logging

The Bridge detects devices connecting to the network it secures. These events are logged locally regardless of how *Learned Device Auditing Settings* are configured.

When audit logging is enabled and an external syslog server is configured on the Bridge (refer to Section 4.6.1), you can configure the Bridge to send events associated with *Learned Device* connections to the audit log, and you can filter logged events by the Fortress security status and type of interface on which the device is learned.

Figure 4.27. Advanced View *Learned Device Auditing Settings* frame, all radio-equipped platforms

To configure learned device audit logging:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Configure -> Logging/Auditing** from the menu on the left.
2. On the *Logging/Auditing* screen, in the *Learned Device Auditing Settings* frame, click to **ENABLE/DISABLE** audit event logging of devices learned:
   - on one of the *Clear Interfaces*
   - on one of the *Encrypted Interfaces*
   - on a *Wired* interface
   - on a *Wireless* interface
3. Click **APPLY** in the upper right of the screen (or **RESET** screen settings to cancel your changes).

NOTE: The *Wireless* interface type does not apply to Bridges without radios and will not be present for those models (refer to Table 1.1 on page 3).

Chapter 5
System and Network Monitoring

The Bridge GUI provides access to an array of system and operating information on **Configure -> Administration** and under **Monitor** on the main menu and displays the FIPS indicators described below on every screen.

5.1 FIPS Indicators

In the upper left of Bridge GUI screens, above the main menu, the Bridge reports three pieces of information relevant to Federal Information Processing Standards (FIPS) 140-2 Security Level 2.

Figure 5.1. FIPS indicators, all screens, all platforms

- *Mode* - is the *Operating Mode*, as configured on **Configure -> Security** and explained in Section 4.1.1
  - *FIPS* - Bridge operation complies with FIPS 140-2 Security Level 2.
  - *Normal* - Bridge operation can be secured but does not meet FIPS requirements.
- *Cleartext* - is the *Cleartext Traffic* setting, as configured on **Configure -> Security** and described in Section 4.1.10.
  - *Enabled* - the Bridge allows clear text from specified devices to pass on its encrypted interfaces (Ethernet ports or radio BSSs on which *Fortress Security* is **Enabled**).
  - *Disabled* - the Bridge allows no clear text to pass on any encrypted interface.
- *Status* - when the Bridge is in *FIPS* operating mode, indicates the current state of FIPS self testing (refer to Section 4.1.8). The Bridge's color indicator to the left of

NOTE: In FIPS terminology, the Bridge is in FIPS *Bypass Mode (BPM)* when cleartext is permitted to pass on any of its encrypted interfaces.

these fields displays the basic FIPS state; the text output can reiterate or augment the indicator:

- **Green** - *Healthy* - The Bridge passed the last FIPS tests.
- **Yellow** - *Testing* - The Bridge is running FIPS self tests.
- **Red** - *Critical* - The Bridge is in FIPS failed state and will reboot (refer to Section 4.1.1).

A Bridge in *Normal* operating mode always displays a *Status* of *Healthy*.

5.2 Administrative Account Details

In Advanced View, you can click the *Username* of any account listed in **Configure -> Administration ->** *Administrator Settings* for details of the account's creation and modification and a record of logon activity on the account since the Bridge last booted.

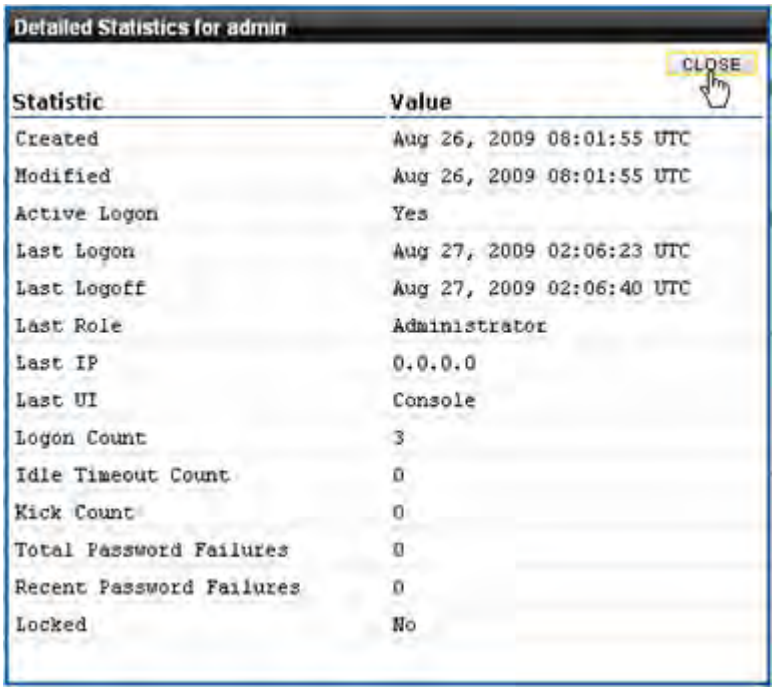


Figure 5.2. administrator *Detailed Statistics* dialog, all platforms

5.3 System Information

In addition to the configured (or default) values of the settings on the *Administration* screen (**Configure -> Administration**), the Bridge GUI displays basic *System Information* at the top of the screen.

Figure 5.3. *System Info* frame, all platforms (with relevant changes of *Model Name*)

System Information displays:

- *Unencrypted MAC* - the MAC address of the Bridge's management interface
- *Device ID* - the Fortress Device ID, as uniquely generated for each device on a Fortress-secured network and used, when applicable, for device authentication.
- *Software Version*/*Firmware Revision* - the Fortress software and firmware currently running on the Bridge
- The *Model Name* and *Assembly Number* - the Fortress hardware device on which the Bridge software is running

5.4 Topology View

On Bridges equipped with one or more radios (refer to Table 1.1 on page 3) and operating as a node in a wireless network, the *Topology View* screen provides a visual representation of the network to which the Bridge belongs. The screen displays an icon for the Bridge you are currently logged onto—identified by a blue box around the its IP address—and each of the Bridges (nodes) the current Bridge is connected to. When you first view this screen, the Bridges are arranged randomly, but within your frame of view.

Figure 5.4. ***Topology View*, all radio-equipped platforms (with relevant changes of current device indicator)**

Bridges on **Monitor -> Topology View** are connected by lines, which, by default, indicate by color the *Link Speed* in Mbps of each connection. You can change screen **OPTIONS** to have the lines indicate the **Signal Strength (dBm)** or to remove the lines

(**No Lines**). The legend in the top right corner of the screen shows what the lines depict and the relative ranges indicated by Green, Yellow, and Red status colors.

By default, Bridges in the *Topology View* are labeled with their IPv4 addresses. Alternatively, you can change the **OPTIONS** to label network Bridges by **Hostname**, **IPv6 Address**, **MAC Address**, **Device ID**, or **No Labels**.

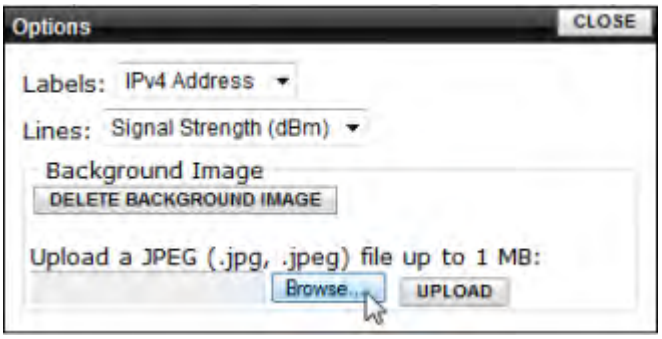


Figure 5.5. Topology View Options dialog, all radio-equipped platforms

You can view the nodes on the default grid or you can upload a map or satellite image of your location to use as the background for the *Topology View* (refer to Section 5.4.1). If you use your own image, you can then manually place each of the nodes near their physical location to make the view more representative.

Alternatively, you can use the *Arrange* icons at the top of the screen to view the nodes in a grid, ellipse or in an STP tree configuration based on the STP root. The STP tree view is not available until an STP root has been discovered, which can take a few seconds after the page loads. In STP tree view, the zoom buttons are disabled and the background image and associated options are hidden.

NOTE: Clicking an **Arrange** icon overrides each bridge's previous placement, so you may not want to use these icons if you have spent time manually dragging each node into place.

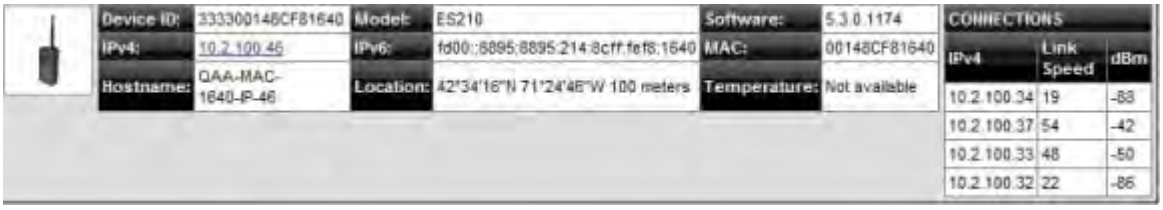


Figure 5.6. *Topology View* device details frame (for an ES210), all radio-equipped platforms

Click any Bridge icon to open a frame at the bottom of the screen. The frame displays the selected Bridge's *Device ID*, *IPv4 Address*, *Hostname*, *Model*, *IPv6 Address*, *Location*, *Software* version, *MAC* Address, and *Temperature*. Any field that is not available for the selected Bridge is left blank. The *IPv4 Address* serves as a link to that Bridge's GUI logon screen.

5.4.1 Uploading a Background Image

You can upload a JPEG (.jpg) image file of up to 1 MB, typically a map or satellite image, to use as the *Topology View* background.

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Monitor -> Topology View** from the menu on the left.
2. On the *Topology View* screen, click **OPTIONS**.
3. On the resulting screen, click **Browse**.
4. On the resulting screen, navigate to the image file you want to upload and click **OK**.
5. Click **UPLOAD**.
6. Once the image has loaded, click **CLOSE**.

The image is now the background of the *Topology View* screen. You can reposition your image or zoom the view in or out as needed.

5.5 Connections and DHCP Lease Monitoring

The tabs under **Monitor -> Connections** provide monitoring of all devices currently connected to the Bridge and simple network access controls for devices connected to the Bridge's encrypted interface(s). The last tab displays current leases on the Bridge's internal DHCP servers, when enabled.

Each tab heading shows the type of connection displayed on the tab and, in brackets, a current count of connected devices of that type.

The Bridge's three status icons apply to the *Connections* shown on all tabs.

 successful connection

 unknown connection

 blocked connection

You can sort the entries on any *Connections* tab, in ascending or descending order, by any displayed parameter, by clicking on the corresponding column heading.

5.5.1 Associations Connections

On Bridges equipped with one or more radios (refer to Table 1.1 on page 3), the **Associations** tab of the **Monitor -> Connections** screen shows current connections to any BSSs

NOTE: *Associations* are not relevant to Bridge models that do not contain radios.

configured (as APs or FP Mesh *Access* interfaces) to provide network access to wireless devices within range.

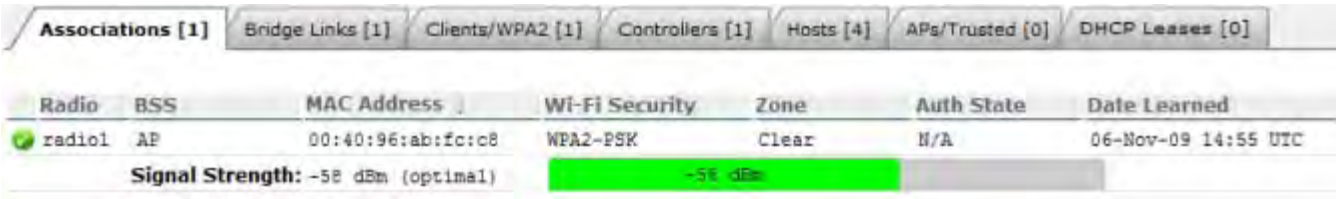


Figure 5.7. *Connections* screen, *Associations* tab, all radio-equipped platforms

- *Radio* - identifies the radio to which the device is connected.
- *BSS* - shows the name of the Basic Service Set through which the device is connected.
- *MAC Address* - displays the Media Access Control address of the associated device.
- *Wi-Fi Security* - displays the IEEE 802.11i security protocol the device is using.
- *Zone* - indicates whether the BSS to which the device is connected is *Encrypted* (*Fortress Security* is **Enabled**) or *Clear* (*Fortress Security* is **Disabled**).
- *Auth State* - the state of the device's network authentication process. Possible values include:
  - *Unknown* - connected, not yet ready to proceed
  - *Initial* - ready to proceed, waiting for device to respond
  - *Started* - response received, authentication in process
  - *Success* - authentication succeeded: network access permitted
  - *Locked* - authentication failed: network access blocked
- *Date Learned* - the start date/time of the device's current session

5.5.2 Bridge Links

On Bridges equipped with one or more radios (refer to Table 1.1 on page 3), the *Bridge Links* tab of the *Connections* screen

NOTE: *Bridge Links* are not relevant to Bridge models that do not contain radios.

shows current connections to any BSS the Bridge configured as the bridging interface in a network of Fortress Bridges.

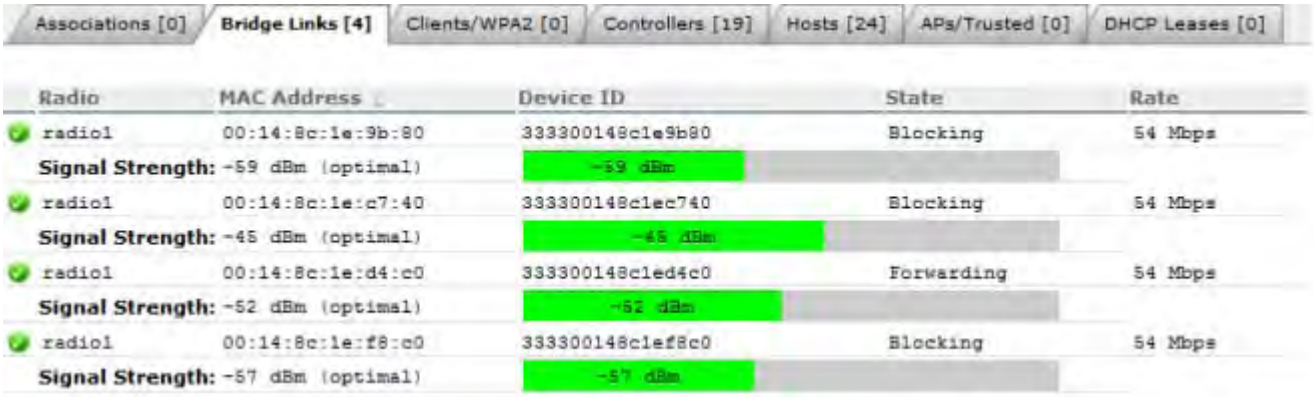


Figure 5.8. *Connections* screen, *Bridge Links* tab, all radio-equipped platforms

- *radio*N - identifies the radio on which the BSS forming the bridging link is configured.
- *Signal Strength* - dynamically displays the strength of the RF signal forming the link, measured in real time at one-second intervals, in decibels referenced to milliwatts.
- *MAC Address* - the Media Access Control address of the connected network node
- *Device ID* - the Device ID—the unique hexadecimal Fortress-generated identifier—which provides device authentication on the Bridge-secured network—of the connected network node
- *State* - the bridging status of the connected network node. Possible values and meanings depend on the Bridge's current *Bridging Mode* setting (Section 3.2):
  - When **STP** is used for bridging, possible values include:
    - *Disabled* - the interface is not passing traffic
    - *Forwarding* - the interface is passing all traffic
    - *Listening* - the interface is listening for BPDUs (Bridge Protocol Data Units) in order to build its loop-free path, but is not yet forwarding general data frames
    - *Blocking* - the interface is blocking user traffic (usually because it is a duplicate or sub-optimal path)
  - When **FastPath Mesh** is used for bridging, possible values include:
    - *Disabled* - the interface is not passing traffic
    - *Forwarding All* - the interface is passing all traffic
    - *Blocking* - the interface is blocking all traffic
- *Rate* - the maximum data transmission rate of the link in megabits per second

Because of the radio enhancements and traffic handling efficiencies defined in the newer standard, bridging links formed between radios configured to use 802.11n (refer to Section 3.3.2.2) can show *Rate* values higher than the *Maximum Rate* configured for either individual interface (refer to Section 3.3.4.10).

5.5.3 Secure Client and WPA2 Device Connections

Fortress Secure Clients connect to an encrypted interface on the Bridge using Fortress's Mobile Security Protocol (MSP). Secure Client connections can be made through an Ethernet interface configured to apply *Fortress Security* (refer to Section 3.7.4) or through a BSS (Basic Service Set) on one of the Bridge's radios that has been configured to apply *Fortress Security* (refer to Section 3.3.4.13).

WPA2 (Wi-Fi Protected Access 2) clients connect to the Bridge using the 802.11i WPA2 security standard through a BSS on one of the Bridge's radios that has been configured to use the same standard: **WPA2**, **WPA2-Mixed**, **WPA2-PSK**, or **WPA2-Mixed-PSK** (refer to Section 3.3.4.14).

NOTE: The *WPA2 Client Type* applies only on Bridges equipped with one or more radios.

Secure Client and WPA2 connections are shown on the **Clients/WPA2** tab of the *Connections* screen.

Figure 5.9. *Connections* screen, *Clients/WPA2* tab, all platforms[8]

The *Connections* screen displays these attributes of the connected device:

- *Client Type* - whether the device is an *MSP* (Fortress Secure) Client, or a *WPA2* Client.
- *MAC Address* - the Media Access Control address of the Client device
- *Key Length* - the key establishment method (refer to Section 4.1.3) used to secure the current session
- *Device ID* - if the device is an *MSP* Client, the device's unique, hexadecimal, Fortress-generated identifier, which provides device authentication on the Bridge-secured network (when device authentication is enabled). WPA2 client devices are not assigned Device IDs.
- *Client Ver.* - if the device is a Fortress Secure Client, the version of the Fortress software currently running on the connected device. WPA2 client devices, which do not run Fortress software, report *N/A*.

8. **Associations** and **Bridge Links** tabs absent when no internal radio is present (refer to Table 1.1 on page 3).

- *Auth State* - the state of the device's network authentication process. Possible values include:
  - *Unknown* - connected, not yet ready to proceed
  - *Initial* - ready to proceed, waiting for Client to respond
  - *Started* - response received, authentication in process
  - *Success* - authentication succeeded: network access permitted
  - *Locked* - authentication failed: network access blocked
- *Conn. State* - the state of the device's network connection. Possible values depend upon whether the Secure Client is authenticating through the current Bridge or through another Fortress controller device to which the current Bridge is connected:
  - If the Secure Client device is authenticating through the current Bridge, the state of its connection is reported:
    - *Initializing* - key exchange with Client device initializing
    - *SKey* - static keys exchanged with Client device
    - *DKey* - dynamic keys exchanged with Client device
    - *Blocked* - key exchange with Client device failed
    - *Unbound* - Client device is not connecting via another Fortress controller device when it is expected to be
    - *Bound* - Client device is connecting via another Fortress controller device, should be followed by *Partner Connection States* (below).
    - *Inferior DKey* - Received inferior dynamic key from Client device
    - *Key Failed* - key exchange with Client device failed
  - If the Secure Client device is authenticating through another Fortress controller device, the state of that device's connection to the current Bridge is reported:
    - *Partner Initializing* - key exchange with controller device initializing
    - *Partner Negotiating* - static keys exchanged with controller device
    - *Partner Secure* - dynamic keys exchanged with controller device
    - *Partner Failed* - key exchange with controller device failed
    - *Partner Inferior DKey* - Received inferior dynamic key from controller device
    - *Partner Key Failed* - key exchange with controller device failed
- *Date Learned* - the start date/time of the connected device's current session

The controls at the upper left of the tab and individual checkboxes for connected Clients permit you to:

- **RESET** selected sessions: end their current sessions and force them to reauthenticate on the Bridge.

  When *Allow Cached Credentials* is **Enabled** (the default), locally authenticated users are reauthenticated transparently, using cached user credentials; when the function is **Disabled**, locally authenticated users are prompted for their login credentials (Section 4.1.13).

5.5.4 Controllers Connections

Fortress *Controllers* include Fortress ES-series Bridges and the Fortress Controller, or FC-*X* (refer to Section 1.3.1 for more detail). The Bridge GUI displays connections to them on the **Controller** tab of the *Connections* screen.

Figure 5.10. *Connections* screen, *Controllers* tab, all platforms[9]

- *MAC Address* - the Media Access Control address of the controller device
- *Hostname* - the network hostname of the device
- *Device ID* - the device's unique, hexadecimal, Fortress-generated identifier, which provides device authentication on the Bridge-secured network (when device authentication is enabled)
- *Conn. State* - the state of the controller device's network connection. Possible values include:
  - *Initializing* - key exchange with device initializing
  - *Negotiating* - static keys exchanged with the device
  - *Secure* - dynamic keys exchanged with the device
  - *Failed* - key exchange with the device failed
  - *Inferior DKey* - Received inferior dynamic key from the device
  - *Key Failed* - key exchange with the device failed

9. **Associations** and **Bridge Links** tabs absent when no internal radio is present (refer to Table 1.1 on page 3).

- *Update Access ID* - Access ID push in progress for the device

- *Date Learned* - the start date/time of the controller device's current session

The controls at the upper left of the tab and individual checkboxes for connected controller devices permit you to:

- **RESET** selected sessions: end their current sessions and force them to reauthenticate on the Bridge.

5.5.5 Hosts Connections

Host devices are those connected to the Bridge's clear interface(s), either through a clear interface on the current Bridge or through a clear interface on a remote Bridge with an encrypted connection to the current Bridge. The Bridge GUI displays these connections on the **Hosts** tab of the *Connections* screen.

Figure 5.11. ***Connections*** **screen,** ***Hosts*** **tab, all platforms**[10]

- *MAC Address* - the Media Access Control address of the host device
- *Interface - for devices connected through a clear interface on the current Bridge,* the Bridge interface the host device is connected through. If the host was learned from a remote Bridge with a wireless bridging link to the current Bridge, *Interface* identifies the internal radio on which the *MRP* (mesh radio port) link resides.
- *Device ID - for devices connected through a clear interface on a remote Bridge,* the Fortress Device ID of the remote Bridge the host device is connected through. *Device ID* does not apply to hosts connected through a clear interface on the current Bridge, unless the connected host is another Fortress Bridge (or controller device).
- *Auth State - for devices connected through a clear interface on a remote Bridge, the* state of the remote Bridge's network authentication process. Possible values include:
  - *Unknown* - connected, not yet ready to proceed
  - *Initial* - ready to proceed, waiting for controller device to respond
  - *Started* - response received, authentication in process

NOTE: Device IDs are unique Fortress-generated identifiers that enable device authentication on the Bridge-secured network (Section 5.3).

10.**Associations** and **Bridge Links** tabs absent when no internal radio is present (refer to Table 1.1 on page 3).

- *Success* - authentication succeeded: network access permitted
- *Locked* - authentication failed: network access blocked

Auth State does not apply to hosts connected through a clear interface on the current Bridge.

- *Date Learned* - the start date/time of the current session with the host device

5.5.6 AP and Trusted Devices Connections

Trusted Devices or 3rd-Party access points (APs) can be configured on the Bridge for encrypted interface access (Section 4.5.3). When these devices are connected, the Bridge GUI displays them on the **AP/Trusted Device** tab of the *Connections* screen.

- *Device Type* - whether the device is configured as an **Access Point** or **Trusted Device**
- *MAC Address* - the Media Access Control address of the AP or Trusted Device
- *IP Address* - the IP (version 4) address of the device
- *Device Name* - the *Device Name* configured for the device
- *Port List* - ports the AP or Trusted Device is configured to access.
- *Auth State* - the state of the device's network authentication process. Possible values include:
  - *Unknown* - connected, not yet ready to proceed
  - *Initial* - ready to proceed, waiting for device to respond
  - *Started* - response received, authentication in process
  - *Success* - authentication succeeded: network access permitted
  - Locked - authentication failed: network access blocked
- *Date Learned* - the start date/time of the device's current session

The controls at the upper left of the tab and individual checkboxes for connected devices permit you to:

- **RESET** selected sessions: end their current sessions and force them to reauthenticate on the Bridge.

5.5.7 DHCP Leases

Leases obtained from the Bridge's internal IPv4 and IPv6 DHCP servers are shown on the **DHCP Leases** tab on **Monitor -> Connections**.

The *MAC Address*, *IP Address* and *Hostname* of the DHCP client device are displayed, followed by the date and time the lease *Expires*.

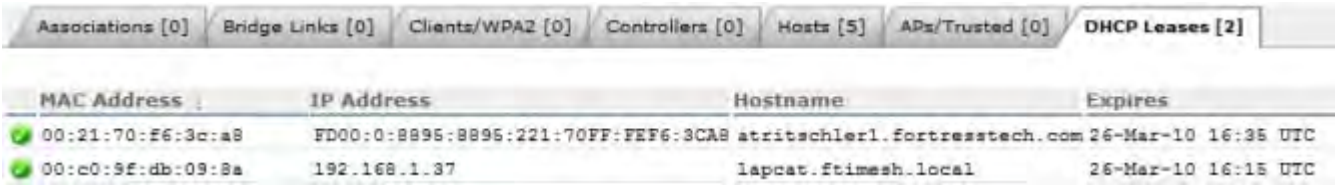


Figure 5.12. *Connections* screen, *DHCP Leases* tab, all platforms[11]

Configuration and operation of the Bridge's DHCP services are described in Section 3.6.1.

5.6 Statistics Monitoring

Traffic Statistics at the top of the **Monitor -> Statistics** screen displays statistics for overall encrypted-interface traffic. Subsequent frames provide statistics for each of the Bridge's physical or virtual interfaces—including:

- physical Ethernet ports
- Basic Service Sets configured on the radio(s) internal to the Bridge (when present)
- any VLANs configured on the Bridge.

5.6.1 Traffic Statistics

The packets that the Bridge has transmitted and received the encrypted interface(s) since cryptographic processing was last started are shown in the *Traffic Statistics* frame:

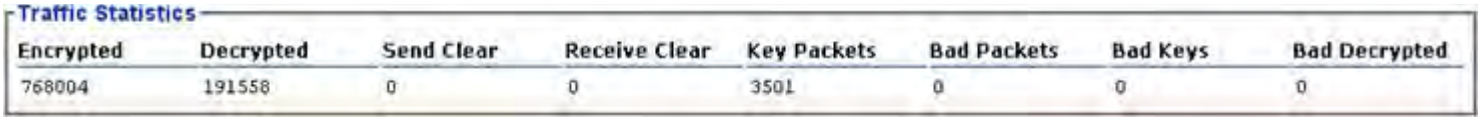


Figure 5.13. *Statistics* screen, *Traffic Statistics* frame, all platforms

- *Encrypted* - encrypted packets—the packets received on a clear interface, encrypted, and then transmitted on an encrypted interface
- *Decrypted* - decrypted packets—the packets received on an encrypted interface, decrypted, and then transmitted on a clear interface
- *Send Clear* - cleartext packets sent to cleartext devices on an encrypted interface
- *Receive Clear* - cleartext packets received from cleartext devices an encrypted interface
- *Key Packets* - valid key exchange packets

11. **Associations** and **Bridge Links** tabs absent when no internal radio is present (refer to Table 1.1 on page 3).

- *Bad Packets* - malformed packet received (Packets can be malformed for a number of reasons, such as version incompatibility or a failed hash check.)
- *Bad Keys* - bad key packets—malformed key exchange packets
- *Bad Decrypted* - key packets the Bridge was unable to decrypt

5.6.2 Interface Statistics

Bridge interfaces displayed on the **Monitor -> Statistics** screen are grouped by type.

Regardless of type, the *Status* of each interface can be: *Up* or *Down*, and a common set of traffic statistics is shown for each interface's receive (*RX*) and transmit (*TX*) functions:

- *Bytes* - the total number of bytes received/transmitted on the interface
- *Packets* - the total number of packets received/transmitted on the interface
- *Errors* - the total number of receive/transmit errors reported on the interface

The *Statistics* screen provides additional information, according to interface type.

5.6.2.1 Ethernet Interface Statistics

Ethernet Interface Statistics

Ethernet MAC Address: 00:14:8c:2a:0c:80

Interface	Link	Speed (Mbps)	Duplex	State	Status	RX Bytes	RX Packets	RX Errors	TX Bytes	TX Packets	TX Errors
aux	Up	100 Mbps	Full Duplex	Forwarding	Up	302444	3557	55	455160	1787	7
wan	Up	100 Mbps	Full Duplex	Forwarding	Up	37664	232	0	49606	257	5

Figure 5.14. *Statistics* screen, *Ethernet Interface Statistics* frame, ES210, ES440, ES820

For each of the Bridge's Ethernet interfaces, the Bridge displays the *Status* and basic interface statistics described above, as well as:

- *Link* - displays whether the interface's physical link is:
  - *Up* - successful data connection with a device attached to that port
  - *Down* - no data link with a device attached to the port, or the port is disconnected
  - *Negotiating* or *Resolved* - transient states between a physical connection being made to the port and a data link being established (*Up*) or failing to be established (*Down*)
- *Speed* - displays the speed at which the interface is passing traffic in megabits per second.

- *Duplex* - displays whether the device's transmission mode is *Full Duplex* or *Half Duplex* (or displays *n/a* if the duplex setting does not apply.
- *State* - the bridging status of the node from which the link is made: Possible values and meanings depend on the Bridge's current *Bridging Mode* setting (Section 3.2):
  - When **STP** is used for bridging, possible values include:
    - *Disabled* - the interface is not passing traffic
    - *Forwarding* - the interface is passing all traffic
    - *Listening* - the interface is listening for BPDUs (Bridge Protocol Data Units) in order to build its loop-free path, but is not yet forwarding general data frames
    - *Blocking* - the interface is blocking user traffic (usually because it is a duplicate or sub-optimal path)
  - When **FastPath Mesh** is used for bridging, possible values include:
    - *Disabled* - the interface is not passing traffic
    - *Forwarding All* - the interface is passing all traffic
    - *Blocking* - the interface is blocking all traffic
- Above these statistics, the Bridge displays the global *Ethernet MAC Address*.

5.6.2.2 BSS Interface Statistics

On Bridges equipped with one or more radios (refer to Table 1.1 on page 3), the Bridge displays the *Status* and basic interface statistics (described in Section 5.3.2) for any Basic Service Sets (BSSs) configured on its radio(s).

BSS Interface Statistics

				RX			TX		
Radio	BSS	MAC Address	Status	Bytes	Packets	Errors	Bytes	Packets	Errors
radio1	QA_SWAB_UseCase_MSP_A	00:14:8c:08:07:68	Up	0	0	0	15604808	97941	80
radio1	QA_SWAB_UseCase_MSP_G	00:14:8c:08:07:90	Up	0	0	0	15609990	97979	60
radio1	QA_SWAB_UseCase_WPA2_A	00:14:8c:08:07:8a	Up	0	0	0	3474525	45025	16
radio1	QA_SWAB_UseCase_WPA2_G	00:14:8c:08:07:93	Up	0	0	0	3474849	45034	7
radio1	QA_SWAB_UseCase_WPA2_PSK_A	00:14:8c:08:07:89	Up	0	0	0	3474555	45026	37
radio1	QA_SWAB_UseCase_WPA2_PSK_G	00:14:8c:08:07:92	Up	0	0	0	3474897	45035	34
radio1	QA_SWAB_UseCase_WPA_PSK_G	00:14:8c:08:07:91	Up	0	0	0	3475005	45038	31

Figure 5.15. *Statistics* screen, *BSS Interface Statistics* frame, all radio-equipped platforms

BSSs that are acting as access points (i.e., those that do not have bridging enabled) are shown in their own frame with this additional information:

- *Radio* - the radio on which the BSS is configured
- *BSS* - the name configured for the BSS (Section 3.3.4.1)

- *MAC Address* - the Media Access Control address of the virtual interface the BSS provides

5.6.2.3 Bridge Link Interface Statistics

BSSs that are acting as nodes in a mesh network of Fortress Bridges (i.e., those performing a network bridging function) are shown in their own frame.

Bridge Link Interface Statistics

				RX			TX		
Radio	MAC Address	State	Status	Bytes	Packets	Errors	Bytes	Packets	Errors
radio1	00:14:8c:2a:1c:14	Forwarding	Up	1334854	8486	40	1577988	10606	6290
radio1	00:14:8c:08:10:94	Forwarding	Up	1466102	9774	2	982866	5543	1274

Figure 5.16. *Statistics* screen, *Bridge Link Interface Statistics* frame, all radio-equipped platforms

In addition to the *Status* and basic interface statistics (described in Section 5.3.2), the Bridge displays this additional information for bridging links:

- *Radio* - the radio internal to the Bridge on which the MRP BSS is configured
- *MAC Address* - the Media Access Control address of the virtual interface the BSS provides
- *State* - the bridging status of the node from which the link is made: Possible values and meanings depend on the Bridge's current *Bridging Mode* setting (Section 3.2):
  - When **STP** is used for bridging, possible values include:
    - *Disabled* - the interface is not passing traffic
    - *Forwarding* - the interface is passing all traffic
    - *Listening* - the interface is listening for BPDUs (Bridge Protocol Data Units) in order to build its loop-free path, but is not yet forwarding general data frames
    - *Blocking* - the interface is blocking user traffic (usually because it is a duplicate or sub-optimal path)
  - When **FastPath Mesh** is used for bridging, possible values include:
    - *Disabled* - the interface is not passing traffic
    - *Forwarding All* - the interface is passing all traffic
    - *Blocking* - the interface is blocking all traffic

5.6.3 VLAN Statistics

The Bridge tracks VLAN traffic and displays the information, by VLAN ID, for each configured VLAN ID, in **Monitoring -> Statistics ->** *VLAN Statistics*.

VLAN Statistics

	RX					TX			
VLAN ID	Clear	Encrypted	Config	Key Exch.	VLAN Mgmt.	Clear	Encrypted	Config	Key Exch.
1	0	0	0	297	0	0	0	0	18

Figure 5.17. *Statistics* screen, *VLAN Statistics* frame, all platforms

For each of packets received (*RX*) and packets sent (*TX*) on each VLAN configured on the Bridge, the screen displays:

- *Clear* - unencrypted packets received/sent
- *Encrypted* - encrypted packets received/sent
- *Config.* - configuration packets received/sent
- *Key Exch.* - key exchange packets received/sent

In addition, for packets received (*RX*), *under VLAN Mgmt.*, the number of VLAN management packets received on the VLAN are shown.

5.7 IPsec SAs Monitoring

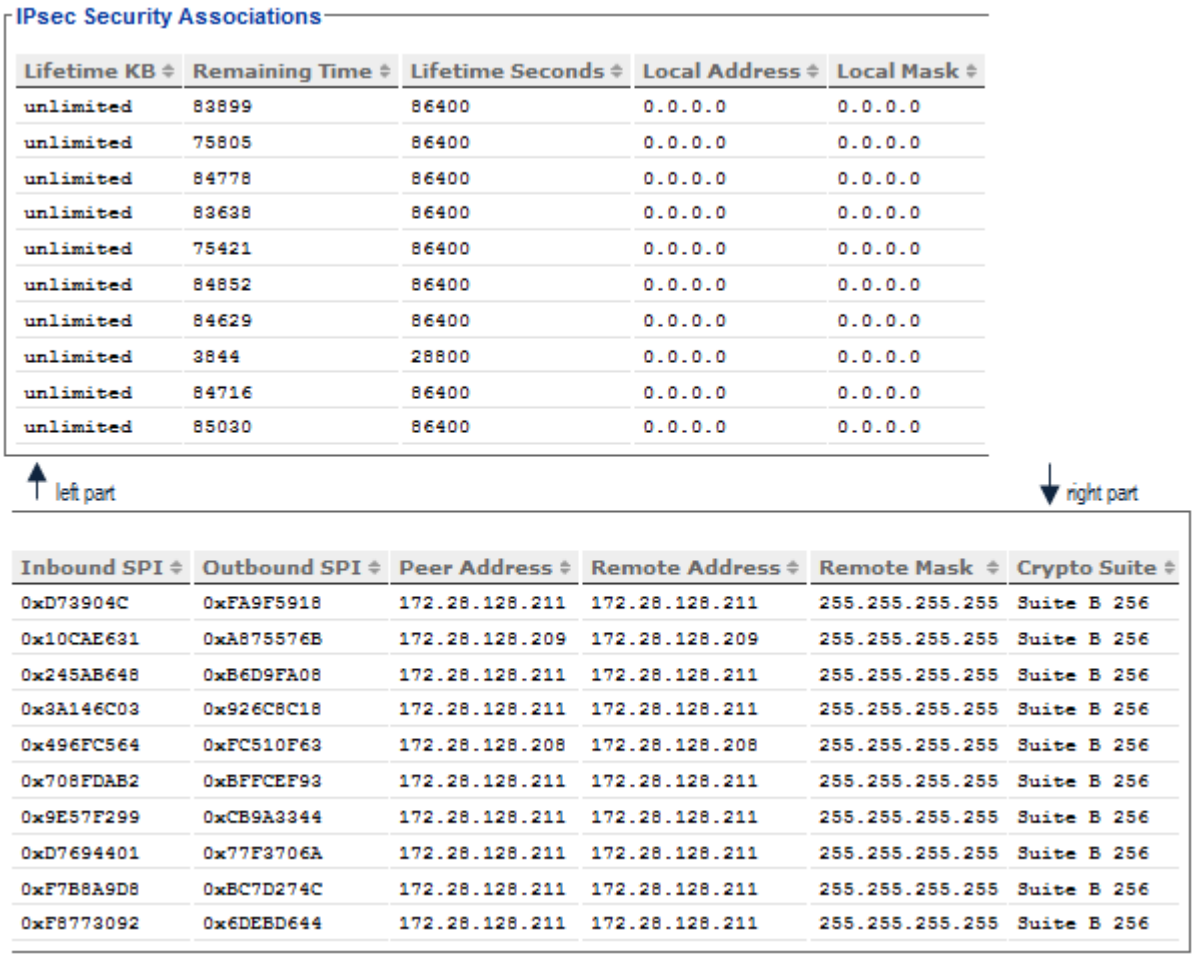
The Security Associations established between the Bridge and its IPsec peers are displayed on **Monitor -> IPsec Status**.

Except for the *Remaining Time* countdown, *Inbound SPI* and *Outbound SPI* (Security Parameter Index), the parameters shown here are configured, globally or per SPD (Security Policy Database) entry, with the settings accessed through **Configure -> IPsec** (refer to Section 4.2).

- *Lifetime KB* - optionally, a limit on the amount of data an SA can pass before being deleted can be globally set, in kilobytes, and the value displayed on *IPsec Status*. The default global setting configures no data limit for SAs, as indicated by the displayed value: *unlimited*.
- *Remaining Time* and *Lifetime Seconds* - a global SA time limit can also be specified and the value displayed on *IPsec Status*, in seconds, for all SAs present. The *Remaining Time* displayed is a countdown from this value, also in seconds.
- *Local Address* and *Local Mask* - identify the subnet of local IP addresses defined in the SPD entry used by the SA (the outbound source subnet or inbound destination subnet).
- *Inbound SPI* and *Outbound SPI* - the 32-bit Security Parameter Index included in an IPsec packet, together with the destination IP address and IPsec protocol, uniquely identifies the SA. SPIs are pseudorandomly derived during IKE transactions.

NOTE: If both data and time limits are configured, an SA will expire at whichever comes first, potentially when *Remaining Time* still shows a positive value.

- *Peer Address* - identifies the remote IPsec peer participating in the SA by IP address.
- *Remote Address* and *Remote Mask* - identify the subnet of remote IP addresses defined in the SPD entry used by the SA (the inbound source subnet or outbound destination subnet).
- *Crypto Suite* - shows the cryptographic algorithm suite in use by the SA.



IPsec Security Associations

Lifetime KB	Remaining Time	Lifetime Seconds	Local Address	Local Mask
unlimited	83899	86400	0.0.0.0	0.0.0.0
unlimited	75805	86400	0.0.0.0	0.0.0.0
unlimited	84778	86400	0.0.0.0	0.0.0.0
unlimited	83638	86400	0.0.0.0	0.0.0.0
unlimited	75421	86400	0.0.0.0	0.0.0.0
unlimited	84852	86400	0.0.0.0	0.0.0.0
unlimited	84629	86400	0.0.0.0	0.0.0.0
unlimited	3844	28800	0.0.0.0	0.0.0.0
unlimited	84716	86400	0.0.0.0	0.0.0.0
unlimited	85030	86400	0.0.0.0	0.0.0.0

Inbound SPI	Outbound SPI	Peer Address	Remote Address	Remote Mask	Crypto Suite
0xD73904C	0xFA9F5918	172.28.128.211	172.28.128.211	255.255.255.255	Suite B 256
0x10CAE631	0xA875576B	172.28.128.209	172.28.128.209	255.255.255.255	Suite B 256
0x245AB648	0xB6D9FA08	172.28.128.211	172.28.128.211	255.255.255.255	Suite B 256
0x3A146C03	0x926C8C18	172.28.128.211	172.28.128.211	255.255.255.255	Suite B 256
0x496FC564	0xFC510F63	172.28.128.208	172.28.128.208	255.255.255.255	Suite B 256
0x708FDAB2	0xBFFCEF93	172.28.128.211	172.28.128.211	255.255.255.255	Suite B 256
0x9E57F299	0xCB9A3344	172.28.128.211	172.28.128.211	255.255.255.255	Suite B 256
0xD7694401	0x77F3706A	172.28.128.211	172.28.128.211	255.255.255.255	Suite B 256
0xF7B8A9D8	0xBC7D274C	172.28.128.211	172.28.128.211	255.255.255.255	Suite B 256
0xF8773092	0x6DEBD644	172.28.128.211	172.28.128.211	255.255.255.255	Suite B 256

Figure 5.18. *IPsec Status* screen, all platforms

5.8 FastPath Mesh Monitoring

When FastPath Mesh is licensed (Section 6.3) and enabled (Section 3.2.1), the Bridge GUI provides an array of information on the configuration, composition and operation of the FP Mesh network on **Monitor -> Mesh Status**.

5.8.1 FastPath Mesh Bridging Configuration

The settings configured on **Configure -> Administration ->** *Bridging Configuration* and/or **Configure -> FastPath Mesh ->**

Global Settings are displayed in the *Bridging Configuration* frame and described in detail in sections 3.2.1.1 through 3.2.1.5.

Figure 5.19. *Mesh Status* screen, *Bridging Configuration* frame, all platforms

5.8.2 FastPath Mesh Statistics

When FP Mesh is licensed and enabled, the Fortress Bridge gathers statistics on mesh network operations for display in the *FastPath Mesh Statistics* frame.

Statistics can be cleared manually (see below) or by a reboot.

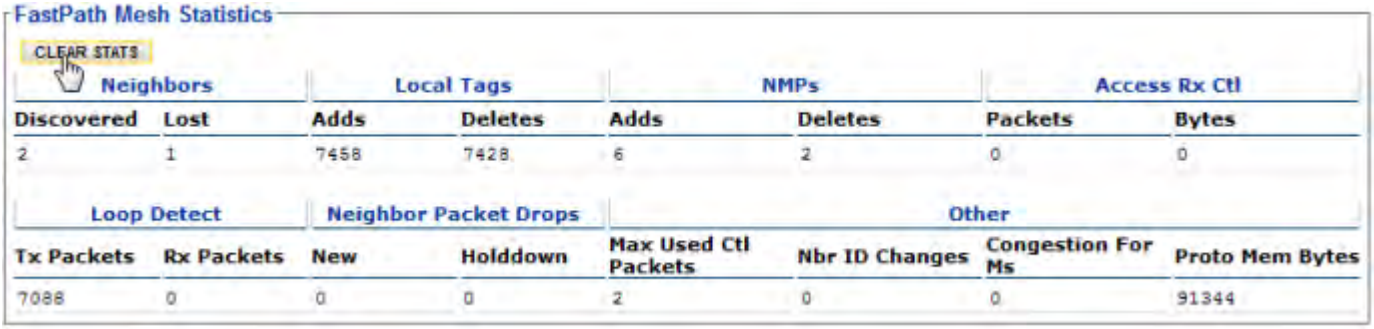


Figure 5.20. *Mesh Status* screen, *FastPath Mesh Statistics* frame, all platforms

- *Neighbors* - are other FP Mesh network Mesh Points (MPs) directly linked to the current MP (refer to Section 3.2.1).
  - *Discovered* - a count of MP nodes that have linked directly to one of the current MP's FP Mesh Core interfaces since *Statistics* were last cleared
  - *Lost* - a count of neighbors (above) whose connection to the current MP has been lost since *Statistics* were last cleared, because they have moved to a more remote location relative to the current MP or have left the network.

  A neighbor can also be "bounced" into a *Lost* state and then back to a *Discovered* state, due to a temporary deterioration of its link to the current MP, followed by the link's restoration.
- *Local Tags* - are non-routing control information in FP Mesh protocol packets provided by the local MP for distribution to network peers since *Statistics* were last cleared.
  - *Adds* - the number of tags added by the current MP
  - *Deletes* - the number of tags deleted by the current MP
- *NMPs* - are control information pertaining to NMPs inserted into FP Mesh protocol packets by network peers and

received by the current MP since *Statistics* were last cleared.

- *Adds* - NMP information added by network peers
- *Deletes* - NMP information deleted by network peers

- *Access Rx Ctl* - count of the number of FP Mesh control packets received on the current MP's Access interfaces (refer to Section 3.2.1) since *Statistics* were last cleared. In a correctly configured FP Mesh network these counts should always be *0* (zero).
  - *Packets* - total number of packets received
  - *Bytes* - total number of bytes received
- *Loop Detect* - counts loop detection protocol packets since *Statistics* were last cleared.
  - *Tx Packets* - the number of loop detection packets transmitted by the current Bridge
  - *Rx Packets* - the number of loop detection packets received by the current Bridged
- *Neighbor Packet Drops* - counts FP Mesh routing protocol packets dropped by the current Bridge since *Statistics* were last cleared.
  - *New* - the number of routing protocol packets received from new neighbors and dropped because of congestion
  - *Holddown* - the number of routing protocol packets received from unstable neighbors and therefore dropped
- *Other* - displays additional statistical information.
  - *Max Used Ctl Packets* - maximum FP Mesh control packets received in a single 250-millisecond interval, up to a maximum measurable count of *30*, indicating how busy the FP Mesh network is.
  - *Nbr ID Changes* - counts the number of times the current MP has detected a change in the routing protocol identifier of a neighbor since *Statistics* were last cleared.
  - *Congestion for Ms* - shows current measure of the length of time in milliseconds that the current MP will remain in congested mode while processing routing control packets.
  - *Proto. Mem. Bytes* - protocol memory bytes, shows current measure of the amount of Bridge memory used by the FP Mesh routing protocol.

CAUTION: Non-zero counts for *Access Rx* are caused by an FP Mesh bridging link on the current MP being incorrectly configured as an Access, rather than as a Core interface.

Clear the Bridge's record of FastPath Mesh statistics by clicking **CLEAR STATS** in the upper right of the screen.

5.8.3 FastPath Mesh Peers and Neighbors

All MP nodes on the FP Mesh network, including the current MP, are shown in the *Peers* frame of the *Mesh Status* screen. MPs directly connected to the current MP are shown in *Neighbors*.

For each MP of either type the Bridge GUI displays:

- *MAC Address* - the MP's Media Access Control address
- *Name* - the MP's hostname
- *Cost* - the lowest cost associated in FP Mesh of reaching the remote MP from the current MP

  Path cost is additive by hops. The current Bridge has a constant *Cost* of *0* (zero). Wired interfaces cost much less than wireless. A *Cost* of *4,294,967,295* is "infinite": the MP is unreachable, a transient condition just before the MP leaves the list. The greater the cost to a peer, the less preferred is any route to or through that peer.
- *IP Address* - the IPv4 address of the MP
- *IPv6 Addresses* - all IPv6 addresses of the MP, including the link local address, the RFC-4193 unique local address, and any other user-configured or auto-configured global addresses.

Peers

MAC Address	Name	Cost	IP Address	IPv6 Addresses	NMPs
00:14:8c:08:10:80	ES-24656196	0	192.168.1.6	FE80:0:0:0:214:8CFF:FE08:1080 FD00:0:8895:8895:214:8CFF:FE08:1080	00:12:f0:95:23:b7 00:18:3a:53:36:e7 00:24:e8:a4:61:d0 00:c0:9f:db:09:8a
00:14:8c:08:55:80	ES-20271356	7418	192.168.1.7	FE80:0:0:0:214:8CFF:FE08:5580 FD00:0:8895:8895:214:8CFF:FE08:5580	

Figure 5.21. *Mesh Status* screen, *Peers* frame, all platforms

For each MP listed on *Peers*, under *NMPs*, the MAC addresses of any connected Non-Mesh Points (devices on the peer MP's Access interface[s]) are shown.

Neighbors

MAC Address	Name	Cost	IP Address	IPv6 Addresses	NMP Count	Interfaces
00:14:8c:08:55:80	ES-20271356	7418	192.168.1.7	FE80:0:0:0:214:8CFF:FE08:5580 FD00:0:8895:8895:214:8CFF:FE08:5580	0	Bridge

Figure 5.22. *Mesh Status* screen, *Neighbors* frame, all platforms

For each of the current MP's *Neighbors*, the number of connected NMPs is displayed under *NMP Count*, followed by the *Interfaces* over which the current MP is connected to the neighbor. An MP can be connected to a neighbor over multiple interfaces.

5.8.4 Multicast / Broadcast Forwarding

The three values that FP Mesh takes into account when making multicast forwarding decisions—destination, source

and previous hop—are shown in the first three columns of the *Multicast/Broadcast Forwarding* frame, along with local interface and mode information.

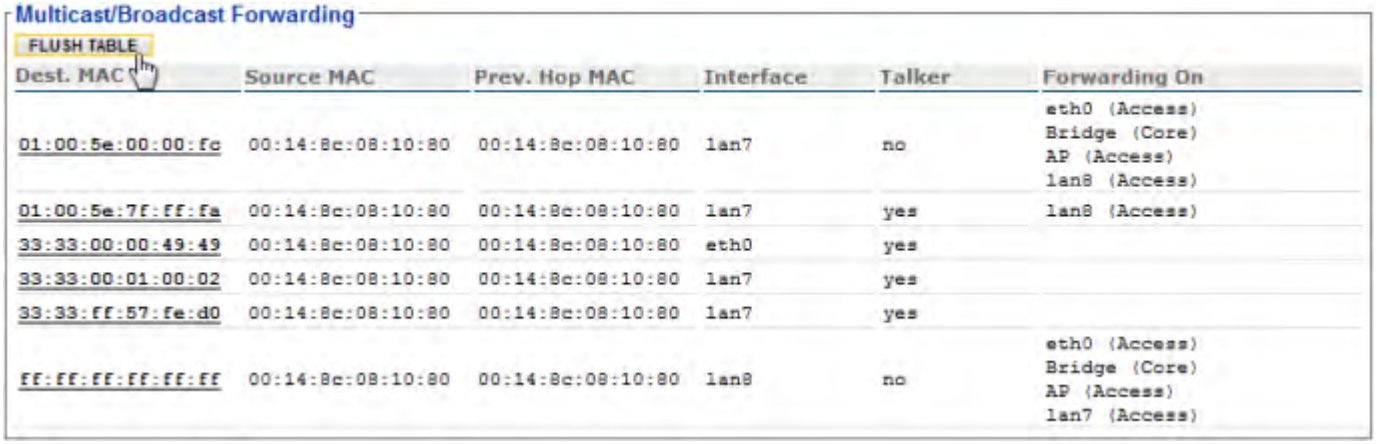


Figure 5.23. *Mesh Status* screen, *Multicast/Broadcast Forwarding* frame, all platforms

- *Dest. MAC* - the destination MAC address of the multicast
- *Source MAC* - the MAC address of the MP from which the multicast originated (The actual source may be an NMP behind the MP.)
- *Prev. Hop MAC* - the MAC address of the previous hop in the multicast route
- *Interface* - the interface on which the multicast is received, if it is an Access interface (Core interfaces show N/A, not applicable.)
- *Talker* - whether the current MP is a sender for the destination MAC address (*yes*) or only a listener (*no*)

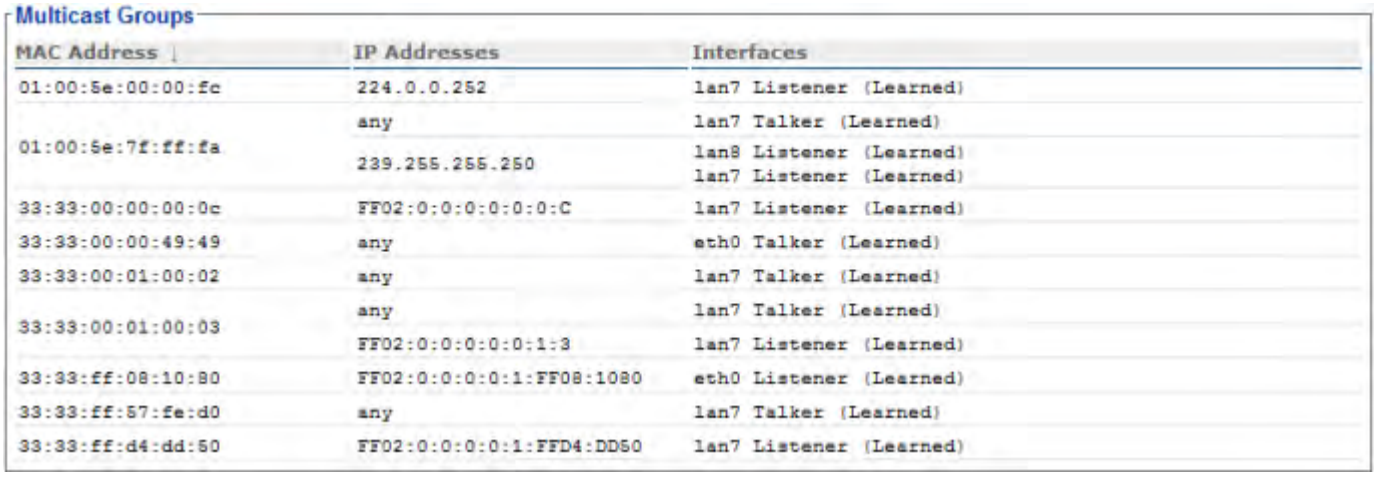
  An MP becomes a talker for a multicast group when it receives a packet from a sender on one of the MP's FP Mesh Access interfaces, or when the MP is manually configured as a **Talker** (refer to Section 3.2.1.7). MPs do not show up as talkers on broadcast flows, even though the broadcast source may be on one of the MP's Access interfaces.
- *Forwarding On* - the interfaces on which the multicast on this route is forwarded.

Clear the Bridge's *Multicast/Broadcast Forwarding* information by clicking **FLUSH TABLE** in the upper right of the screen.

5.8.5 FastPath Mesh Multicast Groups

A FastPath MP automatically subscribes to and leaves multicast groups on behalf of NMPs by snooping IP multicast control messages on FP Mesh Access interfaces. You can also establish multicast stream subscriptions manually (refer to Section 3.2.1.7). Regardless of how they were established,

current multicast subscriptions are shown in the *Multicast Groups* frame.



Multicast Groups

MAC Address	IP Addresses	Interfaces
01:00:5e:00:00:fc	224.0.0.252	lan7 Listener (Learned)
01:00:5e:7f:ff:fa	any	lan7 Talker (Learned)
	239.255.255.250	lan8 Listener (Learned) lan7 Listener (Learned)
33:33:00:00:00:0c	FF02:0:0:0:0:0:0:C	lan7 Listener (Learned)
33:33:00:00:49:49	any	eth0 Talker (Learned)
33:33:00:01:00:02	any	lan7 Talker (Learned)
33:33:00:01:00:03	any	lan7 Talker (Learned)
	FF02:0:0:0:0:0:1:3	lan7 Listener (Learned)
33:33:ff:08:10:80	FF02:0:0:0:0:1:FF08:1080	eth0 Listener (Learned)
33:33:ff:57:fe:d0	any	lan7 Talker (Learned)
33:33:ff:d4:dd:50	FF02:0:0:0:0:1:FFD4:DD50	lan7 Listener (Learned)

Figure 5.24. *Mesh Status* screen, *Multicast Groups* frame, all platforms

- *MAC Address* - the MAC address of the multicast stream
- *IP Addresses* - the addresses of IP multicast groups the MP is currently subscribed to that map to this MAC address
- *Interfaces* - FP Mesh Access interfaces on the current MP that are subscribed to this multicast, identifying the subscription mode as:
  - *Listener* - receives multicast packets
  - *Talker* - sends multicast packets
  - *Both* - receives and sends

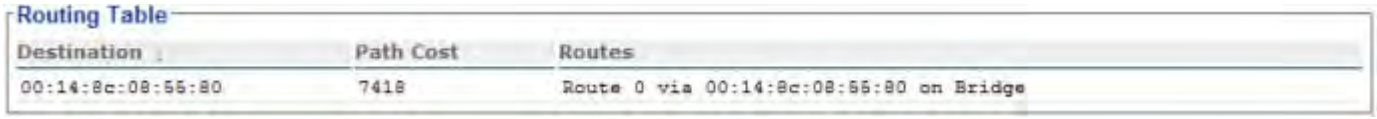
  In parentheses, *Interfaces* also shows whether the group was *Learned* from IGMP (as a listener) or incoming data packet (as a talker), or whether the group was manually *Configured*.

Manually subscribing to multicast groups is described in Section 3.2.1.7.

5.8.6 FastPath Mesh Routing Table

FP Mesh computes and records many routes to a given destination. While only the lowest cost route among these is stored in the *forwarding table* and used to forward traffic, all computed routes are shown in the *Routing Table* frame on the *Mesh Status* screen.

NOTE: The *Routing Table* shows only routes to other MPs.



Routing Table

Destination	Path Cost	Routes
00:14:8c:08:55:80	7418	Route 0 via 00:14:8c:08:55:80 on Bridge

Figure 5.25. *Mesh Status* screen, *Routing Table* frame, all platforms

- *Destination* - MAC address of the destination MP
- *Path Cost* - the lowest cost associated in FP Mesh of reaching the remote MP from the current MP (Paths are

listed in ascending order of cost, with the lowest cost path listed first.)

- *Routes* - possible routes to the destination MP in descending order of preference

5.8.7 FastPath Mesh Loops

FP Mesh prevents bridging loops from forming on Core interfaces, which connect MPs to one another. A network loop can form, however, when MPs can also detect one another on their FP Mesh Access interfaces. If such a loop exists on the network, it is displayed in the *Mesh Status* screen's *Loops* frame.

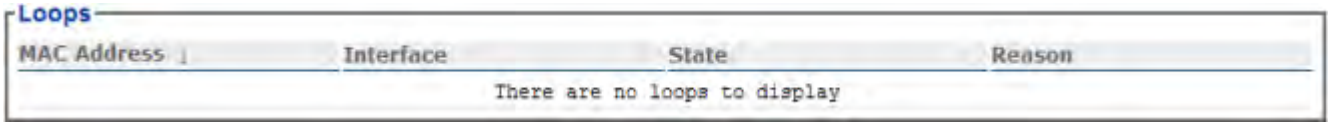


Figure 5.26. *Mesh Status* screen, *Loops* frame, all platforms

Review the network topology to make sure that the connections causing the loops are intentional (for purposes of redundancy) rather than accidental.

- *MAC Address* - the MAC address of the Mesh Point detected by the current MP on an FP Mesh Access interface
- *Interface* - the FP Mesh Access interface on which the network MP is detected
- *State* - whether that interface is *blocking*, *forwarding* or *disabled*
- *Reason* - why the interface is the current *State* (above)

5.9 System Log Monitoring

The Bridge logs significant system activity and status information.

Access the log by clicking **Monitor -> System Log**.

If you log on to a *Log Viewer*-level account, the Bridge GUI opens on the *System Log* screen. *Administrator*- and *Maintenance*-level administrators can view the entire log, while *Log Viewer*-level administrators can view only non-configuration events.

Each activity item is date-and-time stamped, its severity is indicated and a brief text description is given. Among other information, the log records:

- FIPS self-test runs and results
- when Secure Clients contact and negotiate keys with the Bridge
- system configuration changes

- when the cryptographic processor is restarted
- system and communication errors
- when FP Mesh neighbors are discovered and lost (when Fortress's FastPath Mesh is licensed and enabled)

The log is allocated 256 Kbytes of memory and can contain a maximum of approximately 2,000 log messages (approximate because record sizes vary somewhat). When the log is full, the oldest records are overwritten as new messages are added to the log.

Severity	Date/Time	Facility	Message
Notice	11/07/2008 19:49:01	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:48:40	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:48:02	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:47:27	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:47:09	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:46:02	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:45:40	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:44:39	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:43:39	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:42:58	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:42:34	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:42:13	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Info	11/07/2008 19:41:32	FIPS	FIPS tests completed successfully
Info	11/07/2008 19:41:32	DBP	AUDIT internal: SUCCESS Setting FIPS to be Non Periodic
Info	11/07/2008 19:41:31	FIPS	FIPS running these tests: Wlls Bypass Tests
Info	11/07/2008 19:41:31	FIPS	FIPS beginning test run
Info	11/07/2008 19:41:31	Access	AUDIT internal: Creating Device '00:00:39:9d:1d:c7' learned on a Wired interface in the Clear zone
Info	11/07/2008 19:41:31	DBP	AUDIT internal: SUCCESS Setting FIPS to be Run Once
Notice	11/07/2008 19:40:09	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state
Notice	11/07/2008 19:39:51	Radio Mgr	Mesh radio connection to 00:14:8c:08:0e:cb lost while in INIT state

Figure 5.27. *System Log* screen, all platforms[12]

The Bridge's three status icons indicate the severity of *System Log* messages:

Notice or *Info* - message is purely informational

Warning - unexpected event may indicate a problem/require attention

Error - failure or attempted breach requires attention

You can use the controls at the lower right of the screen to page through the log and specify the number of messages shown per page: **10**, **20**, **40** or **60**.

12.**Radio-associated messages** absent when no internal radio is present (refer to Table 1.1 on page 3).

When remote audit logging is enabled (Section 4.6.1), log messages sent to the external audit log are identified as *AUDIT* messages. Internally generated audit events are flagged *AUDIT internal*. Audit events generated by administrative action additionally identify the account and interface the administrator was logged onto at the time of the event.

Chapter 6
System and Network Maintenance

The Bridge GUI provides access to a number of administrative and diagnostic functions under **Maintenance** on the main menu. Only Bridge GUI Advanced View displays the **Licensing** link.

6.1 System Maintenance

The administrative functions you can access through **Maintain -> System** vary according to whether you are in Bridge GUI Simple View or Advanced View, as shown in Table 6.1

Table 6.1. System Maintenance Functions

Simple & Advanced Views	Advanced View Only
Version	*Reset Clients*
Restart Controller Device	*FIPS Retest*
Upgrade Controller Device	*Reset to Factory Defaults*
Backup System Settings	
Restore System Settings	

6.1.1 Resetting Connections

You can reset all of the Bridge's network connections, forcing users and devices to rekey and reauthenticate.

If *Cached Auth. Credentials* is **Disabled** users are prompted to re-enter their user names and passwords in order to re-establish their network connections. If *Allow Cached Credentials* is **Enabled** (the default) locally authenticated users are reauthenticated transparently, using their cached user credentials (Section 4.1.13).

Resetting connections can be useful after network reconfiguration, as part of a diagnostic procedure, or if an expected device is missing from the network.

You can reset sessions only in Advanced View.

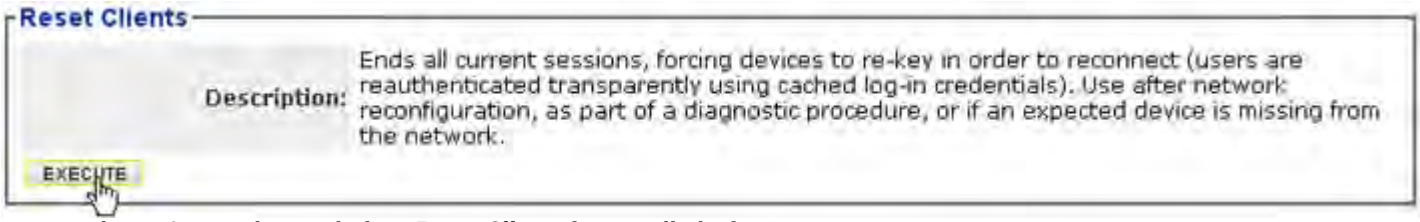


Figure 6.1. Advanced View *Reset Clients* frame, all platforms

To reset connections:

1 Log on to the Bridge GUI through an *Administrator*-level or *Maintenance*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Maintain -> System** from the menu on the left.

2 In the *System* screen's *Reset Clients* frame, click **EXECUTE**.

6.1.2 Rebooting the Bridge

The reboot option power cycles the Bridge, ending all sessions and forcing Secure Client devices (and any other Fortress Bridges) in communication with the Bridge to re-key in order to start a new session.

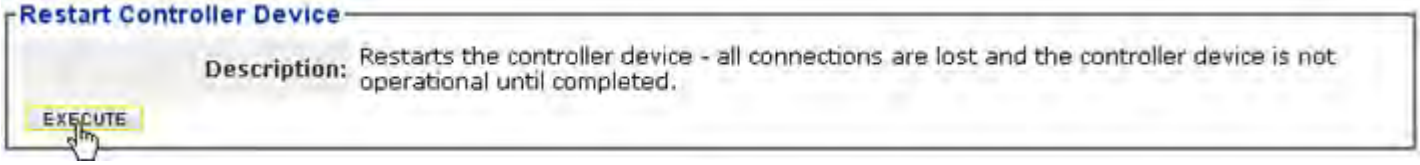


Figure 6.2. *Restart Controller Device* frame, all platforms

To reboot the Bridge:

1 Log on to the Bridge GUI through an *Administrator*-level or *Maintenance*-level account and select **Maintain -> System** from the menu on the left.

1 In the *System* screen's *Restart Controller Device* frame, click **EXECUTE**.

2 A dialog asks you to confirm your intention: click **OK.**

The Bridge GUI displays *Restarting the controller device - please be patient*. Bridge chassis LEDs go dark, then signal the boot process, and finally resume normal operation (refer to the Fortress *Hardware Guide* for your Bridge model for more detail).

NOTE: You can also reboot the Bridge with chassis controls (refer to the appropriate ***Hardware Guide***) or from the Bridge CLI (refer to the ***CLI Software Guide***).

CAUTION: When in blackout mode, some model Bridges still exhibits a single, initial blink of less than half a second, at the beginning of the boot process.

6.1.3 Viewing the Software Version

To view the software version currently running on the Bridge, log on to the Bridge GUI through an *Administrator*-level account and from the menu on the left, select: **Maintain -> System**, and refer to *Currently Running* in the *Version* frame.

6.1.4 Booting Selectable Software Images

The Bridge stores two, user-selectable copies (or images) of the Bridge software on separate partitions of the internal flash memory.

When the Bridge's software is upgraded (Section 6.1.5), the new software is first written to the non-running boot partition, overwriting any version stored there. When the Bridge is rebooted to complete the upgrade process, it boots from the partition to which the upgrade was downloaded, with the same configuration settings that were in effect before the upgrade procedure.

The Bridge then defaults to the boot partition with the latest software image—the last image booted—whenever it restarts.

New configuration changes are not written to the non-running boot partition. If you boot from the non-running boot partition, configuration settings will return to those in effect at the time the Bridge's software was last upgraded.

To select the next boot image:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> System** from the menu on the left.

2 In the *System* screen's *Version* frame, in *Image for Next Boot*, select the next image to boot from the dropdown.

3 Click **EXECUTE**.

CAUTION: If *Image for Next Boot* indicates *INVALID,* do ***not*** select it or click **EXECUTE**.

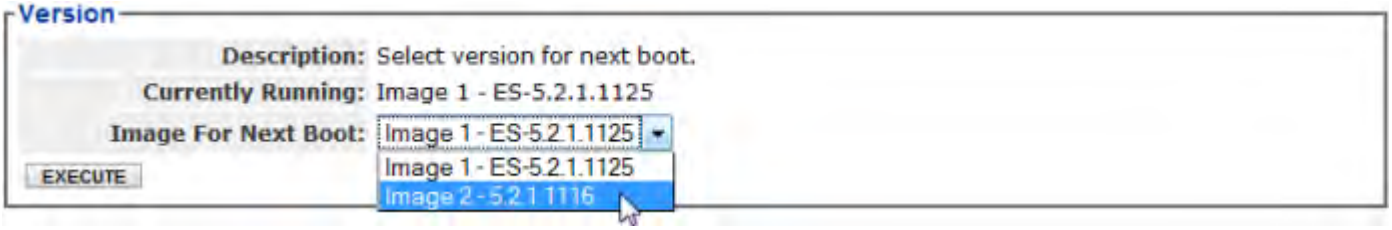


Figure 6.3. *Version* frame, all platforms

The next time the Bridge boots, it will boot the specified image.

6.1.5 Upgrading Bridge Software

Fortress Technologies regularly releases updated versions of Fortress Bridge software to add new features, improve functionality and/or fix known bugs. Upgrade files may be shipped to you on CD-ROM or, more often, made available for downloading from your account on **www.fortresstech.com**.

Fortress Secure Clients are backward compatible with Bridge software. It is nonetheless recommended that the Secure Clients of the Bridge be upgraded to the most recent version of the Secure Client software available for their respective platforms.

The Bridge flash memory is partitioned into two, bootable image areas. The software upgrade file is written to the non-running partition—i.e., the partition that does ***not*** contain the software currently running on the Bridge. The upgrade does not therefore take effect until the Bridge is rebooted (as described in Section 6.1.2), and the currently running software is retained on the partition it was originally written to.

The software image on a given flash partition cannot be downgraded, and you should not overwrite an image with an earlier version of the software. You can, however, revert to the earlier version of the software even after you have upgraded and rebooted the Bridge (refer to Section 6.1.2).

Figure 6.4. *Upgrade Controller Device* frame, all platforms

To upgrade Bridge software:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> System** from the menu on the left.

2 In the *System* screen's *Upgrade Controller Device* frame:
- Click to **Browse** to the location of the Bridge upgrade file and select it for upload.
- Enter the *Upgrade Package Password* : **`fortress`**
- Ensure that the **Distribute only - do not upgrade this unit** box is ***not*** selected (the default).

The **Distribute only - do not upgrade this unit** checkbox is intended to be used in conjunction with the Bridge's Auto-Config function, as are the **Upgrade using stored file** checkbox and **DELETE STORED FILE** button that will be present if an upgrade file has been uploaded for distribution. These controls should not be used during standard upgrade procedures; refer to the *Auto Config Software Guide* for more information.

3 Click **EXECUTE**. The *Upgrade Status* dialog displays the name of the upgrade package, notes approximately how long the upgrade process will take, and provides dynamic *Upgrade Status* and *Upgrade Operation* information. Operations display in order: *Starting*, *Uploading*, *Preparing*, *Loading*, *Decrypting*, *Checking Signature*, *Validating*, *Unpacking*, *Installing*, and finally, *Finished*. Depending on

CAUTION: If you have problems after successfully booting from the upgraded partition, *do not retry the upgrade while the Bridge is still running the newer software*. Revert to the previous software version before retrying the upgrade.

how quickly each completes, you may not see every operation.

When upgrade operations are *Finished*, the dialog *Note* instructs you to restart the controller device to activate the newly upgraded software image.

4 Click to **CLOSE** the *Upgrade Status* dialog.

The *Version* frame on the *System* screen shows the non-running image number as the *Image for Next Boot*.

5 In the *System* screen's *Restart Controller Device* frame, click **EXECUTE**.

The status line at the top of the screen advises: *Restarting the controller device - please be patient.* You will have to log back on after the Bridge reboots.

After the upgrade, the Bridge defaults to the boot partition with the latest software image—the last image booted—whenever it restarts.

If you experience problems after rebooting, revert to the previous Bridge software version (below) and then retry the upgrade.

To revert to the previous software version:

Because it is not overwritten, the software version the Bridge was running before the upgrade remains available in the event of a problem with the newer version of the software.

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> System** from the menu on the left.

2 In the *System* screen's *Version* frame, in *Image for Next Boot*, select the non-running image of the software version in effect before you upgraded from the dropdown.

3 Click **EXECUTE**.

4 In the same screen's *Restart Controller Device* frame, click **EXECUTE**.

The status line at the top of the screen advises: *Restarting the controller device - please be patient.* You will have to log back on after the Bridge reboots.

NOTE: Configuration changes are written *only* to the running boot partition. If you boot from the non-running boot partition, settings will revert to those in effect at the time the Bridge's software was last upgraded.

6.1.6 Backing Up and Restoring

The backup/restore function of the Bridge creates and downloads a configuration file that can be used to restore the settings it saves. You can create multiple backup files under pathnames of your choosing.

Most Bridge configuration settings are saved to the backup file. The only exceptions are the Bridge's *System Time* and *System Date* settings (**Configure -> Administration ->** *Time Configuration*). When you restore from the backup file, the rest of the settings in the current configuration are overwritten by those in the backup file.

Fortress Technologies recommends backing up the Bridge configuration:

- when the Bridge is first set up
- immediately before configuration changes are made
- after changes are made and the new configuration has been tested and proved fully operational

You can also use the restore function to reconfigure a Bridge using a backup file created on a different Bridge.

NOTE: The backup file used to restore the Bridge configuration ***must*** have been made on the current or another Bridge ***of the same model***. You cannot restore from a backup file created on a different Fortress Bridge model.

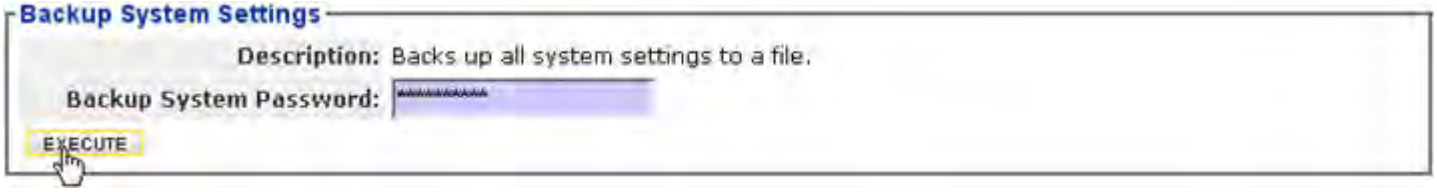


Figure 6.5. ***Backup System Settings*** **frame, all platforms**

To back up the Bridge configuration:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> System** from the menu on the left.
2. In the *System* screen's *Backup System Settings* frame, optionally enter a *Backup System Password*, or leave the field empty to apply a default password. *You do not need to know the default password to restore from a file that uses it. Leave the password field empty during the restore operation, and the default will again be applied transparently.*

   If you created a non-default password for the backup file, record it in a secure place; you will need it to restore from the backup file.
3. Click **EXECUTE**. The standard browser dialog asks whether you want to open or save the file (if the .cfg file type is not yet associated with an application, IE7 presents options to find or save it). **Save** the file with the name and in the location of your choice.

   The default backup filename is *configuration-backup.cfg*.

NOTE: Backup file passwords must be a minimum of ten alphanumeric characters. Strong passwords contain a mix of upper and lower cases.

To restore the Bridge configuration from a backup file:

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> System** from the menu on the left.

2 In the *System* screen's *Restore System Settings* frame, in *Restore System File*, enter the pathname or browse to the location of the Bridge backup configuration file.

3 In the same frame, enter the *Restore System Password* (the *Backup System Password* from the backup procedure above).

4 Click **EXECUTE**. The *Restore Status* dialog displays the progress of the restore operation and notifies you when it has completed.

CAUTION: The restore operation overwrites existing settings with those in the backup file.

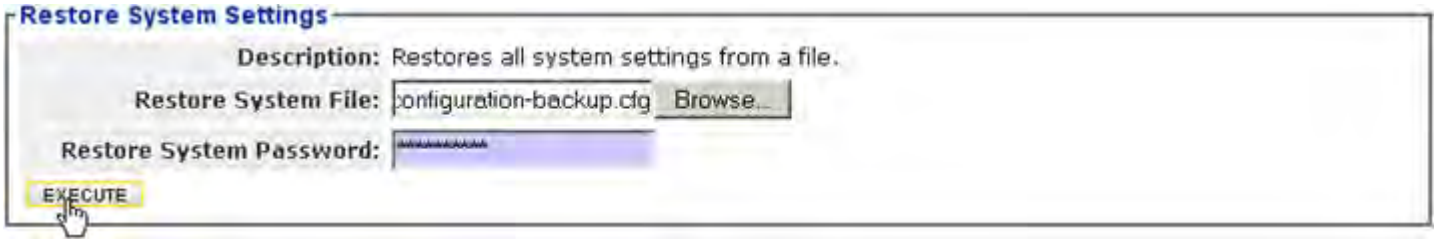


Figure 6.6. *Restore System Settings* frame, all platforms

5 Click **OK** to close the dialog informing you that a reboot is required to complete the restore procedure.

6 In the same screen's *Restart Controller Device* frame, click **EXECUTE**.

6.1.7 Initiating FIPS Retests

You can manually initiate the same self-tests that the Bridge runs automatically in accordance with FIPS 140-2, (Federal Information Processing Standards' *Security Requirements for Cryptographic Modules*).

When the Bridge is in FIPS operating mode, it will shut down and automatically reboot in the event of a FIPS self-test failure. It will not resume normal operation until it has passed FIPS power-on self-tests (refer to Section 4.1.1).

When in Normal (non-FIPS) operating mode, the Bridge logs FIPS self-test failures, but continues to operate even if self-tests fail.

Figure 6.7. Advanced View *FIPS Retest* frame, all platforms

You can initiate FIPS self tests only in Advanced View.

To run FIPS tests manually:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Maintain -> System** from the menu on the left.
2. In the *System* screen's *FIPS Retest* frame, click **EXECUTE**.

6.1.8 Restoring Default Settings

With the exceptions of any special features it has been licensed to use, the Fortress Bridge's factory default configuration settings can be restored in their entirety.

Because the Bridge's configuration settings could themselves be sensitive, Fortress Technologies recommends restoring them to their default values whenever the Bridge is to be shipped (or otherwise transported) out of a secured location.

In order to fully restore the Bridge to its factory configuration defaults, you must perform a separate restore operation for the software image on each of the Bridge's flash memory partitions (refer to Section 6.1.4).

You can reset to factory defaults only in Advanced View.

NOTE: Licensed features are retained even after the Bridge is reset to factory defaults.

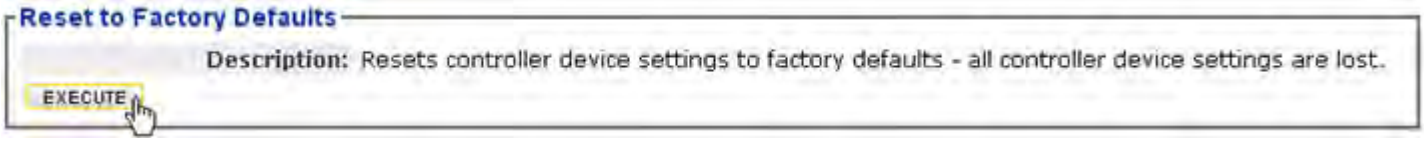


Figure 6.8. Advanced View *Reset to Factory Defaults* frame, all platforms

To restore the factory default configuration:

1. Log on to the Bridge GUI through an *Administrator*-level and select **ADVANCED VIEW** in the upper right corner of the page, then **Maintain -> System** from the menu on the left.
2. In the *System* screen's *Reset to Factory Defaults* frame click **EXECUTE**.
3. Click **OK** at the confirmation query.

   At the top of the screen the GUI displays: *Reset to Factory Defaults - please be patient.*
4. Close your browser.

NOTE: You can also restore the Bridge to its factory default settings with the chassis controls (refer to the appropriate ***Hardware Guide***) and from the CLI (refer to the ***CLI Software Guide***).

5 If you want to restore the default configuration on both of the Bridge's flash memory partitions, reopen your browser.

6 Log back on to the Bridge GUI (at the default IP address: 192.168.254.254) through an *Administrator*-level account and select **Tools -> System Tools** from the menu on the left.

7 In the *Version* frame's *Image For Next Boot* field, select the non-running software image.

8 On the same screen, in the *Restart Controller Device* frame button click **EXECUTE**.

9 When the Bridge has rebooted, repeat steps 1 through 4, above.

After restoring default settings, the Bridge will have to be reconfigured for use. To do so you can re-install it as you would a new Bridge. Alternatively, you can back the configuration up before you reset the Bridge to its defaults and then restore the backup configuration, after you have manually configured network properties and passwords.

NOTE: In order to re-access a Bridge at factory defaults, you must use a new browser instance on a computer with a non-routed connection to a clear interface on the Bridge and an IP address in the same subnet as the Bridge's default address.

6.2 Digital Certificates

The Bridge automatically generates a self-signed digital certificate conforming to the X.509 ITU-T[13] standard for a public key infrastructure (PKI). This certificate and associated RSA 2048-bit public/private key pair are present in the Bridge's certificate management configuration and used by the Bridge GUI by default.

6.2.1 Generating CSRs and Key Pairs

The **GENERATE CSR** button allows you to generate a PKCS (Public Key Cryptography Standards) #10 certificate signing request (CSR) and a corresponding public/private key pair, at the same time.

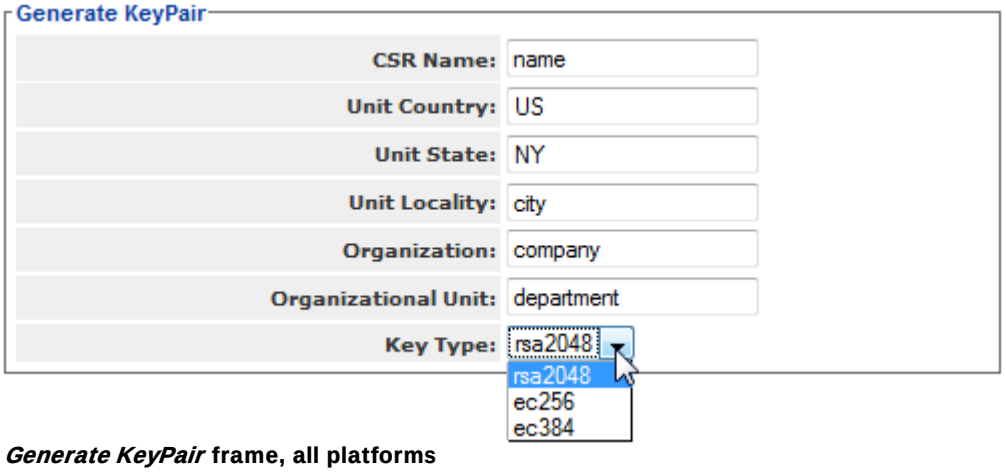


Figure 6.9. *Generate KeyPair* frame, all platforms

13.International Telecommunication Union-Telecommunication Standardization Sector; formerly, CCITT

The generated key pair is saved for use by the Bridge's certificate management function.

The PEM-formatted CSR generated is suitable for cutting and pasting for submission to a Certificate Authority (CA). It is not retained in the Bridge's configuration, but you can open (or save) it at the time you generate the CSR, or reconstruct it later with the **GET CSR** button associated with its entry in the *X.509 Keys* list.

```
-----BEGIN CERTIFICATE REQUEST-----
MIIByDCCATECAQAwgYcxFDASBgNVBAMTCzE5Mi4xNjguMS42MQswCQYDVQQGEwJV
UzELMAkGA1UECBMCTlkxDDAKBgNVBAcTA05ZQzEQMA4GA1UEChMHQ29tcGFueTET
MBEGA1UECxMKRGVwYXJ0bWVudDEgMB4GCSqGSIb3DQEJARYRYWRtaW5AY29tcGFu
eS5jb20wgZ8wDQYJKoZIhvcNAQEBBQADgY0AMIGJAoGBAMxwsi83t4QTyp4SFjxS
VIQnv8qpPRSS4xOaenO486gQsfQ5Cf4YyQ4/AZ3OZBr4ZsJgGmivXOTM2nz1d9BF
8U7mXmSvOq/EOHVi7tweJv7zFyhl5AnwfuVamXrqn17EH2KoFXAygbqjhncVksvk
e3qHftzm0b7c4S8/h7pBo2RlAgMBAAGgADANBgkqhkiG9w0BAQUFAAOBgQBOhM5T
vfZq9wgyyyCknX/H7NYcNDKy7Tym3qaQCKdIP/S4Wq/LHJI7I3NerSNSDPODuJyz
DGgfPdVbvU+mICd4gNsTzjaB0bG/WJ9ccc6DtyJ6lAk2N8Sv9l5IT6CGjLBFedQg
67WFokZq8H4i6EjfBrxXu0XrPp6IOIC2rsj51w==
-----END CERTIFICATE REQUEST-----
```

In order to generate a CSR/key pair, you must provide a name to associate with the stored key pair and specify at least one X.500 distinguished name (DN) attribute:

- *CSR Name* - establishes a name for the public/private key pair generated with the CSR.
- *Unit Country*, *Unit State*, *Unit Locality* - establish the country (C), State or Province (ST) and Locality (L) attributes of the DN.
- *Organization*, *Organizational Unit* - establish the Organization (O) and Organizational Unit (OU) attributes of the DN.
- *Key Type* - selects the algorithm and key length, in bits, for the key pair to be generated for the CSR:
  - **rsa2048** - (the default) RSA (Rivest, Shamir and Adleman) 2048-bit
  - **ec256** - elliptical curve 256-bit
  - **ec384** - elliptical curve 384-bit

  Key types are listed on the dropdown (and above) from lowest to highest level of security.

To generate a CSR and key pair:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> Certificates** from the menu on the left.
2. In the *X.509 Keys* frame of the *Certificates* screen, click **GENERATE CSR**.

3 In the resulting *Generate KeyPair* frame, enter values into the fields provided (described above) and click **APPLY** (or **CANCEL** the addition).

The generation of the CSR will be recorded in the *X.509 Keys* frame, with the associated key pair displayed by *Name*, with fields indicating the key *Type* and whether a certificate corresponding to the key pair is present in the local store (*Valid* displays *yes*) or no certificate has yet been imported for the key pair (*Valid* displays *no*).

NOTE: You can retrieve the CSR for a key pair with the associated **GET CSR** button.

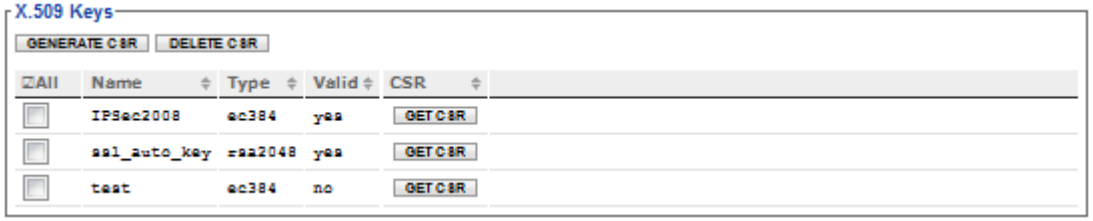


Figure 6.10. *X.509 Keys* frame, all platforms

To delete public/private key pairs:

You can delete a single key pair, selected key pairs, or all key pairs present on the Bridge.

1 Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> Certificates** from the menu on the left.

2 In the *X.509 Keys* frame of the *Certificates* screen:

- If you want to delete a single or selected key pair(s), click to place a checkmark in the box(es) beside the key(s) you want to eliminate.

or

- If you want to delete all key pairs, click **ALL** at the top of the *X.509 Keys* list to checkmark all keys.

Click the **DELETE CSR** button (or **CANCEL** the deletion).

3 Click **OK** in the confirmation dialog (or **CANCEL**).

Deleted key pairs are removed from the *X.509 Keys* list.

6.2.2 Managing Local Certificates

The Bridge's self-signed certificate, used by default for the Bridge GUI, is automatically generated and always present in the local certificate store.

You can import additional PEM-formatted or ASN.1 DER encoded X.509 signed certificate files into the Bridge's certificate store, and you can assign digital certificates stored on the Bridge to be used by specific Bridge functions.

6.2.2.1 Importing and Deleting Signed Certificates

An imported certificate can be:

- the certificate of a trusted root CA

- an intermediate CA certificate
- an end certificate corresponding to a public key manually generated on the Bridge with the **GENERATE KEY/CSR** button (described above) or Bridge CLI `generate` command (refer to the *CLI Software Guide*).

Figure 6.11. ***X.509 Certificates*** **frame, all platforms**

In order to import a signed digital certificate, you must specify:

- *CSR Name* or *Certificate Name* - specifies a name for the imported certificate, used to identify the certificate on the Bridge.

  If the certificate is an end certificate, you must select the *CSR Name* associated with the certificate's public key from the dropdown.

  If the certificate is a *trust anchor* certificate, you must first check the box to indicate this (see below), and then enter a *Certificate Name* unique to the local certificate store. The name does not have to be related to either the issuer or subject DN in the certificate.

- **Trusted Anchor** - when more than one root CA certificate is present, selects which will serve as *trust anchors,* or root certificates signed by trusted CAs in chains of trust applicable to the Bridge's current requirements.
- *Signed Certificate File* - permits you to **Browse** to the location of the certificate file to be imported.

NOTE: The certificate contains the information necessary to determine whether the certificate belongs to a CA or to an end entity or whether it is a root certificate.

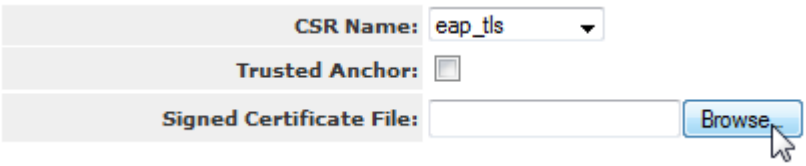


Figure 6.12. ***Upload Certificate*** **frame, all platforms**

In addition to the certificate's *Name*, the *X.509 Certificates* list displays:

- *Subject* - shows the IP address of the device that generated the associated CSR and the subject X.500 distinguished name (DN), consisting a concatenation of selected attributes, or relative distinguished name (RDNs).

- *Issuer* - identifies the issuer X.500 DN.
- *Valid As Of* / *Valid Until* - define the time span during which the certificate is valid by start and end times.
- *In Use* - identifies the Bridge function to which the certificate is assigned.
- *Use* - provides controls for assigning the certificate for use by specific Bridge functions.

Section 6.2.2.2 (below) covers the possible values of *In Use* and instructions for the buttons under *Use*.

To import a signed certificate file:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> Certificates** from the menu on the left.
2. In the *X.509 Certificates* frame of the *Certificates* screen, click **INSTALL CERTIFICATE**.
3. In the resulting *Install a signed certificate* dialog, enter values into the fields provided (described above) and click **APPLY** (or **CANCEL** the action).

The imported certificate will be listed in the *X.509 Certificates* frame.

To delete digital certificates:

You can delete a single or selected certificate(s), or all certificates in the Bridge's certificate store.

NOTE: If you delete the self-signed certificate, the Bridge will automatically generate a new one.

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> Certificates** from the menu on the left.
2. In the *X.509 Certificates* frame of the *Certificates* screen:
   - If you want to delete a single or selected certificate(s), click to place a checkmark in the box(es) beside the certificate(s) you want to eliminate.

   or

   - If you want to delete all certificates, click **ALL** at the top of the *X.509 Certificates* list to checkmark all accounts.

   Click the **DELETE** *checked certificates* button (or **CANCEL** the deletion).
3. Click **OK** in the confirmation dialog (or **CANCEL**).

Deleted certificates are removed from the *X.509 Certificates* list.

With the exception of the self-signed SSL certificate, if a deleted certificate was in use, the function to which it was assigned will no longer be able to perform certificate-dependent authentication transactions until a new valid certificate is assigned.

6.2.2.2 Assigning Stored Certificates to Bridge Functions

Locally stored signed certificates can have any of three applications on the Bridge, as indicated in the *In Use* column of the *X.509 Certificates* list:

- *ssl* - the Secure Socket Layer certificate is used by the Bridge GUI to secure browser connections to the management interface via https (refer to Section 2.1.2).

  By default, the Bridge GUI uses the automatically generated self-signed certificate for SSL. When additional certificates have been imported, you can change this assignment.

- *IPsec* - the Internet Protocol Security certificate is used to authenticate the Bridge as an endpoint in IPsec transactions (refer to Section 4.2).
- *eaptls* - the Extensible Authentication Protocol-Transport Layer Security certificate is used:
  - to authenticate EAP-TLS 802.1X supplicants—when the Bridge's internal authentication server is configured to provide 802.1X authentication service (refer to Section 4.3.2).
  - to authenticate an ES210 Bridge as a wireless station—when it is dedicated to act as a wireless Client (refer to Section 3.3.5.10).

  Because Bridges used as wireless Clients must be dedicated to the function, the EAP-TLS certificate will only be used for one of these applications.

A given function can have only one certificate assigned to it. You can, however, assign the same certificate to more than one function.

To assign local certificates to Bridge functions:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> Certificates** from the menu on the left.
2. In the *X.509 Certificates* frame of the *Certificates* screen, in the *Use* column, click the button for the relevant function: **USE IPSEC** or **USE EAPTLS**, to the right of the certificate you are assigning to that function.

   The button(s) for a given function will only be present if no certificate has yet been assigned to it.

The specified function will be listed for that certificate in the *X.509 Certificates* frame, under *In Use*.

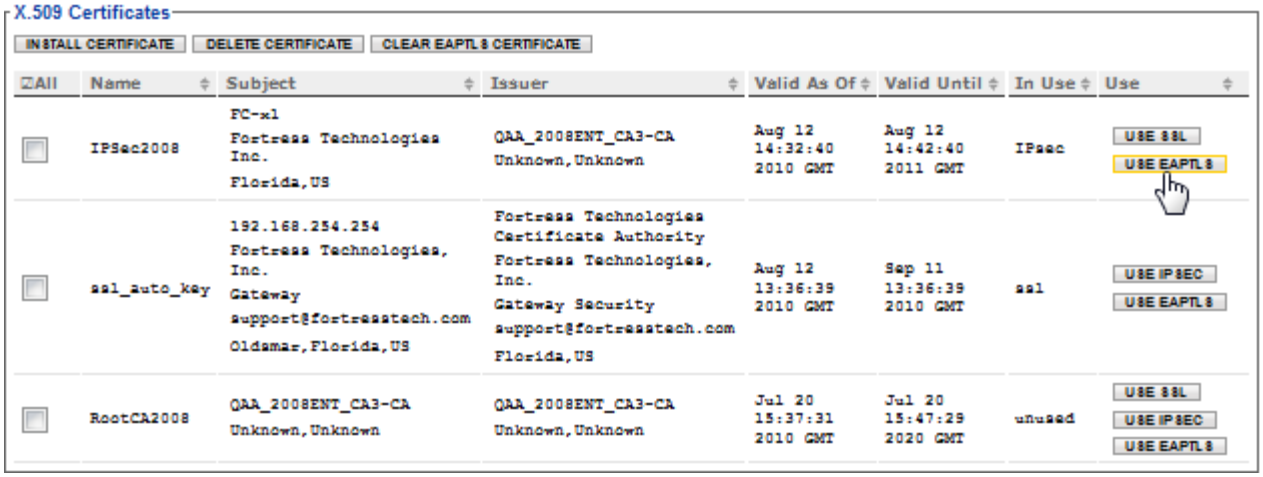


Figure 6.13. *X.509 Certificates* frame, all platforms

6.2.2.3 Changing and Clearing Certificate Assignments

You can change the SSL certificate assignment from the default, automatically generated, self-signed certificate, but you cannot configure the Bridge to use no digital certificate for SSL. If you assign a different certificate to the function, and then delete that certificate or the associated key pair (or if the certificate and key pair are mismatched), the Bridge GUI SSL function will revert to using the default certificate.

Once established, you can also change the certificates assigned to EAP-TLS and to IPsec.

To change certificate assignments:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> Certificates** from the menu on the left.
2. In the *X.509 Certificates* frame of the *Certificates* screen, to the right of the certificate you want to assign, click the relevant button for the function you want to assign it to: **USE SSL**, **USE IPSEC**, or **USE EAPTLS**.

The selected function will be displayed for the newly assigned certificate in the *In Use* column of the *X.509 Certificates* list, and the button for the function will be added to the *Use* column of the certificate formerly assigned to it.

You can use the **CLEAR EAPTLS CERTIFICATE** button to return the Bridge's EAP-TLS function to the default state, in which no certificate is assigned and only PSK is used for authentication (if pre-shared keys have been configured). Refer to Section 4.3.2.7 for more information on the local 802.1X authentication service and to Section 3.3.5.10 for more on authenticating ES210 Bridges deployed as wireless clients.

The **CLEAR IPSEC CERTIFICATE** button likewise returns the Bridge's IPsec function to the default state, in which no certificate is assigned and only PSK is used to authenticate IPsec peers (if pre-shared keys have been configured). Refer to Section 4.2 for more information on IPsec operation and configuration.

To clear certificate assignments:

1. Log on to the Bridge GUI through an *Administrator*-level account and select **Maintain -> Certificates** from the menu on the left.
2. In the *X.509 Certificates* frame of the *Certificates* screen, click the button at the top of the frame that corresponds to the function for which you want to clear the certificate:
   - **CLEAR EAPTLS CERTIFICATE**

   or

   - **CLEAR IPSEC CERTIFICATE**

There must be a valid certificate assigned to the application in order for authentication transactions to be successfully performed by the Bridge for the corresponding function.

6.3 Features Licensing

There are various optional features on Fortress Bridges that you can enable only after entering or uploading valid license keys for these functions.

- *mesh - FastPath Mesh* enables Fortress's FastPath Mesh bridging link management function (refer to Section 3.2.1). This feature applies to all Fortress Bridges.
- *advradio - Advanced Radio* enables 802.11a radio support for additional licensed and unlicensed frequencies (refer to Section 3.3.1). This feature applies only to radio-equipped Bridges; refer to Section 1.3.1.
- *country - Country* enables an additional 70 selectable countries of operation through which to identify the regulatory domain for Bridge 802.11a radio operation (refer to Section 3.3.1.3). This feature applies only to radio-equipped Bridges; refer to Section 1.3.1.
- *suite-b - Suite B Security* enables support for an additional key establishment method that employs NSA (National Security Agency) Suite B cryptography (refer to Section 4.1.3). This feature applies to all Fortress Bridges.
- *perf-level - Performance Level* allows for three field-upgradable performance configurations for the FC-*X*. Performance level numbers represent optimum

performance at that level, with no more than the maximum number of active connections shown in Table 6.2.

Table 6.2. Performance Levels

Configuration	Encrypted Throughput	Maximum Active Devices[a]
FC-250:	250 Mbps	500
FC-500:	500 Mbps	1000
FC-1500:	1.5 Gbps	3000

a. concurrently connected Secure Clients, Trusted Devices and APs

This feature applies only to FC-*X* model Fortress Controllers.


Installed Licenses

Feature	Description	Status	Upgrade Date
advradio	Advanced Radio	Installed	Mar-12-2009
country	Country	Installed	Mar-12-2009
mesh	Mesh	Installed	Dec-03-2009
suite-b	Suite B Security	Not installed	Jan-18-2010

Figure 6.14. Advanced View *Installed Licenses* frame, all platforms

The Bridge GUI displays licensing options and the status of each on **Maintain -> Licensing**, available only in Advanced View.

The *Advanced Radio* and *Country* licensed features are automatically enabled when you enter or upload valid license keys for the feature, as are performance upgrades for the FC-*X*.

Once licensed, FastPath Mesh can be enabled on **Configure -> Administration** in *Bridging Configuration* (in Simple View and Advanced View) and on **Configure -> FastPath Mesh** (in Advanced View only).

After it has been licensed, Suite B can be enabled on **Configure -> Security**.

By default, no licenses are installed nor licensed features enabled on the Bridge.

6.3.1 Obtaining License Keys

A unique, 20-character, hexadecimal key is required for each licensed feature on each Bridge, based on the Bridge's serial number.

Fortress can generate a single 20-digit license key for a single feature on a single Fortress Bridge, or a set of license keys for multiple features and/or multiple Bridges in a group license text file.

Fortress's group license files contain all the information needed to license a given set of features on a given set of Bridges. You

NOTE: If you purchased the Bridge with a license for a given feature, the license key is included in your shipment. You can obtain special feature licenses after your initial purchase from Fortress Technologies.

must upload the file—or paste the entire file into the field provided—on each Bridge it applies to. (Refer to Section 6.3.2 for detailed instructions.)

If you have not yet obtained a license key or group license for feature(s) you want to enable on Bridge(s) already in your possession, you will need to give Fortress Technologies the serial number of each Bridge on which you wish to enable a new feature.

The serial number is displayed on the first frame of **Maintain -> Licensing**.

Figure 6.15. Advanced View *License Purchasing* frame, all platforms

Call your Fortress Technologies sales representative to purchase a new feature or group license and obtain valid license keys.

You can access Bridge GUI licensing screens and functions only in Advanced View.

6.3.2 Licensing New Features

NOTE: Bridge feature licensing is unchanged when configuration settings are restored from a backup file or reset to their factory defaults (refer to Section 6.1.8).

1. Log on to the Bridge GUI through an *Administrator*-level account and select **ADVANCED VIEW** in the upper right corner of the page, then **Maintain -> Licensing** from the menu on the left.
2. In the *License Purchasing* frame of the *Licensing* screen, click the button that corresponds to the action you want to perform:
   - **ENTER LICENSE KEY** - to enter a single key for a single advanced feature.

Figure 6.16. Advanced View *Enter License Key* dialog, all platforms

   - **ENTER LICENSE GROUP** - to enter a plaintext group license file that covers multiple Bridges and/or multiple features: Copy and paste the entire license file into the

field provided. (Group licensing files include a digital signature and must be used intact.)

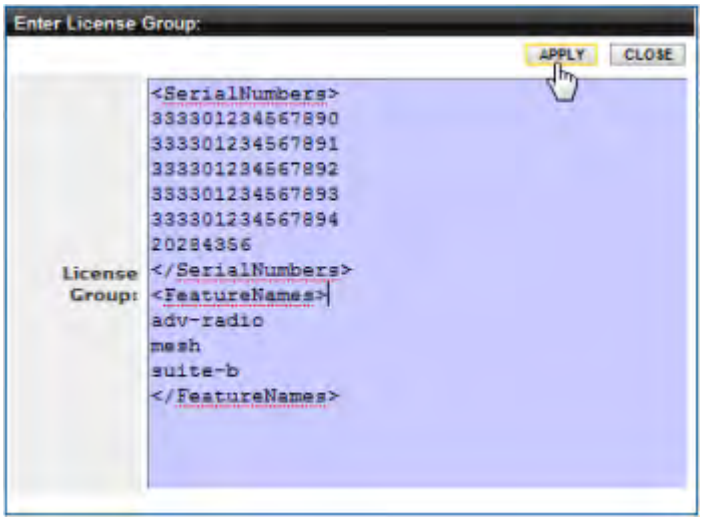


Figure 6.17. Advanced View *Enter License Group* dialog, all platforms

- **UPLOAD LICENSE GROUP** - to browse to the location of a group licensing file and select it for upload.

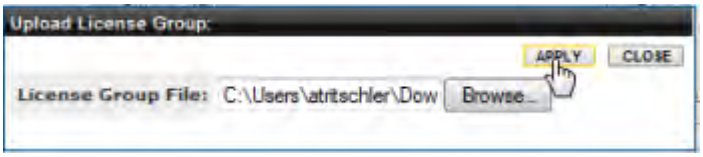


Figure 6.18. Advanced View *Upload License Group* dialog, all platforms

3. In the resulting dialog, enter the license key or group license file, or browse to and select the group license file, and click **Apply**.
4. As the Bridge GUI indicates, you must reboot the Bridge in order for the license to take effect. Do so according to the directions in Section 6.1.2.

6.4 Network Tools

Maintain -> Network provides standard ICMP (Internet Control Message Protocol) ping and traceroute tools.

If FastPath Mesh is enabled (refer to Section 3.2.1), the screen also provides a *Mesh Path* trace tool that displays the total end-to-end cost to reach a particular node in a FastPath Mesh network, along with each hop with its associated cost.

NOTE: The *Mesh Path* trace tool is intended for use only when FastPath Mesh is licensed and enabled on the Bridge.

Figure 6.19. *Network* diagnostics screen, all platforms

1. Log on to the Bridge GUI through an *Administrator*-level or a *Maintenance*-level account and select **Maintain -> Network** from the menu on the left.
2. In the *Network* screen's *Operation* frame, use the *Type* radio buttons to select the tool you want to use: **Ping**, **Traceroute** or **Mesh Path**.
3. In the same frame, in *Hostname/IP Address*, enter the IP address (IPv4 or IPv6) or hostname of the device you want to ping or trace a route to.
4. Click **START** in the upper right of the screen.

   The Bridge will ping the target IP or trace a packet to the address, according to your selection in Step 2, and display the *Result*.
5. To interrupt the operation, click **STOP** in the upper right of the screen.

6.5 Support Package Diagnostics Files

To assist in diagnosing a problem with the Bridge, Technical Support may request that you generate a diagnostics file.

Diagnostics files encrypt the information collected from the Bridge, so the file can be securely sent as an e-mail attachment.

Figure 6.20. *Receiving Product Support* frame, all platforms

1. Log on to the Bridge GUI through an *Administrator*-level or a *Maintenance*-level account and select **Maintain -> Support** from the menu on the left.
2. In the *Support* screen's *Receiving Product Support* frame, enter a *Password* for the support package file.

Record the password in a secure place; Fortress Technical Support will need it to decrypt the support package file.

3 Click **DOWNLOAD**, and, if your browser is set to block pop-ups/file downloads, take the necessary actions to allow the file to download.

The progress of file generation is displayed.

4 When the download completes, **Save** the file, *support.pkg*, to the location of your choice.

NOTE: Support package file passwords can be 1–20 alphanumeric characters and/or symbols.

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Glossary

3DES	Triple Data Encryption Standard—a FIPS-approved NIST standard for data encryption using 192-bits (168-bit encryption, 24 parity bits) for protecting sensitive (unclassified) U.S. government (and related) data. NIST amended and re-approved 3DES for FIPS in May, 2004.
802.11	The IEEE standard that specifies technologies for wireless networks.
802.11i	The amendment to the 802.11 standard that describes security for wireless networks, or *Robust Security Networks*.
802.1X	The IEEE standard for port-based network access control, providing authentication and authorization to devices attached to a given port (or preventing access from that port if authentication fails).
802.16	The IEEE standard that specifies technologies for fixed broadband wireless MANs that use a point-to-multipoint architecture, also called WiMAX, WirelessMAN™ or the Air Interface Standard.
Access ID	In Fortress Technologies products, a user-defined, 16-digit hexadecimal value that provides network authentication for all devices authorized to communicate over a Fortress-secured network. Network authentication is one of the components of Multi-factor Authentication™.
access point (AP)	A device that transmits and receives data between a wired LAN and a WLAN, to connect wireless devices within range to the LAN.
AES	Advanced Encryption Standard—a FIPS-approved NIST standard for 128/192/256-bit data encryption for protecting sensitive (unclassified) U.S. government (and related) data; also referred to as the *Rijndael algorithm*. NIST FIPS-approved AES in November, 2001.
administrator password	In Fortress Technologies products, a password that guards against unauthorized modifications to the system or its components (compare *user password*).
APIPA	Automatic Private IP Addressing—a Microsoft feature that allows a DHCP client unable to acquire an address from a DHCP server to automatically configure itself with an IP address from a reserved range (169.254.0.1 through 169.254.255.254). The client uses the self-configured IP address until a DHCP server becomes available.
ARP	Address Resolution Protocol—describes how IP addresses are converted into physical, DLC addresses (ex., MAC addresses).
AS	Authentication Server—a network device running an authentication service: software that checks credentials to verify the identity of network users and/or devices in order to restrict access to the network or to its resources or to track network activity. Autonomous System—as defined by RFC 1930, a network or connected set of networks, usually under a single administrative entity, with a single clearly defined routing policy; “the unit of routing policy in the modern world of exterior routing.”

ATM	Asynchronous Transfer Mode—a technology for transferring data over a network in packets or cells of a fixed size.
BGP	Border Gateway Protocol—a protocol, defined by RFC 1771, for interautonomous system routing; the interdomain routing protocol used by TCP/IP.
BPM	In FIPS, bypass mode—state in which cleartext is allowed to pass on an encrypted interface.
bridge	A network device that connects two networks or two segments of the same network.
Bridge	Refer to *Fortress Secure Bridge* and *Fortress Secure Wireless Bridge.*
Bridge GUI	The browser-based graphical user interface through which a Fortress Bridge is configured and managed, locally or remotely.
BSS	Basic Service Set—the primary collection of entities associated in a wireless network, as defined in the IEEE 802.11 standard.
CAC	Common Access Card—a United States Department of Defense (DoD) smartcard issued as standard identification for active duty military personnel, reserve personnel, civilian employees, and eligible contractor personnel.
CCITT	Comite Consultatif Internationale de Telegraphie et Telephonie, former name of the ITU-T.
CLI	command-line interface—a user interface in which the user enters textual commands on a single line on the monitor screen.
client	In client-server architecture, an application that relies on another, shared application (server) to perform some of its functions, typically for an end-user device.
Client	Refer to *Fortress Secure Client*.
Controller	Refer to *Fortress Controller.*
controller device	See Fortress controller device
Controller GUI	The browser-based graphical user interface through which the Fortress Controller is configured and managed, locally or remotely.
Crypto Officer password	A FIPS-defined term—sometimes, *Crypto password*—the a*dministrator password* in Fortress devices operating in *FIPS* mode.
Data Link Layer	Refer to *DLC*.
dBi	decibels over isotropic—a unit of measure of RF antenna gain: the power emitted by an antenna in its direction of strongest RF emission divided by the power that would be transmitted by an isotropic antenna emitting the same total power.
dBm	decibels referenced to milliwatts—an absolute (non-relative) unit of power measurement that indicates the ratio, in decibels (dB), of measured power referenced to one milliwatt (mW)
DES	Data Encryption Standard—formerly, a FIPS-approved NIST standard for data encryption using 64 bits (56-bit encryption, 8 parity bits). NIST withdrew its FIPS-approval for DES on May 19, 2005.
device authentication	In Fortress Technologies products, a means of controlling network access at the level of individual devices, tracking them via their generated Device IDs and providing controls to explicitly allow and disallow them on the network; one of the factors in Fortress's Multi-factor Authentication™.
Device ID	In Fortress Technologies products, a 16-digit hexadecimal value generated for and unique to each Fortress Bridge, Controller or MSP Secure Client device on the Fortress-secured network. Device IDs are used for *device authentication* and are neither modifiable nor transferable.

DHCP	Dynamic Host Configuration Protocol—an Internet protocol describing a method for flexibly assigning device IP addresses from a defined pool of available addresses as each networked device comes online, through a client-server architecture. DHCP is an alternative to a network of fixed IP addresses.
Diffie-Hellman key establishment	A protocol by which two parties with no prior knowledge of one another can agree upon a shared secret key for symmetric key encryption of data over an insecure channel. Also, *Diffie-Hellman-Merkle key establishment*; *exponential key exchange*.
DLC	Data Link Control—the second lowest network layer in the OSI Model, also referred to as the *Data Link Layer*, *OSI Layer 2* or simply *Layer 2*. The DLC layer contains two sub-layers: the MAC and LLC layers.
DMZ	Demilitarized Zone—in IT, a computer (or subnet) located between the private LAN and a public network, usually the Internet.
DNS	*Domain Name System*, *Server* or *Service*—a system or network service, defined in the TCP/IP Internet Protocol Suite, that translates between textual domain and host names and numerical IP addresses.
DoD	Department of Defense—the United States military.
EAP	Extensible Authentication Protocol—defined by RFC 2284, a general protocol for user authentication. EAP is implemented by a number of authentication services, including RADIUS.
EAP-MD5	An EAP security algorithm developed by RSA Security® that uses a 128-bit generated number string to verify the authenticity of data transfers.
EAP-TLS	EAP-Transport Layer Security—a Point-to-Point Protocol (PPP) extension supporting mutual authentication, integrity-protected cipher suite negotiation, and key exchange between two endpoints, within PPP.
EAP-TTLS	EAP-Tunneled TLS—An EAP-TLS protocol developed by Funk and Certicom that uses TLS to establish a secure connection between a client and server.
ES300	The Fortress hardware model identifier of the *Secure Bridge*.
ES520	The Fortress hardware model identifier of the *Secure Wireless Bridge*.
failover	A device or system configuration in which two, identical components are installed for a given function so that if one of them fails the redundant component can carry on operations without substantial service interruption. Also, an instance in which an active component becomes inoperative and *fails over* operations to its partner.
FC-*X*	The Fortress hardware model identifier of the *Fortress Controller*.
FIPS	Federal Information Processing Standards—issued by NIST, FIPS mandate how IT, including network security, is implemented by the U.S. government and associated agencies.
FIPS operating mode	In Fortress Technologies products, the operating mode that complies with FIPS 140-2 Security Level 2.
Fortress Controller	Sometimes, *Fortress Security Controller*—Fortress's FC-*X* model network device for securing communications between wireless devices and a LAN, or between devices within a LAN, or in a networked configuration.
Fortress controller device	A collective noun for Fortress network devices (Fortress Bridges and Controllers).
Fortress Secure Client	A software client module for securing network communications on devices such as laptops, PDAs, tablet PCs, and industrial equipment such as barcode scanners and portable terminals.
Fortress Secure Client Bridge	Also, *Fortress SCB* or *SCB*—a hardware device for providing wireless connectivity and securing network communications on wired devices such as portable medical equipment and point-of-sale (POS) terminals.

Fortress Security System	The secure network deployment of one or more Fortress Bridges and the Fortress Secure Clients and/or Secure Client Bridges that will communicate with the Bridge(s).
Fortress Secure Bridge	Fortress's ES300 model network device for securing communications between wireless devices and a LAN, or between devices within a LAN, or in a networked configuration.
Fortress Secure Wireless Bridge	Fortress's ES520 model and ES210 model radio-equipped network devices that can act as wireless access points and/or bridges in a mesh network.
FQDN	Fully Qualified Domain Name—the complete, unambiguous domain name specifying the exact location in the DNS hierarchy of a particular entity on the network.
frame	In Fortress Technologies GUIs, a portion of a larger screen or dialog, graphically set apart from other elements on the screen and providing the interface for a specific feature or function set. In IT, a packet of data transmitted/received.
gateway	In IT, a node on a network, usually a router, that provides a connection to another network.
GINA	A library developed by Microsoft®; it is a component of some Microsoft Windows® operating systems and provides secure authentication and interactive logon services.
GPS	Global Positioning System
groups	An association of network objects (users, devices, etc.) typically used to allocate shared resources and apply access policies.
GUI	graphical user interface—a user interface in which the user manipulates various interactive objects (menu items, buttons, etc.) displayed on the monitor screen.
hash function	Mathematical computation for deriving a condensed representation or *hash value*, usually a fixed-size string, from a variable-size message or data file.
HTTP	Hypertext Transfer Protocol—used to transmit and receive all data over the World Wide Web.
HTTPS	HTTP Secure sockets—HTTP with an encryption/authentication layer.
IANA	Internet Assigned Number Authority—the organization that assigns Internet Protocol (IP) addresses and port numbers.
ICMP	Internet Control Message Protocol —supports packets containing error, control, and informational messages. The **`ping`** command uses ICMP to test an Internet connection.
IDS	Intrusion Detection System—monitors network activity to identify suspicious patterns that may indicate a network or system attack and supports automated and/or manual real-time responses.
IEEE	Institute of Electrical and Electronics Engineers—a nonprofit technical professional association that develops, promotes, and reviews standards within the electronics and computer science industries.
IETF	Internet Engineering Task Force—the primary standards organization for the Internet.
IGMP	Internet Group Management Protocol—The portion of the IP multicast specification that describes dynamically managing the membership of multicast groups.
Internet Protocol Suite	Also, TCP/IP—the basic, two-part communication protocol in use on the Internet (refer to IP and TCP).
IP	Internet Protocol—defines a method for transmitting data, in packets, from one computer to another over a network; one of the founding protocols in the TCP/IP suite of networking protocols.
IPS	Intrusion Prevention System—allows network administrators to apply policies and rules to network traffic, as it is monitored by an intrusion detection system.

IPsec	Internet Protocol security—a set of protocols developed by the IETF to support secure exchange of packets at the IP layer, deployed widely to implement VPNs.
IPv4	Internet Protocol version 4—the first widely implemented and still the most prevalent version of IP.
IPv6	Internet Protocol version 6—the next version of IP slated for wide implementation, intended to overcome the limitations of, and to eventually replace, IPv4.
ISO	International Organization for Standardization, formerly the International Standards Organization—ISO still refers to standards (ex., ISO 9000); the whole name refers to the organization, sometimes appending the earlier initialization in parentheses.
isotropic antenna	A theoretical, idealized antenna that would transmit power uniformly in all directions; used to measure antenna gain in dBi.
IT	Information Technology
ITU-T	International Telecommunications Union-Telecommunication, Geneva-based international organization for telecommunications standards, formerly CCITT.
key establishment	An transaction through which two parties with no prior knowledge of one another can agree upon a shared secret key for symmetric key encryption of data over an insecure channel. Sometimes, key exchange.
LAN	Local Area Network—a collection of computers located within a small area (such as an office building) that shares a common communications infrastructure and network resources (i.e., printers, servers, etc.).
Layer 2	Refer to DLC.
LDAP	Lightweight Directory Access Protocol—a protocol used to access directories on a network, including the Internet. LDAP makes it possible to search compliant directories to locate information and resources on a network. LDAP is a streamlined version of the Directory Access Protocol, part of the X.500 standard for network directory services.
LLC	Logical Link Control—one of two sublayers of OSI Layer 2 (refer to *DLC*), in which frame synchronization, flow control and error checking takes place.
MAC	Media Access Control—one of two sublayers of the OSI Model's DLC, at which data access and transmission permissions are controlled.
MAC address	Media Access Control address—a unique number that identifies a device, used to properly direct network traffic to the device.
MAN	Metropolitan Area Network—a collection of interconnected computers within a town or city.
MBG	Mesh Border Gateway—in Fortress Secure Wireless Bridges, an MP that connects the FastPath Mesh network to a conventional hierarchical network.
MIB	Management Information Base—SNMP-compliant information that an SNMP agent stores about itself and sends in response to SNMP server requests (PDUs).
MITM	Man in the Middle attack—a network security breach in which an attacker is able to intercept, read, insert and modify messages between two parties without their knowing that the link between them has been compromised.
MLD	Multicast Listener Discovery—a means, defined in the IPv6 ICMPv6 protocol, of discovering multicast listeners on a directly attached link (analogous to IGMP in IPv4).
MobileLink™	In GE Medical Systems *Information Technologies*, a proprietary method for wireless transmission of serial output.
MP	Mesh Point—in Fortress Secure Wireless Bridges, a Bridge on which FastPath Mesh routing is enabled.
MRD	Multicast Router Discovery—a mechanism, defined in IETF RFC 4286, for identifying multicast routers independent of the multicast routing protocol they use.

MRP	Mesh Radio Port—in Fortress Secure Wireless Bridges, a pair-wise network link formed between WDS-enabled BSSs configured on the Bridges.
MSI	The Microsoft installer system written by Microsoft for Windows platforms.
MSP	The Fortress protocol that provides authentication and encryption at the Media Access Control (MAC) sublayer, within the Data Link Layer (Layer 2) of the Open System Interconnection (OSI) networking model.
Multi-factor Authentication™	In Fortress Technologies products, the combination of network authentication (through the network Access ID), device authentication (through the Device ID), and user authentication (through user credentials), that guards the network against unwanted access.
multiplexing	The practice of transmitting multiple signals over a single connection.
NetBIOS	Network Basic Input/Output System—an API that originally provided basic I/O services for a PC-Network and that has been variously adapted and augmented to support current LAN/WLAN technologies.
network authentication	In Fortress Technologies products, the requirement that all devices must authenticate with the correct *Access ID* in order to connect to the Fortress-secured network; one of the factors in Fortress's Multi-factor Authentication™.
network resource	An entity on the network that provides a service or function, such as e-mail or printing, to devices and users on the network.
NIC	Network Interface Card—computer circuit board that enables a computer to connect to a network.
NIAP	National Information Assurance Partnership—a collaboration between NIST and the National Security Agency (NSA), in response to the Computer Security Act of 1987 (PL 100-235), to promote sound security requirements for IT products and systems and appropriate measures for evaluating them.
NIST	National Institute of Standards and Technology, the U.S. Government agency responsible for publishing FIPS.
NMP	Non-Mesh Point—in Fortress Secure Wireless Bridges, any node on a Fortress FastPath Mesh network that is not an MP.
NSA	National Security Agency—United States intelligence agency administered by the Department of Defense.
NTLM	Windows NT LAN Manager—a user authentication protocol developed by Microsoft®.
operating mode	In Fortress Technologies products, the way in which access controls and cryptographic processing are implemented on the Fortress-secured network.
OSI Model	Open System Interconnection Model—an ISO standard that defines a networking framework for implementing data transfer and processing protocols in seven layers. (Also see, *DLC*.)
PAN	Personal Area Network—a collection of networked computers and devices worn by or within reach of an individual person
PDU	Protocol Data Unit—often synonymous with *packet*, a unit of data and/or control information as defined by an OSI layer protocol.
PKI	Public Key Infrastructure (PKI), a system of digital certificates and other registration authorities that authenticate the validity of each party involved in an Internet transaction; sometimes, trusted hierarchy.
policy	The means by which access to the secure network and its resources are controlled for users, devices and groups.
PPP	Point-to-Point Protocol—a method for communicating TCP/IP traffic over serial point-to-point connections.

QoS	Quality of Service
RSA SecurID®	An authentication method created and owned by RSA Security.
RADIUS	Remote Authentication Dial-In User Service—an authentication service design that issues challenges to connecting users for their usernames and passwords and authenticates their responses against a database of valid usernames and passwords; described in RFC 2865.
RF	Radio Frequency
RFC	Request for Comments—a document proposing an Internet standard that has been accepted by the IETF as potentially developing into an established Internet standard.
RSN	*Robust Security Network* - the concept, introduced in the 802.11i amendment to the IEEE 802.11 standard, of a wireless security network that allows only *RSNAs* to be created.
RSNA	*Robust Security Network Association* - in the IEEE 802.11i amendment, a wireless connection between 802.11i entities established through the 802.11i 4-Way Handshake key management scheme.
RRL	Resilient Radio Link—in Fortress Secure Wireless Bridges, active wireless links that form along the best available path between the WDS-enabled BSSs of networked Bridges. RRLs provide fault-tolerant connections for Fortress's self-healing wireless networks.
SCB	Refer to *Fortress Secure Client Bridge*.
Secure Client	Refer to *Fortress Secure Client*.
Secure Client Bridge	Refer to *Fortress Secure Client Bridge*.
Secure Client device	In Fortress Technologies products, a device such as a laptop, PDA, tablet PC, or barcode scanner, that has the Fortress Secure Client installed and configured to permit the device to communicate on the Fortress-secured network.
SFP	Small Form Pluggable—shorthand for fiber optic Small Form Pluggable transceiver.
SHA	Secure Hash Algorithm, cryptographic hash functions developed by the NSA and published by NIST in FIPS 180-2.
SHS	Secure Hash Standard—FIPS-approved NIST standard specifying five secure hash algorithms: SHA-1, SHA-224, SHA-256, SHA-384, and SHA-512
SLIP	Serial Line Internet Protocol—a method for communicating over serial lines, developed for dial-up connections.
SMTP	Simple Mail Transfer Protocol—describes a method for transmitting e-mail between servers.
SNMP	Simple Network Management Protocol—a set of protocols for simplifying management of complex networks. The SNMP server sends requests (PDUs) to network devices, and SNMP-compliant devices (SNMP agents) respond with data about themselves (stored in MIBs).
SNMP agent	Any network device running the SNMP daemon and storing a MIB, a client of the SNMP server.
SSH®	Secure Shell®, sometimes, Secure Socket Shell—a protocol, developed by SSH Communication Security®, for providing authenticated and encrypted logon, file transfer and remote command execution over a network.
SSID	Service Set Identifier—a unique name that identifies a particular wireless network
STP	Spanning Tree Protocol—a link management protocol, operating at OSI layer 2, that prevents bridging loops while permitting path redundancy in a bridged network.
Suite B	A set of cryptographic algorithms promulgated by the National Security Agency as part of its Cryptographic Modernization Program. Suite B is available in the Secure Client *when licensed*.

SWLAN	Secure Wireless Local Area Network
symmetric key encryption	A class of cryptographic algorithm in which a shared secret between two or more parties is used to maintain a private connection between or among them.
Tactical Mesh Point	In Fortress Secure Wireless Bridges, alternative name for the ES210 Secure Wireless Bridge.
TCP	Transmission Control Protocol—defines a method for reliable (i.e., in order, with integrity checking) delivery of data packets over a network; one of the founding protocols in the TCP/IP suite of networking protocols.
TCP/IP	Transmission Control Protocol/Internet Protocol, also Internet Protocol Suite—the basic, two-part communication protocol in use on the Internet (refer to IP and TCP).
TLS	Transport Layer Security—a two-part protocol that defines secure data transmission between client/server applications communicating over the Internet. TLS Record Protocol uses data encryption to secure data transfer, and the TLS Handshake Protocol allows the client and server to authenticate each other and negotiate the encryption method to use before exchanging data.
Trusted Device	In Fortress Technologies products, a device that does not have the Secure Client installed but is allowed network access through rules defined for it on the Fortress Bridge.
trusted hierarchy	Refer to PKI.
UDP	User Datagram Protocol—defines a method for “best effort” delivery of data packets over a network that, like TCP, runs on top of IP but, unlike TCP, does not guarantee the order of delivery or provide integrity checking.
UI	User Interface—the means by which a human end user provides input to and receives output from computer software.
ULA	Unique Local Address—an IPv6 globally unique unicast address (subnet identifier), defined in IETF RFC 4193, intended for local (intranet) communications and not intended to be routable on the Internet.
user authentication	A mechanism for requiring users to submit established credentials (user name and password, smartcard, etc.) and checking the validity of these credentials before allowing users to log on to a device or network.
user password	The password an end must enter in order to access a network or device that requires user authentication (compare *administrator password*).
VLAN	Virtual Local Area Network—a collection of computers configured through software to behave as though they are members of the same network, even though they may be physically connected to separate subnets.
VoIP	Voice over IP, sometimes VOI (Voice over Internet)—any of several means for transmitting audio communications over the Internet.
VPN	Virtual Private Network—a private network of computers connected, entirely or in part, by public phone lines.
WAN	Wide Area Network—a collection of interconnected computers covering a large geographic area.
WDS	Wireless Distribution System—a means for interconnecting multiple stations (STAs), access points or nodes in a wireless network.
WEP	Wired Equivalent Privacy—a security protocol for wireless networks, defined in the IEEE 802.11b amendment. WEP has been found to be vulnerable to attack, and WPA is intended to supplant it in current and future 802.11 standards.
Wi-Fi®	Wireless Fidelity—used generically to refer to any type of 802.11 network (referred originally to the narrower 802.11b specification for WLANs).

WiMAX	Worldwide Interoperability for Microwave Access—the IEEE 802.16 specification for fixed, broadband, wireless MANs that use a point-to-multipoint architecture, defining bandwidth use in the licensed frequency range of 10GHz–66GHz and the licensed and unlicensed frequency range of 2GHZ–11GHz.
WIDS	Wireless Intrusion Detection System—a means for detecting and preventing unauthorized or unwelcome connections to a network.
WLAN	Wireless Local Area Network. A local area network that allows mobile users network access through radio waves rather than cables.
WMM®	Wi-Fi Multimedia wireless quality of service implementation defined in subset of the IEEE standard 802.11e, *QoS for Wireless LAN*.
WPA	Wi-Fi Protected Access—a security protocol for wireless networks, defined in the IEEE 802.11i amendment, that uses 802.1X and EAP to restrict network access, and TKIP encryption to secure data transfer. WPA is intended to replace WEP in current and future 802.11 standards.
WPA2	Wi-Fi Protected Access 2—a later implementation of WPA that uses the FIPS 140-2 compliant AES encryption algorithm.