Installation and Configuration Guide

Avaya P333T

Stackable Switch

Software Version 4.0

April 2003

Table of Contents

Section 2 Installing the P330

Section 3 Configuration of the P330

Section 4 Troubleshooting and Maintaining the P330

Before you Install the P333T

Safety Information

Caution: The Avaya P330 switch and modules contain components sensitive to electrostatic discharge. Do not touch the circuit boards unless instructed to do so.

Caution: Do not leave any slots open. Cover empty slots using the blanking plates supplied.

Warning: The fans are on whenever the power is on in the chassis.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications to this equipment not expressly approved by Avaya Inc. could void the user's authority to operate the equipment.

Conventions Used in the Documentation

Documentation for this product uses the following conventions to convey instructions and information:

CLI Conventions

- Mandatory keywords are in the **`computer bold`** font.

- Information displayed on screen is displayed in `computer` font.
- Variables that you supply are in pointed brackets <>.
- Optional keywords are in square brackets [].
- Alternative but mandatory keywords are grouped in braces {} and separated by a vertical bar `|`.
- Lists of parameters from which you should choose are enclosed in square brackets [ ] and separated by a vertical bar `|`.
- If you enter an alphanumeric string of two words or more, enclose the string in inverted ”commas”.

Notes, Cautions and Warnings

Note: Notes contain helpful information or hints or reference to material in other documentation.

Caution: You should take care. You could do something that may damage equipment or result in loss of data.

Warning: This means danger. Failure to follow the instructions or warnings may result in bodily injury. You should ensure that you are qualified for this task and have read and understood *all* the instructions

Avaya P333T

Section 1: Overview of the P330

Avaya P333T Overview

Introduction

The Avaya P330 family of stackable Ethernet workgroup switches includes a range of modules with 10/100/1000 Mbps ports, a Layer 3 capability, and ATM and WAN expansion modules. The Avaya P333T switch has 24 x10/100 Mbps ports and an Expansion Module slot. The optional expansion modules provide additional Ethernet, Fast Ethernet, and Gigabit Ethernet connectivity.

An Avaya P330 stack can contain up to 10 switches and up to 3 backup power supply units. The stacked switches are connected using the Avaya X330STK stacking Modules which plug into a slot in the back of the Avaya P330. They are connected using the X330SC or X330LC cable (if the stack is split between two racks). The Avaya X330RC cable connects the top and bottom switches in the stack and provides redundancy and hot-swappability in the same way that modules can be swapped in a modular switching chassis.

The Avaya P330 is fully compliant with IEEE standards for VLAN Tagging, Gigabit Ethernet, Spanning Tree and Flow Control. This full standards-compliance, combined with auto-negotiation for 10/100/1000 Mbps and half/full duplex facilitates the expansion of your network to match your company's growing needs.

Avaya P330 Family Features

- You can connect up to 10 Avaya P330 switches in a stack. Moreover, this stack can be either in one rack or split over several racks using the X330LC Long Cable, according to your requirements.
- Avaya X330STK - this stacking Module is used to connect Avaya P330 switches in a stack, via the Octaplane.
- Avaya P330 BUPS - this back-up power supply module supports up to four Avaya P330 switches.
- One RJ-45/RS232 front panel console connector for both terminal and modem sessions.
- Two fan units in every switch, with operation sensors.
- One virtual IP address for managing the whole stack, the P330 stack is managed as a single entity.
- Hot-swapping of one switch at a time - by activation of the redundant cable:
  - — Does not disrupt the operation of other Avaya P330 switches.
  - — Does not change stack configuration.
  - — Does not require network downtime.

- Connection through Telnet from the front panel ports of *any* switch, with:
  - — multiple levels of password protection
  - — login and inactivity timeouts

Avaya P330 Network Management

Comprehensive network management is a key component of today's networks. Therefore we have provided multiple ways of managing the Avaya P330 to suit your needs.

Avaya P330 Device Manager (Embedded Web)

The built-in Avaya P330 Device Manager (Embedded Web Manager) allows you to manage an Avaya P330 stack using a Web browser without purchasing additional software. This application works with the Microsoft® Internet Explorer and Netscape® Navigator web browsers and Sun Microsystems Java™ Plug-in.

Avaya P330 Command Line Interface (CLI)

The Avaya P330 CLI provides a terminal type configuration tool for local or remote configuration of Avaya P330 features and functions.

Avaya Multi-Service Network Manager™ (MSNM)

When you need extra control and monitoring or wish to manage other Avaya network equipment, then the Avaya Multi-Service Network Manager network management suite is the answer. This suite provides the ease-of-use and features necessary for optimal network utilization.

Avaya Multi-Service Network Manager is available for Windows® NT®/2000 and Solaris 8. It can also operate in Stand-Alone mode with Windows® NT®/2000. Finally, Avaya Multi-Service Network Manager can operate under HP OpenView for Windows® NT®/2000 and Solaris 8.

Port Mirroring

The P330 provides port mirroring for additional network monitoring functionality. You can filter the traffic and mirror either incoming traffic to the source port or both incoming and outgoing traffic. This allows you to monitor the network traffic you need.

Ports which are members in a Link Aggregation Group (LAG) cannot *also* be used as Port Mirroring Destination or Source ports.

SMON

The P330 supports Avaya's ground-breaking SMON Switched Network Monitoring, which the IETF has now adopted as a standard (RFC2613). SMON provides unprecedented top-down monitoring of switched network traffic at the following levels:

- Enterprise Monitoring
- Device Monitoring
- VLAN Monitoring
- Port-level Monitoring

This top-down approach gives you rapid troubleshooting and performance trending to keep the network running optimally.

Note: MSNM Licence is required to run SMON monitoring.

Note: You need to purchase one SMON License per P330 Stack

Fans, Power Supply and BUPS Monitoring

The P330 module has integrated sensors which provide advance warnings of fan failure, power supply failure or Backup Power Supply (BUPS) failure via management.

Standards and Compatibility

Avaya P330 Standards Supported

The Avaya P330 complies with the following standards.

IEEE

- 802.3x Flow Control on all ports
- 802.1Q VLAN Tagging support on all ports
- 802.1p Priority Tagging compatible on all ports
- 802.1D Bridges and STA
- 802.1w Rapid Spanning Tree Protocol
- 802.1X Port Based Network Access Control
- 802.3z Gigabit Ethernet on expansion module

IETF - Layer 2

- MIB-II - RFC 1213
- Structure and identification of management information for TCP/IP-based Internet - RFC 1155
- Simple Network Management Protocol (SNMP) - RFC 1157
- PPP Internet Protocol Control Protocol (IPCP) - RFC 1332
- PPP Authentication Protocols (PAP & CHAP) - RFC 1334
- PPP - RFC 1661
- ATM Management - RFC 1695
- RMON - RFC 1757
- SMON - RFC 2613
- Bridge MIB Groups - RFC 2674 dot1dbase and dot1dStp fully implemented. Support for relevant MIB objects: dot1q (dot1qBase, dot1qVlanCurrent)
- The Interfaces Group MIB - RFC 2863
- Remote Authentication Dial In User Service (RADIUS) - RFC 2865

IIETF - Network Monitoring

- RMON (RFC 1757) support for groups 1,2,3 and 9
  - — Statistics
  - — History
  - — Alarms
  - — Events

- SMON (RFC 2613) support for groups
  - Data Source Capabilities
  - Port Copy
  - VLAN and Priority Statistics
- Bridge MIB Groups - RFC 2674
  - dot1dbase and dot1dStp fully implemented.
  - Support for relevant MIB objects: dot1q (dot1qBase, dot1qVlanCurrent)

Specifications

Avaya P333T Switch

Physical

Height	2U (88 mm, 3.5”)
Width	482.6 mm (19”)
Depth	450 mm (17.7”)
Weight	7.5 kg (16.5 lb)

Power Requirements — AC

Input voltage	100 to 240 VAC, 50/60 Hz
Power dissipation	150 W max
Input current	5.3 A

Power Requirements — DC

Input voltage	-36 to -72 VDC
Power dissipation	150 W max
Input current	5.1 A max

Environmental

Operating Temp.	-5 to 50°C (23 to 122°F)
Relative Humidity	5% to 95% non-condensing

Safety

- UL for US approved according to UL195O Std.
- C-UL(UL for Canada) approved according to C22.2 No.950 Std.
- CE for Europe approved according to EN 60950 Std.
- Laser components are Laser Class I approved:
  - — EN-60825/IEC-825 for Europe
  - — FDA CFR 1040 for USA

Safety - AC Version

- Overcurrent Protection: A readily accessible Listed safety-approved protective device with a 16A rating must be incorporated in series with building installation AC power wiring for the equipment under protection.

Safety - DC Version

- Restricted Access Area: This unit must be installed in Restricted Access Areas only.
- Installation Codes: This unit must be installed in accordance with the US National Electrical Code, Article 110 and the Canadian Electrical Code, Section 12.
- Conductor Ampacity: Per UL 1950, Annex NAE (NEC Article 645-5(a)), the branch-circuit conductors supply shall have the ampacity of not less than 125 percent of the total connected load. For input leads use at least 18 AWG copper conductors.
- Overcurrent Protection: Per UL 1950, Annex NAE (NEC Article 240-3), a readily accessible listed branch-circuit overcurrent protective device rated maximum 10A must be incorporated into the building wiring.

Agency Approvals

EMC Emissions

Approved according to:

- US - FCC Part 15 Subpart B, Class A
- EU - EN55022 Class A
- EU - EN61000-3-2
- Japan - VCCI-A

Immunity

Approved according to:

- EN55024
- EU - EN61000-3-3

Other

Approved according to:

- CLEI Code: According to Tecordia (Bellcore) KS-22022 Standard
- NEBS Level 3 (optional mounting brackets)

Interfaces

- 24 x 10/100BASE-T RJ45 port connectors.
- RS-232 for terminal setup via RJ45 connector on front panel.

Basic MTBF

- 140,000 hrs minimum

Stacking Module

Table A.1 Stacking Module

Name	Number of Ports
X330STK	2

Expansion Modules

Gigabit Ethernet Expansion Modules

Table A.2 Gigabit Ethernet Expansion Modules

Name	Number of Ports	Interface
X330S2	2	1000Base-SX
X330L2	2	1000Base-LX
X330S1	1	1000Base-SX
X330L1	1	1000Base-LX

Laser Safety

The Avaya X330S1/S2 multi-mode transceivers and the Avaya X330L1/X330L2 single mode transceivers are Class 1 laser products.

They comply with IEC 825-1 and Food and Drug Administration (FDA) 21 CFR 1040.10 and 1040.11.

The transceivers must be operated under recommended operating conditions.

Laser Classification

CLASS 1
LASER PRODUCT

Note: Class 1 lasers are inherently safe under reasonably foreseeable conditions of operation.

Caution: The use of optical instruments with this product will increase eye hazard.

Usage Restriction

The optical ports of the module must be terminated with an optical connector or a dust plug when not in use.

Laser Data

Avaya P330S1/2 Expansion Modules

Wavelength: 850 nm

Output power dissipation: Max. 0.63W

Transmit power: Min. -9 dbm, Max. -4 dbm

Receive power: Min. -17 dbm, Max. 0 dbm

Avaya P330L1/2 Expansion Modules

Wavelength: 1300 nm

Output power dissipation: Max. 0.68W

Transmit power (9 µm SMF): Min. -9.5 dbm, Max. -3 dbm

Transmit power (62.5 µm and 50 µm MMF): Min. -11.5 dbm, Max. -3 dbm

Receive power (9 µm SMF, 62.5 µm and 50 µm MMF): Min. -20 dbm, Max. -3 dbm

Fast Ethernet Fiber Expansion Module

Table A.3 Fiber Fast Ethernet Expansion Module

Name	Number of Ports	Interface
X330F2	2	100Base-FX

Ethernet/Fast Ethernet Expansion Module

Table A.4 Ethernet/Fast Ethernet Expansion Module

Name	Number of Ports	Interface
X330T16	16	10/100Base-T

GBIC Expansion Module

The Avaya X330G2 Expansion Module is the GBIC (1.25 Gbit/s Gigabit Ethernet) Expansion Module for the Avaya P330 family of stackable switches.

Note: In order to use this module the Avaya P330 switch must must have Embedded S/W Version 2.2 or higher.

The X330G2 can be used either as a Gigabit Ethernet link or as a high Bandwidth backplane for connecting switches. The introduction of the GBIC interface to the Avaya P330 family presents an added value over the existing Gigabit Ethernet expansion modules. You can insert any of the Avaya-authorized GBIC transceivers into the X330G2 Expansion Module socket. This provides you with a highly modular and customisable Gigabit Ethernet interface. The GBIC transceivers are hot-swappable.

Safety Information

The multimode and single-mode GBIC transceivers are Class 1 Laser products. They comply with EN 60825-1 and Food and Drug Administration (FDA) 21 CFR 1040.10 and 1040.11.

The GBIC transceivers must be operated under recommended operating conditions.

Laser Classification

CLASS 1
LASER PRODUCT

Note: Class 1 lasers are inherently safe under reasonably foreseeable conditions of operation.

Caution: The use of optical instruments with this product will increase eye hazard.

Usage Restriction

When a GBIC transceiver is inserted into the X330G2 Expansion Module but is not in use, then the Tx and Rx ports should be protected with an optical connector or a dust plug.

Avaya Approved GBIC Transceivers

Caution: All Avaya approved GBICs are 5V. Do not insert a 3.3V GBIC.

Avaya supplies the following two GBIC transceivers for the Avaya P330 X330G2 Expansion Modules. You can order these directly from your local Avaya representative using the PEC or COM Codes:

Type	Description	PEC Code	COM Code
GBIC SX Transceiver	Multimode Fiber 1000BaseSx (550 m)	4705-122	108659228
GBIC LX Transceiver	Single-mode Fiber 1000BaseLx (10 km)	4705-121	108659210

In addition, Avaya has tested and approved a number of GBIC transceivers from other manufacturers for use with the Avaya X330G2 Expansion Module.
An up-to-date list can be found in Avaya's website at the following address:
www.avaya.com/support

Specifications

X330G2- LX GBIC Transceiver

A 9 mm or 10 mm single-mode fiber (SMF) cable may be connected to a 1000Base-LX GBIC port. The maximum length is 10 km (32,808 ft).

A 50 mm or 62.5 mm multimode (MMF) fiber cable may be connected to a 1000Base-LX GBIC port. The maximum length is 550 m (1,804 ft.) for 50 mm and 62.5 mm cable.

The LX transceiver has a Wavelength of 1300 nm, Transmission Rate of 1.25 Gbps and Input Power of 5V.

X330G2- SX GBIC Transceiver

A 50 µm or 62.5 µm multimode (MMF) fiber cable may be connected to a 1000Base-SX GBIC port. The maximum length is 500 m (1,640 ft.) for 50 µm cable and 220 m (722 ft.) for 62.5 µm cable.

The SX transceiver has a Wavelength of 850 nm, Transmission Rate of 1.25 Gbps and Input Power of 5V.

Agency Approval

The transceivers comply with:

- EMC Emission: US – FCC Part 15, Subpart B, Class A;
  Europe – EN55022 class A
- Immunity: EN50082-1
- Safety: UL for US UL 1950 Std., C-UL (UL for Canada) C22.2 No.950 Std., Food and Drug Administration (FDA) 21 CFR 1040.10 and 1040.11, and CE for Europe EN60950 Std. Complies with EN 60825-1.

MTBF

The Mean Time Between Failures (MTBF) for the X330G2 Expansion Sub-module is 594,639 hours.

X330GT2 Gigabit Ethernet Expansion Module

The X330GT2 Expansion Module provides two copper Gigabit Ethernet 1000Base-T ports.

Note: The X330GT2 module is only supported by Avaya P330 embedded software versions 2.4 and higher.

ATM Expansion Modules

There are two Avaya P330 ATM Expansion Modules:

- X330-OC12F1: 500m, Multimode fiber, can also be OC-3 reduced range
- X330-OC12S1: 15 km, Single-mode fiber, can also be OC-3

The ATM Modules can be installed in the following Avaya P330 Family switches:

- Avaya P333T Hardware Version C/S 1.3 and higher, with Embedded S/W 2.4 and higher.

Note: The ATM Expansion Module cannot be used in Avaya P333T hardware Versions lower than C/S 1.3.

- Avaya P334T Embedded S/W Ver. 2.4 and higher.
- Avaya P332MF Embedded S/W Ver. 3.0 and higher.
- Avaya P333R Embedded S/W Ver. 2.4 and higher.

Refer to the Avaya X330 ATM Access Module Installation Guide for installation procedures.

The multimode Avaya X330-OC12F1 and X330-OC3F1 (future) ATM Modules are Class 1 LED products. The single-mode X330-OC12S1 ATM Module is a Class 1

Laser product. They comply with EN 60825-1 and Food and Drug Administration (FDA) 21 CFR 1040.10 and 1040.11.

The Modules must be operated under recommended operating conditions.

Safety Information

Single-mode Module Laser Classification

CLASS 1
LASER PRODUCT

Note: Class 1 lasers are inherently safe under reasonably foreseeable conditions of operation.

Caution: The use of optical instruments with this product will increase eye hazard.

Multi-Mode Module LED Warning

The following warnings apply to the X330 ATM Modules equipped with multi-mode fiber.

Class 1
LED Product

Warning: Class 1 LED Product. Do not view the LED through any magnifying device while it is powered on. Never look directly at the fiber Tx port and fiber cable ends when powered on.

WAN Expansion Modules

Avaya X330WAN is a series of WAN Edge Router expansion modules for the P330 Stackable Switching System . X330WAN enables you to connect your Avaya P330 switch to a WAN. X330WAN is part of Avaya's Converged Networks Solution that includes IP telephones, data switches and IP exchanges.

The X330WAN family includes the following modules:

- X330W-2DS1 access router module has 2 E1/T1 interfaces, a single 10/

100Base-T Fast Ethernet port, and a Console port.

- The X330W-2USP contains 2 USP (Universal Serial Ports), one 10/100Base-T Fast Ethernet port and one Console port.

An Avaya P330 stack can have X330WAN access router modules inserted in each of the switches in the stack with an expansion slot. A maximum stack configuration of 10 P334T switches using the X330WAN provides 490 Fast Ethernet 10/100 ports, and 20 E1/T1 or USP ports.

Avaya P333T

Section 2: Installing the P330

Installation

This chapter describes the basic hardware Installation procedures for the Avaya P330.

Required Tools

Make sure you have the following tools at hand before undertaking the Installation procedures:

- Philips (cross-blade) screwdriver

Site Preparation

Avaya P330 can be mounted alone or in a stack in a standard 19-inch equipment rack in a wiring closet or equipment room. Up to 10 units can be stacked in this way. When deciding where to position the unit, ensure that:

- It is accessible and cables can be connected easily and according to the configuration rule.
- Cabling is away from sources of electrical noise such as radio transmitters, broadcast amplifiers, power lines and fluorescent lighting fixtures.
- Water or moisture cannot enter the case of the unit.
- There is a free flow of air around the unit and that the vents in the sides of the case are not blocked.

Note: Use Octaplane cables to interconnect with other switches.

- The environmental conditions match the requirements listed below:

Table 4.1 Environmental Prerequisites

Operating Temp.	-5 to 50°C (23 to 122°F)
Relative Humidity	5% to 95% non-condensing

- The power source matches the specifications listed below:

Table 4.2 Power Requirements — AC

Input voltage	100 to 240 VAC, 50/60 Hz

Power dissipation	150 W max
Input current	5.3 A

Table 4.3 Power Requirements — DC

Input voltage	-36 to -72 VDC
Power dissipation	150 W max
Input current	5.1 A max

Rack Mounting (Optional)

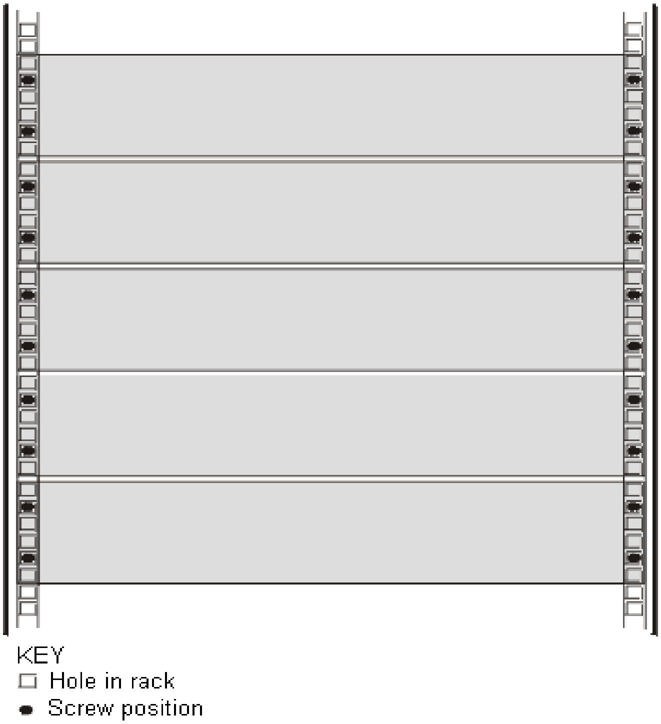
The Avaya P330 case fits in most standard 19-inch racks. Avaya P330 is 2U (88mm, 3.5”) high.

Place the Avaya P330 in the rack as follows:

1 Snap open the hinged ends of the front panel to reveal the fixing holes.

2 Insert the unit into the rack. Ensure that the four Avaya P330 screw holes are aligned with the rack hole positions as shown in Figure 4.1.

Figure 4.1 Avaya P330 Rack Mounting



3 Secure the unit in the rack using the screws. Use two screws on each side. Do not overtighten the screws.

4 Snap closed the hinged ends of the front panel.

5 Ensure that ventilation holes are not obstructed.

Stacking Switches (Optional)

Avaya P330 is a stackable switching system. Stacking involves the mounting and connecting of stacking sub-modules in the P330 switch.

Installing the X330STK Stacking Sub-module in the P330

Caution: The stacking sub-modules contain components sensitive to electrostatic discharge. Do not touch the circuit board unless instructed to do so.

To install the stacking sub-module in the Avaya P330:

1. Remove the blanking plate from the back of the Avaya P330 switch.
2. Insert the stacking sub-module gently into the slot, ensuring that the metal base plate is aligned with the guide rails.
   The metal plate of the X330STK (and *not* the PCB) fits onto the guide rails.
3. Press the sub-module in firmly until it is completely inserted into the Avaya P330.
4. Gently tighten the two screws on the side panel of the stacking sub-module by turning them.

Note: The Avaya P330 switch must not be operated with the back-slot open; the stacking sub-module should be covered with the supplied blanking plate if necessary.

Connecting Stacking Sub-modules

Before attempting to connect stacking sub-modules, verify that you have the required Octaplane cables.

Note: The two ends of the Octaplane cable terminate with different connectors. Each connector can only be connected to its matching port.

The following cables are used to connect stacked switches:

- Short Octaplane cable (X330SC) – ivory-colored, used to connect adjacent switches (Catalog No. CB0223) or switches separated by a BUPS unit.
- Long/Extra Long Octaplane cable (X330LC/X330L-LC) – ivory-colored, used to connect switches from two different physical stacks, or switches separated by a BUPS unit (Catalog No. CB0225/CB0270).
- Redundant/Long Redundant Octaplane cable (X330RC/X330L-RC) – black, used to connect the top and bottom switches of a stack (Catalog No. CB0222/ CB0269).

These are the same cables that are used with all P330 family modules.

To connect stacked switches:

Note: When adding a module to an existing stack, first connect the stacking cables and then power up the module.

1 Plug the light grey connector of the Short Octaplane cable into the port marked "to upper unit" of the bottom Avaya P330 switch.
2 Plug dark grey connector of same Short Octaplane cable to the port marked "to lower unit" in the unit above. The connections are illustrated in Figure 4.3.
3 Repeat Steps 1 and 2 until you reach the top switch in the stack.
4 If you wish to implement stack redundancy, use the Redundant Cable to connect the port marked "to lower unit" on the bottom switch to the port marked "to upper unit" on the top switch of the stack.
5 Power up the added modules.

Caution: Do not cross-connect two Avaya P330 switches with two Octaplane (light-colored) cables. If you wish to cross-connect for redundancy, use one light-colored Octaplane cable and one black redundancy cable. Figure 4.2 shows an incorrect connection.

Note: You can build a stack of up to 10 Avaya P330 switches. If you do not wish to stack all the switches in a single rack, use long Octaplane cables to connect two physical stacks as shown in Figure 4.3.

Figure 4.2 Incorrect Stack Connection

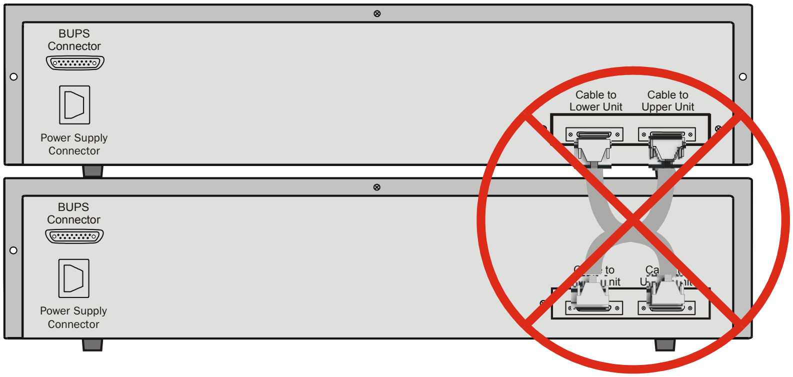
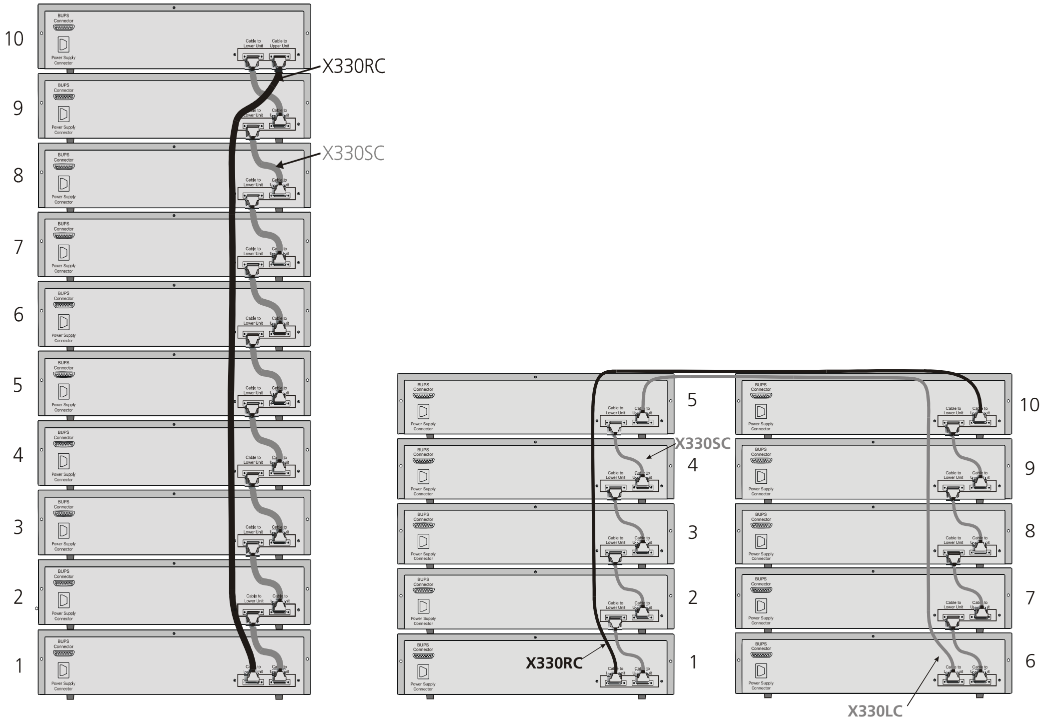


Figure 4.3 Avaya P330 Stack Connections



Installing Expansion Sub-modules

Caution: The expansion sub-modules contain components sensitive to electrostatic discharge. Do not touch the circuit board unless instructed to do so.

Installing the Expansion Sub-module into the Avaya P330

1 Remove the blanking plate or other sub-module (if installed).

2 Insert the sub-module gently into the slot, ensuring that the Printed Circuit Board (PCB) is aligned with the guide rails.
The PCB *not* the metal base plate fits into the guide rail.

3 Firmly press the sub-module until it is completely inserted into the Avaya P330.

4 Gently tighten the two screws on the front panel of the expansion sub-module by turning them.

Note: The Avaya P330 switch must not be operated with the expansion slot open; the expansion sub-module slot should be covered with the supplied blanking plate if necessary.

Making Connections to Network Equipment

This section describes the physical connections that you can make between the Avaya P330 switch and other network equipment.

Prerequisites

Make sure you have the following before attempting to connect network equipment to the P330 switch:

- a list of network equipment to be connected to the P330 switch, detailing the connector types on the various units
- all required cables (see below). Appropriate cables are available from your local supplier.

Port Types

Avaya P330 supports the following types of ports (according to the speed and standard they support):

- LAN — 10/100Base-T, 100Base-FX, 1000Base-T 1000Base-SX and 1000Base-LX
- WAN — by type:
  - — X330W-2DS1: E1/T1, 10/100Base-T
  - — X330W-2USP: USP (V.35), 10/100Base-T

Note: To interconnect Avaya P330 switches with twisted pairs, crossed cables are required.

- The maximum UTP cable length connected to a 10/100 Mbps port operating as 10Base-T, is 100 m (328 ft.).
- A UTP Category 5 cable must be connected to any 100Base-TX port, via an RJ45 connector. The maximum UTP cable length connected to a 10/100 Mbps port operating as 100Base-TX, is 100 m (328 ft.).
- A fiberoptic cable must be connected to any 100Base-FX port, via a SC connectors. The maximum fiber cable length connected to a 100Base-FX port is 412 m (1,352 ft) when operating in half duplex, and 2 km (6,562 ft) when operating in full duplex.
- A fiberoptic cable must be connected to 1000Base-SX or 1000Base-LX port, via SC connectors, according to the table below.

Table 4.4 Gigabit Ethernet Cabling

Gigabit Interface	Fiber Type	Diameter (µm)	Modal Bandwidth (MhzKm)	Maximum Distance (m)	Minimum Distance (m)	Wavelength (nm)
1000BASE-SX	MM	62.5	160	220	2	850
1000BASE-SX	MM	62.5	200	275	2	850
1000BASE-SX	MM	50	400	500	2	850
1000BASE-SX	MM	50	500	550	2	850
1000BASE-LX	MM	62.5	500	550	2	1310
1000BASE-LX	MM	50	400	550	2	1310
1000BASE-LX	SM	9	NA	10,000	2	1310

Powering Up the Avaya P330

This section describes the procedures for powering up the Avaya P330 unit.

Powering On – Avaya P330 Module AC

For the AC input version of the Avaya P330, insert the AC power cord into the power inlet in the back of the unit. The unit powers up.

If you are using a BUPS, insert a power cord from the BUPS into the BUPS connector in the back of the unit. The unit powers up even if no direct AC power is applied to the unit.

After power up or reset, the Avaya P330 performs a self test procedure.

applied to it.

Powering On – Avaya P330 Module DC

For the DC input version of the Avaya P330, connect the power cable to the switch at the input terminal block.

1 The terminals are marked “+”, “-“ and with the IEC 5019a Ground symbol.
2 The size of the three screws in the terminal block is M3.5.
3 The pitch between each screw is 9.5mm.

Connect the power cable to the DC power supply. After power up or reset, the Avaya P330 performs a self test procedure.

Warning: Before performing any of the following procedures, ensure that DC power is OFF.

Caution: This product is intended for installation in restricted access areas and is approved for use with 18 AWG copper conductors only. The installation must comply with all applicable codes.

Warning: The proper wiring sequence is ground to ground, positive to positive and negative to negative. Always connect the ground wire first and disconnect it last.

Post-Installation

The following indicate that you have performed the installation procedure correctly:

Table 5.1 Post-Installation Indications

Procedure	Indication	Troubleshooting Information
Powering the P330	All front panel LEDs illuminate briefly	Page 97
Creating Stacks	The LED next to the appropriate connection (“Cable to upper unit” or “Cable to lower unit”) is lit.	Page 97
Installing Expansion Modules	The LEDs on the Expansion Module flash briefly.	Page 97

If you do not receive the appropriate indication, please refer to "Troubleshooting the Installation".

Avaya P333T Front and Back Panels

Avaya P333T Front Panel

The Avaya P333T front panel contains LEDs, controls, connectors and an expansion Module slot, as well as a console connector. The status LEDs and control buttons provide at-a-glance information.

The front panel LEDs consist of Port LEDs and Function LEDs. The Port LEDs display information for each port according to the illuminated function LED. The function is selected by pressing the left or right button until the desired parameter LED is illuminated.

For example, if the COL LED is illuminated, then all Port LEDs show the collision status of their respective port. If you wish to select the LAG function, then press the right button until the LAG Function LED is lit; if you then wish to select Rx then press the left button several times until the Rx function LED lights.

Figure 6.1 shows the Avaya P333T front panel. Figure 6.2 shows a detailed view of the LEDs (described in Table 6.1), pushbuttons, the Expansion Module slot, and the RJ-45 console connector at the bottom right.

Figure 6.1   Avaya P333T Front Panel

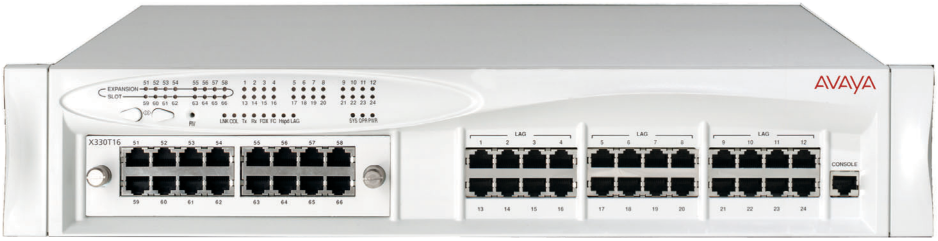
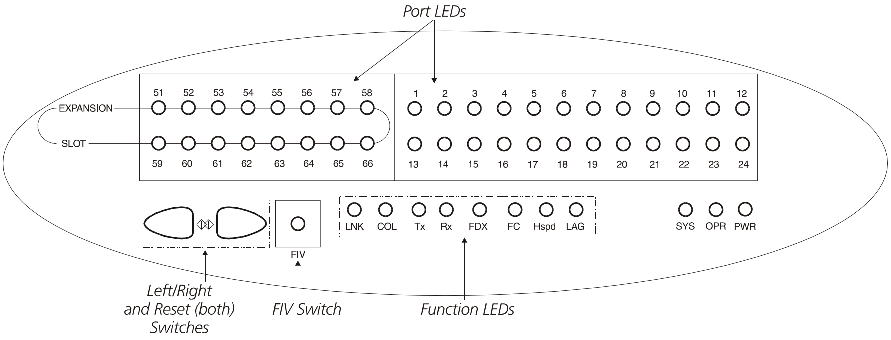


Figure 6.2 Avaya P333T LEDs



Note: All LEDs are lit during a reset.

Table 6.1 Avaya P333T LED Descriptions

LED Name	Description	LED Status
PWR	Power status	OFF – power is off
		ON – power is on
		Blink – using BUPS only
OPR	CPU operation	OFF – Module is booting
		ON – Normal operation
SYS	System Status	OFF – Module is a slave in a stack
		ON – Module is the Master of the stack and the Octaplane and Redundant cable are connected correctly. This LED will also light in Standalone mode.
		Blink – Box is the stack Master and the stack is in redundant mode.
The following Function LEDs apply to ports 1 to 66		
LNK	Port status	OFF – Port disabled
		ON – Port enabled and link OK
		Blink – Port enabled and the link is down

Table 6.1 Avaya P333T LED Descriptions

LED Name	Description	LED Status
COL	Collision	OFF – No collision or FDX port
		ON – Collision occurred on line
Tx	Transmit to line	OFF – No transmit activity
		ON – Data transmitted on line from the module
Rx	Receive from line	OFF – No receive activity
		ON – Data received from the line into the module
FDX	Half/Full Duplex	OFF – Half duplex mode
		ON – Full duplex mode
FC	Flow Control	OFF – No Flow Control
		ON – Symmetric/Asymmetric Flow Control mode is *enabled* and port is in full duplex mode.
Hspd	High Speed	10/100 1000 OFF: 10 N/A ON: 100 1000
LAG	Link Aggregation Group (Trunking)	OFF – No LAG defined for this port
		ON – Port belongs to a LAG

Table 6.2 Avaya P330 <- -> Select buttons

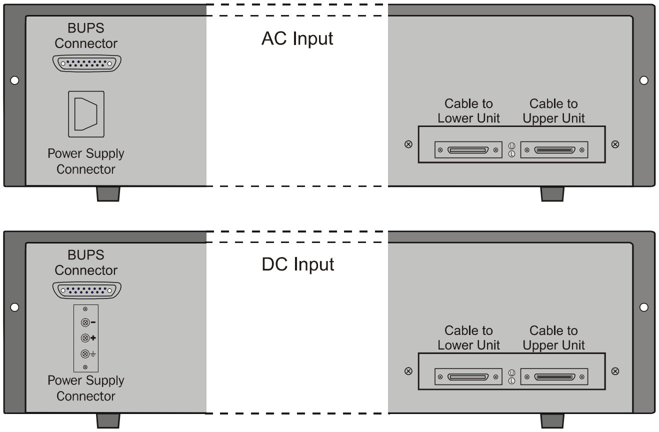
Description	Function
Left/Right	Individual – select LED function (see table above).
Reset module	Press both right and left buttons together for approximately two seconds. All LEDs on module light up until buttons are released.
Reset stack	Press both right and left buttons together for 4 seconds. All LEDs on stack light up until buttons are released.
FIV	Not in use.

Note: The Port LEDs of the P333T are numbered from 1-24. Expansion Module ports are numbered from 51. Port LED numbers 49-50 are reserved.

Avaya P330 Back Panel

The Avaya P330 back panel contains a stacking sub-module slot, power supply and BUPS connector. Figure 6.3 shows the back panel of the AC switch (top) and the DC switch (bottom) with a stacking sub-module installed.

Figure 6.3 Avaya P330 AC and DC Back Panels



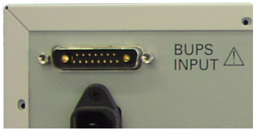
Note: Further illustrations of the Avaya P330 Back Panel will be that of the AC model, the topmost panel in Figure 6.3.

Figure 6.3 shows the back panel of the AC switch (top) and the DC switch (bottom) with a stacking sub-module installed.

BUPS Input Connector

The BUPS input connector is a 5 VDC connector for use with the Avaya P330 BUPS unit only. A BUPS Input sticker appears directly to the right the BUPS input connector.

Figure 6.4 BUPS Input Connector Sticker



Establishing Switch Access

This chapter describes various methods for accessing the Avaya P330 CLI, including:

- a terminal to the serial port on the switch
- P330 Sessions
- a workstation running a Telnet session connected via the network
- a remote terminal/workstation attached via a modem (PPP connection)

Establishing a Serial Connection

This section describes the procedure for establishing switch access between a terminal and the Avaya P330 switch over the serial port provided on the front panel of the P330 (RJ-45 connector labeled "Console").

Configuring the Terminal Serial Port Parameters

The serial port settings for using a terminal or terminal emulator are as follows:

- Baud Rate - 9600 bps
- Data Bits - 8 bits
- Parity - None
- Stop Bit - 1
- Flow Control - None
- Terminal Emulation - VT-100

Connecting a Terminal to the Avaya P330 Serial port

Perform the following steps to connect a terminal to the Avaya P330 Switch Console port for acessing the text-based CLI:

1 The P330 device is supplied with a console cable and a RJ-45-to-DB-9 adaptor. Use these items to connect the serial (COM) port on your PC/terminal to the Avaya P330 console port.

2 Ensure that the serial port settings on the terminal are 9600 baud, 8 bits, 1 stop bit and no parity.

3 When you are prompted for a Login Name, enter the default login. The default login is **`root`**.

4 When you are promoted for a password, enter the user level password **`root`**.

5 Now you can begin the configuration of Module or Stack parameters.

P330 Sessions

You can use sessions to switch between the CLI of P330 modules / other stack entities (for example, an X330 ATM or WAN entity plugged into a specific P330 switch or with the G700 Media Gateway Precessor) or to switch between Layer 2 and Layer 3 commands in the router module.

To switch between P330 modules use the command:
`session [<mod_num>] <mode>`.

The <mod_num> is the number of the module in the stack, counting from the bottom up.

The <mode> can be either **switch**, **router, wan, atm, mgp**.

Use **switch** mode to configure layer 2 commands.

Use **router** mode to configure routing commands.

Examples:

To configure router parameters in the module that you are currently logged into, type the following command:

`session router`.

To configure the switch parameters, on module 6, type the command:
`session 6 switch`.

Note: When you use the `session` command the security level stays the same.

Assigning P330's IP Stack Address

Note: All P330 switches are shipped with the same default IP address. You must change the IP address of the master P330 switch in a stack in order to guarantee that the stack has its own unique IP address in the network.

The network management station or a workstaion running Telnet session can establish communications with the stack once this address had been assigned and the stack has been inserted into the network. Use the CLI to assign the P330 stack an IP address and net mask.

To assign a P330 IP stack address:

1 Establish a serial connection by connecting a terminal to the Master P330 switch of the stack.

2 When prompted for a Login Name, enter the default name **`root`**

3 When you are prompted for a password, enter the password **`root.`** You are now in Supervisor Level.

4 At the prompt, type:
`set interface inband` `<vlan> <ip_address> <netmask>`
Replace `<vlan>`, `<ip_address>` and `<netmask>` with the VLAN, IP address and net mask of the stack.

5 Press Enter to save the IP address and net mask.

6 At the prompt, type **`reset`** and press Enter to reset the stack. After the Reset, log in again as described above.

7 At the prompt, type **`set ip route`** `<dest> <gateway>` and replace `<dest>` and `<gateway>` with the destination and gateway IP addresses.

8 Press Enter to save the destination and gateway IP addresses.

Establishing a Telnet Connection

Perform the following steps to establish a Telnet connection to the Avaya P330 for configuration of Stack or Router parameters. You can Telnet the Stack Master IP address:

1 Connect your station to the network.

2 Verify that you can communicate with the Avaya P330 using Ping to the IP of the Avaya P330. If there is no response using Ping, check the IP address and default gateway of both the Avaya P330 and the station.

Note: The Avaya P330 default IP address is 149.49.32.134 and the default subnet mask is 255.255.255.0.

3 From the Microsoft Windows® taskbar of your PC click **Start** and then **Run** (or from the DOS prompt of your PC), then start the Telnet session by typing:
`telnet` *`<P330_IP_address>`*
For example: **`telnet 149.49.32.134`**

4 If the IP Address in Telnet command is the IP address of the stack, then connection is established with the Switch CLI entity of the Master module. When you see the “Welcome to P330” menu and are prompted for a Login Name, enter the default name **`root`**

5 When you are prompted for a password, enter the User Level password **`root`** in lower case letters (do NOT use uppercase letters). The User level prompt will appear when you have established communications with the Avaya P330. You can now configure the Avaya P330 stack and change its default IP address.

Establishing a Modem (PPP) Connection with the P330

Overview

Point-to-Point Protocol (PPP) provides a Layer 2 method for transporting multi-protocol datagrams over modem links.

Connecting a Modem to the Console Port

A PPP connection with a modem can be established only after the Avaya P330 is configured with an IP address and net-mask, and the PPP parameters used in the Avaya P330 are compatible with the modem's PPP parameters.

1 Connect a terminal to the console port of the Avaya P330 switch as described in Connecting a Terminal to the Avaya P330 Serial port.

2 When you are prompted for a Login Name, enter the default name **root**.

3 When you are prompted for a password, enter the password **root**. You are now in Supervisor Level.

4 At the prompt, type:

```
set interface ppp <ip_addr><net-mask>
```

with an IP address and netmask to be used by the Avaya P330 to connect via its PPP interface.

Note: The PPP interface configured with the `set interface ppp` command must be on a different subnet from the stack inband interface.

5 Set the baud rate, ppp authentication, and ppp time out required to match your modem. These commands are described in the "Command Line Interface" chapter.

6 At the prompt, type:

```
set interface ppp enable
```

The CLI responds with the following:

```
Entering the Modem mode within 60 seconds...
Please check that the proprietary modem cable is plugged
into the console port
```

7 Use the DB-25 to RJ-45 connector to plug the console cable to the modem's DB-25 connector. Plug the other end of the cable RJ-45 connector to the Avaya P330 console's RJ-45 port.

8 The Avaya P330 enters modem mode.

9 You can now dial into the switch from a remote station, and open a Telnet session to the PPP interface IP address.

User Authentication

Introduction

A secure system provides safeguards to insure that only authorized personnel can perform configuration procedures. In Avaya P330, these safeguards form part of the CLI architecture and conventions.

Security Levels

There are four security access levels – User, Privileged, Configure and Supervisor.

- The User level ('read-only') is a general access level used to show system parameter values.
- The Privileged level ('read-write') is used by site personnel to access stack configuration options.
- The Configure level is used by site personnel for Layer 3 configuration.
- (Note: This is not applicable to Avaya P333-T.)
- The Supervisor level ('administrator') is used to define user names, passwords, and access levels of up to 10 local users. In Supervisor level you can also access RADIUS authentication configuration commands.

Note: If you wish to define more than ten users per switch, or accounts for a user on multiple switches, you should use RADIUS (Remote Authentication Dial-In User Service).

A login name and password are always required to access the CLI and the commands. The login name, password, and access-type (i.e., security level) for a user account are established using the `username` command.

Switching between the entities, does not effect the security level since security levels are established specifically for each user. For example, if the operator with a privileged security level in the Switch entity switches to the Router entity the privileged security level is retained.

Note: If you wish to increase security, you can change the default user accounts and SNMP communities.

Note: The Web management passwords are the same as those of the CLI. If you change the passwords of the CLI then those passwords become active for Web management as well.

Entering the Supervisor Level

The Supervisor level is the level in which you first enter P330 CLI and establish user names for up to 10 local users. When you enter the Supervisor level, you are asked for a Login name. Type `root` as the Login name and the default password `root` (in lowercase letters):

```
Welcome to P330
Login: root
Password:****
Password accepted.
Cajun_P330-N(super)#
```

Defining new local users

Define new users and access levels using the following command in Supervisor Level.

In order to...	Use the following command...
Add a local user account and configure a user (name, password and access level)	username
To remove a local user account	no username
Display the username, password and access type for all users on the switch	show username

Exiting the Supervisor Level

To exit the Supervisor level, type the command `exit`.

Entering the CLI

To enter the CLI, enter your username and password. Your access level is indicated in the prompt as follows:

The User level prompt is shown below:

```
Cajun_P330-N>
```

The Privileged level prompt is shown below:

```
Cajun_P330-N#
```

The Configure level prompt for Layer 3 configuration is shown below:

```
P330-N(configure)#
```

The Supervisor level prompt is shown below:

```
Cajun_P330-N(super)#
```

RADIUS

Introduction to RADIUS

User accounts are typically maintained locally on the switch. Therefore, if a site contains multiple Avaya Switches, it is necessary to configure each switch with its own user accounts. Additionally, if for example a 'read-write' user has to be changed into a 'read-only' user, you must change all the 'read-write' passwords configured locally in every switch, in order to prevent him from accessing this level. This is obviously not effective management. A better solution is to have all of the user login information kept in a central location where all the switches can access it. P330 features such a solution: the Remote Authentication Dial-In User Service (RADIUS).

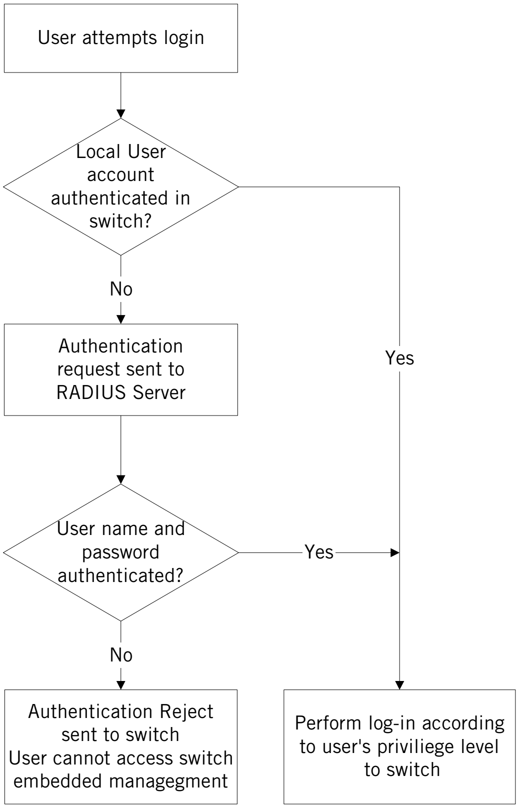
A RADIUS authentication server is installed on a central computer at the customer's site. On this server user authentication (account) information is configured that provides various degrees of access to the switch. The P330 will run as a RADIUS client. When a user attempts to log into the switch, if there is no local user account for the entered user name and password, then the switch will send an Authentication Request to the RADIUS server in an attempt to authenticate the user remotely. If the user name and password are authenticated, then the RADIUS server responds to the switch with an Authentication Acknowledgement that includes information on the user's privileges ('administrator', 'read-write', or 'read-only'), and the user is allowed to gain access to the switch. If the user is not authenticated, then an Authentication Reject is sent to the switch and the user is not allowed access to the switch's embedded management.

The Remote Authentication Dial-In User Service (RADIUS) is an IETF standard (RFC 2138) client/server security protocol. Security and login information is stored in a central location known as the RADIUS server. RADIUS clients such as the P330, communicate with the RADIUS server to authenticate users.

All transactions between the RADIUS client and server are authenticated through the use of a "shared secret" which is not sent over the network. The shared secret is an authentication password configured on both the RADIUS client and its RADIUS servers. The shared secret is stored as clear text in the client's file on the RADIUS server, and in the non-volatile memory of the P330. In addition, user passwords are sent between the client and server are encrypted for increased security.

Figure 8.1 illustrates the RADIUS authentication procedure:

Figure 8.1 RADIUS Authentication Procedure


User attempts login
Local User account authenticated in switch?
No
Yes
Authentication request sent to RADIUS Server
User name and password authenticated?
Yes
No
Authentication Reject sent to switch User cannot access switch embedded managegment
Perform log-in according to user's priviliege level to switch

Radius Commands

The following radius commands are accessible from Supervisor level.

In order to...	Use the following command...
Enable or disable authentication for the P330 switch. RADIUS authentication is disabled by default	set radius authentication
Set a primary or secondary RADIUS server IP address	set radius authentication server
Configure a character string to be used as a “shared secret” between the switch and the RADIUS server.	set radius authentication secret
Set the RFC 2138 approved UDP port number.	set radius authentication udp-port
Set the number of times an access request is sent when there is no response	set radius authentication retry-number
Set the time to wait before re-sending an access request.	set radius authentication retry-time
Remove a primary or secondary RADIUS authentication server	clear radius authentication server
Display all RADIUS authentication configurations. The shared secrets will not be displayed	show radius authentication

For a complete description of the RADIUS CLI commands, including syntax and output examples, refer to *Avaya P330: Reference Guide*.

Allowed Managers

With the Allowed Managers feature, the network manager can determine who may or may not gain management access to the switch. The feature can be enabled or disabled (default is disabled). When enabled, only those users that are configured in the Allowed Managers table are able to gain Telnet, HTTP, and SNMP management access to the switch.

You can configure up to 20 Allowed Mangers by adding or removing their IP address from the Allowed Managers List.

Note: The identification of an “Allowed Manager” is done by checking the Source IP address of the packets, thus if the Source IP address is modified on the way (NAT, Proxy, etc.), even an “Allowed Manager” will not be able to access the P330.

Allowed Manager CLI Commands

In order to...	Use the following command...
When set to enabled - only managers with ip address specified in the allowed table will be able to access the device	set allowed managers
Add/delete ip address of manager to/from the allowed table	set allowed managers ip
Show the IP addresses of the managers that are allowed to access the device	show allowed managers table
Show whether the status of allowed managers is enabled or disabled	show allowed managers status
Show the IP addresses of the managers that are currently connected	show secure current

Avaya P333T

Section 3: Configuration of the P330

Default Settings of the P330

This section describes the procedures for the first-time configuration of the Avaya P330. The factory defaults are set out in detail in the tables included in this chapter.

Configuring the Switch

The Avaya P330 may be configured using the text-based Command Line Interface (CLI), the built-in Avaya P330 Device Manager (Embedded Web) or Avaya Multi-Service Network Manager™.

For instructions on the text-based CLI, see the *Avaya P330 Reference Guide*.

For instructions on installation of the graphical user interfaces, see Embedded Web Manager. For instructions on the use of the graphical user interfaces, refer to the Device Manager User's Guide on the Documentation and Utilities CD.

Avaya P330 Default Settings

The default settings for the Avaya P330 switch and its ports are determined by the Avaya P330 software. These default settings are subject to change in newer versions of the Avaya P330 software. See the Release Notes for the most up-to-date settings.

Table 9.1 Default Switch Settings

Function	Default Setting
IP address	149.49.32.134
Subnet Mask	255.255.255.0
Default gateway	0.0.0.0
Management VLAN ID	1
Spanning tree	Enabled
Bridge priority for Spanning Tree	32768
Keep alive frame transmission	Enabled
Network time acquisition	Enabled, Time protocol
Time server IP address	0.0.0.0

Table 9.1 Default Switch Settings

Function	Default Setting
Timezone offset	0 hours
SNMP communities: Read-only Read-write Trap SNMP	 Public Public Public
SNMP retries number	3
SNMP timeout	2000 Seconds
SNMP authentication trap	Disabled
CLI timeout	15 Minutes
User Name/Password	root/root

Table 9.2 Default Port Settings

Function	Default Setting		
	10/100Base-TX ports	**100Base-F ports**	**1000 Base-X ports**
Duplex mode	Full duplex	Full duplex	Full duplex only
Port Speed	100M	100M	1000M
Flow control	Off	Off	Off
Flow control advertisement	Off	N/A	Off (No pause)
Backpressure	On (only in Half duplex)	Not Applicable	Not Applicable
Autopartitioning	Disabled (only in Half duplex)	N/A	N/A
Auto-negotiation	Enable	Not Applicable	Enable[1]
Administration status	Enable	Enable	Enable
Port VLAN	1	1	1
Tagging mode	Clear	Clear	Clear

Table 9.2 Default Port Settings

Function	Default Setting		
Port priority	0	0	0
Spanning Tree cost	20	20	4
Spanning Tree port priority	128	128	128

[1] Ensure that the other side is also set to Autonegotiation Enabled

Note: Functions operate in their default settings unless configured otherwise.

Basic Switch Configuration

Introduction

This chapter describes the parameters you can define for the chassis, such as its name and location, time parameters, and so on.

Use the CLI commands briefly described below for configuring the display on your terminal or workstation.

In order to...	Use the following command...
Open a CLI session to a P330 module in the stack, ATM or WAN expansion modules and Media Gateway Processor of G700.	session
Display or set the terminal width (in characters)	terminal width
Display or set the terminal length (in lines)	terminal length
Display or set the prompt	hostname
Return the prompt to its default value	no hostname
Clear the current terminal display	clear screen
Set the number of minutes before an inactive CLI session automatically logs out	set logout
Display the number of minutes before an inactive CLI session automatically times out	show logout
Access Layer 3 configuration if not logged in as supervisor (see “User Authentication“ chapter)	configure

System Parameter Configuration

Identifying the system

In order to make a P330 switch easier to identify, you can define a name for the switch, contact information for the switch technician and the location of the switch in the organization.

In order to...	Use the following command...
Configure the system name.	set system name
Configure the system contact person	set system contact
Configure the system location	set system location

Operating parameters

You can use the following commands to configure and display the mode of operation for the switch and display key parameters.

In order to...	Use the following command...
Configure the basic mode of operation of a module to either Layer 2 or Router	set device-mode
Display the mode of operation	show device-mode
Display system parameters	show system
Display module information for all modules within the stack	show module

Network Time Acquiring Protocols Parameter Configuration

The P330 can acquire the time form a Network Time Server. P330 supports the SNTP Protocol (RFC 958) over UDP port 123 or TIME protocol over UDP port 37. Use the CLI commands briefly described below for configuring and display time information and acquiring parameters.

In order to...	Use the following command...
Restore the time zone to its default, UTC.	clear timezone
Configure the time zone for the system	set timezone
Configure the time protocol for use in the system	set time protocol
Enable or disable the time client	set time client
Configure the network time server IP address	set time server
Display the current time	show time
Display the time status and parameters	show time parameters
Display the current time zone offset	show timezone
Get the time from the time server	get time

Chapter 11

Avaya P330 Layer 2 Features

This section describes the Avaya P330 Layer 2 features. It provides the basic procedures for configuring the P330 for Layer 2 operation.

Overview

The P330 family supports a range of Layer 2 features. Each feature has CLI commands associated with it. These commands are used to configure, operate, or monitor switch activity for each of the Layer 2 features.

This section of the *User's Guide* explains each of the features. Specifically, the topics discussed here include:

- Ethernet
- VLAN
- Port Based Network Access Control
- Spanning Tree Protocol
- Rapid Spanning Tree Protocol
- MAC Security
- Link Aggregation Group (LAG)
- Port Redundancy
- IP Multicast Filtering
- Stack Health
- Stack Redundancy
- Port Classification

Ethernet

Ethernet is one of the most widely implemented LAN standards. It uses the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method to handle simultaneous demands. CSMA/CD is a multi-user network allocation procedure in which every station can receive the transmissions of every other station. Each station waits for the network to be idle before transmitting and each station can detect collisions by other stations.

The first version of Ethernet supported data transfer rates of 10 Mbps, and is therefore known as 10BASE-T.

Fast Ethernet

Fast Ethernet is a newer version of Ethernet, supporting data transfer rates of 100 Mbps. Fast Ethernet is sufficiently similar to Ethernet to support the use of most existing Ethernet applications and network management tools. Fast Ethernet is also known as 100BASE-T (over copper) or 100BASE-FX (over fiber).

Fast Ethernet is standardized as IEEE 802.3u.

Gigabit Ethernet

Gigabit Ethernet supports data rates of 1 Gbps. It is also known as 1000BASE-T (over copper) or 1000BASE-FX (over fiber).

Gigabit Ethernet is standardized as IEEE 802.3z.

Configuring Ethernet Parameters

Auto-negotiation

Auto-Negotiation is a protocol that runs between two stations, two switchs or a station and a switch. When enabled, Auto-Negotiation negotiates port speed and duplex mode by detecting the highest common denominator port connection for the endstations. For example, if one workstation supports both 10 Mbps and 100 Mbps speed ports, while the other workstation only supports 10 Mbps, then Auto-Negotiation sets the port speed to 10 Mbps.

For Gigabit ports, Auto-Negotiation determines the Flow Control configuration of the port.

Full-Duplex/Half-Duplex

Devices that support Full-Duplex can transmit and receive data simultaneously, as opposed to half-duplex transmission where each device can only communicate in turn.

Full-Duplex provides higher throughput than half-duplex.

Speed

The IEEE defines three standard speeds for Ethernet: 10, 100 and 1000 Mbps (also known as Ethernet, Fast Ethernet and Gigabit Ethernet respectively).

Flow Control

The process of adjusting the flow of data from one device to another to ensure that the receiving device can handle all of the incoming data. This is particularly important where the sending device is capable of sending data much faster than the receiving device can receive it.

There are many flow control mechanisms. One of the most common flow control protocols, used in Ethernet full-duplex, is called xon-xoff. In this case, the receiving device sends a an xoff message to the sending device when its buffer is full. The sending device then stops sending data. When the receiving device is ready to receive more data, it sends an *xon* signal.

Priority

By its nature, network traffic varies greatly over time, so short-term peak loads may exceed the switch capacity. When this occurs, the switch must buffer frames until there is enough capacity to forward them to the appropriate ports.

This, however, can interrupt time-sensitive traffic streams, such as Voice and other converged applications. These packets need to be forwarded with the minimum of delay or buffering. In other words, they need to be given high priority over other types of networkl traffic.

Priority determines in which order packets are sent on the network and is a key part of QoS (Quality of Service). The IEEE standard for priority on Ethernet networks is 802.1p.

Avaya P330 switches supports two internal priority queues – the High Priority queue and the Normal Priority queue.

- Packets tagged with priorities 4-7 are mapped to the High Priority queue; packets tagged with priorities 0-3 are mapped to the Normal Priority queue. This classification is based either on the packet's original priority tag, or, if the packet arrives at the port untagged, based on the priority configured for the ingress port (set using the `set port level` CLI command).

In cases where the packet was received tagged, this priority tag is retained when the packet is transmitted through a tagging port.

In cases where the priority is assigned based on the ingress priority of the port, then on an egress tagging port the packet will carry either priority 0 or priority 4, depending on the queue it was assigned to (High Priority=4, Normal Priority=0).

MAC Address

The MAC address is a unique 48-bit value associated with any network adapter. MAC addresses are also known as hardware addresses or physical addresses. They uniquely identify an adapter on a LAN.

MAC addresses are 12-digit hexadecimal numbers (48 bits in length). By convention, MAC addresses are usually written in one of the following two formats:

- MM:MM:MM:SS:SS:SS

- MM-MM-MM-SS-SS-SS

The first half of a MAC address contains the ID number of the device manufacturer. These IDs are regulated by an Internet standards body. The second half of a MAC address represents the serial number assigned to the device by the manufacturer.

CAM Table

The *CAM Table* contains a mapping of learned MAC addresses to ports. The switch checks forwarding requests against the addresses contained in the CAM Table:

- If the MAC address appears in the CAM Table, the packet is forwarded to the appropriate port.
- If the MAC address does not appear in the CAM Table, or the MAC Address mapping has changed, the frame is duplicated and copied to all the ports. Once a reply is received, the CAM table is updated with the new address/VLAN port mapping.

Ethernet Configuration CLI Commands

The following table contains a list of the configuration CLI commands for the Ethernet feature. The rules of syntax and output examples are all set out in detail in the *Reference Guide*.

Table 11.1 Configuration CLI Commands for Ethernet Feature

In order to...	Use the following command...
Set the auto negotiation mode of a port	set port negotiation
Administratively enable a port	set port enable
Administratively disable a port	set port disable
Set the speed for a 10/100 port	set port speed
Configure the duplex mode of a 10/100BASE-T port	set port duplex
Configure a name for a port	set port name
Set the send/receive mode for flow-control frames for a full duplex port	set port flowcontrol
Set the flow control advertisement for a Gigabit port when performing autonegotiation	set port auto-negotiation-flowcontrol-advertisement

In order to...	Use the following command...
Set the priority level of a port	set port level
Display settings and status for all ports	show port
Display per-port status information related to flow control	show port flowcontrol
Display the flow control advertisement for a Gigabit port used to perform auto-negotiation	show port auto-negotiation-flowcontrol-advertisement
Display the CAM table entries for a specific port	show cam
Clear all the CAM entries.	clear cam
Display the autopartition settings	show autopartition

Ethernet Implementation in the Avaya PP333T

This section describes the implementation of the Ethernet feature in the Avaya **P333T**:

- Speed — 10/100 and 1G ports
- Priority queuing — 2 queues
- CAM size — 4K addresses

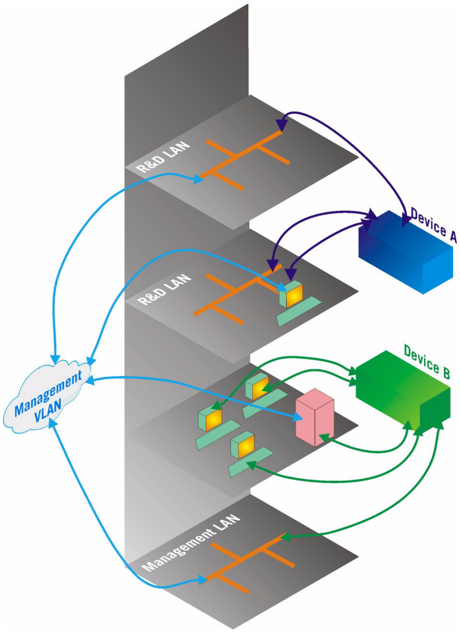
VLAN Configuration

VLAN Overview

A VLAN is made up of a group of devices on one or more LANs that are configured so that they operate as if they form an independent LAN, when in fact they may be located on a number of different LAN segments. VLANs can be used to group together departments and other logical groups, thereby reducing network traffic flow and increasing security within the VLAN.

The figure below illustrates how a simple VLAN can connect several endpoints in different locations and attached to different hubs. In this example, the Management VLAN consists of stations on numerous floors of the building and which are connected to both Device A and Device B.

Figure 11.1 VLAN Overview



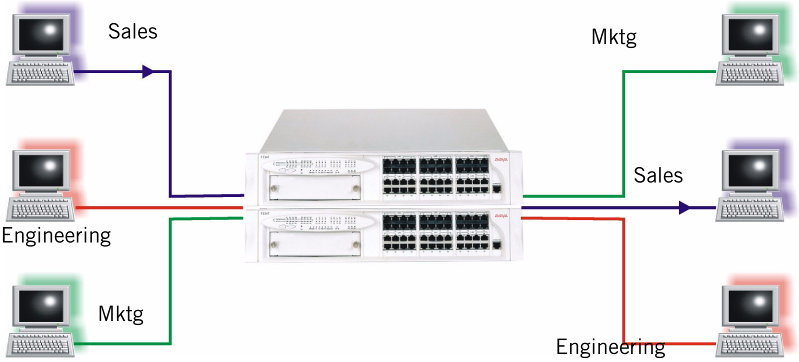
In virtual topological networks, the network devices may be located in diverse places around the LAN—such as in different departments, on different floors or in different buildings. Connections are made through software. Each network device is connected to a hub, and the network manager uses management software to assign each device to a virtual topological network. Elements can be combined into a VLAN even if they are connected to different devices.

VLANs should be used whenever there are one or more groups of network users that you want to separate from the rest of the network.

In Figure 11.2, the switch has three separate VLANs: Sales, Engineering, and

Marketing (Mktg). Each VLAN has several physical ports assigned to it with PC's connected to those ports. When traffic flows from a PC on the Sales VLAN for example, that traffic is *only* forwarded out the other ports assigned to that VLAN. Thus, the Engineering and Mktg VLANs are not burdened with processing that traffic.

Figure 11.2 VLAN Switching and Bridging



VLAN Tagging

VLAN Tagging is a method of controlling the distribution of information on the network. The ports on devices supporting VLAN Tagging are configured with the following parameters:

- Port VLAN ID
- Tagging Mode

The Port VLAN ID is the number of the VLAN to which the port is assigned. Untagged frames (and frames tagged with VLAN 0) entering the port are assigned the port's VLAN ID. Tagged frames are unaffected by the port's VLAN ID.

The Tagging Mode determines the behavior of the port that processes outgoing frames:

- If Tagging Mode is set to “Clear”, the port transmits frames that belong to the port's VLAN table. These frames leave the device untagged.
- If Tagging Mode is set to “IEEE-802.1Q”, all frames keep their tags when they leave the device. Frames that enter the switch without a VLAN tag will be tagged with the VLAN ID of the port they entered through.

Multi VLAN Binding

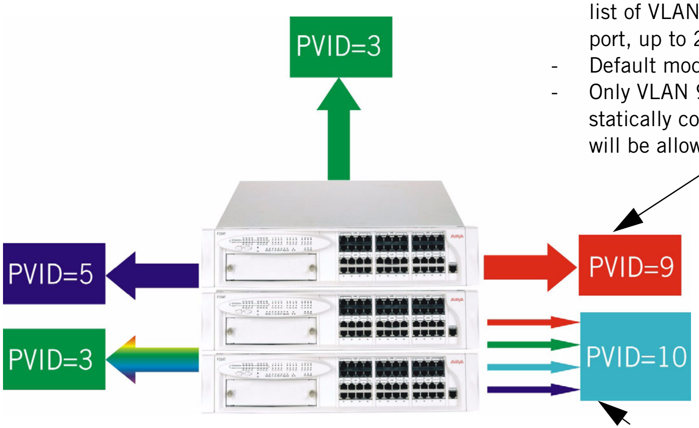
Multi VLAN binding (Multiple VLANs per port) allows access to shared resources by stations that belong to different VLANs through the same port. This is useful in applications such as multi-tenant networks, where each user has his a VLAN for privacy, but the whole building has a shared high-speed connection to the ISP.

In order to accomplish this, P330 allows you to set multiple VLANs per port. The three available Port Multi-VLAN binding modes are:

- **Bind to All** - the port is programmed to support the entire 3K VLANs range. Traffic from any VLAN is forwarded through a port defined as “Bind to All”. This is intended mainly for easy backbone link configuration
- **Bind to Configured** - the port supports all the VLANs configured in the switch/stack. These may be either Port VLAN IDs (PVID) or VLANs that were manually added to the switch.
- **Statically Bound** - the port supports VLANs manually configured on it.

Figure 11.3 illustrates these binding modes in P330.

Figure 11.3 Multiple VLAN Per-port Binding Modes



Static Binding

- The user manually specifies the list of VLAN IDs to be bound to the port, up to 253 VLANs
- Default mode for every port
- Only VLAN 9, and any otherVLANs statically configured on the port will be allowed to access this port

Bind to All

- Any VLAN in the range of 1-4094 will be allowed access through this port
- Intended mainly for easy backbone link

Bind to Configured

- The VLAN table of the port will support all the Static VLAN entries and all the ports’ VLAN IDs (PVIDs) present in the switch
- VLANs 1,3,5,9,10 coming from the bus will be allowed access through this port
- All the ports in Bound to Configured mode will support the same list of VLANs

Ingress VLAN Security

When a VLAN-tagged packet arrives at a port, only the packets with the VLAN tag corresponding to the VLANs which are configured on the port will be accepted. Packets with other VLAN tags will be dropped.

VLAN CLI Commands

The following table contains a list of the CLI commands for the VLAN feature. The rules of syntax and output examples are all set out in detail in the *Reference Guide*.

Table 11.2 VLAN CLI Commands

In order to...	Use the following command...
Assign the Port VLAN ID (PVID)	set port vlan
Define the port binding method	set port vlan-binding-mode
Define a static VLAN for a port	set port static-vlan
Configure the tagging mode of a port	set trunk
Create VLANs	set vlan
Display the port VLAN binding mode settings	show port vlan-binding-mode
Display VLAN tagging information of the ports, port binding mode, port VLAN ID and the allowed VLANs on a port	show trunk
Display the VLANs configured in the switch.	show vlan
Clear VLAN entries	clear vlan
Clear a VLAN statically configured on a port	clear port static-vlan

VLAN Implementation in the Avaya P333T

This section describes the implementation of the VLAN feature in the Avaya **P333T**:

- No. of VLANs — 1024 tagged VLANs ranging from 1 to 3071

Port Based Network Access Control (PBNAC)

Port Based Network Access Control (IEEE 802.1X) is a method for performing authentication to obtain access to IEEE 802 LANs. The protocol defines an interaction between 3 entitites:

- Supplicant — an entity at one end of a point-to-point LAN segment that is being authenticated by an authenticator attached to the other end of that link.
- Authenticator — an entity at one end of a point-to-point LAN segment that facilitates authentication of the entity attached to the other end of that link; in this case, the P330.
- Authentication (RADIUS) Server — an entity that provides an authentication service to an authenticator. This service determines, from the credentials provided by the supplicant, whether the supplicant is authorized to access the services provided by the authenticator.

The process begins with the supplicant trying to access a certain restricted network resource, and upon successful authentication by the authentication server, the supplicant is granted access to the network resources.

How "Port Based" Authentication Works

802.1X provides a means of authenticating and authorizing users attached to a LAN port and of preventing access to that port in cases wher the authentication process fails. The authentication procedure is port based, which means:

- access control is achieved by enforcing authetication on connected ports
- if an end-point station that connects to a port is not authorized, the port state is set to "unauthorized" which closes the port to any traffic.
- As a result of an authentication attempt, the P330 port can be either in a "blocked" or a "forwarding" state.

802.1X interacts with existing standards to perform its authentication operation. Specifically, it makes use of Extensible Authentication Protocol (EAP) messages encapsulated within Ethernet frames (EAPOL), and EAP over RADIUS for the communication between the Authenticator and the Authentication Server.

PBNAC Implementation in the P330 Family

This section lists the conditions that govern the implementation of the 802.1X standard in the P330 line:

- You can configure PBNAC on the 10/100 Mbps Ethernet ports only.
- PBNAC can work only if a RADIUS server is configured on the P330 and the RADIUS server is carefully configured to support 802.1X.
- PBNAC and port/intermodule redundancy can co-exist on the same ports.
- PBNAC and LAGs can coexist on the same ports.
- PBNAC and Spanning Tree can be simultaneously active on a module.

Note: If either PBNAC or STP/RSTP are in a blocking state, the final state of the port will be blocked.

- When PBNAC is activated, the application immediately places all ports in a blocking state unless they were declared "Force Authenticate". They will be reverted to “Forwarding” state only when the port is authorized by the RADIUS server.

Note: The actual state of ports configured as "Force Authenticate" is determined by the STA.

Configuring the P330 for PBNAC

This section lists the basic tasks required to configure a P330 stack for PBNAC. To configure P330 for PBNAC, do the following:

- Configure a RADIUS server on a network reachable from the P330:
  - — Create user names and passwords for allowed users.
  - — Make sure the EAP option is enabled on this server.
- Configure the P330 for RADIUS:
  - — Configure RADIUS parameters.
  - — Enable the RADIUS feature.
  - — Configure the port used to access the RADIUS server as “force-authorized.”
- Connect the Supplicant—i.e., Windows XP clients—directly to the P330.
- Verify that the dot1x port-control is in auto mode.
- Set the dot1x system-auth-config to enable; the authentication process starts:
  - — The supplicant is asked to supply a user name and password.
  - — If authentication is enabled on the port, the Authenticator initiates authentication when the link is up.
  - — Authentification Succeeds: after the authentication process completes, the supplicant will receive a Permit/Deny notification.
  - — Authentication Fails: authentication will fail when the Supplicant fails to respond to requests from the Authenticator, when management controls prevent the port from being authorized, when the link is down, or when the user supplied incorrect logon information.

PBNAC CLI Commands

The following table contains a list of the CLI commands for the PBNAC feature. The rules of syntax and output examples are all set out in detail in the *Reference Guide*.

PBNAC CLI Commands

In order to...	Use the following command...
Configure dot1x on a system	set dot1x
Disable dot1x on all ports and return to default values	clear dot1x config
Display the system dot1x capabilities, protocol version, and timer values	show dot1x
Display all the configurable values associated with the authenticator port access entity (PAE) and backend authenticator	show port dot1x
Display all the port dot1x statistics	show port dot1x statistics
Set the minimal idle time between authentication attempts	set dot1x quiet-period
Set the time interval between attempts to access the Authenticated Station	set dot1x tx-period
Set the server retransmission timeout period for all ports	set dot1x server-timeout
Set the authentication period (an idle time between re-authentication attempts)	set dot1x re-authperiod
Set the authenticator-to-supplicant retransmission timeout period (the time for the switch to wait for a reply from the Authenticated Station)	set dot1x supp-timeout
Set the max-req for all ports (the maximal number of times the port tries to retransmit requests to the Authenticated Station before the session is terminated)	set dot1x max-req

In order to...	Use the following command...
Globally enable/disable 802.1x	set dot1x system-auth-control enable/disable
Set dot1x control parameter per port	set port dot1x port-control
Initialize port dot1x	set port dot1x initialize
Set the port to re-authenticate	set port dot1x re-authenticate
Set dot1x re-authentication mode per port	set port dot1x re-authentication
Set the 802.1x quiet period per port	set port dot1x quiet-period
Set the transmit period per port (a time interval between attempts to access the Authenticated Station)	set port dot1x tx-period
Set the supp-timeout per port (a time for the port to wait for a reply from the Authenticated Station)	set port dot1x supp-timeout
Set the server-timeout per port (a time to wait for a reply from the Authentication Server)	set port dot1x server-timeout
Set the re-authentication period per port (an idle time between re-authentication attempts)	set port dot1x re-authperiod
Set the max-req per port (the maximal number of times the port tries to retransmit requests to the Authenticated Station before the session is terminated)	set port dot1x max-req

Spanning Tree Protocol

Overview

Avaya P330 devices support both common Spanning Tree protocol (802.1d) and the enhanced Rapid Spanning Tree protocol (802.1w). The 802.1w is a faster and more sophisticated version of the 802.1d (STP) standard. Spanning Tree makes it possible to recover connectivity after an outage within a minute or so. RSTP, with its "rapid" algorithm, can restore connectivity to a network where a backbone link has failed in much less time.

In order to configure the switch to either common Spanning Tree or Rapid Spanning Tree protocol, use the `set spantree version` command.

Spanning Tree Protocol

The Spanning Tree Algorithm ensures the existence of a loop-free topology in networks that contain parallel bridges. A loop occurs when there are alternate routes between hosts. If there is a loop in an extended network, bridges may forward traffic indefinitely, which can result in increased traffic and degradation in network performance.

The Spanning Tree Algorithm:

- Produces a logical tree topology out of any arrangement of bridges. The result is a single path between any two end stations on an extended network.
- Provides a high degree of fault tolerance. It allows the network to automatically reconfigure the spanning tree topology if there is a bridge or data-path failure.

The Spanning Tree Algorithm requires five values to derive the spanning tree topology. These are:

1. A multicast address specifying all bridges on the extended network. This address is media-dependent and is automatically determined by the software.
2. A network-unique identifier for each bridge on the extended network.
3. A unique identifier for each bridge/LAN interface (a port).
4. The relative priority of each port.
5. The cost of each port.

After these values are assigned, bridges multicast and process the formatted frames (called Bridge Protocol Data Units, or BPDUs) to derive a single, loop-free topology throughout the extended network. The bridges exchange BPDU frames quickly, minimizing the time that service is unavailable between hosts.

Spanning Tree per Port

The Spanning Tree can take up to 30 seconds to open traffic on a port. This delay can cause problems on ports carrying time-sensitive traffic. You can therefore enable/disable Spanning Tree in P330 on a per-port basis to minimize this effect.

Rapid Spanning Tree Protocol (RSTP)

About the 802.1w Standard

The enhanced feature set of the 802.1w standard includes:

- Bridge Protocol Data Unit (BPDU) type 2
- New port roles: Alternate port, Backup port
- Direct handshaking between adjacent bridges regarding a desired topology change (TC). This eliminates the need to wait for the timer to expire.
- Improvement in the time it takes to propagate TC information. Specifically, TC information does not have to be propagated all the way back to the Root Bridge (and back) to be changed.
- Origination of BPDUs on a port-by-port basis.

Port Roles

At the center of RSTP—specifically as an improvement over STP (802.1d)—are the roles that are assigned to the ports. There are four port roles:

- Root port — port closest to the root bridge
- Designated port — corresponding port on the remote bridge of the local root port
- Alternate port — an alternate route to the root
- Backup port — an alternate route to the network segment

The RSTP algorithm makes it possible to change port roles rapidly through its fast topology change propagation mechanism. For example, a port in the “blocking” state can be assigned the role of “alternate port.” When the backbone of the network fails the port may be rapidly changed to forwarding.

Whereas the STA *passively* waited for the network to converge before turning a port into the forwarding state, RSTP *actively* confirms that a port can safely transition to forwarding without relying on any specific, programmed timer configuration.

RSTP provides a means of fast network convergence after a topology change. It does this by assigning different treatments to different port types. The port types and the treatment they receive follow:

- Edge ports — Setting a port to "edge-port" admin state indicates that this port is connected directly to end stations that cannot create bridging loops in the network. These ports transition quickly to forwarding state. However, if BPDUs are received on an Edge port, it’s operational state will be changed to "non-edge-port" and bridging loops will be avoided by the RSTP algorithm. The default admin state of all ports is "edge-port".

Note: You must manually configure uplink and backbone ports (including LAG logical ports) to be "non-edge" ports, using the CLI command `set port edge admin state`.

- Point-to-point Link ports — This port type applies only to ports interconnecting RSTP compliant switches and is used to define whether the devices are interconnected using shared Ethernet segment or pont-to-point Ethernet link. RSTP convergence is faster when switches are connected using point-to-point links. The default setting for all ports – automatic detection of point-to-point link – is sufficent for most networks.

Spanning Tree Implementation in the P330 Family

RSTP is implemented in P330 family of products so that it is interoperable with the existing implementation of STP. In order to configure the switch to either common Spanning Tree or Rapid Spanning Tree protocol, use the `set spantree version` command.

- After upgrading to software version 4.0, the default is spanning tree version STP. The default after NVRAM INIT remains STP.

The balance of this section lists the conditions and limitations that govern the implementation of Spanning Tree in the P330 line.

- RSTP's fast convergence benefits are lost when interacting with legacy (STP) bridges.
- When RSTP detects STP Bridge Protocol Data Units (BPDUs type 1) on a specific port, it will begin to "speak" 802.1d on this port only. Specifically, this means:
  - 802.1d bridges will ignore RSTP BPDUs and drop them.
  - 802.1d bridges will send 802.1d format BPDUs back to the switch.
  - The switch will change to 802.1d mode for that port only.

The P330 configured to RSTP is therefore able to simultaneously work with other switches implementing either RSTP or STP without specific user intervention.

- Spanning Tree configuration is performed on the stack level.
- If you do not upgrade all switches in the stack to firmware version 4.0, spanning tree will continue its normal operation. However, configuring Spanning Tree will not be possible until all switches are upgraded to version 4.0.
- RSTP is interoperable with P330 Port Redundancy and PBNAC applications. If either RSTP or PBNAC put the port in blocking, its final state will be "blocking".
- STP and Self Loop Discovery (SLD) are incompatible. However, If Spanning Tree is set to rapid-spanning-tree version, there is no need to use the Self-loop-discovery feature ; the RSTP algorithm avoids loops generated by the IBM token ring cabling.

- The 802.1w standard defines differently the default path cost for a port compared to STP (802.1d). In order to avoid network topology change when migrating to RSTP, the STP path cost is preserved when changing the spanning tree version to RSTP. You can use the default RSTP port cost by using the CLI command `set port spantree cost auto.`

Spanning Tree Protocol CLI Commands

The following table contains a list of CLI commands for the Spanning Tree feature. The rules of syntax and output examples are all set out in detail in the *Reference Guide*.

Table 11.3 Spanning Tree Protocol CLI Commandss

In order to...	Use the following command...
Enable/Disable the spanning tree application for the switch	set spantree
Set the bridge priority for spanning tree	set spantree priority
Set the RSTP bridge spanning tree max-age parameter	set spantree max-age
Set the RSTP bridge hello-time parameter	set spantree hello-time
Set the RSTP bridge forward-delay time prameter	set spantree forward-delay
Select between STP operation or RSTP switch operation	set spantree version
Display the bridge and per-port spanning tree information	show spantree
Set the TX hold count for the STA	set spantree priority
Add a port to the spanning tree application	set port spantree enable
Remove a port from the spanning tree application	set port spantree disable
Set the port spantree priority level	set port spantree priority
Set the cost of a port	set port spantree cost

Table 11.3 Spanning Tree Protocol CLI Commandss

In order to...	Use the following command...
Set the port as an RSTP port (and not as a common STA port)	set port spantree force-protocol-migration
Display a port's edge admin and operational RSTP state	show port edge state
Set the port as an RSTP edge port or non-edge port	set port edge admin state
Set the port point-to-point admin status	set port point-to-point admin status
Show the port's point-to-point admin and operational RSTP status	show port point-to-point status

MAC Security

The MAC security function is intended to filter incoming frames (from the line) with an unauthorized source MAC address (SA).

MAC Security Implementation in P330

When a frame is received on a secured port, its SA is checked against the MAC Address Table. If either the SA is not found there, or it is found but with a different port location, then the frame is rejected without being learned. A message is then sent to the CPU.

The Agent reports the attempted intrusion via an SNMP security violation trap containing the intruder's MAC address. To prevent the flooding of the Console's trap log / network, the Agent sends an intruder alert every 5 seconds for the first 3 times a specific intruder is detected on a port, and then every 15 minutes if the intrusion continues.

User should first enable the MAC security global mode (`set security mode`) and then configure the ports which should be secured (`set port security`). When setting a port to secured, the MAC addresses that a currently learnt on this port are preserved and considered as secure MAC, unless they are removed using `clear secure mac` command. Individual secure MACs can also be added.

Note: If the secure MAC editing command are to be implemented on a switch other than the stack master, a session should be opened to the relevant switch.

Note: Ports that are members of a port redundency scheme should not be also configured as secure ports.

MAC Security CLI Commands

The following table contains a list of the CLI commands for the MAC Security feature. The rules of syntax and output examples are all set out in detail in the *P330 Reference Guide*.

Table 11.4 MAC Security CLI Commands

In order to...	Use the following command...
Enable or disable the switch MAC security	set security mode

In order to...	Use the following command...
Enable or disable MAC security on a port	set port security
Add a unicast MAC address into the CAM table of a secured port (session command)	set secure mac
Remove a unicast MAC address from CAM table of a secured port (session command)	clear secure mac
Display the status of the MAC security feature (enabled/disabled)	show security mode
Display the secure MAC addresses of a port (session command)	show secure mac port
List the security mode of the ports of a switch	show port security

LAG

LAG Overview

A LAG uses multiple ports to create a high bandwidth connection with another device. For example: Assigning four 100BASE-T ports to a LAG on an Avaya P330 allows the switch to communicate at an effective rate of 400 Mbps with another switch.

LAGs provide a cost-effective method for creating a high bandwidth connection.

LAGs also provide built-in redundancy for the ports that belong to a LAG. If a port in a LAG fails, its traffic is directed to another port within the LAG.

The behavior of the LAG is derived from the base port (the first port that becomes a LAG member). The attributes of the base port, such as port speed, VLAN number, etc., are applied to all the other member ports in the LAG.

When created, each LAG is automatically assigned a logical port number (usually designated 10x). This logical port number can then be used as any regular panel port for all configuration required for the LAG (Spanning Tree, Redundancy, etc.)

Note: In the P330-ML switches you need to erase **all** ports in t.he LAG in order to remove it.

LAG CLI Commands

The following table contains a list of the CLI commands for the LAG feature. The rules of syntax and output examples are all set out in detail in the *P330 Reference Guide*.

Table 11.5 LAG CLI Commands

In order to...	Use the following command...
Enable or disable a Link Aggregation Group (LAG) logical port on the switch	set port channel
Display Link Aggregation Group (LAG) information for a specific switch or port	show port channel

LAG Implementation in the Avaya P330 Family of Products

This section describes the implementation of the LAG feature in the P330 Family of products.

The P333T supports up to 5 LAGs:

- Up to three LAGs from three groups of 8 10/100 Mbps ports:
  - Logical port 101 — ports1-4, 13-16
  - Logical port 102 — ports 5-8, 17-20
  - Logical port 103 — ports 9-12, 21-24
- Up to 2 LAGs (Logical ports 104-105) on the expansion module

Port Redundancy

Port redundancy involves the duplication of devices, services, or connections, so that, in the event of a failure, the redundant device, service, or connection can take over for the one that failed.

In addition to Link Aggregation Groups—which comprise the basic redundancy mechanism within the switch—the P330 offers an additional port redundancy scheme. To achieve port redundancy, you can define a redundancy relationship between any two ports in a stack. One port is defined as the primary port and the other as the secondary port. If the primary port fails, the secondary port takes over. You can configure up to 20 pairs of ports (or LAGs) per stack for port redundancy, and 1 pair per stack for intermodule redundancy. Each pair contains a primary and secondary port. You can configure any type of port to be redundant to any other.

Port Redundancy Operation

The Port Redundancy feature supports up to 20 pairs of ports per stack. The redundant or secondary port takes over when the primary port link is down. Port redundancy provides for the following in the P330:

- Switchback from the secondary to primary port is allowed
- Switching time intervals can be set by the user

Note: Port Redundancy interworks with the Spnning Tree Algorithm.

The Port Redundancy feature functions as follows:

- Port Redundancy enables the user to establish 20 pairs of ports. Within each pair, primary and secondary ports are defined. To prevent loops, only one port is enabled at a time.
- Following initialization, the primary port is enabled and the secondary port is disabled.
  - — If the active port link fails, the system enables the secondary port.
  - — If the secondary port is enabled and the primary port link becomes available again, the system will “switchback” to the primary port, unless configured otherwise by the user.
- Two timers are available:
  - — “min-time-between-switchovers” —minimum time (in seconds) between the failure of the primary port link and switchover to the secondary (backup) port.

Note: The first time the primary port fails, the switchover is immediate. This timer applies to subsequent failures.

— "switchback-interval" — the minimum time (in seconds) that the primary port link has to be up (following failure) before the system switches back to the primary port. The "none" parameter, if configured, prevents switching back to the primary.

Intermodule Port Redundancy

The intermodule port redundancy feature supports one pair of redundant ports per stack. The secondary port is activated:

- when the primary port link is down, or
- when the module in the stack holding the primary port has been powered down or removed.

Switching time for intermodule port redundancy is approximately 1 second.

Note: Defining intermodule port redundancy on ports with no link causes both ports to be disabled. You should connect the link prior to attempting to define intermodule port redundancy.

Note: Once a port has been designated in a redundancy scheme, either as a primary or a secondary port, it can not be designated in any other redundancy scheme.

Note: Intermodule Port Redundancy does not interworks with the Spnning Tree Algorithm.

Port Redundancy CLI Commands

The following table contains a list of the CLI commands for the Redundancy feature. The rules of syntax and output examples are all set out in detail in the *P330 Reference Guide*.

Table 11.6 Redundancy CLI Commands (check spec)

In order to...	Use the following command...
Define or remove port redundancy schemes	set port redundancy
Enable the defined port redundancy schemes	set port redundancy enable

In order to...	Use the following command...
Disable the defined port redundancy schemes	set port redundancy disable
Define the timers that control the port redundancy operation	set port redundancy-interval
Display information on port redundancy schemes.	show port redundancy
Define the switch's unique intermodule redundancy scheme	set intermodule port redundancy
Clear the intermodule redundancy	set intermodule port redundancy off
display the intermodule redundancy entry defined for the switch	show intermodule port redundancy

IP Multicast Filtering

Overview

IP Multicast is a method of sending a single copy of an IP packet to multiple destinations. It can be used by different applications including video streaming and video conferencing.

The Multicast packet is forwarded from the sender to the recipients, duplicated only when needed by routers along the way and sent in multiple directions such that it reaches all the members of the Multicast group. Multicast addresses are a special kind of IP addresses (class D), each identifying a multicast group. Stations join and leave multicast groups using IGMP. This is a control-plane protocol through which IP hosts register with their router to receive packets for certain multicast addresses.

IP multicast packets are transmitted on LANs in MAC multicast frames. Traditional LAN switches flood these multicast packets like broadcast packets to all stations in the VLAN. In order to avoid sending multicast packets where they are not required, multicast filtering functions may be added to the layer 2 switches, as described in IEEE standard 802.1D. Layer 2 switches capable of multicast filtering send the multicast packets only to ports connecting members of that multicast group. This is typically based on IGMP snooping.

The Avaya P330 supports multicast filtering. The P330 learns which switch ports need to receive which multicast packets and configures the necessary information into the switch's hardware tables. This learning is based on IGMP (version 1 or 2) snooping.

The multicast filtering function in the P330 is transparent to the IP hosts and routers. It does not affect the forwarding behavior apart from filtering multicast packets from certain ports where they are not needed. To the ports that do get the multicast, forwarding is performed in the same way as if there was no filtering, and the multicast packet will not be sent to any ports that would not receive it if there was no filtering.

The multicast filtering function operates per VLAN. A multicast packet arriving at the device on a certain VLAN will be forwarded only to a subset of the ports of that VLAN. If VLAN tagging mode is used on the output port, then the multicast packet will be tagged with the same VLAN number with which it arrived. This is interoperable with multicast routers that expect Layer 2 switching to be done independently for each VLAN.

IP Multicast Filtering configuration is associated with the setting up of three timers:

- The **Router Port Pruning** timer ages out Router port information if IGMP queries are not received within the configured time.
- The **Client Port Pruning** time is the time after the P330 switch reset that the filtering information is learned by the switch but not configured on the ports.
- The **Group Filtering Delay** time is the time that the switch waits between becoming aware of a Multicast group on a certain VLAN and starting to filter traffic for this group.

IP Multicast CLI Commands

The following table contains a list of the CLI commands for the IP Multicast feature. The rules of syntax and output examples are all set out in detail in the *Reference Guide*.

Table 11.7 IP Multicast CLI Commands

In order to...	Use the following command...
Enable or disable the IP multicast filtering application	set intelligent-multicast
Define aging time for client ports	set intelligent-multicast client port pruning time
Define aging time for router ports	set intelligent-multicast router port pruning time
Define group filtering time delays	set intelligent-multicast group-filtering delay time
Display the status IP multicast filtering application	show intelligent-multicast
Shows whether the connected unit's hardware supports IP multicast filtering	show intelligent-multicast hardware-support

IP Multicast Implementation in the Avaya P333T

This section describes the implementation of the IP multicast feature in the Avaya **P333T**:

- No. of multicast groups — 1000

Stack Health

The P330 software provides a Stack Helath feature for verifying the integrity of the P330 stack cascading module and cables.

Overview

The Stack Health feature will identify defective modules and cables that may be installed in the P330 stack. The Stack Health algorithm separately checks all stacking modules and the Octaplane connections (including Redundant cable).

Implementation of Stack Health in the P330 Family

When activating the Stack Health feature, the agents in all modules start sending special packets of various length via all stacking cables to one another. The Master module synchronizes this process and collects the results.

- When the Redundant Cable is present, the user is prompted to disconnect one of the short Octaplane cables and the redundant connection will be checked. Then, when prompted, the cable should be reconnected and the test will run a second time to check the regular Octaplane connections.
- The stack is reset after the Stack Health process completes.

Note: You should not load the stack with traffic during this test.

Note: If the stack health process fails, try to fasten or replace the stack cable between the modules where the failure has occurred. If the problem persists, try to fasten or replace either or both of the stacking modules.

Stack Health CLI Commands

The following table contains a list of the CLI commands for the Stack Health feature. The rules of syntax and output examples are all set out in detail in the *Reference Guide*.

Table 11.8 Stack Health CLI Command

In order to...	Use the following command...
Initiate the stack health testing procedure	set stack health

Port Classification

Overview

With the P330, you can classify any port as regular or valuable. Setting a port to valuable means that, in case of Ethernet link failure of that port, a link fault trap can be sent even when the port is disabled and a fast aging operation on the CAM table will be performed. This feature is particularly useful for the link/intermodule redundancy application, where you need to be informed about a link failure on the dormant port and resume traffic quickly.

Port Classification CLI Commands

In order to...	Use the following command...
Set the port classification to either regular or valuable	set port classification
Display a port’s classification	show port classification

Stack Redundancy

In the unlikely event that a P330 switch or Octaplane link should fail, stack integrity is maintained if the redundant cable is connected to the stack. The broken link is bypassed and data transmission continues uninterrupted. The single management IP address for the stack is also preserved for uninterrupted management and monitoring. You can remove or replace any unit within the stack without disrupting operation or performing stack-level reconfiguration.

Since each P330 module has an integral SNMP agent, any module in a stack can serve as the stack Network Managment Agent (NMA) while other NMAs act as redundant agents in “hot” standby. If the “live” NMA fails then a backup is activated instantaneously.

Chapter 12

Embedded Web Manager

This chapter describes the installation procedures for the Embedded Web Manager of the Avaya P330.

Overview

The Embedded Web Manager provides the following:

- Managing and monitoring Power over Ethernet.
- Device Configuration - Viewing and modifying the different device configurations.
- Virtual LANs - Viewing and editing Virtual LAN information.
- Link Aggregation Groups (LAGs) - Viewing and editing LAG information.
- Software Redundancy - Setting software redundancy for ports in an Avaya P330 Switch.
- Port Mirroring - Setting up port mirroring for ports in an Avaya P330 Switch.
- Trap Managers Configuration - Viewing and modifying the Trap Managers Table.
- Switch Connected Addresses - View devices connected to selected ports. Port Security.
- Intermodule Redundancy
  - One pair per stack.
  - Also operates as a result of a module fault, e.g., power failure.

System Requirements

Minimum hardware and Operating System requirements are:

- One of the following operating systems:
  - Windows® 95
  - Windows 98 SP1
  - Windows 98 OSR (Second Edition)
  - Windows ME
  - Windows NT® 4 Workstation or Server
  - Windows 2000 Professional or Server
- Pentium® II 400 Mhz-based computer with 256 Mb of RAM (512 Mb recommended)
- Minimum screen resolution of 1024 x 768 pixels
- Sun Microsystems Java™ plug-in version 1.3.1

- Microsoft® Internet Explorer® **or** Netscape Navigator/Communicator® (see table)

Table 12.1 Embedded Web Manager/Browser Compatability

	Windows 95 or NT	Windows 98, ME or 2000
Internet Explorer	5.0 or higher	5.01 or higher
Netscape Navigator/ Communicator	4.7	4.73

Note for users of Netscape Navigator: The Java plug-in requires certain services from **Windows 95** which are not present if **Internet Explorer** is not installed. In order to add these services to the operating system, please install Internet Explorer version 3 or higher. You can then use either browser to manage the switch.

Running the Embedded Web Manager

Note: You should assign an IP address to the switch before beginning this procedure.

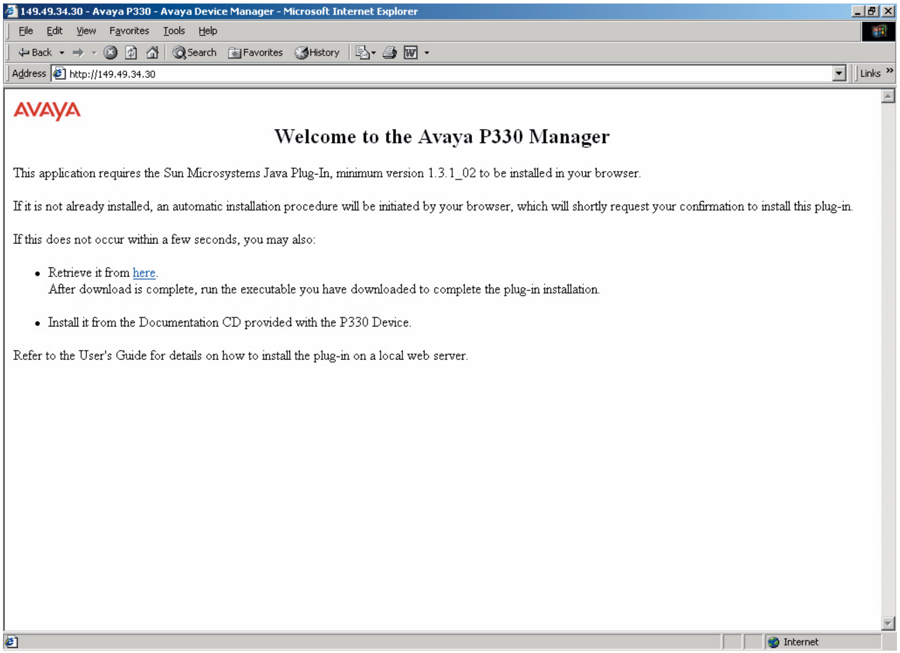
1. Open your browser.
2. Enter the url of the switch in the format `http://aaa.bbb.ccc.ddd` where `aaa.bbb.ccc.ddd` is the IP address of the switch.

Note: The user name is "root"
The default password for read-write access is "root".

Note: The Web management passwords are the same as those of the CLI. If you have created additional CLI user names or changed the default passwords then you can use those passwords for Web management as well.

The welcome page is displayed:

Figure 12.1 The Welcome Page



149.49.34.30 - Avaya P330 - Avaya Device Manager - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
Address http://149.49.34.30
Links
AVAYA
Internet

Welcome to the Avaya P330 Manager

This application requires the Sun Microsystems Java Plug-In, minimum version 1.3.1_02 to be installed in your browser.

If it is not already installed, an automatic installation procedure will be initiated by your browser, which will shortly request your confirmation to install this plug-in.

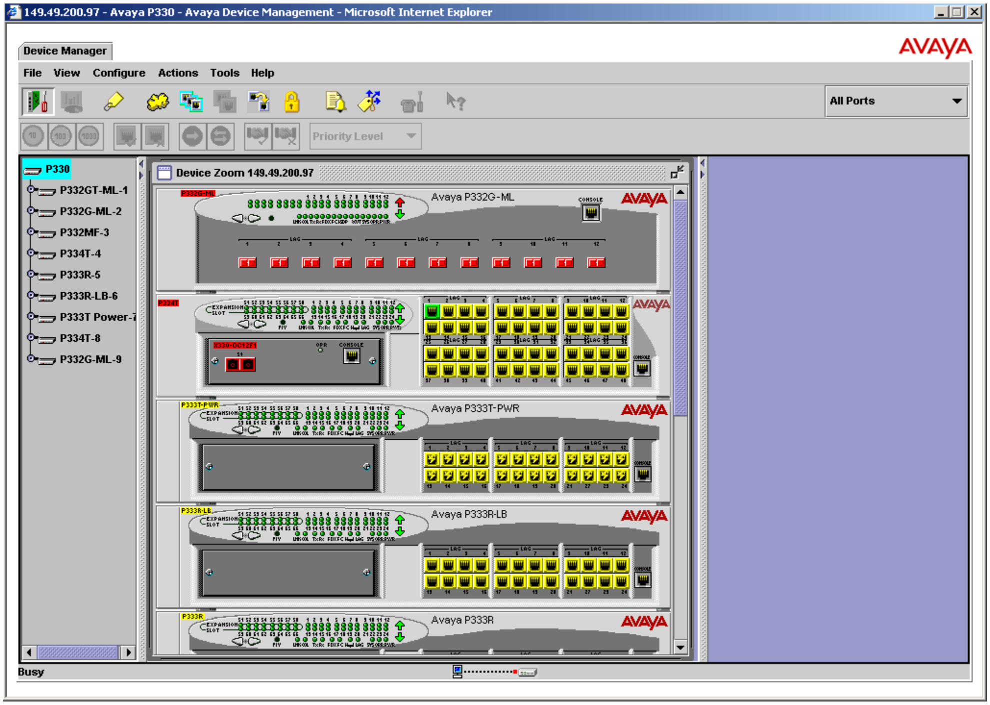
If this does not occur within a few seconds, you may also:

- Retrieve it from here.
  After download is complete, run the executable you have downloaded to complete the plug-in installation.
- Install it from the Documentation CD provided with the P330 Device.

Refer to the User's Guide for details on how to install the plug-in on a local web server.

— If you have the Java plug-in installed, the Web-based manager should open in a new window (see Figure 12.2).

Figure 12.2 Web-based Manager



— If you do **not** have the Java plug-in installed, follow the instructions on the Welcome page that offers a variety of options to install the plug-in (see Figure 12.1).

Installing the Java Plug-in

If the network manager has configured the system, the plug-in should be installed automatically.

Note: Ensure that Java or JavaScript is enabled on your Web browser. Please refer to your browser on-line help or documentation for further information.

If the plug-in is not installed automatically, then you have three options for installing it manually:

Installing from the Avaya P330 Documentation and Utilities CD

1 Close all unnecessary applications on your PC.
2 Insert the "Avaya P330 Documentation and Utilities" CD into the CD drive.
3 Click **Start** on the task bar.
4 Select Run.
5 Type ***x:*\emweb-aux-files\plug-in_1_3_1.exe** where ***x:*** is the CD drive letter.
6 Follow the instructions on screen.

Install from the Avaya Site

Click on the link in the Welcome page.

Install from your Local Web Site

Click on the link in the Welcome page.

Note: This option is only available if the network manager has placed the files on the local Web server.

Installing the On-Line Help and Java Plug-In on your Web Site

Note: This procedure is optional.

Copying the help files and Java plug-in to a local Web server allows users to access the on-line help for the Embedded Manager and enables automatic installation of the Java plug-in the first time the users tries to manage the device.

1 Copy the `emweb-aux-files` directory from the "Avaya P330 Documentation and Utilities" CD to your local Web server. Please refer to your Web server documentation for full instructions.

2 Define the URL in the Avaya P330 using the following CLI command:
`set web aux-files-url` ***`//IP address/directory name`***
where ***`//IP address/directory name`*** is the location of the directory from the previous step.
Refer to Chapter 6 for further details of the command.

Avaya P333T

Section 4: Troubleshooting and Maintaining the P330

Chapter 14

Troubleshooting the Installation

Troubleshooting the Installation

This section will allow you to perform basic troubleshooting of the installation. If you are unable to solve the problem after following the procedures in this chapter, please contact Avaya Technical Support. Refer to “How to Contact Us“for full details.

Table 14.1 Troubleshooting

Problem/Cause	Suggested Solution
Switch does not power up	
• AC power cord not inserted or faulty	• Check that the AC power cord is inserted correctly • Replace the power cord
If the cord is inserted correctly, check that the AC power source is working by connecting a different device in place of the P3330. • If that device works, refer to the next step. • If that device does not work, check the AC power	
• P3330 AC power supply not functioning	• Use an optional BUPS (Backup Power Supply) • Contact your local Avaya distributor. *The power supply is not user-replaceable.*
Stacking not functioning	
• X330-STK modules not inserted correctly (LEDs on stacking module do not light)	• Check that modules are installed correctly
• Octaplane™ cables not installed correctly (LEDs on stacking module do not light)	• Check that the cables are inserted correctly • Check that there are no cross-corrections
Expansion module not functioning	

Table 14.1 Troubleshooting

Problem/Cause	Suggested Solution
• Expansion module not inserted correctly	• Check that module are installed correctly

Maintenance

Introduction

This section provides basic maintenance information for the Avaya P330 switch and its components. For issues that are not covered in this chapter or in "Troubleshooting the Installation," please contact your Avaya representative.

Caution: Please refer to "Before You Install the P330" before undertaking any of the procedures detailed in this section.

Adding/Replacing an Expansion Sub-module

Caution: The expansion sub-modules contain components sensitive to electrostatic discharge. Do not touch the circuit board unless instructed to do so.

Adding an Expansion Sub-module to Avaya P330

1 Remove the blanking plate or other sub-module (if installed).

2 Insert the sub-module gently into the slot, ensuring that the Printed Circuit Board (PCB) is aligned with the guide rails.
The PCB *not* the metal base plate fits into the guide rail.

3 Firmly press the sub-module until it is completely inserted into the Avaya P330.

4 Gently tighten the two screws on the front panel of the expansion sub-module by turning them.

Note: The Avaya P330 switch must not be operated with the expansion slot open; the expansion sub-module slot should be covered with the supplied blanking plate if necessary.

Replacing an Existing Expansion Sub-module

If an expansion sub-module is removed from the stack with the power supply on, all configuration definitions on expansion sub-modules are lost. Both procedures for replacing an expansion sub-module—with saving and without saving configuration definitions —follow:

Saving Configuration Definitions

1 Turn off the power supply.
2 Remove an expansion sub-module.
3 Insert another expansion sub-module.
4 Turn on the power supply.

Without Saving Configuration Definitions

1 Loosen the screws by turning the knobs.
2 Take hold of the two knobs (one near each side of the front panel) and pull gently but firmly towards yourself.
3 Insert another expansion sub-module or the blanking plate.

Replacing the Stacking Sub-module

To replace the X330STK stacking sub-module:

1 Power to the switch may remain on.
2 Loosen the screws to the stacking sub-module by turning the knobs.
3 Take hold of the two knobs (one near each side of the front panel) and pull gently but firmly towards yourself.
4 Insert the new stacking sub-module gently into the slot, ensuring that the metal base plate is aligned with the guide rails.
The metal plate—*not* the PCB of the X330STK— fits onto the guide rails.
5 Press the sub-module in firmly until it is completely inserted into the Avaya P330.

Caution: Ensure that the screws on the module are properly aligned with the holes in the chassis before tightening them.

6 Gently tighten the two screws on the side panel of the stacking module by turning the screws. **Do not use excessive force when tightening the screws.**

Chapter 16

Updating the Software

This section provides the basic procedure for downloading and updating the P330 system software.

Caution: Please refer to "Before You Install the P330" before undertaking any of the procedures detailed in this section.

Software Download

You can perform software download using the CLI or Avaya UpdateMaster (part of the Avaya Multi-Service Network Manager Suite).

Obtain Software Online

You can download the firmware and Embedded Web Manager from the "Software Download" section at www.avaya.com/support.

Downloading Software

Download the firmware and Embedded Web Manager as follows:

Use the command in the Avaya P330 CLI:

```
copy tftp SW_image <image-file> EW_archive <filename> <ip>
<mod_num>
```

image-file	firmware image file name (full path)
filename	Embedded Web Manager image file name (full path)
ip	The IP address of the TFTP server
mod_num	Target module number

Please see the CLI Chapters of the User's Guides for related information.

Note: Upgrading from firmware Versions Below 2.4
When you upgrade the firmware from below version 2.4, you must upgrade in two steps: First upgrade to 2.4 and then upgrade to 3.x or higher.
If you try to upgrade directly from any version below 2.4 to Version 3.x or higher, the upgrade will fail and you will get the following error message: `file too big`.

Note: Please download both the new Avaya firmware and the new Embedded Web Manager versions. Whichever version of the firmware you decide to run, always be sure to match the correct firmware and Embedded Web Manager versions.

Download New Version without Overwriting Existing Version

Sometimes it is desirable to upgrade to a new software version while retaining the option of booting from the previous version. The following process copies the previous version from memory Bank B to Bank A, and download the new version to Bank B. This process accomplishes the following:

- prevents the embedded web image-file from being downloaded into Bank A - by providing a non-existant file name for the Embedded Web image file.
- preserves the old version in Bank A
- allows the user to boot from either Bank A or Bank B (i.e., using either the old or new software version)

Note: In normal operation, the Embedded Web file should be copied to Bank A, and the new software version should be downloaded to Bank B. This process copies the old software version to Bank A and the new software version to Bank B, and allows the user to boot from either version via the `set boot bank` command.

To perform this process:

```
copy tftp SW_image <new_ver_file> EW_image <dummy_file_name>
<TFTP_server_IP_addr> <module_number>
```

Example:

```
copy tftp SW_image c:\versions\p330\p333t EW_image x 149.49.138.170 1
```

Note: Since file "x" doesn't exist the Embedded web image will not be downloaded.

How to Contact Us

To contact Avaya's technical support, please call:

In the United States

Dial 1-800-237-0016, press 0, then press 73300.In the EMEA (Europe, Middle East and Africa) Region

Country	Local Dial-In Number
Albania	+31 70 414 8001
Austria	+43 1 36 0277 1000
Azerbaijan	+31 70 414 8047
Bahrain	+800 610
Belgium	+32 2 626 8420
Belorussia	+31 70 414 8047
Bosnia Herzegovina	+31 70 414 8042
Bulgaria	+31 70 414 8004
Croatia	+31 70 414 8039
Cyprus	+31 70 414 8005
Czech Rep.	+31 70 414 8006
Denmark	+45 8233 2807
Egypt	+31 70 414 8008
Estonia	+372 6604736
Estonia	+372 6604736
Latvia	+371 721 4368

Country	Local Dial-In Number
Finland	+358 981 710 081
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Ghana	+31 70 414 8044
Gibraltar	+31 70 414 8013
Greece	+00800 3122 1288
Hungary	+06800 13839
Iceland	+0800 8125
Ireland	+353 160 58 479
Israel	+1 800 93 00 900
Italy	+39 02 7541 9636
Jordan	+31 70 414 8045
Kazakhstan	+31 70 414 8020
Kenya	+31 70 414 8049
Kuwait	+31 70 414 8052
Saudi Arabia	+31 70 414 8022

Country	Local Dial-In Number
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Luxemburg	+352 29 6969 5624
Macedonia	+31 70 414 8041
Malta	+31 70 414 8022
Mauritius	+31 70 414 8054
Morocco	+31 70 414 8055
Netherlands	+31 70 414 8023
Nigeria	+31 70 414 8056
Norway	+47 235 001 00
Oman	+31 70 414 8057
Pakistan	+31 70 414 8058
Poland	+0800 311 1273
Portugal	+351 21 318 0047
Qatar	+31 70 414 8059
Romania	+31 70 414 8027
Russia	+7 095 733 9055

Country	Local Dial-In Number
Slovakia	+31 70 414 8066
Slovenia	+31 70 414 8040
South Africa	+0800 995 059
Spain	+34 91 375 3023
Sweden	+46 851 992 080
Switzerland	+41 22 827 8741
Tanzania	+31 70 414 8060
Tunisia	+31 70 414 8069
Turkey	+800 4491 3919
UAE	+31 70 414 8036
Uganda	+31 70 414 8061
UK	+44 0207 5195000
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Japan	+0 120 766 227
Korea	+0 80 766 2580

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For updated information, visit www.avaya.com/support and click “Global Support Organization (GSO)”.