



# CHAPTER 1

## Introducing the Cisco Wide Area Application Engine

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This chapter provides a basic functional overview of the Cisco Wide Area Application Engine 512 and 612 (WAE-512 and WAE-612), and describes the hardware, major components, and front and back panel indicators and controls.

This chapter contains the following sections:

- [Introduction, page 1-1](#)
- [Software Functional Description, page 1-4](#)
- [Hardware Features, page 1-6](#)

## Introduction

The Wide Area Application Engines (WAE-512 and WAE-612) support three different software installations that provide a comprehensive set of services for the remote office: Cisco Wide Area Application Services (WAAS) software, Cisco Wide Area File System (WAFS) software and Cisco Application and Content Networking System (ACNS) software.

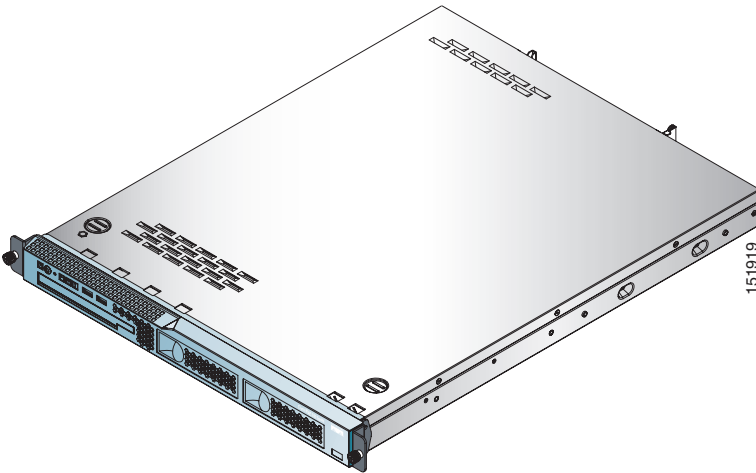
The following software releases support the WAE-512 and WAE-612 appliances:

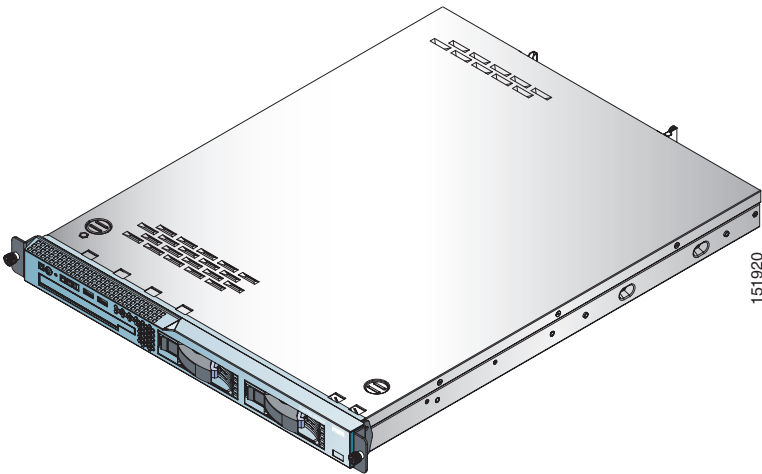
- WAAS 4.0.1 and later
- WAFS 3.0.7 and later
- ACNS 5.4.3 and later
- ACNS 5.5.1 and later

When WAAS software is installed, the WAE appliance can function as either a Central Manager or as an Application Acceleration Engine. When ACNS software is installed, the WAE appliance functions as a Content Engine or one of the other ACNS device modes (Content Router or Content Distribution Manager). When WAFS software is installed, the WAE appliance functions as a File Engine.

Figure 1-1 shows the WAE-512 and Figure 1-2 shows the WAE-612.

**Figure 1-1** WAE-512—Front View



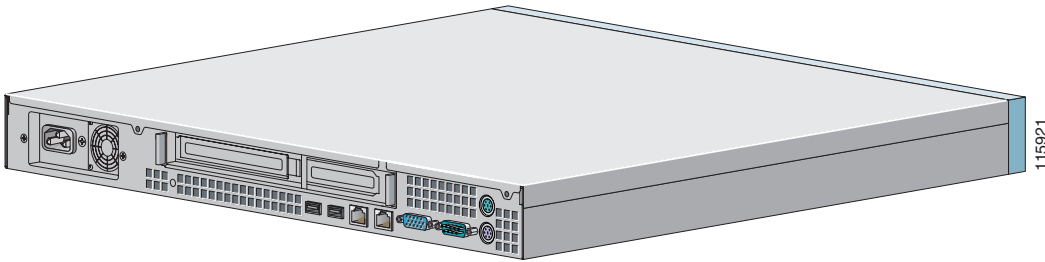
**Figure 1-2 WAE-612—Front View**

The WAE-512 and WAE-612 are configured for AC-input power and have a single AC-input power supply.

The WAE appliance has an integrated dual-port Ethernet controller, which supports 10BASE-T/100BASE-TX/1000BASE-TX Ethernet using RJ-45 receptacles. Both Ethernet ports support autodetect speed mode and full-duplex operation, which enable simultaneous transmission and reception of data on the Ethernet LAN.

WAE-512 and 612 models that are operating with ACNS software support an MPEG A/V decoder adapter. This adapter is user-replaceable and is installed in PCI-X slot 1 on the back panel.

[Figure 1-3](#) shows the WAE rear view.

**Figure 1-3** WAE-512 and WAE-612 Back Panel

## Software Functional Description

The operation of the WAE is dependent on the software application that is installed on it. This section describes WAAS, ACNS and WAFS software:

- [WAAS Software Description, page 1-4](#)
- [ACNS Software Description, page 1-5](#)
- [WAFS Software Description, page 1-6](#)

## WAAS Software Description

With WAAS software installed, the WAE appliance functions as either a WAAS Central Manager or a WAAS Application Acceleration Engine. The WAAS Central Manager provides a graphical user interface to monitor and configure all Acceleration Engines. The WAAS Acceleration Engine is deployed in remote branch offices and in the data center to accelerate TCP applications that access data across the network.

The Application Acceleration Engine functionality operates at different levels based on the software licenses purchased. WAAS 4.x, software offers the WAAS Transport License or the WAAS Enterprise License options.

Cisco WAAS software helps enterprises meet the following objectives:

- Provide branch office employees with LAN-like access to information and applications across a geographically distributed network.

- Migrate application and file servers from branch offices into centrally managed data centers.
- Minimize unnecessary WAN bandwidth consumption through the use of advanced compression algorithms.
- Provide print services to branch office users. Cisco WAAS allows you to configure a WAE as a print server so you do not need to deploy a dedicated system to fulfill print requests.
- Improve application performance over the WAN by addressing the following common issues:
  - Low data rates (constrained bandwidth)
  - Slow delivery of frames (high network latency)
  - Higher rates of packet loss (low reliability)

## ACNS Software Description

With ACNS software installed, the WAE appliance functions as a Content Distribution Manager, Content Engine, or Content Router. The Content Distribution Manager provides a graphical user interface to manage registered Content Engines and Content Routers. The ACNS solution addresses the need to distribute and receive high-bandwidth, media-rich content across the Internet or an intranet without performance losses or content-delivery delays.

ACNS software offers the following content-based services:

- Content caching and hosting
- Proxy services
- Content replication
- Video streaming

In Content Engine mode, the WAE operates either as a component of an ACNS network or as a standalone content-caching device and is generally positioned on the WAN edge between your enterprise network and the Internet.



### Note

The WAE-612 supports device-mode configuration and can be configured with ACNS 5.x software to operate as a Content Engine, a Content Router, a Content Distribution Manager, or an IP/TV Program Manager. The WAE-512 operates as a Content Engine only.

To deploy Cisco Content Engines with Cisco ACNS software within your existing network, your network must support Cisco IOS software and the Web Cache Communication Protocol (WCCP). WCCP transparently redirects HTTP requests to a Content Engine, and the Content Engine responds to those requests.

## WAFS Software Description

With WAFS software installed, the WAE appliance functions as a File Engine. The File Engine is an Internet file delivery device that provides the following file-based services:

- Segment-level file and metadata caching
- Protocol-specific latency reduction
- WAN transport-level optimization
- Policy-based prepositioning
- Global locking and coherency
- Native end-to-end CIFS/NFS support
- Web-based centralized control and management
- Branch file server replacement

## Hardware Features

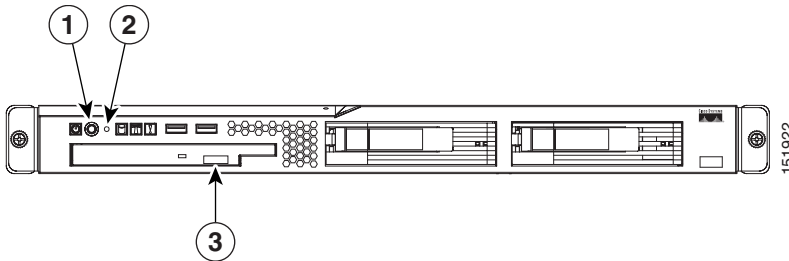
This section illustrates and describes the front and back panel controls, ports, and LED indicators on the WAE-512 and WAE-612. It contains the following topics:

- [Front Panel Control Buttons, page 1-7](#)
- [LED Indicators, page 1-7](#)
- [Input/Output Ports and Connectors, page 1-10](#)
- [Inline Network Adapter Description, page 1-14](#)

## Front Panel Control Buttons

Figure 1-4 shows the WAE front panel, and Table 1-1 describes the front panel control buttons.

**Figure 1-4** Front Panel Control Buttons



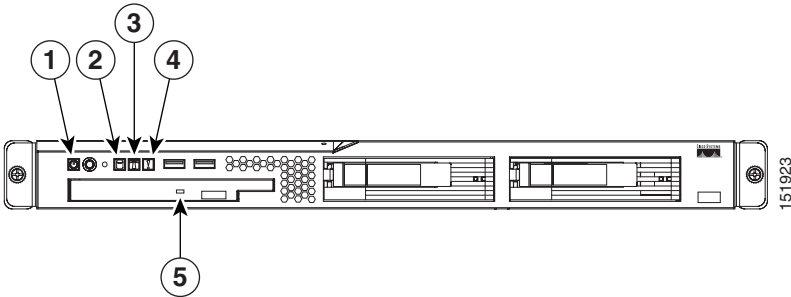
<b>1</b>	Power control button	<b>2</b>	Reset button
<b>3</b>	CD eject button		

**Table 1-1** Front Panel Control Buttons

Item	Description
Power control button	Powers up the device. You might need to use a pen or the end of a straightened paper clip to press the button.
Reset button	Resets the device and runs the power-on self-test (POST). You might need to use a pen or the end of a straightened paper clip to press the button. <b>Note</b> This is a hardware reset button and does not restore the device to the factory default software settings.
CD eject button	Opens the CD drive tray.

## LED Indicators

Figure 1-5 shows the location of front panel LEDs, and Table 1-2 describes their function.

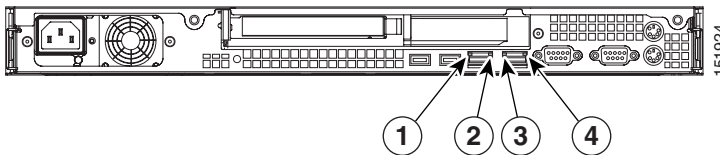
**Figure 1-5 Front Panel LEDs**

<b>1</b>	Power on	<b>2</b>	Hard disk drive activity
<b>3</b>	System locator (not supported on Content Engine models)	<b>4</b>	System error
<b>5</b>	CD-ROM drive activity		

**Table 1-2 Front Panel LEDs**

LED	Color	State	Description
Power	Green	On	Power is flowing to the device.
		Flashing	The device is in standby mode.
Hard disk drive activity	Green	Flashing	The associated hard disk drive is in use.
System error	Amber	On	A system error has occurred.
CD-ROM drive activity	Green	On	The CD-ROM drive is in use.

Figure 1-6 shows the location of back panel LEDs, and Table 1-3 describes their function.

**Figure 1-6 Back Panel LEDs**

<b>1</b>	Ethernet 1 transmit receive activity	<b>2</b>	Ethernet 1 speed
<b>3</b>	Ethernet 2 transmit receive activity	<b>4</b>	Ethernet 2 speed

**Table 1-3 Back Panel LEDs**

Indicator	Color	State	Description
Ethernet 1 transmit receive activity	Green	On	There is an active link connection on the 10/100/1000BASE-T interface for Ethernet port 1.
Ethernet 1 speed	Green	On	The speed of the Ethernet LAN is 1000BASE-TX.
		Off	The speed of the Ethernet LAN is 10BASE-T/100BASE-TX.
Ethernet 2 transmit receive activity	Green	On	There is an active link connection on the 10/100/1000BASE-T interface for Ethernet port 2.
Ethernet 2 speed	Green	On	The speed of the Ethernet LAN is 1000BASE-TX.
		Off	The speed of the Ethernet LAN is 10BASE-T/100BASE-TX.

**Note**

The MPEG A/V decoder adapter does not have any LEDs.

## Input/Output Ports and Connectors

Your WAE appliance supports the following I/O connectors on the back of the device:

- Ethernet connectors
- Serial connector
- Video and audio connectors (on optional adapter)

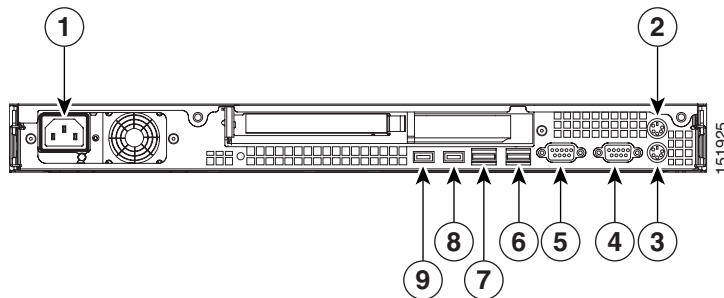


### Warning

**To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.** Statement 1021

Figure 1-7 shows the location of the WAE back panel connectors and receptacles.

**Figure 1-7** WAE-512 and WAE-612 Back Panel Connectors and Receptacles



<b>1</b>	AC power receptacle	<b>2</b>	Mouse connector <sup>1</sup>
<b>3</b>	Keyboard connector <sup>1</sup>	<b>4</b>	Serial port
<b>5</b>	Monitor connector <sup>1</sup>	<b>6</b>	Ethernet 2 port connector
<b>7</b>	Ethernet 1 port connector	<b>8</b>	USB 1 port (not supported)
<b>9</b>	USB 2 port (not supported)		

1. Not required for normal operation. Can be used for troubleshooting purposes.

**Note**

The system software does not support the use of a keyboard or mouse (Personal System 2 [PS/2] or Universal Serial Bus [USB]). The BIOS does support a keyboard and a mouse for power-on self-test (POST) and the configuration/setup utility.

To troubleshoot the BIOS boot process, you can connect a keyboard to any USB port and connect a monitor to the video connector. Video output is for troubleshooting only during the BIOS boot process. The video output stops displaying when the serial port becomes active. To monitor the boot process in normal operation, use the serial console port.

Table 1-4 describes the back panel ports and receptacles.

**Table 1-4 Back Panel Ports and Connectors**

Item	Description
AC power receptacle	The AC power cord connects to this plug.
Ethernet 1 port	This 10/100/1000BASE-T port is autosensing with full-duplex capability; it connects your device to the Ethernet LAN.
Ethernet 2 port	This 10/100/1000BASE-T port is autosensing with full-duplex capability; it connects your device to the Ethernet LAN.
Serial port	This is a standard serial port for connecting to a console or terminal.
Audio/video port (on optional MPEG A/V decoder adapter)	<ul style="list-style-type: none"> <li>• 3 BNC<sup>1</sup> connectors for YUV, RGB<sup>2</sup>, and composite video output</li> <li>• Mini-XLR 8-pin connector for S/PDIF<sup>3</sup> and analog stereo audio output</li> <li>• Mini-XLR 8-pin connector for VGA<sup>4</sup> output</li> </ul>

1. BNC = Bayonet Neill-Concelman
2. RGB = red green blue
3. S/PDIF = Sony/Philips Digital Interface
4. VGA = video graphics array

## Ethernet Port Connector

The WAE appliance comes with one integrated dual-port Ethernet controller. This controller provides an interface for connecting to 10-Mbps, 100-Mbps, or 1000-Mbps networks and provides full-duplex (FDX) capability, which enables simultaneous transmission and reception of data on the Ethernet LAN.

To access the Ethernet port, connect a Category 3, 4, or 5 unshielded twisted-pair (UTP) cable to the RJ-45 connector on the back of the device.

**Note**

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The 100BASE-TX/1000BASE-TX Ethernet standard requires that the cabling in the network be Category 5 or higher.

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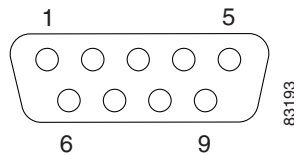
[Figure 1-8](#) shows the pin number assignments for the Ethernet RJ-45 port.

**Figure 1-8** *Ethernet Port Connector*

## Serial Port Connector

The WAE appliance has one standard serial port connector located on the back of the device.

[Figure 1-9](#) shows the pin number assignments for the 9-pin, male D-shell serial port connector on the back of the device. These pin number assignments conform to the industry standard for RS-232 communications.

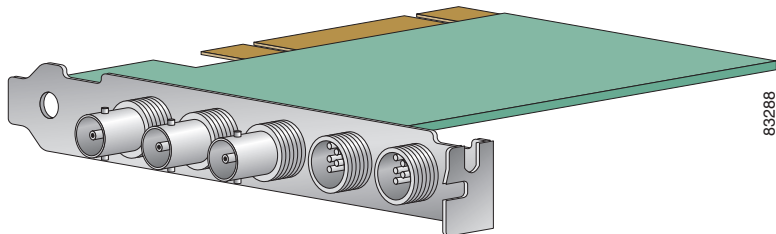
**Figure 1-9 Serial Port Connector**

## Video Port Connectors

The WAE-512 and WAE-612 support one optional MPEG A/V decoder adapter that has one audio and video input/output port.

[Figure 1-10](#) shows the following five connectors for the audio and video input/output port:

- 3 BNC connectors for YUV, RGB, and composite video output
- Mini-XLR 8-pin connector for Sony/Philips Digital Interface (S/PDIF) and analog stereo audio output
- Mini-XLR 8-pin connector for video graphics array (VGA) output

**Figure 1-10 Video Input/Output Connectors**

[Table 1-5](#) provides the pinout for the audio output mini-XLR 8-pin connector, and [Table 1-6](#) provides the pinout for the VGA output mini-XLR 8-pin connector.

**Table 1-5 Audio Output Connector Pinout**

Pin Number	Destination
1	Audio left (-)
2	Ground
3	Audio left (+)
4	Audio right (+)
5	Ground
6	Audio left (-)
7	Ground
8	S/PDIF

**Table 1-6 VGA Output Connector Pinout**

Pin Number	Destination
1	Vsync
2	Ground
3	Hsync
4	Blue
5	Ground
6	Red
7	Green
8	Ground

## Inline Network Adapter Description

This section describes the following features of the WAE inline network adapter:

- [Form and Function](#)
- [Ports and LED Indicators](#)
- [Inline Network Adapter Cabling Requirements](#)

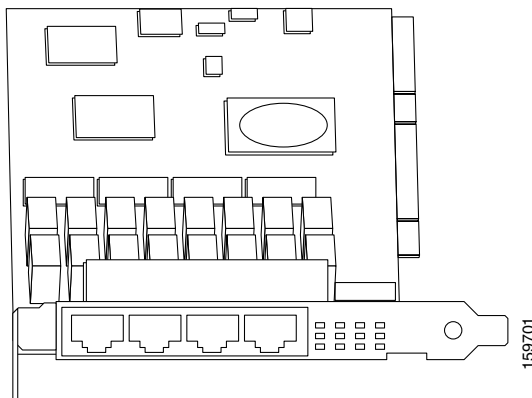
- [Installation Scenarios and Cabling Examples for Fast Ethernet Connections](#)

For adapter specifications, see [Table A-4](#) in Appendix A.

## Form and Function

Your appliance supports one optional 4-port Ethernet inline network adapter. The inline network adapter is a full-height, three-quarter-length PCI-X network interface card that contains four independent Gigabit Ethernet ports. (See [Figure 1-11](#).)

**Figure 1-11** *Inline Network Adapter*



The Cisco WAE inline network adapter provides inline traffic interception capability for your appliance. When your appliance is configured for inline interception mode, you can set attributes to control which interfaces are to be used over which VLANs. By default, the adapter operates on all inline-capable interfaces and VLANs. You can configure the inline redirection feature using the WAAS 4.0.7 CLI or the WAAS 4.0.7 Central Manager GUI.

The WAAS software defines two new interface types: A group interface that represents an inline pair grouping and a port interface that represents the individual port. These interfaces are referred to as `inlineGroup` and `inlinePort`, respectively.

InlineGroup interfaces are numbered using the format slot/group. The slot number is the slot in which the adapter is inserted. (In the WAE 500 series and 600 series appliances, the adapter must be installed in slot 1 only.) The group number is either 0 or 1 (each adapter has 2 group pairs). The group number is displayed on the adapter label.

InlinePort interfaces are numbered slot/group/lan or slot/group/wan. The last attribute is the LAN or WAN designator.

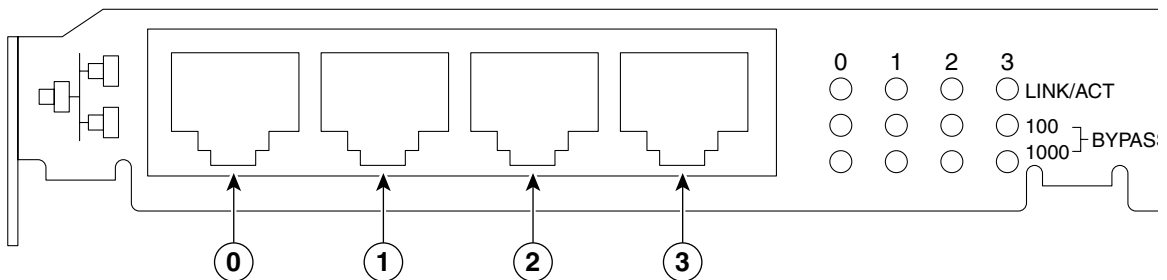
The inline network adapter also includes an onboard programmable Watch Dog Timer (WDT) controller. You can set the time to wait after a failure event, such as a power outage or a kernel crash, before the unit begins to operate in mechanical bypass mode. In mechanical bypass mode, traffic is bridged between the LAN and WAN ports of each group. Mechanical bypass mode prevents the WAE from becoming a single point of failure and allows traffic to continue to flow between the router and the client while it passes through an unresponsive WAE without being processed.

For more information about configuring the inline network adapter, see the *Cisco Wide Area Application Services Configuration Guide*.

## Ports and LED Indicators

Figure 1-12 shows the inline network adapter port numbers, interface designations, and LEDs. Table 1-7 describes the LED functions.

**Figure 1-12** *Inline Network Adapter Port Numbering and LEDs*



<b>0</b>	Port 0; Group 1 WAN interface	<b>1</b>	Port 1; Group 1 LAN interface
<b>2</b>	Port 2; Group 0 WAN interface	<b>3</b>	Port 3; Group 0 LAN interface

The inline network adapter has three LEDs that correspond to each port (the 0 LEDs correspond to Port 0, and so forth). [Table 1-7](#) describes the LEDs.

**Table 1-7** *Inline Network Adapter LEDs*

LEDs	State	Description
Link / Activity	On	The 10/100/1000BASE-T interface is receiving power.
	Blinking	The Ethernet link is transmitting data.
100	On	The speed of the Ethernet connection is 100BASE-TX.
1000	On	The speed of the Ethernet connection is 1000BASE-TX.
Bypass	Both the 100 and 1000 LEDs are on	The corresponding ports are in mechanical bypass mode.

## Inline Network Adapter Cabling Requirements

Your inline network adapter ships with two types of cables: crossover and straight-through. When you connect the WAE inline network adapter, proper cabling depends on the link speed (Gigabit Ethernet or Fast Ethernet) and the types of devices (DCE or DTE) being connected.



### Note

You must retain the same link speed from one end of the connection to the other end. Inline adapter interfaces are able to autonegotiate link speeds. If any of your connecting interfaces are configured for Fast Ethernet (whether on a switch or a router), your WAE inline adapter uses Fast Ethernet. If any of your connecting interfaces are configured for Gigabit Ethernet, your WAE inline adapter uses Gigabit Ethernet. Speed and duplex settings are port-specific, so two inline ports can negotiate different speeds independently.

If you are connecting a WAE inline appliance between two devices using Gigabit Ethernet, you can use either straight-through cables, crossover cables, or any combination of the two cable types, regardless of the type of device. However, for consistency, we recommend that you use straight-through cables for all Gigabit Ethernet connections.

Table 1-8 shows the cable requirements for WAE and non-WAE connections when you are using Gigabit Ethernet end to end.

**Table 1-8 Cable Requirements for WAE Connections Using Gigabit Ethernet**

Connection	Required Cable
Switch to switch (no WAE)	Crossover or Straight-through
Switch to router (no WAE)	Crossover or Straight-through
Router to router (no WAE)	Crossover or Straight-through
Switch to WAE and WAE to Router	Crossover or Straight-through
Switch to WAE and WAE to Switch	Crossover or Straight-through
Router to WAE and WAE to Router	Crossover or Straight-through
WAE to WAE	Crossover or Straight-through

Some switches support automatic medium-dependent interface crossover (MDIX). You can configure MDIX by using the **mdix auto** global configuration switch command. If your switch supports MDIX, you do not need to follow these cabling rules because MDIX automatically adjusts transmit and receive pairs when an incorrect cable type (crossover or straight-through) is installed on a 10/100 Fast Ethernet port. However, when you configure MDIX, you must also configure the port to use autosense (not manual selection of speed/duplex).



**Caution**

If you are connecting to Fast Ethernet ports on both the LAN and the WAN sides of the WAE inline appliance, you must consider the types of devices that are being connected, and you must use the correct cables. You must follow these cabling

instructions for the inline network adapter to work properly. (See [Table 1-9](#). For illustrations and examples, see the “[Installation Scenarios and Cabling Examples for Fast Ethernet Connections](#)” section on page 1-20.)

To connect the inline network adapter using the correct cables for Fast Ethernet connections, follow these steps:

- Step 1** Determine which type of cable you would use for a direct connection between your two end devices (without a WAE inline network appliance connected between them) by using the following standard cabling rules:
- When you are directly connecting two network devices that are similar, such as two switches, use a crossover cable.
  - When you are directly connecting two network devices that are different, such as a switch and router, use a straight-through cable.



**Note** Because the inline network adapter has an internal crossover connection that becomes active when the InlineGroup interface is placed in mechanical bypass mode, you must figure out which cable you would use to connect the two network devices directly, and then you must install the other cable type (on one side, usually the WAN side of the inline appliance) instead.

[Table 1-9](#) shows the cable requirements for WAE and non-WAE connections when you are using Fast Ethernet end to end.

**Table 1-9** *Cable Requirements for WAE Connections Using Fast Ethernet*

Connection	Required Cable
Switch to switch (no WAE)	Crossover
Switch to router (no WAE)	Straight-through
Router to router (no WAE)	Crossover
Switch to WAE and WAE to Router	Straight-through Crossover
Switch to WAE and WAE to Switch	Straight-through Straight-through

**Table 1-9** Cable Requirements for WAE Connections Using Fast Ethernet

Connection	Required Cable
Router to WAE and	Straight-through
WAE to Router	Straight-through
WAE to WAE	Crossover

**Step 2** Connect Fast Ethernet ports on both the LAN and the WAN sides of the WAE inline appliance by using the following cable types:

- On the LAN side of the connection, use a straight-through cable between the WAE inline appliance and the network device.
- On the WAN side of the connection, use the cable that is different from the cable that you would use to connect the two network devices directly (as determined in [Step 1](#)).

For example, if you are connecting a router and a switch (two different devices) through the WAE inline appliance, use a straight-through cable on the LAN side of the connection and use a crossover cable on the WAN side of the connection. (If you were connecting the two different devices directly, you would use a straight-through cable, so use the crossover cable instead.)

If you are connecting two switches (or two similar devices), use straight-through cables on both the LAN and the WAN sides of the WAE inline appliance.

[Figure 1-13](#) through [Figure 1-15](#) show the cables to use for the WAE LAN and WAN connections between Fast Ethernet ports.

## Installation Scenarios and Cabling Examples for Fast Ethernet Connections

WAE appliances can be installed physically between two network devices (such as the branch office router and branch office LAN switch) by connecting the WAE inline network adapter ports to the network devices using the proper cables.

If you are connecting a WAE inline appliance between two devices using Gigabit Ethernet, you can use either straight-through cables, crossover cables, or any combination of the two cable types, regardless of the type of device. This section shows cabling examples for Fast Ethernet connections only, because Fast Ethernet has specific cabling requirements.

The inline network adapter has four ports that are divided into two inline groups (see the “[Ports and LED Indicators](#)” section on page 1-16). The WAE can be physically placed inline between two distinct network paths, creating redundant WAN links. (See [Figure 1-13](#).)

Two WAEs with inline network adapters can also be installed back-to-back in a serial fashion between two network devices for failover purposes. In this type of serial cluster configuration, if one WAE fails, the other WAE can provide optimization. (See [Figure 1-14](#).)

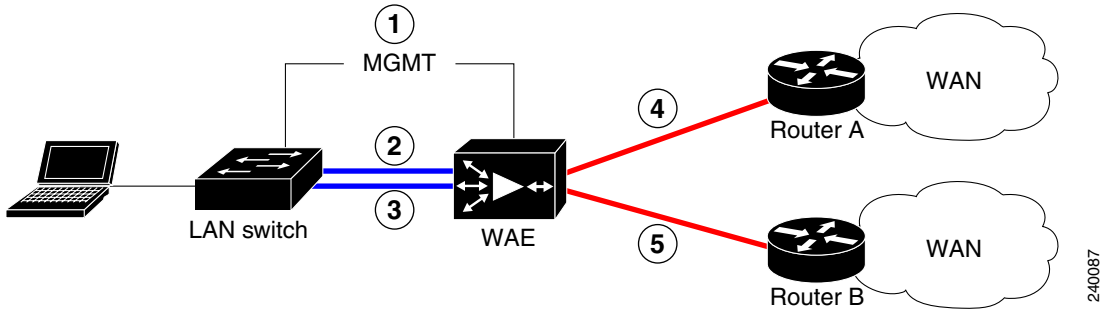
**Note**

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When you connect two WAE inline appliances to each other in serial fashion, always use a crossover cable between the two WAEs. (See [Figure 1-15](#).)

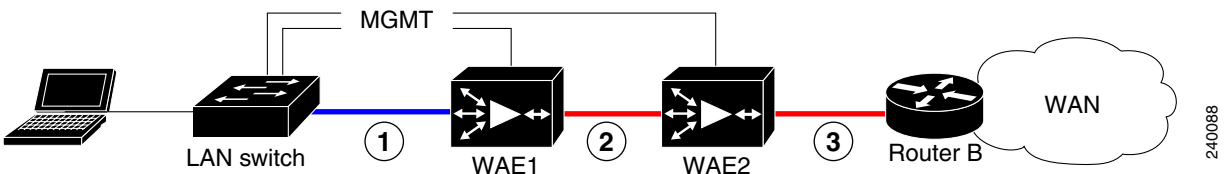
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**Figure 1-13** Cabling for a Single Inline WAE with Redundant WAN Connections



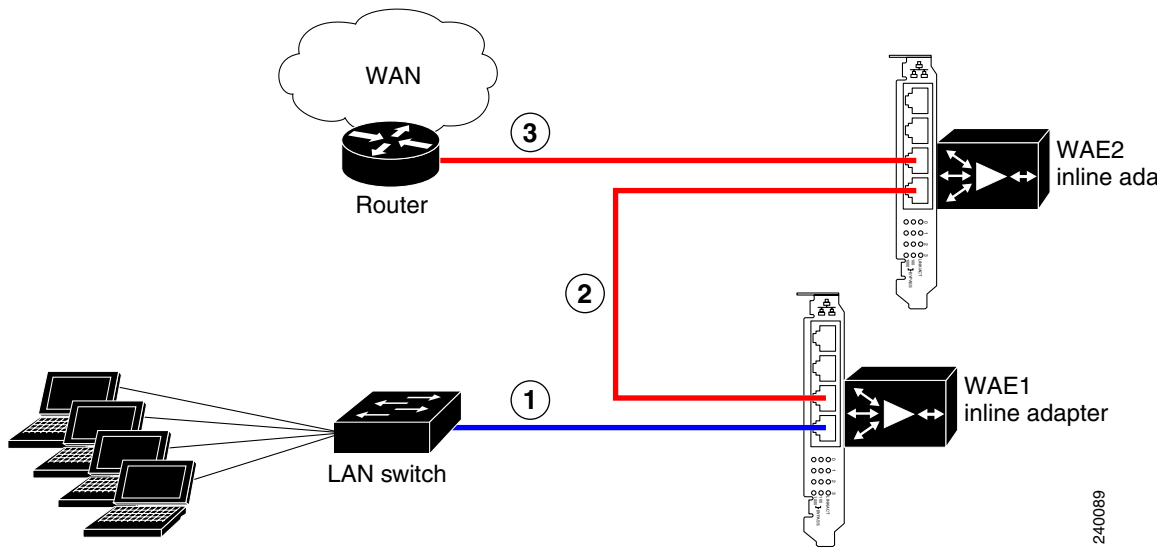
1	Connection: Management Gigabit Ethernet: 1/0 Cable type: Straight-through (recommended)	2	Connection: WAE to LAN switch (using InlineGroup 1/0) Fast Ethernet: LAN0 (InlinePort 1/0/lan) Cable type: Straight-through
3	Connection: WAE to LAN switch (using InlineGroup 1/1) Fast Ethernet: LAN1 (InlinePort 1/1/lan) Cable type: Straight-through	4	Connection: WAE to WAN router A (using InlineGroup 1/0) Fast Ethernet: WAN0 (InlinePort 1/0/wan) Cable type: Crossover
5	Connection: WAE to WAN router B (using InlineGroup 1/1) Fast Ethernet: WAN1 (InlinePort 1/1/wan) Cable type: Crossover		

**Figure 1-14** Cabling for Serial Cluster Inline WAEs with a Single WAN Connection



1	Connection: WAE 1 to LAN switch Fast Ethernet: LAN0 (InlinePort 1/0/lan) Cable type: Straight-through	2	Connection: WAE 1 to WAE 2 Fast Ethernet: WAE1 WAN0 (InlinePort 1/0/wan) to WAE 2 LAN0 (InlinePort 1/0/lan) Cable type: Crossover
3	Connection: WAE 2 to WAN router Fast Ethernet: WAE 2 WAN0 (InlinePort 1/0/wan) Cable type: Crossover		

**Figure 1-15** Cabling Between Two Inline WAEs



240089

1	<p>Connection: WAE 1 to LAN switch</p> <p>Fast Ethernet: WAE 1 LAN0 (InlinePort 1/0/lan)</p> <p>Cable type: Straight-through</p>	2	<p>Connection: WAE 1 to WAE 2</p> <p>Fast Ethernet: WAE 1 WAN0 (InlinePort 1/0/wan) to WAE 2 LAN0 (InlinePort 1/0/lan)</p> <p>Cable type: Crossover</p>
3	<p>Connection: WAE 2 to WAN router</p> <p>Fast Ethernet: WAE 2 WAN0 (InlinePort 1/0/wan)</p> <p>Cable type: Crossover</p>		