CHAPTER 12

Configuring Interface Characteristics

This chapter defines the types of interfaces on the Catalyst 3750-E or 3560-E switch and describes how to configure them. Unless otherwise noted, the term *switch* refers to a Catalyst 3750-E or 3560-E standalone switch and to a Catalyst 3750-E switch stack.

The chapter consists of these sections:

Note For complete syntax and usage information for the commands used in this chapter, see the switch command reference for this release and the online *Cisco IOS Interface Command Reference, Release 12.2.*

Understanding Interface Types

This section describes the different types of interfaces supported by the switch with references to chapters that contain more detailed information about configuring these interface types. The rest of the chapter describes configuration procedures for physical interface characteristics.

Note The stack ports on the rear of the Catalyst 3750-E switch are not Ethernet ports and cannot be configured.

These sections describe the interface types:

Port-Based VLANs

A VLAN is a switched network that is logically segmented by function, team, or application, without regard to the physical location of the users. For more information about VLANs, see Chapter 14, "Configuring VLANs." Packets received on a port are forwarded only to ports that belong to the same VLAN as the receiving port. Network devices in different VLANs cannot communicate with one another without a Layer 3 device to route traffic between the VLANs.

VLAN partitions provide hard firewalls for traffic in the VLAN, and each VLAN has its own MAC address table. A VLAN comes into existence when a local port is configured to be associated with the VLAN, when the VLAN Trunking Protocol (VTP) learns of its existence from a neighbor on a trunk, or when a user creates a VLAN. VLANs can be formed with ports across the stack.

To configure VLANs, use the **vlan** *vlan-id* global configuration command to enter VLAN configuration mode. The VLAN configurations for normal-range VLANs (VLAN IDs 1 to 1005) are saved in the VLAN database. If VTP is version 1 or 2, to configure extended-range VLANs (VLAN IDs 1006 to 4094), you must first set VTP mode to transparent. Extended-range VLANs created in transparent mode are not added to the VLAN database but are saved in the switch running configuration. With VTP version 3, you can create extended-range VLANs in client or server mode. These VLANs are saved in the VLAN database.

In a switch stack, the VLAN database is downloaded to all switches in a stack, and all switches in the stack build the same VLAN database. The running configuration and the saved configuration are the same for all switches in a stack.

Add ports to a VLAN by using the **switchport** interface configuration commands:

- Identify the interface.
- For a trunk port, set trunk characteristics, and, if desired, define the VLANs to which it can belong.
- For an access port, set and define the VLAN to which it belongs.
- For a tunnel port, set and define the VLAN ID for the customer-specific VLAN tag. See Chapter 18, "Configuring IEEE 802.1Q and Layer 2 Protocol Tunneling."

Switch Ports

Switch ports are Layer 2-only interfaces associated with a physical port. Switch ports belong to one or more VLANs. A switch port can be an access port, a trunk port, or a tunnel port. You can configure a port as an access port or trunk port or let the Dynamic Trunking Protocol (DTP) operate on a per-port basis to set the switchport mode by negotiating with the port on the other end of the link. You must manually configure tunnel ports as part of an asymmetric link connected to an IEEE 802.1Q trunk port. Switch ports are used for managing the physical interface and associated Layer 2 protocols and do not handle routing or bridging.

Configure switch ports by using the **switchport** interface configuration commands. Use the **switchport** command with no keywords to put an interface that is in Layer 3 mode into Layer 2 mode.

Note When you put an interface that is in Layer 3 mode into Layer 2 mode, the previous configuration information related to the affected interface might be lost, and the interface is returned to its default configuration.

For detailed information about configuring access port and trunk port characteristics, see Chapter 14, "Configuring VLANs." For more information about tunnel ports, see Chapter 18, "Configuring IEEE 802.1Q and Layer 2 Protocol Tunneling."

Access Ports

An access port belongs to and carries the traffic of only one VLAN (unless it is configured as a voice VLAN port). Traffic is received and sent in native formats with no VLAN tagging. Traffic arriving on an access port is assumed to belong to the VLAN assigned to the port. If an access port receives a tagged packet (Inter-Switch Link [ISL] or IEEE 802.1Q tagged), the packet is dropped, and the source address is not learned.

Two types of access ports are supported:

- Static access ports are manually assigned to a VLAN (or through a RADIUS server for use with IEEE 802.1x. For more information, see the "802.1x Readiness Check" section on page 10-15.)
- VLAN membership of dynamic access ports is learned through incoming packets. By default, a dynamic access port is not a member of any VLAN, and forwarding to and from the port is enabled only when the VLAN membership of the port is discovered. Dynamic access ports on the switch are assigned to a VLAN by a VLAN Membership Policy Server (VMPS). The VMPS can be a Catalyst 6500 series switch; the Catalyst 3750-E or 3560-E switch cannot be a VMPS server.

You can also configure an access port with an attached Cisco IP Phone to use one VLAN for voice traffic and another VLAN for data traffic from a device attached to the phone. For more information about voice VLAN ports, see Chapter 16, "Configuring Voice VLAN."

Trunk Ports

A trunk port carries the traffic of multiple VLANs and by default is a member of all VLANs in the VLAN database. These trunk port types are supported:

- In an ISL trunk port, all received packets are expected to be encapsulated with an ISL header, and all transmitted packets are sent with an ISL header. Native (non-tagged) frames received from an ISL trunk port are dropped.
- An IEEE 802.1Q trunk port supports simultaneous tagged and untagged traffic. An IEEE 802.1Q trunk port is assigned a default port VLAN ID (PVID), and all untagged traffic travels on the port default PVID. All untagged traffic and tagged traffic with a NULL VLAN ID are assumed to belong to the port default PVID. A packet with a VLAN ID equal to the outgoing port default PVID is sent untagged. All other traffic is sent with a VLAN tag.

Although by default, a trunk port is a member of every VLAN known to the VTP, you can limit VLAN membership by configuring an allowed list of VLANs for each trunk port. The list of allowed VLANs does not affect any other port but the associated trunk port. By default, all possible VLANs (VLAN ID 1 to 4094) are in the allowed list. A trunk port can become a member of a VLAN only if VTP knows of the VLAN and if the VLAN is in the enabled state. If VTP learns of a new, enabled VLAN and the VLAN is in the allowed list for a trunk port, the trunk port automatically becomes a member of that VLAN and

traffic is forwarded to and from the trunk port for that VLAN. If VTP learns of a new, enabled VLAN that is not in the allowed list for a trunk port, the port does not become a member of the VLAN, and no traffic for the VLAN is forwarded to or from the port.

For more information about trunk ports, see Chapter 14, "Configuring VLANs."

Tunnel Ports

Tunnel ports are used in IEEE 802.1Q tunneling to segregate the traffic of customers in a service-provider network from other customers who are using the same VLAN number. You configure an asymmetric link from a tunnel port on a service-provider edge switch to an IEEE 802.1Q trunk port on the customer switch. Packets entering the tunnel port on the edge switch, already IEEE 802.1Q-tagged with the customer VLANs, are encapsulated with another layer of an IEEE 802.1Q tag (called the metro tag), containing a VLAN ID unique in the service-provider network, for each customer. The double-tagged packets go through the service-provider network keeping the original customer VLANs separate from those of other customers. At the outbound interface, also a tunnel port, the metro tag is removed, and the original VLAN numbers from the customer network are retrieved.

Tunnel ports cannot be trunk ports or access ports and must belong to a VLAN unique to each customer.

For more information about tunnel ports, see Chapter 18, "Configuring IEEE 802.1Q and Layer 2 Protocol Tunneling."

Routed Ports

A routed port is a physical port that acts like a port on a router; it does not have to be connected to a router. A routed port is not associated with a particular VLAN, as is an access port. A routed port behaves like a regular router interface, except that it does not support VLAN subinterfaces. Routed ports can be configured with a Layer 3 routing protocol. A routed port is a Layer 3 interface only and does not support Layer 2 protocols, such as DTP and STP.

Configure routed ports by putting the interface into Layer 3 mode with the **no switchport** interface configuration command. Then assign an IP address to the port, enable routing, and assign routing protocol characteristics by using the **ip routing** and **router** *protocol* global configuration commands.

Note Entering a **no switchport** interface configuration command shuts down the interface and then re-enables it, which might generate messages on the device to which the interface is connected. When you put an interface that is in Layer 2 mode into Layer 3 mode, the previous configuration information related to the affected interface might be lost.

The number of routed ports that you can configure is not limited by software. However, the interrelationship between this number and the number of other features being configured might impact CPU performance because of hardware limitations. See the "Configuring Layer 3 Interfaces" section on page 12-32 for information about what happens when hardware resource limitations are reached.

For more information about IP unicast and multicast routing and routing protocols, see Chapter 40, "Configuring IP Unicast Routing" and Chapter 46, "Configuring IP Multicast Routing."

Note The IP base feature set supports static routing and the Routing Information Protocol (RIP). For full Layer 3 routing or for fallback bridging, you must enable the IP services feature set on the standalone switch, or the stack master.

Switch Virtual Interfaces

A switch virtual interface (SVI) represents a VLAN of switch ports as one interface to the routing or bridging function in the system. Only one SVI can be associated with a VLAN, but you need to configure an SVI for a VLAN only when you wish to route between VLANs, to fallback-bridge nonroutable protocols between VLANs, or to provide IP host connectivity to the switch. By default, an SVI is created for the default VLAN (VLAN 1) to permit remote switch administration. Additional SVIs must be explicitly configured.

Note You cannot delete interface VLAN 1.

SVIs provide IP host connectivity only to the system; in Layer 3 mode, you can configure routing across SVIs.

Although the switch stack or switch supports a total of 1005 VLANs (and SVIs), the interrelationship between the number of SVIs and routed ports and the number of other features being configured might impact CPU performance because of hardware limitations. See the "Configuring Layer 3 Interfaces" section on page 12-32 for information about what happens when hardware resource limitations are reached.

SVIs are created the first time that you enter the **vlan** interface configuration command for a VLAN interface. The VLAN corresponds to the VLAN tag associated with data frames on an ISL or IEEE 802.1Q encapsulated trunk or the VLAN ID configured for an access port. Configure a VLAN interface for each VLAN for which you want to route traffic, and assign it an IP address. For more information, see the "Manually Assigning IP Information" section on page 3-15.

Note When you create an SVI, it does not become active until it is associated with a physical port.

SVIs support routing protocols and bridging configurations. For more information about configuring IP routing, see Chapter 40, "Configuring IP Unicast Routing," Chapter 46, "Configuring IP Multicast Routing,"and Chapter 48, "Configuring Fallback Bridging."

Note The IP base feature set supports static routing and RIP. For more advanced routing or for fallback bridging, enable the IP services feature set on the standalone switch or the stack master. For information about using the software activation feature to install a software license for a specific feature set, see the *Cisco Software Activation and Compatibility Document*.

SVI Autostate Exclude

The line state of an SVI with multiple ports on a VLAN is in the *up* state when it meets these conditions:

- The VLAN exists and is active in the VLAN database on the switch.
- The VLAN interface exists and is not administratively down.
- At least one Layer 2 (access or trunk) port exists, has a link in the *up* state on this VLAN, and is in the spanning-tree forwarding state on the VLAN.

Note The protocol link state for VLAN interfaces come up when the first switchport belonging to the corresponding VLAN link comes up and is in STP forwarding state.

The default action, when a VLAN has multiple ports, is that the SVI goes down when all ports in the VLAN go down. You can use the SVI autostate exclude feature to configure a port so that it is not included in the SVI line-state up-an- down calculation. For example, if the only active port on the VLAN is a monitoring port, you might configure autostate exclude on that port so that the VLAN goes down when all other ports go down. When enabled on a port, **autostate exclude** applies to all VLANs that are enabled on that port.

The VLAN interface is brought up when one Layer 2 port in the VLAN has had time to converge (transition from STP listening-learning state to forwarding state). This prevents features such as routing protocols from using the VLAN interface as if it were fully operational and minimizes other problems, such as routing black holes. For information about configuring autostate exclude, see the "Configuring SVI Autostate Exclude" section on page 12-34.

EtherChannel Port Groups

EtherChannel port groups treat multiple switch ports as one switch port. These port groups act as a single logical port for high-bandwidth connections between switches or between switches and servers. An EtherChannel balances the traffic load across the links in the channel. If a link within the EtherChannel fails, traffic previously carried over the failed link changes to the remaining links. You can group multiple trunk ports into one logical trunk port, group multiple access ports into one logical access port, group multiple tunnel ports into one logical tunnel port, or group multiple routed ports into one logical routed port. Most protocols operate over either single ports or aggregated switch ports and do not recognize the physical ports within the port group. Exceptions are the DTP, the Cisco Discovery Protocol (CDP), and the Port Aggregation Protocol (PAgP), which operate only on physical ports.

When you configure an EtherChannel, you create a port-channel logical interface and assign an interface to the EtherChannel. For Layer 3 interfaces, you manually create the logical interface by using the **interface port-channel** global configuration command. Then you manually assign an interface to the EtherChannel by using the **channel-group** interface configuration command. For Layer 2 interfaces, use the **channel-group** interface configuration command to dynamically create the port-channel logical interface. This command binds the physical and logical ports together. For more information, see Chapter 39, "Configuring EtherChannels and Link-State Tracking."

10-Gigabit Ethernet Interfaces

The Catalyst 3750-E and 3560-E switches have two 10-Gigabit Ethernet module slots. For uplink connections to other switches and routers, use the Cisco TwinGig Converter Modules.

A 10-Gigabit Ethernet interface operates only in full-duplex mode. The interface can be configured as a switched or routed port.

For more information about the Cisco TwinGig Converter Module, see the switch hardware installation guide and your transceiver module documentation.

Power over Ethernet Ports

A PoE-capable switch port automatically supplies power to one of these connected devices if the switch senses that there is no power on the circuit:

- Cisco pre-standard powered device (such as a Cisco IP Phone or a Cisco Aironet Access Point)
- IEEE 802.3af-compliant powered device

In Cisco IOS Release 12.2(40)SE and earlier, each 10/100/1000 PoE port provides up to 15.4 W of power to the device. Cisco IOS Release 12.2(44)SE and later supports enhanced PoE. Enhanced PoE should be configured on a port to power a device requiring up to 20 W of power, such as the Cisco AP1250 wireless access point.

A powered device can receive redundant power when it is connected to a PoE switch port and to an AC power source. The device does not receive redundant power when it is only connected to the PoE port.

After the switch detects a powered device, the switch determines the device power requirements and then grants or denies power to the device. The switch can also sense the real-time power consumption of the device by monitoring and policing the power usage.

This section has this PoE information:

- Supported Protocols and Standards, page 12-7
- Powered-Device Detection and Initial Power Allocation, page 12-7
- Power Management Modes, page 12-9
- Power Monitoring and Power Policing, page 12-10

Supported Protocols and Standards

The switch uses these protocols and standards to support PoE:

- CDP with power consumption—The powered device notifies the switch of the amount of power it is consuming. The switch does not reply to the power-consumption messages. The switch can only supply power to or remove power from the PoE port.
- Cisco intelligent power management—The powered device and the switch negotiate through power-negotiation CDP messages for an agreed-upon power-consumption level. The negotiation allows a high-power Cisco powered device, which consumes more than 7 W, to operate at its highest power mode. The powered device first boots up in low-power mode, consumes less than 7 W, and negotiates to obtain enough power to operate in high-power mode. The device changes to high-power mode only when it receives confirmation from the switch.

  High-power devices can operate in low-power mode on switches that do not support power-negotiation CDP.

  Cisco intelligent power management is backward-compatible with CDP with power consumption; the switch responds according to the CDP message that it receives. CDP is not supported on third-party powered devices; therefore, the switch uses the IEEE classification to determine the power usage of the device.
- IEEE 802.3af—The major features of this standard are powered-device discovery, power administration, disconnect detection, and optional powered-device power classification. For more information, see the standard.
- IEEE 802.11n (pre-draft standard)—This standard allows you to increase the power on an enhanced PoE port up to 20W.

Powered-Device Detection and Initial Power Allocation

The switch detects a Cisco pre-standard or an IEEE-compliant powered device when the PoE-capable port is in the no-shutdown state, PoE is enabled (the default), and the connected device is not being powered by an AC adaptor.

After device detection, the switch determines the device power requirements based on its type:

- A Cisco pre-standard powered device does not provide its power requirement when the switch detects it, so the switch allocates 15.4 W as the initial allocation for power budgeting.

  The initial power allocation is the maximum amount of power that a powered device requires. The switch initially allocates this amount of power when it detects and powers the powered device. As the switch receives CDP messages from the powered device and as the powered device negotiates power levels with the switch through CDP power-negotiation messages, the initial power allocation might be adjusted.
- The switch classifies the detected IEEE device within a power consumption class. Based on the available power in the power budget, the switch determines if a port can be powered. Table 12-1 lists these levels.

Table 12-1 IEEE Power Classifications

Class	Maximum Power Level Required from the Switch
0 (class status unknown)	15.4 W
1	4 W
2	7 W
3	15.4 W
4 (reserved for future use)	Treat as class 0

The switch monitors and tracks requests for power and grants power only when it is available. The switch tracks its power budget (the amount of power available on the switch for PoE). The switch performs power-accounting calculations when a port is granted or denied power to keep the power budget up to date.

After power is applied to the port, the switch uses CDP to determine the *CDP-specific* power consumption requirement of the connected Cisco powered devices, which is the amount of power to allocate based on the CDP messages. The switch adjusts the power budget accordingly. This does not apply to third-party PoE devices. The switch processes a request and either grants or denies power. If the request is granted, the switch updates the power budget. If the request is denied, the switch ensures that power to the port is turned off, generates a syslog message, and updates the LEDs. Powered devices can also negotiate with the switch for more power.

Note The CDP-specific power consumption requirement is referred to as the *actual* power consumption requirement in the Catalyst 3750 and 3560 software configuration guides and command references.

If the switch detects a fault caused by an undervoltage, overvoltage, overtemperature, oscillator-fault, or short-circuit condition, it turns off power to the port, generates a syslog message, and updates the power budget and LEDs.

On a Catalyst 3750-E switch, the PoE feature operates the same whether or not the switch is a stack member. The power budget is per-switch and independent of any other switch in the stack. Election of a new stack master does not affect PoE operation. The stack master keeps track of the PoE status for all switches and ports in the stack and includes the status in output displays.

Power Management Modes

The switch supports these PoE modes:

- **auto**—The switch automatically detects if the connected device requires power. If the switch discovers a powered device connected to the port and if the switch has enough power, it grants power, updates the power budget, turns on power to the port on a first-come, first-served basis, and updates the LEDs. For LED information, see the hardware installation guide.

  If the switch has enough power for all the powered devices, they all come up. If enough power is available for all powered devices connected to the switch, power is turned on to all devices. If there is not enough available PoE, or if a device is disconnected and reconnected while other devices are waiting for power, it cannot be determined which devices are granted or are denied power.

  If granting power would exceed the system power budget, the switch denies power, ensures that power to the port is turned off, generates a syslog message, and updates the LEDs. After power has been denied, the switch periodically rechecks the power budget and continues to attempt to grant the request for power.

  If a device being powered by the switch is then connected to wall power, the switch might continue to power the device. The switch might continue to report that it is still powering the device whether the device is being powered by the switch or receiving power from an AC power source.

  If a powered device is removed, the switch automatically detects the disconnect and removes power from the port. You can connect a nonpowered device without damaging it.

  You can specify the maximum wattage that is allowed on the port. If the IEEE class maximum wattage of the powered device is greater than the configured maximum value, the switch does not provide power to the port. If the switch powers a powered device, but the powered device later requests through CDP messages more than the configured maximum value, the switch removes power to the port. The power that was allocated to the powered device is reclaimed into the global power budget. If you do not specify a wattage, the switch delivers the maximum value. Use the **auto** setting on any PoE port. The auto mode is the default setting.

- **static**—The switch pre-allocates power to the port (even when no powered device is connected) and guarantees that power will be available for the port. The switch allocates the port configured maximum wattage, and the amount is never adjusted through the IEEE class or by CDP messages from the powered device. Because power is pre-allocated, any powered device that uses less than or equal to the maximum wattage is guaranteed to be powered when it is connected to the static port. The port no longer participates in the first-come, first-served model.

  However, if the powered-device IEEE class is greater than the maximum wattage, the switch does not supply power to it. If the switch learns through CDP messages that the powered device needs more than the maximum wattage, the switch shuts down the powered device.

  If you do not specify a wattage, the switch pre-allocates the maximum value. The switch powers the port only if it discovers a powered device. Use the **static** setting on a high-priority interface.

- **never**—The switch disables powered-device detection and never powers the PoE port even if an unpowered device is connected. Use this mode only when you want to make sure that power is never applied to a PoE-capable port, making the port a data-only port.

For information on configuring a PoE port, see the "Configuring a Power Management Mode on a PoE Port" section on page 12-27.

Power Monitoring and Power Policing

When policing of the real-time power consumption is enabled, the switch takes action when a powered device consumes more power than the maximum amount allocated, also referred to as the *cutoff-power value*.

When PoE is enabled, the switch senses the real-time power consumption of the powered device. The switch monitors the real-time power consumption of the connected powered device; this is called *power monitoring* or *power sensing*. The switch also polices the power usage with the *power policing* feature.

Power monitoring is backward-compatible with Cisco intelligent power management and CDP-based power consumption. It works with these features to ensure that the PoE port can supply power to the powered device. For more information about these PoE features, see the "Supported Protocols and Standards" section on page 12-7.

The switch senses the real-time power consumption of the connected device as follows:

1. The switch monitors the real-time power consumption on individual ports.
2. The switch records the power consumption, including peak power usage. The switch reports the information through the CISCO-POWER-ETHERNET-EXT-MIB.
3. If power policing is enabled, the switch polices power usage by comparing the real-time power consumption to the maximum power allocated to the device. For more information about the maximum power consumption, also referred to as the *cutoff power*, on a PoE port, see the "Maximum Power Allocation (Cutoff Power) on a PoE Port" section on page 12-10.

   If the device uses more than the maximum power allocation on the port, the switch can either turn off power to the port, or the switch can generate a syslog message and update the LEDs (the port LED is now blinking amber) while still providing power to the device based on the switch configuration. By default, power-usage policing is disabled on all PoE ports.

   If error recovery from the PoE error-disabled state is enabled, the switch automatically takes the PoE port out of the error-disabled state after the specified amount of time.

   If error recovery is disabled, you can manually re-enable the PoE port by using the **shutdown** and **no shutdown** interface configuration commands.
4. If policing is disabled, no action occurs when the powered device consumes more than the maximum power allocation on the PoE port, which could adversely affect the switch.

Maximum Power Allocation (Cutoff Power) on a PoE Port

When power policing is enabled, the switch determines one of the these values as the cutoff power on the PoE port in this order:

1. Manually when you set the user-defined power level that the switch budgets for the port by using the **power inline consumption default** *wattage* global or interface configuration command
2. Manually when you set the user-defined power level that limits the power allowed on the port by using the **power inline auto max** *max-wattage* or the **power inline static max** *max-wattage* interface configuration command
3. Automatically when the switch sets the power usage of the device by using CDP power negotiation or by the IEEE classification
4. Automatically when the switch sets the power usage to be the default value of 15.4 W

Use the first or second method in the previous list to manually configure the cutoff-power value by entering the **power inline consumption default** *wattage* or the **power inline** [**auto** | **static max**] *max-wattage* command. If you are not manually configuring the cutoff-power value, the switch

automatically determines the value by using CDP power negotiation or the device IEEE classification, which is the third method in the previous list. If the switch cannot determine the value by using one of these methods, it uses the default value of 15.4 W (the fourth method in the previous list).

Power Consumption Values

You can configure the initial power allocation and the maximum power allocation on a port. However, these values are only the configured values that determine when the switch should turn on or turn off power on the PoE port. The maximum power allocation is not the same as the actual power consumption of the powered device. The actual cutoff power value that the switch uses for power policing is not equal to the configured power value.

When power policing is enabled, the switch polices the power usage *at the switch port*, which is greater than the power consumption of the device. When you are manually set the maximum power allocation, you must consider the power loss over the cable from the switch port to the powered device. The cutoff power is the sum of the rated power consumption of the powered device and the worst-case power loss over the cable.

The actual amount of power consumed by a powered device on a PoE port is the cutoff-power value plus a calibration factor of 500 mW (0.5 W). The actual cutoff value is approximate and varies from the configured value by a percentage of the configured value. For example, if the configured cutoff power is 12 W, the actual cutoff-value is 11.4 W, which is 0.05% less than the configured value.

We recommend that you enable power policing when PoE is enabled on your switch. For example, if policing is disabled and you set the cutoff-power value by using the **power inline auto max 6300** interface configuration command, the configured maximum power allocation on the PoE port is 6.3 W (6300 mW). The switch provides power to the connected devices on the port if the device needs up to 6.3 W. If the CDP-power negotiated value or the IEEE classification value exceeds the configured cutoff value, the switch does not provide power to the connected device. After the switch turns on power on the PoE port, the switch does not police the real-time power consumption of the device, and the device can consume more power than the maximum allocated amount, which could adversely affect the switch and the devices connected to the other PoE ports.

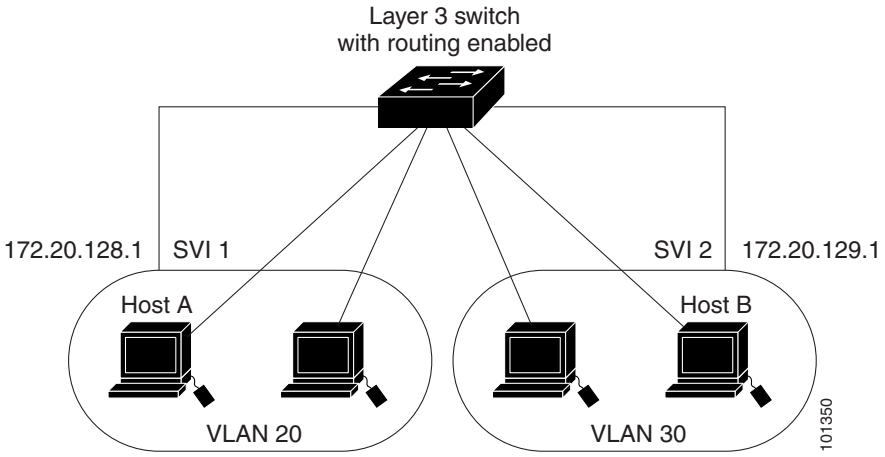
Because the switch supports internal power supplies and the Cisco Redundant Power System 2300 (also referred to as the RPS 2300), the total amount of power available for the powered devices varies depending on the power supply configuration.

- If a power supply is removed and replaced by a new power supply with less power and the switch does not have enough power for the powered devices, the switch denies power to the PoE ports in auto mode in descending order of the port numbers. If the switch still does not have enough power, the switch then denies power to the PoE ports in static mode in descending order of the port numbers.
- If the new power supply supports more power than the previous one and the switch now has more power available, the switch grants power to the PoE ports in static mode in ascending order of the port numbers. If it still has power available, the switch then grants power to the PoE ports in auto mode in ascending order of the port numbers.

Connecting Interfaces

Devices within a single VLAN can communicate directly through any switch. Ports in different VLANs cannot exchange data without going through a routing device. With a standard Layer 2 switch, ports in different VLANs have to exchange information through a router. By using the switch with routing enabled, when you configure both VLAN 20 and VLAN 30 with an SVI to which an IP address is assigned, packets can be sent from Host A to Host B directly through the switch with no need for an external router (Figure 12-1).

Figure 12-1 Connecting VLANs with the Catalyst 3750-E or 3560-E Switch



When the IP services feature set is running on the switch or the stack master, the switch uses two methods to forward traffic between interfaces: routing and fallback bridging. If the IP base feature set is on the switch or the stack master, only basic routing (static routing and RIP) is supported. Whenever possible, to maintain high performance, forwarding is done by the switch hardware. However, only IPv4 packets with Ethernet II encapsulation are routed in hardware. Non-IP traffic and traffic with other encapsulation methods are fallback-bridged by hardware.

- The routing function can be enabled on all SVIs and routed ports. The switch routes only IP traffic. When IP routing protocol parameters and address configuration are added to an SVI or routed port, any IP traffic received from these ports is routed. For more information, see Chapter 40, "Configuring IP Unicast Routing," Chapter 46, "Configuring IP Multicast Routing," and Chapter 47, "Configuring MSDP."
- Fallback bridging forwards traffic that the switch does not route or traffic belonging to a nonroutable protocol, such as DECnet. Fallback bridging connects multiple VLANs into one bridge domain by bridging between two or more SVIs or routed ports. When configuring fallback bridging, you assign SVIs or routed ports to bridge groups with each SVI or routed port assigned to only one bridge group. All interfaces in the same group belong to the same bridge domain. For more information, see Chapter 48, "Configuring Fallback Bridging."

Using Interface Configuration Mode

The switch supports these interface types:

- Physical ports—switch ports and routed ports
- VLANs—switch virtual interfaces
- Port channels—EtherChannel interfaces

You can also configure a range of interfaces (see the "Configuring a Range of Interfaces" section on page 12-14).

To configure a physical interface (port), specify the interface type, stack member number (only Catalyst 3750-E switches), module number, and switch port number, and enter interface configuration mode.

- Type—Gigabit Ethernet (gigabitethernet or gi) for 10/100/1000 Mb/s Ethernet ports, 10-Gigabit Ethernet (tengigabitethernet or te) for 10,000 Mb/s, or small form-factor pluggable (SFP) module Gigabit Ethernet interfaces (gigabitethernet or gi).
- Stack member number—The number that identifies the switch within the stack. The switch number range is 1 to 9 and is assigned the first time the switch initializes. The default switch number, before it is integrated into a switch stack, is 1. When a switch has been assigned a stack member number, it keeps that number until another is assigned to it.

  You can use the switch port LEDs in Stack mode to identify the stack member number of a switch.

  For information about stack member numbers, see the "Stack Member Numbers" section on page 5-6.
- Module number—The module or slot number on the switch that is always 0.
- Port number—The interface number on the switch. The 10/100/1000 port numbers always begin at 1, starting with the far left port when facing the front of the switch, for example, gigabitethernet1/0/1 or gigabitethernet1/0/8.

  On a switch with 10/100/1000 ports and Cisco TwinGig Converter Modules in the 10-Gigabit Ethernet module slots, the port numbers restart with the 10-Gigabit Ethernet ports: tengigabitethernet1/0/1.

  On a switch with 10/100/1000 ports and Cisco dual SFP X2 converter modules in the 10-Gigabit Ethernet module slots, the SFP module ports are numbered consecutively following the 10/100/1000 interfaces. For example, if the switch has 24 10/100/1000 ports, the SFP module ports are gigabitethernet1/0/25 through gigabitethernet1/0/28.

You can identify physical interfaces by physically checking the interface location on the switch. You can also use the **show** privileged EXEC commands to display information about a specific interface or all the interfaces on the switch. The remainder of this chapter primarily provides physical interface configuration procedures.

These are examples of how to identify interfaces on a Catalyst 3750-E switch:

- To configure 10/100/1000 port 4 on a standalone switch, enter this command:

  ```
  Switch(config)# interface gigabitethernet1/0/4
  ```

- To configure 10-Gigabit Ethernet port 1 on a standalone switch, enter this command:

  ```
  Switch(config)# interface tengigabitethernet1/0/1
  ```

- To configure 10-Gigabit Ethernet port on stack member 3, enter this command:

  ```
  Switch(config)# interface tengigabitethernet3/0/1
  ```

If the switch has SFP modules, the port numbers continue consecutively.To configure the first SFP module port on stack member 1 with 16 10/100/1000 ports, enter this command:

```
Switch(config)# interface gigabitethernet1/0/25
```

Procedures for Configuring Interfaces

These general instructions apply to all interface configuration processes.

Step 1 Enter the **configure terminal** command at the privileged EXEC prompt:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#
```

Step 2 Enter the **interface** global configuration command. Identify the interface type, the switch number (only Catalyst 3750-E switches), and the number of the connector. In this example, Gigabit Ethernet port 1 on switch 1 is selected:

```
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)#
```

Note You do not need to add a space between the interface type and the interface number. For example, in the preceding line, you can specify either **gigabitethernet 1/0/1**, **gigabitethernet1/0/1**, **gi 1/0/1**, or **gi1/0/1**.

Step 3 Follow each **interface** command with the interface configuration commands that the interface requires. The commands that you enter define the protocols and applications that will run on the interface. The commands are collected and applied to the interface when you enter another interface command or enter **end** to return to privileged EXEC mode.

You can also configure a range of interfaces by using the **interface range** or **interface range macro** global configuration commands. Interfaces configured in a range must be the same type and must be configured with the same feature options.

Step 4 After you configure an interface, verify its status by using the **show** privileged EXEC commands listed in the "Monitoring and Maintaining the Interfaces" section on page 12-40.

Enter the **show interfaces** privileged EXEC command to see a list of all interfaces on or configured for the switch. A report is provided for each interface that the device supports or for the specified interface.

Configuring a Range of Interfaces

You can use the **interface range** global configuration command to configure multiple interfaces with the same configuration parameters. When you enter the interface-range configuration mode, all command parameters that you enter are attributed to all interfaces within that range until you exit this mode.

Beginning in privileged EXEC mode, follow these steps to configure a range of interfaces with the same parameters:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**interface range** {*port-range* | **macro** *macro_name*}	Specify the range of interfaces (VLANs or physical ports) to be configured, and enter interface-range configuration mode. • You can use the **interface range** command to configure up to five port ranges or a previously defined macro. • The **macro** variable is explained in the "Configuring and Using Interface Range Macros" section on page 12-16. • In a comma-separated *port-range*, you must enter the interface type for each entry and enter spaces before and after the comma. • In a hyphen-separated *port-range*, you do not need to re-enter the interface type, but you must enter a space before the hyphen.
Step 3		Use the normal configuration commands to apply the configuration parameters to all interfaces in the range. Each command is executed as it is entered.
Step 4	**end**	Return to privileged EXEC mode.
Step 5	**show interfaces** [*interface-id*]	Verify the configuration of the interfaces in the range.
Step 6	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

When using the **interface range** global configuration command, note these guidelines:

- Valid entries for *port-range*:
  - **vlan** *vlan-ID - vlan-ID*, where the VLAN ID is 1 to 4094
  - **gigabitethernet** module/{first *port*} - {*last port*}, where the module is always 0 (for Catalyst 3560-E switches)

    gigabitethernet stack member/module/{first *port*} - {*last port*}, where the module is always 0 (for Catalyst 3750-E switches)
  - **tengigabitethernet** module/{*first port*} - {*last port*}, where the module is always 0 (for Catalyst 3560-E switches)

    tengigabitethernet stack member/module/{*first port*} - {*last port*}, where the module is always 0 (for Catalyst 3750-E switches)
  - **gigabitethernet** stack member/module/{first *port*} - {*last port*}, where the module is always 0
  - **tengigabitethernet** stack member/module/{*first port*} - {*last port*}, where the module is always 0
  - **port-channel** *port-channel-number - port-channel-number*, where the *port-channel-number* is 1 to 48

    Note When you use the **interface range** command with port channels, the first and last port-channel number must be active port channels.

- You must add a space between the first interface number and the hyphen when using the **interface range** command. For example, the command **interface range gigabitethernet1/0/1 - 4** is a valid range; the command **interface range gigabitethernet1/0/1-4** is not a valid range.
- The **interface range** command only works with VLAN interfaces that have been configured with the **interface vlan** command. The **show running-config** privileged EXEC command displays the configured VLAN interfaces. VLAN interfaces not displayed by the **show running-config** command cannot be used with the **interface range** command.
- All interfaces defined in a range must be the same type (all Gigabit Ethernet ports, all 10-Gigabit Ethernet ports, all EtherChannel ports, or all VLANs), but you can enter multiple ranges in a command.

This example shows how to use the **interface range** global configuration command to set the speed to 100 Mb/s on ports 1 to 4 on switch 1:

```
Switch# configure terminal
Switch(config)# interface range gigabitethernet1/0/1 - 4
Switch(config-if-range)# speed 100
```

This example shows how to use a comma to add different interface type strings to the range to enable Gigabit Ethernet ports 1 to 3 and 10-Gigabit Ethernet ports 1 and 2 to receive flow-control pause frames:

```
Switch# configure terminal
Switch(config)# interface range gigabitethernet1/0/1 - 3 , tengigabitethernet1/0/1 - 2
Switch(config-if-range)# flowcontrol receive on
```

If you enter multiple configuration commands while you are in interface-range mode, each command is executed as it is entered. The commands are not batched and executed after you exit interface-range mode. If you exit interface-range configuration mode while the commands are being executed, some commands might not be executed on all interfaces in the range. Wait until the command prompt reappears before exiting interface-range configuration mode.

Configuring and Using Interface Range Macros

You can create an interface range macro to automatically select a range of interfaces for configuration. Before you can use the **macro** keyword in the **interface range macro** global configuration command string, you must use the **define interface-range** global configuration command to define the macro.

Beginning in privileged EXEC mode, follow these steps to define an interface range macro:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**define interface-range** *macro_name interface-range*	Define the interface-range macro, and save it in NVRAM. • The *macro_name* is a 32-character maximum character string. • A macro can contain up to five comma-separated interface ranges. • Each *interface-range* must consist of the same port type.
Step 3	**interface range macro** *macro_name*	Select the interface range to be configured using the values saved in the interface-range macro called *macro_name.* You can now use the normal configuration commands to apply the configuration to all interfaces in the defined macro.
Step 4	**end**	Return to privileged EXEC mode.

	Command	Purpose
Step 5	**show running-config | include define**	Show the defined interface range macro configuration.
Step 6	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

Use the **no define interface-range** *macro_name* global configuration command to delete a macro.

When using the **define interface-range** global configuration command, note these guidelines:

- Valid entries for *interface-range*:
  - **vlan** *vlan-ID - vlan-ID*, where the VLAN ID is 1 to 4094
  - **gigabitethernet** module/{*first port*} - {*last port*}, where the module is always 0 (for Catalyst 3560-E switches)

    gigabitethernet stack member/module/{*first port*} - {*last port*}, where the module is always 0 (for Catalyst 3750-E switches)
  - **tengigabitethernet** module/{*first port*} - {*last port*}, where the module is always 0 (for Catalyst 3560-E switches)

    tengigabitethernet stack member/module/{*first port*} - {*last port*}, where the module is always 0 (for Catalyst 3750-E switches)
  - **gigabitethernet** stack member/module/{*first port*} - {*last port*}, where the module is always 0
  - **tengigabitethernet** stack member/module/{*first port*} - {*last port*}, where the module is always 0
  - **port-channel** *port-channel-number - port-channel-number*, where the *port-channel-number* is 1 to 48.

    Note When you use the interface ranges with port channels, the first and last port-channel number must be active port channels.

- You must add a space between the first interface number and the hyphen when entering an *interface-range*. For example, **gigabitethernet1/0/1 - 4** is a valid range; **gigabitethernet1/0/1-4** is not a valid range.
- The VLAN interfaces must have been configured with the **interface vlan** command. The **show running-config** privileged EXEC command displays the configured VLAN interfaces. VLAN interfaces not displayed by the **show running-config** command cannot be used as *interface-ranges*.
- All interfaces defined as in a range must be the same type (all Gigabit Ethernet ports, all 10-Gigabit Ethernet ports, all EtherChannel ports, or all VLANs), but you can combine multiple interface types in a macro.

This example shows how to define an interface-range named *enet_list* to include ports 1 and 2 on switch 1 and to verify the macro configuration:

```
Switch# configure terminal
Switch(config)# define interface-range enet_list gigabitethernet1/0/1 - 2
Switch(config)# end
Switch# show running-config | include define
define interface-range enet_list GigabitEthernet1/0/1 - 2
```

This example shows how to create a multiple-interface macro named *macro1*:

```
Switch# configure terminal
Switch(config)# define interface-range macro1 gigabitethernet1/0/1 - 2,
gigabitethernet1/0/5 - 7, tengigabitethernet1/0/1 -2
```

```
Switch(config)# end
```

This example shows how to enter interface-range configuration mode for the interface-range macro *enet_list*:

```
Switch# configure terminal
Switch(config)# interface range macro enet_list
Switch(config-if-range)#
```

This example shows how to delete the interface-range macro *enet_list* and to verify that it was deleted.

```
Switch# configure terminal
Switch(config)# no define interface-range enet_list
Switch(config)# end
Switch# show run | include define
Switch#
```

Using the Ethernet Management Port

This section has this information:

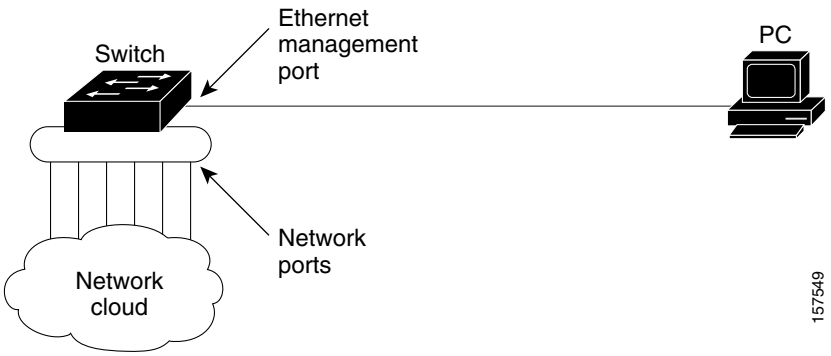
Understanding the Ethernet Management Port

The Ethernet management port, also referred to as the *Fa0 or fastethernet0 port*, is a Layer 3 host port to which you can connect a PC. You can use the Ethernet management port instead of the switch console port for network management. When managing a switch stack, connect the PC to the Ethernet management port on a Catalyst 3750-E stack member.

When connecting a PC to the Ethernet management port, you must assign an IP address.

For a Catalyst 3560-E switch or a standalone Catalyst 3750-E switch, connect the Ethernet management port to the PC as shown in Figure 12-2.

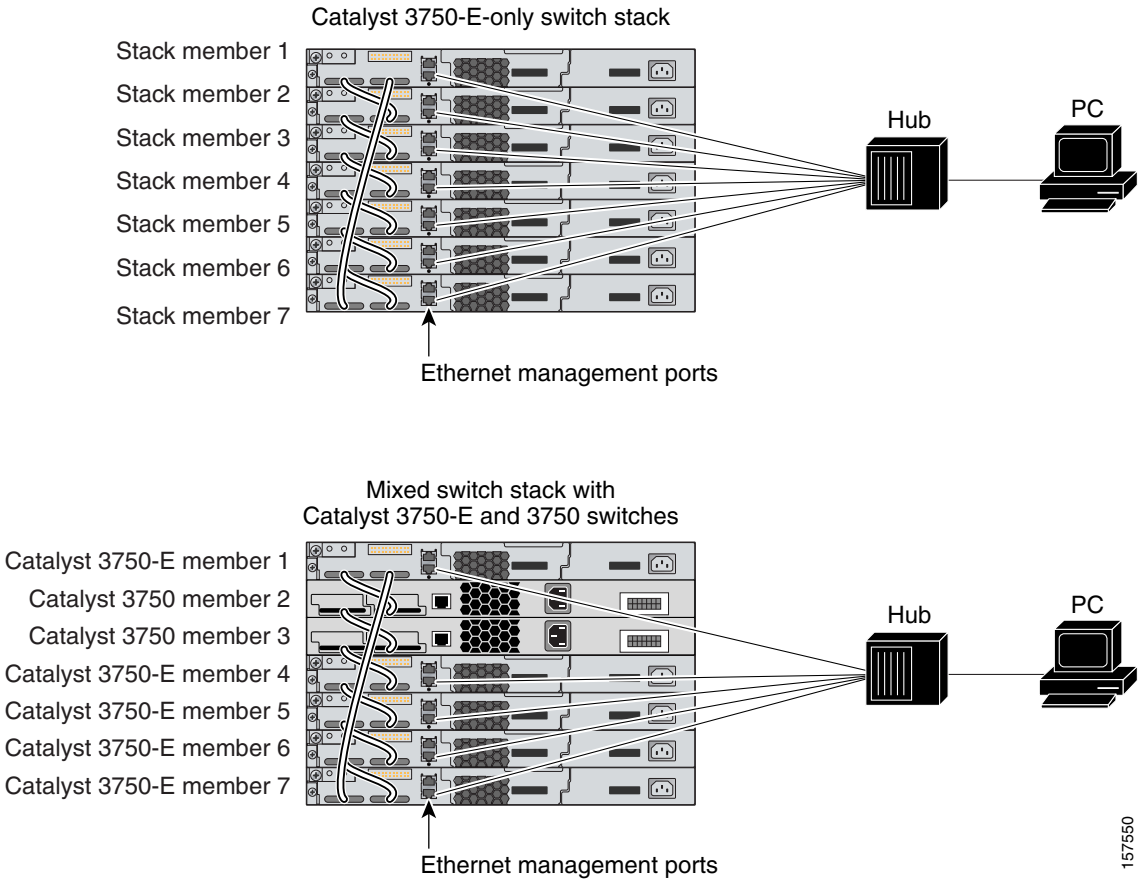
Figure 12-2 Connecting a Switch to a PC



In a Catalyst 3750-E-only stack, all the Ethernet management ports on the stack members are connected to a hub to which the PC is connected. The active link is from the Ethernet management port on the stack master (switch 2), through the hub, to the PC. If the stack master fails and a new stack master is elected, the active link is now from the Ethernet management port on the new stack master to the PC.

In a mixed switch stack, only the Catalyst 3750-E stack members are connected to the PC through the Ethernet management ports. As shown in Figure 12-3, the active link is from the stack master, a Catalyst 3750-E switch (switch 1) to the PC. If the Catalyst 3750-E stack master fails and the elected stack master is a Catalyst 3750 switch (switch 2), the active link can be from a Catalyst 3750-E stack member (switch 5) to the PC.

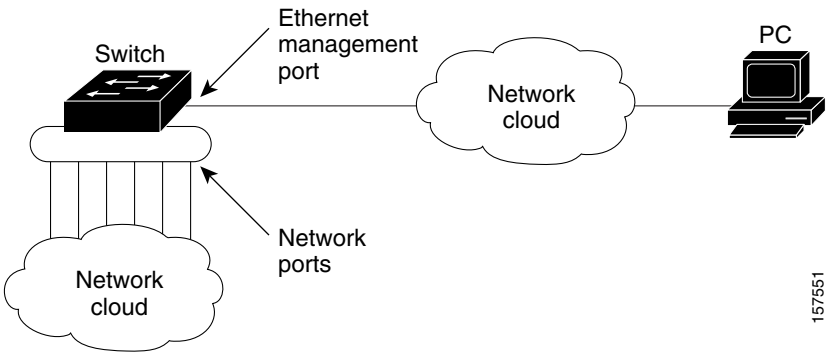
Figure 12-3 Connecting a Switch Stack to a PC



By default, the Ethernet management port is enabled. The switch cannot route packets from the Ethernet management port to a network port, and the reverse.

Even though the Ethernet management port does not support routing, you might need to enable routing protocols on the port (see Figure 12-4). For example, in Figure 12-4, you must enable routing protocols on the Ethernet management port when the PC is multiple hops away from the switch and the packets must pass through multiple Layer 3 devices to reach the PC.

Figure 12-4 Network Example with Routing Protocols Enabled



In Figure 12-4, if the Ethernet management port and the network ports are associated with the same routing process, the routes are propagated as follows:

- The routes from the Ethernet management port are propagated through the network ports to the network.
- The routes from the network ports are propagated through the Ethernet management port to the network.

Because routing is not supported between the Ethernet management port and the network ports, traffic between these ports cannot be sent or received. If this happens, data packet loops occur between the ports, which disrupt the switch and network operation. To prevent the loops, configure route filters to avoid routes between the Ethernet management port and the network ports.

Supported Features on the Ethernet Management Port

The Ethernet management port supports these features:

- Express Setup (only in switch stacks)
- Network Assistant
- Telnet with passwords
- TFTP
- Secure Shell (SSH)
- DHCP-based autoconfiguration
- SMNP (only the ENTITY-MIB and the IF-MIB)
- IP ping
- Interface features
  - Speed—10 Mb/s, 100 Mb/s, and autonegotiation
  - Duplex mode—Full, half, and autonegotiation
  - Loopback detection
- Cisco Discovery Protocol (CDP)
- DHCP relay agent
- IPv4 and IPv6 access control lists (ACLs)
- Routing protocols

Caution Before enabling a feature on the Ethernet management port, make sure that the feature is supported. If you try to configure an unsupported feature on the Ethernet Management port, the feature might not work properly, and the switch might fail.

Configuring the Ethernet Management Port

To specify the Ethernet management port in the CLI, enter **fastethernet0**.

To disable the port, use the **shutdown** interface configuration command. To enable the port, use the **no shutdown** interface configuration command.

To find out the link status to the PC, you can monitor the LED for the Ethernet management port. The LED is green (on) when the link is active, and the LED is off when the link is down. The LED is amber when there is a POST failure.

To display the link status, use the **show interfaces fastethernet 0** privileged EXEC command.

TFTP and the Ethernet Management Port

Use the commands in Table 12-2 when using TFTP to download or upload a configuration file to the boot loader.

Table 12-2 Boot Loader Commands

Command	Description
arp [*ip_address*]	Displays the currently cached ARP[1] table when this command is entered without the *ip_address* parameter. Enables ARP to associate a MAC address with the specified IP address when this command is entered with the *ip_address* parameter.
mgmt_clr	Clears the statistics for the Ethernet management port.
mgmt_init	Starts the Ethernet management port.
mgmt_show	Displays the statistics for the Ethernet management port.
ping *host_ip_address*	Sends ICMP ECHO_REQUEST packets to the specified network host.
boot tftp*:/file-url ...*	Loads and boots an executable image from the TFTP server and enters the command-line interface. For more details, see the command reference for this release.
copy tftp:/*source-file-url filesystem***:/***destination-file-url*	Copies a Cisco IOS image from the TFTP server to the specified location. For more details, see the command reference for this release.

1. ARP = Address Resolution Protocol.

Configuring Ethernet Interfaces

These sections contain this configuration information:

Default Ethernet Interface Configuration

Table 12-3 shows the Ethernet interface default configuration, including some features that apply only to Layer 2 interfaces. For more details on the VLAN parameters listed in the table, see Chapter 14, "Configuring VLANs." For details on controlling traffic to the port, see Chapter 27, "Configuring Port-Based Traffic Control."

Note To configure Layer 2 parameters, if the interface is in Layer 3 mode, you must enter the **switchport** interface configuration command without any parameters to put the interface into Layer 2 mode. This shuts down the interface and then re-enables it, which might generate messages on the device to which the interface is connected. When you put an interface that is in Layer 3 mode into Layer 2 mode, the previous configuration information related to the affected interface might be lost, and the interface is returned to its default configuration.

Table 12-3 Default Layer 2 Ethernet Interface Configuration

Feature	Default Setting
Operating mode	Layer 2 or switching mode (**switchport** command).
Allowed VLAN range	VLANs 1– 4094.
Default VLAN (for access ports)	VLAN 1 (Layer 2 interfaces only).
Native VLAN (for IEEE 802.1Q trunks)	VLAN 1 (Layer 2 interfaces only).
VLAN trunking	Switchport mode dynamic auto (supports DTP) (Layer 2 interfaces only).
Port enable state	All ports are enabled.
Port description	None defined.
Speed	Autonegotiate. (Not supported on the 10-Gigabit interfaces.)
Duplex mode	Autonegotiate. (Not supported on the 10-Gigabit interfaces.)
Flow control	Flow control is set to **receive**: **off**. It is always off for sent packets.

Table 12-3 Default Layer 2 Ethernet Interface Configuration (continued)

Feature	Default Setting
EtherChannel (PAgP)	Disabled on all Ethernet ports. See Chapter 39, "Configuring EtherChannels and Link-State Tracking."
Port blocking (unknown multicast and unknown unicast traffic)	Disabled (not blocked) (Layer 2 interfaces only). See the "Configuring Port Blocking" section on page 27-7.
Broadcast, multicast, and unicast storm control	Disabled. See the "Default Storm Control Configuration" section on page 27-3.
Protected port	Disabled (Layer 2 interfaces only). See the "Configuring Protected Ports" section on page 27-6.
Port security	Disabled (Layer 2 interfaces only). See the "Default Port Security Configuration" section on page 27-11.
Port Fast	Disabled. See the "Default Optional Spanning-Tree Configuration" section on page 21-12.
Auto-MDIX	Enabled. **Note** The switch might not support a pre-standard powered device—such as Cisco IP phones and access points that do not fully support IEEE 802.3af—if that powered device is connected to the switch through a crossover cable. This is regardless of whether auto-MIDX is enabled on the switch port.
Power over Ethernet (PoE)	Enabled (auto).

Configuring Interface Speed and Duplex Mode

Ethernet interfaces on the switch operate at 10, 100, 1000, or 10,000 Mb/s and in either full- or half-duplex mode. In full-duplex mode, two stations can send and receive traffic at the same time. Normally, 10-Mb/s ports operate in half-duplex mode, which means that stations can either receive or send traffic.

Switch models include Gigabit Ethernet (10/100/1000-Mb/s) ports, 10-Gigabit Ethernet ports, and small form-factor pluggable (SFP) module slots supporting SFP modules.

These sections describe how to configure the interface speed and duplex mode:

- Speed and Duplex Configuration Guidelines, page 12-23
- Setting the Interface Speed and Duplex Parameters, page 12-24

Speed and Duplex Configuration Guidelines

When configuring an interface speed and duplex mode, note these guidelines:

- The 10-Gigabit Ethernet ports do not support the speed and duplex features. These ports operate only at 10,000 Mb/s and in full-duplex mode.
- Gigabit Ethernet (10/100/1000-Mb/s) ports support all speed options and all duplex options (auto, half, and full). However, Gigabit Ethernet ports operating at 1000 Mb/s do not support half-duplex mode.

- For SFP module ports, the speed and duplex CLI options change depending on the SFP module type:
  - The 1000BASE-*x* (where -*x* is -BX, -CWDM, -LX, -SX, and -ZX) SFP module ports support the **nonegotiate** keyword in the **speed** interface configuration command. Duplex options are not supported.
  - The 1000BASE-T SFP module ports support the same speed and duplex options as the 10/100/1000-Mb/s ports.

  For information about which SFP modules are supported on your switch, see the product release notes.
- If both ends of the line support autonegotiation, we highly recommend the default setting of **auto** negotiation.
- If one interface supports autonegotiation and the other end does not, configure duplex and speed on both interfaces; do not use the **auto** setting on the supported side.
- When STP is enabled and a port is reconfigured, the switch can take up to 30 seconds to check for loops. The port LED is amber while STP reconfigures.

Caution Changing the interface speed and duplex mode configuration might shut down and re-enable the interface during the reconfiguration.

Setting the Interface Speed and Duplex Parameters

Beginning in privileged EXEC mode, follow these steps to set the speed and duplex mode for a physical interface:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**interface** *interface-id*	Specify the physical interface to be configured, and enter interface configuration mode.
Step 3	**speed** {**10** | **100** | **1000** | **auto** [**10** | **100** | **1000**] | **nonegotiate**}	This command is not available on a 10-Gigabit Ethernet interface. Enter the appropriate speed parameter for the interface: • Enter **10**, **100**, or **1000** to set a specific speed for the interface. The **1000** keyword is available only for 10/100/1000 Mb/s ports. • Enter **auto** to enable the interface to autonegotiate speed with the connected device. If you use the **10**, **100**, or the **1000** keywords with the **auto** keyword, the port autonegotiates only at the specified speeds. • The **nonegotiate** keyword is available only for SFP module ports. SFP module ports operate only at 1000 Mb/s but can be configured to not negotiate if connected to a device that does not support autonegotiation. For more information about speed settings, see the "Speed and Duplex Configuration Guidelines" section on page 12-23.

	Command	Purpose
Step 4	**duplex** {**auto** | **full** | **half**}	This command is not available on a 10-Gigabit Ethernet interface. Enter the duplex parameter for the interface. Enable half-duplex mode (for interfaces operating only at 10 or 100 Mb/s). You cannot configure half-duplex mode for interfaces operating at 1000 Mb/s. You can configure the duplex setting when the speed is set to **auto**. For more information about duplex settings, see the "Speed and Duplex Configuration Guidelines" section on page 12-23.
Step 5	**end**	Return to privileged EXEC mode.
Step 6	**show interfaces** *interface-id*	Display the interface speed and duplex mode configuration.
Step 7	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

Use the **no speed** and **no duplex** interface configuration commands to return the interface to the default speed and duplex settings (autonegotiate). To return all interface settings to the defaults, use the **default interface** *interface-id* interface configuration command.

This example shows how to set the interface speed to 100 Mb/s and the duplex mode to half on a 10/100/1000 Mb/s port:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/0/3
Switch(config-if)# speed 10
Switch(config-if)# duplex half
```

This example shows how to set the interface speed to 100 Mb/s on a 10/100/1000 Mb/s port:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/0/2
Switch(config-if)# speed 100
```

Configuring IEEE 802.3x Flow Control

Flow control enables connected Ethernet ports to control traffic rates during congestion by allowing congested nodes to pause link operation at the other end. If one port experiences congestion and cannot receive any more traffic, it notifies the other port by sending a pause frame to stop sending until the condition clears. Upon receipt of a pause frame, the sending device stops sending any data packets, which prevents any loss of data packets during the congestion period.

Note Catalyst 3750-E or 3560-E ports can receive, but not send, pause frames.

You use the **flowcontrol** interface configuration command to set the interface's ability to **receive** pause frames to **on**, **off**, or **desired**. The default state is **off**.

When set to **desired**, an interface can operate with an attached device that is required to send flow-control packets or with an attached device that is not required to but can send flow-control packets.

These rules apply to flow control settings on the device:

- **receive on** (or **desired**): The port cannot send pause frames but can operate with an attached device that is required to or can send pause frames; the port can receive pause frames.
- **receive off**: Flow control does not operate in either direction. In case of congestion, no indication is given to the link partner, and no pause frames are sent or received by either device.

Note For details on the command settings and the resulting flow control resolution on local and remote ports, see the **flowcontrol** interface configuration command in the command reference for this release.

Beginning in privileged EXEC mode, follow these steps to configure flow control on an interface:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode
Step 2	**interface** *interface-id*	Specify the physical interface to be configured, and enter interface configuration mode.
Step 3	**flowcontrol** {**receive**} {**on** | **off** | **desired**}	Configure the flow control mode for the port.
Step 4	**end**	Return to privileged EXEC mode.
Step 5	**show interfaces** *interface-id*	Verify the interface flow control settings.
Step 6	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To disable flow control, use the **flowcontrol receive off** interface configuration command.

This example shows how to turn on flow control on a port:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)# flowcontrol receive on
Switch(config-if)# end
```

Configuring Auto-MDIX on an Interface

When automatic medium-dependent interface crossover (auto-MDIX) is enabled on an interface, the interface automatically detects the required cable connection type (straight through or crossover) and configures the connection appropriately. When connecting switches without the auto-MDIX feature, you must use straight-through cables to connect to devices such as servers, workstations, or routers and crossover cables to connect to other switches or repeaters. With auto-MDIX enabled, you can use either type of cable to connect to other devices, and the interface automatically corrects for any incorrect cabling. For more information about cabling requirements, see the hardware installation guide.

Auto-MDIX is enabled by default. When you enable auto-MDIX, you must also set the interface speed and duplex to **auto** so that the feature operates correctly. Auto-MDIX is supported on all 10/100/1000-Mb/s and on 10/100/1000BASE-TX small form-factor pluggable (SFP)-module interfaces. It is not supported on 1000BASE-SX or -LX SFP module interfaces.

Table 12-4 shows the link states that result from auto-MDIX settings and correct and incorrect cabling.

Table 12-4 Link Conditions and Auto-MDIX Settings

Local Side Auto-MDIX	Remote Side Auto-MDIX	With Correct Cabling	With Incorrect Cabling
On	On	Link up	Link up
On	Off	Link up	Link up
Off	On	Link up	Link up
Off	Off	Link up	Link down

Beginning in privileged EXEC mode, follow these steps to configure auto-MDIX on an interface:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode
Step 2	**interface** *interface-id*	Specify the physical interface to be configured, and enter interface configuration mode.
Step 3	**speed auto**	Configure the interface to autonegotiate speed with the connected device.
Step 4	**duplex auto**	Configure the interface to autonegotiate duplex mode with the connected device.
Step 5	**mdix auto**	Enable auto-MDIX on the interface.
Step 6	**end**	Return to privileged EXEC mode.
Step 7	**show controllers ethernet-controller** *interface-id* **phy**	Verify the operational state of the auto-MDIX feature on the interface.
Step 8	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To disable auto-MDIX, use the **no mdix auto** interface configuration command.

This example shows how to enable auto-MDIX on a port:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)# speed auto
Switch(config-if)# duplex auto
Switch(config-if)# mdix auto
Switch(config-if)# end
```

Configuring a Power Management Mode on a PoE Port

For most situations, the default configuration (auto mode) works well, providing plug-and-play operation. No further configuration is required. However, use the following procedure to give a PoE port higher priority, to make it data only, or to specify a maximum wattage to disallow high-power powered devices on a port.

Note When you make PoE configuration changes, the port being configured drops power. Depending on the new configuration, the state of the other PoE ports, and the state of the power budget, the port might not be powered up again. For example, port 1 is in the auto and on state, and you configure it for static mode. The switch removes power from port 1, detects the powered device, and repowers the port. If port 1 is

in the auto and on state and you configure it with a maximum wattage of 10 W, the switch removes power from the port and then redetects the powered device. The switch repowers the port only if the powered device is a class 1, class 2, or a Cisco-only powered device.

Beginning in privileged EXEC mode, follow these steps to configure a power management mode on a PoE-capable port:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**interface** *interface-id*	Specify the physical port to be configured, and enter interface configuration mode.
Step 3	**power inline** {**auto** [**max** *max-wattage*] | **never** | **static** [**max** *max-wattage*]}	Configure the PoE mode on the port. The keywords have these meanings: • **auto**—Enable powered-device detection. If enough power is available, automatically allocate power to the PoE port after device detection. This is the default setting. • (Optional) **max** *max-wattage*—Limit the power allowed on the port. The range is 4000 to 15400 mW. If no value is specified, the maximum is allowed (15400 mW). • **never**—Disable device detection, and disable power to the port. **Note** If a port has a Cisco powered device connected to it, do not use the **power inline never** command to configure the port. A false link-up can occur, placing the port into the error-disabled state. • **static**—Enable powered-device detection. Pre-allocate (reserve) power for a port before the switch discovers the powered device. The switch reserves power for this port even when no device is connected and guarantees that power will be provided upon device detection. The switch allocates power to a port configured in static mode before it allocates power to a port configured in auto mode.
Step 4	**end**	Return to privileged EXEC mode.
Step 5	**show power inline** [*interface-id* | **module** *switch-number*]	Display PoE status for a switch or a switch stack, for the specified interface, or for a specified stack member. The **module** *switch-number* keywords are supported only on Catalyst 3750-E switches.
Step 6	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

For information about the output of the **show power inline** user EXEC command, see the command reference for this release. For more information about PoE-related commands, see the "Troubleshooting Power over Ethernet Switch Ports" section on page 49-14. For information about configuring voice VLAN, see Chapter 16, "Configuring Voice VLAN."

Budgeting Power for Devices Connected to a PoE Port

When Cisco powered devices are connected to PoE ports, the switch uses Cisco Discovery Protocol (CDP) to determine the *CDP-specific* power consumption of the devices, and the switch adjusts the power budget accordingly. This does not apply to IEEE third-party powered devices. For these devices, when the switch grants a power request, the switch adjusts the power budget according to the powered-device IEEE classification. If the powered device is a class 0 (class status unknown) or a class 3, the switch budgets 15,400 mW for the device, regardless of the CDP-specific amount of power needed. If the powered device reports a higher class than its CDP-specific consumption or does not support power classification (defaults to class 0), the switch can power fewer devices because it uses the IEEE class information to track the global power budget.

By using the **power inline consumption** *wattage* interface configuration command or the **power inline consumption default** *wattage* global configuration command, you can override the default power requirement specified by the IEEE classification. The difference between what is mandated by the IEEE classification and what is actually needed by the device is reclaimed into the global power budget for use by additional devices. You can then extend the switch power budget and use it more effectively.

Caution You should carefully plan your switch power budget, enable the power monitoring feature, and make certain not to oversubscribe the power supply.

Note When you manually configure the power budget, you must also consider the power loss over the cable between the switch and the powered device.

When you enter the **power inline consumption default** *wattage* or the **no power inline consumption default** global configuration command or the **power inline consumption** *wattage* or the **no power inline consumption** interface configuration command, this caution message appears:

```
%CAUTION: Interface Gi1/0/1: Misconfiguring the 'power inline  consumption/allocation'
command may cause damage to the switch and void  your warranty. Take precaution not to
oversubscribe the power supply.
 It is recommended to enable power policing if the switch supports it.
 Refer to documentation.
```

For more information about the IEEE power classifications, see the "Power over Ethernet Ports" section on page 12-6.

Beginning in privileged EXEC mode, follow these steps to configure the amount of power budgeted to a powered device connected to each PoE port on a switch:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**no cdp run**	(Optional) Disable CDP.
Step 3	**power inline consumption default** *wattage*	Configure the power consumption of powered devices connected to each the PoE port on the switch. The range for each device is 4000 to 15400 mW. The default is 15400 mW.
Step 4	**end**	Return to privileged EXEC mode.

	Command	Purpose
Step 5	**show power inline consumption default**	Display the power consumption status.
Step 6	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To return to the default setting, use the **no power inline consumption default** global configuration command.

Beginning in privileged EXEC mode, follow these steps to configure amount of power budgeted to a powered device connected to a specific PoE port:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**no cdp run**	(Optional) Disable CDP.
Step 3	**interface** *interface-id*	Specify the physical port to be configured, and enter interface configuration mode.
Step 4	**power inline consumption** *wattage* or power inline port *maximum*	Configure the power consumption of a powered device connected to a PoE port on the switch. The range for each device is 4000 to 15400 mW. The default is 15400 mW. Configure enhanced PoE to increase the maximum power supplied to a device (up to 20 W).
Step 5	**end**	Return to privileged EXEC mode.
Step 6	**show power inline consumption default**	Display the power consumption data.
Step 7	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To return to the default setting, use the **no power inline consumption** interface configuration command.

For information about the output of the **show power inline consumption** privileged EXEC command, see the command reference for this release.

Configuring Power Policing

By default, the switch monitors the real-time power consumption of connected powered devices. You can configure the switch to police the power usage. By default, policing is disabled.

For more information about the cutoff power value, the power consumption values that the switch uses, and the actual power consumption value of the connected device, see the "Power Monitoring and Power Policing" section in the "Configuring Interface Characteristics" chapter of the software configuration guide for this release.

Beginning in privileged EXEC mode, follow these steps to enable policing of the real-time power consumption of a powered device connected to a PoE port:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**interface** *interface-id*	Specify the physical port to be configured, and enter interface configuration mode.
Step 3	**power inline police** [**action log**]	If the real-time power consumption exceeds the maximum power allocation on the port, configure the switch to take one of these actions: • Shut down the PoE port, turn off power to it, and put it in the error-dsabled state—Enter the **power inline police** command. **Note** You can enable error detection for the PoE error-disabled cause by using the **errdisable detect cause inline-power** global configuration command. You can also enable the timer to recover from the PoE error-disabled state by using the **errdisable recovery cause inline-power interval** *interval* global configuration command. • Generate a syslog message while still providing power to the port—Enter the **power inline police action log** command. If you do not enter the **action log** keywords, the default action shuts down the port and puts the port in the error-disabled state.
Step 4	**exit**	Return to global configuration mode.
Step 5	**errdisable detect cause inline-power** and **errdisable recovery cause inline-power** and **errdisable recovery interval** *interval*	(Optional) Enable error recovery from the PoE error-disabled state, and configure the PoE recover mechanism variables. By default, the recovery interval is 300 seconds. For **interval** *interval*, specify the time in seconds to recover from the error-disabled state. The range is 30 to 86400.
Step 6	exit	Return to privileged EXEC mode.
Step 7	**show power inline police** show errdisable recovery	Display the power monitoring status, and verify the error recovery settings.
Step 8	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To disable policing of the real-time power consumption, use the **no power inline police** interface configuration command. To disable error recovery for PoE error-disabled cause, use the **no errdisable recovery cause inline-power** global configuration command.

For information about the output from the **show power inline police** privileged EXEC command, see the command reference for this release.

Adding a Description for an Interface

You can add a description about an interface to help you remember its function. The description appears in the output of these privileged EXEC commands: **show configuration**, **show running-config**, and **show interfaces**.

Beginning in privileged EXEC mode, follow these steps to add a description for an interface:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**interface** *interface-id*	Specify the interface for which you are adding a description, and enter interface configuration mode.
Step 3	**description** *string*	Add a description (up to 240 characters) for an interface.
Step 4	**end**	Return to privileged EXEC mode.
Step 5	**show interfaces** *interface-id* **description** or **show running-config**	Verify your entry.
Step 6	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

Use the **no description** interface configuration command to delete the description.

This example shows how to add a description on a port and how to verify the description:

```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# interface gigabitethernet1/0/2
Switch(config-if)# description Connects to Marketing
Switch(config-if)# end
Switch# show interfaces gigabitethernet1/0/2 description
Interface Status         Protocol Description
Gi1/0/2   admin down     down     Connects to Marketing
```

Configuring Layer 3 Interfaces

The switch supports these types of Layer 3 interfaces:

- SVIs: You should configure SVIs for any VLANs for which you want to route traffic. SVIs are created when you enter a VLAN ID following the **interface vlan** global configuration command. To delete an SVI, use the **no interface vlan** global configuration command. You cannot delete interface VLAN 1.

  Note When you create an SVI, it does not become active until it is associated with a physical port. For information about assigning Layer 2 ports to VLANs, see Chapter 14, "Configuring VLANs."

  When configuring SVIs, you can also configure SVI autostate exclude on a port in the SVI to exclude that port from being included in determining SVI line-state status. See the "Configuring SVI Autostate Exclude" section on page 12-34.

- Routed ports: Routed ports are physical ports configured to be in Layer 3 mode by using the **no switchport** interface configuration command.
- Layer 3 EtherChannel ports: EtherChannel interfaces made up of routed ports.

  EtherChannel port interfaces are described in Chapter 39, "Configuring EtherChannels and Link-State Tracking."

A Layer 3 switch can have an IP address assigned to each routed port and SVI.

There is no defined limit to the number of SVIs and routed ports that can be configured in a switch or in a switch stack. However, the interrelationship between the number of SVIs and routed ports and the number of other features being configured might have an impact on CPU usage because of hardware limitations. If the switch is using its maximum hardware resources, attempts to create a routed port or SVI have these results:

- If you try to create a new routed port, the switch generates a message that there are not enough resources to convert the interface to a routed port, and the interface remains as a switchport.
- If you try to create an extended-range VLAN, an error message is generated, and the extended-range VLAN is rejected.
- If the switch is notified by VLAN Trunking Protocol (VTP) of a new VLAN, it sends a message that there are not enough hardware resources available and shuts down the VLAN. The output of the **show vlan** user EXEC command shows the VLAN in a suspended state.
- If the switch attempts to boot up with a configuration that has more VLANs and routed ports than hardware can support, the VLANs are created, but the routed ports are shut down, and the switch sends a message that this was due to insufficient hardware resources.

All Layer 3 interfaces require an IP address to route traffic. This procedure shows how to configure an interface as a Layer 3 interface and how to assign an IP address to an interface.

Note If the physical port is in Layer 2 mode (the default), you must enter the **no switchport** interface configuration command to put the interface into Layer 3 mode. Entering a **no switchport** command disables and then re-enables the interface, which might generate messages on the device to which the interface is connected. Furthermore, when you put an interface that is in Layer 2 mode into Layer 3 mode, the previous configuration information related to the affected interface might be lost, and the interface is returned to its default configuration

Beginning in privileged EXEC mode, follow these steps to configure a Layer 3 interface:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**interface** {**gigabitethernet** *interface-id*} | {**vlan** *vlan-id*} | {**port-channel** *port-channel-number*}	Specify the interface to be configured as a Layer 3 interface, and enter interface configuration mode.
Step 3	**no switchport**	For physical ports only, enter Layer 3 mode.
Step 4	**ip address** *ip_address subnet_mask*	Configure the IP address and IP subnet.
Step 5	**no shutdown**	Enable the interface.
Step 6	**end**	Return to privileged EXEC mode.

	Command	Purpose
Step 7	**show interfaces** [*interface-id*] **show ip interface** [*interface-id*] **show running-config interface** [*interface-id*]	Verify the configuration.
Step 8	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To remove an IP address from an interface, use the **no ip address** interface configuration command.

This example shows how to configure a port as a routed port and to assign it an IP address:

```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# interface gigabitethernet1/0/2
Switch(config-if)# no switchport
Switch(config-if)# ip address 192.20.135.21 255.255.255.0
Switch(config-if)# no shutdown
```

Configuring SVI Autostate Exclude

Configuring SVI autostate exclude on an access or trunk port in an SVI excludes that port in the calculation of the status of the SVI line state (up or down) status even if it belongs to the same VLAN. When the excluded port is in the up state, and all other ports in the VLAN are in the down state, the SVI state is changed to down.

At least one port in the VLAN should be up and not excluded to keep the SVI state up. You can use this command to exclude the monitoring port status when determining the status of the SVI.

Beginning in privileged EXEC mode, follow these steps to exclude a port from SVI state-change calculations:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**interface** *interface-id*	Specify a Layer 2 interface (physical port or port channel), and enter interface configuration mode.
Step 3	**switchport autostate exclude**	Exclude the access or trunk port when defining the status of an SVI line state (up or down)
Step 4	**end**	Return to privileged EXEC mode.
Step 5	**show running config interface** *interface-id* **show interface** *interface-id* **switchport**	(Optional) Show the running configuration. Verify the configuration.
Step 6	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

This example shows how to configure an access or trunk port in an SVI to be excluded from the line-state status calculation:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface gigabitethernet1/0/2
Switch(config-if)# switchport autostate exclude
Switch(config-if)# exit
```

Configuring the System MTU

The default maximum transmission unit (MTU) size for frames received and sent on all interfaces on the switch or switch stack is 1500 bytes. You can change the MTU size to support switched jumbo frames on all Gigabit Ethernet and 10-Gigabit Ethernet interfaces and to support routed frames on all routed ports.

- The system jumbo MTU value applies to switched packets on the Gigabit Ethernet and 10-Gigabit Ethernet ports of the switch or switch stack. Use the **system mtu jumbo** *bytes* global configuration command to specify the system jumbo MTU value.
- The system routing MTU value applies only to routed packets on all routed ports of the switch or switch stack. Use the **system mtu routing** *bytes* global configuration command to specify the system routing MTU value.

When configuring the system MTU values, follow these guidelines:

- The switch does not support the MTU on a per-interface basis.
- You can enter the **system mtu** *bytes* global configuration command on a Catalyst 3750-E switch, but the command does not take effect on the switch. This command only affects the system MTU size on Fast Ethernet ports on Catalyst 3750 members in a mixed hardware switch stack. In this stack, you can use the **system mtu** *bytes* global configuration command on a Catalyst 3750-E member to configure the system MTU size on a Catalyst 3750 member.
- The **system mtu**, **system mtu jumbo**, and **system mtu routing** global configuration commands do not take effect in these cases:
  - When you enter the **system mtu** command on a Catalyst 3750-E or 3560-E switch
  - In a mixed stack when you enter the **system mtu jumbo** command for the Fast Ethernet ports on a Catalyst 3750 member
  - When you enter the **system mtu routing** command on a switch on which only Layer 2 ports are configured
- When you use the **system mtu** *bytes* or **system mtu jumbo** *bytes* command to change the system MTU or system jumbo MTU size, you must reset the switch before the new configuration takes effect. The **system mtu routing** command does not require a switch reset to take effect.

  The system MTU setting is saved in the switch environmental variable in NVRAM and becomes effective when the switch reloads. Unlike the system MTU routing configuration, the MTU settings you enter with the **system mtu** and **system mtu jumbo** commands are not saved in the switch Cisco IOS configuration file, even if you enter the **copy running-config startup-config** privileged EXEC command. Therefore, if you use TFTP to configure a new switch by using a backup configuration file and want the system MTU to be other than the default, you must explicitly configure the **system mtu** and **system mtu jumbo** settings on the new switch and then reload the switch.

In a switch stack, the MTU values applied to the members depend on the stack configuration:

- A stack consisting of only Catalyst 3750-E switches, also referred to as a Catalyst 3750-E-only stack
- A stack consisting of Catalyst 3750-E switches and Catalyst 3750 switches, also referred to as a mixed hardware stack
- A stack consisting of only Catalyst 3750 switches, also referred to as a Catalyst 3750-only stack

Table 12-5 shows how the MTU values are applied depending on the configuration.

Table 12-5 System MTU Values

Configuration	System MTU	System Jumbo MTU	System Routing MTU
Catalyst 3750-E-only stack Catalyst 3750-E switch Catalyst 3560-E switch	The system MTU value does not take effect on a Catalyst 3750-E or 3560-E switch, but you can enter the command on the switch. [1]	Use the **system mtu jumbo** *bytes* command. The range is from 1500 to 9198 bytes.	Use the **system mtu routing** *bytes* command. The range is from 1500 to the system jumbo MTU value (in bytes).[2]
Mixed hardware stack	Use the **system mtu** *bytes* command, which takes effect only on Catalyst 3750 members.[1] The range is from 1500 to 1998 bytes.	Use the **system mtu jumbo** *bytes* command. The range is from 1500 to 9000 bytes.	Use the **system mtu routing** *bytes* command. The range is from 1500 to the system MTU value (in bytes).[2]
Catalyst 3750-only stack Catalyst 3750 switch Catalyst 3560 switch	Use the **system mtu** *bytes* command. The range is from 1500 to 1998 bytes.	Use the **system mtu jumbo** *bytes* command. The range is from 1500 to 9000 bytes.	Use the **system mtu routing** *bytes* command. The range is from 1500 to the system MTU value (in bytes).

1. If you use the **system mtu** *bytes* command on a Catalyst 3750-E member in a mixed hardware stack, the setting takes effect on the Fast Ethernet ports of Catalyst 3750 members.
2. The system routing MTU value is the applied value, not the configured value.

The upper limit of the system routing MTU value is based on the switch or switch stack configuration and refers to either the currently applied system MTU or the system jumbo MTU value. For more information about setting the MTU sizes, see the **system mtu** global configuration command in the command reference for this release.

Beginning in privileged EXEC mode, follow these steps to change the MTU size for switched and routed packets:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**system mtu jumbo** *bytes*	(Optional) Change the MTU size for all Gigabit Ethernet and 10-Gigabit Ethernet interfaces on the switch or the switch stack. For information about the range for *bytes*, see Table 12-5.
Step 3	**system mtu routing** *bytes*	(Optional) Change the system MTU for routed ports. You can also set the maximum MTU to be advertised by the routing protocols that support the configured MTU size. The system routing MTU is the maximum MTU for routed packets and is also the maximum MTU that the switch advertises in routing updates for protocols such as OSPF. For information about the range for *bytes*, see Table 12-5.

	Command	Purpose
Step 4	**system mtu** *bytes*	(Optional) In a mixed hardware stack, change the MTU size for all Fast Ethernet interfaces on the Catalyst 3750 members. The range is 1500 to 1998 bytes; the default is 1500 bytes. **Note** This command does not apply to Catalyst 3560-E switches.
Step 5	**end**	Return to privileged EXEC mode.
Step 6	**copy running-config startup-config**	Save your entries in the configuration file.
Step 7	**reload**	Reload the operating system.
Step 8	show system mtu	Verify your settings.

If you enter a value that is outside the allowed range for the specific type of interface, the value is not accepted.

This example shows how to set the maximum packet size for a Gigabit Ethernet port to 7500 bytes:

```
Switch(config)# system mtu jumbo 7500
Switch(config)# exit
Switch# reload
```

This example shows the response when you try to set Gigabit Ethernet interfaces to an out-of-range number:

```
Switch(config)# system mtu jumbo 25000
                                 ^
% Invalid input detected at '^' marker.
```

Configuring the Cisco Redundant Power System 2300

You can configure and manage the Cisco Redundant Power System 2300, also known as the RPS 2300.

Follow these guidelines:

- The RPS name is a 16-character-maximum string.
- On a Catalyst 3560-E or a standalone Catalyst 3750-E switch, the RPS name applies to the connected RPS 2300.
- In a switch stack, the RPS name applies to the RPS ports connected to the specified switch.
- If you do not want the RPS 2300 to provide power to a switch, but do not want to disconnect the RPS cable between the switch and the RPS 2300, use the **power rps** *switch-number* **port** *rps-port-id* **mode standby** user EXEC command.
- You can configure the priority of an RPS 2300 port from 1 to 6. Specifying a value of 1 assigns the port and its connected devices the highest priority and specifying a value of 6 assigns the port and its connected devices the lowest priority.

  If multiple switches connected to the RPS 2300 need power, the RPS 2300 provides power to the switches with the highest priority. If the RPS 2300 still has power available, it can then provide power to the switches with lower priorities.

Beginning in user EXEC mode, follow these steps to configure and manage the RPS 2300:

	Command	Purpose
Step 1	**power rps** *switch-number* **name** {*string* | **serialnumber**}	Specify the name of the RPS 2300. The keywords have these meanings: • *switch-number*—Specify the stack member to which the RPS 2300 is connected. The range is 1 to 9, depending on the switch member numbers in the stack. This keyword is supported only on Catalyst 3750-E switches. • **name**—Set the name of the RPS 2300 and enter one of these options: – *string*—Specify the name such as *port1* or *"port 1"*. Using quotation marks before and after the name is optional, but you must use quotation marks if you want to include spaces in the port name. The name can have up to 16 characters. – **serialnumber**—Configure the switch to use the RPS 2300 serial number as the name.
Step 2	**power rps** *switch-number* **port** *rps-port-id* **mode** {**active** | **standby**}	Specify the mode of the RPS 2300 port. The keywords have these meanings: • *switch-number*—Specify the stack member to which the RPS 2300 is connected. The range is 1 to 9, depending on the switch member numbers in the stack. This keyword is supported only on Catalyst 3750-E switches. • **port** *rps-port-id*—Specify the RPS 2300 port. The range is from 1 to 6. • **mode**—Set the mode of the RPS 2300 port: – **active**—The RPS 2300 can provide the power to a switch when the switch internal power supply cannot. – **standby**—The RPS 2300 is not providing power to a switch. The default mode for RPS ports is **active**.
Step 3	**power rps** *switch-number* **priority** *priority*	Set the priority of the RPS 2300 port. The range is from 1 to 6, where 1 is the highest priority and 6 is the lowest priority. The default port priority is 6.
Step 4	**show env rps**	Verify your settings.
Step 5	**copy running-config startup-config**	(Optional) **Save your entries in the configuration file.**

To return to the RPS 2300 default settings, use these commands:

- To return to the default name setting (no name is configured), use the **power rps** *switch-number* **port** *rps-port-id* **name ““** user EXEC command with no space between the quotation marks.
- To return to the default port mode, use the **power rps** *switch-number* **port** *rps-port-id* **active** command.
- To return to the default port priority, use the **power rps** *switch-number* **port** *rps-port-id* **priority** command.

For more information about using the **power rps** user EXEC command, see the command reference for this release.

Configuring the Power Supplies

You can enter the **power supply** user EXEC command to configure and manage the internal power supply on the switch.

Note The Catalyst 3750 and 3560 switches do not support the **power supply** command.

Beginning in user EXEC mode, follow these steps to configure and manage the power supply:

	Command	Purpose
Step 1	**power supply** *switch-number* {**off** | **on**}	Set the switch power supply to **off** or **on** by using one of these keywords: • **off**—Set the power supply off. • **on**—Set the power supply on. The *switch-number* is supported only on Catalyst 3750-E switches. By default, the switch power supply is **on**.
Step 2	**show env power**	Verify your settings.
Step 3	**copy running-config startup-config**	(Optional) **Save your entries in the configuration file.**

The switch does not support the **no power supply** user EXEC command. To return to the default setting, use the **power supply** *switch-number* **on** command.

For more information about using the **power supply** user EXEC command, see the command reference for this release.

Monitoring and Maintaining the Interfaces

These sections contain interface monitoring and maintenance information:

Monitoring Interface Status

Commands entered at the privileged EXEC prompt display information about the interface, including the versions of the software and the hardware, the configuration, and statistics about the interfaces. Table 12-6 lists some of these interface monitoring commands. (You can display the full list of **show** commands by using the **show ?** command at the privileged EXEC prompt.) These commands are fully described in the *Cisco IOS Interface Command Reference, Release 12.2*.

Table 12-6 Show Commands for Interfaces

Command	Purpose
show env power switch [*switch-number*]	(Optional) Display the status of the internal power supplies for each switch in the stack or for the specified switch. The range is 1 to 9, depending on the switch member numbers in the stack. These keywords are available only on Catalyst 3750-E switches.
show env rps	Display whether a redundant power system (RPS) is connected to the switch as follows: – Catalyst 3750-E or 3560-E switch—Cisco Redundant Power System 2300, also referred to as the RPS 2300. – Catalyst 3750v2 or 3560v2 switch—Cisco Redundant Power System 2300. – Catalyst 3750, 3560, 2970, or 2960 switches—RPS 2300 or Cisco RPS 675 Redundant Power System, also referred to as the RPS 675.
show env rps detail	(Optional) Display the details about the RPSs that are connected to the switch or switch stack.
show env rps switch [*switch-number*]	(Optional) Display the RPSs that are connected to each switch in the stack or to the specified switch. The range is 1 to 9, depending on the switch member numbers in the stack. This keyword is available only on Catalyst 3750-E switches.
show interfaces [*interface-id*]	Display the status and configuration of all interfaces or a specific interface.
show interfaces *interface-id* **status** [**err-disabled**]	Display interface status or a list of interfaces in the error-disabled state.
show interfaces [*interface-id*] **switchport**	Display administrative and operational status of switching (nonrouting) ports. You can use this command to find out if a port is in routing or in switching mode.

Table 12-6 Show Commands for Interfaces (continued)

Command	Purpose
show interfaces [*interface-id*] **description**	Display the description configured on an interface or all interfaces and the interface status.
show ip interface [*interface-id*]	Display the usability status of all interfaces configured for IP routing or the specified interface.
show interface [*interface-id*] **stats**	Display the input and output packets by the switching path for the interface.
show interfaces *interface-id*	(Optional) Display speed and duplex on the interface.
show interfaces transceiver dom-supported-list	(Optional) Display Digital Optical Monitoring (DOM) status on the connect SFP modules.
show interfaces transceiver properties	(Optional) Display temperature, voltage, or amount of current on the interface.
show interfaces [*interface-id*] [{**transceiver properties** | **detail**}] *module number*]	Display physical and operational status about an SFP module.
show running-config interface [*interface-id*]	Display the running configuration in RAM for the interface.
show version	Display the hardware configuration, software version, the names and sources of configuration files, and the boot images.
show controllers ethernet-controller *interface-id* **phy**	Display the operational state of the auto-MDIX feature on the interface.
show power inline [*interface-id* | **module** *switch-number*]	Display PoE status for a switch or switch stack, for an interface, or for a specific switch in the stack.
show power inline consumption	Display the power consumption data.
show power inline police	Display the power policing data.

Clearing and Resetting Interfaces and Counters

Table 12-7 lists the privileged EXEC mode **clear** commands that you can use to clear counters and reset interfaces.

Table 12-7 Clear Commands for Interfaces

Command	Purpose
clear counters [*interface-id*]	Clear interface counters.
clear interface *interface-id*	Reset the hardware logic on an interface.
clear line [*number* | **console 0** | **vty** *number*]	Reset the hardware logic on an asynchronous serial line.

To clear the interface counters shown by the **show interfaces** privileged EXEC command, use the **clear counters** privileged EXEC command. The **clear counters** command clears all current interface counters from the interface unless you specify optional arguments that clear only a specific interface type from a specific interface number.

Note The **clear counters** privileged EXEC command does not clear counters retrieved by using Simple Network Management Protocol (SNMP), but only those seen with the **show interface** privileged EXEC command.

Shutting Down and Restarting the Interface

Shutting down an interface disables all functions on the specified interface and marks the interface as unavailable on all monitoring command displays. This information is communicated to other network servers through all dynamic routing protocols. The interface is not mentioned in any routing updates.

Beginning in privileged EXEC mode, follow these steps to shut down an interface:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**interface** {**vlan** *vlan-id*} | {**gigabitethernet** *interface-id*} | {**port-channel** *port-channel-number*}	Select the interface to be configured.
Step 3	**shutdown**	Shut down an interface.
Step 4	**end**	Return to privileged EXEC mode.
Step 5	**show running-config**	Verify your entry.

Use the **no shutdown** interface configuration command to restart the interface.

To verify that an interface is disabled, enter the **show interfaces** privileged EXEC command. A disabled interface is shown as *administratively down* in the display.