CHAPTER 1

Multiprocessor WAN Application Module

This chapter describes the Multiprocessor WAN Application Module (MWAM) and includes the following sections:

Product Overview

The MWAM is a Cisco IOS application module that you can install in the Cisco Catalyst 6500 Series switch or the Cisco 7600 Series Internet Router.

Each MWAM contains three processor complexes, with two CPUs each. Each CPU can be used to run an independent IOS image. Two CPUs in each processor complex share one Gigabit Ethernet interface to the switching fabric on the Catalyst 6500 switch or Cisco 7600 router. These Gigabit Ethernet interfaces perform as 802.1Q trunk ports, which carry virtual LAN (VLAN) encapsulated traffic to and from the network. Two processor complexes have access to 1 GB of memory and the third has access to 512 MB.

Features unique to the MWAM are:

- Provides up to 5 IOS images on one card
- Uses IPSec Acceleration Module for hardware support of IPSec
- Supports several Cisco mobile wireless applications to increase session density, improve management capabilities, and reduce complexity of configuration. These include:
  - Cisco Gateway GPRS Support (GGSN)—General Packet Radio Service (GPRS) Packet Gateway
  - Cisco Home Agent (HA)—Mobile IP Agent
  - Cisco Packet Data Serving Node (PDSN)—Code Division Multiple Access (CDMA) Packet Gateway
  - Cisco Service Selection Gateway (SSG)—Service Creation and Management Gateway

Note Each application on the MWAM has its own release schedule. For this reason, some MWAM features and commands documented in this publication may have changed for your application. Refer to the release notes for your application to determine the latest information about specific features and commands.

For release notes and feature module descriptions of mobile wireless applications that are supported on MWAM, see the "Supported Applications" section on page 1-8 of this user guide.

MWAM Ordering Information

The MWAM comes in two product types with the WS-SVC-MWAM-1 product having two options:

- WS-SVC-MWAM-1—Cisco Multiprocessor WAN Application Module (base card)
  - MEM-MWAM-512MB—Standard option for 512 MB memory per MWAM processor
  - MEM-MWAM-1GB—Option for 1 GB memory per MWAM processor
- SC-SVC-NAP-1.0—Cisco Multiprocessor WAN Application Module with No Application (NOAP)

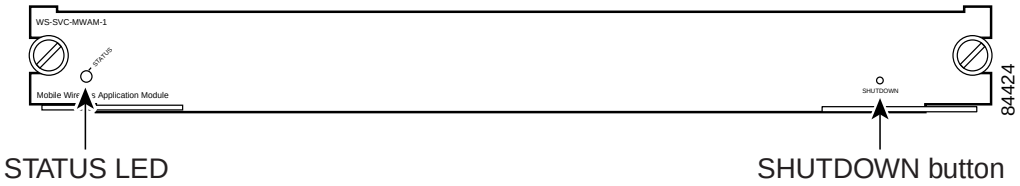
Hardware Description

Contained in a standard circuit card module, the MWAM weighs from 3-5 pounds (1.36-2.27 kg) and measures 1.18 in. high x 15.51 in. wide x 16.34 in. deep (3.0 cm x 39.4 cm x 41.5 cm). Each base MWAM contains six 700-MHz MIPs CPUs, one DIMM supporting up to 64 MB of Flash memory, and an SDRAM containing 5 DIMMs supporting 512 MB each, two processor complexes with 2 DIMMs each, and one processor complex with 1 DIMM (see the "Functional Description" section on page 1-4). Each module slides into a Catalyst 6500/Cisco 7600 chassis slot and connects directly to the backplane where each connects to power and communications located on the rear panel.

Front-Panel Features

On the MWAM front panel (see Figure 1-1), an LED (labeled STATUS) indicates the operating status of the MWAM and a recessed pushbutton (labeled SHUTDOWN) is used to manually shutdown (power off) the MWAM.

Figure 1-1 MWAM Front Panel



LED

Table 1-1 describes the MWAM LED.

Table 1-1 MWAM LED Description

LED	Color	State	Description
Status (labeled STATUS)	Green	On	All diagnostic tests pass. The MWAM is operational.
	Red	On	A diagnostic other than an individual port test failed.
	Orange	On	Indicates one of three conditions: • The MWAM is running through its boot and self-test diagnostic sequence. • The MWAM is disabled. • The MWAM is in the shutdown state.
		Off	The MWAM is powered off.

Shutdown Button

The SHUTDOWN button is used to manually shut down the MWAM. If the MWAM fails to respond to a **shutdown** command (see the following MWAM Shutdown section), you can shutdown the MWAM by using a small, pointed object (such as a paper clip) to access the recessed SHUTDOWN button on the front panel (see Figure 1-1 on page 1-3).

MWAM Shutdown

Caution The MWAM is *not* hot-swappable. Do *NOT* remove the MWAM from the chassis until the module has shut down completely and the STATUS LED is orange or off. You can damage the MWAM if you remove it from the chassis before it completely shuts down.

Shutting Down the MWAM

To shut down the MWAM, perform the following steps:

1. Enter the **show module** command and verify the MWAM status is `OK`.
2. Shut down the module with the **hw-module module** *mod* **shutdown** command in the privileged mode.
3. Enter the **show module** command and verify the MWAM status is `ShutDown` and the LED is orange.
4. Remove the MWAM as described in the "MWAM Removal" section on page 3-10.

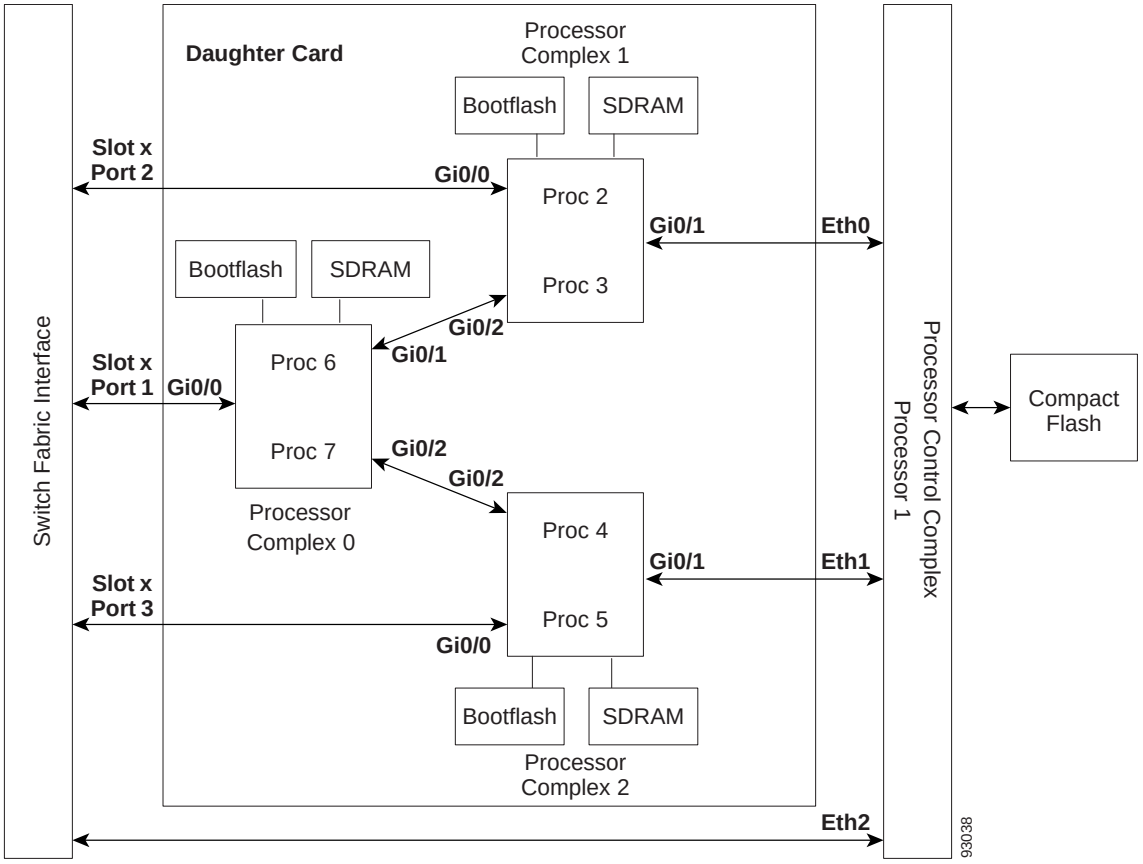
If the MWAM fails to respond to the **shutdown** command, a console message indicates `no response`. Issuing the **show module** command would reveal that the MWAM status is `Other`. In this case, shut down the module by using a small, pointed object (such as a paper clip) to access the SHUTDOWN button on the front panel (see Figure 1-1 on page 1-3).

Note The shutdown procedure may require several minutes. The STATUS LED turns off when power to the module is off.

Functional Description

The architecture of the MWAM uses a base module and daughter card arrangement to provide distributed functions. The daughter card contains three processor complexes with two processors on each complex (see Figure 1-2 on page 1-5). Two processor complexes have access to 1 GB of memory and the third has access to 512 MB. The processor complexes are controlled by a processor control complex on the base module. The processor control complex provides module initialization, control, and interface functions and two Gigabit Ethernet links to the daughter card.

Figure 1-2 MWAM Architecture



Processor Complexes

The daughter card has three dual-processor complexes. Each of the processors runs one Cisco IOS application image. Table 1-2 provides the specifications of the MWAM processors and complexes.

Table 1-2 MWAM Processor Matrix

Processor	Complex	Memory Option		Interface Mapping	
1	Processor Control	MEM-MWAM-512MB	MEM-MWAM-1GB[1]	From Processor	From Switch Fabric
2	1	1 Gigabyte	2 Gigabyte	Gi 0/0	Slot x, port 2
3					
4	2	1 Gigabyte	2 Gigabyte	Gi 0/0	Slot x, port 3
5					
6	0	512 Megabyte	1 Gigabyte	Gi 0/0	Slot x, port 1
7[2]					

1. This memory option was introduced with Cisco IOS 12.3(7)T1.
2. Processor 7 is disabled (not used by mobile wireless applications).

For mobile wireless applications, the MWAM runs five instances of the Cisco IOS software simultaneously. Each MWAM has one IOS application image—all processors on the MWAM are loaded with the same image. Mixed applications (for example, PDSN, GGSN, and SSG) on the same MWAM are *not* supported. The Catalyst 6500 chassis and Cisco 7600 chassis can accommodate multiple MWAMs. Therefore, multiple applications could run in the same chassis on different MWAMs.

Memory

As shown in Table 1-2 on page 1-5, each processor complex has a memory allocation that is based on the memory option purchased. Processor complex 0 has only one memory slot instead of two; therefore, processor 7 is disabled. This allows all MWAM processors (2-6) to have the same memory allocation, see "Configuring the MWAM Memory Allocation" section on page 6-17 for details on allocating IO memory.

Bootflash

Each processor complex has bootflash memory that it uses to store IOS configurations, crash information, Read Only Memory for Monitor (ROMMON) images, and variables for both processors. The 8 MB bootflash is partitioned as follows:

- IOS configuration—NVRAM 512 KB for each processor
- Backup configuration—NVRAM 512 KB for each processor (only for local mode operation)
- Crash information region—512 KB for each processor
- ROMMON Variables—64 KB for each processor
- Field-Upgradable ROMMON (FUR) 1 MB
- Standard ROMMON 1 MB

Caution The total disk space for bootflash memory cannot exceed 524,288 bytes. Also, no more than five files can be stored in bootflash memory. Ensure that enough disk space is available for a crash file by keeping no more than four files and using no more than approximately 300 KB of bootflash memory.

Both processors on a processor complex share the same physical bootflash memory. However, each processor has its own partition. If you list the directory of each processor, you observe that even though the processors share the same bootflash memory, the contents of each directory are unique. For example:

```
proc2#dir
Directory of bootflash:/

No files in directory

524288 bytes total (524288 bytes free)
proc2#


proc3#dir
Directory of bootflash:/

0  -rw-        1897   Jun 13 2003 22:25:41  running-config
1  -rw-        1897   Jun 14 2003 03:54:35  running-2

524288 bytes total (520110 bytes free)
```

Note Because the bootflash memory is shared by two processors, simultaneous read and write operations are not allowed. For example, if you issue the **copy running-config** command from MWAM processor 4 and then issue the **dir bootflash:** command from processor 5, the console returns a resource busy message because both processors share the same bootflash memory.

Compact Flash

The compact flash (cf) card is integrated with the processor control complex and is configured with the partitions listed in Table 1-3.

Table 1-3 Compact Flash Partitions[1]

Partition	Size	Description
1	16 MB	Maintenance Partition (boot partition)
2	1 MB	Maintenance Partition
3	7 MB	Maintenance Partition
4	100 MB	Application Partition (extended/boot partition)
5	16 MB	Application Partition (root partition)
6	48 MB	Application Partition (IOS image partition)
7	36 MB	Application Partition (logging/debugging partition)

1. Partitions, sizes, and descriptions listed here are introduced with IOS image 12.3(5a)B. Before this release, only six partitions were configured and sizes for the Application Partition were different from the values listed here.

Gigabit Ethernet Interfaces

Each processor complex shares one Gigabit Ethernet link to the switching fabric on the Catalyst 6500 switch or Cisco 7600 router. Gigabit Ethernet links to the switching fabric perform as 802.1Q trunks. Additional Gigabit Ethernet interfaces provide internal connections between the processor complexes and to the processor control complex.

Each of the three MWAM processor complexes has one Gigabit Ethernet interface (Gi0/0) that maps to the three Gigabit Ethernet interfaces known by the Supervisor module (see Figure 1-2 on page 1-5). Therefore two processors on each processor complex share a single Gigabit Ethernet interface. Each processor interface can be configured with multiple subinterfaces as required by the application.

Software Description

The MWAM requires two software components for its operation:

- Supervisor 2 Cisco IOS image—12.2(14)ZA or higher
- MWAM software

Supervisor 2 IOS Software Image

The first software component is the Cisco IOS image on the Catalyst 6500/Cisco 7600 Supervisor 2 Engine. This image on the Supervisor module recognizes and initializes the MWAM and its processors. You must use a Cisco IOS image that supports the MWAM—12.2(14)ZA or higher.

MWAM Software

The MWAM software resides in the compact flash (cf) card that is integrated with the processor control complex:

- Maintenance Partition (MP)—software required for base module initialization and daughter card control functions (identified as cf:1)
- Application Partition (AP)—the Cisco IOS image for the application (for example, GGSN, PDSN, or SSG) being installed (identified as cf:4)

The MWAM software on the compact flash card can be upgraded by the user through the Supervisor console. The upgrade process downloads the latest versions of the AP and MP images from the Cisco Software Center to the compact flash card.

The standard process involves booting the daughter card from the MP partition, copying the AP image to the compact flash card, then resetting the daughter card to the AP partition. Then, from the AP partition, you copy the MP image to the compact flash card. An inline IOS image upgrade procedure is also provided. See the "Standard Upgrade Procedures" section on page 5-4 of this guide for more information about these procedures.

The application processors (2-6) boot from processor 1. All processors run the same IOS application image.

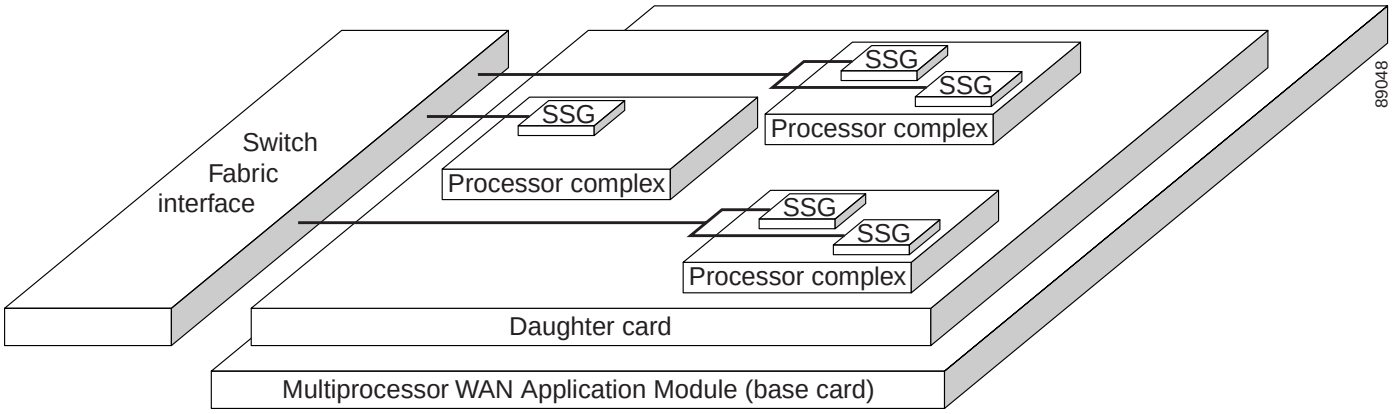
Supported Applications

The MWAM platform is not a generic platform and only the following application images are supported:

- GGSN - **c6svc5fmwam-g8is-mz**
- Home Agent - **c6svc5fmwam-h1is-mz**
- PDSN - **c6svc5fmwam-c6is-mz**
- SSG - **c6svc5fmwam-g4js-mz**

The MWAM architecture allows five mobile wireless applications to reside on a single MWAM. Figure 1-3 on page 1-9 shows an example of five SSGs on one module. Each Catalyst 6500/Cisco 7600 chassis can be populated with multiple MWAMs. Therefore, a chassis with three MWAMs can support 15 SSGs. The MWAM also supports the PDSN/HA and GGSN applications. Three MWAMs in a chassis can support, for example, five PDSNs, five SSGs, and five GGSNs.

Figure 1-3 Example of SSG Application on MWAM



Application Releases

Tip Some of the features and commands described in this publication are provided by the IOS image on the MWAM processors. The features and commands available to your application are dependent on the release level of this IOS image. See the "Features" section on page 1-10 of this chapter and the release notes for your application to determine the availability of specific features and commands.

For release notes and feature module descriptions of the mobile wireless applications that are supported on the MWAM, refer to the Cisco publications at the following URLs:

Cisco Gateway GPRS Support Node (GGSN)

http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123limit/123x/123xb/123xb2/ggsn40/index.htm

Cisco Mobile Wireless Home Agent: (HA)

http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122z/122zb8/ha12/index.htm

Cisco Packet Data Serving Node (PDSN)

http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122z/122zb8/pdsn12/index.htm

Cisco Service Selection Gateway (SSG)

http://www.cisco.com/en/US/products/sw/iosswrel/ps5413/prod_release_note09186a00801b43aa.html

http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123cgcr/wan_vcg.htm#1000988

http://www.cisco.com/en/US/products/sw/iosswrel/ps5413/products_feature_guides_list.html

Supervisor Releases

Tip Some of the features and commands described in this publication are provided by the IOS image on the Supervisor 2 module. The features and commands available to your application are dependent on the release level of the Supervisor 2 IOS image. Refer to the "Features" section and the release notes for your application to determine the availability of specific features and commands.

For information about the Supervisor image that supports the mobile wireless applications on the MWAM, refer to the Cisco publication at the following URL:

Supervisor Image That Supports MWAM Applications

http://www.cisco.com/univercd/cc/td/doc/product/lan/cat6000/122sx/ol_4164.htm

Features

Table 1-4 lists the MWAM features:

Table 1-4 MWAM Features and IOS Image Requirements

Feature Description	IOS Image Requirement
Multiple processors on one MWAM running a Cisco IOS software image that supports an application (PDSN/HA, GGSN, or SSG).	Different for each application (check the release notes for the application).
Cisco IOS software image on the MSFC2 (daughter card on the Supervisor module) that supports the application image on the MWAM.	Cisco IOS 12.2(14)ZA or higher.
Bulk storage of MWAM configurations on Supervisor bootflash.	Cisco IOS 12.2(14)ZA5 or higher.
Remote console to MWAM processors 2-6 to: • Unify command operations (debug control, system information display, file listing, and pinging MWAM processors from a single console) • Display output of show and debug commands (through remote VTY) • Direct MWAM logs to console, buffer, or SysLog	Cisco IOS 12.2(14)ZA4 or higher.
Assignment of MWAM traffic to VLAN Quality of Service (QoS)	Cisco IOS 12.2(14)ZA7 or higher.
Remote console support for MWAM processor 1 (processor control).	Cisco IOS 12.3(5a)B or higher.
Persistent log files.	Cisco IOS 12.3(5a)B or higher.
Inline IOS image upgrades	Cisco IOS 12.3(5a)B or higher.
1 Gigabyte memory per processor	Cisco IOS 12.3(7)T1 or higher.
Supervisor mode feature improvement	Cisco IOS 12.3(11)T or higher.

Bulk Storage of MWAM Configurations on Supervisor Bootflash

Note This feature requires Cisco IOS 12.2(14)ZA5 (or higher) on the Supervisor module.

Configuration files for MWAM processors can be stored in either of the following locations:

- NVRAM of each MWAM processor (local mode)
- Supervisor bootflash (Supervisor mode)

Local Mode

The MWAM provides local storage of IOS configurations in NVRAM. However, if a fully configured MWAM requires replacement, you must perform the following tasks:

1. Log into the Supervisor module.
2. Session sequentially into each processor on the MWAM to copy its configurations to a TFTP server.
3. Replace the MWAM.
4. Session sequentially into each processor on the new MWAM to restore the configurations from the TFTP server.

This replacement scenario requires time-consuming intervention by an operator. To reduce operator intervention, you can configure the MWAM to provide Supervisor (bootflash) storage instead of local (NVRAM) storage of configuration files.

Supervisor Mode

Note Feature Improvement. The Supervisor storage mode behavior has been updated (see the "Feature Improvement" section on page 1-13 for details).

The Supervisor storage mode allows MWAM configuration files to be stored in the Supervisor bootflash. This mode allows centralized management of all MWAM configuration files. In the Supervisor mode, when an MWAM is replaced all processors on the MWAM automatically load their configuration files from the Supervisor bootflash. *No* configuration files are contained locally in NVRAM.

The Supervisor module verifies that its bootflash contains a properly named configuration file for each MWAM processor. The following naming convention is used:

`SLOTxPCy.cfg`

The variable *x* represents the MWAM slot number and *y* represents the processor number. For example, SLOT6PC3.cfg is the configuration file for processor 3 on the MWAM in slot 6.

The following example shows the display of MWAM configuration files on the Supervisor module:

```
ce-cat6k-1# dir bootflash:
Directory of bootflash:/

    1  -rw-     1733412   May 28 2002 18:59:10  c6msfc2-boot-mz.121-11b.E
    2  -rw-    11280364   May 28 2002 18:59:22  c6msfc2-psv-mz.121-11b.E.bin
   73  -rw-          42   Jun 24 2003 22:24:31  SLOT4PC7.cfg
   74  -rw-        2876   Jun 24 2003 22:24:32  SLOT6PC2.cfg
   75  -rw-          42   Jun 24 2003 22:24:32  SLOT6PC3.cfg
```

```
 79  -rw-         482   Jun 24 2003 22:24:34  SLOT6PC7.cfg
 85  -rw-        2747   Jul 01 2003 19:56:02  SLOT6PC6.cfg
 86  -rw-         450   Jul 01 2003 19:58:04  SLOT4PC2.cfg
 87  -rw-         450   Jul 01 2003 19:58:47  SLOT4PC3.cfg
 89  -rw-         450   Jul 01 2003 20:02:25  SLOT4PC4.cfg
 90  -rw-         450   Jul 01 2003 20:03:30  SLOT4PC5.cfg
 91  -rw-         450   Jul 01 2003 20:04:13  SLOT4PC6.cfg
107  -rw-         455   Jul 16 2003 11:31:50  SLOT6PC5.cfg
109  -rw-         505   Jul 25 2003 08:43:55  SLOT6PC4.cfg
```

If a standby (slave) Supervisor is installed, the slave bootflash stores backups of the MWAM configuration files that are on the master Supervisor. If a difference is detected between corresponding files on the active and standby Supervisor modules, the file on the bootflash is copied over from the file on the slave bootflash. This compare and copy operation occurs after MWAM replacement or when the active Supervisor module detects that a standby Supervisor module is installed.

When operating in Supervisor mode, the NVRAM on the MWAM does not keep a backup configuration file. Instead, the backup files for MWAM configurations are stored on the standby Supervisor. The following example shows the display of MWAM configuration files on the standby Supervisor module:

```
ce-cat6k-1# dir slavebootflash:
Directory of slavebootflash:/

  1  -rw-     1693168   May 08 2003 02:18:54  c6msfc2-boot-mz.121-8a.EX
  2  -rw-    27411228   May 28 2003 19:39:52  c6k222-jsv-mz.122-14.ZA1.bin
877  -rw-         450   Jul 25 2003 08:26:41  SLOT4PC2.cfg
878  -rw-         450   Jul 25 2003 08:26:42  SLOT4PC3.cfg
879  -rw-         450   Jul 25 2003 08:26:42  SLOT4PC4.cfg
880  -rw-         450   Jul 25 2003 08:26:43  SLOT4PC5.cfg
881  -rw-         450   Jul 25 2003 08:26:44  SLOT4PC6.cfg
882  -rw-          42   Jul 25 2003 08:26:44  SLOT4PC7.cfg
883  -rw-        2876   Jul 25 2003 08:26:45  SLOT6PC2.cfg
884  -rw-          42   Jul 25 2003 08:26:46  SLOT6PC3.cfg
886  -rw-         455   Jul 25 2003 08:26:47  SLOT6PC5.cfg
887  -rw-        2747   Jul 25 2003 08:26:48  SLOT6PC6.cfg
888  -rw-         482   Jul 25 2003 08:26:49  SLOT6PC7.cfg
889  -rw-         505   Jul 25 2003 08:43:36  SLOT6PC4.cfg
```

Caution If a standby Supervisor module is not equipped, copy all MWAM configuration files from the active Supervisor module to a TFTP server. Failure to take this precaution may result in the loss of all MWAM configuration files (if the Supervisor module fails).

Note The Supervisor mode is the default mode of operation for all new MWAMs. To convert an existing MWAM from local mode to Supervisor mode, session to the processor level and issue the **mwam config-mode supervisor** command.

The following commands are provided for storage mode configuration:

- **mwam bootflash access**
- **mwam config-mode** [**local** | **supervisor**]
- **show mwam config-mode**

  See Appendix A, "Command Reference" of this guide for syntax and usage guidelines.

Tip Best operating practice is to configure all MWAMs in a chassis for either local mode or Supervisor mode (no mixing of local-mode and Supervisor-mode MWAMs in the same chassis).

Feature Improvement

The following feature improvement introduces new behavior when operating in the Supervisor mode. This feature improvement is implemented in Cisco IOS 12.3(13)T and later releases.

New Behavior

When operating in the Supervisor mode, the running configuration is written to the following locations when the MWAM image is reloaded:

- Supervisor bootflash on the active Supervisor module
- Supervisor slave bootflash on the standby Supervisor module
- NVRAM on the MWAM (cached copy only)

Previously, the mode of operation (Supervisor or local) was determined by the contents of the configuration file in the NVRAM. If the file was empty (0 bytes long), the mode was set to Supervisor; if the file was not empty, the mode was set to local. With this feature improvement, the mode of operation is now determined by the setting of a persistent flag.

The previous behavior read the configuration file in the Supervisor directly into the running image. Now when a processor is reloaded and the MWAM initializes in Supervisor mode, the configuration file is copied from the Supervisor bootflash to the NVRAM.

Note If the configuration file is completely missing from the Supervisor at the time the processor is reloaded, the cached copy in the NVRAM will remain intact. If there is any configuration file on the Supervisor bootflash and **mwam bootflash access** is on (default), the configuration file will be loaded and will overwrite the cached configuration file in the NVRAM.

Another difference in the behavior of this feature concerns the CLI prompt. Previously, the CLI prompt was displayed before the configuration was downloaded from the Supervisor module. With the improved feature, no prompt is displayed until the configuration completes its download to the NVRAM. If there is a problem with configuration download, the attempt times out in 12 minutes.

See the "Converting to Supervisor Mode" section on page 6-15 for new behavior when converting to the Supervisor mode.

New CLI

On the MWAM console, a new optional keyword is added to the **mwam config-mode** command:

```
mwam config-mode {local|supervisor} [nowrite]
```

Use the **nowrite** option to change the mode without changing the contents of the configuration on the Supervisor (if Supervisor mode) or NVRAM (if local mode).

Note This feature improvement is implemented in Cisco IOS 12.3(13)T and later releases.

A new command is available at the PC console:

boot-mode {**supervisor**|**local**} [*complex*|**all**]

Note This feature improvement is implemented in AP version 2.1(2.0) and later releases.

For more information on these commands, see Appendix A, "Command Reference".

Remote Console for MWAMs

Note The Remote Console and Logging feature requires Cisco IOS 12.2(14)ZA4 (or higher) on the Supervisor module.

The remote console for MWAMs allows operators to use the existing Supervisor console as a single connection point to control debugging, display show commands, and view logging output for MWAM processors 2-6. The remote console has three related components:

- A mechanism for unified command operations from the Supervisor console to MWAM processors in the chassis
- A remote Virtual Terminal Line (VTY) to display the output of show and debug commands
- A remote logging utility to direct logging output from individual MWAM processors to any currently supported logging facility in the chassis (console, buffer, or SysLog)

The User Data Protocol (UDP) transports the remote console commands, VTY output, and logging information. Initially, the traffic flows through the processor control complex, which allows logging information to be relayed to the Supervisor module before the MWAM processors have been configured. When the MWAM processors are configured, the traffic can continue to be transmitted through the processor control complex, or it can be redirected to the switching fabric using a configuration command on the MWAM processor.

Unified Command Operations

The remote console provides a mechanism to execute supported commands on a specified MWAM processor in the chassis. The targeted processor receives the command through a registered UDP port, reassigns its VTY to the remote VTY, and executes the command. When the command operation completes, the VTY is restored.

The supported commands for unified operation from the remote console are listed alphabetically in Table 1-5.

Table 1-5 Unified Command Set

Command	Description
debug	Enables debugging functions
dir	Lists files in a file system
log dir	Logs the dir command to SysLog
log show	Logs the show command to SysLog
log systat	Logs the systat command to SysLog

Table 1-5 Unified Command Set (continued)

Command	Description
mwam	Allows remote execution of **mwam config-mode local** and **mwam config-mode supervisor** commands
ping *ip_address*	Executes a ping on a remote processor
show	Displays running system information
systat	Displays information about terminal lines
undebug	Disables debugging functions

The mechanism for unified command operation is provided in the following command:

execute-on *slot processor command*

The *slot* and *processor* variables represent the MWAM slot and processor numbers. The *command* variable can be any command in the unified command set listed in Table 1-5. Additional syntax and usage guidelines are provided in Appendix A, "Command Reference" of this guide.

Remote Console Support for the Processor Control Complex

This feature is introduced with Cisco IOS release 12.3(5a)B.

Remote console support for the processor control complex allows you to access the processor control complex using the **execute-on** command. With this feature, you can execute processor control commands from the Supervisor console (see the "Processor Control Commands" section on page A-16); you do not have to session down to the processor control complex. To enable remote console support for the processor control complex, configure UDP port 4000 on the Supervisor and the MWAM processor (see the "Configuring Remote Console and Logging" section on page 6-16 of this guide.).

The supported commands for processor control complex unified operation are listed alphabetically in Table 1-6.

Table 1-6 Processor Control Complex Unified Command Set

Command	Description
boot-mode	Set MWAM processors to boot Supervisor or Local configurations
clear	Clears logging information
logout	Logout of shell
normal-ios	Boot IOS with normal configuration
password	Set the password of the current user
recover-ios	Boots IOS with clean configuration
reload	Reloads MWAM processors or complexes
restore ios	Restores previous images following upgrade
show	Displays running system information

The mechanism for unified command operation is provided in the following command:

execute-on *slot processor command*

The *slot* variable represents the MWAM slot and the *processor* variable is always 1 for the processor control complex (see Table 1-2 on page 1-5). The *command* variable can be any command in the processor control complex unified command set listed in Table 1-6 on page 1-15. Additional syntax and usage guidelines are provided in Appendix A, "Command Reference" of this guide.

Show and Debug Display

The remote VTY function directs output from executive level commands to the appropriate console. Commands that are received and processed by the MWAM processor are directed to a remote VTY process on the Supervisor module. The remote VTY process directs the output to the Supervisor level for either:

- Remote display of command output during normal operation
- Logging of show output to capture failure information of an MWAM processor

MWAM Logging to Console, Buffer, or SysLog

The remote logging capability uses logging information from the MWAM logger process. When the MWAM attempts to log an event, the MWAM logger process invokes a list of destinations for the log. If the Supervisor logger is enabled on the MWAM processor, then the log flows through the remote VTY and is processed by the Supervisor. At the Supervisor, the log can be directed to one or more of several destinations including console, buffer, or SysLog.

Logs received by the Supervisor are prefixed with information that identifies which processor generated the log. Examples of log messages follow.

Processor 5 on the MWAM in slot 6 generated the following error message:

```
MWAM 06/5: 00:02:05: %SNMP-5-MODULETRAP: Module 6 [Up] Trap
```

Processor 4 on the MWAM in slot 2 generated the following debug message:

```
MWAM 02/4: 00:03:42: ICMP: echo reply sent, src 10.10.10.2, dst 10.10.10.1
```

Using the Log Option

When using the **execute-on** *slot processor* **log show** command, the volume of logging information can be large. Under these conditions, the console processing can load down the Supervisor CPU.

To prevent overloading the console, two options are available:

1. Configure the logging console feature as follows:

   ```
   no logging console guaranteed
   ```

   This configuration allows the output to be dropped when the console backs up.

2. Configure the logging console debug as follows:

   ```
   no logging console debug
   ```

   This configuration directs the output to other logging endpoints, such as buffer or SysLog.

Note These configurations are only necessary if command output is expected to be significant (for example, more than 100 lines of output).

Example Usage

The following examples illustrate ways you can use the Remote Console and Logging feature to manage MWAM processors from the Supervisor console.

Show Logs for All MWAM Processors

You can display logging information for all MWAM processors in a chassis with a single command from the Supervisor console. First, configure each MWAM processor to locally store logs (in each processor). You can set the buffer logging level on each processor to include the required level of information (the default setting is the debug level). Then you can display logs for all the processors in the chassis by entering the following command from the Supervisor console:

```
Sup-7600# execute-on all all show logging
```

Show Image Version of All MWAM Processors

You can display the software image versions running on all MWAM processors in a chassis with a single command from the Supervisor console. The following example illustrates this capability:

```
Sup-7600# execute-on all all show version

----------- Slot 3/CPU 2, show ver-------------
Cisco Internetwork Operating System Software
IOS (tm) MWAM Software (MWAM-G7IS-M), Experimental Version
12.3(20031015:202420) [GGSN_R3_R4_1015_1 103]
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Wed 15-Oct-03 15:53 by tester
Image text-base:0x20200D40, data-base:0x21168000

ROM:System Bootstrap, Version 12.2(11r)YS1, RELEASE SOFTWARE (fc1)

Router uptime is 2 days, 23 hours, 52 minutes
System returned to ROM by power-on
System restarted at 01:09:42 UTC Tue Oct 21 2003
System image file is "svcmwam-g7is-mz.r3_r4-1015"

Cisco MWAM (MWAM) processor with 473088K/32768K bytes of memory.
SB-1 CPU at 700Mhz, Implementation 1, Rev 0.2

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
1 Gigabit Ethernet/IEEE 802.3 interface(s)
511K bytes of non-volatile configuration memory.

Configuration register is 0x0


----------- Slot 3/CPU 3, show ver-------------
Cisco Internetwork Operating System Software
IOS (tm) MWAM Software (MWAM-G7IS-M), Experimental Version
12.3(20031015:202420) [howang-GGSN_R3_R4_1015_1 103]
Copyright (c) 1986-2003 by cisco Systems, Inc.
```

```
Compiled Wed 15-Oct-03 15:53 by howang
Image text-base:0x20200D40, data-base:0x21168000

ROM:System Bootstrap, Version 12.2(11r)YS1, RELEASE SOFTWARE (fc1)

Router uptime is 2 days, 23 hours, 52 minutes
System returned to ROM by power-on
System restarted at 01:10:19 UTC Tue Oct 21 2003
System image file is "svcmwam-g7is-mz.r3_r4-1015"

Cisco MWAM (MWAM) processor with 473088K/32768K bytes of memory.
SB-1 CPU at 700Mhz, Implementation 1, Rev 0.2

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
1 Gigabit Ethernet/IEEE 802.3 interface(s)
511K bytes of non-volatile configuration memory.

Configuration register is 0x0
```

Tip To minimize the command output, you can use the pipe (|) support to include only lines of text that match the regular expression following the pipe. For example:

```
Sup-7600# execute-on all all show version | include image
```

Persistent Log Files

This feature was introduced with Cisco IOS release 12.3(5a)B.

Logs are stored on the processor control complex. These logs can be used to help diagnose system failures.

Inline IOS Image Upgrades from AP

This feature was introduced with Cisco IOS release 12.3(5a)B.

The "Inline IOS Image Upgrade Procedure" section on page 5-8 is similar to the AP upgrade in that both procedures upgrade the image used by the application. However, the inline IOS image upgrade is performed from the AP, not the MP; therefore, you do not have to reset the module. This significantly reduces the amount of down time associated with module resets.

Note After performing the inline IOS image upgrade, you must reload the MWAM processor(s).

AP 2.1(2.0) Unsolicted SCP Message

The latest version of AP 2.1(2.0) now sends an unsolicited SCP message to the Supervisor indicating that it supports SSO (stateful switchover). If you are running an older Supervisor image which does not recognize this message, then you will get the "unsolicited message" indicator. Ignore this message as it does not mean anything.