

Cisco 1600 Series Memory Architecture

Cisco 1600 series routers from Cisco Systems have two memory architectures: run-from-Flash (RFF) and run-from-RAM (RFR). Router model names with an R (such as 1601 R) are RFR routers; all other models are RFF. In this document, model names without an R refer to both RFF and RFR models, except where noted. This document describes the two memory architectures used in the Cisco 1600 series routers.

Run-from-RAM Architecture

With RFR, the Cisco IOS® software image is stored in Flash memory (usually in compressed form), but is loaded into RAM before being executed by the router. Because the running software image then resides in RAM, a new software image can be downloaded and copied over the software image stored in Flash memory.

In RFR routers, only a minimal boot-helper image is stored in the ROM for disaster recovery (such as the Cisco IOS software image in Flash becomes corrupted). Initial loading of a software image into Flash memory is done over the console port or the local Ethernet port.

Because the Cisco IOS software image is stored in compressed form in Flash memory and then decompressed when loaded into RAM, the standard configuration for the RFR models contains less Flash memory but more DRAM than the RFF models.

Run-from-Flash Architecture

With RFF, the router executes the uncompressed Cisco IOS software image stored in Flash memory. RAM stores working data such as Cisco IOS data structures, network routing tables, and packets to be transmitted to and received from network interfaces.

The running software image cannot be used to download new software to Flash memory because it would attempt to overwrite itself. (However, when you are using Dual Flash Bank memory, you can download the new software image into a different Flash memory partition.)

To download a new software image without using Dual Flash Bank memory, a boot-helper image (called XBOOT) has been added to the ROM on the RFF models. The boot-helper image is a small subset of Cisco IOS software that supports only a subset of the WAN interfaces and the protocols. RFF ROM supports the following WAN interfaces. (These are all onboard interfaces, not WAN-interface-card interfaces.)

- Serial (synchronous and asynchronous) (Cisco 1601)
- Digital service unit/channel service unit (DSU/CSU) (Cisco 1602)
- ISDN S/T (Cisco 1603)
- ISDN U (Cisco 1604 and Cisco 1604 R)

When upgrading the Cisco IOS software in Flash memory, you must boot the router from the ROM image. The Flash memory can be overwritten because the Cisco IOS software that is stored in Flash memory is not being used to run the router. Table 1 is a summary comparison of these two memory architectures.

Table 1 Memory Architecture Comparison

Feature	Run-from-Flash Routers	Run-from-RAM Routers
Cisco IOS Software Online Download	Yes, when using Dual Flash Bank memory	Yes
Flash Memory Use	<ul style="list-style-type: none"> Stores uncompressed Cisco IOS software image The Flash PC card cannot be removed when the router is operating 	<ul style="list-style-type: none"> Stores compressed Cisco IOS software image The Flash PC card can be removed after the router has finished booting up and has passed the power-on self-test
RAM Use	<ul style="list-style-type: none"> Packet memory Routing tables Dynamic memory used by Cisco IOS software 	<ul style="list-style-type: none"> Packet memory Routing tables Dynamic memory used by Cisco IOS software Running uncompressed Cisco IOS software image
DRAM Capacity	<ul style="list-style-type: none"> Standard: 2 MB on board Maximum: 18 MB (with 16-MB SIMM) 	<ul style="list-style-type: none"> Standard: 8 MB on board Maximum: 24 MB (with 16-MB SIMM)
Flash PC Card Capacity	<ul style="list-style-type: none"> Standard: 4 MB Maximum: 16 MB 	<ul style="list-style-type: none"> Standard: 2 MB Maximum: 16 MB
Disaster Recovery (Router Fails and Image Store in Flash Memory Is Corrupted)	<ul style="list-style-type: none"> Cisco IOS software image can be downloaded over any interface and with any WAN protocol supported by the ROM boot helper Cisco IOS software image can be downloaded over the console port by using the xmodem or ymodem commands Flash PC card can be upgraded by booting from a Cisco IOS software image stored in another Flash memory bank (if using Dual Flash Bank memory) 	<ul style="list-style-type: none"> Cisco IOS software image can be downloaded with the ROM boot helper over the Ethernet 0 interface Cisco IOS software image can be downloaded over the console port by using the xmodem or ymodem commands Flash PC card can be upgraded by booting from a Cisco IOS software image stored in another Flash memory bank (if using Dual Flash Bank memory)

Identifying the Memory Architecture from Cisco IOS Software

Use the Cisco IOS “show version” command to display some memory architecture information for your router (show in boldface in the example output):

- Amount of onboard DRAM (a type of RAM)
- Whether the Cisco IOS software is running from RAM or Flash memory
- Amount of Flash memory

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Router#sh ver
Cisco Internetwork Operating System Software
IOS (tm) 1600 Software (C1600-BNSY-M), EARLY DEPLOYMENT RELEASE SOFTWARE
11.2(9)P
Copyright (c) 1986-1997 by cisco Systems, Inc.
Compiled Mon 11-Aug-97 14:10 by claux
Image text-base: 0x02005000, data-base: 0x02477BD0
ROM: System Bootstrap, Version 11.1(12)AA, EARLY DEPLOYMENT RELEASE
SOFTWARE (f)
ROM: 1600 Software (C1600-RBOOT-R), Version 11.1(12)AA, EARLY DEPLOYMENT
RELEASE
Router uptime is 12 minutes
System restarted by power-on
System image file is "flash:c1600-bnsy-mz", booted via flash
cisco 1605 (68360) processor (revision C) with 7680K/512K bytes of memory.
Processor board ID 06027889, with hardware revision 00000000
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
2 Ethernet/IEEE 802.3 interface(s)
System/IO memory with parity disabled
8192K bytes of DRAM onboard
System running from RAM
8K bytes of non-volatile configuration memory.
4096K bytes of processor board PCMCIA flash (Read/Write)
Configuration register is 0x2102
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Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

European Headquarters
Cisco Systems Europe s.a.r.l.
Parc Evolic, Batiment L1/L2
16 Avenue du Quebec
Villebon, BP 706
91961 Courtaboeuf Cedex
France
<http://www-europe.cisco.com>
Tel: 33 1 69 18 61 00
Fax: 33 1 69 28 83 26

Americas
Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-7660
Fax: 408 527-0883

Asia Headquarters
Nihon Cisco Systems K.K.
Fuji Building, 9th Floor
3-2-3 Marunouchi
Chiyoda-ku, Tokyo 100
Japan
<http://www.cisco.com>
Tel: 81 3 5219 6250
Fax: 81 3 5219 6001

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