

Comparison of Cisco 1601–Cisco 1604 and Cisco 1605–R Memory Architectures

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Introduction

The Cisco 1605–R router has a number of memory architecture differences from the Cisco 1601–Cisco 1604 routers.

Before You Begin

Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

Prerequisites

There are no specific prerequisites for this document.

Components Used

This document is not restricted to specific software and hardware versions.

Comparison Table

The differences between the Cisco 1605–R and the Cisco 1601–Cisco 1604 routers are summarized in the table below.

Feature	Cisco 1601–Cisco 1604	Cisco 1605–R
Memory Architecture	Run From Flash.	Run From RAM.

Motherboard Memory	2 MB plus one SIMM socket (maximum 18 MB).	8 MB plus one SIMM socket (maximum 24 MB).
Flash Memory (PC Card)	4 MB, 6 MB, 8 MB, 12 MB Flash cards with 80 nanosecond access time. Use of 120 nanosecond Flash degrades system performance.	2 MB, 4 MB, 6 MB, 8 MB, 12 MB Flash cards, supports 80 or 120 nanosecond access time with no performance penalty.
Boot ROMs	Boot helper (RXBOOT) supports LAN, on-board WAN, and some WAN Interface Cards (WICs).	Boot helper (RXBOOT) supports Ethernet 0 only.

Cisco IOS® routers have two memory architectures for running Cisco IOS images. The IOS can run directly where it is stored in Flash memory, which is called "run from Flash." The IOS can also be copied into Random Access Memory (RAM) and executed in RAM. This is called "run from RAM."

Run From Flash

Cisco routers that use a "run-from-Flash" architecture include the Cisco 1601–Cisco 1604 and the Cisco 2500 series.

Because the router is running from the Flash memory, you cannot download a new version of the Cisco IOS to the Flash memory where the running IOS image is stored. In the run-from-Flash architecture, the IOS cannot be compressed.

There are two ways to update the Cisco IOS image: use the boot helper in ROM or use the IOS feature dual Flash bank.

The Boot Helper

The boot helper (also referred to as "XBOOT") is a small subset of Cisco IOS that is used for network booting and loading IOS images. On the Cisco 1600 Series, the boot helper is burned into a physical ROM on the motherboard. The boot helper needs to support the physical media (for example, Ethernet, Serial, or ISDN BRI) and the WAN protocol (for example, Frame Relay, X.25, or PPP) in use on the router port that you wish to use for the Cisco IOS download. If you need to support a new physical interface, a new WAN protocol, or a bug fix in the boot helper, you need to update the boot helper. On the Cisco 1600 you must replace the physical ROMs on the motherboard.

The table below describes the interfaces supported by the Boot Helper.

Router	Ethernet	Serial	On-board 56K CSU/DSU	On-board ISDN BRI	WIC-1T	WIC-1B-S/T, WIC-1B-U	WIC-1DSU-56K4	WIC-1B-S/T-L1
Cisco 1601	yes	yes			yes	yes	Not Supported by the Boot Helper	Not Supported by the Boot Helper
Cisco 1602	yes		yes		yes	yes	Not Supported by the Boot Helper	Not Supported by the Boot Helper

Cisco 1603	yes			yes	yes		Not Supported by the Boot Helper	Not Supported by the Boot Helper
Cisco 1604	yes			yes	yes		Not Supported by the Boot Helper	Not Supported by the Boot Helper
Cisco 1605–R	Ethernet 0 only						Not Supported by the Boot Helper	Not Supported by the Boot Helper

Flash Load Helper is a Cisco IOS feature that assists in loading Cisco IOS images in a run–from–Flash architecture. When you issue the command **copy tftp flash**, Cisco IOS will prompt check to see if you want to overwrite the Cisco IOS image that the IOS is running from. If so, the Flash Load Helper invokes the boot helper in ROM in order to download the new Cisco IOS image. When using the boot helper, the router stops running the Cisco IOS image in Flash, and transfers operation to the boot helper for the duration of the image load. This means that the router is off–line and does not route network traffic during the download.

Dual Flash Bank

Dual Flash bank works by dividing the Flash memory into two partitions. Each partition holds a Cisco IOS image; therefore, the router must have enough Flash memory to hold two IOS images. You partition the Flash memory with the global configuration command **partition flash 2**.

When the Cisco IOS is running from one partition, you can download a Cisco IOS image into another partition. This download happens while the Cisco IOS is running and forwarding network traffic.

Run From RAM

Cisco routers such as the 1000, 3600, 4x00, and 7x00 series run from RAM. The Cisco 1605–R also runs from RAM. If you network–boot any Cisco router, (including the Cisco 1601–Cisco 1604 and Cisco 2500 series) it will run from RAM.

In a run–from–RAM architecture, the Cisco IOS image can be compressed and stored in Flash memory. This reduces the amount of Flash memory required to store the software. The router will decompress the Cisco IOS image and copy it into RAM in order to run Cisco IOS.

Cisco IOS image downloads are done while the router is online. The router continues to forward network traffic while the download is taking place. The Cisco IOS image download can take place using any network interface and protocol that the running image supports.

The table below shows a comparison of Cisco 1601–1604 with Cisco 1605–R memory architectures.

Feature	Cisco 1600 Run from Flash	Cisco 1600 Run From RAM
Performance	Up to 4,000 packets per second fast–switched.	Up to 5,200 packets per second fast–switched. Up to 30% faster in CPU–intensive operations.
Online Cisco IOS Downloads	Only when using dual Flash bank.	Yes. Download is also faster because the Cisco IOS image is compressed.

Boot ROM Upgrades	Boot ROM upgrades are required to support Cisco IOS downloads over new interfaces and WAN protocols (unless using dual Flash bank).	Infrequent boot ROM upgrades because Cisco IOS downloads do not use the boot helper in ROM.
Flash Memory Usage	Requires enough Flash memory to hold an uncompressed Cisco IOS image. Flash card cannot be removed while the router is running.	Requires less Flash memory to hold a compressed Cisco IOS image. Flash card can be removed after the router has booted.
RAM Usage	RAM is used to hold packet memory, routing tables, and dynamic memory used by Cisco IOS.	RAM must also hold the running Cisco IOS image (uncompressed).
Recovery From Damaged Or Missing Cisco IOS Image In Flash	Download Cisco IOS image over any interface and WAN protocol supported by the boot helper in ROM. Download Cisco IOS image via the console using XMODEM/YMODEM. Boot from a Cisco IOS image in another Flash bank (dual Flash bank). Insert PC Card Flash card with valid Cisco IOS image.	Download Cisco IOS image over Ethernet 0 interface in boot helper in ROM. Download Cisco IOS image via the console using XMODEM/YMODEM. Boot from a Cisco IOS image in another Flash bank (dual Flash bank). Insert PC Card Flash card with valid Cisco IOS image.

Managing Cisco 1600 Memory Architectures

The following table shows the memory requirements for Cisco IOS 11.2P.

Cisco IOS Feature Set	Cisco 1600 Run From Flash	Cisco 1600 Run From Flash	Cisco 1600 Run From RAM	Cisco 1600 Run From RAM
IP Only	4 MB	RAM 2 MB	Flash 2 MB	RAM 8 MB
IP Plus	6 MB	4 MB	4 MB	8 MB

IP/IPX	4 MB	2 MB	2 MB	8 MB
IP/IPX Plus	6 MB	4 MB	4 MB	10 MB
IP/AT	4 MB	2 MB	2 MB	8 MB
IP/AT Plus	6 MB	4 MB	4 MB	10 MB
IP/IPX/AT	6 MB	4 MB	4 MB	8 MB
IP/IPX/AT Plus	6 MB	4 MB	4 MB	10 MB
IP/IPX/IBM	6 MB	4 MB	4 MB	10 MB
IP/IPX IBM Plus	8 MB	4 MB	4 MB	12 MB

Identifying Run-From-Flash Versus Run-From-RAM Images

Cisco 1600 series Cisco IOS image file names use the following format:

```

c1600-bnsy56-l-112-9.P
c1600          Platform Identifier
c1600 = Cisco 1600 Series

bnsy56        Cisco IOS Feature Set
b = Appletalk
n = Novell IPX
r2 = IBM features
s = Plus features
y = IP
40 = 40 bit encryption
56 = 56 bit encryption

l Image type
  l = relocatable, can run from Flash in any partition, or in RAM
  m = run from RAM
  z = compressed

112-9.P Cisco IOS version

```

Identifying The Memory Architecture from Cisco IOS

The Cisco IOS **show version** command has been enhanced to report several new items to manage the memory architecture. The router will display how much RAM is physically on the motherboard and whether the router is running from Flash or from RAM. Here is an example of a **show version** command from a Cisco 1605-R:

```

Router#show version
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
```

Converting the Cisco 1601–1604 to Run From RAM

The Cisco 1601–1604 routers can be converted to run from RAM by adding enough RAM to the router, then loading a run–from–RAM image for the 1605–R (with "mz" in the image file name). There is no boot ROM upgrade required.

You cannot convert the Cisco 1605–R to a run–from–Flash architecture. If you load a relocatable image into the Cisco 1605–R, it will copy the image into RAM in order to run Cisco IOS.

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