



Developer Note

Apple Workgroup Server 9650/350




Developer Note

8/7/97

Apple Technical Publications

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About This Developer Note

This developer note describes the Apple Workgroup Server 9650/350, which is an enhanced version of the Workgroup Server 9650/233. This developer note describes only the changes that make the new Workgroup Server 9650/350 different from its predecessor and its Power Macintosh counterpart. For information about earlier models, see “Supplemental Reference Documents,” later in this preface.

This developer note is intended to help hardware and software developers design products that are compatible with the Macintosh products described here. If you are not already familiar with Macintosh computers or if you would simply like additional technical information, you may wish to read the supplementary reference documents described in this preface.

This note is published only in electronic form, as an Adobe™ Acrobat™ PDF (portable document file). The file is available from two sources:

- on the World Wide Web at <<http://devworld.apple.com/dev/devnotes/dntable1.html>>
- on the Reference Library Edition of the Developer CD Series, which is distributed as part of the monthly mailing to registered developers

IMPORTANT

This note contains preliminary information about forthcoming Apple products. The information in this note is subject to change; no representation or guarantee is made about its accuracy or completeness. ▲

Contents of This Note

This note has only one chapter: a delta guide describing the differences between the Workgroup Server 9650/350 model and the Power Macintosh 9600 computer upon which it is based. Because the note is so short, it has no index.

Supplemental Reference Documents

Developers should have the developer notes that describe the earlier counterparts of the new model. The relevant developer notes are:

- *Power Macintosh 9500 Computer*

- *Power Macintosh 7300, 7600, 8600, and 9600 Computers*
- *Enhanced Power Macintosh 8600 and 9600 Computers*

Acrobat PDF versions of these developer notes are available on the Developer CD and on the World Wide Web at <<http://devworld.apple.com/dev/devnotes/dntable1.html>>.

Note

Developer notes are not available in printed form. The PDF files are designed so that developers may print them for their own use. ◆

For a description of the version of the Mac OS that comes with the new models, developers should refer to the Technotes about System 7.6.1 and Mac OS 8. Technotes are available on the Developer CD Series and on the Technote web site at <<http://devworld.apple.com/dev/technotes.shtml>>. Printed copies of Technotes are available from Field Copy and Printing, telephone 1-415-323-3155.

Developers should also have copies of the relevant books of the *Inside Macintosh* series, available in technical bookstores.

Additional information about Apple server products can be found on the Apple Product Information web site at <<http://www.servers.apple.com>>.

Conventions and Abbreviations

This developer note uses the following typographical conventions and abbreviations.

Typographical Conventions

Note

A note like this contains information that is of interest but is not essential for an understanding of the text. ◆

IMPORTANT

A note like this contains important information that you should read before proceeding. ▲

Abbreviations

When unusual abbreviations appear in this developer note, the corresponding terms are also spelled out. Standard units of measure and other widely used abbreviations are not spelled out.

P R E F A C E

Here are the standard units of measure used in this developer note:

GB	gigabytes	MB	megabytes
Hz	hertz	MHz	megahertz
KB	kilobytes	V	volts

Other abbreviations used in this note include:

ADB	Apple Desktop Bus
AWAC	audio waveform amplifier and converter
CD-ROM	compact disc read-only memory
CPU	central processing unit, the PowerPC microprocessor is a CPU
DAT	digital audio tape, a high capacity storage medium
DDC1	digital data channel one
DDC2b	digital data channel two b
DIMM	Dual Inline Memory Module
DRAM	dynamic RAM
EDO	extended data out
FPM	fast page mode
GCR	group code recording, a floppy disk format
IC	integrated circuit
I/O	input/output
JEDEC	Joint Electron Device Engineering Council
L1	level 1 or first level, a type of cache
L2	level 2 or second level, a type of cache
MESH	an Apple custom IC
PCI	Peripheral Component Interconnect, an industry-standard expansion bus
PDF	portable document file
PRAM	parameter random-access memory
RAM	random-access memory
ROM	read-only memory
RTC	real time clock
SCC	Serial Communications Controller
SCSI	Small Computer System Interface
SGRAM	synchronous graphics random access memory
SWIM	Super Woz Integrated Machine, custom IC that controls the floppy disk interface
VGA	video graphics adapter
VIA	versatile interface array

P R E F A C E

Workgroup Server 9650/350

Workgroup Server 9650/350

The Workgroup Server 9650/350 is an enhanced version of the Workgroup Server 9650/233 and is based on the design of the new Power Macintosh 9600/350 computer. This chapter is a delta guide—it describes only the changes in features from the previous Workgroup Server 9650/233 model and its Power Macintosh 9600 counterpart. For descriptions of the Power Macintosh 9600 models, see “Supplemental Reference Documents” on page vii.

New Features

The Workgroup Server 9650/350 has a higher processor clock speed than its Workgroup Server 9650/233 predecessor and other performance improvements, which are described in this chapter.

The new features in the Workgroup Server 9650/350 model are:

- a new processor card with 1 MB of Apple inline cache (level 2)
- a new PowerPC microprocessor, code named Mach 5
- faster processor speed: 350 MHz
- a system bus speed of 50 MHz and a CPU to system bus ratio of 7:1
- the processor to inline level 2 cache speed is 100 MHz
- Ultra Wide SCSI-3 PCI card with 2x to 3x performance increase over SCSI-2, supports 4 internal SCSI-3 devices
- dual 4 GB Ultra Wide SCSI-3 hard drives with 16-bit data path
- a built-in 24X-speed SCSI CD-ROM drive
- 3D accelerated PCI graphics display card
- 10/100 Base-Tx Fast-Ethernet PCI card
- the latest version of the Mac OS: System 7.6.1

The new features are described in the following sections

New Processor Card

The only architectural difference between the new model and its older counterpart is a new type of processor card, the Apple Inline Cache Processor Card. The new processor card includes 1 megabyte of Apple inline cache (level 2) and a cache controller. Figure 1-1 on page 4 is a simplified block diagram of the Workgroup Server 9650/350 computer, showing the inline cache and controller on the processor card.

Having the inline L2 cache on the processor card provides improved performance compared with previous models because data moves between the cache and the microprocessor over a bus with a faster clock speed (100 MHz). In the previous design, the cache was connected to the 50 MHz system bus on the main logic board.

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The new processor card is designed around the Brick custom IC, which controls the inline cache and the bus traffic to and from the microprocessor, the cache, and the main system bus. The Brick IC makes all bus cycles from the main system bus available for the microprocessor's internal L1 cache as well as the inline L2 cache.

IMPORTANT

The control logic on the main logic board has been changed to support the inline cache on the processor card. The new processor card will not work in an older model Workgroup Server 9650/233. ▲

Mach 5 Microprocessor

The Workgroup Server 9650/350 uses a new microprocessor, code named Mach 5, that is based on the 604e architecture. Among the features of the Mach 5 microprocessor are:

- on-chip data and instruction caches of 32 KB each
- processor clock speed up to 7 times the bus clock speed

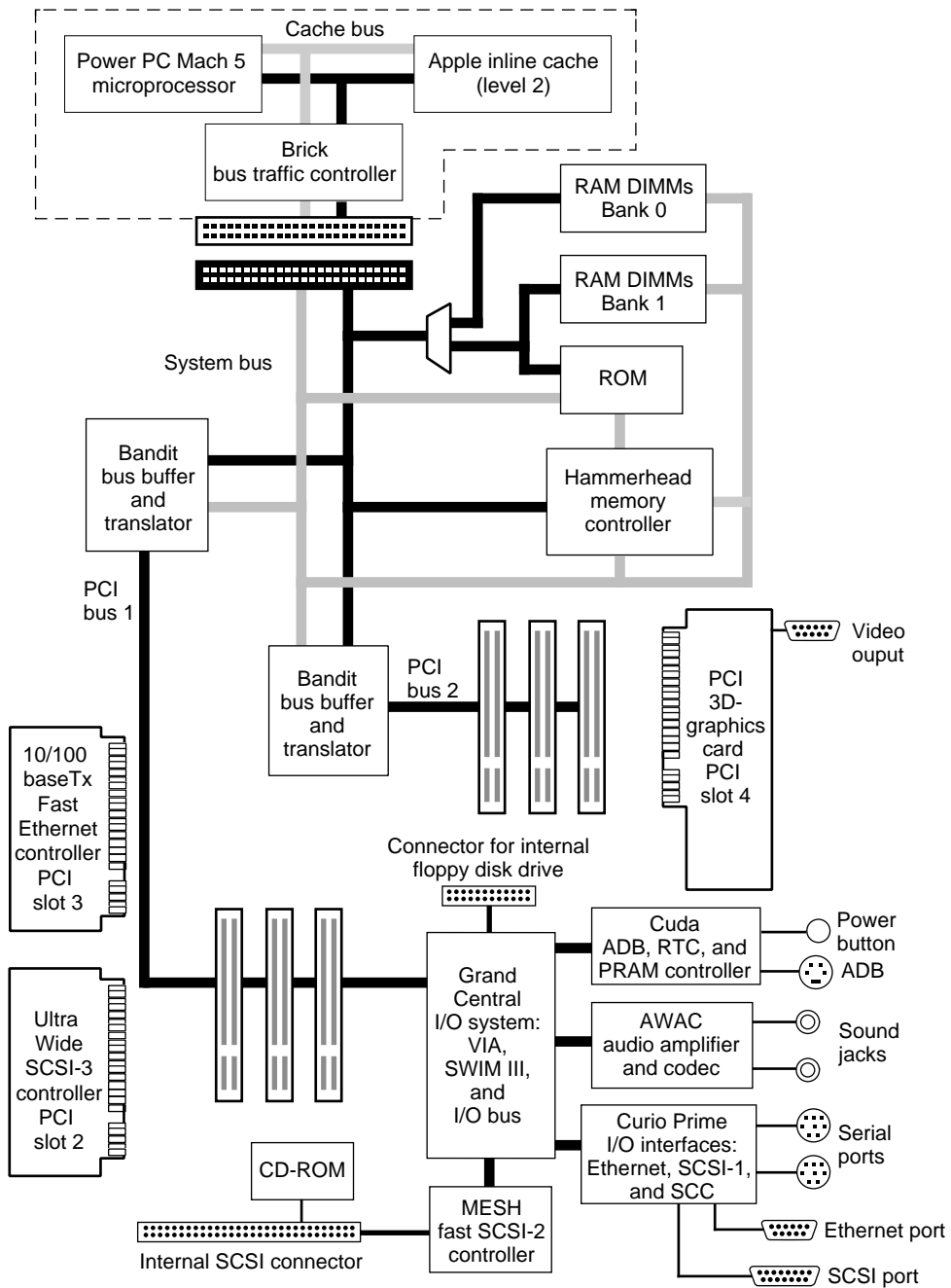
Apple Inline Cache

The second-level cache is an inline L2 cache soldered on the processor card. The inline cache is made up of pipeline burst static RAM devices and operates in write-through mode. The size of the inline cache is 1 MB.

Ultra Wide SCSI Hard Disk Size

The size of each of the hard disks in the Workgroup Server 9650/350 is 4 GB, providing a total of 8 GB of storage capacity. The hard disks are Ultra Wide SCSI-3 with a 16-bit wide data path. The Ultra Wide SCSI controller card supports a maximum data transfer rate of 40 MB per second. For additional information about maintaining the best performance using the Ultra Wide SCSI interface in a Workgroup Server 9650/350, see "Ultra Wide SCSI-3 Channel Configuration" on page 8.

Figure 1-1 Block diagram of the Workgroup Server 9650/350



24X-Speed CD-ROM Drive

The server includes a built-in 24X-speed SCSI CD-ROM drive. The drive features a 24X-speed mechanism that supports sustained data transfer rates of 3600 KB per second and a data buffer that further enhances performance.

The drive supports the worldwide standards and specifications for CD-ROM and CD-digital audio discs described in the Sony/Philips Yellow Book and Red Book. The drive can read CD-ROM, CD-ROM XA, CD-I, and PhotoCD discs as well as play standard audio discs.

Accelerated Display Card

The video display card supports acceleration of 2D and 3D graphics. The display card has 4 MB of SGRAM buffer memory and can be expanded to 6 or 8 MB. The card includes a Macintosh 15-pin video connector and a standard 3-row VGA connector. Only one connector can be used at a time.

The display card supports pixel depths of 8, 16, and 24 bits per pixel on various sizes of monitors, as shown in Table 1-1. The card supports DDC1/2b and Macintosh monitor sensing codes.

Table 1-1 Display types and pixel depths for the display card

Resolution (pixels)	Vertical frequency (Hz)	Bits per pixel with 4 MB	Bits per pixel with 6 MB	Bits per pixel with 8 MB
512 by 384	70	8, 16, or 24	8, 16, or 24	8, 16, or 24
640 by 480	60, 67, 72, 75, 85, 90, 100, or 120	8, 16, or 24	8, 16, or 24	8, 16, or 24
640 by 870	75	8, 16, or 24	8, 16, or 24	8, 16, or 24
800 by 600	56, 60, 72, 75, 85, 90, 100, or 120	8, 16, or 24	8, 16, or 24	8, 16, or 24
832 by 624	75	8, 16, or 24	8, 16, or 24	8, 16, or 24
1024 by 768	60, 70, 75, 85, or 90	8, 16, or 24	8, 16, or 24	8, 16, or 24
1024 by 768	100 or 120	8 or 16	8 or 16	8 or 16
1152 by 870	75	8, 16, or 24	8, 16, or 24	8, 16, or 24
1280 by 960	75	8 or 24	8 or 24	8 or 24
1280 by 1024	60	8 or 24	8, 16, or 24	8, 16, or 24
1280 by 1024	60, 75, or 85	8 or 24	8 or 24	8 or 24
1600 by 1200	60, 65, 70, or 75	8 or 24	8 or 24	8 or 24

Note

Some monitors from manufacturers other than Apple Computer have a video connector with the green video component and the synchronizing signal on the same pin, an arrangement called “sync on green.” The Workgroup Server 9650/350 display card does not support sync on green. ♦

Configuration

The Workgroup Server 9650/350 has a 1 megabyte inline L2 cache on the 350 MHz processor card and 64 MB of DRAM. It has two 4 GB internal Ultra Wide SCSI-3 hard disks, a built-in 24X-speed SCSI CD-ROM drive, a 1.4 MB GCR floppy drive, a 2D/3D accelerated graphics card, and a 10/100Base-Tx Ethernet PCI card.

The Workgroup Server 9650/350 supports three SCSI buses: Ultra Wide SCSI-3, Fast/Narrow SCSI-2, and Narrow SCSI-1. The dual 4 GB hard drives are on the 68-pin Ultra Wide SCSI-3 bus, the CD-ROM is on the 50-pin internal Fast/Narrow SCSI-2 bus, and a 25-pin connector for the SCSI-1 bus is provided for external devices.

One of the Ultra Wide SCSI-3 hard drives is configured as ID-0 with bus termination enabled. It is located at the end of the SCSI cable in the drive bay above the power supply. This drive, or any drive in this location, must remain terminated. The second Ultra Wide SCSI-3 hard drive is configured as ID-1, it is not terminated and is located in the bottom of the case. Two additional Ultra Wide SCSI-3 devices can be added to the 68-pin Ultra Wide bus, for a total of 4 devices.

The CD-ROM is connected to the built-in internal SCSI-2 bus. Additional SCSI-2 devices, such as Zip or DAT drives, can be added to the internal SCSI-2 bus by connecting the devices to the 50-pin SCSI cable and power connectors.

System Software

The system software installed on Workgroup Server 9650/350 is System 7.6.1. For a list of the features of System 7.6.1, see Technote 1096, “System 7.6.1.” To find out how to obtain Technotes, see “Supplemental Reference Documents” on page vii.

Changes in the ROM

Changes have been made in the ROM software to support:

- the new processor card with Apple inline cache and Brick custom IC (cache and bus controller)
- higher clock frequencies and multipliers with the Mach 5 PowerPC microprocessor
- higher bus frequencies

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Changes in the Disk Software

The System 7.6.1 software includes support for the new video display card with its 8 MB of RAM and additional display modes.

Compatibility Issues

Except for the changes described in this developer note, the features of the Workgroup Server 9650/350 are the same as those of the Workgroup Server 9650/233. There should be no compatibility problems with applications and peripherals that operate correctly with the earlier model.

Machine Identification

Applications can find out which computer they are running on by using the Gestalt Manager. For the Workgroup Server 9650/350, the `gestaltMachineType` value returned is 103 (hexadecimal 67). This is the same machine type value returned for the Power Macintosh 9600/233, because the system ROM is not modified for its Workgroup Server 9650/350 counterpart. *Inside Macintosh: Overview* describes the Gestalt Manager and tells how to use the `gestaltMachineType` value to obtain the machine name string.

System Software

The version of the Mac OS installed on the Workgroup Server 9650/350 is System 7.6.1. For a list of the features of System 7.6.1, see Technote 1096, “System 7.6.1.” To find out how to obtain Apple Computer’s Technotes, see “Supplemental Reference Documents” on page vii.

RAM DIMM Specifications

The method of RAM expansion in the new model is essentially the same as in the earlier Workgroup Server 9650/233 counterpart: 168-pin, 5-volt, 64-bit DIMMs, as defined in the JEDEC MO-161 specification.

IMPORTANT

Both the previous Workgroup Server 9650/233 and the Workgroup Server 9650/350 computers accommodate RAM DIMMs of 1.1 and 1.255 inches in height. ▲

The RAM expansion DIMMs in the Workgroup Server 9650/350 can use either extended data out (EDO) or fast page mode (FPM) DRAM devices. The computers always operate the devices in fast page mode.

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IMPORTANT

As in the previous Workgroup Server 9650/233 model, only 5-V power is available on the RAM DIMM slots. Devices that require 3.3-V power cannot be used. ▲

Ultra Wide SCSI-3 Channel Configuration

The signaling rates for Ultra Wide SCSI-3 bus greatly exceed those of SCSI-2 and SCSI-1 busses. To ensure data integrity the cable impedance must be tightly controlled. The Workgroup Server 9650/350 uses a 0.025-inch pitch teflon-jacketed 68-pin SCSI cable with a characteristic impedance of 90 Ohms. Standard PVC-jacketed cables have a characteristic impedance of 75 Ohms, which is outside the 84 to 96 Ohm specification for SCSI-3 implementations.

If a new cable is required for the Ultra Wide SCSI-3 bus in the Workgroup Server 9650/350, PVC cabling is not recommended for Apple server configurations. The cable should be a high-impedance design of 90 Ohms \pm 6 Ohms, such as Temp-Flex 0.025-inch cable part number F3001S-68-125-85.

The total length of the Ultra Wide SCSI-3 bus cable must be limited to 5 feet or less. Because the length of the factory installed internal cable is already over 3 feet, the addition of cabling necessary for external SCSI-3 devices is not supported when the internal SCSI-3 devices are also connected to the SCSI-3 PCI card and supplied internal cable.

PCI Slots

The main logic board and enclosure for the Workgroup Server 9650/350 includes 6 PCI expansion slots. The system is configured with PCI expansion cards that occupy three of the six available PCI slots in the computer, which leaves three PCI slots for I/O expansion cards. However, the factory installed Ultra Wide SCSI-3 hard drive in the bottom of the system case interferes with clearance for cards at PCI slot 1 (the lowest slot in the enclosure) leaving only two PCI slots for system I/O expansion. To provide access to PCI slot 1, the Ultra Wide SCSI-3 drive in the bottom of the case can be moved to one of the upper bays, if one is available.

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