



A+ Guide to Hardware, 4e

Chapter 5 *Motherboards*

Objectives

- Learn about the different types of motherboards and how to select one
- Learn how to support and configure a motherboard
- Learn how to install or replace a motherboard
- Learn how to troubleshoot a motherboard and processor

Introduction

- Some topics covered:
 - The role of buses and expansion slots
 - How to configure components, such as buses
- The motherboard is a field replaceable unit
- Practical skills to acquire:
 - Troubleshooting the motherboard
 - Installing and replacing a motherboard

Selecting a Motherboard

- Motherboard form factor
 - Determines the size of the board
 - Drives selection of power supply, case, CPU, cards
- ATX: most popular motherboard form factor
- BTX: the latest motherboard form factor
- Three types of motherboards you can select:
 - A board providing the most room for expansion
 - A board suiting the computer's current configuration
 - A board falling in between current and future needs

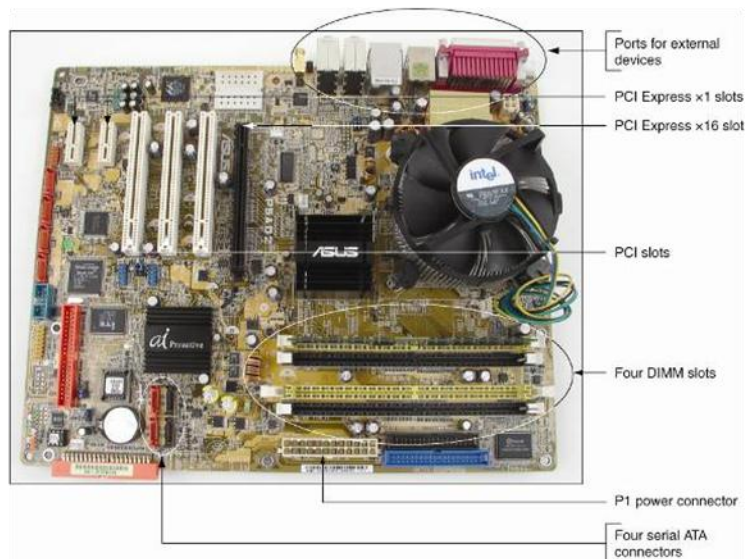


Figure 5-1 An ATX motherboard with PCI Express and Socket 775

Selecting a Motherboard (continued)

- Some questions to ask when picking a motherboard
 - What form factor does the motherboard use?
 - Does the motherboard provide proper CPU support?
 - What type of BIOS does the motherboard use?
 - Does the board fit the case you plan to use?
 - What is the warranty on the board?
- Embedded (on-board) component
 - Component located on the board
 - Avoid board with too many embedded components
 - Such boards do not easily accept add-on devices

Configuring and Supporting a Motherboard

- Components that require configuration and support:
 - Expansion slots
 - Internal and external connectors
- Expansion slots are supported by buses
 - Before configuring slots, learn about buses

Buses and Expansion Slots

- Buses are like highway transportation systems
- Four types of cargo carried by a bus:
 - Power, control signals, memory addresses, data
- Bus evolution
 - Buses have evolved around data path and speed
 - Synchronous components work with clock cycle
 - Asynchronous components are out of step with CPU
 - Wait state: command to CPU to wait for slower device
 - Bus types: expansion, local, local I/O, local video
 - Expansion buses are asynchronous components

Bus	Bus Type	Data Path in Bits	Address Lines	Bus Speed in MHz	Throughput
System bus	Local	64	32	Up to 1600	Up to 3.2 GB/sec
Newer Bus Standards					
PCI Express x16	Local video and local I/O	Up to 16 lanes	Up to 16 lanes	2.5 GHz to 40 GHz	Up to 4 GB/sec
PCI-X	Local I/O	64	32	66, 133, 266, 533, 1066	Up to 8.5 GB/sec
AGP	Local video	32	NA	66, 75, 100 . . .	Up to 528 MB/sec
PCI	Local I/O	32 or 64	32	33, 66	133, 266, or 532 MB/sec
FireWire	Local I/O or expansion	1	Serial	NA	Up to 3.2 Gb/sec (gigabits)
USB	Expansion	1	Serial	3	12 to 480 Mbps (megabits)
Older Bus Standards					
VESA or VL Bus	Local video or expansion	32	32	Up to 33	Up to 250 MB/sec
MCA	Expansion	32	32	12	Up to 40 MB/sec
EISA	Expansion	32	32	12	Up to 32 MB/sec
16-bit ISA	Expansion	16	24	8.33	8 MB/sec
8-bit ISA	Expansion	8	20	4.77	1 MB/sec

Table 5-3 Buses listed by throughput

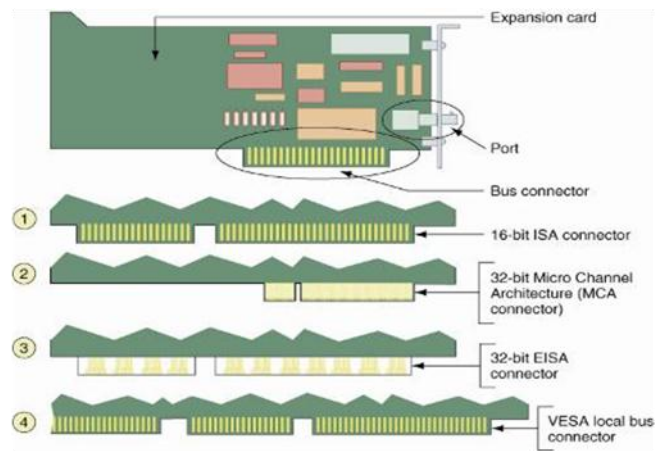


Figure 5-6 Four outdated bus connections on expansion cards

Buses and Expansion Slots (continued)

- The PCI buses
 - Intended to replace the 16-bit ISA bus
 - Types: Conventional PCI, PCI-X, PCI Express
- On-board ports (integrated components)
 - Examples: keyboard, mouse port, parallel printer, USB
- Internal connectors
 - EIDE, floppy drive connector, serial ATA, SCSI, 1394
- Riser slots
 - Audio/modem riser (AMR)
 - Communication and networking riser (CNR)

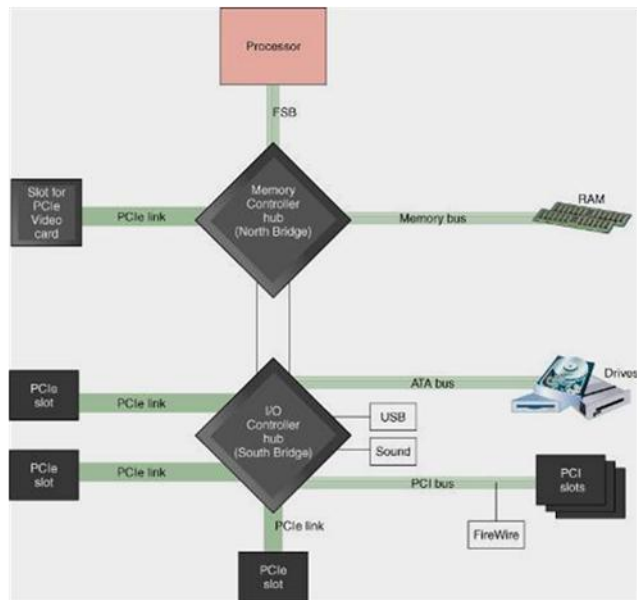


Figure 5-10 How PCI Express connects to the chipset and processor

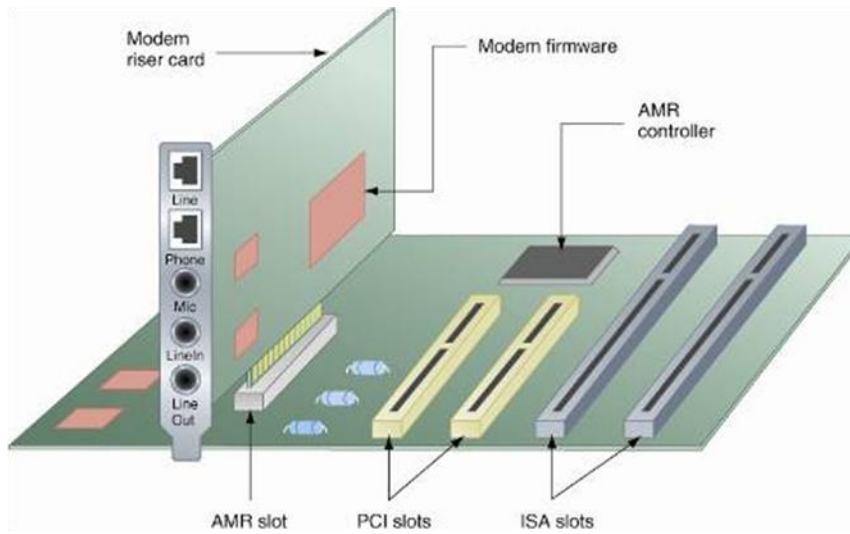


Figure 5-12 An audio/modem riser slot can accommodate an inexpensive modem riser card

Hardware Configuration

- Three ways to configure the motherboard:
 - DIP switches, jumpers, CMOS RAM
- Dual inline package (DIP) switch
 - Has ON (binary 1) and OFF (binary 0) positions
 - Reset DIP switch when adding or removing device
 - Use pointed instrument other than graphite pencil
- Jumpers
 - Retain setup or installation information
 - Are opened and closed using jumper covers
 - Typical setting: enabling/disabling keyboard power-up

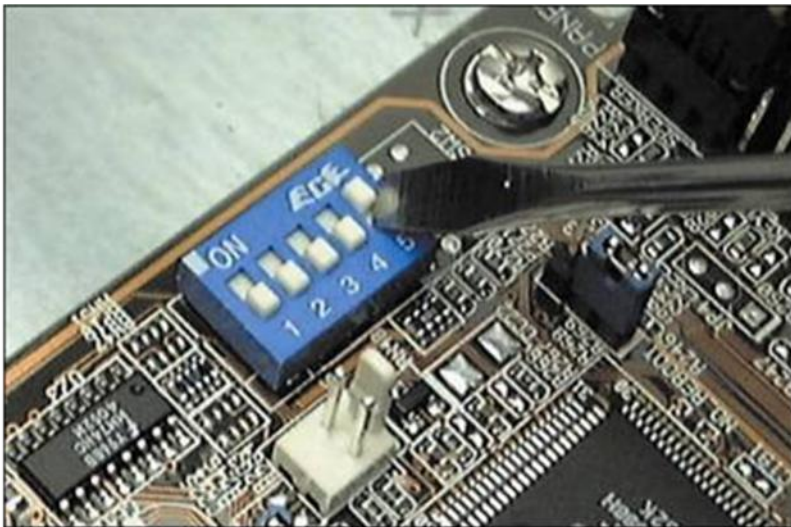


Figure 5-14 DIP switches are sometimes used to store setup data on motherboards

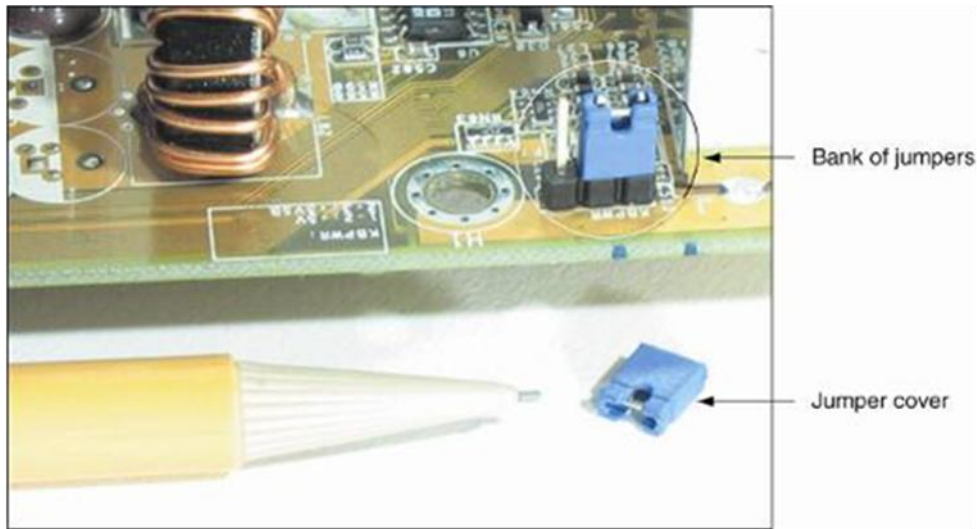


Figure 5-15 Setup information about the motherboard can be stored by setting a jumper on (closed) or off (open). A jumper is closed if the cover is in place, connecting the two pins that make up the jumper; a jumper is open if the cover is not in place.

Hardware Configuration (continued)

- CMOS RAM
 - Also called clock/nonvolatile RAM (RTC/NVRAM)
 - Stores most configuration for the motherboard
 - Can be accessed without opening the case
- CMOS setup program
 - Stored on a floppy disk or ROM BIOS chip
 - Access built-in program by pressing key during POST
 - Menus: Main, Advanced, Power, Boot, and Exit
 - Brand name PCs, such as IBM, have custom screens

BIOS	Key to Press During POST to Access Setup
AMI BIOS	Del
Award BIOS	Del
Older Phoenix BIOS	Ctrl+Alt+Esc or Ctrl+Alt+s
Newer Phoenix BIOS	F2 or F1
Dell computers using Phoenix BIOS	Ctrl+Alt+Enter
Older Compaq computers such as the Deskpro 286 or 386	Place the diagnostics disk in the disk drive, reboot your system, and choose Computer Setup from the menu
Newer Compaq computers such as the ProLinea, Deskpro, Deskpro XL, Deskpro XE, or Presario	Press the F10 key while the cursor is in the upper-right corner of the screen, which happens just after the two beeps during booting*
All other older computers	Use a setup program on the disk that came with the PC

*For Compaq computers, the CMOS setup program is stored on the hard drive in a small, non-DOS partition of about 3 MB. If this partition becomes corrupted, you must run setup from a bootable CD or floppy disk that comes with the system. If you cannot run setup by pressing F10 at startup, suspect a damaged partition or a virus taking up space in conventional memory.

Table 5-4 How to access CMOS setup

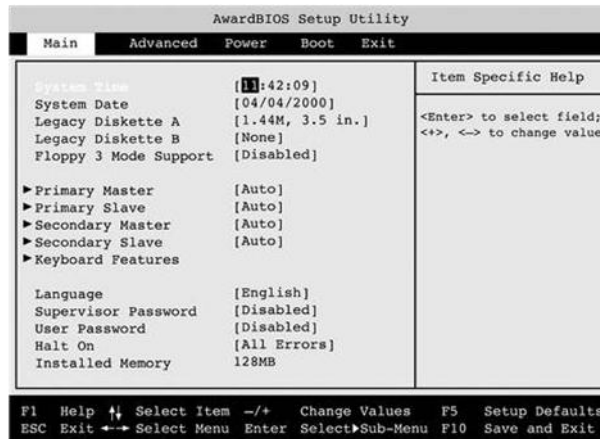


Figure 5-18 CMOS Setup Main menu

Hardware Configuration (continued)

- Battery power to CMOS RAM
 - Enables CMOS to hold data after the PC is turned off
 - Setup information is lost if battery fails or disconnects
- Startup passwords in CMOS
 - Stored in CMOS RAM and changed in setup screen
 - Should be distinguished from OS passwords
- CMOS settings are specified in motherboard manuals
- Documentation of configuration settings
 - Enables you to recapture lost or altered settings
 - Should be labeled and stored in a safe place



Figure 5-24 The coin cell is the most common type of CMOS battery

Flashing ROM BIOS

- Programs stored in the ROM BIOS chip:
 - CMOS setup program
 - Startup BIOS that manages the startup process
 - System BIOS that manages basic I/O functions
- Programs on ROM BIOS may need upgrades
- Flashing: upgrading or refreshing ROM BIOS chip
- Sources for ROM BIOS upgrades
 - Manufacturer's Web site
 - <http://www.esupport.com>

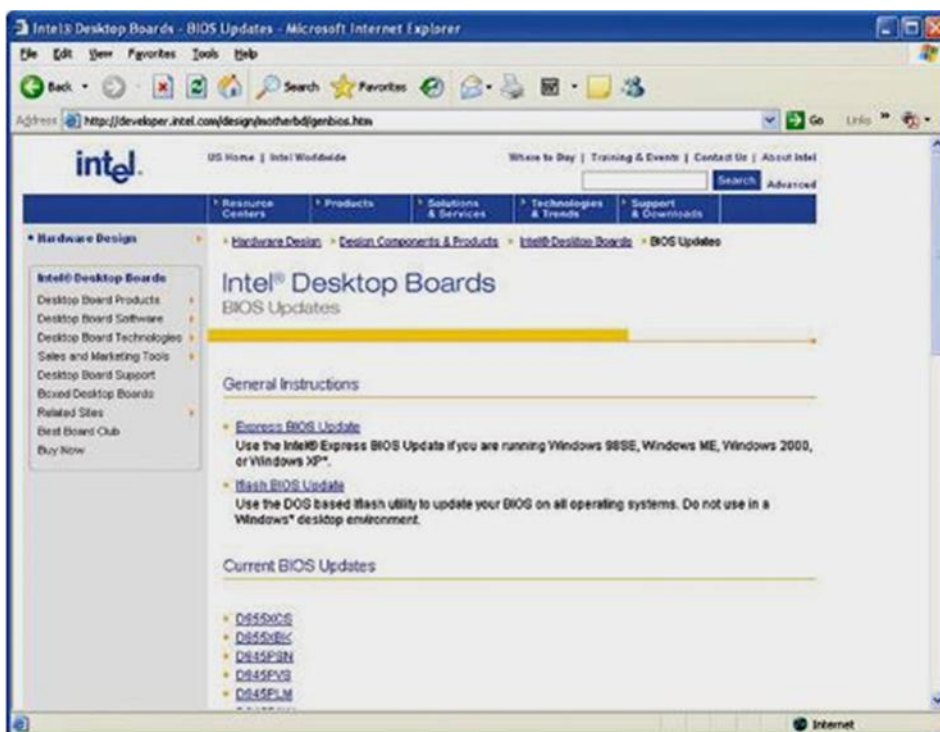


Figure 5-26 Intel displays a list of motherboard model numbers that have a Flash BIOS upgrade available

Motherboard Drivers

- Located on CD bundled with motherboard
- Motherboard CD may also contain useful utilities
- Drivers are periodically updated by manufacturer
- Dealing with an unstable motherboard
 - Check for updated drivers, especially chipset drivers
 - Install updated drivers for non-functioning devices

Replacing a Motherboard

- Overview of the replacement process
 - 1. Verify that you have selected the right motherboard
 - 2. Determine the power configuration settings
 - 3. Remove components to reach the old motherboard
 - 4. Set any jumpers or switches on the motherboard
 - 5. Install the processor and processor cooler
 - 6. Install RAM into appropriate slots on motherboard
 - 7. Install the motherboard
 - 8. Attach cabling (case switches, power supply, drives)
 - 9. Install the video card on the motherboard

- Overview of the replacement process (continued)
 - 10. Plug in PC and then attach monitor and keyboard
 - 11. Boot the system and enter CMOS setup
 - 12. Make sure the settings are set to default
 - 13. Observe POST and verify that no error occurs
 - 14. Check for conflicts with system resources
 - 15. Install the motherboard drives
 - 16. Install any other expansion cards and drives
 - 17. Verify the system is up and running

Preparing the Motherboard to Go Into the Case

- Read the manual before preparing the motherboard
- Setting the jumpers
 - First step in preparing the motherboard
 - The manual explains jumper and DIP switch settings
 - Information differs from one motherboard to the next
- Tasks performed after setting the jumpers
 - Install the processor and cooler (Chapter 4)
 - Install the memory modules (Chapter 6)




Jumper Position	Mode	Description
 1 3	Normal (default)	The current BIOS configuration is used for booting.
 1 3	Configure	After POST, the BIOS displays a menu in CMOS setup that can be used to clear the user and supervisor power-on passwords.
 1 3	Recovery	Recovery is used to recover from a failed BIOS update. Details can be found on the motherboard CD.

Figure 5-27 BIOS configuration jumper settings

Installing the Motherboard in the Case

- Overview of the eight general steps:
 - 1. Install the faceplate (I/O shield)
 - 2. Install the standoffs (spacers)
 - 3. Secure the motherboard in the case
 - 4. Connect the power cord to the PI power connection
 - 5. Connect 4-pin auxiliary power cord to motherboard
 - 6. Connect the wire leads from front panel of case
 - 7. Refer to manual to verify wire to pin connection
 - 8. Connect USB connection (if present) to USB ports

Completing the Installation

- Following the connection of cables and cords
 - Install the video card
 - Plug in the keyboard and monitor
 - Turn the system on
 - Look out for errors during POST
 - Install drivers from CD bundled with motherboard
 - Verify operations
 - Make OS and CMOS adjustments as needed

Troubleshooting the Motherboard and Processor

- Field replaceable units (FRUs) on old motherboards
 - CPU, RAM, RAM cache, ROM BIOS, CMOS battery
- FRU components on newer motherboards:
 - CPU, RAM, CMOS battery, and motherboard itself
- POST reporting aids diagnosis
 - Chapter 2 or manufacturer Web site describe codes
- A good tactic: replace a bad device with a new one
 - Caveat: check voltage from power supply first
 - If voltage is excessive, new part may be damaged

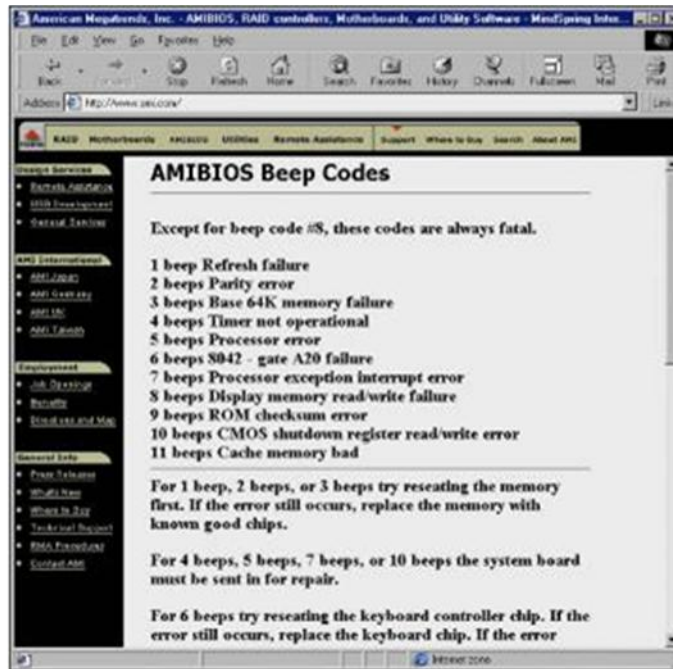


Figure 5-40 The ROM BIOS manufacturer's Web site is a good source of information about beep codes

Problems with Installations

- If CPU was added to working motherboard, check:
 - Thermal paste between CPU and heat sink
 - Fastening between cooler and motherboard frame
 - Pins or lands on the socket and processor
- Things to check if new motherboard is not working:
 - Whether the front cover of the case is installed
 - Whether the power switch on back of the case is on
 - Incorrect connections
 - Installation of CPU, thermal compound, and cooler
 - Installation of all motherboard drivers on the CD

Problems with the Motherboard and Processor

- Some symptoms of impending failure
 - The system begins to boot but then powers down
 - Intermittent Windows or hard drive errors occur
- First troubleshooting task to perform
 - Update drivers of components not working
 - Use support CD bundled with motherboard
- A few other tasks to perform if update does not work
 - Change power saving features, such as sleep mode
 - Check jumpers, DIP switches, CMOS settings
 - Exchange the processor

Summary

- Motherboard form factor drives selection of motherboard
- Configurable components: bus, expansion slots, other connectors
- Cargo carried by a computer bus: electrical power, control signals, memory address, data
- Bus types: local, local video, local I/O, expansion
- The PCI bus was designed to replace the ISA bus

- Three tools for configuring a motherboard: DIP switches, jumpers, CMOS setup program
- The CMOS setup program is stored on a floppy disk or ROM BIOS chip
- Document configuration settings for recovery needs
- Upgrade ROM BIOS using a technique called flashing
- Use POST reporting to help diagnose problems