

How a Computer Starts

Step-by-Step Boot Process with Details

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Step 1-2: Power ON and BIOS/UEFI Start

- **Power Button Pressed:**

- Activates Power Supply Unit (PSU), which provides power to motherboard and components.
- Sends a “**Power Good**” signal when voltages stabilize.

- **CPU Initialization:**

- CPU resets and starts fetching instructions from a predefined address (e.g., 0xFFFF0).
- This points to firmware stored in ROM (BIOS/UEFI).

- **BIOS/UEFI Starts:**

- Initializes key hardware: RAM, display, keyboard, disks.
- Provides a minimal runtime environment for diagnostics and boot setup.

Step 3-4: POST and Boot Device Detection

- **Power-On Self-Test (POST):**

- Verifies that essential hardware (RAM, CPU, GPU, keyboard) is working.
- On success, one beep (usually); errors are shown via beep codes or screen messages.

- **Detect Bootable Devices:**

- BIOS/UEFI checks boot priority list (set via firmware settings).
- Looks for Master Boot Record (MBR) or EFI partition.
- Loads the first sector (512 bytes in MBR-based systems) into memory.

Step 5-6: Bootloader and Kernel Loading

- **Load Bootloader:**

- Bootloader (e.g., GRUB, LILO, BOOTMGR) is a small program that helps load the OS.
- May offer boot menu for OS selection or recovery mode.

- **Load Operating System Kernel:**

- Bootloader loads the OS kernel (Linux kernel, Windows NT kernel) into RAM.
- Control is transferred to the kernel.
- Kernel initializes low-level drivers, memory manager, scheduler.

Step 7-9: Start Services and Show User Interface

- **System Services Start:**

- OS starts background daemons/services.
- Examples: `systemd`, `init` (Linux); `wininit.exe`, `services.exe` (Windows).

- **User Interface Loads:**

- Login screen or graphical desktop environment is started.
- User can now enter credentials and access applications.

- **System Ready:**

- At this point, all hardware and services are initialized and the OS is ready for use.