CompTIA A+ Core 1 (220-1101)

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1. What is Troubleshooting Theory?

Troubleshooting Theory is a systematic, step-by-step methodology used to diagnose and resolve technical issues (hardware, software, or network-related).

The 6-Step Troubleshooting Process (CompTIA A+ Framework):

- **Identify the problem:** Understand the user's issue by asking questions and gathering information.
- **Establish a probable cause:** Based on the information, determine the most likely cause of the problem.
- **Test the theory:** Verify the probable cause by testing it.
- **Establish a plan of action:** Develop a plan to resolve the issue and implement it.
- **Verify full functionality:** Ensure the problem is fully resolved and the system is functioning correctly.
- **Document findings:** Record the steps taken and the solution for future reference.

2. Primary PC components?

- **System Unit:** The main part of the computer, containing the CPU, RAM, hard drives, and other essential components.
- **Peripheral Devices:** Includes the monitor (output interface), keyboard and mouse (input devices), printer (paper output), speakers (sound output), game controller, web camera, external hard drive, headset, and microphone.
- **Cabling:** Cables are essential for connecting all these components, even if some devices are wireless.

3. What is a computer?

- **Core Components:** A computer must have a CPU (processor), RAM (memory), and mass storage (like SSDs or hard drives)**.**
- **Functionality:** Computers are used to perform tasks, either for work or play, by running programs and applications.
- **Versatility:** Computers come in various forms, from desktops and laptops to tablets, smartphones, and even household appliances like washers and dryers, all of which contain a CPU, RAM, and storage.

4. What is a CPU?

- **Definition and Function:** A CPU (Central Processing Unit) is like a powerful calculator that performs billions of calculations per second. It's essential for running programs and processing data**.**
- **Communication with CPU:** The CPU communicates using binary code (ones and zeros) through an external data bus, which allows it to receive and execute commands.
- **Registers and Machine Language:** The CPU uses registers (storage areas) to perform calculations and follows a code book known as machine language to understand and execute different patterns of binary values.

5. Modern CPUs?

- **Clock Speed and Cores:** Modern CPUs are measured by clock speed (gigahertz) and the number of cores (single-core, dual-core, quad-core, etc.). More cores allow for better multitasking and performance.

- **Types of CPUs:**

    - **ARM Chips**: Used in devices like Raspberry Pi and some Apple products, designed for simplified instruction sets and higher processing speeds.
    - **APUs:** Combine CPU and graphics processing capabilities, suitable for basic tasks like video streaming and light gaming.

- **CPU-Z Tool**: A useful tool for identifying detailed information about your CPU, including its features and capabilities.

6. 32-bit vs. 64-bit computing?

Data Handling Capacity: A 32-bit system can handle 4 billion bits of information at once, while a 64-bit system can handle 4 billion times more data than a 32-bit system. *32-bit (4 byte) data; address space = 2^32 = 4,294,967,296 ≈ 4 GiB RAM*

Performance and Compatibility: 64-bit systems offer better security, graphics performance, and overall system output compared to 32-bit systems. Most modern hardware and software are designed to be 64-bit.

64-bit (8 byte) data; address space = 2^64 = 18,446,744,073,709,551,616 ≈ 16 GiB RAM

7. Installing and troubleshooting a CPU?

- **ESD Protection and Handling:** Use ESD (**Electrostatic Discharge: Anti-static wrist strap + anti-static mat + Grounding yourself**) protection and avoid touching the pins on the CPU to prevent damage.
- **CPU Installation:** Understand the difference between LGA (Land Grid Array) and PGA (Pin Grid Array) sockets, and use the zero insertion force (ZIF) mechanism to install the CPU correctly.
- **Troubleshooting Steps:** Follow CompTIA's troubleshooting theory steps: identify the problem, establish a theory of probable cause, test the theory, establish a plan of action, verify full system functionality, and document the findings.

8. RAM? Virtual Memory? Installing and troubleshooting a RAM?

- **Types of RAM:** The various types of RAM, including ***SDRAM, DDR, DDR2, DDR3, and DDR4***, are highlighted with their differences in speed and pin configurations.
- **Virtual Memory**: When RAM is insufficient, ***a portion of the hard drive*** can be used as virtual memory, which acts like RAM. This is a temporary solution to avoid memory errors. Using virtual memory can significantly slow down your computer. The best solution to avoid relying on virtual memory is to add more RAM to your system.
- **Installing and Troubleshooting RAM:**
    - **Identify the Problem**: Ensure the RAM fits correctly in the slot. If it doesn't, it might be the wrong type of RAM.
    - **Establish and Test Theory**: Verify the RAM type with the manufacturer's materials. Test by using known compatible RAM.
    - **Implement Solution**: Install the correct RAM and ensure it locks into place. Verify system functionality.
    - **Document Findings**: Keep a log of troubleshooting steps and solutions for future reference.

9. Firmware? BIOS? Power-on Self-Test (POST)?

Firmware is a specific type of software that is permanently programmed or "embedded" directly onto a hardware device. It acts as the fundamental, low-level control code that allows the hardware to function and communicate with other software.

BIOS Definition: BIOS (Basic Input/Output Services) is firmware built into the motherboard that allows the computer to communicate with hardware before the operating system loads.

Functions of BIOS: BIOS includes the power-on self-test (POST) to check hardware functionality before booting, and system setup for configuring hardware settings.

10. POST? How does POST work?

The POST (Power-On Self-Test) process begins immediately after you press the computer's power button, but it concludes before the operating system (e.g., Windows, Linux) starts loading.

What Does POST Do?

1. **Checks Critical Hardware Components:**
    - CPU (Processor)
    - RAM (Memory)
    - GPU (Graphics Card)
    - Storage Devices (HDD, SSD)
    - Keyboard and Mouse
2. **If an Error Is Detected:**
    - It produces beep codes (via the motherboard speaker).
    - It displays error messages on the screen (if the GPU and monitor are functional).

9. Troubleshooting Firmware?

1. **Firmware is Generally Stable**: It rarely causes issues unless manually changed, corrupted, or after a failed update.

2. **Key Terminology: Firmware**: Low-level software controlling hardware.

- BIOS: Older text-based firmware.
- UEFI: Modern graphical firmware (replaces BIOS).
- CMOS: Chip storing BIOS/UEFI settings and time.
- CMOS Battery: Powers the CMOS chip when the PC is off.

3. **Most Common Issue:** Dead CMOS Battery

- **Symptoms**:
  - Incorrect date/time after shutdown.
  - BIOS/UEFI settings resetting.
- **Fix**: Replace the CR2032 coin cell battery on the motherboard.

4. **Flashing BIOS/UEFI (Risky!)**

- Why Update? For new CPU support, hardware fixes, and security patches.
- ⚠️ Warning: A failed update can permanently damage the motherboard.
- **Safety Tips:**
  - Use a stable power source (UPS/laptop battery).
  - Do not interrupt the process.
  - Only update if necessary.

5. **Quick Fixes**

- Reset BIOS/UEFI to default settings.
- Clear CMOS (via jumper or battery removal) for persistent issues.

Note: Firmware problems are rare but critical. Handle with caution!

11. The Complete Guide to Motherboards?

1. Form Factor (The Size & Shape)

The form factor defines the motherboard's physical dimensions, layout, and screw positions. It determines which computer case it will fit into.

Form Factor	Dimensions (Inches)	Key Features
ATX	12" x 9.6"	Most expansion slots (PCIe), 4+ RAM slots, robust features.
Micro-ATX (mATX)	9.6" x 9.6"	Fewer PCIe slots than ATX, typically 4 RAM slots.
Mini-ITX	6.7" x 6.7"	Very compact, usually 1 PCIe slot, 2 RAM slots.
E-ATX	12" x 13"	Largest consumer size, extreme features, maximum slots.

Key Takeaway: Choose your case first, then pick a motherboard with a compatible form factor (e.g., an ATX case can fit ATX and smaller boards).

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12. Troubleshooting Motherboards?

❌ **No power** → PSU / power connectors / dead motherboard

🔊 **POST errors / beeps** → RAM, CPU, expansion card সমস্যা
🔁 **Random shutdown/reboot** → overheating, bad capacitors, short circuit
🔥 **Burnt smell / bulging capacitor** → motherboard damage

🔌 **Connectivity issue** → loose cable, damaged port/slot

13. Mass Storage? Magnetic disk drives (HDDs), Solid State Drives (SSDs), Small Computer System Interfaces (SCSI)?

Mass Storage: Mass storage refers to devices that store large amounts of data permanently (non-volatile storage). These devices hold the operating system, applications, and user data.

Types of Mass Storage

1. **HDD (Hard Disk Drive)** – Uses magnetic disks, has high capacity, slower speed, and moving parts.
2. **SSD (Solid State Drive)** – Uses flash memory, very fast, durable, but more expensive.
3. **Hybrid Drive (SSHD)** – Combines SSD (for speed) and HDD (for capacity).
4. **Optical Storage** – CD, DVD, Blu-ray; laser-based, mostly for backup/distribution.
5. **External/Removable Storage** – USB flash drives, external HDD/SSD, memory cards.

SCSI (Small Computer System Interface)

- **Definition:** Standard interface to connect **storage devices** (HDD, SSD, tape) & **peripherals** (printers, scanners).

- **Features:**
    - Supports **multiple devices** on one bus (8–16 devices)
    - **High-speed data transfer**
    - **Standard command set** → compatibility across devices
    - **Hot-swappable** (some types)
- **Types:**
    - **Parallel SCSI (P-SCSI)** – old, parallel communication
    - **Serial Attached SCSI (SAS)** – modern, faster, reliable

Key Point: SCSI = **high-performance, multi-device interface**, mostly used in servers.

14. RAID, Software RAID Vs Hardware RAID, Encrypting Mass Storage? Mass Storage Troubleshooting?

RAID: (Redundant Array of Independent/Inexpensive Disks **)**

- **Definition:** Combines multiple drives into one logical unit for redundancy and/or performance.

Common RAID Levels

1. **RAID 0 – Striping** → splits data across drives → **faster**, no redundancy
2. **RAID 1 – Mirroring** → duplicates data → **redundancy**, 50% storage use
3. **RAID 5 – Striping with Parity** → data + parity on 3+ drives → **speed + redundancy**
4. **RAID 10 (1+0)** → mirrored + striped → **high performance + redundancy**

Commonly used in *servers, NAS, and high-performance PCs.*

💾 RAID Types: Software vs Hardware

Feature	Software RAID	Hardware RAID
Management	Managed by **OS/CPU**	Managed by **dedicated RAID controller**
Cost	Cheaper, no extra hardware	Expensive (RAID card/chip needed)
Performance	Slower (CPU handles RAID tasks)	Faster (controller handles RAID tasks)
Flexibility	Easy to change RAID levels	Depends on controller, less flexible
Use Case	Desktops, small servers	Enterprise servers, high-performance storage
Fault Tolerance	Limited, depends on RAID level	High, robust for critical data

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✅ Summary (Short for Exam/Viva)

- **Software RAID:** OS handles RAID, cheaper & flexible, but slower.
- **Hardware RAID:** Dedicated controller handles RAID, faster & reliable, used in servers.

🔒 Encrypting Mass Storage

Types of Encryption:

- **File-based Encryption:** Encrypts individual files or folders.
- **Disk-based Encryption:** Encrypts the entire storage device.

Encryption Tools:

- **Windows:**
  - File-based → EFS (Encrypting File System)
  - Disk-based → BitLocker
- **macOS:** File Vault
- **Linux:** Various options available

Importance of TPM:

- **Trusted Platform Module (TPM)** provides a robust key for disk-based encryption.
- Ensures **data security** even if the storage device is removed.

🛠️ Mass Storage Troubleshooting

Backup:

- Always **backup your data** before troubleshooting to avoid data loss.

Mental Reinstall:

- Go through the **mental process of reinstalling the device** to ensure all steps are followed correctly.

Common Issues & Solutions:

1. **Drive not recognized / RAID not found** → Check connections, BIOS/UEFI settings, RAID configuration.
2. **Read/Write Failures** → Run disk utility (CHKDSK, fsck), check for corrupted files.
3. **Slow Performance** → Check disk space, fragmentation, or failing drive.
4. **Loud Clicking Noises (HDD)** → Possible hardware failure, backup immediately.
5. **Failure to Boot / Continuous Reboots** → Verify boot order, repair bootloader or replace drive.

Troubleshooting Steps:

1. Identify the problem.
2. Check physical connections & device health.
3. Use software tools to diagnose errors.
4. Backup important data.
5. Repair or replace faulty drive if needed.