Chapter 6: Bus Interface

SECTION-II (Short Questions)

1. **Name different interfaces used in computer.**
   Some common computer interfaces/buses are: ISA bus, EISA bus, VESA Local Bus, PCI bus, AGP (Accelerated Graphics Port), and USB (Universal Serial Bus).
2. **Why ports are needed in the process of interfacing?**
   Ports provide physical and logical connection points that allow the CPU/motherboard to communicate with peripherals or expansion cards. Without ports (slots or connectors), devices such as graphics cards, network cards, or USB devices could not be attached or addressed. Ports define how devices plug in and how data and control signals pass between components. They also help standardize hardware so different devices can work with the computer.
3. **Define ISA (Industry Standard Architecture) Bus.**
   The ISA bus is an early internal expansion bus standard originally used in early IBM-PC machines. It started as an 8-bit bus and later extended to 16 bits with the IBM PC AT architecture.
   It enabled connection of peripheral cards (e.g. sound cards, modems, network cards) to the computer's motherboard.
4. **Write applications of ISA bus.**
   - Connecting low-speed peripherals like modems, serial ports, network cards, or sound cards.
   - Attaching expansion cards such as additional I/O cards, older video cards, or legacy devices in older PC systems.
   - Supporting backward compatibility for early PC-XT / PC-AT compatible machines and older software/hardware ecosystems.
5. **Define EISA bus.**
   EISA stands for Extended Industry Standard Architecture. It is an enhanced version of ISA that extends the bus width to 32 bits.
   EISA was developed to provide better data throughput and to support more advanced devices than ISA.
6. **What is the advantage of EISA bus over ISA bus?**
   - EISA supports 32-bit data transfers (versus 8- or 16-bit in ISA), allowing larger data at a time. EISA offers higher data transfer rates compared to ISA, making it more suitable for devices demanding higher bandwidth.
   - It retains backward compatibility with ISA devices while giving a path to improved performance.
7. **Define PCI (Peripheral Component Interconnect) Bus.**
   PCI is a local bus standard developed to replace (or suplement) older buses like ISA/EISA for expansion cards. It is processor-independent and supports 32-bit (and sometimes 64-bit) data paths. It provides faster data transfer and better flexibility for modern peripherals — such as SCSI, networking, audio, USB controllers — compared to older buses.
8. **What is the application of Accelerated Graphics Port (AGP)?**
   AGP was designed specifically to attach a video card (graphics adapter) directly to the motherboard for accelerated 3D and 2D graphics.
   It allowed the graphics card to access system memory directly for storing textures and other graphics data — improving performance for graphics-intensive applications like CAD, 3-D modelling, games, and visualization.
9. **What is the purpose of Universal Serial Bus (USB)?**
   USB provides a standardized, high-flexibility serial interface for connecting a wide variety of peripherals (e.g. keyboards, mice, printers, external storage, cameras, etc.) to a computer. It supports hot-plugging (i.e. you can connect/disconnect devices while the computer is on) and often supplies power to connected devices.
10. **How many USB can be connected through a USB bus?**
    Technically, one USB host controller (USB bus) can support up to **127 devices** (including hubs and the host controller itself) according to the USB specification.
    In real-world use, actual workable number tends to be much lower due to bandwidth, power supply, and hub limitations.

SECTION-III (Long Questions)

1. Extended ISA bus and VESA Local Bus

The Extended ISA bus (EISA) was developed as an improvement over the older ISA standard. While ISA supported 8-bit or 16-bit data widths, EISA extended this to a 32-bit interface. This widening of the data path

meant EISA could handle larger chunks of data per cycle — improving throughput and making it more suitable for devices needing higher bandwidth, such as SCSI controllers, network cards, or more advanced peripherals.

EISA also preserved compatibility with many existing ISA cards, offering a transitional path from older hardware to more capable systems. However, EISA did not ultimately become the dominant expansion bus for all PCs — because even faster and more flexible bus standards appeared.

One such standard was the VESA Local Bus (VLB), created in the early 1990s, mainly to support faster graphics performance. VLB provided a "local bus" interface connecting graphics cards (and sometimes other high-speed devices) more directly to the CPU and memory, bypassing some of the limitations (bottlenecks) of ISA. Because VLB offered wider data paths and faster data flow, it improved performance for graphics and high-speed peripherals, especially in video-intensive applications.

In summary, EISA and VESA Local Bus were both evolutionary steps in bus architecture: EISA extended data width and retained backward compatibility, while VLB targeted performance-critical components (especially graphics) by providing a faster, more direct bus path.

2. Universal Serial Bus (USB) — Detailed Discussion

The Universal Serial Bus (USB) revolutionized how peripherals connect to computers. Its core purpose is to standardize the connection of diverse external devices (keyboards, mice, printers, storage devices, cameras, etc.) — replacing a multitude of older, specialized ports and connectors. **Key characteristics of USB:**

- **Hot-plugging:** Devices can be connected and disconnected while the computer is running, without the need to reboot or switch off.
- **Flexible topology:** USB supports a hub-based tree/starlike structure — you can connect a USB hub to a single port, then plug several devices (or more hubs) into that hub
- **Large device support:** The USB standard allows up to 127 devices per host controller.
- **Power supply and data combined:** USB ports typically supply power to connected devices, enabling small devices (like mice, keyboards, flash drives) to run without a separate power source
- **How USB works in practice:** When you plug a device in, the host (computer's USB controller) assigns it a unique USB address and sets up communication. If you need more ports, you attach a hub — the hub itself uses one address, and devices connected to it take additional addresses, up to the limit of 127

Advantages over older interfaces:

- Replaces many types of legacy ports with a single universal interface.
- Easier plug-and-play — no need to configure IRQs, I/O addresses, jumpers, or special drivers manually (in most OSes).
- Supports a wide variety of devices (storage, input, audio, video, networking, etc.) with a unified standard.

Limitations:

- Although up to 127 devices are allowed, in real-world usage performance suffers if many high-bandwidth devices share the same bus. Bandwidth and power limitations become bottlenecks.
- Hubs count as devices too, so using many hubs reduces how many "real peripherals" you can connect before reaching the 127-device limit.
- **Example:** If you connect a USB hub to your laptop's single USB port, then plug in a keyboard, a mouse, a flash drive, and a printer into the hub, the computer treats each as separate devices on the same USB bus. If you then connect a second hub into that hub's port and add more peripherals, all still share the same USB bus — until the theoretical maximum of 127 devices per host controller is reached (though practicality usually limits far fewer).

Thus, USB offers a simple, flexible, and powerful way to manage many peripherals with minimum hassle — which is why it remains the dominant external interface on modern computers.