

Homework Assignment 2 Solutions

1. Can increasing the memory (RAM) capacity of a PC improve its performance speed? How?

Increasing the RAM capacity, in and of itself, has no impact on speeds. It can however reduce the number of swaps and page faults, which results in the secondary storage no longer being the bottleneck. Hard drive interactions are much slower than RAM interactions.

2. What is a device driver? Why do they often run in kernel mode?

A device driver is a program that facilitates the interaction between the OS and a piece of hardware. The kernel mode is one of the operation modes of the CPU that enables unrestricted access to hardware, which is necessary for a driver to perform its task.

3. What do DirectX and its open source counterpart, OpenGL, do? Why and when should a program choose to use it?

In the early days, programs had to directly work with hardware components in order to perform even the most basic of tasks. They implemented their own drivers, which was a cumbersome task for the developer, but it also allowed for absolute freedom to micromanage and precise fine-tuning of hardware operations.

Modern operating systems, such as Windows, restrict hardware access in order to effectively manage the resources of a system. They also provide basic infrastructure and API for common tasks such as displaying things and playing sounds, which is sufficient for ordinary programs.

Certain programs, such as games and multimedia applications, however, utilize low-level features of hardware components, especially the graphics card, and benefited from that direct communication.

DirectX is a separate set of API on Windows that addresses issues by facilitating a closer interaction between programs and graphics or audio devices in a standardized manner. It relieves the developer from the complications of creating their own drivers and still offers the kind of control over the hardware that a game needs.

One such example is delegating shader calculations to the GPU and bypassing the CPU.

OpenGL is an API specification for a similar goal with many open source implementations.

The source code for one such implementation can be found here:

<https://github.com/rswinkle/PortableGL>

4. What is CUDA? When and how can your program utilize it?

CUDA is a platform and API for running programs on GPUs instead of CPUs and suitable for intensive calculations that can benefit from parallelized deployments of programs that have been compiled according to nVidia's instruction set.

5. What is boot priority? How and why would one modify the boot priority of the devices in a PC?

The boot priority indicates which storage device should be looked for an OS first.

One can find and edit these priorities in their BIOS settings, usually by pressing a key indicated by the motherboard firmware at an early boot stage.

Changing boot priorities is necessary for installing an operating system on a PC.