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**CE521 - Real-time Systems and Programming**

**Homework Assignment #2**

**Due day: 2/20/2022**

**Instruction:**

1. **Push the answer sheet to Github**
2. **Overdue homework submission could not be accepted.**
3. **Takes academic honesty and integrity seriously (Zero Tolerance of Cheating & Plagiarism)**
4. Why do some systems store the operating system in firmware, while others store it on disk?

Answer –

The reason why some systems store the OS in firmware, while other store it on disk is that an operating system provides base for PC and is in charge of setting up the PC during bootup, giving access to that equipment and other framework assets through interfaces for example, process planning and virtual memory, whereas, firmware that may little devices like TV remote or more sizeable device such as IDE hard drive or DVD player.

Firmware is the little, regularly unmodifiable code and information that controls equipment gadgets. Firmware enables gadget producers to utilize universally useful, programmable chips rather than custom-reason equipment.

Consider, BIOS is Firmware and Microsoft Windows is Operating System.

* Firmware ordinarily lives in ROM, OS live on circle
* Firmware program is small, OS is immense one.
* Firmware is normally settled, OS regularly refreshed.
* Firmware low-level activities, OS abnormal state interfaces.

1. How could a system be designed to allow a choice of operating systems from which to boot? What would the bootstrap program need to do?

Answer –

A small piece of code known as the bootstrap program or bootstrap loader locates on most of computer systems loads the kernel into main memory and start its execution. Some computer systems, such as PCs, use a two-step process in which a simple bootstrap loader fetches a more complex boot program from disk, which in turn loads the kernel. The bootstrap program can perform a variety of tasks.

Usually, one task is to run diagnostics to determine with the booting steps. It can also initialize all aspects of the system, from CPU registers to device controllers and the contents of main memory and OS is turned ON.

1. The services and functions provided by an operating system can be divided into two main categories. Briefly describe the two categories and discuss how they differ.

Answer –

One class of services provided by an operating system is to enforce protection between different processes running concurrently in the system. Processes are allowed to access only those memory locations that are associated with their address spaces. Also, processes are not allowed to corrupt files associated with other users.

A process is also not allowed to access devices directly without operating system intervention. The second class of services provided by an operating system is to provide new functionality that is not supported directly by the underlying hardware. Virtual memory and file systems are two such examples of new services provided by an operating system.

1. What is the main advantage of the microkernel approach to system design? How do user programs and system services interact in microkernel architecture? What are the disadvantages of using the microkernel approach?

Answer –

The advantages of the micro kernel approach are-

* Adding a new service does not require modifying the kernel,
* It is more secure as more operations are done in user mode than in kernel mode, and
* A simpler kernel design and functionality typically results in a more reliable operating system.

For interaction between user programs and system services in micro kernel architecture an inter process communication mechanism such as messaging. Operating system convey these messages for communication.

The disadvantages of using the micro kernel approach include -

* The overheads associated within inter process communication and the frequent use of the operating system’s messaging functions in order to enable the user process and the system service to interact with each other.
* As in all cases of modular design, designing an operating system in a modular way has several advantages. The system is easier to debug and modify because changes affect only limited sections of the system rather than touching all sections of the operating system. Information is kept only where it is needed and is accessible only within a defined and restricted area, so any bugs affecting that data must be limited to a specific module or layer.

1. Explain why Java programs running on Android systems do not use the standard Java API and virtual machine.

Answer –

Java API and Virtual Machines are not compatible to android system or mobile devices, these are only supported by the desktop systems. The java programs running on android will have some other software to run which are DVM (Dalvik Virtual Machine). For example, take any one desktop application which are written in java having .jar extension and try to run the same in mobile device having android, it won’t work because the compiler on mobile device doesn't support this type.

Then take same application which is of mobile application also written in java having .jar and this will work because it will be written to execute under the DVM.As the standard API and virtual machine are designed for desktop and server systems, not mobile devices. Google developed a separate API and virtual machine for mobile devices. The reason for java programs running on mobile devices not requiring java API and virtual machine is because standard java API and virtual machine are designed to work on desktop and laptop and not on mobile devices.