

Assignment 1

Vaibhav Sharma
200365101

SHARMA3V@UREGINA.CA

1. Short Answer Questions

1.1 Solution 1

Trap is basically an exception in a user process. It is an interrupt which is generated by software. Trap is caused by invalid memory access or by division of zero, both of which are invalid software routines. Also, traps are synchronous. Trap is used to invoke a kernel routine, as they have higher priority than code. An Interrupt is similar to a system call, except it is generated by devices. It is basically a fault, which is generated by hardware, which means, an interrupt is caused by devices like the hard disk, graphics card, I/O, ports etc. Also, interrupts are asynchronous. Interrupt handling shares some of the code that is needed for system calls and exceptions. The memory location of an interrupt handler is given by an interrupt vector and this interrupt handler is generated when the interrupt is called.

1.2 Solution 2

Von Neumann architecture is a theoretical design for a stored program computer, which is the basis of modern computing. This theoretical architecture consists of a central processing unit, memory unit, mass storage, input and output. In this architecture, data reading and writing to and from the main memory is done on one data bus, fetching instructions for execution is done on another data bus. The memory addresses are different in the von neumann architecture. In a von neumann architecture, there is an Arithmetic Logic Unit in the processor which can implement the basic functions and operations. It also has the temporary storage which can store a few words of data.

1.3 Solution 3

CPUs and multiple devices are connected through a common bus. Each device controller is kept in charge of a specific device. The movement between the peripheral devices and the local buffer is controlled by the device controller. The device controller is used for data transfer between devices that it controls, as well as local buffer storage. Usually, each operating system has a device driver for every device controller. This runs the device, and acts as an interface between the device controller and the operating system. This driver understands this device controller and presents a uniform interface for the device to the rest of the operating system. A common example is USB, which helps the user and system communicate through the device.

1.4 Solution 4

Clustered systems are similar to parallel systems, they both have multiple CPUs. They are formed by merging two or more computer systems together. This is the reason why they can work as parallel systems, resulting in high performance. These clustered systems have hardware clusters and software clusters. The clustered system provides the high availability service because in this clustered system, a group of hosts get more efficient by acting as a single system. These clusters are used for load balancing, back up as well as high availability service because it enhances power processing. The clustered systems are quite fault tolerant, also, a single failure does not disrupt the entire system. They also have nodes, in case some nodes stop working, and these can take their place.

1.5 Solution 5

There are two modes of the operating system. first mode is USER and second is KERNEL. The user modes are represented using binary values of 0 and 1. The kernel mode gets unrestricted access to the hardware but User mode has no ability to directly access hardware. Kernel mode can execute any CPU instruction and access any memory but User mode is delegated to system APIs to access any hardware or memory. Most of the code running on the system is executed in User mode as it adds a layer of security against crashes which can be very damaging in kernel mode.

1.6 Solution 6

The cache is a form of memory used to reduce memory accesses and time used in accessing same memory again. If a user is accessing certain data from memory again and again then it will be added to cache as it's highly likely that user will access it again. This process make memory access much efficient and gives faster experience to the user. Cache coherency ensures that multiple caches store the most updated data. Cache Coherency plays an important role in multiprocessors and DMS as it supports consistent storage of data in multiple caches.

1.7 Solution 7

The DMA channel allows the channel to communicate between peripheral devices and the system memory. All the system resources rely on certain lines in a bus. The lines on the bus are used for IRQs, addresses or DMA channels. The main idea of the DMA channel is to transfer data, without putting the whole load on the CPU. The DMA helps in transferring data from the devices and the main memory. Even If the CPU is busy, the DMA allows hardware to access memory. Direct memory access (DMA) allows an input/output (I/O) device to send or receive data directly to or from the main memory, and therefore speeds up the memory operations. This process is managed by a chip known as a DMA controller (DMAC). It removes the scope of complete dependence on CPU for transferring for transferring data. As the CPU is not accessed every time the system's memory has to be accessed, the time taken for the input output devices to access system memory is automatically reduced.

1.8 Solution 8

Multi core processing means two or more CPUs are working on the same chip. A single physical processor contains the core logic of two or more processors, which are packed into a single integrated circuit. The multi-core processing is way more efficient than placing each processor on its own chip, This is because, in multi-processing the chip has two or more processors, which ensures faster processing. Due to a multiprocessor system, each core is able to perform its own function independently, irrespective of another processor.

Thus, the multi-processor system ensures efficiency and speed, which enables the system to perform more tasks and therefore enhances the performances. Multi-core technology can be used in desktops, mobile PCs, servers as well as workstations.

1.9 Solution 9

The system-call interface of a programming language serves as a link to system calls which are made available by the operating system. This interface intercepts function calls in the API as well as makes the necessary system call in the operating system. A user can't see most of the system calls, as they are hidden by the Application Programming Interface and are managed by the run-time support library.

An API is a collection of classes, functions, as well as structures. The main function of an API is that it makes communication better and easier, and make applications interact with the operating systems. Software can communicate with each other with the help of APIs. An API behaves like a software interface between the external software components. By the system calls, the external software modifies the operating systems. Operating system is the last layer between the users/applications and the hardware. The operating system controls the interaction between the external hardware and the handling of the input/output and memory. The operating system uses or modifies the hardware as per the requirements.

1.10 Solution 10

Some requirements and goals to consider are as follows :

- The system should be easy to use by the user while still having the capacity to perform complex functions
- The complexity of algorithms used in operating systems should be able to handle enough requests while still running at high efficiency.
- Access to memory should be fast and secure.
- All of the hardware and system resources should be used at all times to deliver highest efficiency.
- The overall system should be easy to design, develop, test and maintain by developers and users.

1.11 Solution 11

The modular approach solves the problem of scalability when it comes to dynamically expanding vertically or horizontally as it uses both layered and micro kernel design techniques. The current modular kernel also helps reduce booting time as it only uses required kernels. In this approach, the kernel's are divided into sub modules which allows the system to

only use the required kernels and leave the other modules. This allows system to efficiently prioritize and only the selected modules which makes the task much for efficient and fast. These modules can dynamically loaded any time which system is trying to scale up.

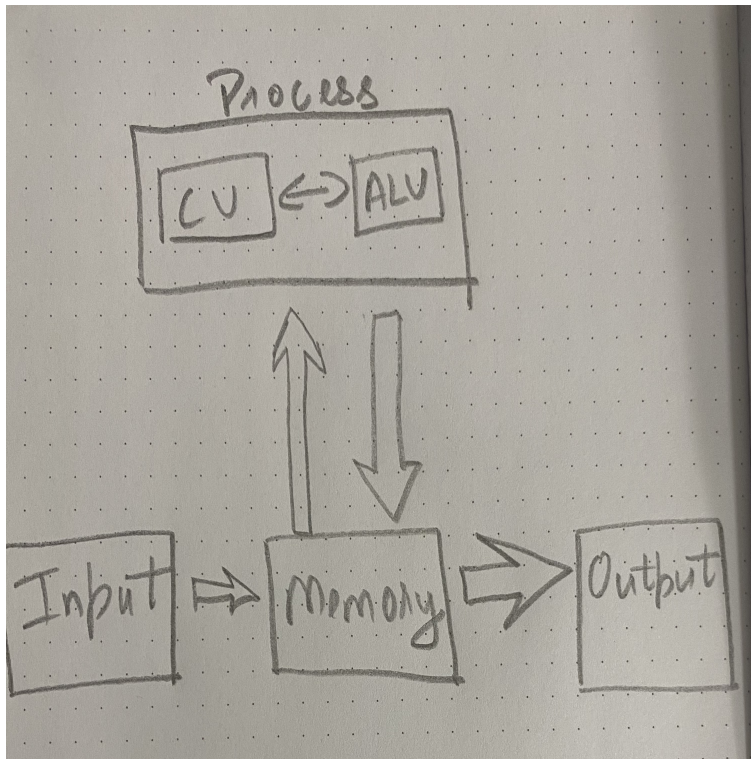
1.12 Solution 12

Virtualization means creating a virtual version of something, which includes networks, storage devices as well as computer network resources. When virtualizing the system hardware, it provides an appearance to the user that a brand new system is being used where as system is just creating a virtual facade. This is very efficient as it does not affect processing speeds.

Simulation is not a real environment, it is a controlled software environment, in which a user is allowed to implement things like the real environment. Simulation is basically a model, which is used specially for study purposes.

2. Long Answer Questions

2.1 Solution 1



In this world every things and object has its architecture, like human body architecture, car model architecture and office building has its own architecture. Architecture defines how the object models and works.

The same way computer also has its own architecture on which its run.

There are two types of architecture :- 1) Von-Neumann Architecture 2) Harvard Architecture

Von Neumann Architecture was designed by the great mathematician and scientist John Von Neumann in 1945. Most of the computer of the world runs on this architecture.

Von Neumann Architecture has four components :- 1) Input

2) Memory 3) Process 4) Output

Once Input comes into the system, it is stored in the memory. the input then becomes the command that is ready to be processed. The processor fetches the command from the memory. There are two parts in processors. first Control unit and second Arithmetic logical unit. After the process is finished, the control unit stores the result in memory and displays the output.