

HW1

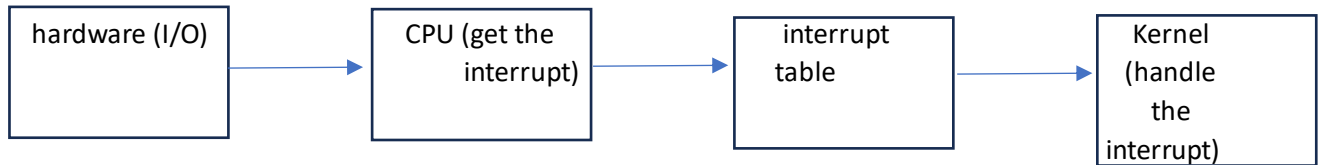
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Question 1:

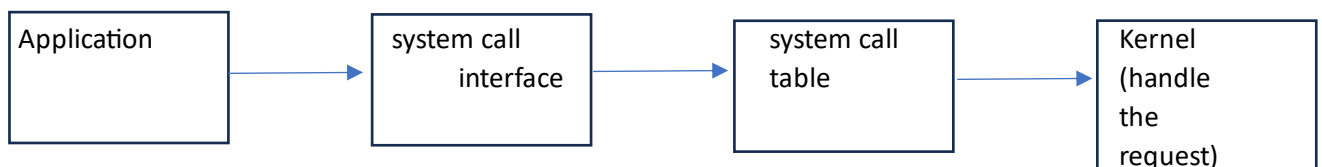
	Operation	Protected/not protected	explanation
1	Set value of computer clock	protected	Changing the clock can mess with system security and logs.
2	Read the computer clock	Not protected	Reading the clock is safe and doesn't affect security.
3	Make intensive calculations	Not protected	Doing heavy calculations is fine without restrictions.
4	Read the memory of other processes	protected	Reading other processes' memory can expose sensitive data.
5	Issue a trap/exception instruction	protected	Issuing a trap can disrupt system stability.
6	Block all interrupts in the system	protected	Blocking interrupts can make the system unstable.
7	Switch from user to kernel mode (change the mode-bit)	protected	Switching to kernel mode needs protection for security.
8	Switch from kernel to user mode (change the mode-bit)	protected	Switching to user mode is necessary for normal use.
9	Read the keyboard input	protected	Keyboard input can include sensitive information.
10	Read the mouse input	Not protected	Reading mouse input is not a security risk.
11	Making a 'beep' sound	Not protected	Making a beep sound is harmless.
12	Read current user name (not the password)	Not protected	Reading the username is not a security risk.
13	Access the hard disk drive (HDD) for writing	protected	Writing to the disk can delete or change important data.
14	Access the Wi-Fi hardware for sending packets	protected	Sending Wi-Fi packets can be used maliciously.
15	Controlling the keyboard status LEDs: CAPS-LOCK & NUM-LOCK	Not protected	Changing keyboard LEDs is harmless.
16	Controlling the microphone (recording)	protected	Recording audio can violate privacy.
17	Shutting down the computer	protected	Shutting down the computer can cause data loss.
18	Putting a pixel on screen at (x,y)	Not protected	Drawing on the screen is safe.
19	Read the number of processes in the system (how many processes are currently running, with no further information)	Not protected	Knowing the number of processes isn't a security risk.
20	(Smartphones OS): reading the battery charge level	Not protected	Reading battery level is harmless.

Question 2:

A. The interrupt table is like a guide for the computer that helps it decide what to do when it receives a signal from hardware, such as a keyboard or mouse. It allows the CPU to quickly locate the correct code to handle the interrupt efficiently.



B. The system call table is a reference that the operating system uses to figure out how to respond when an application requests a service, such as reading from a file or displaying something on the screen. It ensures that the request is sent to the appropriate function in the kernel for processing.



C.

DMA allows hardware devices to transfer data directly to or from memory without involving the CPU. This frees up the CPU to perform other tasks while the data transfer takes place, improving overall system performance.

The key benefit of DMA is that it enhances data transfer speed, as the CPU doesn't need to handle every step of the process.

However, one downside of DMA is that managing it can be complex, especially when multiple devices use it simultaneously. They may conflict and cause errors.

For instance, if a network card and a disk drive both attempt to use DMA to access the same memory area, it could result in data being corrupted or lost.

Question 3:

A + B.

Server Operating Systems : A central server (known as a server) whose role is to support several additional servers (located outside the computer where the central server is located) (client server of the machines that the communication between them is conducted in a server-client architecture). This operating system is often implemented in places where heavy computational operations are performed but with logic it should be done. A functional use for the system is this example for servers Internet (service web) the help to enable parallel access to hundreds of thousands of users.

Advantages:

- (1) Very rich hardware and large volume memory - manages a lot of information and data also with capacity Very high memory which helps it serve many "accounts".
- (2) There is no direct communication between the customers so that if one falls - there is no impact on the rest and the system can continue to run, in addition lack of communication between the client can information compartmentalization and helps security subtitle.

Disadvantages:

- (1) More emphasis on performance and less emphasis on user interface (when of course the user This refers to the company using this type of operating system and not to the customers).
- (2) scalable - any additional server that is added to the system as a client requires additional memory resources, Additional hardware and software.

Batch Operating System: an operating system that holds a mapping component (operating computer). When a task is given when it arrives from the user (job) transfers the task to a task cluster of the same type (that received the same match from the operator) so that each group of requests is called a batch. After The entire batch is transferred to the operating system that performs the jobs.

Advantages:

- (1) There is no direct communication between a user and an operating system so that human errors do not damage the system activation.
- (2) Many users use users - according to the operator without Depends on which user requested them.

Disadvantages:

- (1) Less communication with the user - a user only submits a request and requests without comments user.
- (2) Non-immediate response - a long process between the moment of contact from the user and the execution of the request.

Real-time Operating System: systems with a very short response time, the time between moments The trigger (alerts, interrupts) until the moment of processing and execution is very short and is called response time. Mainly used in critical systems, meaning the use of a shield around human life dome system Iron, monitors and automatic alerts in the car (a driver who is not wearing a seat belt or a person crossing the road at the time). that the vehicle is too close). These operating systems are divided into 2 subgroups: time – Real Hard: operating systems can have a response time that is too long (relatively) lead to devastating results of loss of human life (such as the systems we described above). time - Real Soft: systems where a short response time is important but human life is not at stake Direct, for example a cyber defense system can respond in a short time but it is a matter of hardware protection and sensitive and indirect information in human life (even though the disclosure of sensitive information can indirectly lead to injury). In human life, such as infiltrating Bezeq's base and retrieving a customer's address (therefore it is A real time system will still calculate.

Advantages:

- (1) Maximum use of hardware and software for the protection and security of the people who own the system Operation of this type (iron dome system).
- (2) These operating systems come out following comprehensive tests and careful planning of cases edge and therefore almost error-free.

Disadvantages:

- (1) The algorithm around operating systems of this type is very complex and difficult to implement.
- (2) requires special hardware components in order to enable a response as short as possible.

Embedded operating system: an operating system that is embedded in the device in which it is adapted to him and his personal use, that is, it is developed together with the development itself in order to enable Specific functionality of Tovthalie is developed. Examples of use: telephones, digital clock, Medical equipment and more.

Advantages:

- (1) Very fast - because it has minimal software suitable for the device itself (and does not try to cover

Lots of functionality to serve several uses (

- (2) For the same reason that this system is customized, it also consumes less resources and memory.
- (3) operating systems that are considered cheap (low cost).

Disadvantages:

- (1) "Narrowing of horizons" includes that which is adapted to specific functionality (i.e. success of an operating system For example adapted for phones will not be reproducible or adapted for computers.
- (2) That is, not flexible to changes - adding functionality, adding users and updates in general It will be difficult to implement this type of operation

C.

1.Hardware and Processors:

- **CPU:** Custom AMD Ryzen™ Zen 2, 8 Cores / 16 Threads, running at up to 3.5 GHz
- **GPU:** Custom AMD Radeon™ RDNA 2-based graphics engine, capable of Ray Tracing, with a variable frequency up to 2.23 GHz (10.3 TFLOPS)
- **Memory:** 16 GB GDDR6 RAM
- **Storage:** Custom 825 GB SSD for ultra-fast load times
- **I/O Throughput:** 5.5 GB/s (Raw), up to 8-9 GB/s (Compressed)
- **Optical Drive:** Ultra HD Blu-ray, supporting up to 100 GB/disc

I/O Hardware Devices:

- **USB Ports:** Multiple USB Type-A and Type-C ports for high-speed data transfer
- **Ethernet:** Gigabit Ethernet (10BASE-T, 100BASE-TX, 1000BASE-T)
- **Wireless:** Wi-Fi 6 (802.11ax) and Bluetooth® 5.1
- **HDMI:** HDMI 2.1 output port, supporting 4K at 120Hz and 8K displays
- **Audio:** Tempest 3D AudioTech for immersive sound, headset jack on the DualSense controller

2. Operating System: Orbis OS

Type of OS: Console Operating System (based on FreeBSD)

3.

Orbis OS is the proprietary operating system that powers the PlayStation 5, developed by Sony Interactive Entertainment. It is derived from FreeBSD, a UNIX-like operating system, and customized to suit the needs of a gaming console. Here are some key features of Orbis OS:

- **Optimized for Performance:** Orbis OS is fine-tuned to take full advantage of the PS5 hardware, ensuring smooth gameplay and quick load times thanks to optimized memory management and the high-speed SSD.
- **User Interface:** The OS offers an intuitive and streamlined user interface, making it easy for users to navigate through games, apps, and system settings.
- **Game Management:** It provides efficient game installation and update processes, allowing players to quickly install, update, and manage their game library.
- **Multitasking Capabilities:** The OS supports seamless multitasking, enabling users to switch between games and apps without significant delays, aided by features like quick resume.
- **Security Features:** Orbis OS includes robust security measures to protect against unauthorized access, piracy, and cheating. It uses encryption and secure boot mechanisms.
- **Networking and Online Services:** The OS offers advanced networking features for online multiplayer gaming, social interactions, and integration with online services like game streaming and sharing.
- **Audio and Visual Enhancements:** Leveraging Tempest 3D AudioTech, Orbis OS delivers immersive audio experiences, and supports high-definition video output, including 4K and HDR gaming.
- **Backward Compatibility:** Orbis OS supports a wide range of PlayStation 4 titles, enhancing the gaming experience by allowing users to play older games on the new console.

D.

OS Custom: The operating system of all models of Tesla vehicles, designed individually for vehicles by the company itself. The operating system combines various functions, including navigation, entertainment and climate control. This operating system is also based on Linux which allows the company to make flexible programming for changes, additions and updates to the system and allows the Custom operating system to be the most efficient and safest to use. The operating system has several main features:

Cruise control: The operating system has unique warning mechanisms that help the driver drive safer

such as:

- Maintaining a uniform path
- Warning of accelerations and increased driving speeds
- Recognition of traffic lights and road signs from a distance
- Navigation on highways
- Automatic parking
- Automatic lane change
- Pedestrian detection nearby.

These are all complex actions that, when performed by the system, avoid human errors resulting from a lack of Attention, reactions to distractions and stimuli while driving or general lack of professionalism in driving, mistakes which may lead to a life-threatening situation for the driver, other drivers next to him and the pedestrians.

Touch screen interface support and voice commands: the operating system allows user control through a screen High resolution touch through which the user selects desired functionality in the vehicle. Avoiding the use of buttons Scattered in the vehicle supports maintaining the driver's concentration while driving and allows him easy access and quick control in the functionality of the vehicle. For the same reason the operating system supports the driver's voice commands, requests Navigation, blending, media and more.

An LTE device for wireless communication (common in mobile devices in general) that allows the driver to connect in a way fast internet, receive regular weather reports or traffic reports or navigation data, enjoy music and additional multimedia.

Question 5:

B.

	1 process	2 processes	4 processes	8 processes	16 processes	32 processes	128 processes	256 processes
1 iterations	0.14941 ms	0.172 ms	0.13543 ms	0.10567 ms	0.10976 ms	0.1318924 ms	0.1252 ms	0.11721 ms
2 iterations	0.15920 ms	0.13570 ms	0.102895 ms	0.13280 ms	0.12095 ms	0.1345 ms	0.1734 ms	0.1953 ms
100 iterations	0.112710 ms	0.172 ms	0.15790 ms	0.12315 ms	0.1920 ms	0.16290 ms	0.2013 ms	0.223 ms
500 iterations	0.1710 ms	0.2180 ms	0.14190 ms	0.16315 ms	0.1845 ms	0.1860 ms	0.1915 ms	0.2025 ms
1000 iterations	0.1935 ms	0.2320 ms	0.2035 ms	0.1895 ms	0.1850 ms	0.2090 ms	0.2015 ms	0.1945 ms
5000 iterations	0.3840 ms	0.2745 ms	0.2833 ms	0.2830 ms	0.2320 ms	0.2925 ms	0.3085 ms	0.3026 ms
10000 iterations	0.412 ms	0.5950 ms	0.568 ms	0.562 ms	0.7185 ms	0.717 ms	0.8930 ms	0.8025 ms

C.

According to the results, several distinctions can be made.

Increasing the number of iterations increases the average time for the process – as we expected, the time. The average performance of each process increases when the number of iterations is increased. This. Since more operations are performed during the process, which requires additional time in the operations The CPU.

Increasing the number of simultaneous processes increases the average time for the process - it can be seen that. When additional processes are added at the same time, the average time for the calculation increases. This is done because the computer only has a limited number of cores and in addition the operating system to manage the resources in its possession in accordance with all the processes that exist in it at the same time. In light of this, the operating system allocates a limited number of cores, which in a personal computer usually does not exist more than 8 active cores at the same time for required processes. The amount of processes that can be performed simultaneously at any time is equal to the number of cores for this process.

Therefore, Mr. Beit, the processes are not carried out simultaneously as was expected. the operating system manages all the processes that are required to be carried out, and the scheduler performs the exchange between the processes performed in the kernel according to its method of operation. In every beginning of a process there is time switch context, at this time the kernel cannot perform another operation, which causes the increase in the average execution time of the processes.