OPERATING SYSTEMS

UE18CS302_Unit 5_Revision_Class_#3

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OPERATING SYSTEMS

Course Syllabus - Unit 5

10 Hours

Unit-5:Unit 5: IO Management and Security

I/O Hardware, polling and interrupts, DMA, Kernel I/O Subsystem and Transforming I/O Requests to Hardware Operations - Device interaction, device driver, buffering System Protection: Goals, Principles and Domain of Protection, Access Matrix, Access control, Access rights. System Security: The Security Problem,Program Threats, System Threats and Network Threats. Case Study: Windows 7/Windows 10

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Course Outline

47	I/O Hardware, polling and interrupts	13.1,13.2
48	DMA	13.2.3
49	Transforming I/O Requests to Hardware Operations, Device interaction, device driver, buffering.	13.5
50	Goals, Principles and Domain of Protection	14.1-14.3
51	Access Matrix	14.4
52	Access control, Access rights	14.5-14.7
53	The Security Problem	15.1
54	Program Threats	15.2
55	System Threats and Network Threats	15.3
56	Case Study : Windows File System	17.5

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What type of operating system is Windows 7 ? Describe two of its major features.

- A 32/64 bit preemptive multitasking operating system supporting multiple users.

  1. The ability automatically to repair application and operating system problems.

  2. Better networking and device experience including digital photography and video.

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List the design goals of Windows 7. Describe two in detail.

Design goals include security, reliability, Windows and POSIX application compatibility, high performance, extensibility, portability and international support.

1) Reliability was perceived as a stringent requirement and included extensive driver verification, facilities for catching programming errors in user-level code, and a rigorous certification process for third-party drivers, applications, and devices.

2) Achieving high performance required examination of past problem areas such as I/O performance, server CPU bottlenecks, and the scalability of multithreaded and multiprocessor environments.

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Describe the three main architectural layers of the Windows 7 kernel

a. **The HAL - Hardware Abstraction Layer** creates operating system portability by hiding hardware differences from the upper layers of the operating system. Administrative details of low-level facilities are provided by HAL interfaces. HAL presents a virtual machine interface that is used by the kernel dispatcher, the executive and device drivers.

b. **The kernel layer** provides a foundation for the executive functions and user-mode subsystems. The kernel remains in memory and is never preempted. Its responsibilities are thread scheduling, interrupt and exception handling, low-level processor synchronization, and power failure recovery.

c. **The executive layer** provides a set of services used by all subsystems: object manager, virtual memory manager, process manager, local procedure call facility, I/O manager, security monitor, plug-and-play manager, registry, and booting.

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How is the NTFS namespace organized ?

- The NTFS namespace is organized as a hierarchy of directories where each directory uses a B+ tree data structure to store an index of the file names in that directory.
- The index root of a directory contains the top level of the B+ tree.
- Each entry in the directory contains the name and file reference of the file as well as the update timestamp and file size.

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How does NTFS handle data structures? How does NTFS recover from a system crash ? What is guaranteed after a recovery takes place ?

- In NTFS , all file-system data structure updates are performed inside transactions. Before a data structure is altered, the transaction writes a log record containing redo and undo information.
- A commit record is written to the log after a transaction has succeeded. After a crash the file system can be restored to a consistent state by processing the log records, first redoing operations for committed transactions and undoing operations for transactions that did not successfully commit.
- This scheme does not guarantee that user file contents are correct after a recovery, but rather that the file-system data structures (file metadata) are undamaged and reflect some consistent state that existed before the crash.

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How does Windows 7 allocate user memory ?

User memory can be allocated according to several schemes: virtual memory, memory-mapped files, heaps, and thread-local storage.

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Describe some of the ways an application can use memory via the Win32 API .

a. Virtual memory provides several functions that allow an application to reserve and release memory, specifying the virtual address at which the memory is allocated.

b. A file may be memory-mapped into address space, providing a means for two processes to share memory.

c. When a Win32 process is initialized, it is created with a default heap. Private heaps can be created that provide regions of reserved address space for applications. Thread management functions are provided to allocate and control thread access to private heaps.

d. A thread-local storage mechanism provides a way for global and static data to work properly in a multithreaded environment. Thread-lock storage allocates global storage on a per-thread basis.

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For all the other relevant Unit 5 concepts refer to the lecture supplements and relevant videos on PESU Academy

THANK YOU

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