



# OPERATING SYSTEMS

UE19CS254 Unit 5 Revision Class #3

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# OPERATING SYSTEMS

## Course Syllabus - Unit 5

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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

# OPERATING SYSTEMS

## 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

**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.

### 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.

### 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.

### 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.

**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.



### 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.

**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-local storage allocates global storage on a per-thread basis.

**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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