OPERATING SYSTEM CONCEPTS - SYLLABUS

Kai Dong, Southeast Univ.

OPERATING SYSTEM CONCEPTS
SYSLLABUS

U = understand; R = remember; M = master.

WEEK #	HOUR #		CONTENTS			REQ.		
	SEU	E.P.	Chapter	Section	Concepts	U	R	M
1	1	1	0. Prologue					
2	7	6	1. Introduction	What Operating Systems Do	Operating System (system view): resource allocator, control program.	○		
				Computer-System Organization	Interrupts; Trap/exception.	○		
				Operating-System Structure	Multiprogramming; Timesharing (multitasking).	○		
				Operating-System Operations	Interrupt driven; Dual-mode; Privileged instructions.	○		
3	11	8	2. Operating-System Structures	System Calls	System Calls.	○		
				Operating-System Design and Implementation	Policy and mechanism.	○		
				Operating-System Structure	Simple / layered / microkernel / modules / hybrid structure.	○		
4	16	12	3. Processes	Process Concept	Processes; Context switch.	○		
					Process states (transitions); PCB.		○	
				Process Scheduling	Long-term / medium / short-term scheduling.	○		
				Operations on Processes	Process APIs.			○
				Interprocess Communication	Shared memory; Message passing.	○		
				Communication in Client– Server Systems	Pipes.	○		
5	20	15	4. Threads	Overview	Threads; Benefits of threads.	○		
				Multicore Programming	Concurrency vs. parallelism.	○		
				Multithreading Models	Kernel / user threads; Motivating kernel / user threads.	○		
					Multithreading models.		○	
				Thread Libraries	Pthread APIs.			○
				Implicit Threading	Thread Pools.	○		
				Threading Issues	Thread cancellation; Signal handling; Thread-local storage; Lightweight process.	○		
7	25	19	5. CPU Scheduling	Basic Concepts	CPU / I/O burst; Scheduling timing; Scheduler; Dispatcher.	○		
				Scheduling Criteria	Scheduling criteria.		○	
				Scheduling algorithms	FCFS; SJF; Preemptive SJF; Priority; RR; Multilevel queue; Multilevel feedback queue; Gantt chart; HRRN.			○
				Thread Scheduling	Process/system-contention scope.	○		
				Multiple-Processor Scheduling	Asymmetric multiprocessing vs. symmetric multiprocessing; Processor (cache) affinity.	○		
9	34	25	6. Process Synchronization	The Critical-Section Problem	Race condition; Critical section; Critical section problem.	○		
					Solution to critical-section problem (three requirements).		○	
				Peterson's Solution	Peterson's Solution.	○	○	
				Synchronization Hardware	Interrupt masks; Test-and-set; Compare-and-swap; Spin-waiting.	○		
					Solution using test-and-set (satisfying bounded waiting).		○	
				Mutex Locks	Mutex.			○
				Semaphores	Semaphores.			○
				Classic Problems of Synchronization	The Bounded-Buffer problem; The Readers–Writers problem; The Dining-Philosophers problem.			
				Monitors	Condition variables.			○
					Monitors.	○		
10	37	28	7. Deadlocks	System Model	Deadlock.			
				Deadlock Characterization	Four necessary conditions; Resource-allocation graph.		○	
				Methods for Handling Deadlocks	Deadlock prevention / avoidance / detection / recovery.	○		
				Deadlock Prevention	Denying the four necessary conditions.		○	
				Deadlock Avoidance	Safe state; Resource-allocation graph alg.; The banker's alg. (Safety alg.; Resource-request alg.).			○
				Deadlock Detection	Wait-for graph alg.; Detection alg..			○
				Recovery from Deadlock	Selecting a victim; Roll back; Starvation.	○		
11	43	33	8. Main Memory	Background	Program loading and linking; Address binding; Logical / physical address space.	○		
				Swapping	swapping.	○		
				Contiguous Memory Allocation	base / limit; MMU; Free list.	○		
					Address translation; Free space management.		○	
				Segmentation	Segmentation.		○	
					External fragmentation.	○		
				Paging	Paging; TLB; Page size issues.		○	
					Internal fragmentation.	○		
				Structure of the Page Table	Paging and Segments; Hierarchical page tables.		○	
					Hashed / inverted page tables.	○		
13	51	38	9. Virtual Memory	Demand Paging	Demand paging; Page fault.	○		
					Effective access time.		○	
				Copy-on-Write	Copy-on-write.	○		
				Page Replacement	modify / dirty bit; Reference string; Belady's anomaly.	○		
					Page replacement algs.: Optimal, FIFO, LRU; LRU approximation algs (Clock, etc.).		○	
				Allocation of Frames	Equal / proportional / priority allocation; Global/local replacement.	○		
				Thrashing	Thrashing.	○		
					Working-set model; page-fault frequency.		○	
				Memory-Mapped Files	Memory-Mapped Files; Shared memory.	○		
				Other Considerations	Page size issues.	○		
14	55	41	10. Mass-Storage Structure	Overview of Mass-Storage Structure	I/O time.	○		
				Disk Structure	Disk Structure.			
				Disk Scheduling	FCFS; SSTF; SCAN; C-SCAN; LOOK; C-LOOK.		○	
				RAID Structure	RAID lv 0 / 1 / 4 / 5.	○		
15	58	43	11. File-System Interface	File-System Interface	inode number; File descriptor; Hard / symbolic link; File sharing; Access control.	○		
16	64	48	12. File-System Implementation	File Organization	FCB/inode; Direct / indirect pointers; extent.	○		
				Allocation Method	Contiguous / linked / indexed allocation.	○		
				Free Space Management	Bitmaps; Free lists.	○		
16	64	48	13. I/O Systems	I/O Systems	Polling; interrupt-driven; Direct memory access.	○		
				Application I/O Interface	Kernel I/O structure.	○		
				Kernel I/O Subsystem	I/O Scheduling; Buffering; Caching; Spooling.	○		