



Processor Design

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Implications of Operating System SW

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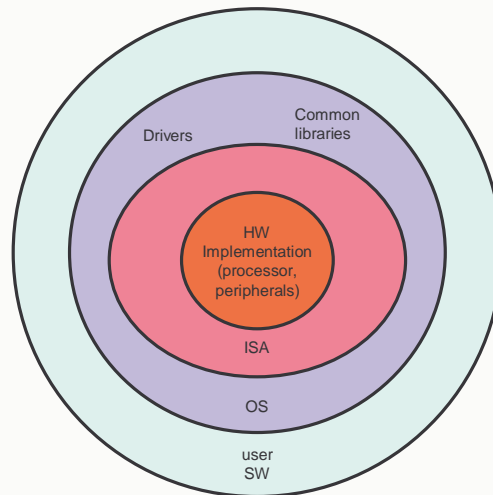


Tasks of the Operating System

- Scheduling of processor time
 - Allocation of memory
 - controlling isolation or sharing of resources
 - I/O services for processes
 - A library of common service programs
 - Mechanisms to enter and leave layers of the OS
 - Interprocess communication and synchronization
 - Memory management mechanisms
 - The context switch
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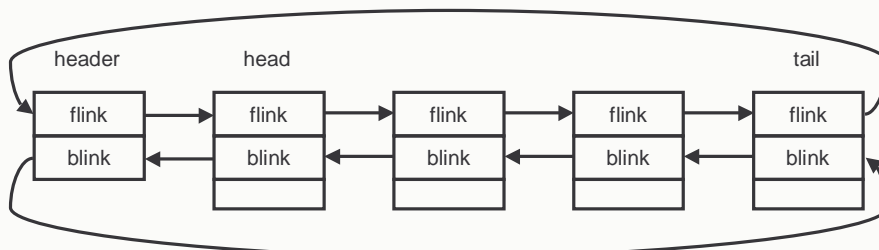


View of the Processor HW and SW



Doubly Linked Lists

- Queues of records, consisting of
 - a header with pointers to the first and last record in the queue
 - 0...N records with pointers to the next and previous record
 - additionally the records include some amount of data
 - the pointers can be called forward (FLINK) and backward link (BLINK)
 - the links can actually be displacements instead of absolute pointers





Use of Doubly Linked Lists

- Used by the OS for process and memory management
 - e.g. queue of timeshared processes in run, list of free memory blocks

 - E.g. a process control block describes the full context
 - by storing all register contents or by storing a (stack) pointer
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Required Features for OS and Shared Data 1

- Change four links of a shared list
 - an interrupt in between may cause a context switch
 - the new process may find half-linked elements
 - a record or the whole list can be lost or the list may remain incoherent
 - a semaphore and atomic test-and-set/test-and-clear of it is required
 - sometimes disabling all interrupts may also be a sufficient solution

 - For multiprocessors this is not enough
 - the other processor may access a cached semaphore
 - some areas of the memory have to be uncacheable (indicated in PTE)
 - this is good for I/O space as well...
 - some memory has to be always resident in memory (OS, interrupt handlers)
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Required Features for OS and Shared Data 2

- Protection of memory areas
 - this is accomplished by the memory management hardware
 - based on allocated memory pages and related protection bits in PTE

 - A system timer hardware is needed if the OS is time-slicing tasks
 - provides also software timer service for the user programs
 - may be also a complete real-time clock device
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Helping The Compiler

- The HLL compiler does not set any specific requirements
 - However, the compiler will appreciate
 - Orthogonality of instructions
 - A lot of registers
 - General-purpose registers
 - Software stack rather than HW stack

 - Processor architectures with direct support to a HLL
 - E.g. Forth, C, java, ...
 - Complex addressing modes targeted at certain HLL operations
 - Or extensive general support for HLL structures like procedure calls
 - Have generally been unsuccessful after all

 - Provide primitives, not complete solutions!
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End of SW impacts

next we will look at arithmetics
and datapath construction
