Operating Systems – EDA093/DIT401
Concluding remarks

Vincenzo Gulisano
vincenzo.gulisano@chalmers.se

UNIVERSITY OF
GOTHENBURG

Important before the exam

Click on the header to change sortorder

Course code	Course name	Department	Examination date	Begins	Location	Length	First day for sign-up	Last day for sign-up
EDA093	Operating systems Course element: 0117	COMPUTER SCIENCE AND ENGINEERING	**24 Oct 2020**	8.30 am	Johanneberg	4 hours	17 Aug 2020	11 Oct 2020
EDA093	Operating systems Course element: 0117	COMPUTER SCIENCE AND ENGINEERING	**04 Jan 2021**	8.30 am	Johanneberg	4 hours	24 Nov 2020	14 Dec 2020
EDA093	Operating systems Course element: 0117	COMPUTER SCIENCE AND ENGINEERING	**17 Aug 2021**	2.00 pm	Johanneberg	4 hours	30 Jun 2021	01 Aug 2021

done using Canvas

most likely done via Canvas

time will tell…

Important before the exam

- Summary study:

- accompany your summary study with the notes received, exercises (those solved in class and others, incl. those in the hard-copy notes) and summary questions at the end of each book chapter

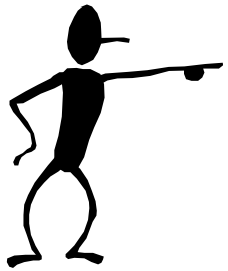
- keep a critical eye in your overview study:
  - why is this so? how does it work?
  - How do the puzzle pieces fit together?

- later: check OS web-page for news

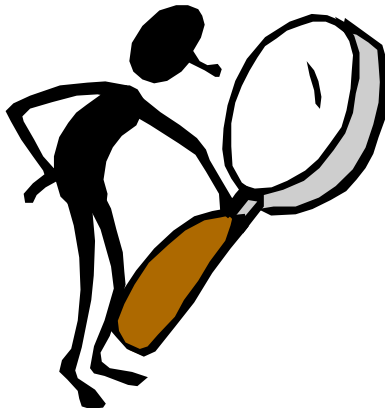
Important before the exam

- Check reading instructions in Canvas page

How do we address a challenge?



Like this!



Like this!
Or this!
Or this!
Maybe also like this…
Why not like this… mmm…

- **Introduction / System Structures**
- Processes / Threads
- Multithreaded Programming
- Process scheduling
- Synchronization
- Deadlocks
- Memory Management
- Virtual Memory
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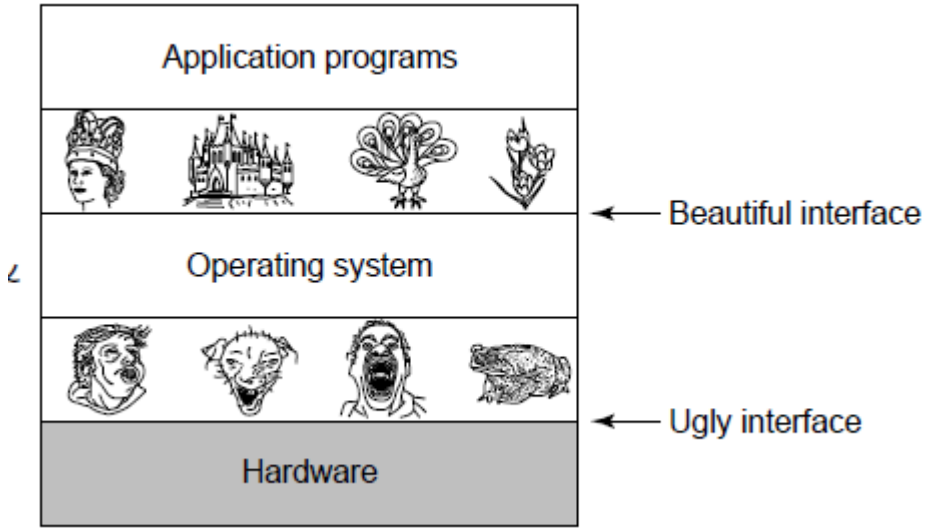
- I/O Systems
- Security / Protection
- Virtualization

Need to decouple Applications/Users from Hardware



… need to build upon a basic instruction cycle

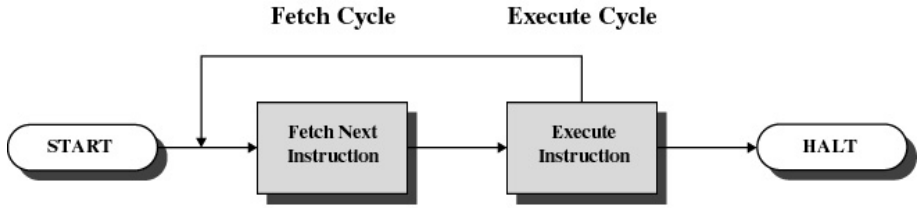


Figure 1.2 Basic Instruction Cycle

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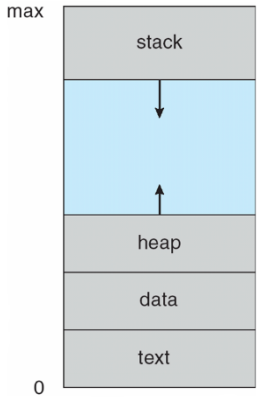
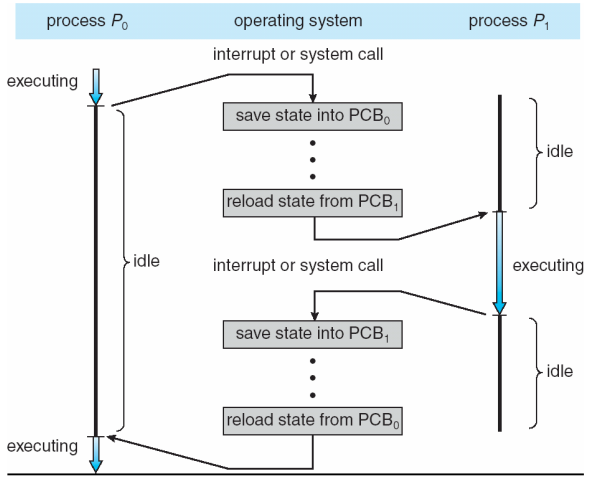
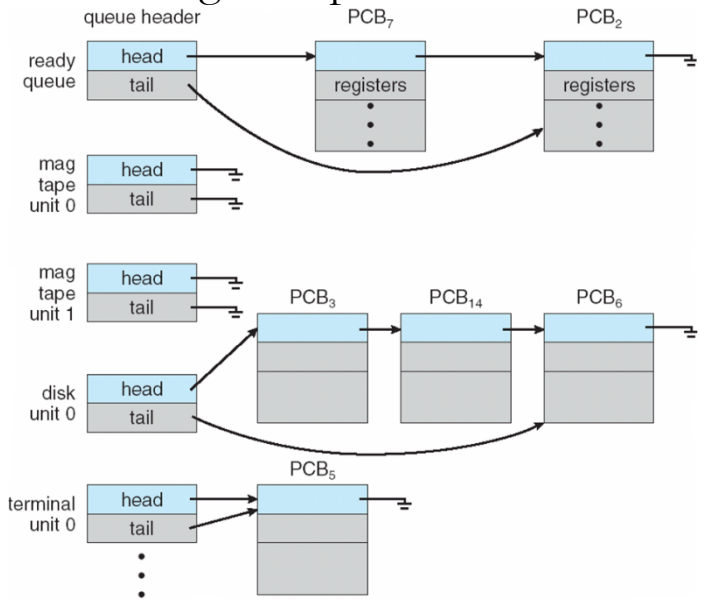
Need to maintain information about processes running in the OS



Need to switch between processes…



Need to organize processes and devices



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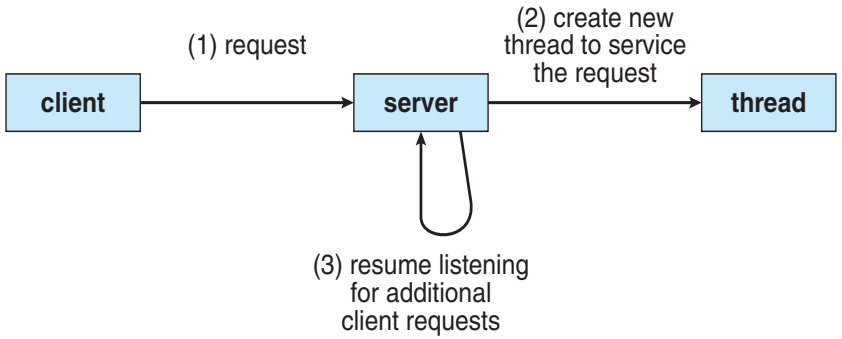
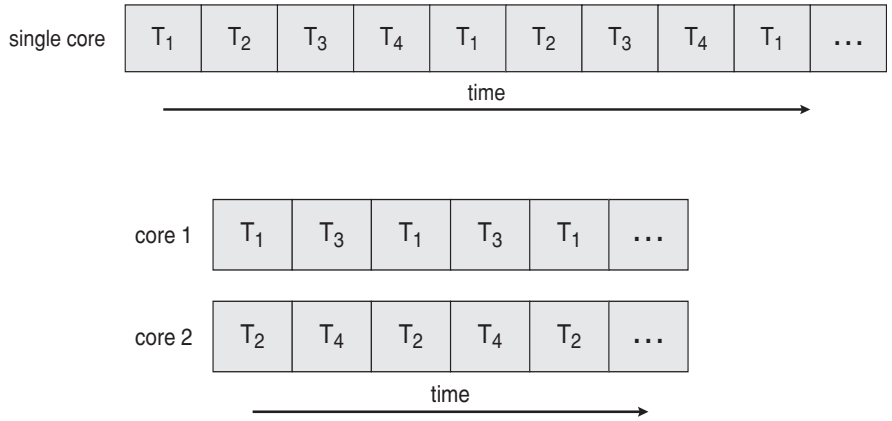
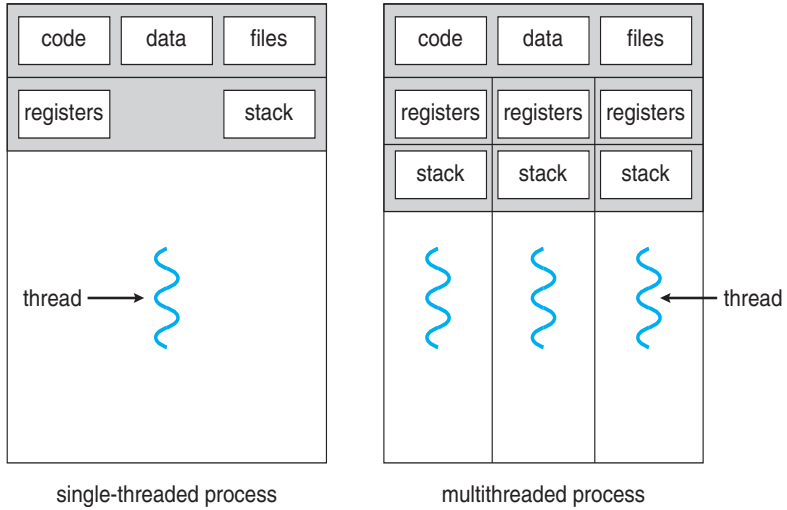
Need mechanisms to improve processes performance / take advantage of hardware

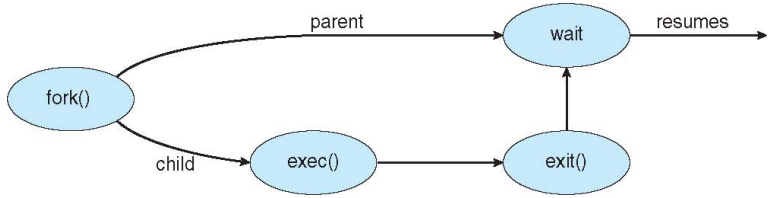




Need to maintain more information…



…and synchronize threads and processes



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Need scheduling at different granularities

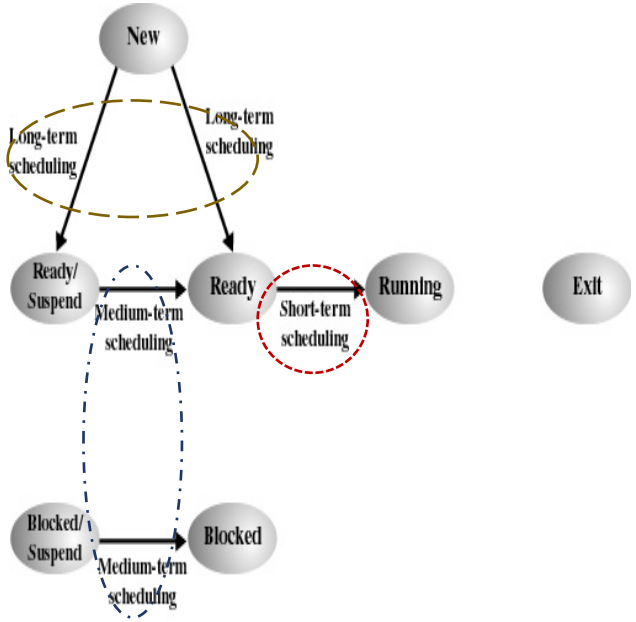

Figure 9.1 Scheduling and Process State Transitions

Need scheduling criteria

CPU utilization

Throughput

Turnaround/Response time

Fairness

Overhead

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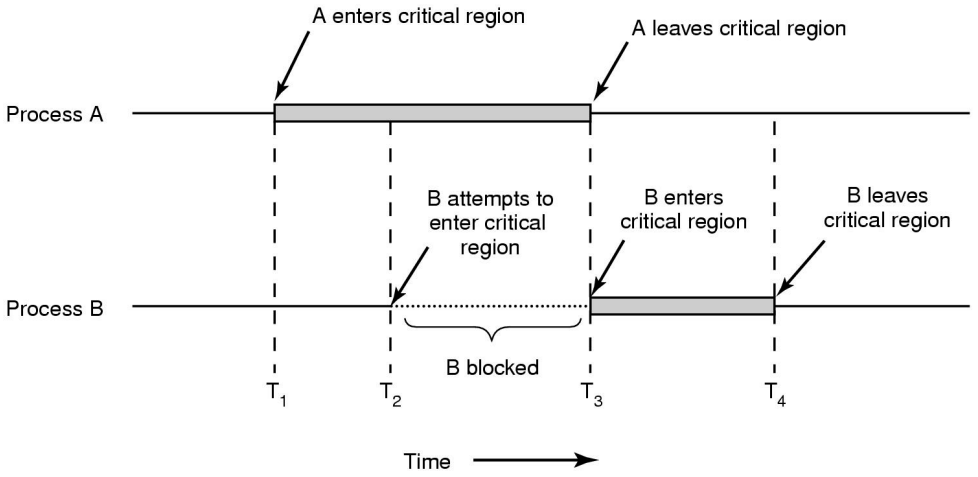
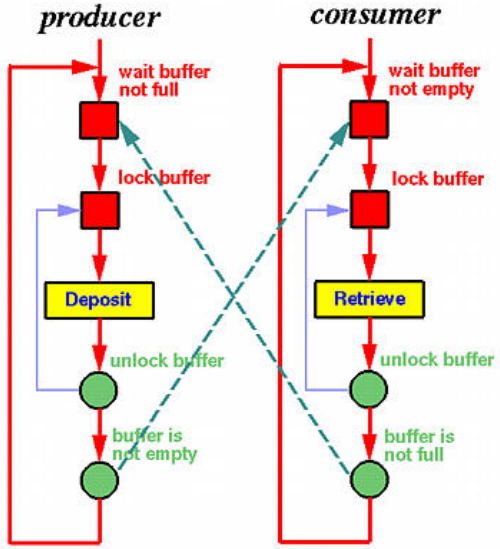
Need to prevent overlapping execution of critical sections



Need to synchronize threads communication



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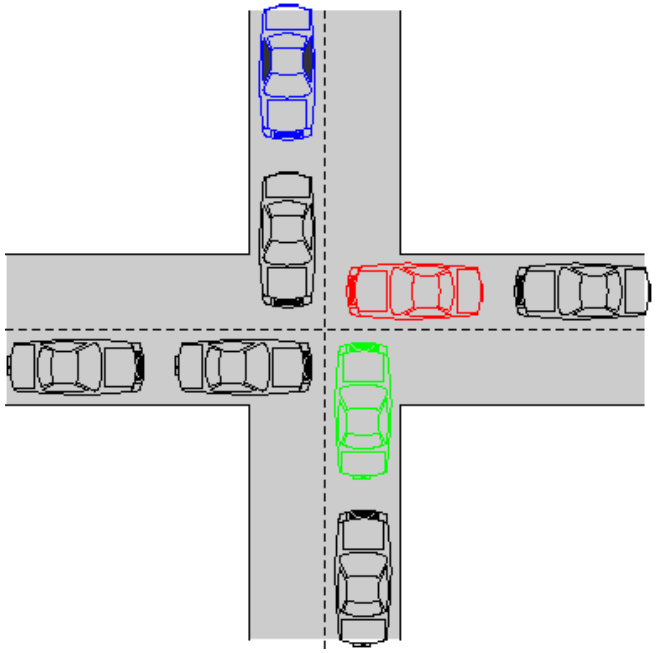
Need to avoid deadlocks



… which can be challenging

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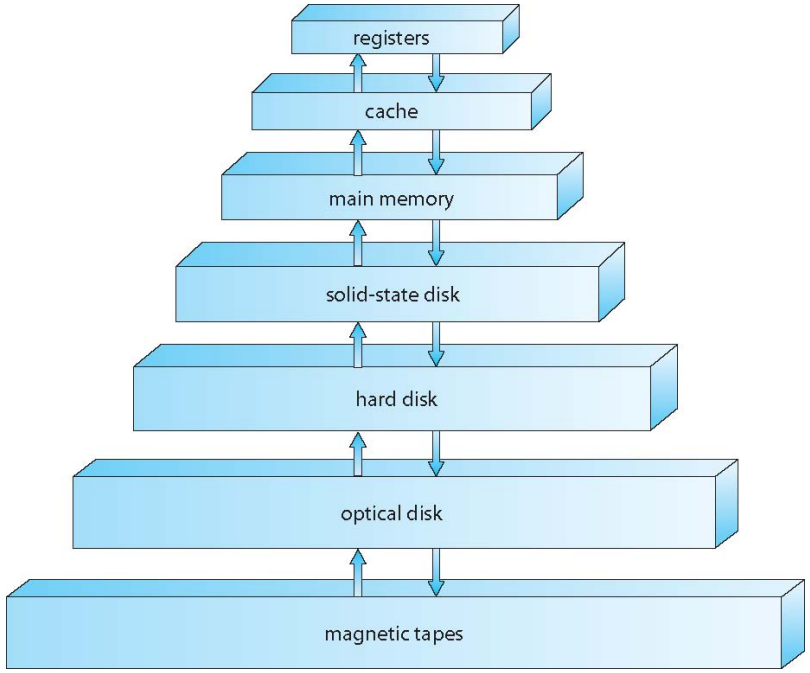
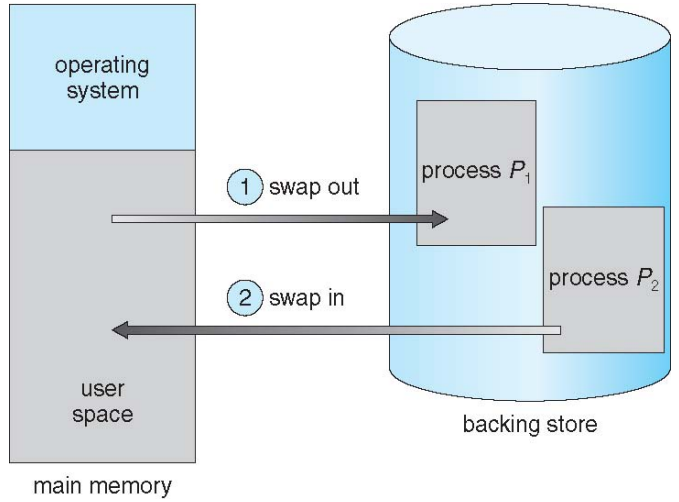
Need to manage information (read / write) based on the available hierarchy



E.g., by swapping processes…



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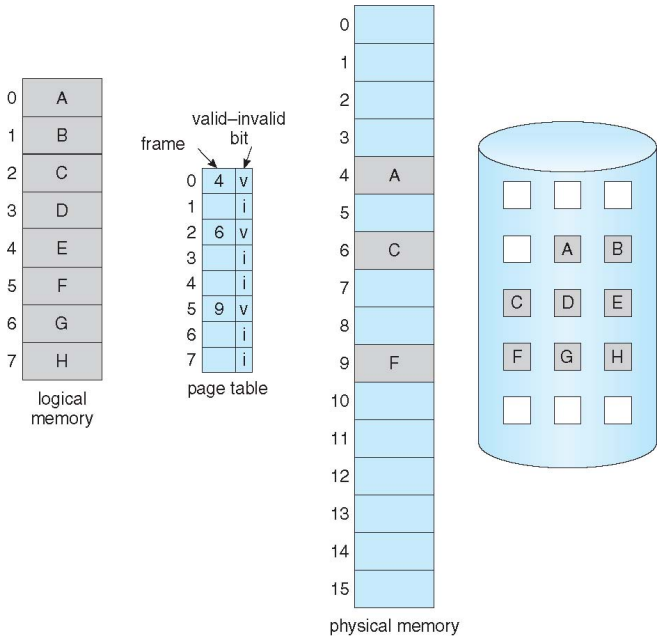
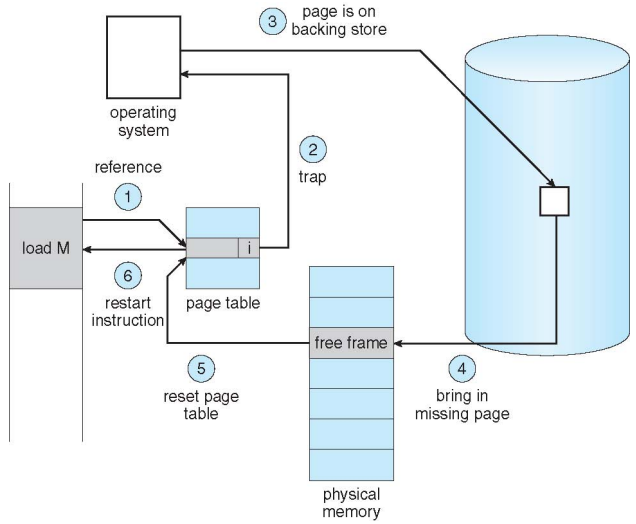
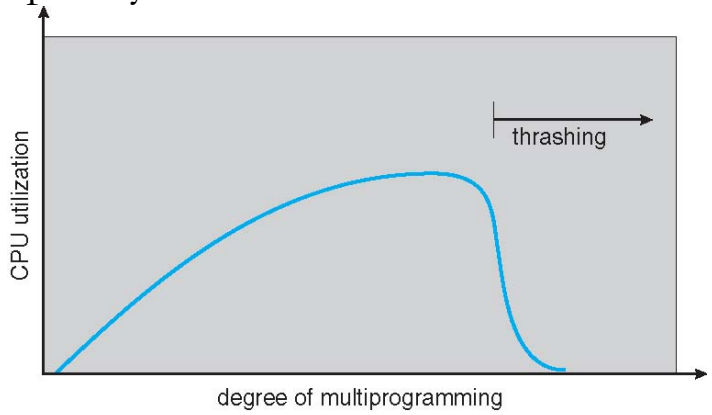
Need to provide more (virtual) memory than available



Need extra overhead to provide that…



Sometimes (hidden?) complexity leads to unexpected behavior…



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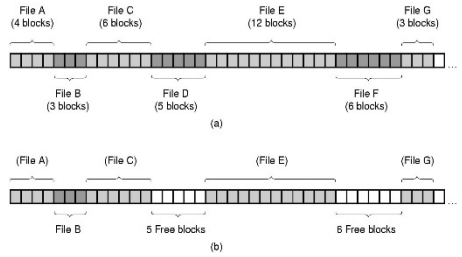
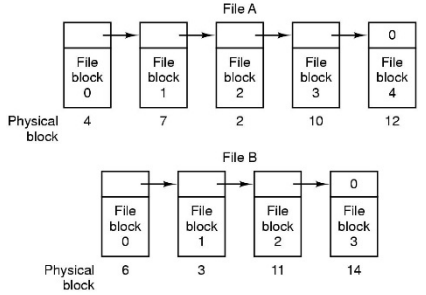
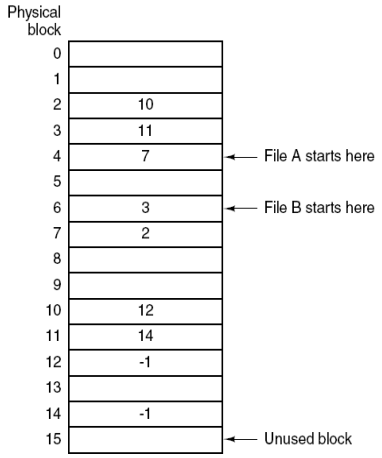
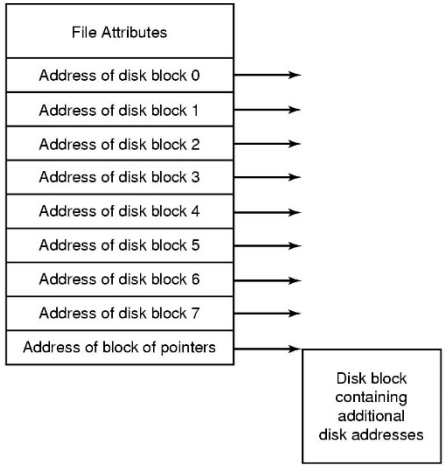
Need to keep track of where files are

Fig. Tanenbaum, Modern Operating Systems

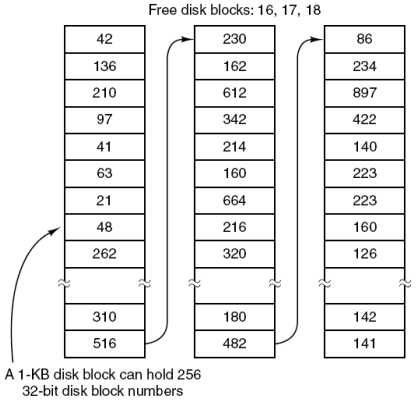


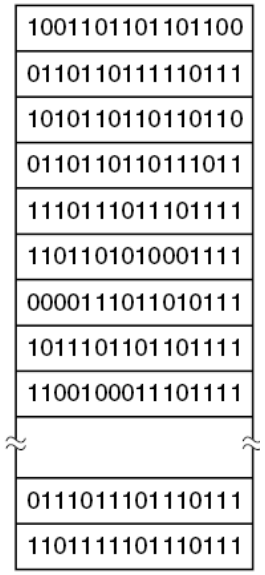




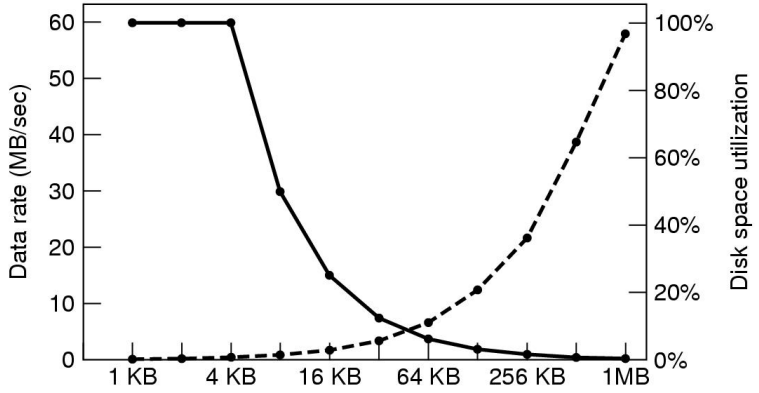


Need to keep track of free space





Need to decide how to use secondary storage



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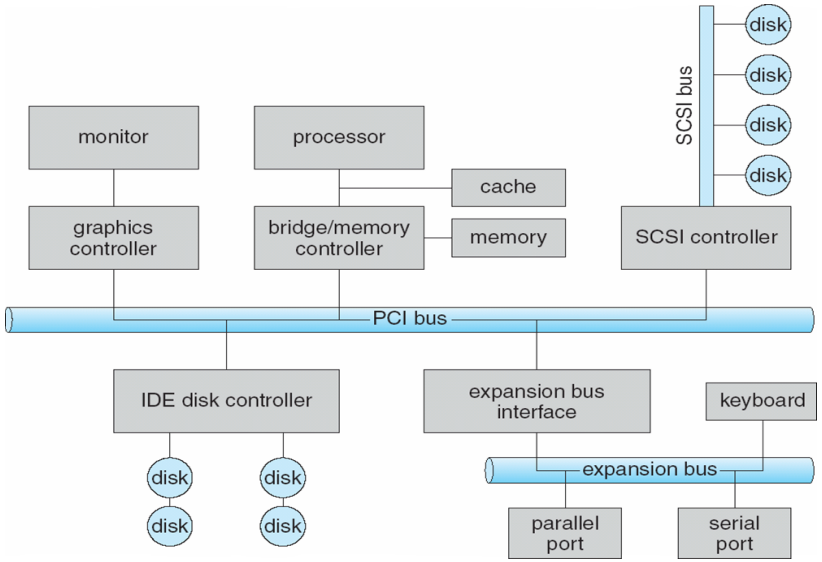
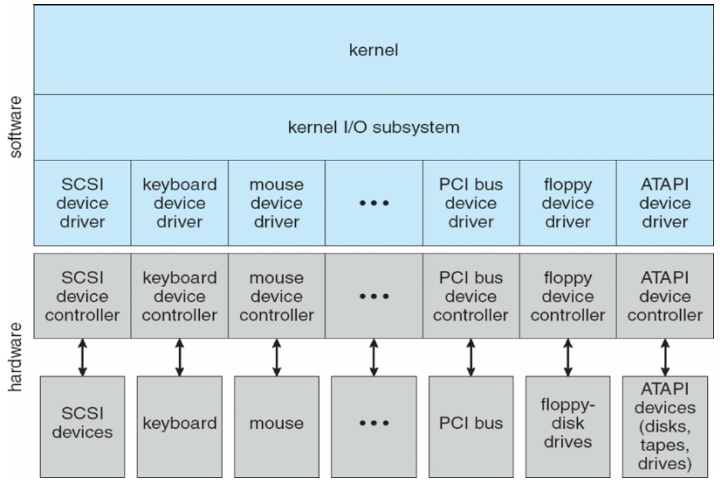
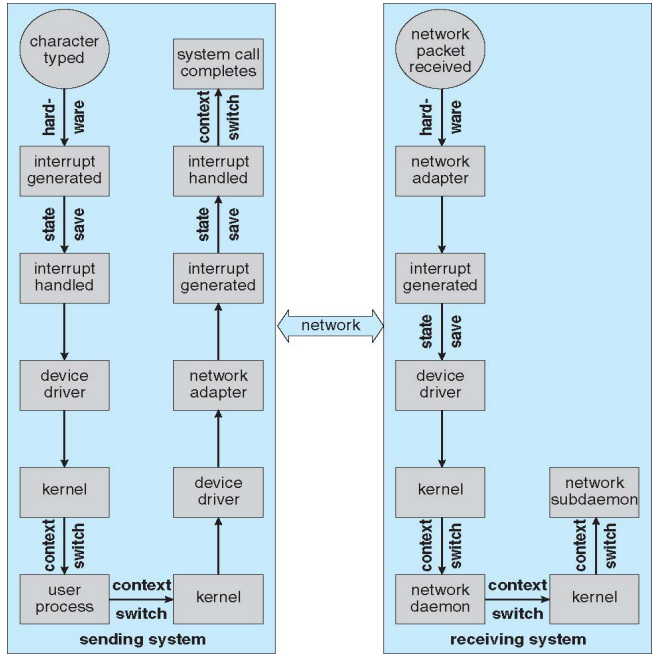
Need to communicate / exchange information with devices



Need to separate applications' and hardware's logic



Need good design to increase performance



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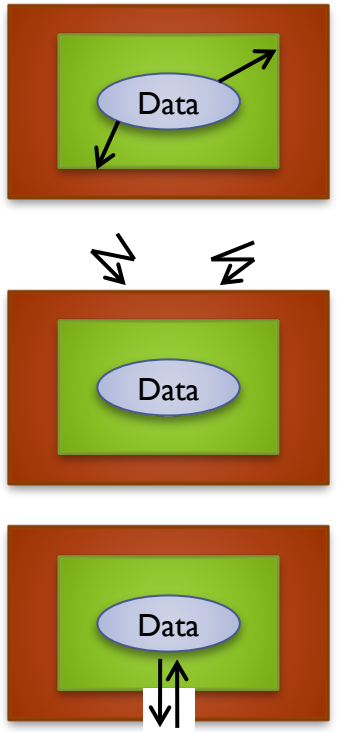
We need mechanisms to protect and share data…

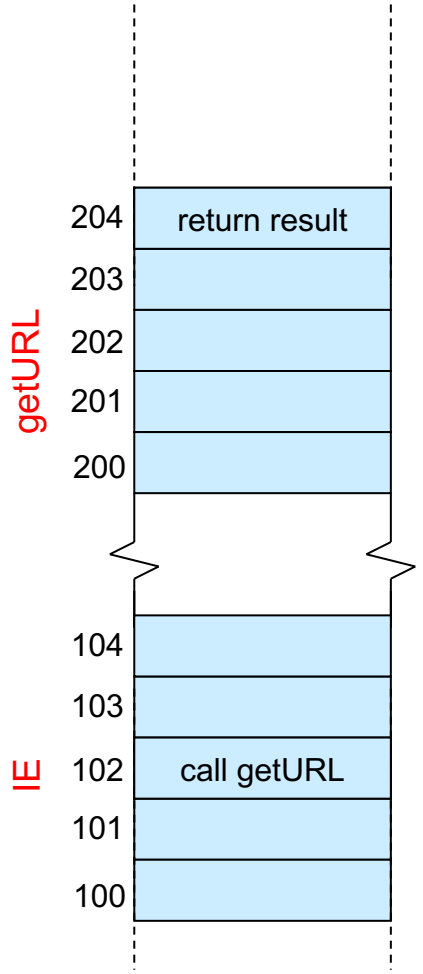


Confidentiality

Integrity

Availability

… from programs' vulnerabilities (e.g., buffer overflows)



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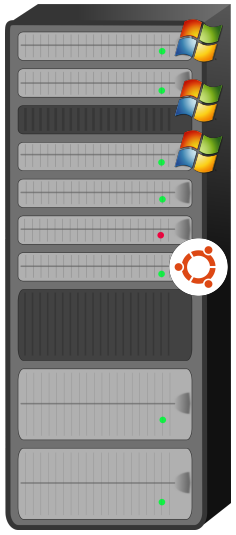
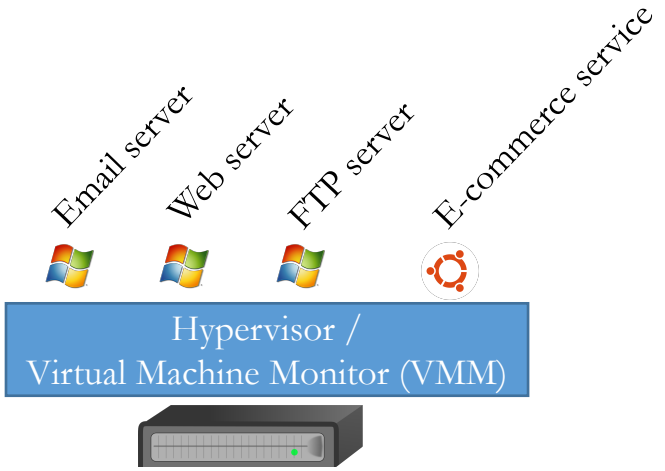
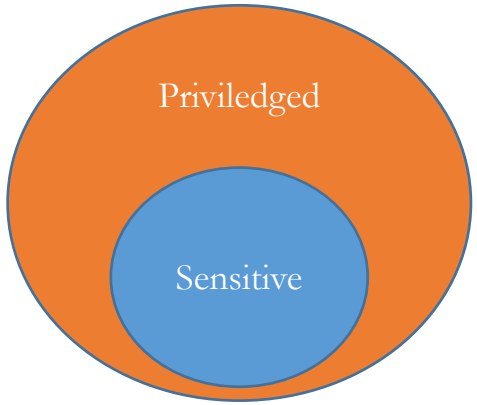
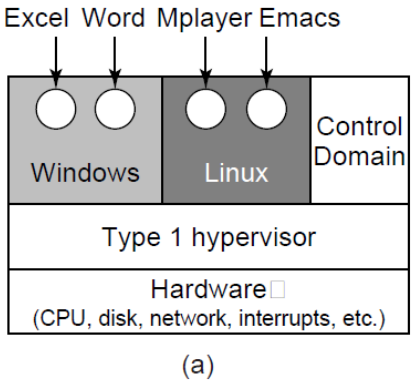


Email server
Web server
FTP server

E-commerce service







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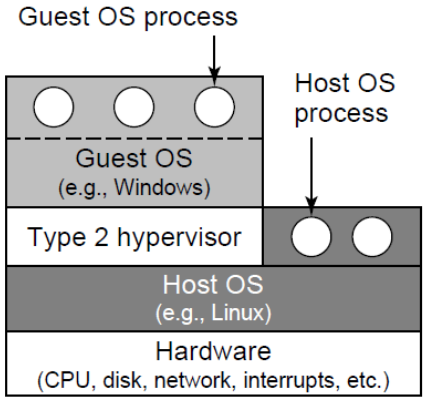

(b)

Thank you for your attention!

…and good luck!