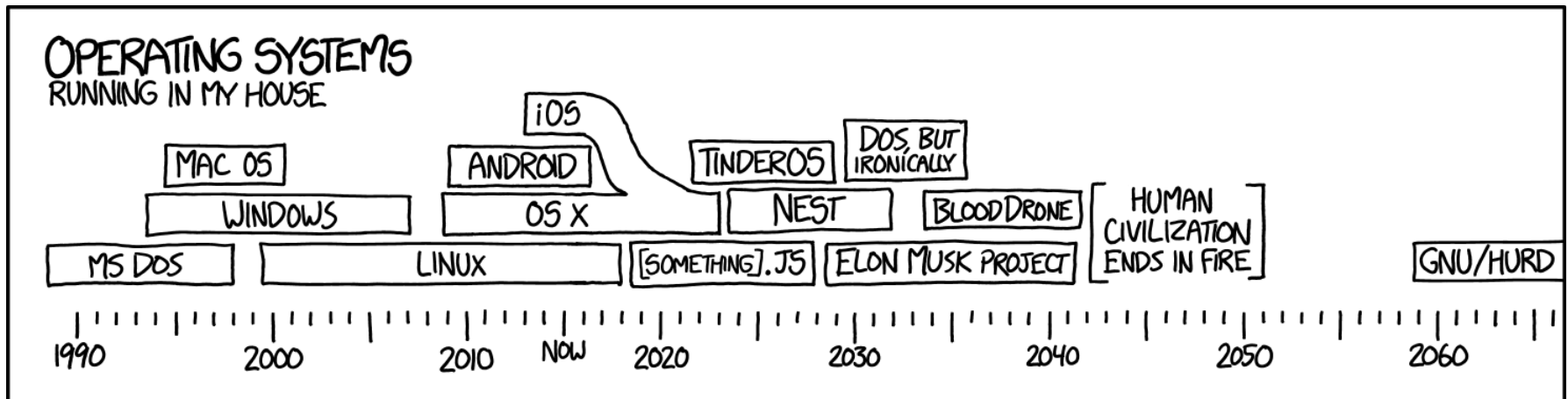


ENGSCI 233 Lecture 12.2

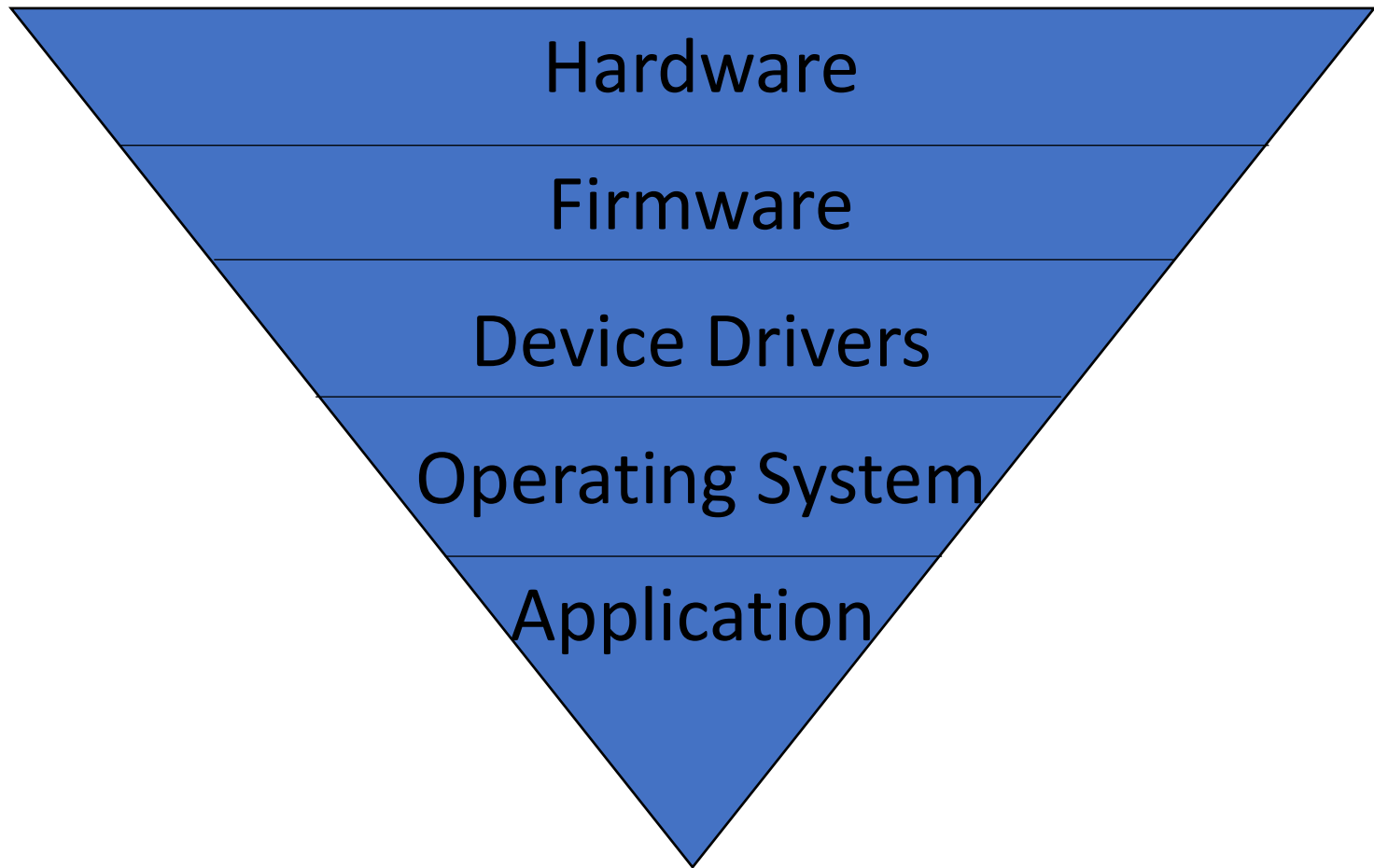
Operating Systems



Today's learning objectives:

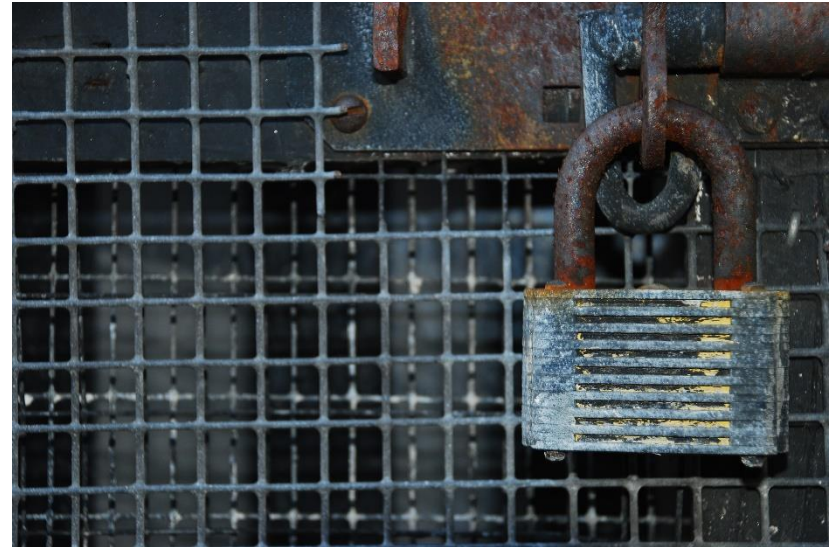
- Understand the main functions of an operating system.
- Understand the major types of operating systems.

Hardware is only one part.



What does the OS do?

- **Manage resources.**
- Provide interfaces.
- Provide services.



Hardware does one thing at a time.

What happens if you want to run several programs at once?

How is the processor shared?

- Single-tasking:
 - One program at a time only
 - Nothing happens until it exits
- Cooperative multi-tasking
 - Programs are written to take turns
 - What happens if one forgets?



How is the processor shared?

- Preemptive multi-tasking
 - The OS gives out time slices and manages switching tasks between slices
 - Hardware can generate *interrupts* to wake up software when needed
- Multi-threading
 - Separate processes in one program that share memory
 - Uses the same multi-tasking approach as separate programs

How is memory shared?

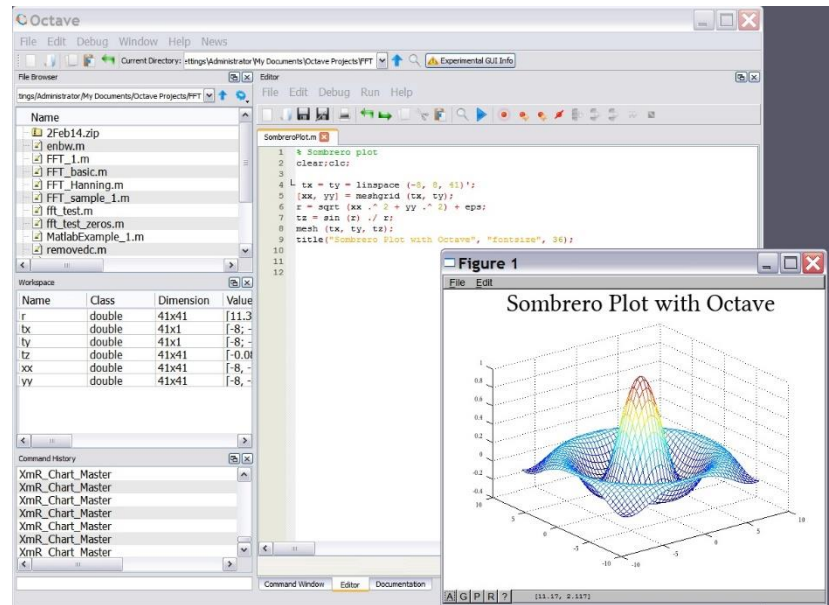
- Memory is organized into *pages*, assigned as needed.
 - Pages are randomly distributed in the physical memory
 - Infrequently-used pages may be stored on the hard drive (*virtual memory*)
- Attempting to access the wrong page generates an error (*segmentation fault*)
- Memory for data can be marked as non-executable.
- Failing to protect memory leads to security holes.

How are other things shared?

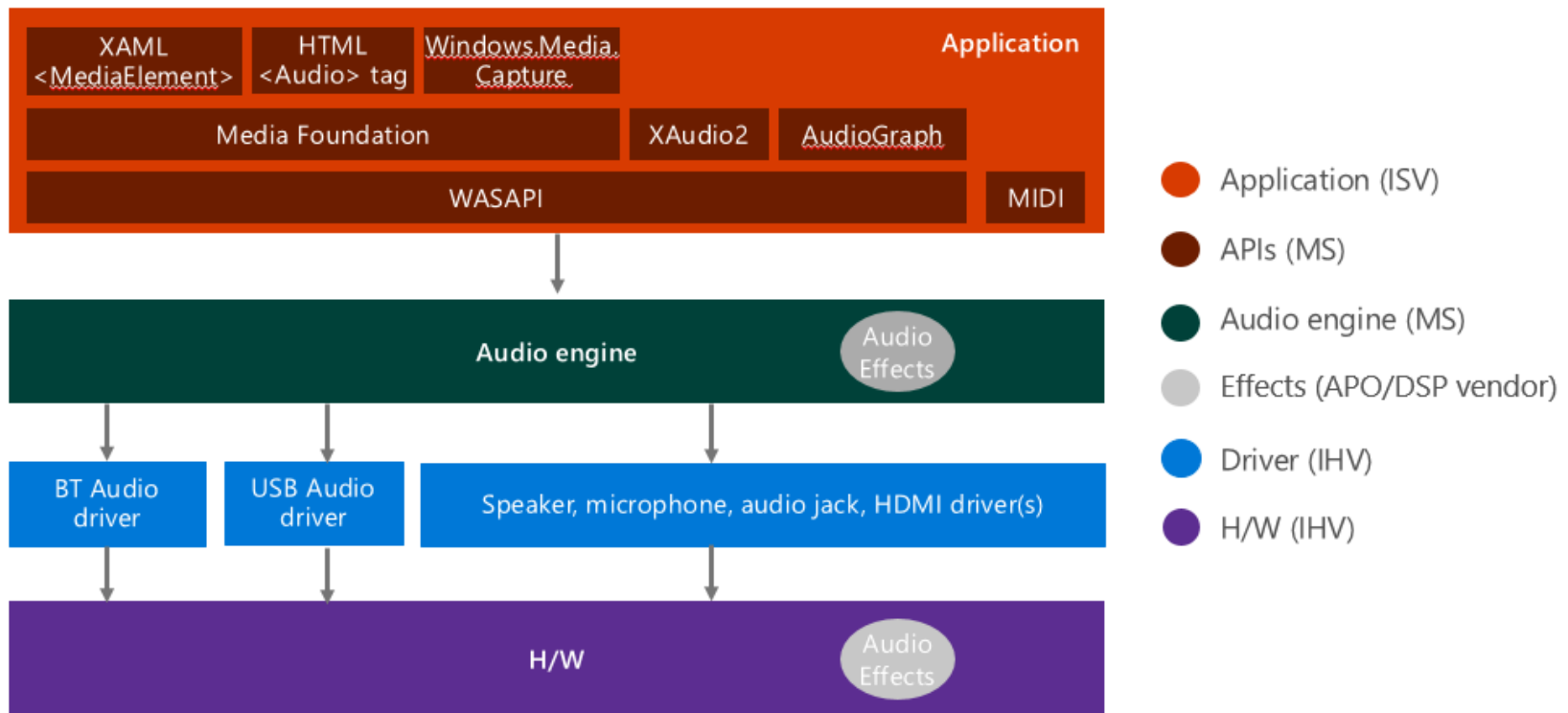
- Mutual exclusion (*mutex*) – one program gets access, others need to wait for it to be unlocked
- Semaphore – variable used to track locks/mutexes
- What happens if this fails?
- Never locked – *race conditions*, unexpected state changes
- Never unlocked – deadlocks, resource unavailable to all

What does the OS do?

- Manage resources.
- **Provide interfaces.**
- Provide services.



Operating systems provide interfaces using APIs.



What does the OS do?

- Manage resources.
- Provide interfaces.
- **Provide services.**



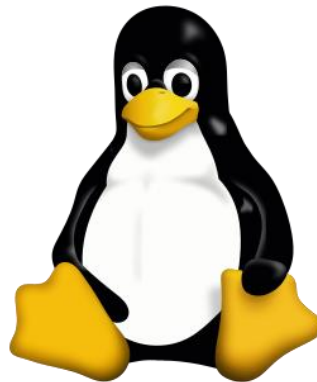
What kind of services?

- File system
- Memory allocation
- Virtual memory
- Network protocols
- Security authentication
- etc.



What types of OS are there?

- **Desktop**
- Mobile
- Embedded/Real-Time
- Server/Distributed



What types of OS are there?

- Desktop
- **Mobile**
- Embedded/Real-Time
- Server/Distributed

android 

iOS

 Windows Phone

 **BlackBerry**

What makes a mobile OS different?



- Usually not multi-tasking
- Security emphasis
- Touch-driven user interface

What types of OS are there?

- Desktop
- Mobile
- Embedded/Real-Time
- Server/Distributed



What do we mean, “real-time”?

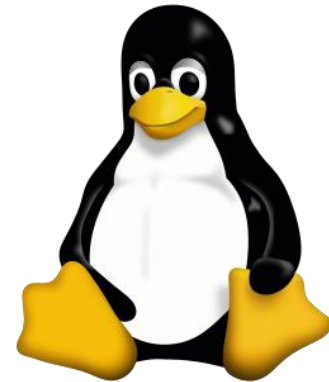


- Does the software have to provide a result by a deadline?
- What happens if it doesn't?
 - Very bad things = hard real-time
 - Performance loss = soft real-time



What types of OS are there?

- Desktop
- Mobile
- Embedded/Real-Time
- **Server/Distributed**



Thank you!

Image References

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