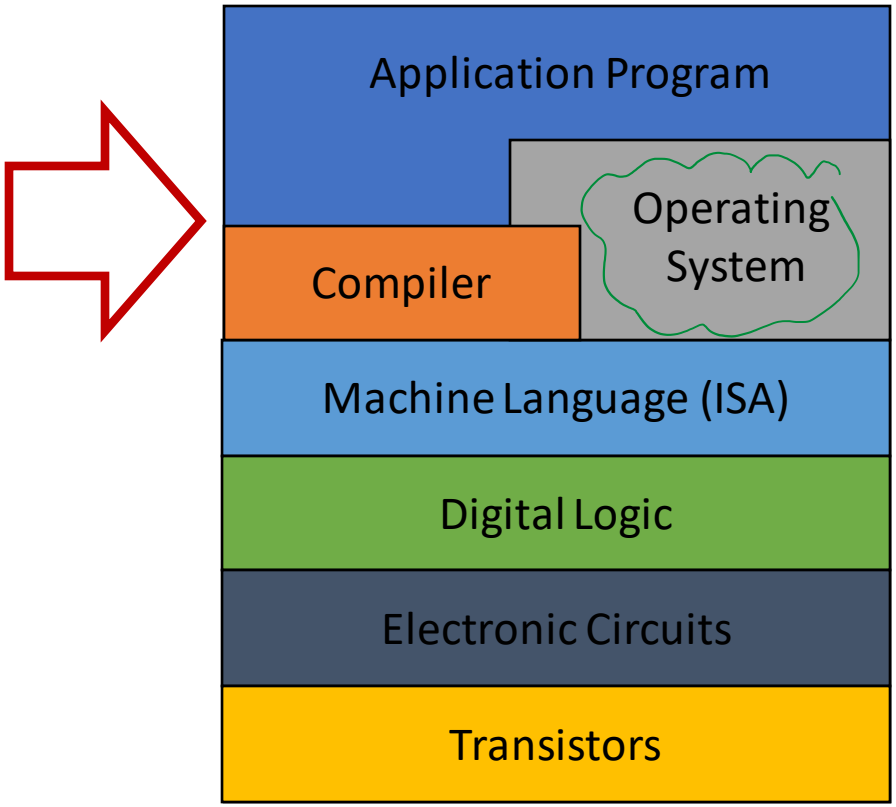
Operating System

EECS388 Fall 2022

Context

- Recommended reading

Chapter 9 of "Introduction to Computing," Patt, Patel



** Picture in the slides are in part taken from "Introduction to Computing From bits & gates to C and beyond" Patt, Patel

TRAP (System Call)

- TRAP calls the operating system to do something
  - E.g., access I/O or Halt

- But what is an operating system?

Operating System

- Microsoft windows, MacOS, Linux, Android, etc.
- Goal: efficiently share resources amongst users while ensuring the users does not do harmful things to any program or data stored in memory
- We need to know three concepts: Privilege, priority, memory address space

Privilege and Priority

- Two concepts associated with processing instructions
- Privilege
  - Right to do something
- Priority
  - Urgency of doing something

Privilege

- Right to execute an instruction or access a memory address
  - E.g., if a computer is shared among users, we don't want all users to be able to execute HALT instruction
  - Or we don't want all users to access all memory addresses and cause system to crash
- Each program is either ***privileged*** or ***unprivileged***

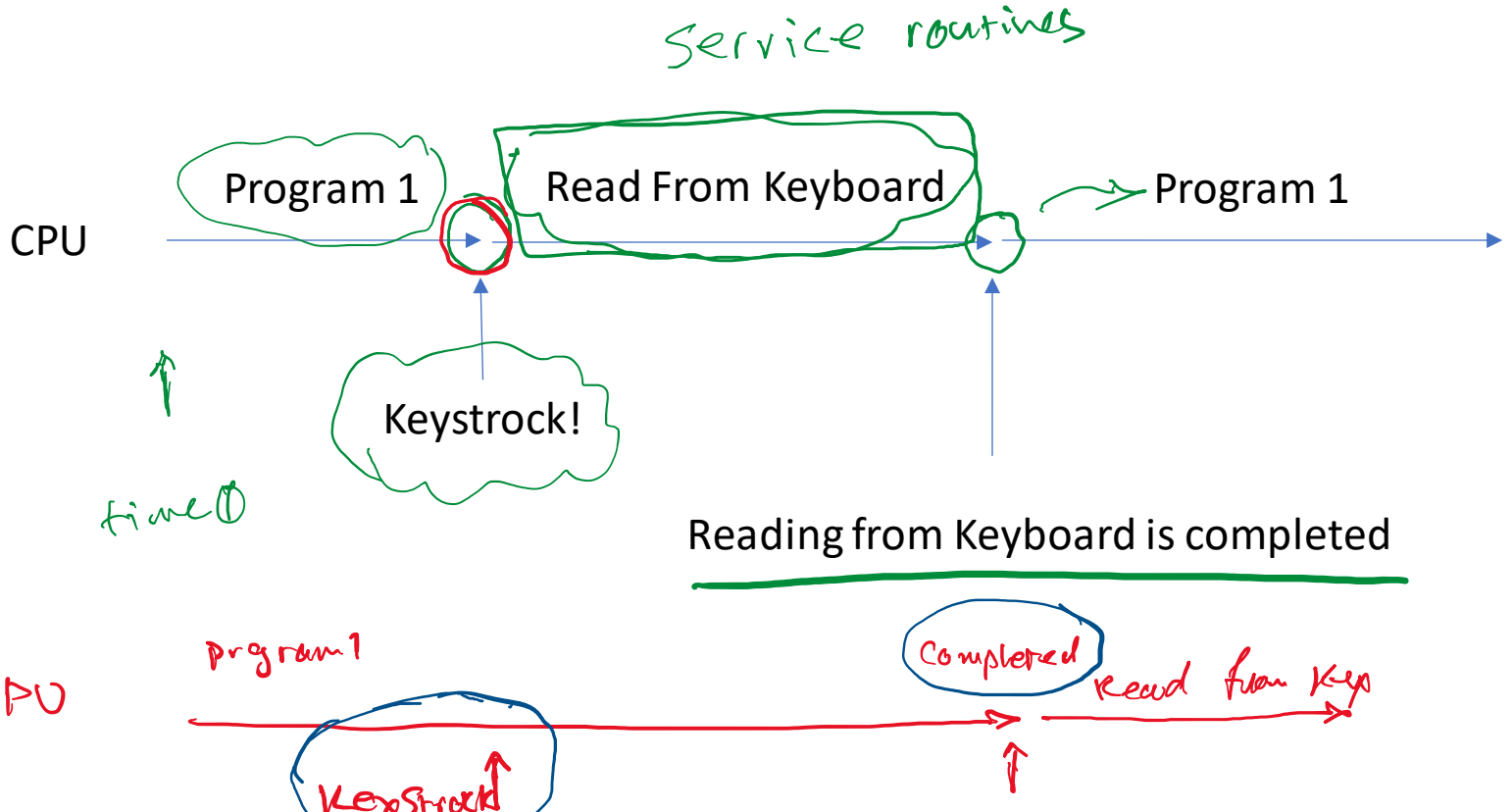
Supervisor vs. User Processing Modes

- A program executing in Supervisor mode is privileged
  - Can execute all instructions and access all memory addresses
- A program executing in User mode is unprivileged
  - Cannot execute privileged instructions or access privileged memory addresses.

T/F: Prog 1 has higher priority than Read from keyboard SR.

Priority

- Urgency of a program to execute compared with other programs

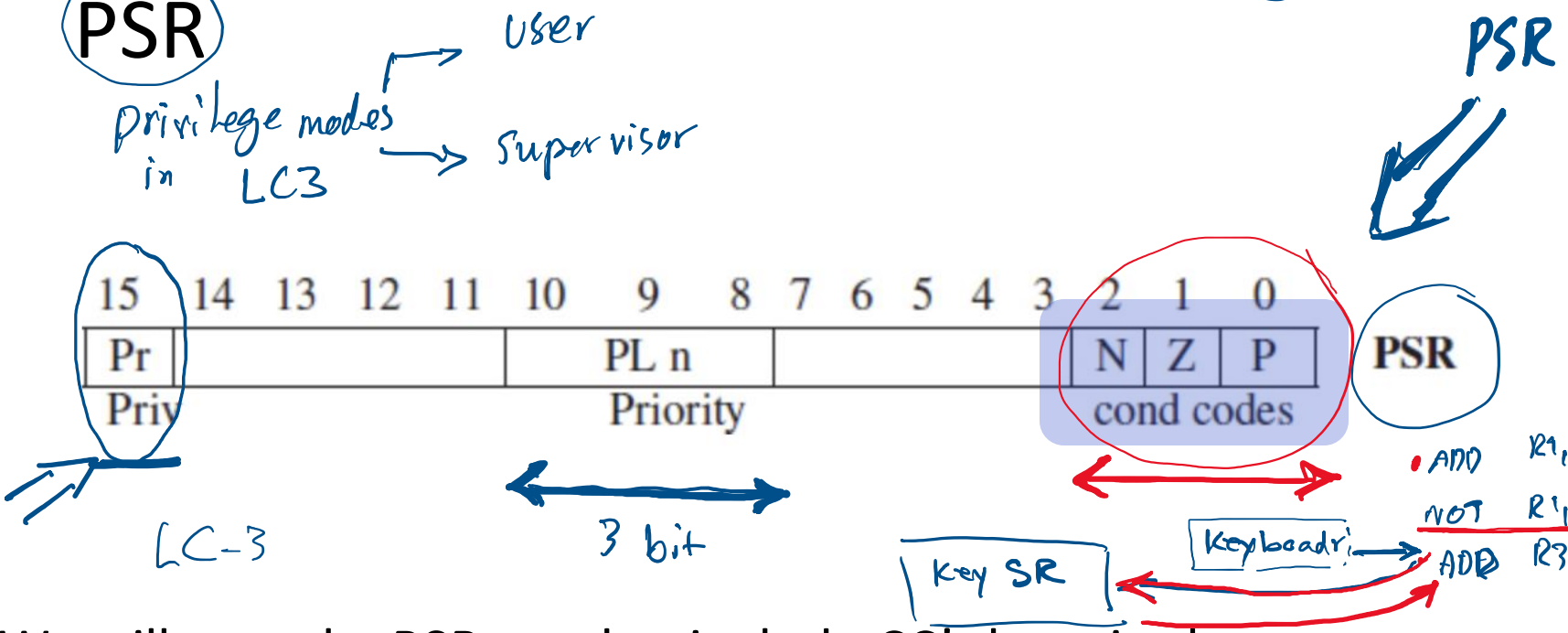


Privilege and Priority are Orthogonal

- They have nothing to do with each other!
- E.g., a program reading sensor value in a nuclear reactor has more priority than reading from keyboard.
  - Sensor read: unprivileged, high priority
  - Keyboard service routine: privileged, low priority

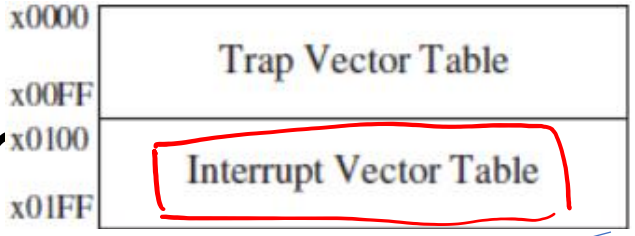
Processor Status Register

- Each program executing on a computer is associated with two registers: PC and PSR

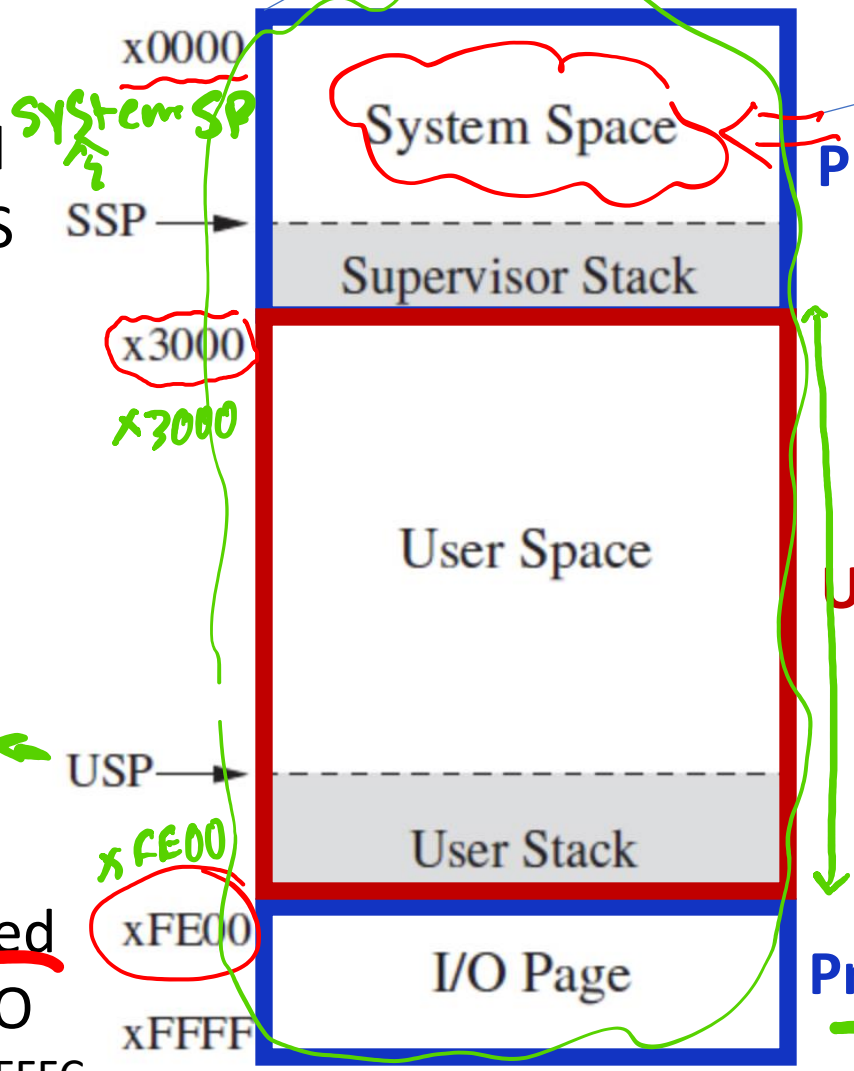


We will see why PSR need to include CC's later in the course

Organization of Memor



Contains data structures and code of the OS



Privileged Memory

User Space Memory

Privileged Memory

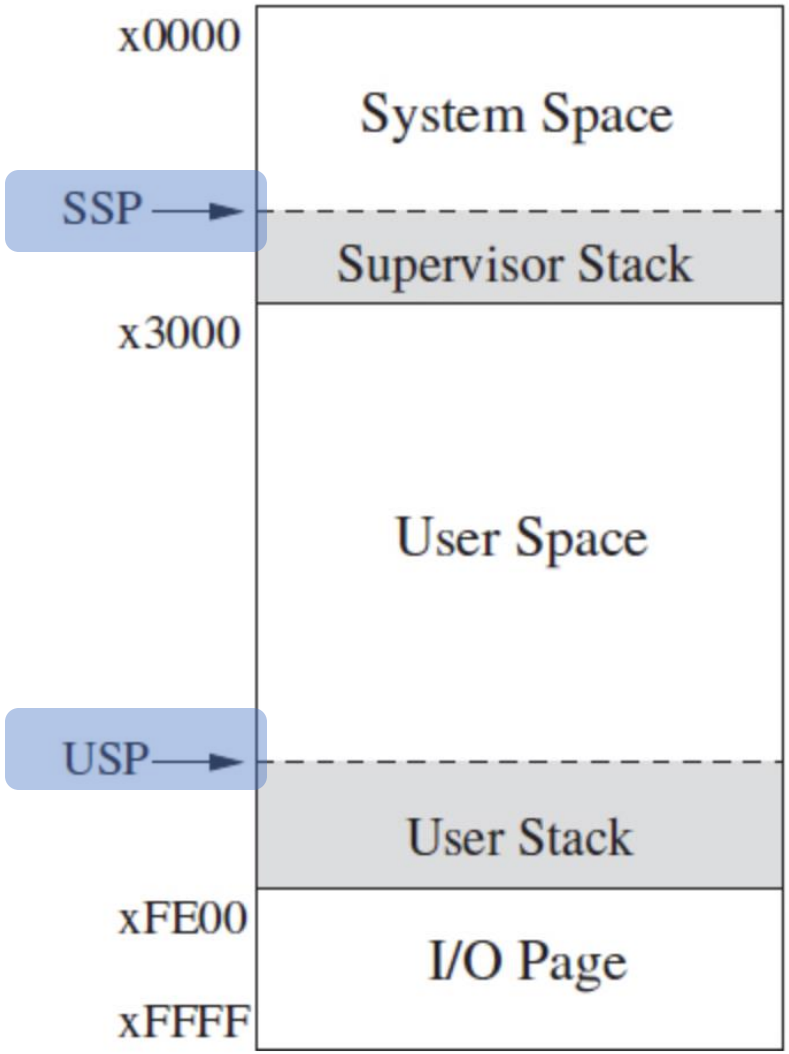
Memory mapped registers and I/O

e.g., PSR is at address xFFFC

Organization of Memory

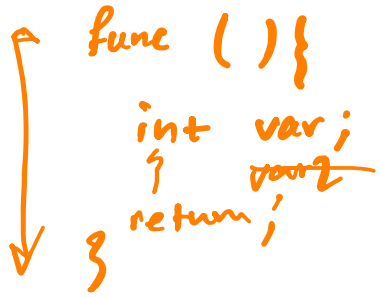
Supervisor Stack Pointer

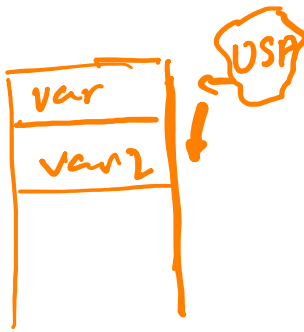
User Stack Pointer



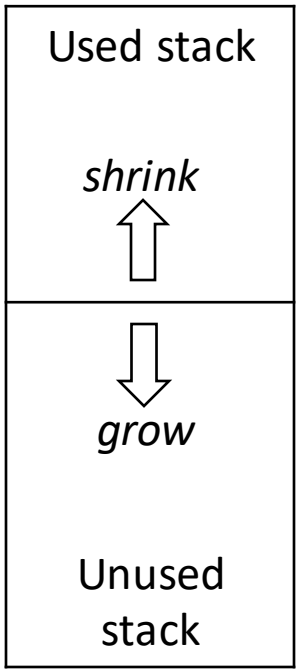
Stack

FILO





- Temporary storage
  - For functions
- Grow/shrink dynamically
  - Call a function → grow
  - Exit a function → shrink



Recap

- Operating System Concept
- Privilege and Priority
- Memory Address Space