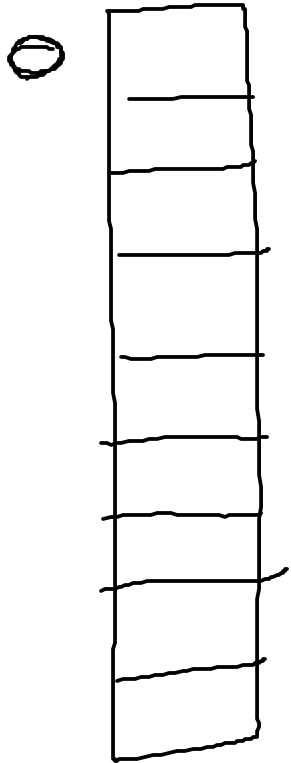


CS324: Introduction to Operating Systems



Process Memory Layout

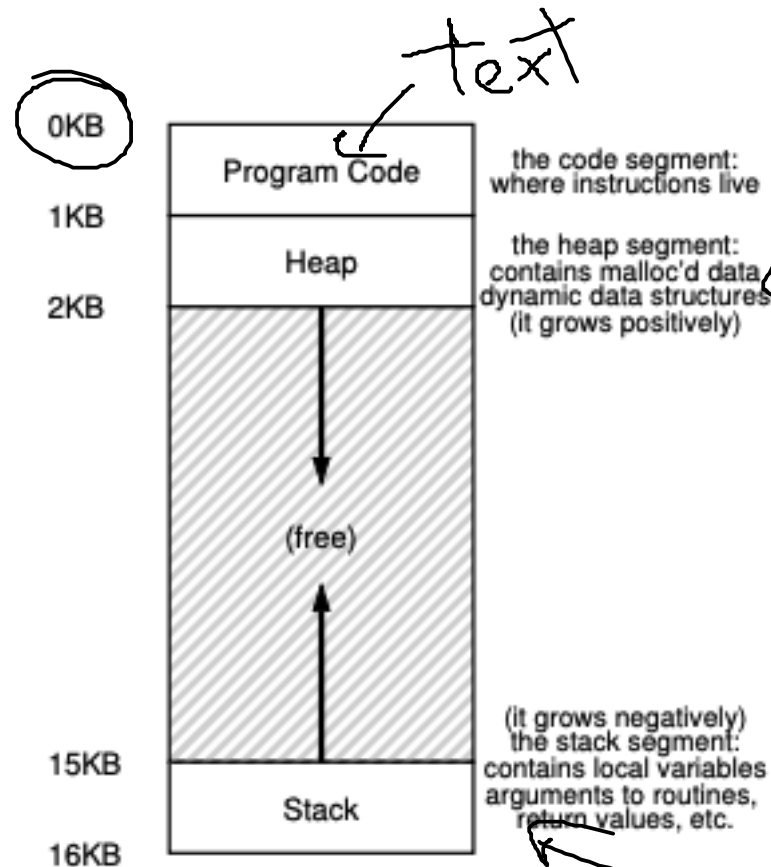
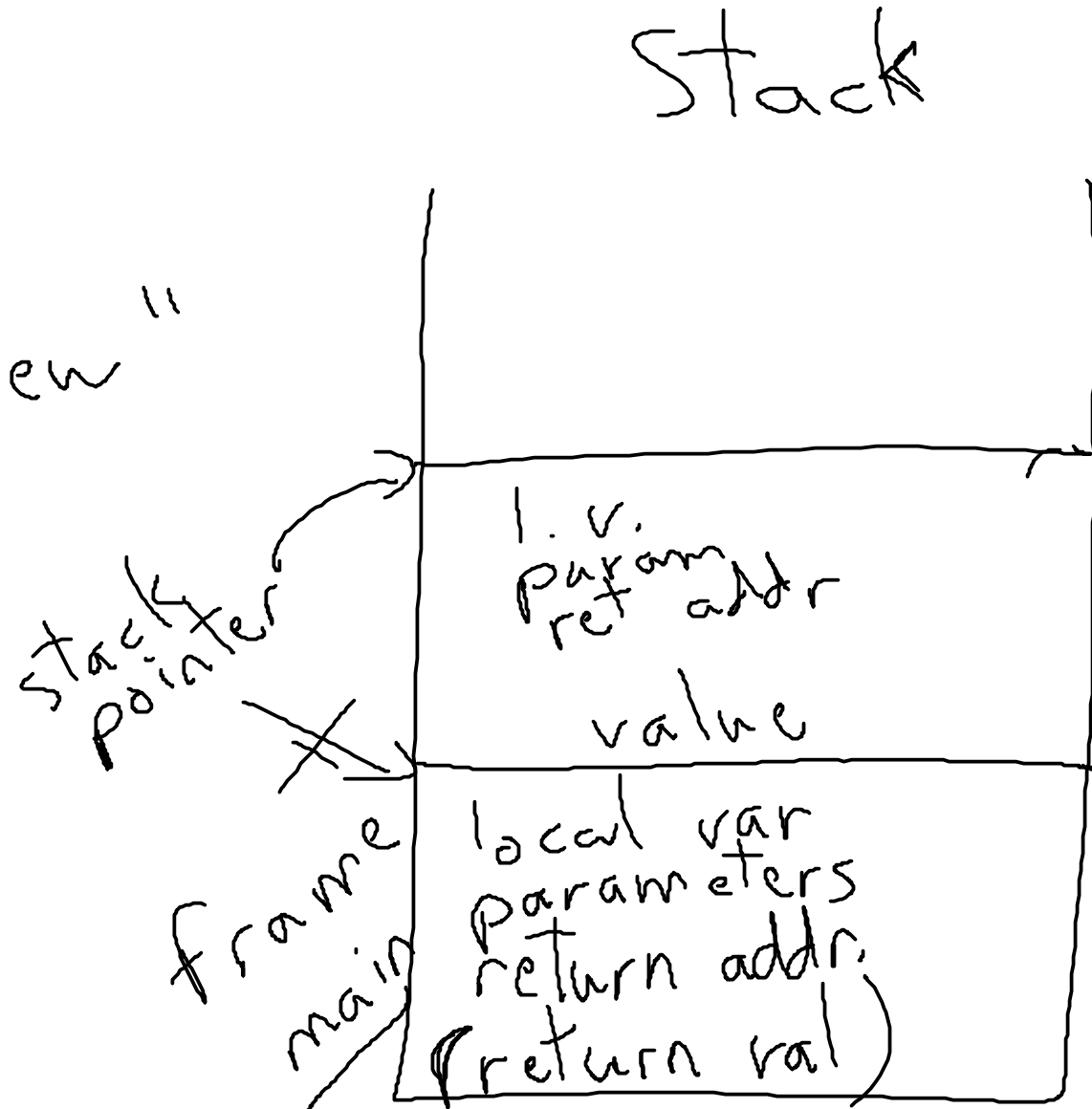


Figure 13.3: An Example Address Space

Virtual address space

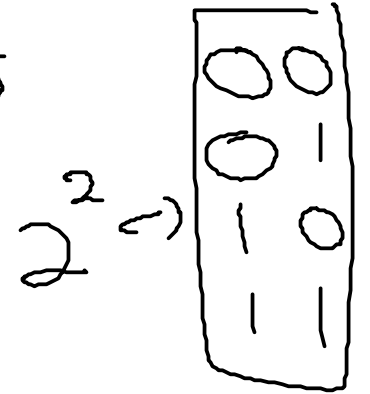
function calls



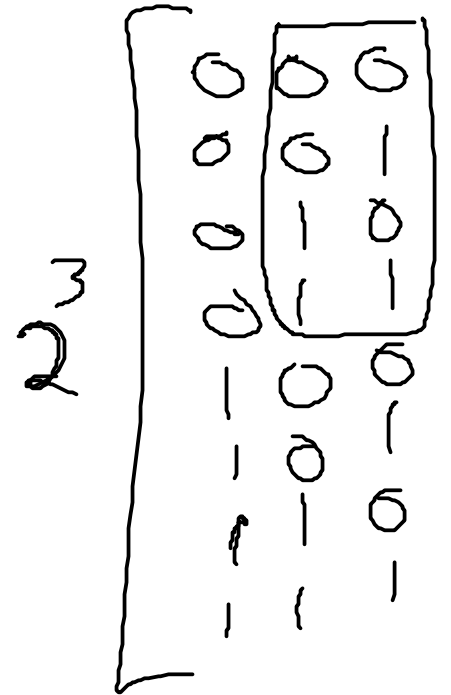
32 bit address

$$2^{32} = \underbrace{2^2}_4 \times \underbrace{2^{30}}_G$$

2 bits



3



System Memory Layout

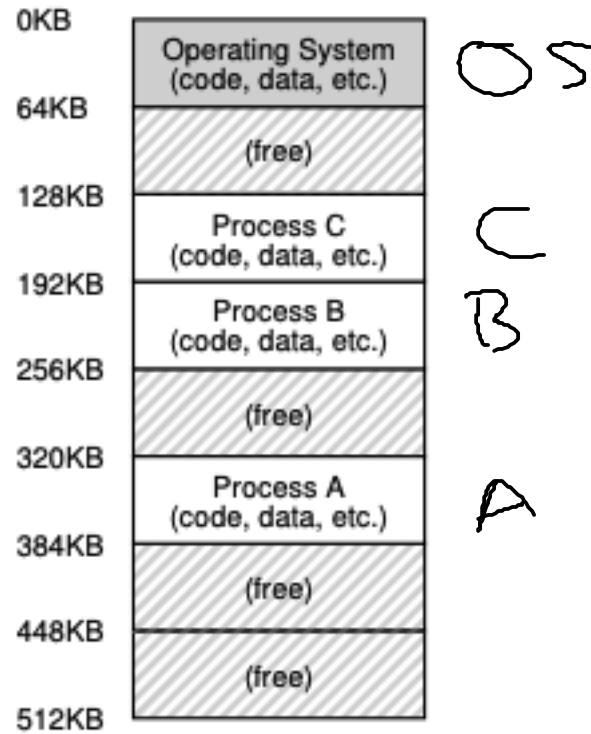
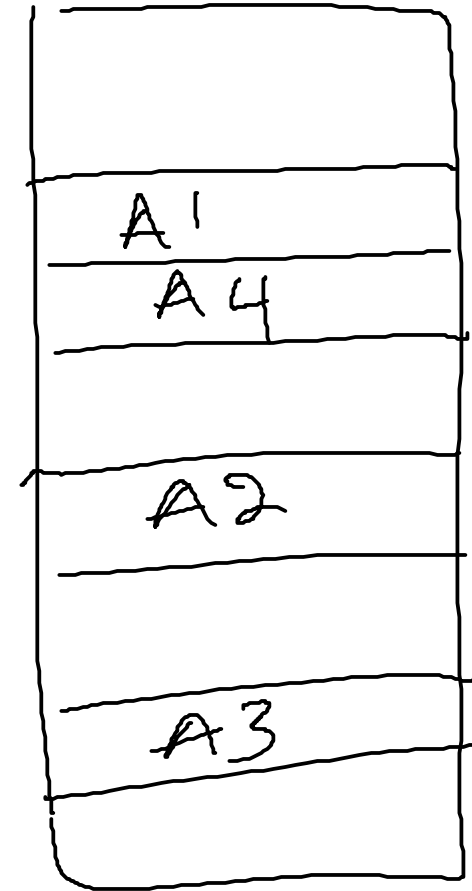


Figure 13.2: Three Processes: Sharing Memory



paging
segmentation

CPU Operation

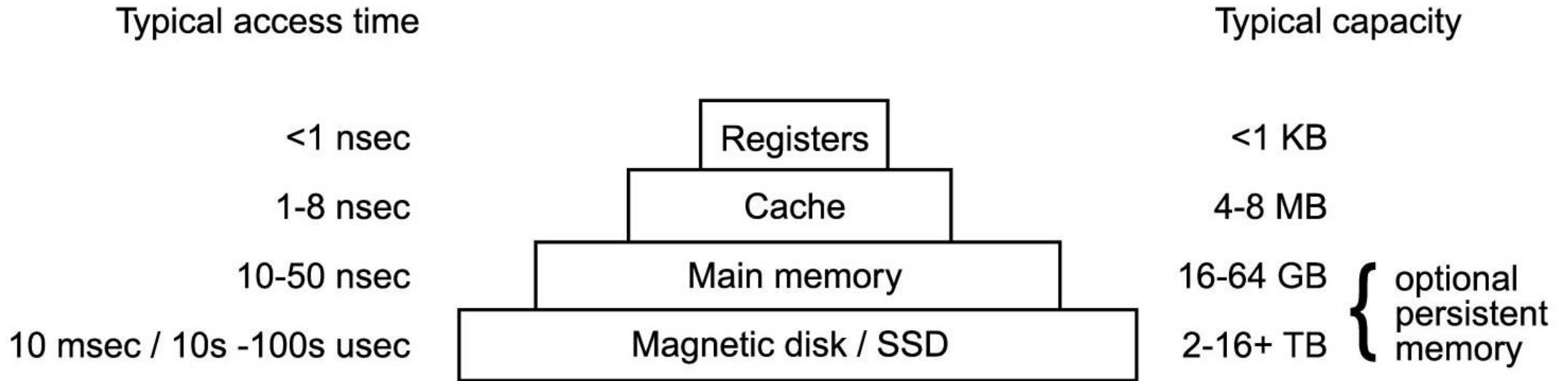
1. Fetch: get the next instruction from memory.
2. Decode: determine the operands.
3. Execute: run the instruction.
4. Write back: store the solution.

program and
data
in memory

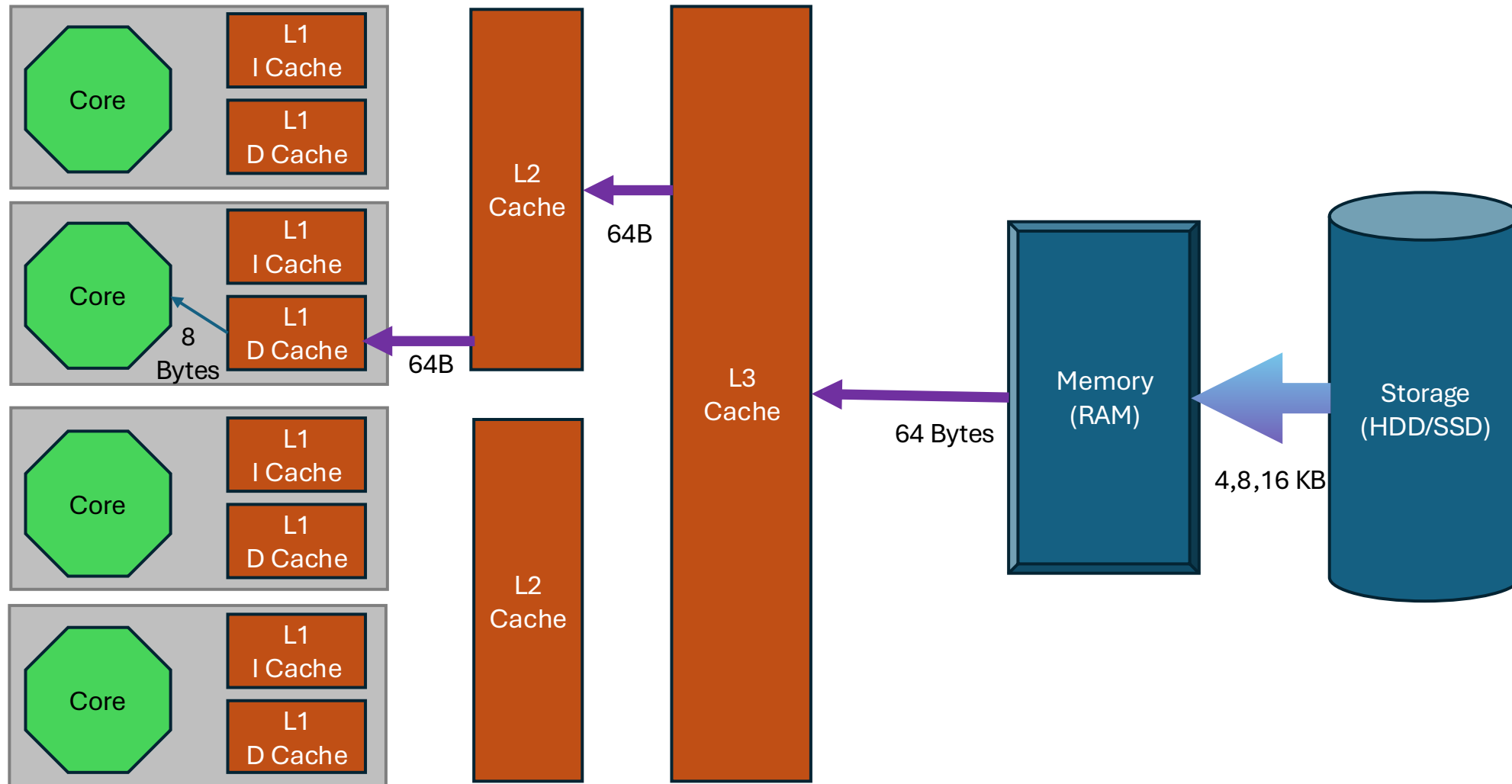
li	\$r2,	12		# \$r2 = 12
lw	\$r3,	x	← mem. addr	# \$r3 = x
add	\$r1,	\$r2,	\$r3	# \$r1 = \$r2 + \$r3

<http://cs.gettysburg.edu/~cpresser/cs324/notes/>

Memory Hierarchy



Multi-core CPU – Cache and Memory



Modes and System Calls

- User mode
- Kernel mode
- System call example

Interrupts

- I/O Device Interaction
- System Calls

Units

Prefix	Base 10	Value	Base 2	Value
Kilo	10^3	1,000	2^{10}	1,024
Mega	10^6	1,000,000	2^{20}	1,048,576
Giga	10^9	1,000,000,000	2^{30}	1,073,741,824
Tera	10^{12}	1,000,000,000,000	2^{40}	1,099,511,627,776
Peta	10^{15}	1,000,000,000,000,000	2^{50}	1,125,899,906,842,624
Exa	10^{18}	1,000,000,000,000,000,000	2^{60}	1,152,921,504,606,846,976