CS202: Virtual Memory

Understanding the Problem

Process A

Process B

Process C

Physical Memory

(CRAM)

m (e.g., \(32 \cdot 2^{30}\))

32 GB

What is desirable?

1. Isolation

Why?

0. Reasoning
2. Position Independence

Why?
3. "Overcommit"—allow processes to access more memory than physically available.

Why?

4. Controlled Sharing
Why?

\[
\text{in64X} = 2
\]

\[
\text{reg} = 5
\]

How?

\[
\text{mov} \%\text{max}, 0x742000
\]
Memory Management Unit

MMU CONFIGURATION

REGISTER (%CR3) — ADDRESS OF PAGE TABLE

PAGE TABLE (ABSTRACT)

Problem: Page Table Size

Solution

1. Map at a coarse granularity
   - 4 KB, ...
   - 1 KB, 1024 Bytes = 0x1000 Bytes
4KB = 4096 bytes = 64 4KB blocks

addr/4K \rightarrow \{ aabbcc \} → N \{ + cdd \}

32-bit

48-bit

\[ \text{ff ee aa bb cc dd ee} \]

\( \text{② Build A TREE} \)

- Assumption: SPARSITY

32-bit

\[ \text{ab cd ef ab} \]

48-bit