Load-Time Relocation

- Operating System
- Process 3
- Process 6
- Process 1
Base & Bounds Example

Process Virtual Address Space

SP

2000

1420

140

62

66

RETURN

CALL 140
x86-64 Address Translation

64-bit Virtual Address

| 16 | 9 | 9 | 9 | 9 | 9 | 12 |

- **PML4** (Page Directory Pointer Table)
- **PML3** (Page Directory)
- **PML2** (Page Table)
- **PML1** (Page Table)

52-bit Physical Address

Page Frame | Offset
--- | ---
40 | 12

PML4 Base
Accessing User Memory

write(fd, buffer, length)
OS and User in Same Address Space

- Operating System
- Code
- Data
- Stack

OS in all Address Spaces

- Shared Code
- Private Data/Stack

Process 1

Process 2