Protected Mode

Protected mode is the main operating mode of modern Intel processors (and clones) since the 80286 (16 bit). On 80386s and later, the 32 bit Protected Mode allows working with several virtual address spaces, each of which has a maximum of 4GB of addressable memory; and enables the system to enforce strict memory and hardware I/O protection as well as restricting the available instruction set via Rings.

A CPU that is initialized by the BIOS starts in Real Mode. Enabling Protected Mode unleashes the real power of your CPU. However, it will prevent you from using most of the BIOS interrupts, since these work in Real Mode (unless you have also written a V86 monitor).

Contents

Entering Protected Mode

Before switching to protected mode, you must:

- Disable interrupts, including NMI (as suggested by Intel Developers Manual).
- Enable the A20 Line.
- Load the Global Descriptor Table with segment descriptors suitable for code, data, and stack.

Whether the CPU is in Real Mode or in Protected Mode is defined by the lowest bit of the CR0 or MSW register.

This example loads a descriptor table into the processor's GDTR register, and then sets the lowest bit of CR0:

```
cli              ; disable interrupts
lgdt [gdtr]      ; load GDT register with start address of Global Descriptor Table
mov eax, cr0
or al, 1         ; set PE (Protection Enable) bit in CR0 (Control Register 0)
mov cr0, eax

; Perform far jump to selector 08h (offset into GDT, pointing at a 32bit PM code segment descriptor)
; to load CS with proper PM32 descriptor)
jmp 08h:PModeMain
```

```
PModeMain:
; Load DS, ES, FS, GS, SS, ESP
```

See Also

Articles

- Real Mode
- Virtual 8086 Mode

External Links

- http://www.osdever.net/tutorials/view/the-world-of-protected-mode - very good tutorial on how to enter protected mode
- OSRC: protected mode (http://www.nondot.org/sabre/os/articles/ProtectedMode/)
- http://home.swipnet.se/smaffy/asm/info/embedded_pmode.pdf - pragmatic tutorial on protected mode (Cached copy (http://web.archive.org/web/20030604185154/http://home.swipnet.se/smaffy/asm/info/embedded_pmode.pdf))
- http://www.brokenthorn.com/Resources/OSDev8.html
- Protected mode Wikipedia page
- http://members.tripod.com/protected_mode/alexfru/pmtuts.html - PMode tutorials in C & Asm