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Compare virtual mode, protected mode and real mode of 80386

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The 80386 microprocessor, also known as Intel 386, introduced by Intel in 1985, offered three distinct operating modes: Real Mode, Protected Mode, and Virtual 8086 Mode. Here's a comparison of these modes:


1. Real Mode:

- In Real Mode, the 80386 behaves similarly to its predecessors like the 8086 and 8088 processors.
- It provides a segmented memory model where memory addresses are calculated by combining a 16-bit segment register with a 16-bit offset.
- It allows direct access to the first 1 MB of memory (from 00000h to FFFFFh).
- Only one program can execute at a time.
- No memory protection or multitasking support is provided.
- Real Mode offers compatibility with older 16-bit software but doesn't utilize the 32-bit capabilities of the 80386.

2. Protected Mode:

- Protected Mode is a 32-bit operating mode of the 80386 processor.
- It allows access to more than 1 MB of memory and supports virtual memory management.
- Memory is organized into pages, typically 4 KB in size, and can be managed by the Memory Management Unit (MMU).
- It supports multitasking and multiple programs running simultaneously.
- Memory protection mechanisms are enforced, preventing one program from accessing another program's memory.
- It provides support for privilege levels (rings), allowing different levels of access control for different software components.
- Protected Mode offers enhanced performance and memory management capabilities compared to Real Mode.

3. Virtual 8086 Mode:

- Virtual 8086 Mode is a special mode introduced with the 80386 processor to provide compatibility with older 16-bit software while running in Protected Mode.
- It allows multiple instances of Real Mode programs to run concurrently, each in its own virtual environment.
- Each virtual machine has its own set of 16-bit registers and memory space.
- The processor manages the execution of these virtual machines, providing memory protection and multitasking capabilities.
- Virtual 8086 Mode allows 16-bit software to run alongside 32-bit protected-mode applications without interfering with each other's memory space. 

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