80286 Microprocessor working modes: Real and Protected mode and differences

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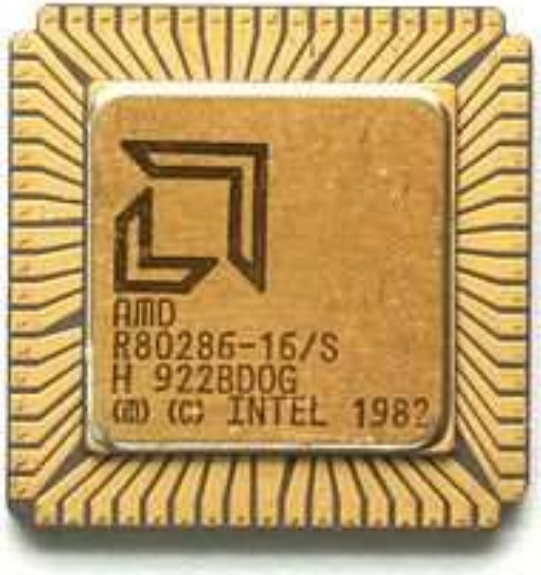
WHAT IS 80286 MICROPROCESSOR?



- Was invented in February 1982 by Intel.
- Is a 16-bit microprocessor that has the ability to execute 16-bit instruction at a time which was was basically an advancement of 8086 microprocessor.
- Size of data bus is 16-bit whereas the size of address bus is 24-bit.
- Has non-multiplexed address and data bus that reduces operational speed.
- Addressable memory in case of 80286 is 16 MB.
- Offers an additional adder for address calculation.
- In 1985, Intel produced upgraded version of 80286 which was a 32-bit microprocessor.

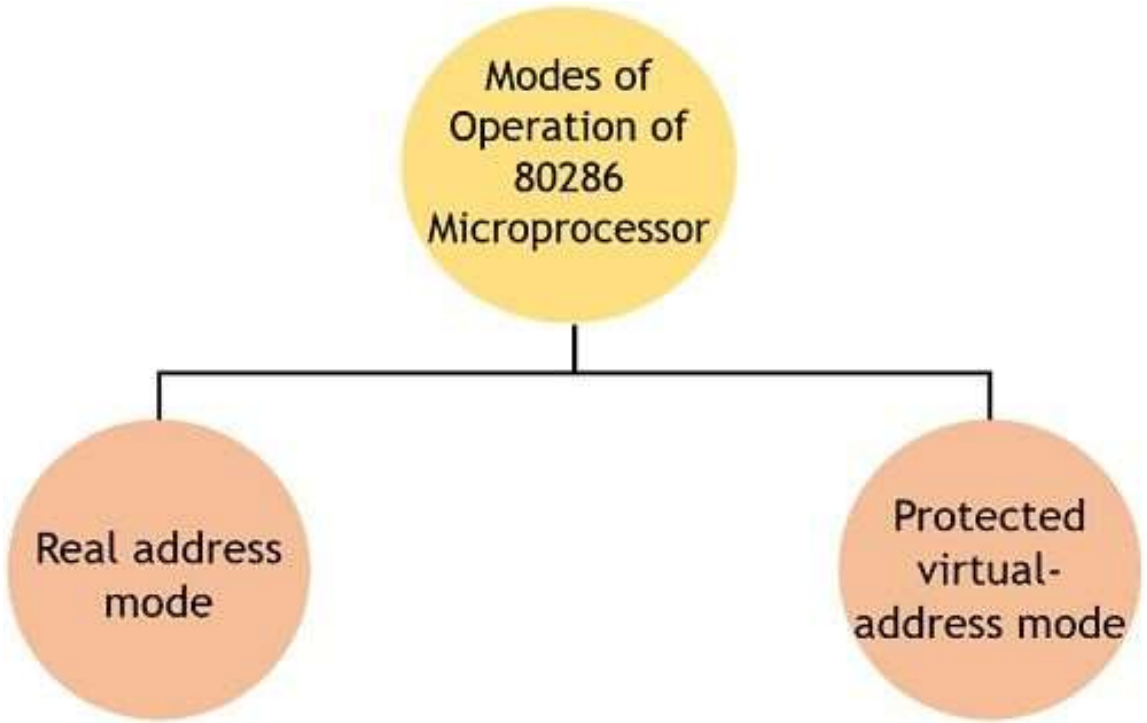
WORKING MODES OF 80286 MICROPROCESSOR:

- 80826 Microprocessor has **2** working/operating modes.

  They are:

  i) **Real address mode**

  ii) **Protected- virtual address mode**



REAL ADDRESS MODE:

- **In real address mode**, this microprocessor acts as a version of 8086 which is quite faster.
- 80286 executes a fully upward-compatible instruction of the 8086 instruction set.
- Without any special modification, the instruction programmed for 8086 can be executed in 80286.
- The 80286 **addresses a contiguous array of up to 1 M** (1,048,576 bytes) of physical memory using A_{19}-A_0 and $\overline{BHE}$.
- A_{23}-A_{20} should not be used by the processor when the 80286 operates in real address mode
- All memory management and protection mechanisms are disabled.

PROTECTED- VIRTUAL ADDRESS MODE :

- The **protected virtual-address mode** of 80286 supports multitasking because multiple programs can be executed using virtual memory.
- Offers memory addressability of 16 MB of physical memory along with 1 GB of virtual memory.
- Uses a 32-bit pointer composed of a 16-bit selector and a 16-bit offset, instead of a simple 20-bit real address.
- Processor enters PVAM from Real Address Mode when the Protection Enable (PE) bit in the machine status word is set using the LMSW (Load Machine Status Word) instruction.
- Used in 80286 so that in case of memory failure in real address mode, it can stay in protected manner.

DIFFERENCES BETWEEH REAL AND PROTECTED ADDRESS MODE:

REAL ADRESS MODE	PROTECTED ADDRESS MODE
Uses a 20-bit address bus, allowing access to a maximum of 1 MB of physical memory.	Uses a 24-bit address bus, providing access to up to 16 MB of physical memory.
Address is formed by combining a 16-bit segment register and a 16-bit offset register, shifted by 4 bits.	Addresses formed by a 16-bit selector and a 16-bit offset.
Does not provide advanced memory management or protection features.	Offers memory management features like segmentation, paging, and virtual memory.
Does not support privilege levels; all code runs at the same level of privilege.	Supports multiple privilege levels (rings), which allow the operating system to protect itself from user applications and other software components.

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REAL ADRESS MODE	PROTECTED ADDRESS MODE
Uses a subset of the 80286 instruction set, similar to the 8086/8088 instruction set.	Includes additional instructions like LMSW(Load Machine Status Word), LGDT(Load Global Descriptor Table) etc. for managing the memory protection and privilege features.
Fully compatible with software written for the 8086/8088, making it suitable for legacy applications.	Not fully compatible with software written for Real Address Mode, as it requires proper handling of descriptors and privilege levels.
No advanced system control mechanisms.	Enables control over multitasking, memory protection, and system stability through descriptors and privilege levels.
Segments are defined by a segment register directly pointing to the segment's base address.	Uses segment descriptors stored in descriptor tables (Global Descriptor Table and Local Descriptor Table).

THANK YOU!!!