The 286 versus 386 argument

There has been an argument brewing over the last couple of years over the role of the 80286 processor in times to come. On the one side, there is the school of thought that maintains that the 80286 is a tried and tested piece of technology that can be coaxed to operate at impressive clock speeds and will outperform a 386 chip with a similar specification.

Exponents of the 386 argue that since it can run in a simulated 286 environment, there is nothing the 286 can do that the 386 cannot match in performance. Couple that with the fact that the 386 has inbuilt memory management capability, together with a true 32-bit external architecture, and what possible reason can anyone have for buying a 286-based PC?

Traditionally, the 286 camp has been able to respond by pointing at the price levels that the 386 commands compared to those of a 286, and say that the price differential does not justify the average features for the man in the street. To a large extent this is true. If you are intending to run a copy of *SuperCalc 3* with a basic word processor, you are going to be more than satisfied with a 286 machine - even an XT might do. Even if you are running company accounts with a heavy word processing load, you will also find that a 286 will be more than sufficient. However, nowadays, the price differential is so small that this argument does not hold the same sway as it did six months ago.

Indeed, the shortcomings of the 286 design only truly come to light when you turn to applications that are written specifically to exploit the 386's additional functions. The address space of the 386 is 4Gb of linear memory, compared to the 16Mb that a 286 will support. The simple increase in size is not the only trick that the 386 can bring to bear to give applications the maximum workspace.

Memory management

Probably the most immediately relevant benefit of the 386 over the 286 is its inbuilt memory management functions. This memory management allows the processor to control which bits of physical Ram appear where in the memory address space. In other words, memory that is actually installed at 2Mb could look to an application as though it were at 1Mb, or even at address 0 if necessary. This is particularly useful for multitasking environments which rely on swapping programs in and out of the same memory area, as is necessary to multitask under Dos.

This memory management also explains the fact that 386 PCs do not require any additional hardware in order to provide expanded memory. A software memory manager such as *386Max* or *Qemm* is able to use the remapping techniques to allow extended memory (which is cheaper) to appear as expanded memory.

A further benefit that results from this memory management technique is the provision of what is called demand paged memory. Demand paging is fundamentally a way by which virtual memory can be simply implemented using the processor itself. Virtual memory is a term that is used to describe a situation where an application is fooled into thinking it has more memory available than is physically present on the computer by utilising disk space to represent the extra capacity.

When a program requests a bit of memory that isn't actually there, the processor looks at the way the memory is currently used and nominates a block that is swapped out to disk. The memory that is required is then retrieved from disk in its place, and then mapped to the correct address using the 386's mapping capabilities. It is precisely this demand paging capability that allows operating systems such as Unix to operate in the size of address space that they do. This feature is also utilised in the enhanced mode of *Windows 3.0*.

The 32-bit advantage

As operating systems develop, the ability to manipulate large amounts of data at high speed becomes more and more desirable, to the point of being a necessity. The fact that a 386 has a 32-bit wide data bus instantly doubles the throughput of data that it can achieve, with the result that developers have an opportunity to create environments that rely on this capability. This is true of a lot of the Unix implementations for the PC, which simply will not run unless they can utilise 32-bit data transfers. No problems here for genuine 386 owners, but a restriction for those with an SX-based system.

Given that a standard AT bus is only 16 bits wide, it should be obvious that you will not be getting the maximum benefit of 386 memory handling by plugging a memory board into a standard expansion slot. This either requires provision of a 32-bit expansion slot, together with an appropriate memory card or, more usually, a facility to plug extra Ram directly onto the motherboard.

SX or DX?

What, then, is lost by running a 386SX instead of a genuine 386DX processor? The primary difference between the two is their physical connection to the outside world. Because the SX was intended to be a direct replacement to the 286, it shares the same external architecture and therefore has a 16-bit data bus. This precludes it from being used in the type of environments that require the full 32-bit operations that a 386DX can provide.

It has to be said, however, that such environments are few and far between, and in a purely Dos context you could be excused for considering it irrelevant. The SX still exhibits all the techniques for memory management as its big brother, and will run any programs that use 386-specific code - the likes of *Paradox 386*, for example. If you are looking for a fast computer that will enhance the operation of your current applications as well as offering the potential to make the most of software advancements in the style of *Windows 3*, the SX is not really a compromise compared to the 386, while it does offer significant improvement over the 286 for relatively little extra money. For this reason, the 386SX may be considered as the new basic AT class machine, which has traditionally been a 286-based computer.

Planning ahead

Corporate buyers would be well advised to consider their future requirements, and if they decide that they wish the technology they are buying today to see them through to their next generation of operating systems then the SX would not be a wise choice. Indeed, we may well see a situation where the 386 itself is replaced in this field by the 486, which boasts even higher speeds and consequently higher data throughput. This will not take place until such time as 486 chip prices drop to more acceptable levels, as they will inevitably do over the course of the next 12 months.

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386SX machines under review