

## Why Intel didn't invent the personal computer?

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### Introduction

Recently it's been suggested that Target stores may drop carrying the popular Kindle computer/reader made by Amazon. The reason given is that Amazon as a retailer competes with Target. So logically, Target doesn't want to support and promote a competitor. This calls to mind for me the early history of Intel.

Intel began as only a semiconductor memory company; a memory chip was the ideal LSI component—large unit sales volume, low package pin count, simple cellular design with a regular on-chip wiring grid. However the only use for memory was in computers and accordingly the only customers were computer manufacturers. To be specific, in 1970 there were IBM and the seven dwarfs, the BUNCH,\* RCA, and GE. DEC (Digital Equipment Corporation) wasn't considered important nor was Xerox (and many other minicomputer manufacturers, although the DEC PDP-8 minicomputer sales volume probably exceeded 5,000 per year). Since Intel had mainly computer companies as customers and relied on them for their prime and only business, Intel didn't want to offend its customer base and “go into” the computer business, competing with its customers.

The world's first microprocessors came from Intel. More specifically, the 8008 single chip CPU was advertised in April 1970. Clearly this could have been a CPU for a general purpose computer, but computer manufacturers weren't interested for several reasons. Firstly, they were in the business of designing CPUs, and their engineering departments wouldn't buy someone else's CPU. Secondly, the 8008 CPU was inferior to any commercial computer CPU, both in performance and in instruction set. Thirdly, the 8008 instruction set and architecture wasn't compatible to any computer then in production; hence, there was no software for it. More importantly there was no compelling economic reason to use a single chip CPU. When one looks at computer system economics there are many costs:

- power supply, chassis, printed circuit board, wiring, cables
- memory
- peripherals
- CPU

Of these factors the memory and the peripherals are the dominate cost. There is negligible impact on the overall final assembly cost regardless of whether a CPU is built for \$150 with multiple IC chips or uses a \$25 single chip CPU.

### Special purpose computers

However, for a special purpose computer, peripherals may not be needed, the memory may be scaled down, and the other items may be simpler. So a specialized, dedicated

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\* BUNCH: Burroughs, Univac, NCR, Control Data, Honeywell.

computer could cost just a few hundred dollars. The 8008 was designed for computers in applications for which minicomputer costs were prohibitive. If the PDP-8 sold for \$10,000 a microcomputer could be used for well under \$1,000, if the slower speed and capability of the microcomputer could do the job.

Intel made microcomputers and tried to avoid being in the actual “computer” business. DEC made mini-computers and tried to avoid being seen as a computer manufacturer. Recall that DEC did not sell computers; it sold Programmed Data Processors (PDP). The subtle joke was that if they sold computers, they would compete with “everybody else” and also their sale/purchase cycle would be controlled by the customer's “computer czar.” By selling a product with another “handle,” they avoided those “political” issues and penetrated the engineering and scientific communities with their products.

### **Intel marketing circa 1975**

Fully realizing that it wasn't feasible to be in the “computer” business, Intel's microcomputer marketing group focused on promoting specialized or dedicated computers in a variety of market places where minicomputers would be too expensive. Hundreds of customers developed their own specialized systems, and many of them produced only hundreds or a few thousand systems per year. Applications included elevator controllers, traffic light controllers, medical instruments, cash registers, and so forth. Intel also sold small scratch pad RAM memory chips, Read Only Memories (ROM) for fixed program storage, and other support chips. Intel promoted microcomputers as a way of expanding their memory chip sales beyond use in general purpose computers. Intel also promoted using microcomputers in a select few high volume markets that we called “strategic” market segments.

I was primarily responsible for pursuing the *entertainment market*: pinball machines, gambling stations, arcade games, smart TVs, and the like. The *automobile market* was handled by another person. The *hobbyist market* was handled by a third person. We purposely ignored the “high performance” workstation market, as we considered that a small market and influenced our competitor (Motorola) to focus on that smaller market. Later Sun Computer was the dominant provider. We also ignored the education market as it was typically revenue starved. Eventually, microcomputers were used in all of these markets. Ford used a microcontroller in cars, Magnavox marketed an interactive video game, and IBM used microprocessors in both their word processor and their personal computer. Thus, our strategic marketing objectives of selling microcomputers in the millions was achieved.

### **“Development tools”**

To succeed in the microcomputer business, we realized that customer product development required both prototyping and software development. Under Ted Hoff's Application Research Department, a number of hardware and software tools were developed in parallel with the original CPU chip design. By 1975 there were tools, software aides, documentation, training, and publicity. Small single board computer

products evolved into much more elaborate systems to help users develop application software. Intel sold a box with a power supply and a disc operating system (ISIS); and although it “walked like a duck, and quacked like a duck,” it wasn’t a duck, i.e., it was not a computer. Rather, it was a Microcomputer Development System (Intellec® MDS®).

I recall the systems marketing manager of that product line making a statement about the strategic direction of his product line: “The market for our engineering tools is small and limited, and therefore there is no price elasticity; on the contrary, to get more revenue, we must provide more features, at a higher average selling price.” For example, an extra cost option, an In-Circuit-Emulator (ICE®) assisted users in debugging, setting program breakpoints, and examining both registers and memory contents.



**Early Intel development system**

Intel sold memory cards, CPU boards, and a complete microcomputer development system with a disk based operating system. The command line interpreter for this system was not so different from that of TOPS-10 or Digital Research CP/M (and thus DOS). The system also had a compiler for the high level language PL/M®, an assembler, an object code loader, and a debugging system. Packaged in a steel case, the sales price was typically around \$15,000. Had marketing bet on price elasticity, packaged it in plastic to reduce the cost, the MDS might have been a PC. Intel might have ended up in the PC business.

### **Benefitting from general purpose computing nonetheless**

Several Intel employees left to help start Apple Computer (HR Department and Board Chairman), and a number of Intel officers were early Apple investors (which also may have included venture capitalist Arthur Rock who was also associated with Intel). It seemed that Intel executives were able to benefit from the emerging PC market without Intel directly participating.

Eventually—by the time Intel developed their 8086 family of products evolving from 16 to 32 and 64 bit single chip CPUs—the microprocessor had become a dominant force in general purpose computing.