Chapter 12
The IBM Personal Computer

Key Topics
Intel 8088
Intel 8086
PC/DOS
MS/DOS
IBM compatible
CP/M
Digital research

12.1 Introduction

The introduction of the IBM Personal Computer in 1981 was a major milestone in the computing field. IBM's traditional approach up to then in product development was to develop a full proprietary solution. However, due to the aggressive timescales associated with the introduction of the IBM PC, it decided instead to outsource the development of the microprocessor to a small company called Intel, and to outsource the development of the operating system to a small company called Microsoft. These decisions would later prove costly to IBM, as Microsoft and Intel later became technology giants (at IBM's expense).

The introduction of the IBM personal computer was a paradigm shift in computing in that it placed computing power in the hands of millions of people. The previous paradigm was that an individual user had limited control over a computer, with the system administrators controlling the access privileges of the individual users.

The awarding of the contract to develop the operating system to Microsoft later proved controversial. IBM had intended awarding the contract to Digital Research a company that had developed the CP/M operating system for several microprocessors. However, IBM and Digital Research were unable to agree terms (there may have been problems with meeting the IBM delivery timescales or the royalties demanded by Digital Research may have been excessive), and IBM instead awarded the contract to Microsoft (a small company that specialized in providing BASIC interpreters). Microsoft hired a consultant to port an existing CP/M operating system to the 8088 microprocessor, and it later became clear to Digital Research that their software had been used to develop the operating system for the IBM personal computer.

G. O'Regan, *A Brief History of Computing*,
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12.2 The IBM Personal Computer

IBM introduced the IBM Personal Computer (PC) in 1981 as a machine to be used by small businesses and users in the home. The IBM goal at the time was to get quickly into the home computer market, which was then dominated by Commodore, Atari and Apple.

IBM assembled a small team of 12 people led by Don Estridge (Fig. 12.1), and their objective was to rapidly get the personal computer to the market. They designed and developed the IBM PC within one year, and as time to market was the key driver they built the machine with "*off-the-shelf*" parts from a number of equipment manufacturers. The normal IBM approach to the design and development of a computer was to develop a full proprietary solution.

The team had intended using the IBM 801 processor, which was being developed at the IBM Research Centre in Yorktown Heights. However, they decided instead to use the existing Intel 8088 microprocessor, which was inferior to the IBM 801. They chose the PC/DOS operating system from Microsoft rather than developing their own operating system.

The unique IBM elements in the personal computer were limited to the system unit and keyboard. The team decided on an open architecture so that other manufacturers could produce and sell peripheral components and software without purchasing a license. They published the *IBM PC Technical Reference Manual*, which included the complete circuit schematics; the IBM ROM BIOS source code; and other engineering and programming information.

The IBM PC (Fig. 12.2) was the cheapest IBM computer produced up to then, and it was priced at an affordable $1,565. It offered 16 kilobytes of memory (expandable to 256 kilobytes); a floppy disk, a keyboard, and a monitor. The IBM personal computer became an immediate success, and it became the industry standard.

Fig. 12.1 Don Estridge. (Courtesy of IBM archives)

The open architecture led to a new industry of "*IBM-compatible*" computers, which had all of the essential features of the IBM PC, except that they were cheaper. The terms of the licensing of PC/DOS operating system gave Microsoft the rights to the MS/DOS operating system on the IBM compatible computers, and this led inexorably to the rise of the Microsoft Corporation. The IBM Personal Computer XT was introduced in 1983. This model had more memory, a dual-sided diskette drive, and a high-performance fixed-disk drive. The Personal Computer/AT was introduced in 1984.

The development of the IBM PC meant that computers were now affordable to ordinary users, and this led to a huge consumer market for personal computers and software. It led to the development of business software such as spreadsheets and accountancy packages, banking packages, programmer developer tools such as compilers for various programming languages, specialized editors, and computer games.

The introduction of the personal computer was a paradigm shift in computing, and it led to a fundamental change in the way in which people worked. It placed computing power directly in the hands of millions of people, with individual users having complete control over the machine. The previous paradigm was that the system administrators strictly controlled the access privileges of the individual users, and so individual users had limited control over the computer. The introduction of the client-server architecture led to the linking of the personal computers

Fig. 12.2 IBM personal computer. (Courtesy of IBM archives)

(clients) to larger computers (servers). These servers contained large amounts of data that could be shared with the individual client computers.

The IBM strategy in developing the IBM personal computer was deeply flawed, and it cost the company dearly. IBM had traditionally produced all of the components for its machines, but with its open architecture model, any manufacturer could now produce an IBM-compatible machine. IBM had outsourced the development of the microprocessor chip to Intel, and Intel later became the dominant player in the microprocessor industry.

The development of the operating system, PC/DOS (PC Disk Operating System) was outsourced to a small company called Microsoft[1]. This proved to be a major mistake by IBM, as the terms of the deal with Microsoft were favorable to the latter, and it allowed Microsoft to sell its own version of the operating system (i.e., MS/DOS) to other manufacturers as the operating system for the many IBM compatibles. Intel and Microsoft became technology giants.

12.3 Operating System for IBM PC

Digital Research lost out on the opportunity of a lifetime to supply the operating for the IBM personal computer to IBM, and instead it was Microsoft that reaped the benefits.

Bloomberg Business Week published an article in 2004 describing the background to the development of the operating system for the IBM PC, and the failed negotiations between Digital Research and IBM on the licensing of the CP/M operating system. The article was titled "*The Man who could have been Bill Gates*" [Blo:04].

The project was subject to an aggressive delivery schedule, and while traditionally IBM developed a full proprietary solution, it decided instead to outsource the development of the microprocessor and the operating system.

The IBM team initially asked Bill Gates and Microsoft in Seattle to supply them with an operating system. Microsoft had already signed a contract with IBM to supply a BASIC interpreter for the IBM PC, but they lacked the expertise in operating system development. Gates referred IBM to Gary Kildall at DRI, and the IBM team approached Digital Research with a view to licensing its CP/M operating system.

Digital Research was working on a new version of CP/M for the 16-bit Intel 8086 microprocessor, which had been introduced in 1978. IBM decided to use the lower cost Intel 8088 microprocessor (a slower version of the 8086) for its new personal computer.

IBM and Digital Research failed to reach an agreement on the licensing of CP/M for the IBM PC. The precise reasons for failure are unclear, but some immediate problems seem to have arisen with respect to the signing of an IBM non-disclosure

[1] Microsoft was founded by Bill Gates and Paul Allen in 1975.

agreement during the visit. It is unclear whether Kildall actually met with IBM and whether there was an informal handshake agreement between both parties. However, there was certainly no documented legal agreement between IBM and DRI.

There may also have been difficulties in relation to the amount of royalty payment being demanded by Digital Research, as well as practical difficulties in achieving the required IBM delivery schedule (due to Digital Research's existing commitments to Intel). Kildall was superb at technical innovation, but he may have lacked the appropriate business acumen to secure a good deal, or he may have oversold his hand.

Gates offered to provide an operating system (later called PC/DOS) and BASIC to IBM on favorable terms. IBM accepted the offer, and the contract allowed Microsoft to market and sell its version (MS/DOS) of the operating systems on IBM compatibles.

Gates was aware of the work done by Tim Patterson on a simple quick and dirty version of CP/M (called QDOS) for the 8086 microprocessor for Seattle Computer Products (SCP). Gates licensed QDOS for $50,000, and he hired Patterson to modify it to run on the IBM PC for the Intel 8088 microprocessor. Gates then licensed the operating system to IBM for a low per-copy royalty fee.

IBM called the new operating system PC/DOS, and Microsoft retained the rights to MS/DOS, which was used on IBM-compatible computers produced by other hardware manufacturers. In time, MS/DOS would later become the dominant operating system (eclipsing PC/DOS due to the open architecture of the IBM PC and the rapid growth of clones) leading to the growth of Microsoft into a major corporation.

DRI released CP/M-86 shortly after IBM released PC DOS. Kildall examined PC/DOS, and it was clear to him that it had been derived from CP/M. He was furious and met separately with IBM and Microsoft, but nothing was resolved. Digital Research considered suing Microsoft for copying all of the CP/M system calls in DOS 1.0, as it was evident to Kildall that Patterson's QDOS was a copy of CP/M.

He considered his legal options but his legal advice suggested that as intellectual copyright law with regard to software had only been recently introduced in the United States, that it was not clear what constituted infringement of copyright. There was no guarantee of success in any legal action against IBM, and considerable expense would be involved. Kildall threatened IBM with legal action, and IBM agreed to offer both CP/M-86 and PC-DOS. However, as CP/M was priced at $240 and DOS at $60, few personal computer owners were willing to pay the extra cost. CP/M was to fade into obscurity.

Perhaps, if Kildall had played his hand differently, he could have been in the position that Bill Gates is in today, and Digital Research could well have been, the "*Microsoft*" of the PC industry. Kildall's delay in developing the operating system gave Patterson the opportunity to create his own version. IBM was under serious time pressures with the development of the IBM PC, and Kildall may have been unable to meet the IBM deadline. This may have resulted in IBM dealing with Gates instead of DRI.

Further, the size of the royalty fee demanded by Kildall for CP/M was not very sensible, as the excessive fee resulted in very low sales for the DRI product, whereas if a more realistic price had been proposed, then DRI may have made some reasonable revenue. Nevertheless, Kildall could justly feel hard done by, and he may have viewed Microsoft's actions as the theft of his intellectual ideas and technical inventions.

12.4 Review Questions

1. Why did IBM launch the personal computer?
2. What mistakes did IBM make with its introduction of the IBM PC?
3. Why has Gary Kildall has been described as "the man who could have been Bill Gates?"
4. Describe the controversy over the operating system for the IBM PC.
5. Describe IBM's contributions to the computing field.
6. Describe Intel's contributions to the computing field.
7. Describe Microsoft's contributions to the computing field.

12.5 Summary

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Don Estridge led the IBM team responsible for the introduction of the IBM PC, and their goal was to design and develop the IBM PC within one year. They built the machine with "*off-the-shelf*" parts from a number of equipment manufacturers, rather than the usual IBM approach developing a full proprietary solution.

The awarding of the contract to develop the operating system to Microsoft later proved controversial. IBM had intended awarding the contract to Digital Research who had introduced the CP/M operating system for several microprocessors. However, negotiations between DR and IBM failed and IBM awarded the contract to Microsoft.