Technology Projection Modeling of Future Computer Systems

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Preface

Why This Book—And Why Now?

Those involved in developing computer systems understand how powerful new technologies shape computer designs and thus affect the systems development process. To control that power and to use it for positive change requires thinking and planning far beyond the next product cycle. A long-range plan for the next decade must be created, then implemented. Without such a plan, system developers will be like aviators flying blindly into a dust storm without instruments. With such a plan, the future can be shaped by thoughtfully choosing the key technologies worthy of investment, and by focusing on the technical problems that block the chosen path.

The need for long-range planning is urgent. At the current rate of technology change, present system designs, processes, and applications will quickly be replaced. The growing demand for information is fueling even more aggressive change. The passage of more data through systems than ever before requires faster circuits, higher capacity memories and storage, and greater system bandwidth. To meet those requirements, system designers are turning to faster processors, higher data transfer rates within and between systems, operating systems with fewer instructions per transaction, and networked systems with distributed functions and very high data transfer rates. Computer systems are increasingly parallel; current designs include processors, multiple processors, and clustered systems with a distributed data base. Computer functions are shifting from central processors to subsystem processors and even to intelligent work stations. Application programs are being designed for more intelligent information processing to make systems easier to use. Intelligent work stations now provide graphics, image, voice, and 3-D presentations in color.

There also have been technology advances in the tools, processes, and information that engineers, programmers, and system integrators use to develop systems. These professionals now use powerful intelligent work stations to develop the complex circuit designs and chip layouts for semiconductors and card packaging. Simulation programs automatically validate these designs before they are committed to silicon. Operating system and subsystem programmers use interactive system terminals with simulated hardware architectures to develop advanced high-speed programs. Application programmers write programs adapted to standard system interfaces to achieve systems compatibility even before new systems are available. These activities all accelerate the development cycle and the introduction of new system concepts. Clearly, technological advances and insatiable demands for information flow are influencing computer systems design.

What Will You Find Here?

This book is intended to provide:

- A methodology and model for computer systems development forecasting with performance evaluation tools that enable quantitative evaluation of how technological changes will affect system attributes for midrange and commercial entry products through the year 2000.
- A flexible method for maintaining a continually updatable understanding of expected technological advances through the year 2000.

The focus in this book is on midrange and commercial entry systems because these are the systems I know best.[1]

In the development of entry and midrange systems, the industry is asking:

- What key technology advances are expected, and are how do those expectations affect system designs and trends? Also, are technology advances slowing down, speeding up, or continuing at a constant rate?
- Will midrange systems be displaced by personal computers and mainframes? Will midrange systems become too complex for the novice user?
- What attributes of midrange systems differentiate them from other systems on the market? Will technological changes in this product range be significant or mundane?

[1] The three general classes of commercial business computers are mainframes, midrange computers, and personal computers. They are generally distinguishable by price, capacity, and the number of end users they can simultaneously support. Mainframes are usually priced above $2 million and can support thousands of end users. Personal computers cost up to $15,000 and usually serve only one user. Midrange systems are classed between these two classes.

To answer these questions, I will identify key technology changes and show how they are expected to affect future computer architecture and hardware development. This information will lead to a clearer understanding of significant potential for entry and midrange systems in commercial business applications.

Another important point is that the book focuses on system hardware, rather than on operating systems. However, intelligent discussion of any system requires a software model. Thus, I have chosen an operating system similar to that used in the IBM System/38 and the AS 400. These operating systems are currently one of the most advanced in use at IBM, and it supports a generic hardware system. Also, because hardware personalization occurs at the lowest level (the vertical microcode level) of the software interface, so that significant hardware technology changes will not affect the basic operating system structure.

My overall approach differs from that taken of earlier authors including Turn (1974), Martino (1972), and Lenz (1972). The basic difference is that I directly relate detailed technology changes to changes in system architecture and structure. I avoid the general notions that future technology changes will be linear extrapolations of the past and that future system structures will be similar to those we value today. Instead, I assume that future technologies will affect both the developer's and end user's views of future systems. Past and present technologies and systems have not been ignored; I have searched diligently for clues to the technology changes that affected the progression of system model development from the past up to present.

This book is organized into eleven chapters and three appendixes. Chapters 1 and 2 discuss the power of technology changes and their influence on the computer developers, manufacturers, technologists, and end users. Chapters 3 and 4 explore a selection of key technology drivers that will affect the development of midrange and entry systems to the year 2000. Chapters 5 to 7 develop a system model and show the generic effect of technology changes on that system model. Chapters 8 to 10 describe the projected effects of new software applications enablers on current computer system hardware and software. Parallel systems architectural designs are illustrated showing significant midrange performance improvements possible. Chapter 11 puts it all into perspective in a summary. The table of contents gives a brief description of each of the chapters and appendixes.

Will this book interest you?

If you are interested in future views of system architecture, system design, and system component technologies, this book should be of value. In particular, I have tried to speak to:

- Students in computer science with a major in systems architecture and hardware/software design
- Professional engineers and programmers interested in advanced hardware and software design
- Professional computer planners and strategists

- Professional engineers interested in component technology developments
- Sophisticated computer users interested in future systems architecture and new applications

To simplify the book for those less technically inclined, I have (as much as possible) confined to the appendixes my discussion of component specifications and the more technical system models and equations.

Remember, the primary purpose of this book is to provide a method for envisioning future entry and midrange systems likely to develop as a result of current day-to-day decisions about technology choices, development processes, and system designs.

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