# Foreword

Input/output has been the abandoned child of computer design. Historically neglected by processor enthusiasts, the prejudice against I/O is institutionalized in popular benchmarks such as SPEC, which disqualifies benchmarks that spend more than 5% of time in I/O. Thus the quality of a computer's I/O system cannot be measured by SPEC. The second-class citizenship of I/O is even apparent in the label central applied to processor units and peripheral applied to I/O devices.

This attitude is contradicted by common sense. A computer without I/O devices is like a car without wheels—you can't get very far without them. And the customer who pays for a computer cares about information storage and retrieval, even if the processor designer doesn't.

Moreover, Moore's Law has enabled extraordinary advance in processor cost and performance, and thus it is increasingly unlikely that the most important goal is keeping the processor busy versus keeping I/O devices busy, as the bulk of the costs may not be with the processor. Past neglect and Amdahl's Law--also know as the Law of Diminishing Returns--has thus thrust I/O to the forefront.

This change in importance is also reflected by the names of our times. Whereas the 1960s to 1980s were called the Computing Revolution, the period since 1990 is been called the Information Age, with concerns focussed on advances in Information Technology versus raw computational power. This shift in focus from computation to storage and communication of information emphasizes reliability and scalability as well as cost-performance. Quoting George Gilder:

*Combining bandwidth and storage ... enables swift and reliable access to the ever expanding troves of content on the proliferating disks and ... repositories of the Internet. ... the capacity of storage arrays of all kinds is rocketing ahead of the advance of computer performance.*

To reflect the increasing importance of I/O, this book has 45 chapters on all aspects of high performance mass-storage systems, hardware, systems software, applications, history, and future trends.

Although one book alone cannot fully reimburse I/O for its neglect, it may at least atone for some of the sins of the past and restore some balance.

**David Patterson**
Professor in Computer Science
University of California, Berkeley
The United States of America (USA)
http://www.cs.berkeley.edu/~pattrsn/