

Preface

The Information and communication technology (ICT) industry is said to account for 2% of the worldwide carbon emissions – a fraction that continues to grow with the relentless push for more and more sophisticated computing equipment, communications infrastructure, and mobile devices. While computers evolved in the direction of higher and higher performance for most of the latter half of the 20th century, the late 1990's and early 2000's saw a new emerging fundamental concern that has begun to shape our day-to-day thinking in system design – power dissipation. As we elaborate in Chapter 1, a variety of factors colluded to raise power-efficiency as a first class design concern in the designer's mind, with profound consequences all over the field: semiconductor process design, circuit design, design automation tools, system and application software, all the way to large data centers.

Power-efficient System Design originated from a desire to capture and highlight the exciting developments in the rapidly evolving field of power and energy optimization in electronic and computer based systems. Tremendous progress has been made in the last two decades, and the topic continues to be a fascinating research area. To develop a clearer focus, we have concentrated on the relatively higher level of design abstraction that is loosely called the *system level*. In addition to the extensive coverage of traditional power reduction targets such as CPU and memory, the book is distinguished by detailed coverage of relatively modern power optimization ideas focussing on components such as compilers, operating systems, servers, data centers, and graphics processors.

The book is primarily intended to serve as a graduate-level text. An elementary familiarity with digital design, computer architecture, and system software utilities such as compilers and operating systems, is necessary in order to appreciate the contents of the book. However, in Chapter 2, we do attempt to quickly cover some of the background material on which the later discussion is based. After reading this book, the reader can expect to obtain a reasonable understanding of the opportunities for introducing power and energy efficiency into electronic and computer based systems, the current approaches targeting this objective, and the challenges ahead.

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