A Comparative Analysis of Operating Systems

Guest Editor’s Introduction

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During recent years the subject of operating systems has received much attention in the computer literature. This is not surprising, since operating systems are the backbone of computer systems, and our understanding of operating systems issues is closely tied to our comprehension of computer science in general. However, most of the available literature deals with theory or with specific implementations. Treatments providing a comparative discussion and analysis of commercial operating system designs are essentially nonexistent. And yet, there is much to be learned from such efforts. It is precisely this observation that motivated this special issue of Computer.

The task of identifying and selecting a set of potential authors for such an issue had to be guided by the following criteria. The authors needed to (1) have a solid foundation in the basic theory; (2) have a close familiarity with at least two existing operating systems; (3) be capable of creating a framework of principles that permitted an unbiased comparative discussion of various operating systems; and (4) be willing to undertake and make a timely commitment to such an effort. It was soon clear that the set of potential authors satisfying the above criteria was indeed small! Nevertheless, a courageous group accepted the challenge and the four tutorial papers which follow represent the pragmatic fruits of their labor.

The first paper, by Professor Rick Bunt, centers on scheduling techniques. It presents a model which serves as a common framework for the description of actual implementations. Specifically, the scheduling philosophies employed in IBM’s System/360/370 OS, in Honeywell’s 645 (MIT) MULTICS, and in Digital Equipment Corporation’s PDP-11/40/45 (Bell Laboratories) UNIX operating systems are placed in perspective.

The second paper, by Professor Bill Atwood, examines the implementation of concurrency. It discusses a number of related issues, the aggregate of which provides an up-to-date basis for the comparative analysis of different concurrency mechanisms. Two operating systems, Control Data Corporation’s 6000 and CYBER series KRONOS, and IBM’s System/360/370 OS, are analyzed and compared.

The third paper, by Professor Bob Doran, treats the subject of virtual memory. It offers a rather interesting approach of dividing the study of virtual memory into two distinct parts: form and implementation. After illuminating virtual memory through some amusing analogies, two operating systems—Burroughs Corporation’s 6700 MCP and Honeywell’s 645 MULTICS—are analyzed and compared.

The last paper, by Mr. Bob Dependahl and this editor, takes up the subject of file input/output control logic. It employs a time-oriented design representation scheme as the basis for the comparison of different designs. Two operating systems, IBM’s System/360 OS and Burroughs Corporation’s 1700 MCP, are analyzed and compared.

The aggregate of papers contains sufficient references to allow the interested reader to pursue further any of the topics covered.

I wish to explicitly acknowledge the help of numerous referees who, in conventional anonymity, gave freely of their time and advice. Thank you! A note of appreciation is also due to Jack Shemer, former technical editor of Computer, for his invitation to serve as guest editor and for his support.

Finally, it must be made very clear that much effort was dedicated to ensure the veracity of the information presented here about existing operating systems. Albeit correct to the best of our knowledge, it is only intended to illuminate current designs and illustrate comparative techniques.

Leon Presser, guest editor, is also the co-author of an article for this issue of Computer. His biographical sketch appears on p. 42.