Fundamentals of Operating Systems

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Fundamentals of Operating Systems

A. M. Lister

University of Queensland

Third Edition

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MACMILLAN

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to my parents

Contents

<i>Preface to the First Edition</i>	<i>xi</i>
<i>Preface to the Second Edition</i>	<i>xii</i>
<i>Preface to the Third Edition</i>	<i>xiii</i>
1 Introduction	1
1.1 Types of operating system	3
1.2 The ‘paper’ operating system	5
2 Functions and Characteristics of an Operating System	7
2.1 Operating system functions	7
2.2 Operating system characteristics	10
2.3 Desirable features	11
3 Concurrent Processes	13
3.1 Programs, processes, and processors	13
3.2 Communication between processes	15
3.3 Semaphores	17
3.4 Monitors	24
3.5 Summary	26
4 The System Nucleus	27
4.1 Essential hardware facilities	27
4.2 Outline of the nucleus	29
4.3 Representation of processes	30
4.4 The first-level interrupt handler	31
4.5 The dispatcher	34
4.6 Implementation of <i>wait</i> and <i>signal</i>	37
5 Memory Management	42
5.1 Objectives	42
5.2 Virtual memory	44
5.3 Implementation of virtual memory	45
5.4 Memory allocation policies	54

5.5 The working set model	60
5.6 Implementation in the paper system	62
6 Input and Output	63
6.1 Design objectives and implications	64
6.2 The I/O procedures	66
6.3 The device handlers	69
6.4 Buffering	71
6.5 File devices	72
6.6 Spooling	74
6.7 Conclusion	76
7 The Filing System	77
7.1 Objectives	77
7.2 File directories	78
7.3 Sharing and security	80
7.4 Secondary memory organisation	82
7.5 File system integrity	87
7.6 Opening and closing files	88
7.7 Conclusion	92
8 Resource Allocation and Scheduling	93
8.1 General observations	93
8.2 Allocation mechanisms	94
8.3 Deadlock	96
8.4 The scheduler	101
8.5 Scheduling algorithms	104
8.6 Process hierarchies	108
8.7 Control and accounting	111
8.8 Summary	115
9 Protection	116
9.1 Motivation	116
9.2 Development of protection mechanisms	117
9.3 A hierarchical protection system	120
9.4 General systems	122
9.5 Conclusion	127
10 Reliability	128
10.1 Objectives and terminology	128
10.2 Fault avoidance	130
10.3 Error detection	133

10.4	Fault treatment	134
10.5	Error recovery	135
10.6	Multilevel error handling	138
10.7	Conclusion	139
11	Job Control	140
11.1	Some general remarks	140
11.2	Command languages	142
11.3	Job control languages	142
11.4	The job pool	145
11.5	System messages	146
11.6	Passage of a job through the system	146
	Conclusion	148
	<i>Appendix: Monitors</i>	<i>152</i>
	<i>References</i>	<i>154</i>
	<i>Index</i>	<i>158</i>

Preface to the First Edition

An operating system is probably the most important part of the body of software which goes with any modern computer system. Its importance is reflected in the large amount of manpower usually invested in its construction, and in the mystique by which it is often surrounded. To the non-expert the design and construction of operating systems has often appeared an activity impenetrable to those who do not practise it. I hope this book will go some way toward dispelling the mystique, and encourage a greater general understanding of the principles on which operating systems are constructed.

The material in the book is based on a course of lectures I have given for the past few years to undergraduate students of computer science. The book is therefore a suitable introduction to operating systems for students who have a basic grounding in computer science, or for people who have worked with computers for some time. Ideally the reader should have a knowledge of programming and be familiar with general machine architecture, common data structures such as lists and trees, and the functions of system software such as compilers, loaders, and editors. It will also be helpful if he has had some experience of using a large operating system, seeing it, as it were, from the outside.

The first two chapters of the book define the functions of an operating system and describe some common operating system characteristics. Chapter 3 establishes the process as a basic concept in the discussion of the concurrent activities which go on inside an operating system, and describes how processes communicate with each other. The rest of the book then describes the construction of an operating system from the bottom up, starting at the interface with the machine hardware and ending at the interface with the user. By the end of the book the system which has been constructed is seen to possess the features demanded at the beginning.

Throughout the book I have tried to show how each stage in the construction of an operating system naturally follows on the previous ones, and have emphasised the logical structure of the system as a whole. I have done this for two reasons. The first is pedagogical: my experience indicates that students gain a better understanding of complex material if it is presented in a coherent manner. The second is frankly polemic: this is the way I believe operating systems should be built. Attention to structure and logical dependence are the

best means we have of building operating systems which are easy to understand, easy to maintain, and relatively error free.

Finally, I would like to thank the many friends and colleagues who have helped in the writing of this book. In particular I would like to thank David Lyons, who has been a fertile source of ideas and comment; and David Howarth, who made valuable comments on an earlier draft. Thanks are also due to Colin Strutt, Morris Sloman, John Forecast, Ron Bushell and Bill Hart, who have made constructive suggestions for improving the text.

ANDREW LISTER

Preface to the Second Edition

Any book on computer science suffers from the fact that its subject matter is undergoing rapid change, both technological and conceptual. A book on operating systems is no exception: the hardware on which systems run is being revolutionised by the large scale integration of components, and ideas about what operating systems should do are being modified by changing user requirements and expectations. Although this book is about ‘fundamentals’, which can be expected to be less volatile than other topics, it would be foolish to ignore the developments which have occurred in the four years since publication.

Consequently I have amended the text in three main ways for this edition. First, there is an additional chapter on reliability, a topic whose importance has increased dramatically as reliance on computer systems has grown in many areas of life. Secondly, the references to real-life operating systems have been updated to include systems which have come into use since the first edition, and references to the literature have been similarly updated. Thirdly, I have altered the presentation of certain topics so as better to reflect current ideas, and have expanded the conclusion to indicate what developments can be expected in the future.

Other changes in the text have been motivated by feedback from readers of the first edition. Here I owe a great debt to my students, who have had the perception to point out errors, and the good sense to expose inadequate exposition. Any improvements in this respect are due largely to them, though any remaining inadequacies are, of course, my own.

A.L.

Preface to the Third Edition

Almost a decade after publication it is reassuring to know that the ‘fundamentals’ of the title remain essentially the same. However, as the systems of the early 1970s fade into distant memory I have found it necessary to update the text by reference to their successors. I have also taken the opportunity to introduce one or two new topics, and to improve the presentation of several others. In this latter respect I am indebted to Morris Sloman and Dirk Vermeir for their valuable suggestions, and, as ever, to my students.

A.L.