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Security of Computer Based Information Systems

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Preface

Today, computer based information systems play a critical role and integral part in business operations. Companies and governments are involved each day with the electronic transfer of highly sensitive personal data and of data representing billions of pounds. Irrespective of whether or not a company is involved in electronic funds transfer, it is apparent that information is an important and valuable resource of small and medium sized businesses as well as large ones. These and other factors, such as data protection legislation, have combined to raise the subject of security of computer systems and computer based information systems to its current level of concern.

This book presents methods for engineering security into computer based information systems. It is not a computer security handbook because there are good handbooks already written; nor does it try to use checklists to show how to provide better levels of security. Instead, it attempts to show the underlying general principles of security. For example, checklists that are used extensively throughout the computer security industry are not shown in the book, but are discussed and explained as part of other heuristic methods.

A universal problem with books on computer security is that the subject embraces a vast number of topics, including physical security of buildings and computer facilities, fire protection, privacy, software, hardware, personnel management, financial control and audit and the psychological and sociological behaviour of people. As a result, some topics must be left in the background. Also authors may write on the subject from different viewpoints. For example, one author may concentrate on crime incidents, another on database security and another on hardware. My approach is from the educational needs of students aspiring to be systems analysts – an approach that naturally has its own strengths and weaknesses – but clearly this book can give only a broad insight into an extremely complex subject.

Structure of the book

Chapter 1 defines the basic terminology of security of computer based information systems and argues the importance of the subject. Chapter 2 summarises the basic concepts of physical security. Chapter 3 discusses the security of data within the computer and at the man-machine interface through consideration of access

control, information flow, inference control in databases and cryptography. The highly specialised subjects of hardware, system software and communications are introduced in chapter 4 but only in so far as they influence computer applications. Chapter 5 explains the critical part played by people in security — people represent both threats and safeguards. In chapter 6 the steps that must be followed to create and build secure application software are examined. Chapter 7 considers operational aspects of security and shows how operational procedures can ensure that well-designed application software does not deteriorate when in operation. Chapter 8 shows how a security programme can be developed for an organisation and stresses the critical role of people — a theme developed earlier in chapter 5. The historical and international background of the UK Data Protection Act with its management, technical and financial implications is reviewed in chapter 9. In chapter 10 the need for both technical and legal deterrents for proprietary software protection is stressed and detailed consideration is given to copyright, trade secret and patent protection. A number of real-life security breaches are described in chapter 11 to highlight points made in earlier parts of the book. One incident is used for a discussion of data protection legislation and the other incidents highlight the importance of contingency planning, company internal controls, recruitment procedures and policies on the use of computer resources by computer centre personnel. The final chapter refers to the need for a holistic approach to security and looks at the security implications of micro-computers.

Suggestions to readers

I have in mind one major group of readers, namely students who in their future careers will design information systems or advise non-computer personnel of a company about security. For these students the book provides a conceptual framework plus an explanation of useful principles and techniques. However, the book should be useful to any reader with a technical background and a serious interest in computing.

To facilitate its use as a textbook, questions are given at the end of each chapter. Pointers to answers are available from the author in a separate document. The majority of questions can be undertaken by a student studying alone, or they can be used for class discussion. There are a few questions, marked 'group problem', which are best studied by three or four students working together.

For the student

The book is intended to serve as a text in computer science or management studies for a senior course at undergraduate level or for postgraduate study. All chapters are appropriate for study but a few chapters — such as those on protection of proprietary software, data protection legislation and the case

studies — can be read as separate self-contained studies. The chapters have some overlap but this is intentional because students must appreciate that the many and various security methods complement each other and that no one method can satisfactorily handle the security problems handled by other methods.

The would-be designer needs to appreciate many methods from a number of different chapters. In this sense, the chapters are purely artificial boundaries constructed to help the reader to approach a large subject.

Teaching

Security is not only a fascinating subject in its own right but is also an ideal vehicle to demonstrate the interactions between people and technology in sociotechnical systems. Ideally, the teaching of security should reflect the multidisciplinary nature of information processing and security. Therefore, it presents a perfect opportunity for team teaching.

Although every effort has been made to eliminate errors, some will inevitably remain. Therefore, I would be grateful to receive comments from readers regarding errors of a typographical or a substantive nature.

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Ideas for this book started well before I received the assignment to write it. The interest in security started during the late 1960s when I was data processing manager in the Joseph Lucas Group with responsibility for designing and operating secure payroll and other financial systems. The interest developed over the next decade, first through consultancy assignments in many industries including the financial sector, later through experience of project management of major projects in the public sector and finally through my lecturing in security.

Consequently, I have learned a great deal from many people with whom I have worked and am most grateful to those who have helped directly and indirectly with my work in security. In particular, I would like to thank John Corcoran of National Giro Bank, Frank Davies of Littlewood Mail Order computer services, Mark Kahrs of the Computing Science Research Center, AT & T Bell Laboratories, New Jersey, John Step of the Audit Consortium of the Brighton, Tunbridge Wells, Eastbourne and Hastings Health Authorities and Frank Wright of Southern Water Authority for reading parts of the book and providing helpful comments, and Peri Loucopoulos of UMIST for encouragement during the preparation of the manuscript. I have received help from many colleagues at North East London Polytechnic; in particular Allan Cheatham and John Peacham have commented

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