

# Preface

As computer systems and networks have evolved and grown more complex, the role of the IT department in most companies has transformed primarily to ensuring that they continue to operate without disruption. IT spending, as reported by a variety of studies, shows the trend that most of the expenses associated with IT are related to the task of operating and managing installed computer systems and applications. Furthermore, the growth in that expense category is outstripping the expense associated with developing new applications. As a consequence, there is a pressing need in the companies and organizations to find qualified people who can manage the installed base of computer systems and networks. This marks a significant shift from the previous trend in companies where the bulk of the IT department expenses were targeted on development of new computer applications.

The shift from developing new applications to managing existing systems is a natural consequence of the maturity of IT industry. Computers are now ubiquitous in every walk of life, and the number of installed successful applications grows steadily over the time. Each installed successful application in a company lasts for a long duration. Consequently, the number of installed applications is much larger than the number of projects focused on developing new applications. While there always will be new applications and systems being developed within companies, the predominance of managing and operating existing applications is likely to continue. A natural consequence of this is that the IT marketplace will continue to shift toward a technical population skilled at operating and managing existing computer applications and systems, as opposed to a technical population skilled at developing new computer applications and systems.

The education and training provided in our computer science courses, however, has not kept pace with the shift in the demand for computer scientists. While most computer science programs have a rich set of courses teaching the students the skills required to develop new systems, there is a paucity of courses that train them to manage and operate installed computer systems, both hardware and software. As a result, there is a mismatch between the demands of the IT marketplace and the supply of the technical talent from our universities. Fortunately, several universities have noticed this shift in the demand and have

started to offer courses in systems and network management. This book is intended to provide the supporting textbook to facilitate the teaching of such courses.

This book tries to define the fundamental principles that every student of systems management ought to be aware of. The algorithms, architectures, and design techniques used for different aspects of systems management are presented in an abstract manner. The technical knowledge required for different aspects of systems management is quite large, spanning mathematical domains such as queuing theory, time-series analysis, graph theory as well as programming domains such as configuration management. The book focuses on showing how the concepts from those domains are applied, rather than on the details of the specific domain – which can be found in many excellent related textbooks.

The abstract principles based approach requires decoupling systems management from the survey of the different management tools that exist currently – in both the open-source community and the commercial product offerings. This is not a book that provides a survey of existing management tools, nor tells the reader how to use such tools. This is a book that provides a survey of the techniques that are used to build those tools. However, this book enables the reader to compare the relative strengths and weaknesses of the different techniques used in these tools.

Apart from the students and teachers who are involved in learning or teaching a course on computer management, the book can also be used as a reference for understanding the basics of systems management. It would be useful for IT practitioners in companies developing systems or network management products. Such practitioners need to embody many of these principles in their products and offerings. Finally, the book should be a useful companion to practitioners involved in software development. Such developers are under an increasing pressure to deliver software that is more usable and manageable.

Structurally, the book is divided into 10 chapters. The first chapter provides an introduction and history of the field of systems management, along with an overview of three specific type of computing environments that are used as examples in subsequent chapters. It also provides an overview of the four stages in the life cycle of a computer system: planning, implementation, operations, and upgrade.

The second chapter discusses the principles involved in planning and implementation stage, i.e., how to design computer systems that can satisfy a variety of requirements ranging from performance and reliability requirements to power management requirements.

The third chapter provides an overview of the tasks required for operations management of computer systems. Operational computer systems management can be defined as consisting of two basic functions, discovery and monitoring, coupled with five analysis functions – fault management, configuration management, accounting management, performance management and security management. Chapters 4–9 deal with each of these functions respectively.

Chapter 4 discusses the subject of discovery. Discovery is the process of finding out the inventory of different components that exist in a computing environment, and the different ways in which the inventory of discovered assets can be maintained.

Chapter 5 discusses the different ways to monitor management data in computer systems, and to store them for analysis. Approaches to deal with scalability of data as well as techniques to deal with errors and data cleansing operations are discussed.

Chapters 6 and 7 discuss algorithms and approaches for fault management and configuration management, respectively.

Chapter 8 discusses the task of performance management and accounting management, including a discussion of capacity planning for computer systems.

Chapter 9 discusses the subject of security management, including a discussion of operational aspects such as security policy specification.

Chapter 10 discusses topics that are related to the principles of systems management, including subjects such as IT Service Management, ITIL, and helpdesk systems.

Overall, this book provides a holistic approach covering all aspects of systems management, and will prepare a student of computer science to take on a career dealing with systems operation and management in the new IT industry.



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Verma, D.C.

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