Preface

In its origins, computing and computer services were confined to a small number of people with specialized knowledge and needs, but this is no longer the case. In recent years, computer services have grown up to become a widespread general resource of interest and has a major impact on our everyday work and lives. In the commercial context, organizations are finding they need to process and store ever-increasing quantities of data and manage constantly evolving technology, although this work is not their core business in most cases. Many, especially small and medium organizations, are looking to Cloud Computing for help with these difficulties. Cloud Computing can offer a ready-made solution which does not require major investment in hardware, infrastructure and expertise, and is also able to expand and contract according to demand whilst the costs incurred reflect only the resources actually used.

This notion of ready access to computing services as and when we need or want them, utility computing, is not new. It represents a vision which was proposed as long ago as the 1960s when John McCarthy suggested that in the future people and organisations would simply plug in to a computing facility for computational resources rather than using their own. His vision was of a pattern of use just like connecting to an electrical outlet for power with fees charged based on what is used. Cloud Computing may be thought of as a logical evolution of these envisioned computing concepts which uses modern techniques to provide an elastic, self-managed, cost- and energy-effective computing environment. Cloud Computing is a new business model that delivers computing capabilities at different levels, ranging from computing infrastructure to high-end applications for a fee according to any agreed service level agreements and usage.

This book looks at a variety of issues and factors which may affect an organization considering; as such, it will be of interest to professionals and researchers working in the field of Cloud Computing in various disciplines such as computer science, consulting, information technology, information and communication sciences, healthcare, and finance. The book also provides insights and support for executives concerned with the management of expertise, knowledge, information, and organizational development of different types of Cloud implementations.

The book is organized into five sections as follows:
CLOUD FUNDAMENTALS AND SURVEYS

The first section includes three chapters, each of which considers fundamental aspects of Cloud adoption, frameworks to assist organizations considering Cloud, and factors which may affect their decision to go ahead.

The first chapter, “Cloud Computing and Frameworks for Organisational Cloud Adoption,” describes existing work to develop frameworks for Cloud adoption. It looks at 11 published frameworks for Cloud adoption, compares and contrasts these various frameworks, and identifies weaknesses within them. The chapter includes a technical review of Cloud Computing and considers how organizations adopt Cloud Computing, business models they use, and risks associated with the adoption. The chapter then proposes a new framework for Cloud adoption that addresses the weaknesses identified in existing work.

The second chapter considers the role of Cloud Computing adoption in global business and how the flexibility offered by Cloud Computing permits small and medium sized enterprises to compete with larger competitors. This is possible because, where in the past these smaller organizations have been unable to afford or justify the costs of traditional IT implementations where the software, hardware and networking, Cloud Computing permits them to gain access to these facilities by buying-in what they need as a service from a Cloud service provider. The chapter considers the implications for global business and proposes a framework for adoption of Cloud computing in this context.

The third chapter considers the implications of another consequence for organizations of adopting Cloud-based storage solutions which is that, whilst remaining readily available, data stored “in the Cloud” is not normally held at the organization’s own premises. A number of consequences follow from this movement of data from the owner’s premises. The most obvious concern is security: loss or unauthorized disclosure of this data. Such events are nearly always embarrassing and may even destroy and organization. Another concerns the necessity for organizations to comply with data protection laws and related regulations. Ideally, these would be the same, or at least compatible, throughout the world, but unfortunately, this is not the case, which can cause difficulties for organizations storing data “in the Cloud” where the service provider operates in more than one country. The chapter focuses on the present regulatory position in Europe and also examines the differences between EU and non-EU regulations. It then discusses have how binding corporate rules might be used to resolve some of the difficulties.

CLOUD ADOPTION ISSUES AND CASES

The second section of the book comprises four chapters that examine Cloud adoption issues in four specific situations.

Chapter 4 looks at how to model the risks associated with adoption of Cloud Computing. The chapter presents a method for the analysis of risk that highlights the importance of differentiating between risks which can be controlled and those which cannot. The first category of risks relate to events such as hardware failures which are in the control of the operator and may be controlled and ameliorated in contrast with the other category, such as a general downturn in economic activity. The chapter shows the proposed modeling technique being applied to a study of Mobile Cloud systems in France and Italy.

The next chapter in this section looks at the adoption of Cloud Computing by small- and medium-sized enterprises in Australia where there is growing interest in Cloud adoption. The authors carried on out a survey of thirty such enterprises with the aim of discovering enabling and inhibiting factors
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for adoption of Cloud Computing. They use their results in the development of a conceptual model for Cloud Computing adoption by small and medium sized enterprises in Australia.

Chapter 6 provides an analysis of Cloud Computing in the consumer products industry, starting with the observation that improvements to IT technology mean services previously limited to large enterprises are now available to all by using Cloud Computing to rent necessary computing resources on demand; Cloud Computing provides a means for enterprises to adjust capacity and capabilities rapidly without investing in new infrastructure and personnel. The chapter presents the position of Cloud services in the consumer products market and outlines an approach to a business process driven evaluation of Cloud Services.

The final chapter in this section looks at the use of Cloud Computing in the delivery of Information and Communications Technologies (ICT) to rural populations located far from urban centres who have traditionally faced a lack of access to infrastructures and services readily available in urban areas. The chapter examines the shortcomings of traditional approaches to ICT implementations for such populations which are unable to afford to buy computing hardware and then looks at how Cloud Computing projects can overcome these issues.

CURRENT CLOUD ADVANCES

The four chapters in this section describe work to develop new Cloud implementations and improvements to existing systems. The first two chapters describe approaches to the construction of Cloud Computing systems; the third describes a novel approach to the construction of a computing cloud whilst the final chapter looks at the communication networks connecting the nodes within computing clusters or Clouds.

The first chapter of this section notes that errors in any distributed system are difficult to locate and correct and this problem is exacerbated by the complexity of modern Cloud implementations. It is therefore proposed that a formal approach be adopted to development of Cloud systems leading to an executable specification which may be subjected to evaluation using model checking software and a framework to support this approach is described.

Automated deployment of resources is a necessary feature of any Cloud Computing environment. It is this property of elasticity whereby resources are allocated to and removed from users as their needs rise and fall that sets it apart from other approaches. This chapter examines work to improve auto-scaling mechanisms and presents an approach to solving the problem.

The third chapter of this section considers a problem in the management of Desktop Clouds. In common with Volunteer Grids, a Desktop Cloud uses spare capacity available in the many personal computers running in offices and homes in place the traditional approach of using dedicated hardware located in purpose-built datacenters. A particular problem for this approach is that individual machines may be withdrawn from the Cloud at any time. This chapter examines this problem and proposes a resource allocation approach able to cope with such failures.

Based on the conjecture that efficient communications between the nodes is a key requirement for good performance of any example of distributed computing whether it be Cluster, GRID, or Cloud, the final chapter in this section looks at a model of the communications between the nodes of a distributed system. It presents a new model of this communications that addresses the particular issues that arise when the nodes of such systems use modern, multi-cored processors.
PROOFS-OF-CONCEPT AND DEMONSTRATIONS

The four chapters in this section describe studies of particular applications of Cloud Computing: ihealth-care, genome sequencing, “green-aware” networks, and intrusion detection systems.

The first chapter in this section identifies that Large IT businesses are investing heavily to facilitate the implementation of Cloud Computing-based solutions for healthcare organizations but that many challenges remain, including ensuring scalability and user satisfaction. It looks in particular at the implementation of a Personal Healthcare Record system as a demonstration of a multidisciplinary project that combines healthcare services.

Bioinformatics is the subject of the second chapter in this section. As an activity that entails storage and analysis of mass data, this is an obvious application for Cloud Computing, yet presently there is little software available that is able to handle such large volumes of data. The chapter looks at options available to researchers and considers future developments and challenges.

The third chapter in this section describes a novel use of SNMP. SNMP or Simple Network Management Protocol is a standard for use with network-attached devices which was developed to enable managers to discern faults or other conditions and events which require administrative attention. It is widely available in routers, switches, servers, workstations, printers and similar hardware. The chapter describes a practical application of this protocol to monitor network traffic and make energy savings by using facilities of the protocol identify devices that may be placed into low energy states without undue adverse effects on network performance.

The final chapter of this section investigates using Cloud Computing in the monitoring and securing of national borders. With increasing numbers of incidents, it is important for countries to support their border personnel with automated systems to assist with the task of identifying and locating intruders. Despite being an application that might appear to be an obvious application for it, current visual surveillance systems make little use of Cloud Computing.

SECURITY

The final section of the book looks at three aspects of security, which is an important consideration in Cloud Computing.

The first security chapter identifies that, if it is to be effective, security needs to be a prime consideration throughout the development of an Enterprise system. A framework is presented for the construction of secure Enterprise systems in which security and trust are important considerations throughout the development.

The next chapter looks at contractual aspects of managing privacy and security, and the individuals’ right to keep personal (and other) information private. It concludes that without adequate information privacy and security control, public and commercial trust in online services cannot be sustained.
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The final chapter looks at one particular implication for Cloud providers of encryption of data. It has been established that there is considerable duplication in the files held by a Cloud service provider providing storage for many individuals, and when working with unencrypted data, the service provider can save considerable resources by noting this duplication and only storing a single copy of files, or file fragments concerned. If users encrypt their data, the similarities are lost and this optimization can no longer be applied. This chapter examines how this problem may be overcome without compromising users’ security.

This collection of publications is useful for academics, researchers, and practitioners seeking the latest practices and knowledge in the field of Cloud Computing, which has transformed the way many organizations work and offers added value for operation management and service computing.

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