Preface

Do not worry about your difficulties in Mathematics. I can assure you mine are still greater. -Albert Einstein

The corresponding book publication summarizes the recent research papers on Cloud Computing design, technologies and applications entitled, “Advanced Research on Cloud Computing Design and Applications.” This book summarizes some current trends in the Cloud Computing such as Cloud services, applications and technologies, and explores one key area of growth: Cloud computing. To illustrate the role of Applications and Services in the growth of Cloud computing industries, a number of examples focusing on the learning, government and security are used. Recommendations for future areas of IJCAC journal are presented.

This book is intended for researchers and practitioners who are interested in issues that arise from using technologies of cloud computing advancements. In addition, this book is also targeted to anyone who wants to learn more about the cloud computing research advancements in design and applications. Cloud computing has become a hot topic in recent years and people at different levels in any organization need to understand cloud computing in different ways.

BOOK DESCRIPTION, MISSION, AND OBJECTIVES

This book focuses on advanced research in the practical applications and the theoretical foundations of Cloud Computing, through presentation of the most up-to-date advances and new directions of research in the field from various scholarly, professional, and practitioner perspectives. An interdisciplinary look at Cloud Computing, including engineering and business aspects, such book covers and encourages high-quality research exposition on such topics as virtualization technology, utility computing, SaaS, and Grid Computing, as well as web services, SOA, Web 2.0, and Services Computing.

Cloud Computing marks a significant change of IT service delivery from on-premise installation to virtualized, on demand, and pay as you go approach. From an IT service provider’s perspective, Cloud Computing means delivering the IT capability to the massive users with highly dynamic and virtualized resources. From an IT user’s perspective, Cloud Computing means enjoying the Cloud services with extremely low cost without the burden to build IT infrastructure by one’s own. The recent rushed announcement of the Open Cloud Manifesto (OCM) confirms that even those late to the party see it as a major sea change in the industry.
Cloud Computing covers both the traditional enterprise IT services and new massive consumer IT services. Examples in the formal case include upgrading traditional data center with virtualization technologies, realizing fast production level infrastructure topologies through private Cloud. Examples in the later case include search Cloud service (Google), e-Business Cloud service (Alibaba in China).

The main mission of this book “Advanced Research on Cloud Computing Design and Applications” is to be the premier and authoritative source for the most innovative scholarly and professional research and information pertaining to aspects of Cloud Applications and Computing. Such book presents advancements in the state-of-the-art, standards, and practices of Cloud Computing, in an effort to identify emerging trends that will ultimately define the future of “the Cloud.” Topics such as Cloud Infrastructure Services, Cloud Platform Services, Cloud Application Services (SaaS), Cloud Business Services, Cloud Human Services are discussed through original papers, review papers, technical reports, case studies, and conference reports for reference use by academics and practitioners alike.

This book is intended to reflect new directions of research and report latest advances. It is a platform for rapid dissemination of high quality research / application / work-in-progress articles on Could Computing solutions for managing challenges and problems within the highlighted scope.

The objectives of this book are multi-folds, including,

1. Establish a significant channel of communication among Cloud Computing researchers, engineers, practitioners and IT policy makers;
2. Provide a space to publish and share the latest high quality research results in the area of Cloud Computing;
3. Promote and coordinate international collaboration in the standards of Cloud and Utility Computing to meet the need to broaden the applicability and scope of the current and future research of Cloud Computing.

Topics to be discussed in this book include the following:

- Technology & service
- Application
- Architecture
- Standard
- Management and optimization
- Cloud engineering
- Business

WHAT THIS BOOK COVERS

In this book, we will present the current state of cloud computing research advancements on design, and applications. So that we will summarize each advanced research, its influence in the science of cloud computing and applications and the marketing feasibility as follows:
Preface

Chapter 1: An entrepreneurial approach to cloud computing design and application: Technological innovation and information system usage.
Vanessa Ratten.

The design and application of cloud computing services is inherently entrepreneurial as it is constantly evolving as a result of technological innovation. This chapter focuses on providing an entrepreneurial approach to understanding change in the cloud computing context by highlighting the importance of innovative system usage. Cloud computing services are creating an ecosystem of mobile commerce applications that is changing the way consumers, businesses and the government collects, disseminates and stores information. These changes have given way to entrepreneurial service innovations in the cloud domain that are a result of consumer demand for more current and relevant technological innovations. This chapter addresses the role of entrepreneurship in technological innovations by focusing on marketing and learning applications that are unique to cloud computing services. The future research suggestions from the chapter stress the importance nature of being entrepreneurial to encourage technological innovation in the cloud computing context.

Importance of the chapter and the area: More research is need on the entrepreneurial approaches to cloud computing as there have been a lot of security issues surrounding the storage of online information that has made its future applications contingent of the proper application of this technological innovation. This chapter is important because cloud computing is continually emerging as an innovative technology that derives its benefits from information system usage. The usage of cloud computing design and application will change depending on the entrepreneurial approaches that developers, businesses and consumers take towards creating better security and knowledge features.

Marketing feasibility: This chapter has good marketing feasibility because most businesses and consumers are using cloud computing in some way and this will increase as cloud computing enhances its security and privacy features in the future.

Thamer Al-Rousan and Shadi Aljawarneh.

For the last two decades, e-government has attracted government around the world to itself. Today almost every country in the world has developed and implemented e-government system in some form or another in order to reduce costs, improve services, save time and increase effectiveness and efficiency in a public sector. With increasing generalization of technology access by citizen and organizations, e-governments across the world face a major challenge in keeping a pace with ever changing technologies and offer an efficient, effective and transparent way of offering its services. Cloud computing is becoming an adoptable technology for many countries. The concept of cloud computing becomes important for each e-government, facilitating its way of work, increasing its productivity and all that leading to cost savings. It will likely have a significant impact on the e-governments in the future. In this chapter, we analyzed cloud computing and its applications in the context of e-government.

Importance of the chapter and the area: E-government refers to government processes in which information and Communications technology (ICT) play an active and significant role for efficient and effective governance, and for making government more accessible and accountable to the citizens, businesses and other governments. Information and Communication Technologies are the key factor for global society development. Innovations in information and communication technology are always there
in order to increase productivity, to change the way we work, to grow business economy, to share global knowledge and to have automated business processes and communications. One important innovation in information and communication technology is cloud computing.

Cloud computing is an emerging computing paradigm that promises to provide opportunities to deliver a diversity of computing services in a way that has not been experienced before. The use of cloud computing in e-government has many benefits, such as cost savings, scalability, integration, reusability of services, or high availability, which make cloud computing interesting for many areas.

Marketing feasibility: This chapter discusses the cloud computing and its applications in the context of e-government and identify the key factors that make cloud computing attractive to the e-government scene. This chapter has a good marketing feasibility because it explains the critical needs to adopting the cloud computing on e-government. The Cloud architectures will help the government to reduce operating costs and increase end user satisfaction levels. Government’s ministries, interested in the environmental pollution and involved in the “Go green” projects, collaborate with each other through cloud computing, using a common infrastructure, platform and applications and delivering cost-effective services to the public. All of these efforts can drive the growth of the economy and government productivity.

Chapter 3: Supply Chain in the Cloud: Opportunities, Barriers and a Generic Treatment.

Goknur Arzu Akyuz and Mohammad Rehan

Cloud Computing is gaining momentum and receiving more and more interest in the literature as a very recent IT paradigm. By offering flexibility, cost reductions, platform independence and on-demand service, cloud paradigm opens up tremendous opportunities from Supply Chain (SC) perspective. However, extant literature reveals that adoption and assimilation of the technology is not mature in SC domain as yet. There exists significant barriers regarding the assimilation, and cloud-based modelling initiatives are only recent. To fill this gap, this study discusses cloud computing from SC perspective, and proposes a generic representation based on cloud philosophy. The proposed representation is a conceptual, flexible and customizable one, utilizing the cloud benefits in a multi-partner setting. Contribution of this study lies in comprehensive treatment of the intersection of cloud computing and SC topics, as well as providing a generic representation.

Importance of the chapter and the area: Cloud concept is directly related with the beyond-ERP integrity and collaboration across a number of heterogeneous Supply Chain partner infrastructures. The technology enables partners to form a collaborative Supply Chain community without the burden of significant IT investment. Cloud applications offer significant opportunities from Supply Chain perspective, and the assimilation of the Cloud technology is not complete yet in Supply Chain domain. It also involves various barriers from implementation perspective, as well as the concerns related with vendor lock-in, security, reliability, privacy and data ownership.

Hence, the chapter is important by providing a comprehensive coverage of the opportunities and barriers as well as the generic treatment from Supply Chain perspective. It also highlights how the cloud technology represents a perfect fit with the ideas of ‘Collaborative Supply Chains’, ‘Business Process Outsourcing’ and ‘long-term strategic partnerships, which are the key themes characterising the Supply Chains of today’s era.

Therefore, the intersection of the topics ‘Cloud computing’ and ‘Supply Chain’ is a promising area for further research. Further studies in a multi-partner setting with respect to a variety of configurations, case studies and applications, as well as the security, reliability and data ownership issues are justified.
Preface

Marketing feasibility: The study addresses both Supply Chain and IT domains, provides a generic treatment, and contains technical as well as managerial perspectives. Thus, the authors believe that the chapter will be appealing to a large profile of audience from both domains, including researchers and practitioners. Anybody dealing with ERP add-ons, Strategic Supply Chain Management and outsourcing, as well as cloud technology in general can benefit from this chapter. Therefore we think that the chapter has significant marketing potential.

Chapter 4: System Benchmarking on Public Clouds: Comparing Instance Types of Virtual Machine Clusters.
Sanjay P. Ahuja.

There are several public cloud providers that provide service across different cloud models such as IaaS, PaaS, and SaaS. Benchmarks have typically been used to evaluate the performance of various systems and can play a vital role in assessing performance of the different public cloud platforms in a vendor neutral manner. Amazon’s EC2 Service is one of the leading public cloud service providers and offers many different levels of service. This research focuses on system level benchmarks and looks into evaluating the memory, CPU, and I/O performance of two different tiers of hardware offered through Amazon’s EC2. Using three distinct types of system benchmarks, the performance of the micro spot instance and the M1 small instance are measured and compared. In order to examine the performance and scalability of the hardware, the virtual machines are set up in a cluster formation ranging from two to eight nodes. The results show that the scalability of the cloud is achieved by increasing resources when applicable.

Importance of the chapter and the area: The cloud is an emerging platform that is taking shape as more vendors offer services and researchers delve deeper into how to use it and how to measure the level of services offered in a vendor agnostic manner. Currently, reliance is placed upon the specifications that each cloud vendor publishes to judge price and performance comparisons. Performance is the one of the key factors for any enterprise when determining the true benefits of cloud computing. Benchmarks have typically been used to evaluate the performance of various systems and can play a vital role in assessing performance of the different cloud platforms in a vendor neutral manner. Benchmarking would allow enterprises to perform transparent and insightful comparisons to see how various types of applications run on different clouds with various kinds of instance configurations. The goal of cloud benchmarking is to help developers predict the behavior of the targeted application and help users to know the performance offered by the target applications for comparison with other offerings. Benchmarking in the cloud computing world can help establishing a baseline of user’s application ability to support business requirements. Many vendors/cloud providers do not reveal the details about the implementations of the services provided by them. So it helps organizations or end users to review the benchmarks and decide which cloud provider is better suited to their needs.

Marketing feasibility: This chapter has excellent marketing feasibility. Cloud computing is experiencing dynamic growth with even governments adopting it to save costs. Smartphones and tablets are bringing cloud-based applications, such as Facebook and Twitter, onto mobile devices. With the amount of data increasing exponentially dependency on the cloud is increasing. Need is growing for cost effectively processing and archiving huge amounts of data to the cloud for all content types—social media feeds, health care records, scientific data, financial data etc. Studies have shown that cloud computing has a role in stimulating the economy and creating jobs. The economic appeal from cloud computing partly
stems from the ability for enterprises to convert capital expenditures to operational expenditures and the pay-as-you model. There is a need for the researchers to evaluate the performance of various cloud offerings using vendor neutral benchmarks. Research into new benchmarks for the cloud is growing.

**Chapter 5:** Approaches to Cloud Computing in the public sector: Case studies in UK Local Government. Jeffrey Chang and Mark Johnston.

Cloud computing refers to a scalable network infrastructure where consumers receive IT services such as software and data storage through the Internet on a subscription basis. Potential benefits include cost savings, simpler IT and reduced energy consumption. The UK government and local authorities, like commercial organisations, are considering cloud-based services. Concerns have been raised, however, over issues such as security, access, data protection and ownership. This study attempts to investigate the likely impact of cloud computing on local government based on a conceptual framework and case studies of four London borough councils. It reveals that the concept of cloud computing is new and not clearly understood. Local authorities, who face further cuts in government funding, welcome a cloud-based IT infrastructure which may lead to considerable savings. Yet local government is conservative, so with their risk-adverse attitude local authorities are more likely to adopt a hybrid approach to implementation.

Importance of the chapter and the area: Cloud computing is an emerging area that has received a lot of attention lately. While an increasing number of studies on cloud computing have been focused on commercial organisations that are moving to a simpler cloud-based IT infrastructure and saving costs, little research has been carried out from the public sector’s perspective. However, public organisations are facing unprecedented economic challenges and funding cuts. They have just the same need as private sector organisations to transform their current IT structures to more cost-efficient ones. Cost efficiency is one of the benefits cloud computing promises. The chapter is important because it begins to fill the gap in the current cloud literature and identify the critical factors when local government considers cloud-based IT services. Future research needs to continue to address this important area.

Marketing feasibility: The chapter would attract a wide range of readers, from academic researchers in the subject area to decision makers within public sector organisations. The findings of the study bring an understanding as to why UK local authorities would consider cloud and what approach and implementation methods they might employ. The perception and experience garnered from UK local government in this study, and the recommendations made, are applicable not only to other local authorities but more widely to other public sector organisations both in the UK and around the globe.

**Chapter 6:** A Mechanism for Securing Hybrid Cloud Outsourced Data: Securing Hybrid Cloud. Abdullah El-Haj and Shadi Aljawarneh.

The existing research related to security mechanisms only focuses on securing the flow of information in the communication networks. There is a lack of work on improving the performance of networks to meet quality of service (QoS) constrains for various services. The security mechanisms work by encryption and decryption of the information, but do not consider the optimised use of the network resources. In this chapter the authors propose a Secure Data Transmission Mechanism (SDTM) with Preemption Algorithm that combines between security and quality of service. Their developed SDTM enhanced with Malicious Packets Detection System (MPDS) which is a set of technologies and solutions. It enforces security policy and bandwidth compliance on all devices seeking to access Cloud network computing
resources, in order to limit damage from emerging security threats and to allow network access only to compliant and trusted endpoint devices.

**Chapter 7: Optimal Resource Provisioning in Federated-Cloud Environments: Optimal Resource Provisioning in Federated-Cloud.**
Veena Goswami.

Cloud computing has emerged as a new paradigm for accessing distributed computing resources such as infrastructure, hardware platform, and software applications on-demand over the internet as services. Multiple Clouds can collaborate in order to integrate different service-models or service providers for end-to-end-requirements. Intercloud Federation and Service delegation models are part of Multi-Cloud environment where the broader target is to achieve infinite pool of resources. This chapter presents an optimal resource management framework for Federated-cloud environments. Each service model caters to specific type of requirements and there are already number of players with own customized products/services offered. They propose an analytical queueing network model to improve the efficiency of the system. Numerical results indicate that the proposed provisioning technique detects changes in arrival pattern, resource demands that occur over time and allocates multiple virtualized IT resources accordingly to achieve application QoS targets.

**Chapter 8: Towards Future IT Service Personalization: Issues in BYOD and the Personal Cloud.**
Stuart Dillon, Florian Stahl and Gottfried Vossen.

Cloud services are ubiquitous today and increasingly used for a variety of purposes, including personal and professional communication, social networking, media streaming, calendar management, file storage etc. In recent years, a fast evolution of cloud services from private applications to corporate usage has been observed. This has led to the question of how private and business cloud services can be dual-accessed through a single device, in particular a mobile device that is used as part of a BYOD (Bring Your Own Device) policy. This chapter considers the issues that arise from a consolidation of private and professional applications when accessed from a single device and introduces the term “personal cloud” to characterise such situations. It also surveys recent work in the field and finally presents an approach to cloud governance from a business perspective focusing in particular on security tokens, hardware keys and smart containers, thereby providing a glimpse into the future of IT service personalization.

**Chapter 9: User Preference based Web Service Composition and Execution Framework.**
Bassam Al-shargabi and Omar Sabri

The main motivation of using Service Oriented architecture is to compose an application as a set of services that are language and platform independent, communicate with each other, Therefore, user preferences rules in web service composition process plays crucial role and has opened a wide spectrum of challenge. In this paper, an agent for composing web services based on user preferences was introduced to fulfill a certain process, where the user preferences are essential for determining which web service are to be selected. In other word, the agent designed to maintain the following function: an intelligent web services selection and planning based on user preferences (such as price or availability), along with web services execution, tracking and adaptation.
Chapter 10: Cloud Security Engineering Concept and Vision.
Shadi Aljawarneh.

The research community found that a software system should be evolved once every few months to ensure it is adapted to the real-world environment. The system evolution requires regularly amendments that append, delete, or alter features. It also migrates or converts the software system from one operating platform to another. These amendments may result in requirements/specifications that were satisfied in a previous release of a software system not being satisfied in the subsequent versions. As a result, software evolutionary changes violate security requirements, and then a system may become vulnerable to different kinds of attacks. In this chapter, concepts and visions are presented to avoid/minimize the Cloud security issues.

Chapter 11: Fairness-Aware Task Allocation for Heterogeneous Multi-Cloud Systems.
Sanjaya Kumar Panda, Roshni Pradhan, Benazir Neha and Sujaya Kumar Sathua.

Cloud computing is rapidly growing for its on-demand services over the Internet. The customers can use these services by placing the requirements in the form of leases. In IaaS cloud, the customer submits the leases in one of the form, namely advance reservation (AR) and best effort (BE). The AR lease has higher priority over the BE lease. Hence, it can preempt the BE lease. It results in starvation among the BE leases and is unfair to the BE leases. In this chapter, the authors present fairness-aware task allocation (FATA) algorithm for heterogeneous multi-cloud systems, which aims to provide fairness among AR and BE leases. We have performed rigorous experiments on some benchmark and synthetic datasets. The performance is measured in terms of two metrics, namely makespan and average cloud utilization. The experimental result shows the superiority of the proposed algorithm over the existing algorithm.

Saad Bani-Mohammad, Ismail Ababneh and Motasem Al Smadi.

This chapter presents an extensive evaluation of a new contiguous allocation strategy proposed for 3D mesh multicomputers. The strategy maintains a list of maximal free sub-meshes and gives priority to allocating corner and boundary free sub-meshes. This strategy, which we refer to as Turning Corner-Boundary Free List (TCBFL) strategy, is compared, using extensive simulation experiments, to several existing allocation strategies for 3D meshes. In addition to allocation strategies, two job scheduling schemes, First-Come-First-Served (FCFS) and Shortest-Service-Demand (SSD) are considered in comparing the performance of the allocation strategies. The simulation results show that TCBFL produces average turnaround times and mean system utilization values that are superior to those of the existing allocation strategies. The results also reveal that SSD scheduling is much better than FCFS scheduling. Thus, the scheduling and allocation strategies both have substantial effect on the performance of contiguous allocation strategies in 3D mesh-connected multicomputers.
Preface

Mahesh Raisinghani, Efosa Carroll Idemudia, Meghana Chekuri, Kendra Fisher and Jennifer Hanna.

The constant changes in technology has posed serious challenges to top management teams, employees, and customers on how to collect, store, and process data for competitive advantage and to make better decisions. To address this issue, we present the managerial perspective of cloud computing that provides the infrastructure and/or tools for decision making in the 21st century. Since the year 2000, the interest in cloud computing has had a steady increase. (Mason, 2002) Not only has cloud computing substantially lowered computing costs for corporations, it continues to increase their abilities for market offerings and to access customers’ information with ease. Cloud computing has allowed managers to focus more on their business plans and bottom line to enhance competitive advantage.

Chapter 14: Bio-Inspired Private Information Retrieval System over Cloud Service using the Social Bees’ Lifestyle with a 3D Visualisation.
Hadj Ahmed Bouarara, Reda Mohamed Hamou and Abdelmalek Amine.

Recently, a new kind of web services had seen the light under the name of Cloud Computing, which represents the dematerialisation of software, systems and infrastructures, based on the virtualisation techniques. In other hand, the users of cloud services starting to ask about their privacy protection. The content of our work is a new system of bio-inspired private information retrieval (PIR), composed of four steps: the authentication to ensure the identification of authorised users. The encryption of stored documents, by the server using the multi-filter cryptosystem based on the life of workers bees. The retrieval model using a combination of distances by social worker bees, where a document must pass through three filters controlled with 3 types of workers, the bee queen represents the query, and the hive represents the class of relevant documents. Experimentation and comparison phase using MEDLINE dataset. Finally, a 3D visualization step in order to make the result in graphical format understandable by humans as a 3D cube. Our objectives is to improve the response to users’ needs.

Ali Madankan and Ali Delavar Khalafi.

The process of entering into the cloud is generally in the form of queue, so that each user needs to wait until the current user is being served. In this model, the web applications are modeled as queues and the virtual machines are modeled as service centers. There is no Virtual Machine live migration involved in this model which makes it much simpler than some existing models. It has shown how the queuing model, M/M/K model is used for multiple priority and multiple server systems with preemptive priorities. To achieve that the paper distinguish two groups of priority classes that each classes includes multiple items, each having their own arrival and service rate. It derives an approximate method to estimate the steady state probabilities with an approximation error that can be made at the expense of some more numerical matrix iterations. It can derive approximations for a wide range of relevant performance characteristics, such as the expected postponement time for each item class and the first and second moment of the number of items of a certain type in the system.
Chapter 16: An Efficient E-Negotiation Agent using Rule Based and Case Based Approaches: An E-Negotiation Agent.
Debajyoti Mukhopadhyay, Sheetal Vij and Amruta More.

Research in the area of automated negotiation systems is going on in many universities. This research is mainly focused on making a practically feasible, faster and reliable E-negotiation system. The ongoing work in this area is happening in the laboratories of the universities mainly for training and research purpose. There are number of negotiation systems such as Henry, Kasbah, Bazaar, Auction Bot, Inspire, Magnet. Our research is based on making an agent software for E-negotiation which will give faster results and also is secure and flexible. The negotiation process can be transformed into rules and cases. Using these features, a new automated negotiation model for agent integrating Rule based and Case based reasoning can be derived. Cloud Computing provides security and flexibility to the user data. Using rule based reasoning and case based reasoning this system should improve the efficiency and success rate of the negotiation process.

Chapter 17: Domain based Dynamic Ranking.
Sutirtha Kumar Guha, Anirban Kundu and Rana Dattagupta.

In this chapter a new method is proposed to rank Web pages in cloud environment. Web pages from the cloud are clustered as ‘Primary’ and ‘Secondary’ domains. ‘Primary’ domain Web pages are fetched based on the keywords. ‘Primary’ Web pages are ranked based on Relevancy Factor (RF) and Turbulence Factor (TF). Relevancy of the Web pages with respect to the user query is measured by Relevancy Factor. Impact of the user query towards similar Web pages is measured by Turbulence Factor. It is observed that a Web page, having relevant information with respect to the user query, may not have matched keyword with respect to the user query. Those Web pages are covered by ‘Secondary’ domain concept. ‘Secondary’ domain is constructed by Nearest Keywords and Similar Web pages. Nearest Keywords are the keywords similar to the matched keywords. Similar Web pages are the Web pages having Nearest Keywords. Matched Web pages of ‘Primary’ and ‘Secondary’ domain are ranked separately. A wide range of Web pages from the cloud would be available and ranked more efficiently by this proposed approach.

Chapter 18: An Approach on Cloud Disk Searching using Parallel Channels.
Saswati Sarkar and Dr. Anirban Kundu.

The authors propose a cloud disk searching technique in this paper. Proposed cloud based searching mechanism shows the utility of indexing, balancing, and data storage in cloud. The paper exhibits complexity of cloud based searching algorithms in real-time scenario. Comparison graphs have been demonstrated for time difference realization in cloud. Parallel concepts have been introduced to facilitate searching the cloud. Sequential and several parallel situations have been compared using time graphs.
Jayalakshmi D. S., Srinivasan R., S. R. M., Srinivasa K. G., M. S. M.

Processing Big Data is a huge challenge for today's technology. There is a need to find, apply and analyze new ways of computing to make use of the Big Data so as to derive business and scientific value from it. Cloud computing with its promise of seemingly infinite computing resources is seen as the solution to this problem. Data Intensive computing on cloud builds upon the already mature parallel and distributed computing technologies such HPC, grid and cluster computing. However, handling Big Data in the cloud presents its own challenges. This paper analyzes issues specific to data intensive cloud computing and provides a study on available solutions in programming models, data distribution and replication, resource provisioning and scheduling with reference to data intensive applications in cloud. Future directions for further research enabling data intensive cloud applications in cloud environment are identified.

Chapter 20: A Key Based Database Sharding Implementation for Big Data Analytics.
Sikha Bagui, Loi T Nguyen.

As the digital revolution heralds into a new era with Big Data on the cloud, the idea of centralized data storage has to be modified to accommodate availability, scalability, reliability and manageability. Higher performance and lower cost become a major challenge. This can be addressed by leveraging on database sharding. With database sharding, the database is divided into smaller chunks or shards across multiple data nodes in the cluster. We used MySQL Cluster for database sharding. Then we used the sharded partitions to perform data analytics, specifically the association rule mining algorithm of data mining. Association rule mining is used to find frequent patterns in large datasets. We ran the association rules using WEKA's Apriori algorithm and presented the association rules for the sharded partitions as well as the non-sharded data. From the association mining results we can see that the partitioned datasets give us rules that the whole dataset was not able to produce.

FUTURE TRENDS IN CLOUD COMPUTING RESEARCH ADVANCEMENTS IN DESIGN AND APPLICATIONS

Analysts say “the global market for cloud computing will grow from $40.7 billion in 2011 to more than $241 billion in 2020” from Source: Forrester Research, “Sizing the Cloud”, April 2011.

It should be noted that the Mobility: Over 80% of the Fortune 100 is deploying or piloting tablets with sales expected to increase by 123%. Where as Storage: Nearly 40% increase expected by 2012 in backing up to/storing data in the cloud. Each day, AWS adds the equivalent server capacity to power Amazon when it was a global, $2.76B enterprise (circa 2000).

In 2015, (i) enterprises expand focus of cloud as a driver of business innovation. (ii) Cloud computing will play a significant role in shaping client value propositions. (iii) Enterprises will look at cloud to drive innovation across the eco-system. (iv) Cloud will be increasingly looked to drive collaboration and reduce business complexity.

Looking at each trend also highlights future research topics. For example, to take advantage of industries, practitioners and governments need to further develop Cloud applications and services and continue to invest in research and development. Metrics are needed to measure the impacts of these investments. How should organizations build trust to achieve collaborative applications and services? What are the legal implications of collaborative Cloud-based commerce, learning and government? Note that the Next generation Cloud provisioning models rely on advanced monitoring and automatic scaling decision capabilities to ensure quality of service (QoS), security and economic sustainability.

Most papers in this book are worried regarding the customer’s fears from using cloud applications and so how to calm these fears from using Cloud applications and services in future. Here I would like to mention some reasons that let the customer’s fears are increased:

- The phone’s customers might be shocked especially from the phones that rely exclusively to communicate with the company’s servers to the keeping and data handling. So that the question is; what happens if I stop company’s servers for work or faced major problems preventing them from working? But the truth is that regardless of the capacity and capabilities of the company that manages these servers, the potential collapse of the system is taken place in everywhere and at any moment, and then this meltdown happens. Thus, the second question, could the cloud computing fail? To overcome this big question another article will discuss this as a part of future work.

- Reputable companies attempted to mitigate the customer fears by confirming that the cloud model is secure, the cloud services is protected, the data centers and hosted servers are encrypted and the communication channel between the customer and the cloud resources is secured and then it is protected from any kind of attack. However, the attackers claimed that the cloud resources are penetrated much more easily than the non-cloud environment. For instance, Sony stated that the customer’s credit card data is a secure, but the attackers claimed that the customer’s credit card data are selling online. So that who inform us the truth and what is the level of protection we believe it does!!! If Sony is telling the truth about encrypting the data, it seems that the level of encryption is not sufficient well.

- Due to lack of control over the Cloud software, platform and/or infrastructure, Academies and practitioners stated that a security is a major challenge in the Cloud.

A summary of the recommendations of this book:

- Importance of the transition from traditional to Cloud in the sense that interested.

- Developing strategies and solutions to the problem of research by linking traditional relationships and concepts that facilitate access to information. For example:
  - Architectural Design for Cloud applications and services
  - How to implement the Cloud applications and services.
  - Cloud computing for large scale applications
  - Cloud technologies for P2P, services, agents, grids and middleware
  - Cloud technologies for software and systems engineering

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Preface

- Cloud for E-government
- Databases, IR and AI technologies for Cloud
- Social networks and processes on the Cloud
- Representing and reasoning about trust, privacy, and security
- Cloud computing techniques and approaches
- Frameworks for developing Web applications
- Security issues for Web applications
- Scalability issues and techniques
- Applications that illustrate interesting new features or implementation techniques
- Performance measurements of Cloud applications
- M-commerce applications, issues, and security

FEEDBACK

This book contains a large of information from many resources on a large variety of topics in the cloud applications and computing. I have tried to be accurate as possible, but there could be errors. Please send your feedback to me shadi.jawarneh@yahoo.com.