

Preface

OVERVIEW

Cloud computing is an emerging computing technology that uses Internet and central remote servers to maintain data and applications. It allows consumers and businesses to use applications without installation and access their personal files at any computer with the help of Internet. It can be defined as anything that provides hosted service over the Internet. Further, it facilitates to collaborate on business activities of multiple organizations across geographic locations. This technology is expected to be much more efficient than the presently available technology by centralizing the storage, memory, processing and bandwidth. Technologies, that made cloud computing feasible are virtualization, cyber-infrastructure, and service orient infrastructure. Apart from cloud computing, big data is another cutting edge technology for global data storage and data handling. These two new technologies are evolving across the globe. Now- a-days, IT organizations are moving towards a concept of seamless computing and real-time processing of data with high degree of resource scalability. Collaboration of these two technologies, enable the scope of another emerging technology Internet-of-Things (IoT). With the help of cloud and big data networking, today it is possible to envision pervasive connectivity, storage and computation which in turn, gives rise to different IoT solutions. In the present globalization scenario cloud services can provide speed and cost effective solutions. These benefits will enable enterprises to become competitive in the market.

Cloud Providers offer services that can be grouped into three service model:

1. **Software as a Service (SaaS):** In this model, a complete application is offered to the customer, as a service on demand. A single instance of the service runs on the cloud and multiple end users are serviced. On the customers' side, there is no need for upfront investment in servers or software licenses, while for the provider, the costs are lowered. Since, only a single application needs to be hosted and maintained. Today SaaS is offered by companies such as Google, Salesforce, Microsoft, Zoho, etc.
2. **Platform as a Service (Paas):** In this service model, a layer of software environment is encapsulated and offered as a service. Other higher levels of services can be built upon it. Customers have the freedom to build his own applications, which runs on the provider's infrastructure. To meet scalability requirements of the applications, PaaS providers offer a predefined combination of OS and application servers. Google's App Engine, Force.com, etc are some of the popular PaaS examples.
3. **Infrastructure as a Service (IaaS):** This service model provides the basic storage and computing capabilities as standardized services over the network. Servers, storage systems, networking equipment, data centre space etc. are pooled and made available to handle workloads. The cus-

tomers would typically deploy his own software on the infrastructure. Some common examples are Amazon, GoGrid etc.

Enterprises can choose to deploy applications on Public, Private or Hybrid clouds. Cloud integrators can play a vital part in determining the right cloud path for each organization.

1. **Public Cloud:** Public clouds are owned and operated by third parties. They deliver superior economies of scale to customers, as the infrastructure costs are spread among a mix of users, giving each individual client an attractive low-cost, “Pay-as-you-go” model. All customers share the same infrastructure pool with limited configuration, security protections, and availability variances. These are managed and supported by the cloud provider. One of the advantages of Public cloud is that they may be larger than an enterprises cloud. Thus providing the ability to scale seamlessly, on demand.
2. **Private Cloud:** Private clouds are built exclusively for a single enterprise. They aim to address concerns on data security and offer greater control, which is typically lacking in a public cloud. There are two variations of private cloud:
 - a. **On-Premise Private Cloud:** On-premise private clouds are also known as internal clouds are hosted within one’s own data center. This model provides a more standardized process and protection, but is limited in aspects of size and scalability. IT departments would also need to incur the capital and operational costs for the physical resources. This is best suited for applications which require complete control and configurability of the infrastructure and security.
 - b. **Externally Hosted Private Cloud:** This type of private cloud is hosted externally with a cloud provider, where the provider facilitates an exclusive cloud environment with full guarantee of privacy. This is best suited for enterprises that do not prefer a public cloud due to sharing of physical resources.
3. **Hybrid Cloud:** Hybrid clouds combine both public and private cloud models. With a Hybrid Cloud, service providers can utilize third party cloud providers in a full or partial manner thus increasing the flexibility of computing. The Hybrid cloud environment is capable of providing on-demand, externally provisioned scale. The ability to augment a private cloud with the resources of a public cloud can be used to manage any unexpected surge in workload.

BENEFITS

Enterprises would need to align their applications, so as to exploit the architectural models that cloud computing offers. Some of the typical benefits are listed below:

1. **Reduced Cost:** There are a number of reasons to attribute cloud technology with lower costs. The billing model is pay as per usage; the infrastructure is not purchased thus lowering maintenance. Initial expense and recurring expenses are much lower than traditional computing.
2. **Increased Storage:** With the massive infrastructure that is offered by Cloud providers today, storage and maintenance of large volumes of data is a reality. Sudden workload spikes are also managed effectively and efficiently, since the cloud can scale dynamically.

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3. **Flexibility:** This is an extremely important characteristic. With enterprises having to adapt, even more rapidly to changing business conditions, speed to deliver is critical. Cloud computing stresses on getting applications to market very quickly, by using the most appropriate building blocks necessary for deployment.

TARGET AUDIENCES

The proposed book would be a reference for research scholars, a course supplement to the students pursuing computer science related subjects specially distributed systems and a resource for software professionals.

GIST OF THE CHAPTERS

Pinnar Kirci in the chapter titled “Ubiquitous and Cloud Computing: Ubiquitous Computing” has described the evolution of ubiquitous computing. They have also explained how an ambient intelligence infrastructure exists due to increased information exchange among users, devices and environment where applications of ubiquitous computing can be deployed. In this chapter they have described the techniques for interoperability of ubiquitous systems, applications, and standards of ubiquitous computing.

Murad and Dowaji in their chapter titled “Using Value-Based Approach for Managing Cloud-Based Services” have discussed about different cloud deployment model and pricing mechanism. According to the authors, work reported in the literature can be classified either from business perspective or from technical perspective. A few are driven by the provider objective, while others are driven by the customer. They said the objective of the provider can be defined by a value. This can be done by providing a quantitative measure using a value based approach derived from the value metrics measurement techniques. They have addressed the business objectives of the business service owner. The objectives are driven by a set of key performance indexes that specify the providers’ priorities at the current stage. They have presented an algorithm for resource allocation to achieve the target value of service owner.

Shalan in his chapter titled “Cloud Service Footprint (CSF): Utilizing Risk and Governance Directions to Characterize a Cloud Service” discussed the challenges to cloud computing. These challenges arises due to the adoption of cloud computing service that might begin outside the technology organization or against a client enterprise strategy leading to loose association. It investigates the effects of maturity status on the enhancement of key cloud computing service features and its value position. This chapter also introduces a new term called cloud service foot print (CSF) to portray an identity for a cloud computing service. According to the author CSF provide enough information for business executives to evaluate cloud computing service and make informed decision.

Sethi and Sruti in their chapter titled “Cloud Security Issues and Challenges” list the parameters that affects cloud security. According to the author virtualization is critical to host security. Therefore, virtualization layer must be kept secured. They have discussed in details the host security for different cloud computing model such as SaaS, PaaS, IaaS. They have also analyzed the security issues and their countermeasures in cloud computing.

Yeboah-Boating in his chapter titled “Cyber-Security Concerns with Cloud Computing: Business Value Creation and Performance Perspectives” said cloud computing has profoundly altered the business value creation landscape, through IT enabled strategic information management. It is essential to store

the sensitive data securely and effectively. This chapter examines cyber-security concerns with cloud computing, both from perspective of cloud service providers and end-users using small-to-medium enterprise in developing economies as a case study. The author noted that it is impossible to eliminate threat. Therefore, protection against them without disruptively business innovation and growth should be the utmost priority.

Paul and Sahoo in their chapter titled “Dynamic Virtual Machine Placement in Cloud Computing” have built an energy consumption model to calculate total energy consumption of physical machines, taking into account different states of virtual machines. They approach the decision making process for dynamic virtual machine placement in a decentralized manner. Two scenarios are considered; one when the physical machines cooperate with one another as in the case of private cloud and the other when they act in a selfish manner in case of hybrid cloud. The authors use cooperative and non-cooperative game theory for the two scenarios respectively for optimal placement of virtual machines onto physical machines to minimize energy consumption.

Mishra et al. in their chapter titled “Metaheuristic Approaches to Task Consolidation Problem in the Cloud” have explained the cloud computing environment along with its various service models. They have also explained the importance of energy consumption in a cloud data center, and different techniques to conserve energy. They have redefined the existing problem, of task scheduling in the cloud environment along with the importance of virtualization technique. Authors have explained the applicability of metaheuristic approaches in scheduling cloud environments. They have also mentioned the implementation issues of various metaheuristic techniques like Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Ant Colony Optimization (ACO), BAT algorithm with various environments for the service allocation problem in the cloud.

Sahoo et al. in their chapter titled “Real Time Task Execution in Cloud Using MapReduce Framework” have proposed a cloud system model for real-time task processing in the cloud. As many applications like smart devices and sensor-based tasks, generate a significant amount of data that has a time constraint, a scalable platform like cloud computing is required to process it. The authors have also discussed a real-time MapReduce framework in cloud computing used for massive data processing. Various MapReduce scheduling quality attributes are studied, and scheduling algorithms are reviewed based on these characteristics.

Dhal et al. in their chapter titled “Resource- and Energy-Efficient Virtual Machine Migration in Cloud Data Centers” have said that the recent advances in cloud computing services have led to increasing amount of energy consumption in data centers. Thus consolidation schemes for virtual machines (VMs) on physical machines on cloud data centers. Consolidation scheme being NP-complete requires heuristic techniques to get a sub-optimal solution. The authors have proposed an adaptive threshold based consolidation scheme for VMs by improving the host overload detection phase with appropriate measure of statistical dispersion and combined with minimum migration time policy of selecting the VMs for migration. This reduces the performance metric involving energy consumption and the level of SLA violations.

Sahoo et al. in their chapter titled “Network Virtualization: Network Resource Management in Cloud” have stated that virtualization provides a number of benefits to the service providers and everyday users. Virtualization technologies have recently shifted from server virtualization to network virtualization. It can deliver a new platform upon which new network architecture can fabricate and experimented. Since network virtualization in a cloud environment is a new research topic, in this chapter authors have trying to discuss various benefits, different research challenges and under taken projects on network virtual-

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ization. Resource discovery and resource allocation are two important task in network virtualization. A mathematical formulation on resource allocations is present in this chapter.

Kasemsap in his chapter titled “Software as Service, Semantic Web, and Big Data: Theories and Applications” consolidated the available literature on SaaS, Semantic web and Big data. The author has described the current issues and trends with SaaS, Semantic web and Big data in order to maximize the technological impact in modern operation. He also explained the perspective of SaaS adoption and challenges of SaaS in the digital age, overview and current trend in Semantic web, Overview, concept and prospect of Big data in the digital age.

Panigrahi et al. in their chapter titled “Software Development Methodology for Cloud Computing and Its Impact” have mentioned that a single software development process model cannot work for all types of project. Software development model is an evolving process which is affected by nature of the project, types of product to be developed etc. They have mentioned how software projects can be developed for cloud computing platform and the impact of cloud computing on software development. They have highlighted the benefit of software development and the agile method of software development in cloud computing platform.

IMPACT OF THIS BOOK

This book outlines advancements in the state-of-the-art, standards, and practices of cloud computing, in an effort to identify emerging trends, research and developments that will ultimately define the future of the cloud and relation with Big Data and IoT. A valuable reference for academics and practitioners alike, this title covers topics such as virtualization technology, Service oriented architecture (SOA), utility computing, cloud application services (SaaS), grid computing, Big Data and IoT.

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