Cloud Computing Services and its solutions: Industry Needs

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ABSTRACT
Strategic measurement of Industry sectors, mainly depends on huge amounts of information to achieve economic benefits without investing own infrastructure set-up information technology,
Industry always needs different IT services with immediate solutions.Number of Companies providing cloud computing services with certain service level management to the Industry sectors for dynamic, growing of today's business environment at an affordable price.The cloud computing business solution allows the Industry to leverage computing resources on which service providers managing their servers or data centers with secure networks. Almost all Industries are witnessing on digital marketing through the use of cloud based platforms and services as it becomes main-stream. In spite of a significant number of challenges along with risks like user privacy, data security, availability of service, disaster recovery, data lock-in and energy-efficiency, providers committed to providing a good advantage to the enterprises through cloud computing. The purpose of this article is mainly to discuss the impact factors of cloud computing a number of service provider,with "price" and "flexibility" as the finding to multiple benefits. In the area of policy, risks and different service models of cloud computing, researchers always look forward to addressing the gaps.
KEY WORDS: Cloud computing, Industry benefits, Solutions

Date of Submission: 14-08-2021   Date of acceptance: 29-08-2021

I.   INTRODUCTION

Presently cloud computing is the fundamental requirement of Industry sectors as due to the massive increase in the current day and age. Employees of 80% of Industry have multi-platform strategy and same will be enhanced to more than 90% by 2025. The expenditure involved in public cloud service of Industry sectors, world-wide is in higher side and the same will again be enhanced due to lots of influential factors. Almost all Industrial sectors expanding their understanding on the huge benefits of cloud computing due to potential technology. Many Companies started migrating to cloud service providers for their entire application depending on workload. As the hiring of managed service like cloud sourcing not only enhancing operational expenditure but also improve efficiency, many Industry players constantly monitoring their core competencies.

Through high energy disturbances and high memory based load balanced remote hosted servers by service providers, Industry depriving of investing from high hardware and expensive software cost along with installation costs. Users using the product and service network without fitting and without knowing the installation due to various deployment of cloud service as PUBLIC, PRIVATE, COMMUNITY & HYBRID. Out of which PUBLIC cloud service compels many Industries to cloud computing as it offers cost reductions and return on investment reduction.As per Bart McDonough, CEO of Agio, there will be rapid growth in PUBLIC cloud mainly due to ease of use and scalability of the technology. The most significant factor in this study on cloud computing is "Adoption". As per recent trend on adoption, automation, business analysis and intelligence, multi-cloud environment, Secure Access Service Edge(SASE) and distributed cloud environment are the influential factors.

As Digital Transformation is more prominent at present, the setting up of remote working place of employees will be very easier through cloud computing. With the latest technological development, enhanced computing power, high speed broadband internet service like FTTH (Fibre to The Home) and 5G service cloud computing can help the Industry for getting better results. According to developer of Machine Learning, Professor John McCarthy, *"Computing may someday be organized as a public utility, just as the telephone system is a public utility".*

The term computing is represented as a public utility after introduction of (AWS) Amazon Web Services by Amazon Company. But at present nearly 80% to 90% of Industry sectors already migrated to cloud service for better solutions.
How Industry sector gets maximum benefits from cloud computing?

What are different service, deployment models of clouds and the right cloud service models?
What are the requirements for calculating cost of cloud migration?
In what way "flexibility" helps to Industry through service providers?
What are different service providers providing cloud service according to recent trend?
All the answers to the above questions are reviewed in this article. The remaining part of the paper is structured as follows that provides related work, Infrastructure and models, Industry needs and solutions, analysis by service providers and finally conclusion with future scope.

II.   RELATED WORK

Industry sectors preferring Cloud computing for the dealing of almost every type of business, according to Gill, Wadhwa and Jatin, 2014 due to the increasing need for better hardware. Industry and schools started the mainframes as "Server Room" and multiple users were using mainframes at the same time in the beginning of the cloud concept in the 1950s. In multiple users' environment, mainframe computers were working well. Computing it to be virtualized and must allow computers to be built from distributed components to be built from distributed components such as processing, storage and software resources and design time sharing systems that facilitates the use of the platform and infrastructure according to [1]. A recent [2] report of Mckinsey claims that resource based services offering like computing, network and storage are the main branches of Clouds, where management of Hardware is highly abstracted from the buyer with infrastructure costs as variable operational expenditure and higher elastic infrastructure capacity. According to Mell and Grance [3],the NIST definition of Cloud Computing, The National Institute of Standard Technology characterizes cloud computing as "…a pay-per-use" model for enabling convenient, on-demand, available network access to a shared pool of resources, which is configurable and can be rapidly provisioned and released with the minimum managerial effort. Database, server and device are the three basic constituents of cloud infrastructure. The database is for storing and manipulating data. To keep the system intact, the role of the server is to link between host and users and maintenance of data flow connectivity for incoming requests. According to the abstraction level of the capability provided and the service model providers, Cloud computing services divided into three layers. [4]
(1) Platform as a Service
(2) Software as a Service
(3) Infrastructure as a service
With the development of cloud computing several types of cloud deployment models have been invented according to usage. And three deployment models are [5]. According to NIST, cloud computing includes following important characteristics like self-service, on-demand, rapid elasticity and broad network access manifested in an Industry context vary according to different models of public, private, community, managed and hybrid.
(1)   Personal   : Provides cloud services for individual or organization.
(2)   Public   : Open for public use and may be free and almost free and different from personal/private cloud.
(3)   Community: Shares services with multiple organizations for satisfying the all needs.
(4)   Hybrid: Composition of two or more clouds that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application probability.
Buyya. R, Yeo. C.S.Venugopal, S.Broberg, J, and Brandic.I[6] stated that, in Enterprise Cloud Computing, the important strategy on Consumption is the Market driven, where users and providers of cloud resources make decisions based on the potential saving and actual profit. D.Abadi [7] observed that more technical issues for enterprise cloud computing adoption arise when considering the operational characteristics and behaviors of transactional and analytical applications, which extend underlie the capabilities of Enterprise Resource Planning.

Cloud computing provides a means to improve or add abilities on-demand without making an investment in setting up infrastructures, training new employees, reasoning processing involves any subscription based or pay-per-use support that, immediately after the online, expands Its current facilities. The importance of cloud computing security is highlighted by Hudic (2014), where evaluation of state of an approach based on the Service Lebel Agreement (SLA), having no such privacy and security measurement. Therefore, such agreements have drawback of possible data exposed to unauthorized users and may result in the loss of sensitive data. D. Pratiba, Dr. G. Shobha and Vijaya Lakshmi. P.S [8] reviewed that sensitive information is centralized into the cloud and this information must be encrypted and uploaded to the cloud for the data privacy and efficient data utilization.

Referring to cost, Industry needs low investment and maintenance information technology cost at indistinguishable service quality. Multitude of cost benefits can be divided into tangible costs like space, utility, low operational cost and low maintenance costs and intangible cost like scalability, flexibility, resource optimization & less down time. Accordingly complete or partial migration of an Industry involves much more

than introducing a few Cloud-based applications to the process. The migration of Industry is best captured by the formula:

$$P \rightarrow P^1_C + P^1_1 \rightarrow P^1_{OFC} + P^1_1$$

$P \rightarrow$ Application before migration running at captive data center

$P^1_C \rightarrow$ Application part after migration and enter into a hybrid cloud mode

$P^1_1 \rightarrow$ Part of the application being run in the captive data center

$P^1_{OFC} \rightarrow$ Application part optimized for cloud

If an Industry cannot be migrated fully, the cost involved will be runningin capacitive data center and rest part being migrated to hybrid mode of cloud. However, when entire Industry migrated to cloud than P^1_1 is null. Indeed, the migration of Industry application P at all the levels like architecture, design, code, application and usage of cloud. But the application P^1_C at any of the five levels without P^1_1 component and cost will be incurred accordingly. Hencethe final price depends on a variety of factors,according to audit of IT infrastructure, which includes

Direct costs (hardware and software cost), IT maintenance costs (including manpower and other facility-related costs) and Indirect costs (the losses for your organization due to downtime). Simply total Industry cost after the migration will be (A) + (B) + (C), where A, B & C are [9]

(A)   Cloud infrastructure costs
The idea of the final price may be estimated on consulting with the top cloud infrastructure provider.

(B)   Cloud migration execution costs
Actual migration cost will depend on size of Industry and no. of cloud infrastructure components. But the actual migration cost of Industry varies on data transfer, Integration and app testing and cloud service provider consulting charges.

(C)   Additional expenses you might have after the migration
This includes monthly infrastructure costs and staff training-administration cost.

Service Models/Layers
Cloud computing services are divided into four models [12] as per Fig-4.1.

Infrastructure as a service: (IaaS) Fundamental resources such as physical machines, virtual machines, virtual storage. Offering virtualized resources (Computation, storage, communication) on demand. Cloud Infrastructure is computer servers, Data storage, Firewall, Load balancer.

Platform as a service: (PaaS) Runtime environment for applications, deployment tools, and development, etc. Offering of an environment by the cloud platform on which developers create and deploy applications without knowing no. of processors & memory that the application will be using. Cloud platforms are programming language, frameworks, mishaps editors, and structured data.

Software as a Service: (SaaS) Allows using software applications as a service to end users. Web-browser (Access by users through web portals) accessing, where consumers shifted from locally installed computer programs to on-line software services functionally. Cloud software are Social Networks, Office suites, CRM, Video processing.

Unified Communications as a Service
UCaaS, where service providers can offer communication solutions for businesses, offering different media like telephone, email, web, or video conference services via the cloud through stable organizational tools.
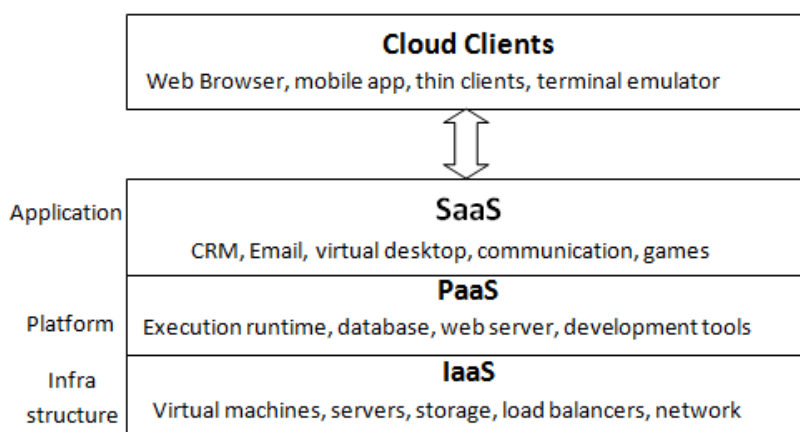

Figure 1: Cloud service models

Deployments

Public Cloud: As a "Cloud made available in a pay-as-you –go manner to the general   public". It does not require any coding and software maintenance. It is easy to use and to be paid only for the services, at the moment of using. Service availability of server of 24x7 is guaranteed. Due to simultaneous using of the same communication network, compromised the reliability on network is available. Also, due to cloud security mechanism, this model is not suitable for sensitive big data handling Industry.

Personal/Private Cloud: As an "Internal data centre of a business or other organization, not made available to the general public". In most cases a personal/Private cloud means restructuring an existing infrastructure by adding virtualization and cloud-like interfaces. This permits users to interact with local data centre while experiencing the same.Advantages of public clouds are per usage metering, billing & privileged access to virtual servers. Though the architecture of public and private cloud are similar, location of availability are different. Private Cloud is owned by one Industry and is also known as the Personal or Internal model. The location of a server either or inside the company or at a remote location. Due to higher cloud computing security, many large Industry preferring this model in recent years. Due to cost factors involved in purchasing of hardware and software, small Industry does not prefer these type of models.

Community Cloud: Shared by several Industry& support specific community that has shared concerns, i.e. mission, security requirement & policy. This Cloud architecture helps Industry save money as it is a sharing mode.

Hybrid Cloud: Personal cloud is supplemented with computing capacity from public clouds and community cloud. It allows combining all potential benefits of public, private, and community models according to the requirements of the Industry.

III.   INDUSTRY BENEFITS OF CLOUD COMPUTING

Most of the Industry, including small, medium and enterprise are selecting to cloud technology due to different computing resources, reduced total cost of ownership, on demand services and many more [10]. Mainly Industries are adopting this change as cloud motivating the business enterprise due number of advantages. As a cloud service provider is taking the responsibility of the Installation and regular updating costs of hardware and software, Industry can utilize their resources like time and money on different way [11]. Number of Industry benefits from cloud computing services are[13]

FLEXIBILITY: Without any investment of additional expenditure of Industry, scaling and flexibility, problem is solved in the case of cloud computing service. If Industry's have own IT Infrastructure, and if they want to expand through procuring of machines simply or when there is more machines according to need, there will be simply wasting the capacities. Accordingly FLEXIBILITY and SCALABILITY are two important features of cloud service provider that can scale up/down to Industry sectors.

SELF-SERVICE: Due to the expectation of self-service of cloud service, Industry users accessed the resources instantly, customize, pay, and the service without the intervention of IT operators.

UNINTERRUPTED SERVICE: Uninterrupted fast, frequent updating with secure disaster recovery internal process of data collection and storage is possible economically by cloud service providers.

COST EFFECTIVENESS: With a simple Internet connection, cloud computing works. Hence it is highly cost effective with higher efficiencies and greater utilization.Accessing of service of cloud from a simple telephone call or through Desktop/lap-top easily without the involvement of costlier hardware and software components.Also Installation is not required for a specific piece of software for accessing or manipulating Cloud application.

PER-USAGE METERING AND BILLING: Elimination of up-front commitment and subsequent allowing of Industry users is possible through cloud computing. Important characteristics of cloud service like pricing, accounting and billing is automatic implemented according to use basis without human intervention. Usage promptly reported for different type of services like storage, network-bandwidth and processing on the proper metering basis.

REDUCED ENERGY: The cost on Electricity expenditure will be reduced on migration to cloud solutions by Industry, as it is already free from Installation and maintenance of IT-Systems.

INCREASED PRODUCTIVITY: During COVID-19 pandemic, workers of Industry have more opportunity to work from home/any location that directly reduces the cost of office administration and Infrastructure on rent. For maximum efficiency and achieving the goal, cloud computing supporting a different work bench.

COMPETITIVE CHALLENGE:
In competitive era, number of Industries are migrating from one cloud service provider to other as 80% to 90% of companies already using the cloud technology due to a gamut of advantages of cloud computing solutions.

IV. INDUSTRY SOLUTIONS BY BEST CLOUD SERVICE PROVIDERS ON RECENT TREND

Due to Covid-19 Pandemic, every Industry already realized the importance of cloud computing services and adopted [12] the remote data-driven and application based technology. Due to a number of recent influencing factorsas required in future like

Automation: Management of reliable, robust and consistent hybrid cloud secured environments.

Distributed Cloud: Availability of distributed cloud service to the Industry users through distributed micro data centers to satisfy the low latency requirements of temporary application.

Business Intelligence: Improvement of business growth without additional expenditure on hardware and software Installation with maintenance cost.

Adoption of Multi cloud-Hybrid cloud model: Opting of multi cloud-Hybrid model strategy for capitalizing potential and strength.

Accordingly Industries have lots of opportunities through number of cloud computing services in order to improve efficiency and reduce costs through digital transformation. Microsoft Azure, Amazon Web Services, Google Cloud, IBM Cloud, Oracle Cloud Infrastructure and Cloud Linux are best cloud storage management services in the recent trend 2021[12]. Out of which one of the best Cloud service providers, Microsoft Azure have number of Industry solutions under different head. The same is analysed in this paper to solve the various problems of Industry by using different products and services as per needs.

Table 1: Analysis of different Industry solutions by best Cloud Service Provider in recent trend

Service Provider	Industry Solutions Type	Category	Description	Product and Service
Microsoft-Azure	Energy	Power and Utilities	• Through highly secure service on cloud innovation with optimized energy management, • (1) Upgradation of electrical grid • (2) Predictive forecasting • (3) Device control • (4) Manage employee productivity • (5) Safe automatic operations by machine learning, is possible •	Azure Kubernate Service (AKS) Azure Serverless Computing Azure Synapse Analytics GitHub Azure Azure Arc
		Oil and Gas	(1) Expansion of opportunities and reducing costs through AI and Machine Learning (2) Management of the asset life cycle and reservoir production with proper maintenance using IoT •	Azure Digital Twins Azure Machine Learning Azure IoT Azure Security Center
	Financial Service	Banking	Predictive analysis of Client Experiences and their relationships using customer data to find out personalized experience	BCi
			Core Banking and Modern with Digital Payments	Manulife
			Risk management platform like fraud detection with enormous computing power with faster speed	UBS
		Capital Markets	Deep differentiated client experience delivered for accessing loyalty and customer growth	HSBC
			Risk detection and improvement of operational efficiency through cloud and revenue platform	BlackRock
			Advanced risk management by making markets faster, informing business, computing in the cloud and investing in new ideas	MUFG
		Insurance	With the help of AI, differentiated policy holder experience delivered with opportunities of possible sales.	Extending Flo Chatbot
			Supporting of new business model through the modernizing insurance system on claims processing, policy pricing and fraud preventing	Swiss Re
			Improvement of risk modelling and easy management of financial risk across the organization. Improvement of employee productivity, automated insurance tools and modernization of the workplace.	MUFG Milliman

	Retail	Reimagine Business	Analytics, AI and machine learning help retailer with ample opportunities.	Migros
		KYC (Know Your Customer)	Using secure cloud based technology, multi-channel retail experiences of digital customer experienced.	Loblaw
		Supply Chain Management	Intelligent supply chain management through cloud technology, to improve operations and reduced costs.	Walgreens
	Gaming	Trust	Cyber security analyst actively monitoring the player along with game on cloud network	PlayFab DevOps
		Customization	As Microsoft is open source and supports for all language, game is built and deployed on any platform and devices.	Spatial Anchors Visual Studio
		Scalability	Reduction of latency, faster and responsive, game closer to player. Auto scale feature of computing resources helps the gaming performance, if the demand of player is different.	DDoS Protection Kubernetes App Center
	Healthcare	Health Information Protection	For enhancing security and privacy, cloud technology safeguards sensitive health data and continual improvement of trust, data governance and modernize health care with predicting risks.	NHS New South Wales Health
		Patient engagement	By securing data flow, physical-virtual care with AI boats, health outcomes improved on improved patient care	Rx.Health
		Empowerment of Health team Collaboration	Simplification of workflow management and secured collaboration, drive among health teams	Northwell Health
	Media and Entertainment	Content Creation	Easy and quick processing of large datasets from Tera bytes to Peta bytes. Scalable Infrastructure accessed and using on-premises file-based workload running as per needs.	vFXT
		Content Management	Content management through optimizing costs and performance by securing archives and storing of contents at right tier. Discovered new form of content like searching of spoken words, faces and emotions through improvement in engagement with video and making of video app more intelligent.	Video Analyzer
		Content Distribution and Monetization	Reach the contents to more people through online mode, protect and delivered with flexibility on cloud workflows, which boosts the media discoverability performance	Multichannel Pipeline Web Interface FedRAMP HITRUST
	Manufacturing	Innovative Business Model	Shifting to intelligent manufacturing due to cost saving for complex industrial operation on enterprise cloud network.	AIRBUS
		Cloud-based Technology	To meet the various issues of manufactures, gain visibility, personalized experience and innovative business model implemented through secured, scalable manufacturing based cloud technology model	KENNAMETAL
		Transform Workforce	Empower work force to maximize safety and health while improving productivity. Stronger customer relationship for delivering the best experience through sales and marketing.	GE Aviation Lexmark
		Use Cases	Remote Manufacturing operations Automated Quality Control Inventory Planning and Optimization	IoT AI Synapse Analytics

V. CONCLUSION

In recent trend, some of the best cloud providers solving the different Industry problem through highly secured, reliable, cost-effective and scalable services. According to Industry needs, cloud computing has many advantage of accessing the different services at any time from any location. Through different deployment modes and service models, cloud technology offering faster computing power, flexibility, security and cost reduction. Accordingly Industries at different sectors, improving their productivity, enhancing their decision making capability effectively.

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