Improvements of Cloud Computing: Scenario of MDCs and LDCs

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Abstract— Cloud computing is a captivating concept that has gained much importance in many countries over the past few years. Now most of the developed countries are trying to take the full advantage of cloud computing. On the other hand, underdeveloped countries are not gaining that much advantage like the developed countries. Salesforce, Amazon, Google and Microsoft are delivering various services of cloud to the users. These main cloud service providers have millions of customers and subscribers around the world where the number of customers and subscribers is increasing day by day. More developed countries (MDCs) are quickly adopting the benefits of cloud computing because of their improved infrastructure. The uses of cloud computing have affected the economy as well as the advancement of technology in MDCs positively. This paper is prepared to know the present condition of cloud computing in MDCs and LDCs with reasons behind their positions.

Index Terms— Cloud, MDCs, LDCs, Service providers, Technology, Information, Performance, ICT

1 Introduction

CLOUD is a concept that has emerged from the nature. In technology, cloud represents the sum total of all connected resources within a particular network. In a broader sense, cloud computing is the delivery of computing services over the Internet where we can get services from any place where Internet is available. Cloud services allow individuals and businesses to use software and hardware that are managed by third parties at remote locations. Examples of cloud services include online file storage, social networking sites, webmail, and online business applications and so on. The cloud computing model allows access to information and computer resources from anywhere that a network connection is available. Salesforce, Amazon, Google and Microsoft are the main cloud service providers in the cloud technology. But the uses of cloud computing are not the same in all countries. Some countries are facing difficulties to implement the cloud computing concept in all technological areas of those countries.

2 Objectives

This paper will focus on the major service providers of cloud computing with revenue and different services. The researchers will identify to what extent we are using cloud computing and which countries are doing better by adopting cloud computing concept. Another objective of this paper is to find the reasons how some countries have achieved the top ranks in the cloud computing arena. And finally this article will conclude with a forecast about cloud computing to show the new directions for the future.

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3 Literature Review

Cloud computing is a contemporary notion in the computer technology. A Cloud is a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resource(s) based on service-level agreements established through negotiation between the service provider and consumers (Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009). With the passage of time, the services of cloud computing provided by service providers are improving.

Stahl, Duijvestijn, Fernandes, Isom, Jewell, Jowett, & Stockslager (2012) provided an overview of cloud computing and its benefits, different cloud computing perspectives, highlighted performance engineering interfaces with cloud solutions, and detailed performance considerations for the cloud. In this regard, World Economic Forum (2010) provides some surprising and useful insights into what current and potential users see as the most important benefits of cloud technologies; which industries, societal, and other stakeholder groups might most benefit from cloud computing; why governments are adopting cloud services at an unexpected higher rate; and what users, providers, and policy-makers fear may disrupt the adoption of cloud services and thus potentially diminish their value.

On the other hand, some authors have tried to find out the indicators of measuring cloud computing performance. Mohana, Saroja, & Venkatachalam (2012) give a quick overview of cloud and describe the key infrastructural elements for cloud computing. They have given a brief survey based on readings of "cloud" computing and they tried to address research topics and challenges related to it. Then, Frey, L¨uthje & Reich (2013) have proposed some key indicators for measuring the performance of cloud service level agreements for the customers. United States IBM Corporation (2009) describes a

high-level cloud computing infrastructure services framework and the underlying technology enablers, such as virtualization, automation, self-service portal, monitoring and capacity planning to measure the performance of cloud computing.

Some teams of researchers have tried to figure out the performances of cloud computing in different countries by using global cloud scoreboard or cloud readiness index. The purpose of one cloud readiness index is to track the development of critical fundamentals for cloud-based services for the Asia Pacific region (Asia Cloud Computing Association, 2012). Current scenario of cloud computing is clear and needs to clarify the reasons for failing to take advantages of cloud computing in the least developed countries.

4 Methodology

The analyses and interpretations stated in this paper mainly depend on reliable secondary data. The researchers have collected information from prominent organizations, brochures, selected recent articles, renowned books and reliable websites. They compared information from different sources to draw an overall conclusion.

5 Some Recent Events that Caused Cloud Computing

We live in the age of information where information is saturated around the world. We create information for numerous purposes, collect information for our decision making and store information for future use. The main source of collecting information is the Internet. According to International Telecommunications Union, 39% of people around the world were using Internet in 2013 where the rate is 77% for the developed countries and 31% for the developing countries [9].

In addition, the amount of emails sent per day and the number of websites around the world are quite overwhelming. There were 2.2 billion email users and 144 billion email traffic per day worldwide in 2012. The number of websites in December, 2012 was around 634 million whereas the number of websites in December, 2013 is at least 1.68 billion. Here we can see almost 165% growth from the year 2012 to the year 2013[27]. Rapid increase in the volume of information is not only limited to the emails and websites.

For instance, in January 2013, Facebook stored more than 240 billion photos, with users uploading an additional 350 million new images every single day. To store those images, Facebook's data center team uses 7 petabytes of storage every month. This nonstop requirement of storage capacity triggers the necessity of cloud storage for the Facebook team. Same thing happens for the Microsoft, Amazon, Megaupload, Dropbox and all other organizations [2].

Moreover, a new Microsoft-funded IDC study states that public and private IT cloud services will produce nearly 14 million jobs worldwide by 2015 — and more than half of those jobs will come from small and medium-sized businesses. The study goes on to predict that cloud computing will generate as much as $1.1 trillion in annual revenue by 2015[30]. Booz Allen Hamilton has conducted an economic analysis and found that the total cost of implementing and sustaining a cloud environment may be as much as two-thirds lower than maintaining a traditional, non-virtualized IT data center [1].

Furthermore, the need for technology resources is increasing around the world. Amazon Web Services (AWS), Microsoft Azure, Google and other similar organizations have developed the concept of cloud computing and they are trying to attract the users by introducing new features frequently. The top level managers of the renowned organizations are looking for the effective and efficient ways of storing the data for future use, analysing the data for special needs and disseminating the information or processed data to the right persons at the right time with minimum effort.

6 Different Types of Cloud Services

Generally, we can divide the cloud services into three main parts. There can be so many divisions under these three main parts.

6.1 SaaS

Software as a Service (SaaS) uses the worldwide network and web applications that are managed by a third-party vendor and whose interface is accessed on the clients' side. Most SaaS applications can be run directly from a Web browser, without any downloads or installations required. SaaS eliminates the need to install and run applications on individual computers. With SaaS, it's easy for enterprises to streamline their maintenance and support, because everything can be managed by vendors: applications, runtime, data, middleware, O/S, virtualization, servers, storage, and networking.
Examples: Gmail, Google Docs, Salesforce CRM, SAP Business by Design.

6.2 PaaS

Platform as a Service (PaaS) provides computational resources through a platform. PaaS makes the development, test, and operation of applications quick, simple, and cost-effective way by eliminating the need to buy the underlying layers of hardware and software. In PaaS, vendors still manage runtime, middleware, O/S, virtualization, servers, storage, and networking, but users manage applications and data. Users don't have to worry about upgrades in PaaS. The company which wants to increase effectiveness can use PaaS.
Examples: Force.com, Google App Engine, Windows Azure (Platform).

6.3 IaaS

Infrastructure as a Service (IaaS) delivers computer infrastructure, storage, and networking. Users can use servers, network

equipment and software without purchasing these. But the users have to pay the rental fees for these services. Here users are responsible for managing more: applications, data, runtime, middleware, and O/S and vendors are responsible for managing the virtualization, servers, hard drives, storage, and networking.

Examples: Amazon S3, SQL Azure, Amazon EC2, Zimory, Elastichosts.

This is noteworthy that top cloud computing service providers are gaining billion dollar annual revenue from their different pool of services. In the table-1, we can see the annual revenues of top 5 cloud service providers with their products. Salesforce.com has achieved $2.27 billion annual revenue which is the highest among all cloud service providers in the year 2012.

Table-1: Major Cloud Computing Service Providers

Service Provider	*Launching year*	*Annual Revenue (2012)*	*Products*
Salesforce.com	1999	$2.27 billion	Sales Cloud, Service Cloud, Exact-Target Marketing Cloud, Salesforce1 Platform, Chatter, Data.com, Work.com
Amazon Web Services (AWS)	2006	$2.1 billion	AWS & Cloud Computing, Compute & Networking, Storage & CDN, Database, Analytics, Application Services, Deployment & Management, AWS Marketplace Software, Start-ups, Enterprises, Government & Education, Web, Mobile, & Social Apps, Digital Media & Marketing, Business Applications, Backup, Archive, & DR, Big Data & HPC
Windows Azure (Microsoft)	2010	$1 billion	Cloud programs, Office 365, Microsoft Dynamics CRM Online, Windows Intune, Windows Azure, Cloud OS
Oracle Exalogic Elastic Cloud	2010	Nearly $1 billion	Engage Customers (Marketing, Sales, Service), Empower People (Global Human Resources, Talent Management, Talent Management for SMB), Empower Business (Enterprise Resource Planning), Manage Enterprise Performance (Enterprise Planning, Financial Reporting), Build Apps (Database, Java, Developer, Documents, Business Intelligence, Mobile) and many more services.
Google Cloud Platform	2006	$314 million	App Engine, Compute Engine, Cloud Storage, Cloud SQL, Cloud Datastore, BigQuery, Prediction API, Translate API, Cloud Endpoints

7 Trends of Cloud Computing Among Different Countries

All of the developed countries and some of the developing countries are using cloud computing services in their technology based activities. The 24 countries together account for 80 percent of the global information and communication technologies (ICT) market. The 24 countries have already taken necessary steps to adopt cloud computing technology and gained substantial level of efficiency in ICT. Japan, Australia, Germany and United States are the leaders in cloud computing arena. We can see the importance of different elements given by each country in cloud computing in table-2 and table-3. We have only shown the rankings of top 10 countries in 2013 and 2012.

Table-2: Global Cloud Computing Scorecard, 2013

Rank	Country	DP (10)	S (10)	C (10)	IPR (20)	SII (10)	PFT (10)	ICT (30)	Total (100)
1	Japan	8.8	8.4	10.0	17.2	8.8	9.2	21.7	**84.1**
2	Australia	7.9	6.4	10.0	17.6	10.0	7.0	21.0	**79.9**
3	US	6.5	7.6	8.8	16.6	10.0	8.0	22.2	**79.7**
4	Germany	6.6	6.4	10.0	16.8	9.8	9.2	20.3	**79.1**
5	Singapore	7.6	3.6	9.0	18.0	8.8	8.6	22.9	**78.5**
6	France	6.5	7.6	10.0	16.8	9.6	8.8	19.0	**78.3**
7	United Kingdom	6.9	8.0	6.8	17.8	9.2	6.8	21.4	**76.9**
8	Korea	9.3	6.0	4.8	17.6	9.6	7.0	21.9	**76.2**
9	Canada	8.1	6.8	6.2	15.6	10.0	9.6	19.5	**75.8**
10	Italy	6.2	7.6	9.6	17.0	9.8	8.8	16.5	**75.5**

[Source: BSA Global Cloud Computing Scorecard, 2013]

Table-3: Global Cloud Computing Scorecard, 2012

Rank	Country	DP (10)	S (10)	C (10)	IPR (20)	SII (10)	PFT (10)	ICT (30)	Total (100)
1	Japan	8.8	8.4	10.0	17.2	8.8	9.2	20.9	**83.3**
2	Australia	7.9	6.0	9.4	17.6	10.0	7.0	20.9	**79.2**
3	Germany	6.6	6.4	10.0	16.8	9.8	9.2	20.2	**79.0**
4	US	6.5	7.6	8.8	16.6	9.4	8.0	21.7	**78.6**
5	France	6.5	7.6	10.0	16.4	9.6	8.8	19.5	**78.4**
6	Italy	6.2	7.6	9.6	17.4	9.8	8.8	17.2	**76.6**
7	United Kingdom	6.9	8.0	6.8	17.4	9.2	6.8	21.5	**76.6**
8	Korea	9.3	6.0	4.8	17.6	9.6	7.0	21.7	**76.0**
9	Spain	6.5	6.4	8.8	15.2	9.8	9.4	17.8	**73.9**
10	Singapore	3.2	3.6	9.0	17.2	8.8	8.6	21.8	**72.2**

[Source: BSA Global Cloud Computing Scorecard, 2012]

DP = Data Privacy
S = Security
C = Cybercrime
IPR = Intellectual Property Rights
SII = Support for Industry-Led Standards & International Harmonization of Rules
PFT = Promoting Free Trade
ICT = ICT Readiness, Broadband Deployment

Seven issues have been considered to measure the above ranking of cloud services in different countries. Singapore jumps from 10th to 5th in 2013 rankings based largely on the adoption of a new privacy law that balances user protections and continued innovation. But the security system of Singapore is not so good like other developed countries. Korea scored well in the privacy section in 2013 because of the comprehensive privacy regimes without any difficult registration requirements.

Significant improvement has been seen in intellectual property in the past years. Canada, India, Malaysia, and Russia passed important amendments to their copyright laws, bringing them in line with international standards. And Malaysia signed the World Intellectual Property Organization (WIPO) Copyright Treaty for the protection of intellectual property.

ICT Readiness, Broadband Deployment of the Scorecard examines and compares the existing infrastructure in each country to support the cloud computing. Japan, Korea, and Singapore have implemented impressive national broadband networks. Japan and Korea have more than half of the 60 million global fiber connections, followed by Russia with 9 million connections and the United States with 6 million.

From our observation, we can easily see that the practice of cloud computing is obtainable only in highly technology based countries like Japan, Singapore, Australia, Germany and other equitable countries.

8 A COMPARATIVE VIEW OF CLOUD COMPUTING IN LDCS AND MDCS

We have taken 3 more developed countries (MDCs) and 4 least developed countries (LDCs) to compare the necessary elements of cloud computing. Japan, Australia and United States are known as MDCs and Bangladesh, Afghanistan, Nepal, Sudan are known as LDCs according to World Bank. We have considered internet access rate, internet download speed, internet upload speed, internet cost and computers per 100 people for each country.

Table-4: Necessary Elements for Implementing Cloud Computing

Country	*Internet Access Rate (2012)*	*Internet Download Speed*	*Internet Upload Speed*	*Internet Cost per megabit per second*	*Personal Computers per 100 persons*
Japan	79.1%	41.74 Mbps	27.81 Mbps	$0.27 USD	40.72 (2003)
Australia	83.3%	14.47 Mbps	2.61 Mbps	$8.87 USD	60.83 (2003)
United States	81%	20.46 Mbps	6.19 Mbps	$3.75 USD	79.89 (2006)
Bangladesh	6.3%	2.71 Mbps	3.81 Mbps	$13 to $40 USD	2.42 (2006)
Afghanistan	5.5%	1.13 Mbps	No Data		0.32 (2005)
Nepal	11.1%	1.63 Mbps	1.06 Mbps	$12 to $16 USD	0.49 (2006)
Sudan	21%	2.17 Mbps	1.22 Mbps		11.45 (2006)

[Source: www.netindex.com]

From table-4, we can see that Japan, Australia and the United States have high access rates in Internet which are around 80%. On the other hand, four LDCs have low Internet access rates which are below 25%. Internet download speeds of MDCs are much better than those of LDCs. Japan is the highest performer in all elements that are necessary to implement cloud computing except computers per 100 persons. But the data regarding personal computers per 100 persons are backdated due to unavailability of data for recent years. So we can easily ignore this datum for our consideration. Again the Internet costs are almost three times cheaper in MDCs than those of LDCs. As a result, the cloud users of LDCs are facing some difficulties to get the benefits of cloud services given by the cloud service providers.

9 FINDINGS

The concept of cloud computing is a recent achievement in the field of technology. The uses of cloud computing are now limited to only large and reputed organizations for storing and sharing files, using web applications, making backup files, hosting web sites and implementing and maintaining e-commerce. Cloud computing can be used in education sector to improve the efficiency of whole system of education of a country. Some countries have already taken initiatives to implement the cloud concept in their education systems. Moreover, cloud computing can be used in various industries like textile industry, automobile industry, pharmaceutical industry, shoe industry, household appliances industry, food industry, banking industry and manufacturing industry.

Cloud computing has a great impact of a country's economy. The ultimate result of cloud computing is to increase the competition among the organizations, increase the jobs and growth of an economy. Forrester predicted that cloud computing industry will be worth of $240 billion by the year 2020. Some experts said that the growth of cloud computing will be a rate of substantial amount over the next few years. Some organizations have already cut the significant amount of costs of services by applying cloud technology.

Some countries are facing problems to implement this cloud technology. The reasons are different in different countries. Some countries face problems like security problems, lack of ICT readiness, minimum broadband deployment and other issues. In this paper, we can see Bangladesh, Nepal, Afghanistan, Sudan are the representatives LDCs which have lower amount of Internet access across the countries, poor quality of Internet connection, lower amount of computers per 100 persons and high Internet access costs. As a result, these least developed countries are not flourishing the success of cloud computing. Most of the developed countries already adopted the benefits of cloud technology because their infrastructures are better than least developed countries. Some countries like Japan, Australia, US and Singapore are investing on cloud technology and monitoring the improvements of cloud computing.

10 CONCLUSION

From the cloud provider's view, the construction of giant data centres at low cost using commodity computing, storage, and networking uncovers the possibility of selling those resources on a pay-as-you-go model. On the other hand, from the cloud user's view, it would be as startling for a new software startup to build its own data centre as it would for a hardware startup to build its own system. Adoption of cloud computing represents many IT decision makers and the lines of business they support. IT executives must to think freshly about "make versus buy" souring decisions for their IT service delivery competence. International Data centres' research indicates that many early cloud computing adopters are finding these types of offers to be sufficiently secure and flexible while helping to reduce costs and standardize service levels. IDC believes cloud computing options will increasingly garner serious consideration from a wide range of businesses and will become a standard sourcing option for many types of applications and infra-

structure solutions. The uses of cloud computing are going to widespread in MDCs. On the other hand, the uses of cloud computing are in primary stage in LDCs. The government and the key people should take necessary steps to improve the uses of cloud computing in LDCs.

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