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Impact of Cloud Services to the Economic Growth

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Abstract—Internet of Things (IoT) and cloud computing has become an intermediate cradle between intelligent objects and applications that make use of the resourcefulness and data provided by these objects. On one side, IoT can get benefit from almost unlimited resource to implement cloud computing management and penning of services related to smart objects and data provision. On the other side, the cloud can benefit IoT by expanding the scope of application operation to address real-time objects. Despite this synergy, the literature lacks a comprehensive and complete overview on what have been investigated and opportunities for the economic development of the common wealth in context to IoT and cloud, especially in the emerging markets (Pakistan). This issue requires further development and in-depth research. The goal of the study is to identify and propose opportunities to fill the gap by systematically investigating the studies available in the literature. To provide an overview of the current state of research on the topic and to obtain a comprehensive overview on the economic developments through IoT and Cloud Computing paradigms and ascertaining opportunities in the existing approaches and recommend research directions.

Keywords—Cloud computing; internet of things; economic developments; emerging markets

I. INTRODUCTION

In 2015, smartphone shipments to the Pakistan climbed to 123%, one of the fastest developmental rates in the developing world. The broadband penetration increased from 3% to more than 15%. According to World Bank studies 10% increase in high-speed internet connections could boost Gross Domestic Product (GDP) by 1.38%, to have a positive impact on country's economic growth [1]. The Internet of Things (IoT) is an emerging concept based on the fundamental interaction of smart objects together through virtual and physical resources via Internet. Despite recent advancements, there are several challenges to the growth for developing its full prospective and promoting tangible benefits to the welfare for society, the environment, the economy and people. Recently, cloud computing has been proposed as a promising glide path to address some of the stream challenges of IoT by creating new opportunities. Cloud computing is an emerging model for computing concept that allows delivery of information technology infrastructure and software as a service directly through the Internet. With this provision, companies can expand the

capacity of the network and directly run the application at vendor's network, and offers many advantages by reducing the technology primary root costs. Cloud communication activities in Pakistan are in its early days. The current technology trend is evolving with the emergence of businesses cloud offerings, which is accelerating the economic growth. Pakistan's digital economy still faces challenges. These include weak regulatory, low digital literacy rate, lack of awareness and privation in legal frameworks, which needs to be addressed for stable growth of Pakistan [2].

Pakistan's information communications and technology (ICT) sector is a vital business driver and has been classified as one of the major contributors to the economy over the last ten years. The current technology trend is evolving with the emergence of businesses cloud offerings, which is accelerating the growth and change. "This is a pronounced time for cloud in the country. Oracle simplifies cloud journey by providing state-of-the-art big data platform, accessible either as an on premise solution or in the cloud, to get companies up and running with big data and rapidly access the power of commercial analytics to gain insights and make better decisions," says, Oracle Country Sales Manager [3].

The Software-as-a-Service (SaaS) would endure to be the leading cloud computing business which offers the harness modern enterprise applications for a range of activities from Enterprise Resource Planning (ERP) to marketing and human resources rapidly and cost efficiently [3]. Pakistan's e-commerce marketplace is projected to exceed a billion dollar in the next five years. The industry experts forecast this trend will continue during the next three to five years and help the segment to surpass around billion-dollar milestone in 2020. At present valued at over \$60 million, the country's e-commerce segment is expanding in size every year; it is growing at a compound annual growth rate (CAGR) of over 100%. However, the broadband penetration (number of internet connections per population size) is the factual driver for the contemporary development in e-commerce. Since the introduction of 3G networks in Pakistan, which started in two years earlier, the country have been adding more than one million users to its base in mobile Internet every month. Number of broadband consumers is skyrocket around 23 million at the end of second quarter of 2015, rises from less than 4.7 million in 2014. Given the nation's overall trade market is worth 40 billion dollars, the

trade experts believe e-commerce in the country is still at its initial stages and it is only just 0.2% of the global marketplace [4]. Cloud computing provides a more profitable, lower risk, way faster alternatives fundamentally to change the on-site application developments, and transform IT (Information Technology) economics. Smaller budget requirements permit smaller companies to piece together, without spending to purchase a traditional server and storage systems company. In addition, development and technical maintenance burden required for the operation of the transfer of knowledge is being transferred to the network service provider. Pay-per time base system helps to create and apply the customized applications to IT sector through these difficult times. By developing applications to provide more profits and low risk alternative to on-site application developments, cloud computing is ready to transform the IT economy in the coming years [2].

II. MARKET DYNAMICS

Information Communications Technology (ICT) has become a greater component of the nation's economy than doubtlessly anything else. However, unless there is a very close collaboration between IT and other ministries, not all those ICT applications and services, which could catapult the efficiencies of those sectors to great heights, can be implemented [5]. Pakistan Telecommunication Company Limited (PTCL) has become the third major player in the country to offer cloud services to large sized and especially to Small and Medium Enterprises (SMEs). While there is no major or official mentioned for the cloud solutions from PTCL's side. Company's dedicated website for cloud services is already up and live. PTCL offers cloud-computing solutions from its data centre in cities of Islamabad, Lahore and Karachi. Corporations operating in the country are getting a good proposition for hosting their websites, which will bring them better ping rates but this will increase the trust factor as well [6]. Cloud computing in education is one of the values of technology to education sector. The practice of technology in education industry has given mobility and flexibility to learning. It is cost-saving and attractive system for schools to make learning easy for students [7]. By 2020, 3G exposure is projected to grasp 90%, while mobile broadband to 40% of the population of Pakistan. Pakistan has prodigious room for growth in terms of e-payments and digital access, since it has a "unique mobile subscriber penetration of 31%, mobile broadband penetration of 5%, and bank-mobile money account penetration among adults of 13%" [8].

Truong and Dudstar [9] outlined three key regions that should be considered in the life cycle of a cloud-based IoT system: Development phase: including selection techniques, composition and integration of components of the system to specify and develop possible operations and control, deployment and provisioning phase: It including techniques for the implementation of various types of software components at different levels of abstraction and the ability to configure continuous implementations and provisioning resources, operation phase: that includes features to monitor statistics from end to end, perform governance processes

throughout the system, and gives control processes coordinated. Transversally, it is essential to provide environments to support progress of applications based on data-streams by devices and obtainable through the cloud.

Cloud market orchestrate conglomerates of cloud computing, cloud storage and infrastructure strengthen the position of network cloud providers and traditional recruitment companies deploying cloud or internal infrastructure provisioning balance of benefits. The largest markets for cloud services are North America and Western Europe. Global cloud market is to growing to \$121 billion in 2015, \$37 billion in 2010 with 26% Compound Annual Growth Rate (CAGR). A large part of the growth of cloud services industry is due the rapid adoption of SaaS platforms to support the productivity of companies and licensing, management and implementation of software and hardware cost savings. Global SaaS software revenue is increasing 21% from 2015 and projected level in 2016 has been forecasted to reach 106 billion dollars. Compared with the overall 5 percent increase of cost with IT enterprise, cloud-computing infrastructure will grow with a CAGR of 30% from 2013 to 2018. Organizations and enterprise are looking for more deals for cloud computing infrastructure and applications. IaaS is expected to grow rapidly because it is a platform where companies will host their own SaaS solutions and other critical infrastructure for the deployment of business. Large number of companies previously reluctant to invest in infrastructure development had their specific concerns that were due to the vendor lock-in, lax security and difficulty of developing cloud solutions. However, now of a large part of industry has been by cloud driven due to their specific needs [2].

As the cloud industry is mature and has begun to respond to these concerns, the solution put in place assures it affects, but the obvious benefits of cloud deployment do not carry a sting in the tail. One aspect of that assurance is the development of open cloud Application Programming Interfaces (API) and cloud applications and standards that are used for control data transfer and allow the necessary flexibility to develop solutions for their short and long-term business goals. Open APIs and standards create an open market and innovation in the cloud space and help to promote discrimination. Availability and performance properties are merits to assess the individual vendors. This is the ability of those companies, which provides the flexibility to be confident on cloud investment returns. The opening of cloud also enables the development of federated cloud environments. Companies can choose components, that best suit their specific needs to create the environment of choice, from the available vendors to build the multi-cloud interoperability environments. Figure 1 shows typical API architecture. The rapid growth in the adoption of multiple devices by consumers, along with access to Internet growth is an important step in the transition to services based on cloud factor, which can provide universal access to content and applications from any device in any location. Many devices have dual mode functionality. This growth, in turn, creates demand for cloud services and content that can be accessed across multiple devices using any means of access -

fixed or mobile. Another important factor of the Internet for everything and the adoption of cloud services is the growth of IPv6 capabilities between users, devices, network connectivity and content enablement [2]. Pakistan's export of IT-enabled services (ITES) and Information Technology (IT) amount to \$2.2 billion in the year 2014-15 at an annual growth rate of 41%, according to Pakistan Software Export Board (PSEB). IT industry's total revenue is around \$2.5 billion a year, Pakistan's Information Technology trade is currently the fastest growing export sector of Pakistan [10].

III. GROWTH DRIVERS

In the recent past, there is a paradigm shift in the use of cloud communication services as a simple notification system with much more interactive experience using multiple communication channels, including SMS, voice and USSD.

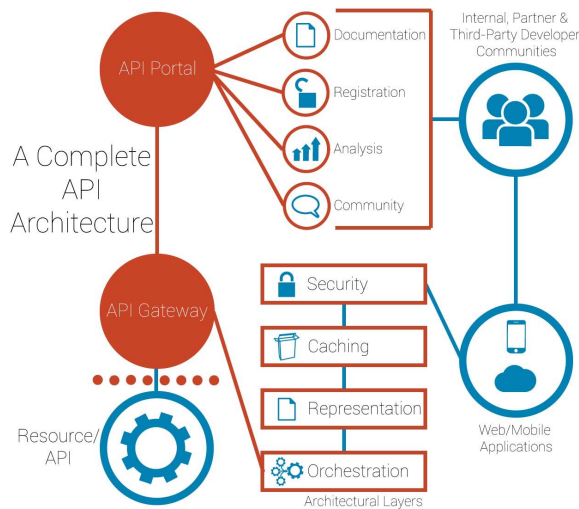


Figure 1. API Architecture

A recent trend has been the adoption of missed call which could initiate an outgoing call to play a special announcement that includes the customer's bank account, loyalty points, or even connect the initiator to a customer care executive. Another trend has been the introduction of a wide range of mobile hardware that nests a multitude of software with only unique constraints, which makes mobile application development in a very costly. USSD a simple function that is compatible with all phones is a hot alternative for the creation of market-ready applications [2].

The spread of the IoT paradigm can have a significant impact on the daily lives of human existence with the growth of new application programs and systems in various sectors of the real world. From the point of view of a user, the IoT can play a leading theatrical role in application scenarios such as home modernization, health care, and improved learning. From the linear perspective of business users, the most evident effects are visible also in areas such as logistics, industry, energy, agriculture and retail. Eventually, IoT can speed up the development of wide-ranging

applications in the context of smart city, environmental monitoring, and overall economic growth [11, 12].

The percentage of global IPv6 users in September 2014 was 4.54 percent, up from 1.82 percent in September 2013, which shows an increase of nearly 150 percent. From the point of view of the device, it is estimated that there will be 10 billion IPv6-capable fixed and mobile devices in 2018, compared with 2 billion in 2013. A CAGR, of 37% and in percentage terms, 47 percent of all fixed network and mobile devices will be compatible with IPv6 by 2018, compared to 16 percent in 2013. This means that by the year 2018, 50% of all devices and fixed and mobile connections will be able to support IPv6. Traffic of the global data center is firmly in the zettabytes and will triple by 2013 to reach 8.6 ZB year in 2018. The fastest growing segment of data center traffic is cloud traffic, which is almost quadrupling during the forecast period and represents more than three quarters of all data center traffic in 2018. An important enabler traffic in the rapidly expanding cloud computing is increasing virtualization of the data center, which provides services that are flexible, easy to implement and efficient. In 2018, more than three quarters of all workloads will be processed in the cloud. Additional trends affecting the growth of cloud computing include the widespread adoption of multiple devices combined with increased expectations of users to access applications and content anytime, anywhere, on any network. To meet these growing needs of users, cloud-based services such as cloud storage consumers are gaining momentum. In 2018, more than 50 percent of the population of Internet consumers will use personal cloud storage [2].

IV. INTERNET OF EVERYTHING

With powerful, ever-changing market trends and the steep demand for suppliers that can offer all solutions in one packet, it is imperative that communications in the cloud will see dynamic growth in the coming days. Cloud communications have seen a high degree of acceptance by the big business community. Clouds market place increase the existing advantages of clouds-on-demand pricing by lowering the capital expenditures, fast implementation that enable business to agile, responsive scale both above and below and flexible API's allow for automation of infrastructure orchestration. The cloud market increases the value of the cloud, providing centralized control for an increasingly diverse set of suppliers. The cloud-based services are essential for most Internet of Everything (IoE). This increases the capacity of persons, property data and communicates with each other through the internet. IoE is generating the large amounts of data, and now only a small part of the data reaches the data center. Even if it is expected that the data center traffic will reach to 8.6 LB in 2018, the total volume of data generated by the IoE in 2018 will be more than 400 KB, or almost 50 times the total amount of the traffic data centers [2].

Current investigation on cloud have largely focused on the prospects provided by the cloud itself, with the origins of such prospects receiving less thoughtfulness. This opens up new paradigm avenues for research in the field. It is true that the present studies includes extensive coverage of system

innovations [13] the diffusion of innovations [14] and acceptance of technology modernizations [15] however, there has been no detailed elaboration of how firms detected these novelties. This is important for the scholars who want to develop a theoretic understanding of opportunities related to cloud computing, and whether existing opportunity concepts hold factual in the framework. The topic is also important for entrepreneurs working in the business, given that cloud study is growing speedily and that it offers a wide field for new commercial prospects. It sheds light on the opportunities for innovation identified in the field of entrepreneurship [16]. Entrepreneurship offers two distinctive concepts on the opportunities. The first is opportunity discovery, seeing opportunities as existing independently, and as objective phenomena to be exploited and identified [17]. Accordingly, opportunities exist and people might become aware of them; however, individual dissimilarities, such as preceding information, entrepreneurial activeness, awareness, and an inclination to allow risks, influence on who will realize and exploit the future prospects [18]. Other theory is of opportunity creation, is based on entrepreneurial awareness, resourcefulness, and societal collaboration [17, 19]. In contrast to prospect discovery, opportunity creation do not implicate prospects external to the entrepreneurs; rather, the prospects are shaped endogenously by the engagements of entrepreneurs to exploit new services/products. One can therefore say that there is no future prospect “waiting to be acknowledged”; what occurs is that an entrepreneur constructs the prospects and perceives how customers and marketplaces react to the created services/products [17]. The findings point towards the general entrepreneurship concepts may be valid in the field of cloud computing for emerging economies to develop. However, the high insight in these theories may overlooks the deeper, environment specific settings. Overall, this study highlights the possible opportunities in which features enabled by cloud computing and gaining the prospects for the macro economic growth of the country. This study also contributes to the research by developing a framework that demonstrates how different pathways can lead to the detection and exploitation of economic based opportunities through Information research and development. Cloud computing may bring competitive advantages with opportunity creation in the nation-state.

As the capacity of the data center improves, IoE locally generated data can be transmitted to a datacenter and the remaining data will be still available for data analysis through virtualization, which allows analyzing distributed data sources. The rapid growth in the adoption of multiple devices of end users, consumers and businesses, is also an important factor in the transition to cloud-based services, which can provide universal access to content and applications from any device in any position. Along with the growth of consumer devices of the internet population and properties of multiple devices, a significant growth in the use of cloud services, such as cloud storage consumer, also called cabinets personal content, can be observed. In addition, the proliferation of tablets, smart phones and other mobile devices allow access to the content of personal

lockers convenient for the user. In 2018, it is expected that 53 percent of the population of Internet consumers will use personal cloud storage, compared with 38 percent in 2013. The SME sector still is warming for this. While companies and individuals have realized the potential of these services for both personal and business needs, many activities have been happening in SME sector. Technology is enabling companies to develop new and grow business in new ways. The expected technology trends are: (a) Network simplification; With more than 20 billion connected devices expected by 2018, work on regional network will be crucial to enable the network to support Internet of Everything (IoE). The organizations focused on ensuring the security of the Internet of things. It will bring the new architecture options of digital security platform, variations on hybrid IT / IOT integration and new industry standards. IT managers will have to adapt to the differences in the technologies through those areas and develop technology and multifunctional for the safety and risks of IoT method. (b) Real-time analytics; Small start-ups are leading the wave of innovation around real-time analysis. In 2016, it is expected that the combination of real-time analytics and cloud computing will help optimize the exploitation of natural resources, from agriculture to oil fields. (c) Growth of encrypted traffic; Encryption of traffic will be a growth accelerator of the Internet economy. In 2016, it is expected that organizations improve their focus on encryption and privacy of information converge [2].

V. WAY FORWARD

Videoconferencing, blogs, messaging, wikis and instant business flows are becoming the norm as companies push to connect employees in groups, skills and geographical boundaries. As almost 60% of services in the cloud using industry today, it is clear that cloud-computing will not only stay here, but also grow exponentially. There are several technological trends that the market for cloud computing will be face, which are; The rise of the hybrid cloud which will end the debate about whether to go to the private cloud or public cloud. Businesses today is more finding practical to combine large volumes of data with cloud computing. The combination offers companies what can be called the most practical way to get a scalable way to make a good position in the highly competitive global market. Cloud computing simplifies the whole process that people can access sensitive corporate data and applications on their personal devices - which can be their smartphone or tablet. The performance of high-end gaming and graphics applications otherwise requires substantial investment in hardware infrastructure. With cloud computing, this is no longer true. It is expected that cloud-based applications using game theory will witness a rebound in 2016. Figure 2 shows proposed IaaS Architecture. Over the years, the dispersion of cloud offerings in the market of Pakistan has seen a dramatic increase. SMEs are estimated to be a large market for cloud service providers with key areas is the demand for disaster management of remote data recovery database, and e-mail hosting. On the other hand, for the preparation of the expected demand, the IT industry of Pakistan has also seen

an increase in the number of cloud partners that cater to SMEs in the country channel. While the market for cloud computing will continue to grow, we will see new tools and approaches that will emerge to support the migration of applications, as well as the most comprehensive cloud migration. This means a greater integration with continuous integration, testing and deployment for cloud based applications for rapidly changing the business needs. These approaches will help more applications to find their way to the cloud and increase the need for an increased capacity of the cloud. Just as agile software development has changed the way in which it is encoded, we are seeing a cloud platform is accelerating business computers in order to turn ideas into applications. Having a common platform for the development of organizations can allow their teams to create and test their ideas quickly in a matter of days instead of months [2].

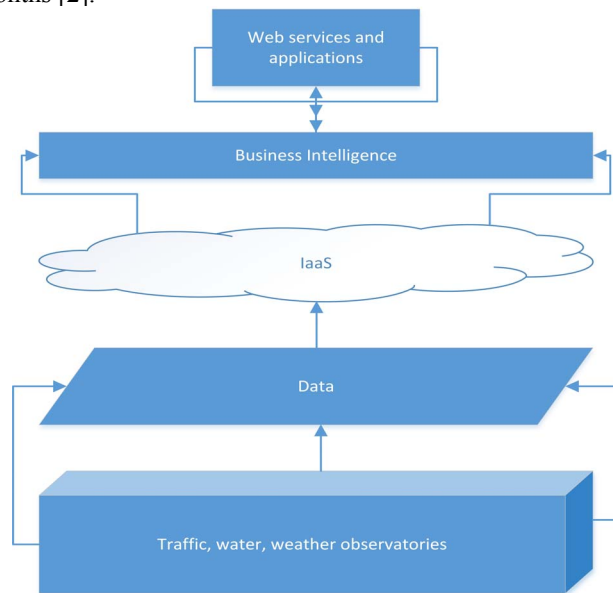


Figure 2. IaaS Architecture

VI. CONCLUSIONS

Pakistan is far away as far as latest advancements and adoption are concerns, especially in the financial sector, some argue it is because of how government handles the commercial sector and it may causes entrepreneurs to stay away from the sector. Technology is a vital need that can keep us in pace in this fast moving world of Information and emerging sciences . Time has arisen for Pakistan to legislate the e-commerce industry, and to keep it up with e-businesses like, Alibaba and Amazon and have huge potential to create these replicas and make assured that businesses has set of defined protocols for carrying out e-commerce [20, 21]. Cloud communication activities in Pakistan are in its early days. As we have emerged a large number of new companies in all segments, the legal situation has stabilized considerably and created a much healthier overall environment. There are a lot of products and services innovation happening from both new and established players. The industry must go through the following trends

in the coming days, the accelerated growth of new channels of communication, industry consolidation, entry of global players, and the emergence of mobile business applications next generation.

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