Providing E-Governance Services To Technologically Challenged Grassroots Environments

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Abstract- Today a number of government services in developing countries are online. In majority they are merely showcasing more of their assigned responsibilities and in a few cases the endpoint reports of achievements, and providing a feedback link that is rarely attended to. Even in cases where citizens could be involved and benefit from government wide information services, the infrastructure is either not available or is prohibitively costly, thereby inhibiting their engagement and transactions. But technologies abound that could be harnessed to cheaply bring governance services nearer to citizens so that the self-serving government activities may be transformed to e-governance service platform. This paper proposes a framework for harnessing the potentials of current developments in mobile and cloud computing technologies to provide e-governance services to technologically disadvantaged grassroots environments. Firstly, it proposes enablers that would help the citizens to participate in governance and democratic activities by accessing and contributing to it, using tools already available and familiar to them. Secondly, it seeks to galvanise researches into the potentials of emerging technologies; mobile government and cloud computing, which can be use to adapt e-governance for societal transformations.

Keywords: E-governance, M-government, Cloud-computing, Success, Acceptance and Challenges

I. INTRODUCTION

The "e-Africa initiative for good governance: building e-governance capacity in Africa" workshop was organised by the NEPAD Heads of State to stimulate the use of ICT as a driving force to foster social and economic development of the continent [7]. Their first on "Building e-Governance Capacity in Africa", addressed these issues at the level of policy and decision makers, stressing the significant development role and crosscutting impact that ICTs can have on all aspects of society.

The promoters of the e-Africa conference recognized the need to mobilize the African and global public administration and ICT communities for e-governance in Africa and agreed on an overall "Framework for Action on e-governance for Africa". It was recognized that the appropriate use and integration of ICTs in the community can enhance and support social and economic development. The objectives were the enhancement of good governance and democracy by ensuring linkages, networking and community cohesion.

The integration of ICTs into governance contributes to informed populations, which are a basis for effective participatory governance. Despite the relative infancy of technology in developing countries, anecdotal evidence suggests that access to government information has a beneficial economic impact [9]. Some developing countries are already engaged in transformation of the governance process through increased citizen participation and are attempting to create an open, transparent environment through convergence of information and services [8].

A major focus of e-government is in expanding agencies' presence on the Web and making government sites more useful. The strategic objective of e-governance is to support and simplify governance for all parties - government, citizens and businesses. E-governance uses electronic means to support and stimulate good governance. Governance it self can be seen as an exercise of economic, political, and administrative authority to better manage affairs of a country at all levels; national and local. The e-governance uses Internet and other ICT applications to enhance e-democracy and e-government by providing citizens access to information and knowledge about the political process, services and choices available to them. Thus, it provides a transition from passive information access to active citizen participation [6].

The use of emerging technologies such as m-applications and cloud computing has further enhanced interactions with various online services and provide governance a platform for deeper penetration to provide: timely, transparent, accountable, efficient, and effective interaction services, improving the management of operations and the reengineering of government systems, facilitating planning and policy making processes, monitoring implementation policies and recording physical and social changes in the community, and therefore improving the quality of life of citizens.

The report [1] on Mobile Applications on Health and Learning stated that Information and Communication Technologies (ICT) have an immense impact on virtually all aspects of our lives and could play a critical role in governance if properly harnessed. The rapid progress of these technologies opens completely new opportunities to attain higher levels of development. Their capacity to reduce many traditional obstacles, especially those of time and distance, is benefiting millions of people in all corners of the world.

In underdeveloped countries that suffer from missing wire-based infrastructures, mobile technologies could offer better opportunity for communication.

Mobile phones are often the only way for people to communicate with each other over longer distances and have become an efficient opportunity for governments to get in contact with citizens. Mobile devices are usually always carried and always on. Hence, these devices are perfectly suitable to act as end-point for services that should be available and accessible independently of the user's location and context.

As 3G networks are becoming increasingly available courtesy of ISPs, Smart phones and other kind of mobile devices such as navigations systems, e-book readers, tablet PCs, etc., are currently gaining popularity. However, from the point of view current studies by the authors, mobile phones are the most popular end devices for the proposed e-Governance services.

In [12] cloud computing is described as a universal collection of data which extends over the internet in the form of resources that form individual units held together by infrastructure providers, service providers and the consumer, and then it is accessed by various users. Cloud Computing technology uses the internet and central remote servers to maintain data and applications, which allows consumers and businesses to use applications without installation to access their personal files at any computer with internet access.

This technology allows for much more efficient computing by centralizing data storage, processing and bandwidth. It's characteristic of device and location independence; enable users to access systems using a web browser regardless of their location or whatever device they are using. As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect from anywhere.

This paper therefore advocates the integration of these technologies to reduce cost of development and usage, and thereby extend their adoption in governance especially in developing countries such as Nigeria. ICT, portable technology through the use of mobile devices (m-technology) is by far the fastest growing segment IT. Therefore, governments should key in by integrating m-technologies and cloud computing platforms to reduce ICT costs and provide cheap access to governance services.

II. WHY M-GOVERNMENT IN E-GOVERNANCE

The peculiar challenges identified in the task of providing ICT access to rural areas of developing countries in [10] will be overcome with proper integration and adaptation of m-technology and cloud computing. The initiative will among other reasons in accordance with a white paper on 'Mobile Government 2010 and Beyond' in [2], exploit the potentials of m-technologies which support and will lead to the following future trends:

- Raising efficiency through increased usage in governmental processes.
- Ensure that no citizen is left behind as governmental services are made accessible to all citizens, regardless of gender, age, nationality, income, or disabilities.
- It will help to satisfy rising needs and expectations of citizens in the context of governmental services.
- Increase collaboration between different organizations in order to assure transparency and accountability and to remain collaborative and responsive.

- Help in achieving the goals of accessibility and broadband availability which have been identified as crucial factors within the public sector.
- Provide multi-channel access which has been identified as key for successful e-Government. It therefore provides a second mobile communication channel.
- With m-Government, citizens can be mobile without losing the opportunity to participate in governmental processes.
- The adoption will help to reduce the digital gap as more citizens engage and transact businesses electronically.
- *Since in* developing rural areas, mobile penetration extends Internet penetration significantly. It will enable governments to offer governmental services to citizens in areas where current Internet access applications do not reach.
- As modern mobile phones are often equipped with integrated GPS modules, such location based processes are expected to further gain in importance in future.

The advancement in the development of powerful communication networks and mobile end devices no doubt is relevant enablers of e-Government. Certainly, the above mentioned points are important as they form the technological basis on which all m-Government services are built on. However, the sole ability to do something is usually not enough; people need to see a personal benefit, otherwise offered services are not accepted [3].

In the context of m-Government, this means that citizens need to see an advantage in doing transactions with governmental authorities with their mobile phones instead of using e-Government based solutions or personal consultations at administrative offices. Fortunately, m-Government provides several benefits for citizens compared to other approaches. The most important ones in [4] white paper have been highlighted below:

- Smart phones and similar mobile devices are usually carried and always on. Hence, these devices provide users the capability to communicate everywhere and anytime. This is a significant advantage compared to classical e-Government based solutions that usually require citizens to sit in front of a PC and hence bind them to fixed locations.
- With the always-on characteristic of mobile phones it can therefore be used to speed up the information flow between different parties such as in broadcasting urgent informational messages from the government to the people.
- Its simplicity can improve several processes in terms of efficiency and can help to save time and money.
- Mobile phones are usually very personal devices compared to computer; hence, when used within m-Government, these devices provide more personalization opportunities for targeting users.
- Smart phones and similar devices support different forms of interaction: based either on voice or alternatively on text messaging.

These choices can assist disabled people to access administrative and governmental services.

- In developing regions, mobile penetration exceeds Internet penetration. Hence, mobile phones are the only available means for people to get in contact with administrative agencies and bodies. M-Government is therefore a solution to the digital divide and can even strengthen democracy.

The above benefits of m-Government affect both citizens and governmental institutions. If developers of m-Government solution manage to ensure that all participants realize these various advantages, m-Government can become a great success. Thus, the various benefits of m-Government are of course also important drivers for its success.

III. THE SUCCESS AND ACCEPTANCE FACTORS

Although there are various advantages of m-Government compared to e-Government or classical administrative procedures, the success of m-Government is no safe bet. The identification of critical success factors for m-government has been the topic of several publications. According to [5], the success of m-Government basically depends on five critical success factors. Their contribution, mainly analyzed the situation of m-Government in India. Nevertheless, the basic ideas and conclusions can be applied to other countries and regions as well. The five critical success factors of m-Government that have been identified by them are briefly described below:

IV. INFRASTRUCTURAL INVESTMENT

Infrastructural investment has been identified as one critical success factor for m-Government, especially in developing countries. The report shows that in India, the development of required infrastructures is often impeded by missing financial resources. This situation can be found in other developing countries as well. They suggested an intensification of public private partnerships (PPP) in order to carry along the private sector in the infrastructural development.

Regulatory and political environment

An appropriate legal framework has to be in place. The framework has to ensure that m-Government services are based on a solid legal basis. Furthermore, for the telecommunication sector it will ensure competitive market situations, which in turn may lead to better services for citizens.

Awareness and acceptance:

The development and rollout of m-Government services is only the first move. Awareness and acceptance of offered services by both citizens and employees of government departments is crucial too. Hence, in order to avoid frustration on both sides, new m-Government services need to be well introduced and participating parties; citizens and employees of administrative bodies, should be provided with related information and training. Only if all participants are familiar with the available m-Government services, will they be willing to use these services and benefit from them. Awareness and acceptance are therefore critical factors for the success of m-Government initiatives.

Security and privacy:

Security is an important requirement for any ICT system that deals with secure or privacy sensitive data. This applies especially to m-Government services because of several reasons. The previously mentioned point has emphasized the importance of acceptance of m-Government services by citizens. Vital conditions for the acceptance of such services are security and privacy. M-Government services won't be accepted and used by citizens if they do not trust them. Users want to be sure that their personal data is processed securely by these services and cannot be accessed or stolen by unauthorized parties. The situation is even more critical with m-Government, since mobile devices are especially prone to loss or theft and usually have only weak built-in security mechanisms. Thus security and privacy are therefore critical success factors of m-Government services.

Equitable access

Kavita et al in [2] stated that equitable access to information is identified as 'one of the most vital principles in the emerging global information economy'. Thanks to quickly growing mobile penetrations, mobile communication technologies and especially m-Government services have the power to contribute to the equitable access of information. Thus equitable access is therefore another factor that will significantly impact the success of m-Government.

The identified success factors have been ranked in [11] according to their importance for successful m-Government. 'Privacy and security' have been considered as the most important factors followed by 'infrastructure'. Also 'user needs and preferences' as well as 'quality and user friendly applications' have been considered to be of significant importance for the success of m-Government. The ranking emphasizes the demand that m-Government applications should be mainly driven by user needs.

V. HOW THE FRAMEWORK

The strategy for extending e-government service by making it mobile is hinged on Cloud computing - computing resources delivered as a service over a network, as the backbone of the framework. Cloud computing relies on sharing of resources to achieve coherence and economies of scale similar to a utility (like the electricity grid) over a network. Underneath of cloud computing is the broader concept of converged infrastructure and shared services.

Figure 1, illustrates the span of this framework in its operation. The cloud-shaped symbol is an abstraction for the complex infrastructure it contains. Cloud computing entrusts remote services with a user's data, software and computation.
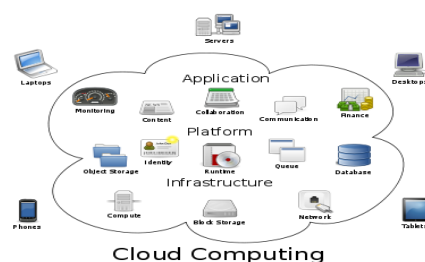

Figure 1: Cloud computing logical diagram from. [12]

Users; governments, citizens and businesses can key in into the cloud's many service options such as Infrastructure, Platform, Software, Storage, Security, Data, API, Desktop, etc, which can be offered (or rented) as services. Users can reduce costs by letting any or some of the services to provide end users access to information to.

End users access cloud-based applications through a web browser or a light-weight desktop or mobile application, while the business software and user's data are stored on servers at a remote location. Cloud advocates claim that this arrangement allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and enables IT to more rapidly adjust resources to meet fluctuating and unpredictable business demand.

VI. SERVICE PROVISION MODELS

The public cloud computing model is where service providers make their computing resources available online for the public. It allows the users to access various important resources on cloud, such as: Software, Applications or Stored data. One of the prime benefits of using public cloud is that the users are emancipated from performing certain important tasks on their computing machines that they cannot get away with otherwise, these include: Installation of resources, their configuration; and Storage.

Cloud computing providers offer their services according to three fundamental models as shown in figure 2: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS), where IaaS is the most basic and each higher model abstracts from the details of the lower models.
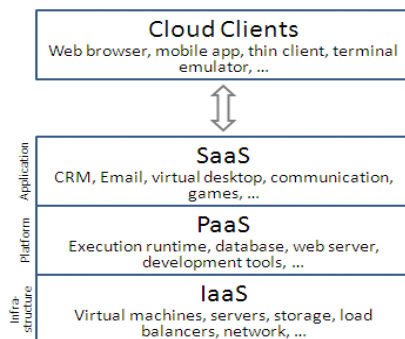

Figure 2: Cloud computing Model [12]

Infrastructure as a Service

In this most basic cloud service model, cloud providers offer computers, as physical or more often as virtual machines, and other resources. The virtual machines are run as guests by a hyper-visor. The management of pools of hyper-visors by the cloud operational support system leads to the ability to scale to support a large number of virtual machines. Other resources in IaaS clouds include images in a virtual machine image library, file-based storage, firewalls, load balancers, IP addresses, virtual local area networks (VLANs), and software bundles. The providers supply these resources on demand from their large pools installed in data centers. For wide area connectivity, the Internet can be used or in carrier clouds dedicated virtual private networks can be configured. To deploy their applications, cloud users then install operating system images on their machines as well as their application software. In this model, it is the cloud user who is responsible for patching and maintaining the operating systems and application software. Cloud providers typically

bill IaaS or any of the services on a utility computing basis, that is, cost will reflect the amount of resources allocated and consumed. This way the cost is borne by end user not government while leveraging the services.

Platform as a service (PaaS)

In the PaaS model, cloud providers deliver a computing platform typically including operating system, programming language execution environment, database, and web server. Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers. With some PaaS offers, the underlying computer and storage resources scale automatically to match application demand such that cloud user does not have to allocate resources manually.

Software as a service (SaaS)

In this model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients. The cloud users do not manage the cloud infrastructure and platform on which the application is running. This eliminates the need to install and run the application on the user's own computers, thus simplifying maintenance and support.

What makes a cloud application different from other applications is its elasticity. This can be achieved by cloning tasks onto multiple virtual machines at run-time to meet the changing work demand. Load balancers distribute the work over the set of virtual machines. This process is not noticeable to the cloud user who sees only a single access point. To accommodate a large number of cloud users, cloud applications can be multitenant, that is, any machine can serve more than one cloud user organization.

It is common to refer to special types of cloud based application software with a similar naming convention: desktop as a service, business process as a service, test environment as a service, communication as a service.

A public cloud is usually established where several organizations for our purpose governments that have similar requirements seek to share infrastructure. In addition, it can be economically attractive as the resources (storage, workstations) utilized and shared in the community are exploited.

Advantages of using Public Cloud

For obvious reasons, public cloud is bound to offer a multitude of benefits for its users. Some of the most important ones are mentioned here:

1. Efficient storage and computing services
2. Inexpensive, since all the virtual resources whether application, hardware or data are covered by the service provider.
3. Allow for easy connectivity to servers and information sharing.
4. Assures appropriate use of resources as the users are required to pay only for the services they require.
5. Highly reliable and redundant.
6. Widespread availability irrespective of geographical precincts.
7. Sets the business people free from the hassles of buying, managing and maintaining all the virtual resources at their own end, the cloud server does it all.

8. Public clouds, in today's advanced workplace, empower employees and enable them to become productive even when outside the office. The SaaS model ensures that corporations save on IT expenditures while delivering the flexibility of productivity software on the cloud.

VII.CONCLUSION & FUTURE WORK

Over the last two decades, there have been great strides in developing and deploying ICTs, The facts still remain that many developing countries are a long way short of computerizing and building the needed telecommunications infrastructure on which many of the advanced e-government systems are based. Government need to be more proactive by contacting the technology market for customable software to meet their cultural context. There are challenges though, of which the summary can be made in six (6) C's; capital, content, capacity, community, commerce and connectivity.

The test of how strategically prepared we are to meet these pre-conditions should be carried out before further funds are outlaid for projects in e-government. In addition, the tactical challenge of choosing and closing in the reality gaps by employing good technologies and designs are critical to these types of projects. We need to adopt good and best practices in the development of e-governance systems to be successful.

The opportunities provided by e-government are economic development and the general improvement in the quality of life, efficient and effective monitoring systems to check corruption in government setups. E-government can narrow the development gaps of the urban and rural areas especially when it is mobile. It also affords citizen access to online services anytime, anywhere in the world thereby enhancing the interaction of citizens with government and businesses. Countries with e-governance systems have news and online registration forms and citizens can give government feedback on request.

E-governance has got the power to transform a nation using relevant ICT tools. It provides the basic change potentials for development through automation of all of government processes using the relevant information gathered to transform society.

E-governance system provides cheaper outputs at lower cost in less time with considerably more innovations.

Clearly, there is much to be done to improve the performance of work, reduce corruption in government offices and to raise the income levels and the physical quality of life of people. This requires greater involvement of the people and greater transparency. These objectives are best met through electronic governance which can be enhanced through m-government.

Notwithstanding the challenges, e-governance has a key roles to play in the current and future development of any country. It can greatly improve the efficiency and effectiveness of governance; and probably offer future legitimacy for governments.

However, the issue for us in the developing countries should therefore be how e-governance can be developed with scarce resources to meet our social and cultural context? In addressing the "how", this paper has shown that we can improve as a nation if we plan ahead and take the necessary steps to develop real-time systems through integrating and adapting mobile government and cloud computing technologies in governance service delivery. Policy makers and implementers need to establish and sketch a clear roadmap to give direction to support these infrastructures. Also our leaders and other stakeholders need to be in the forefront to integrate their vision into the overall concepts of e-governance.

We need to employ best practices that are needed to close the reality gaps and to steer E-governance projects to success.

It is very necessary for governments and other international agencies to organize seminars and conferences on e-government to establish clear cut guidelines to help member countries to develop e-governance system. In all, good governance can be developed when resources are carefully managed to take advantage of the technologies available. The question then is will governments have the courage to commit scarce resources into such capital-intensive adventure?

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