Cloud Computing as an Emerging Technology and its Associated Ethical Issues: Experiences that may be shared between Europe and Africa

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Abstract: This paper will look at research results so far realised from an EU project that has been looking at identifying emerging technologies and their potential related ethical issues. In keeping with the thematic priorities of the conference, the paper will focus on Cloud Computing; one of the projects identified technologies, in relation to its potential benefits and potential ethical issues for would be users, especially in the area of business. As findings stem from an EU project mainly concentrating on the EU, the paper will look at benefits and ethical issues of such an emerging technology basing the results on a more general level. However, the paper will also pay particular attention to Africa by looking at implications of Cloud Computing on Africa. This is in order to understand potential commonalities and cross-overs that may result from the adoption and use of Cloud Computing between the two geographical spheres as well as to understand, share and learn of potential ethical consequences which may to a certain extent be different due to different circumstances between the more developed EU and the still developing African continent.

Keywords: Cloud computing, Emerging Technologies, Ethical Issues, EU, Africa.

1. Introduction

Information and Communication Technologies (ICTs) have become ubiquitous in many if not all facets of our lives. These areas are varied and range from health, education,

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agriculture and business to name a few. The technologies are not only present and used in many areas of everyday life but are also always dynamic and ever changing. The ever changing nature of ICTs means that there is potential to improve lives now and in the future. In fact it has been recognised that ICTs has been and continues to be a catalyst in the economic growths of several countries, particularly in the more developed nations like the USA and Europe (World Economic Forum; 2009). In the same vein, it is believed that similar economic growth can be experienced for less developed countries as a result of ICTs (International Telecommunication Union, 2010). To this end, it is not surprising that new technologies are constantly emerging so that there are better ways that can be found to provide even better services in everyday life which will in turn facilitate the realisation of positive economic outcomes for society. It is on this premise that ETICA, an FP7 EU funded project, has since April 2009 been identifying what possible emerging technologies might be realised in the next 10 to 15 years with a view to understanding ethical issues related to these technologies and applications as well as services based on these technologies. It is this backdrop that provides the premise of the objectives of this paper.

One might wonder why if technology is intended for positive outcomes would there be need to understand ethical issues. The reason is, although technology is usually developed to improve lives and better society, it is also the case that unwanted and/or unexpected consequences do emerge as well. For instance, concerns over privacy have surfaced as a result of using social networking sites such as Facebook (see: http://www.bbc.co.uk/blogs/haveyoursay/2010/05/are_you_worried_about_facebook.html) notwithstanding privacy concerns over Google street view (See http://www.bbc.co.uk/news/technology-11370647) to outline a few examples. As such the project is of the view that in order to avoid or lessen unwanted or unintended consequences of future and emerging technologies such as those that may result from Cloud Computing, which is a technology that this paper will concentrate on, it is better to identify them early on in their emergence and by so doing try and find solutions at an early stage of development or adoption. In this paper a technology is deemed emerging when there is tangible evidence of it being realised in the medium term future as suggested through literature sources, scientific, government/policy, industry and academic discourse. Examples of this can include (The Economist, 2009; Choo, 2010; Kundra, 2010).

With the knowledge that technology is ubiquitous and filters around the world, it is clear that technology knows boundaries. As such it cannot be said that technology will be confined to one geographical region or be specific to the developed world even though the developments are usually from there. Therefore, it is imperative to not only understand the impact and benefits of emerging technologies like Cloud Computing as a potentially universal technology due to technologies ubiquitous nature but to also look at and understand their potential ethical issues contextually and at application level in both developed and less developed countries. Such an understanding will in turn help to understand the real economic possibilities that may or may not result in the uptake of such new and emerging technologies. This is more-so because such technologies have the ability to propel business entities to partake in the global economy. As Phukan and Dhillon (2001) state:

> *Technology can be used to bring about organisational change, to enhance a company's competitive advantage, and to bring efficiency to operations. For a company that operates in the global economy, technology can provide the additional benefits of overcoming barriers such as time zone differences, geographical separation, and training in difficulties. Thus, changes and advances in information technology, including computers, telecommunications, and office automation have brought global*

markets and global competition to the doorstep of even the smallest companies (2001, p. 2).

With the above stated the question remains as to what ethical issues may arise from emerging technologies like Cloud Computing and in addition what impact the issues might have on business growth and as a consequent economic growth in Africa. Aspects of this will be discussed in later sections.

2. Objectives

1. To give a general description of Cloud Computing and its defining features
2. To outline the benefits of Cloud computing
3. To highlight and understand the subsequent ethical issues of Cloud Computing
4. To discuss areas of similar benefits and possible differences of Cloud Computing between the EU and Africa in relation to its uses and unwanted consequences

3. Methodology

There are two areas to concentrate on in the Methodology, the first is on how a technology, such as Cloud Computing was identified as an emerging technology and secondly on how its potential ethical issues were identified:

3.1 – Identifying Cloud Computing as an Emerging Technology

During the first phase of identification of emerging ICTs, data from the following sources was considered:
- Research publications and foresight studies and activities
- Industry / trade journals
- Policy-oriented publications (e.g. parliamentary or government publications)
- Research policy and programme descriptions (including research calls from the EU, US, Australia, Japan, others)

The above data sources mainly concentrated on ICTs that would be a reality in the next 10 – 15 years. Sources were looked at in relation to five areas:
- Technology Description
- Application areas
- Defining features
- Related technologies and
- Critical issues that were likely to arise from the technology(ies)

The data collected was then validated by focus group discussions that allowed end-user, lay person participation. There were two focus group discussions on the subject which were held in the United Kingdom with a total of 20 participants and in Finland which had a total of 9 participants. Questions related to Cloud computing included participants perceptions of Cloud computing as an emerging technology and potential ethical issues that may result as the technology is fully realised.

3.2 – Identifying Ethical Issues of Cloud Computing

The next stage was to identify the resulting ethical issues of Cloud Computing. This was done through:
- An analysis of the Technology description and through
- Focus group discussions

4. Technology Description of Cloud Computing

One can state, that Cloud computing is a recent trend in IT that moves computing and data away from desktop and portable PCs into large data centres. It basically means that software, different kinds of services and applications are all delivered as services over the Internet as well as to the actual cloud infrastructure (Dikaiakos et al 2009, Gartner 2009).

From a user point of view, it means that a user can access their files, data, programs and other services from a Web browser via the Internet that are hosted by other service providers (Won 2009). On the other hand one can also look at Cloud computing from a more general view and define Cloud Computing as a style of computing where scalable and elastic IT-enabled capabilities are delivered as a service to external customers using Internet technologies. As enterprises seek to consume their IT services in the most cost-effective way, interest is growing in drawing a broad range of services (for example, computational power, storage and business applications) from the "cloud," rather than from on-premises equipment. The levels of hype around Cloud computing in the IT industry are deafening, with every vendor expounding its cloud strategy and variations, such as private Cloud computing and hybrid approaches, compounding the hype (Gartner 2009, Won 2009).

4.1 – Defining Features

There are several defining features of Cloud Computing which lend to some of its areas of use. These include the following:

Resource/storage virtualization: The resources and services are delivered to users and/or organizations via Internet from resource clouds where almost all information and tools are preserved. Resources can be added or removed based on the changes in needs. The services could be provided by "pay per use pricing" model. The storage of data may well be in multiple physical locations across many servers around the world possibly owned and administrated by various organizations. There may also be interconnections of multiple services across the cloud. At different levels functionality of different providers is connected to provide a specific service to an end-user. From a business point of view, the most important change is that Cloud computing shift software business from product business to service oriented business.

Scalability, elasticity, efficiency of resource sharing and usage optimizing/optimized by usage: Resources from the service provider are thought to be used with maximum efficiency and serve multiple needs for multiple parties at the same time, as they are shared with other consumers or organizations. People or organizations might not know where the information or services are coming from or where their information is preserved.

Accessibility, ease of usage, fast information sharing, delivery and control: Ease of use of cloud services is emphasized in many scenarios. The service experience is assumed to be smooth and quick with very fast and optimized connections. As one does not have to install anything on their own computer, it is assumed that one will always have the most suitable version of the software and service and that the incompatibility with products and services will not be a problem. On the other hand if the system or service updates automatically then service could also appear as totally different every time one uses it.

From the above defining features, it is therefore feasible to suggest a few application areas where Cloud Computing might be applied and may include but are not limited to:

Nomadic Business Organisation

Where businesses are able to operate fluidly by being able to access information from anywhere and at any place.

Cloud-delivered environments being used within various organizations
There is shared usage of resources and information, particularly for organisations that might be in partnership with each other but are scattered around different localities.

5. Business Benefits for Africa
From the technology description and application areas given above, it can be argued that there are clear benefits in the adoption and use of Cloud Computing especially in business. This is applicable both in Europe and in Africa especially for its business entities. For developing nations especially, such benefits can be advantageous in the growth of business partnerships and by direct implication the development of respective countries. Some of the benefits for African business will include:

5.1 – Access to Technological Infrastructure

Concern for Africa's technological infrastructure has for a long time being singled out as a one of the major hindrances in the utilisation of technology for economic growth (ITU, 2007). With the advent of Cloud Computing and when one looks at its defining features as described above, the case can be made that businesses, especially small scale businesses who are hindered in their expansion due to limited technological infrastructure are likely to have much more access to technological infrastructure. This may potentially enhance their chances to compete on a large scale and as a result attain business growth such as expanding services and clients beyond their local environments. This will be through the possibilities that Cloud Computing allows which is the ability for businesses to be able to use the infrastructure available to store data, access it from anywhere as well as share it between different entities with similar aims where desired. In turn, this may also take away the issue of spending on hardware and software which as a result may lessen costs that may be a consequence of upgrading or keeping up to date with the latest business technological developments.

5.2 – Shared Resources

As Cloud Computing allows for shared resources, it can be said that such a capability might result in a cut in hardware as well as software costs. For Africa especially, "sharing" is a trait recognised at different levels and in different situations. As Heeks (2009) intimates:

This fits well with the Southern pattern of shared ICT access where – for example in the local cybercafé – users cannot guarantee to be using the same client device every time. (2009, p. 7).

Furthermore, cybercafés have for a long time allowed users who have not been able to afford internet access in their individual capacities to be able to have access through such platforms. The Cloud Computing architecture can therefore be a new focal point which allows for shared access.

5.3 – Electronic Collaboration

As Goonatilake et al (2009) have observed, technological advancements allow for e-collaborations which are advantageous for facilitating and expanding both local and international trade notwithstanding the promotion of trade as well. This means that African

businesses can take advantage of this possibility to build new business relationships as well as to acquire and share knowledge in their area of business.

5.4 – Easy Data Storage, Delivery and Accessibility

As highlighted previously, Cloud Computing it would seem would enable easy access to data storage as well as delivery. This will allow clients to be able to access services much more easily and quicker at potentially less cost. In addition, because this is a service provided by other organisations, clients will not necessarily have to worry about IT maintenance and associated updates.

With the above potential benefits for Africa as a result of Cloud Computing, the question of its ethical implications has to be explored in order to understand how far the possibilities that may be afforded by Cloud Computing will go and how far they may be limited as a result of associated ethical issues.

6. Cloud Computing and its Ethical Implications

If as Quinn (2006) suggests, ethics is "a rational examination into people's moral beliefs and behaviour" (p. 55), we then have to consider ethics as about moral issues and values and about the principles as well as practices that are ascribed to in daily life and with that then consider how challenges of Cloud Computing might affect the adoption and use of the technology. In addition, if we are to go with Bynum's (2008) observation on the subject of computer ethics as being:

> *...concerned for the protection and advancement of central human values such as life, health, security, happiness, freedom, knowledge, resources, power, and opportunity. (2008, p. 36)*

then it is right to understand not only the benefits of technologies like Cloud Computing but also the disadvantages that may result thereof. Because ICTs have become an intrinsic part of our everyday lives, ethical issues of ICTs will be about how ICTs have impacted our lives and with that the moral issues resulting or likely to result from the impact. In addition, ethical issues of ICTs will be about how ICTs are being used and whether the ways in which they are used uphold moral values. One would therefore expect that moral principles and values are reflected in ICTs, be it at the development and implementation stage right up to the time they are appropriated for use by the target audience, and in this case users and/or potential users of Cloud Computing. As such, any technological developments need to take into account any potential difficulties that may arise at the adoption stage, during the course of the desired deployment of a technology as well as be able to identify potential ethical issues that are likely to arise when a technology can be and/or is fully developed and ready for use within an environment. This bearing in mind, circumstances of an environment, cultural context of an environment as well as desires of that environment. Identifying such issues at an earlier stage in the development process is advantageous because improvements are likely to be considered perhaps via policy formulation and implementation. This may avoid policy vacuum concerns as observed by Moor (1985) who is quoted by Bynum (2008) in the following statement:

> *A typical problem in computer ethics arises because there is a policy vacuum about how computer technology should be used. Computers provide us with new capabilities and these in turn give us new choices for action. Often, either no policies for conduct in these situations exist or existing policies seem inadequate. A central task of computer ethics is to determine what we should do in such cases, that is, formulate policies to guide our actions (1985, p. 266).*

Although Moor is seemingly alluding to ethical issues in relation to how technology should be used, it can be argued that concerns to do with policy formulation and implementation ought to go beyond how technology ought to be used and cover issues of access as well as those issues that are brought up beyond access and use. For as this paper attempts to argue, often the issues may not be about how technology should be used but whether issues that go beyond using technologies like Cloud Computing can be lessened or dealt with at an early stage. It is therefore important to accept that ethical considerations will matter even more when looking at emerging technologies in the context of less developed countries for the simple reason that have to do with their economic standing, technological know-how, affordability to name a few. With this in mind, the following section will look at some of the ethical findings related to Cloud Computing as well as outline some ethical implications of Cloud computing for African businesses intending to take up Cloud Computing. In analysing the features given above in relation to Cloud Computing including its application areas and benefits, it became evident that they give rise to potential ethical concerns. The analysis was also done in conjunction with focus group discussions with end-users. The idea was to understand lay people's perceptions of Cloud Computing in relation to potential benefits as well as potential ethical issues.

7. Findings

7.1 Overview of Some Ethical Issues of Cloud Computing from End-User Point of View

From inception, the ETICA project has been of the view that wider stakeholder participation in the project's research process would always be enriching. This has meant that the project would not only confine itself to researchers, industry and policy makers for input and/or dissemination purposes, but to incorporate wider end-user and public participation. This has ensured that end-users, that is members of the general public, who play an important role in the uptake and use of technologies in their capacity as target audiences of technologies that are emerging and being developed have an opportunity to give their opinion on emerging technologies like Cloud Computing, hence the idea of focus group discussions. Results from the focus group on Cloud Computing suggest that although discussants were of the view that Cloud Computing would be beneficial especially in regards to saving and optimizing the use of resources, they were also of the view that it came with several ethical concerns. These are as follows:

Ownership of information

That information was stored in "clouds" was a central issue, particularly when it came to the question of who owns the information and how that information can be used. Participants felt that if all the information was kept at one place by the service providers, the service providers would seem to be responsible for it and have control over it. Thinking of these issues raised the question of trust between service providers and customers.

Dependency on technology

Discussants raised the question of what happens when users encounter problems when they have become too dependent on the technology especially in relation to interoperability of devices and systems. In particular the issue of reliability of virtualised services was raised.

Equality to access to services

Participants commented that it is not enough that users could potentially be offered access to the services without fully understanding the "behind the scene" operations. They were of the opinion that users should also be able to understand the system and be able to use the service according to one's skills. Without this, they felt such a technology would result in inequality of access to services on offer not only between people who have the skills but

between lay persons and service providers as well because the two would not be "singing from the same hymn sheet" and as such would be talking different languages.

Trust

Participants also felt that there could be issues of trust, as control of clients data would be in the hands of third parties. They indicated that although they had no doubt there would be assurances of trust, it would be difficult to see how this would be upheld, especially as there could be opportunities where some elements might unwittingly mismanage data thereby causing security concerns as well. The question therefore is how service providers will manage the risks that may result without compromising client data.

Privacy

The issue of trust then yields itself into an issue of privacy. Participants felt that where trust could be comprised, threats to privacy would not be too far off. Questions of how service providers would adhere to privacy concerns and whether there would be any policies put in place to ensure that privacy issues were adhered to were some of the concerns brought to light.

Technology addiction

Participants were also of the view that there was a danger of users become addicted to technologies like Cloud Computing which would to a certain extent leave them vulnerable to privacy problems for instance because they would become too complacent and reliant on others for service provision.

The issues raised above may have been raised by a focus group in Europe and as such the perceptions expressed may be seen as Eurocentric. However, in addressing potential ethical issues in relation to Africa, there may be commonalities and synergies with the issues above. Admittedly, there is no denying the fact that developed countries and developing countries have different circumstances, with developed countries well ahead in technological skills, technological know-how as well as technological developments which lend them to experience a better vantage point in adoption, access, use, affordability, know-how and many other elements but perhaps also to experience different ethical issues from those that Africa might experience. When it comes to developing countries, such countries look to developed countries for most if not all areas related to the technology and its aspects of technological transfer. However, even as the same technology may be used, its use may vary due to social, economic and cultural differences which may include the ability to have access, affordability, know-how, relevance, need as well as the extent with which a technology can be used including policies around ICTs. Bearing these in mind, the following section outlines some of the potential ethical issues of Cloud Computing in relation to Africa.

7.2 *Cloud Computing and its Ethical Implications for Africa*

In critically looking at and analysing the above listed ethical issues, it is clear that there are commonalities as well as differences with potential ethical issues that may arise as African businesses begin to adopt and use Cloud Computing. These will include:

Ownership

Ownership of information will be something that will concern all Cloud Computing users regardless of geographical location. Although the data and information for all intents and purposes ought to be the preserve of the clients, the fact that service providers will be responsible for it and by implication have control over it, raises concerns of autonomy and freedom to one's information be it in Africa or Europe. In addition, such a concern may even be more pertinent for African businesses due to who the service providers are or are

not. Most service providers of Cloud Computing are likely going to be within developed countries as ownership is largely going to be by large international corporations such as Microsoft, Google. This may likely hinder the development of local ICT developers who may be reliant on more developed countries to provide the technological expertise. Therefore the issue will go beyond concern of ownership to concerns of reliance, particularly as providers may not necessarily be local providers but corporate entities from developed nations. Such reliance may also lead to a loss of much more close traditional business ties where businesses did business on a face-to-face, one-to-one basis which helped to create trust.

Trust

On the issue of Trust, Molony (2007) has argued that trust may be an issue when it comes to the use of ICTs in African enterprises. This is because personal social interaction through face-to-face contact and business go hand in hand in an Africa economy. Therefore, the fact that Cloud Computing services may be provided without face-to-face contact may prove problematic for some enterprises, especially in as far as trust is concerned. Therefore, not only is trust an issue associated with control of client data as well as security but it also may have to do with establishing personal social interaction.

Equality and Digital Divide

Although equality has been raised as an issue above in relation to understanding how Cloud Computing might work, this may also apply to African businesses as well. However, in addition, equality will come in relation to whether there is ample opportunity for many businesses to be able to afford the services that come with Cloud Computing. There will of course be businesses that will be able to have access and others that may not have access. This will therefore create a gap between those who can have access and those who cannot and therefore exacerbate and not reduce the digital divide within African businesses and those outside of Africa as well.

Technological Infrastructure Issues

Major uptake of Cloud Computing might not be a reality for some or most small scale African businesses due to limited internet and broadband access. Therefore, if accessing Cloud Computing calls for accessing of services via the Internet, the Internet infrastructure would have to be improved vastly in order to make a major impact for African businesses. If this is not possible, then the issue of inequality and consequently the digital divide will continue to exacerbate not only within and between African businesses but between Africa and the developed world. Furthermore, collaboration and shared resources might be affected as a result. In their white paper, McCalla et al (2009) confirm these concerns by indicating that without robust broadband access or accelerated deployment of affordable broadband, small and medium-sized businesses might not improve their productivity. This is because in this day and age of ICT growth, such business may fail to connect with their customers; farmers to their markets; students to quality education; villagers to modern healthcare; and communities to each other to address a vast array of interests (p. 1). In a much similar argument, Williams (2010) has stated that although sub-Saharan Africa for instance realises that ICT is necessary for long term economic growth, limited broadband connectivity due to high prices and unavailability might be a hindrance to such growth and economic development. This, Williams (2010) argues, is also assuming that once there is availability and cost, there will be uptake of the technology, policy implementation permitting. In essence, Williams is also arguing for policy frameworks and standards that will ensure that the deployment of technologies like Cloud Computing become a reality.

8. Conclusions

This paper has outlined aspects of Cloud computing in relation to its potential benefits and associated ethical issues with particular focus on Europe and Africa. It is evident that with benefits come potential concerns of such a technology. Although these may differ between Europe and Africa, it is clear that there are similarities, differences as well as cross-overs in as far as ICTs and ethics are concerned between Europe and Africa. This calls to question how such issues might be resolved as emerging technologies become a reality. The need to understand and find solutions to ethical issues related to technologies like Cloud Computing may also lead to the building of partnerships that are vital for improving economies in which ICTs play a vital role. For a start, one way of trying to resolve the issues is to find a common ground within which to deal with ethical issues. Such common grounds have began to be suggested by scholars like Capurro (2008) where he calls for intercultural information ethics that addresses similarities as well as differences between different cultures. In much similar terms, Ess (2007) has argued for a global information and computing ethics that will address shared norms and values, practices and traditions of different cultures. With this in mind, the ETICA project in its findings presents an opportunity for Europe and Africa to forge linkages and therefore share knowledge, experience and understanding in the area of emerging technologies like Cloud Computing and its potential ethical issues, while bearing in mind that the benefits and ethical issues of such a technology might differ according to needs and circumstance of the two regions. The project continues with a look at governance structures that address areas within which ethical issues of ICT may be looked.

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