

Southern African Internet Governance Forum

Issue Papers¹ No. 1 of 5

Emerging Issues: Cloud Computing

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Table of contents

1.Introduction: Emerging issues.....	1
2.Cloud computing.....	2
2.1 What is cloud computing? Definitions.....	2
3.Cloud computing for development?	3
3.1 Opportunities.....	3
3.2 Challenges: bandwidth, quality of service and data limits.....	4
3.3 Economic development issues: innovation and effects on the IT industry.....	5
3.4 Possible solutions.....	6
4.Security, privacy and human rights issues.....	6

1. Introduction: Emerging issues

This is the first of a series of papers prepared for the Southern African Internet Governance (SAIGF) forum that serve as an introduction to the themes to be discussed at the 6th Annual Internet Governance Forum in Nairobi 2011. The papers are structured to reflect the themes of the IGF, which correlate with the main sessions and related feeder workshops. The themes to be discussed in this five-part series of issue papers are 1) emerging issues; 2) security, openness and privacy; 3) access and diversity; 4) critical internet resources; and 5) internet governance for development.

These papers are intended to provide an introduction to the possible issues to be discussed at the IGF and to stimulate debate during the SAIGF. The papers raise more questions than they answer and are not intended to inform policy recommendations or provide detailed analysis of any of the issues to be discussed at the IGF.

This paper will address the theme of “emerging issues”. This theme is a forum for any new issues of importance to be discussed. Workshop proposals accepted so far for the 6th Annual Internet

¹APC and SANGONeT would like to thank the Open Society Initiative of Southern Africa (OSISA) for making this issue paper series possible. The papers provide a background introduction and were produced especially for the SA IGF. They do not necessarily reflect the position of the organisers.

Governance Forum (IGF) in Nairobi seem to include the mobile internet, copyright, cloud computing, conflict minerals, ICTs in the environment, ICTs for disaster preparedness, and ICTs for civic engagement and political change, among other issues.²

The first two volumes of this discussion paper series will focus on emerging issues around (1a). could computing and (1b.) the mobile internet. Cloud computing was the main topic of the plenary of the 5th Annual IGF in Vilnius, and continues to be a topic of importance in 2011. Both issues are becoming increasingly related as many mobile phone applications and mobile websites become reliant on cloud computing services.

2. Cloud computing

2.1 What is cloud computing? Definitions

You may be familiar with services that involve cloud computing. Some web-based email services are examples of cloud computing implementations. Other examples are web-based document storage, editing and collaboration tools. Cloud computing services are also used for web-commerce. Increasingly web applications are making use of cloud computing, and many contemporary websites use and integrate a number of cloud computing services.

Cloud computing is a hard topic to define. One should try not to be bogged down with trying to find an exact definition, and should rather pay attention to its characteristics. The US Department of Commerce's National Institute of Standards and Technology defines cloud computing as:

"a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be **rapidly provisioned and released with minimal management effort or service provider interaction.**"³

Wikipedia defines cloud computing as:

"the delivery of computing as a service rather than a product, whereby shared resources, software and information are provided to computers and other devices...

Cloud computing provides computation, software, data access, and storage services that **do not require end-user knowledge of the physical location and configuration of the system that delivers the services.**"⁴

According to Frank-Charles Osafo, of Vericloud (Ghana) and the Patrina Corporation (USA) speaking at the plenary of the Emerging Issues session in Vilnius, a key element of cloud computing is that "services operate consistently regardless of the underlying systems."⁵ Cloud computing is importantly compared to a utility such as an electricity grid because "end-users

² See Internet Governance Forum 2011 Workshop Proposals, intgovforum.org/cms/w2011/proposals

³The NIST Definition of Cloud Computing (Draft), accessible: csrc.nist.gov/publications/drafts/800-145/Draft-SP-800-145_cloud-definition.pdf (added emphasis).

⁴ http://en.wikipedia.org/wiki/Cloud_computing last accessed 17th August (added emphasis).

⁵ Frank-Charles Osafo speaking in speaking at the IGF 2010 plenary/main session: "Emerging issues: Cloud Computing", 6th Annual Meeting of the Internet Governance Forum, Nairobi, 17 September 2010 (transcript: intgovforum.org/cms/component/content/article/102-transcripts2010/674-cloud, video available at webcast.intgovforum.org/ondemand/)

consume power without needing to understand the component devices or infrastructure required to provide the service."⁶

3. Cloud computing for development?

From a development perspective, it may be necessary to discuss the following issues: What possibilities are there for the use of cloud computing for sustainable development? What are the obstacles to using cloud computing for sustainable development? What particular developmental challenges does cloud computing present? What particular challenges are presented to Africa? How can Internet governance encourage the use of cloud computing for sustainable development?

3.1 Opportunities

At the Vilnius plenary on emerging issues, which focused on Cloud computing, Algimantas Juozapavicius, chair at the 2010 IGF session on cloud computing said in his opening remarks:

"imagine a world with technology on tap where people can access computing services on demand from any location without worrying about how these services are delivered and where they are hosted. We expect this vision is now becoming a reality."

He added also that "clouds are expected to be an essential and core component for development."⁷

In the same plenary it was also pointed out cloud computing is expected to enable small and medium businesses to enter the market with lower up-front costs to operate without a large IT department. Cloud computing offers NGOs, government, universities, hospitals and others the opportunities of reduction in IT costs and the rationalization of certain services through economies of scale.

Cloud computing offers a chance for reliable online digital storage of files, often quite helpful for users accessing the internet from mobile phones or internet cafés, and without large storage devices. Cloud computing transfers much of the processing required to use web applications away from the browser as processing is done "in the cloud" in the distributed infrastructure (e.g. servers) of the cloud computing service. Cloud computing is thus in theory quite friendly to cheaper devices with low processing power, and lower storage capacities..

As more processing happens "in the cloud", and more data is stored "in the cloud", the requirements for processing and storage capacity on entry level devices become lower. Cloud computing has indirectly contributed to the growth of the "netbook" and "simputer" market, which has resulted in the prices of entry level computers going down quite significantly. There are now "80 dollar netbooks"⁸ and a large amount of devices running simple and cheap hardware with simple and cheap operating systems. A netbook with a modern operating system (Windows 7

⁶ http://en.wikipedia.org/wiki/Cloud_computing last accessed 17th August

⁷ Algimantas Juozapavicius – Chairman of the IGF*, speaking at the IGF 2010 plenary/main session: "Emerging issues: Cloud Computing"

⁸ Charlie Sorrel, \$80 Windows CE, Netbook runs fast, *Wired* 17.12.09 wired.com/gadgetlab/2009/12/80-windows-ce-netbook-runs-fast/

Starter, or Linux) capable of running office applications (in the cloud, and locally) and playing audio visual media can now be purchased from US\$200 to \$US400.⁹ Whilst this price is not accessible to most, this is a significant development in the portable computer (laptop) market.

Furthermore, these devices mentioned above run a plethora of different operating system, many different versions of Windows and Linux, as well as Android. As applications move to the cloud, computer users become less reliant on specific software, and more reliant on cloud applications accessed through a web browser. The nexus of cloud computing and cheaper computers represents a developmental opportunity. The full potential of which can only be realised in Africa when the costs of internet access also fall.

3.2 Challenges: bandwidth, quality of service and data limits

If you have used cloud computing applications, you may understand the frustration, inconvenience involved in using cloud computing through slow connections. The problems include: unable to log-into or maintain a connection with online email, the online document wont load (see Figure 1.), payment has not been effected etc.. This is the result of slow and poor quality connections. These very real frustrations, often cause people to not use cloud computing services and rather to revert to traditional tools which store and manage data locally – on the user's computer.

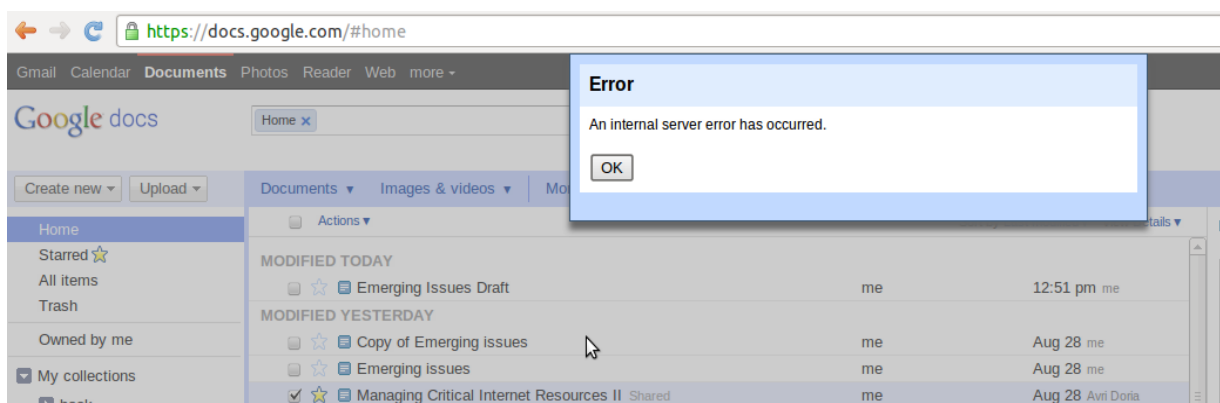


Figure 1: Google Docs exhibiting bandwidth and quality problems on 1024 KB/s shaped ADSL in South Africa

The benefits of cloud computing for development can only be realised if as President of the knowledge society agency, Ministry of Science, technology and higher education stated "there is sufficient and reliable broadband."¹⁰ Cloud computing requires "broadband of considerable speed". If this is not addressed, we may face:

a situation where the main factor of the digital divide will become the lack of high speed broadband infrastructure? What would be the consequences for developing countries and other deprived regions? What policies could mitigate the negative effects?"

⁹ Such models include the Simmbook (aimed at emerging markets and running Ubuntu Linux, possibly retailing at US\$190) and Acer Aspire One A110, Gigabyte Q2005 and Low-end ASUS EEPs (usually running Windows 7 Starter or Windows XP). See also Rudolph Muller, Simmbook: Low Cost Ubuntu Netbook, My Broadband 31.04.2011, mybroadband.co.za/news/hardware/11971-simmbook-low-cost-ubuntu-netbook.html.

¹⁰ Mr. Luis Magalhães, President of the knowledge society agency, Ministry of Science, technology and higher education, Portugal speaking at the IGF 2010 plenary/main session: "Emerging issues: Cloud Computing".

Will cloud computing leave behind those without high speed, and high quality broadband infrastructure?

Cloud computing requires not just high speed, but also high quality broadband connections, that are always connected. Whilst many websites are usable on non-broadband connections or slow broadband connections; cloud-based applications are often not usable. Connection speed in Kilobyte per second (or MB/s and GB/s) is important for use of cloud computing services. Also important are Quality of Service (QoS); indicators for which include the amount of time the connections are dropped, response time (ping), and the extent of the delays in the processing of network data (latency)¹¹ and loss of data (packet loss). If the benefits of cloud computing are to be reaped at a national development level then investment in access infrastructure, backbone infrastructure, the last-mile (or local loop). as well as regulation issues with regards to QoS issues perhaps become important?

Cloud computing can have high costs due to its requirements for both an “always on” connection, as well as using large amounts of data. This is hard for many who pay by Megabyte or by Gigabyte or are limited by a data cap (quite common in Africa). Does current pricing of data in Southern Africa encourage the developmental potential of cloud computing? Is the power of cloud computing currently constrained to those who can offered “uncapped” (unrestricted) or large amount of data?

Do current pricing regimes in Southern Africa make the use of basic cloud computing services too expensive for many to use? If at the same time businesses and corporations behind high quality broadband connections continue to adopt and use cloud-computing infrastructure, will a new digital divide emerge? A Digital Divide 2.0 between those with reliable access to high quality broadband and thus cloud computing applications and those without? How can this be addressed through, policy, infrastructure and regulation?

3.3 Economic development issues: innovation and effects on the IT industry

Many proponents of cloud computing seem to predict the increasing irrelevance of local IT, whether this is in-house IT or IT contractors. How can cloud computing be strategically used in Africa in such a way that simultaneously takes advantage of services whilst building IT capacity? It was asked during the plenary in Vilnius whether there was “a risk of market dominance by the most powerful I.T. Companies?” And can such a possible dominance “further amplify inequalities of wealth distribution in the world?”¹² If governments and corporations increasingly use cloud-services, many of which are controlled by corporations in the Global north that house much of their infrastructure there, how are we to ensure that the move to cloud computing does not deplete local IT infrastructure?

¹¹ “Latency is another element that contributes to network speed. The term latency refers to any of several kinds of delays typically incurred in processing of network data. A so-called low latency network connection is one that generally experiences small delay times, while a high latency connection generally suffers from long delays. Although the theoretical peak bandwidth of a network connection is fixed according to the technology used, the actual bandwidth you will obtain varies over time and is affected by high latencies. Excessive latency creates bottlenecks that prevent data from filling the network pipe, thus decreasing effective bandwidth. The impact of latency on network bandwidth can be temporary (lasting a few seconds) or persistent (constant) depending on the source of the delays.” From Latency, Bradley Mitchell About.com, compnetworking.about.com/od/speedtests/a/network_latency.htm. See also Ping (http://compnetworking.about.com/od/network_ping/g/what-is-a-ping.htm)

¹² Mr. Luis Magalhães, President of the knowledge society agency, Ministry of Science, technology and higher education, Portugal speaking at the IGF 2010 plenary/main session: “Emerging issues: Cloud Computing”.

3.4 Possible solutions

Corporations, Universities, governments, and the public service will begin to turn towards cloud computing services. In Africa, which companies will they be turning to? Will African governments be hosting their email, documents and businesses processes with foreign cloud computing companies? Should governments and businesses be encouraging the development of local cloud-computing companies, which one day may provide them such services? How can this be encouraged? Can this be implemented at procurement level? Do we need to invest more in science, technology and computing education?

Judging from the computing talent we have on the continent, such a suggestion should not be a pipe-dream. We should remind ourselves of immensely successful projects coming out of Africa like Ushahidi for example, a “web mash-up” developed by Kenyans for the “crowd-sourcing of crisis information” and the mapping of just about anything. Another example is Mxit, which is a global leader in mobile chat. Both are complex infrastructures that make use of the latest web technologies and cloud-computing infrastructures. Both are also leading brands in their fields. These serve as examples that there is no reason that Africa cannot and should not focus this talent in producing cloud infrastructure made for African by Africans.

4. Security, privacy and human rights issues

Cloud computing presents specific challenges to privacy and security. When using cloud-based services, one is entrusting their data to a third-party for storage and security. Can one assume that a cloud-based company will protect and secure ones data (back it up, check for data errors, defend against security breaches) if one is using their services at a very low cost? Or often for free? Once data is entrusted to a cloud-based service, which third-parties do they share the information with?

Cloud-sourcing involves the use of many services, and many cloud based services provide services to each other, and thus cloud-based products may have to share your information with third parties if they are involved in processing or transferring of your information. They may share your information with advertisers as well, as many do to help cover the costs.

Of course each cloud-based service has its own terms and conditions, or service level agreement, that the user agrees to (often without reading), and is often updated. Privacy and security issues around cloud computing can also be addressed as an education and awareness issue. People need to be aware of terms and conditions as well as to keep up with updates.

Terms and conditions between user and company cannot alone protect the privacy and security of the users information. Security can be breached, infrastructure can be damaged, and a company can become bankrupt, often leaving users without recourse. Furthermore, terms and conditions or service level agreements, may be unfair, as well as illegal in some countries, and can of course easily be broken.

As well as policy, there needs to be standards and best practices adhered to for storing, encrypting and securing data securely. Some corporations have policies about this, and some countries have

regulations about the protection of private information. But in many countries the storing of personal information by companies is not regulated.

What legislative, judicial, regulatory and policy environments is cloud-based information subject to. This question is hard to ascertain due to the decentralised and global structure of the internet, as well as of cloud computing. The information stored by cloud services is subject to the legal, regulatory and policy environments of the country of domicile of the cloud service, as well as the country in which the server infrastructure is based. This is complicated by the fact that some data in transit may also be regulated.

As more and more information is stored in the cloud these issues become pertinent, and cloud computing will continue to offer challenges to national policy and regulation as well as to internet governance, on how best to resolve privacy and security issues.

Cloud computing also raises significant human rights questions, answers to which may pose obstacles for some wanting to take up this new opportunity. For example, how do cloud computing companies keep information secure and protect rights to freedom of expression and freedom of association? What are the risks that information about human rights promotion, activism and peaceful protest activities will be subject to unwarranted government surveillance or requests for access? What human rights and law enforcement policies will cloud computing services have and how can civil society groups be involved if these are not determined in local contexts? Where do people go if they have complaints? These and other security, privacy and human rights issues need to be considered in diverse African contexts and integrated into service development and dialogue on cloud computing.