The Need for Traffic Based Virtualisation Management for Sustainable Clouds

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ABSTRACT

The subscription based model of cloud computing has allowed users to migrate their processes to off-site network facilities. One of the motivations for deployment of cloud based services is to promote sustainability by reducing green-house emissions at a local level. Although some might argue that this model saves a lot of power at local network facilities, the problem of energy crisis caused by ICT is never-ending. Today, data-centres are bee-hives of exascale computing and high network dependant processing. Work-load on the cloud directly contributes to energy consumption to an extent that currently IT clouds are some of the worst contributors to CO2 emissions. This paper discusses why traffic-management on the cloud is vital to make it more power efficient and how it can be achieved by gathering live network statistics. The discussion fits with the context of “emerging clouds” as thought needs to be given on how to apply energy efficient schemes at various points including at the communication level.

Keywords: Green Computing, Network Management, Networks, SNMP, Sustainable Cloud

INTRODUCTION

The current economic climate has resulted in businesses adopting models that are distributed and which are dependent on Internet communications. One such model is cloud computing. There is a drive from industry, service providers and government bodies to encourage businesses to realize the potential of cloud computing. The European Union considers Cloud computing as a set of technologies that could revolutionize the way businesses operate (European Commission 2014). Cloud computing refers to a large collection of virtualised services and computing applications that are delivered on a subscription based model. It encapsulates complex back-end processes and data-stores. For example, concepts like Business Intelligence as a Service (BlaaS), allows for processing business related data-sets and precision data mining using processes hosted in the cloud (Chang 2014). The concept of big-data is a result of cloud computing to address the need to host databases that can handle “out-of-the-norm” type of data. These are the type of data that could not be accommodated in traditional Relational Database Management Systems (RDBMS). For example, scientific datasets are so huge that without big-databases it would be
almost impossible to store and process them to yield any meaningful information. Therefore, the combination of big-data techniques with cloud computing is a boon for a modern society where ICT is embedded into the way of life. One of the initiatives for adopting cloud computing is the ability to develop organisational IT services and business models that are in accordance with low power consumption policies to tackle climate change (Kasemsap 2015). However, this is not without any negative implications. Hosting big-data services on the cloud will require significant hardware, software and networking resources; all of which contribute to high volumes of energy consumption. Although cloud computing architectures have endeavoured to promote the green theme, there is still a major concern on the amount of green-house gases new ICT systems will contribute to (Mouftah and Kantarci 2013). This problem is not straight-forward as Dastbaz (2015) explains that one of the major challenges ahead is the question of how to accurately measure the energy consumed by power-hungry applications and data stores on the cloud. There is no doubt that clouds will continue to evolve as the dependency on them grows, but it is important to be wary of the environmental impact. It should come as no surprise that the severity of the environmental impact of data-centres has motivated companies like Microsoft, Yahoo and Google to create new data centres on Columbia River to harness renewable energy and cooling from flowing water.

Appreciating and accepting the link between cloud computing and sustainability will allow for research into methods to combat the energy crisis as clouds continue to emerge. These methods should be focussed around components and principles that comprise of the cloud. Some of these are Grid computing, virtualisation, autonomic computing, utility computing etc (Domdouziz, 2015). To address energy efficiency, it is important to acknowledge that the above components which are often in a distributed fashion, process huge amounts of data possibly over large scale networks and/or data centres. Hence sustainability must consider how the “personality” of network traffic can be gathered from various points. This understanding could then form the basis for cloud management algorithms. Saving energy requires using specialist techniques like traffic consolidation, link management etc (Bilal et al, 2014). But his not always easy as there are so many “moving parts” that change rapidly and that have a rippling effect on other entities. This paper looks into some means of gathering network traffic related data and measuring them, based on previous research and related literature.

Outline

It is easy to overlook the fact that something non-tangible as data/information or virtual data stores can contribute to power consumption. Hence, it is not surprising that as clouds evolve the non-abstract entities are the first focuses of any reasonable solutions being applied. Hardware and software elements are always dealt with first when it comes to minimising energy consumption. Hardware based heat reduction systems like fluid/dry cooling and Computer Room Air Conditioning (CRAC) are deployed in almost all data centres. There are also chip and processor level optimisations at electronic levels to tap into multi-processing and multi-threaded operations. But there is also the aspect of data transfer on networks and background processes that apply to routing, maintenance and tearing down of connections. For example, user interaction with Software as a Service (SaaS) is over the internet through an ISP and further into local networks that comprise of the data-centre. Furthermore, the SaaS infrastructure would produce data (possibly through big-data repositories) that is again transferred locally at the data-centre and over the internet. Jingy and Xing (2013) say that it is estimated that a data centre could annually use up to $100,000 equivalent of power. The climate group (2008) estimates that 7% of the overall carbon footprint can be attributed to data centre activities and this will only continue to rise as it is
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