HCloud Modeling and Analysis of Reliable Services for Green Area with Energy Efficiency

B. Prabha

Abstract--- Cloud computing is a model for enabling ubiquitous, convenient on-demand network access to shared pool of configurable computing resources. They can be rapidly provisioned and released with minimal management effort or service provider interaction. For processing large amount of data, management and switching of communications may contribute significantly to energy consumption and cloud computing seems to be an alternative to office-based computing. Network-based cloud computing is rapidly expanding as an alternative to conventional office-based computing. As cloud computing becomes more widespread, the energy consumption of the network and computing Resources that underpin the cloud will grow. In this paper, I present an analysis of energy consumption in cloud computing. And implement software as a service, storage as a service and processing as a service, The analysis considers both public and private clouds, and includes energy consumption in switching and transmission as well as data processing and data storage. I compare that the energy consumption in transport and switching can be a significant percentage of total energy consumption in cloud computing. Cloud computing can enable more energy-efficient use of computing power, especially when the computing tasks are of low intensity or infrequent

Keywords--- Cloud Computing, Energy Consumption, Switching Networks

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I. INTRODUCTION

In the past computing tasks such as word processing were not possible without the installation of application software on a user's computer. A user bought a license for each application from a software vendor and obtained the right to install the application on one computer system. With the development of local area networks (LAN) and more networking capabilities, the client-server model of computing was born, where server computers with enhanced capabilities and large storage devices could be used to host application services and data for a large workgroup. Typically, in client-server computing, a network-friendly client version of the application was required on client computers which utilized the client system's memory and CPU for processing, even though resultant application data files (such as word processing documents) were stored centrally on the data servers. Multiple user licenses of an application were purchased for use by many users on a network.

Cloud computing differs from the classic client-server model by providing applications from a server that are executed and managed by a client's web browser, with no installed client version of an application required. Centralization gives cloud service providers complete control over the versions of the browser-based applications provided to clients, which removes the need for version upgrades or license management on individual client computing devices. The phrase "software as a service" (SaaS) is sometimes used to describe application programs offered through cloud computing.

II. Overview of Cloud Computing

The increasing availability of high-speed Internet and corporate IP connections is enabling the delivery of new network-based services. While Internet-based mail services have been operating for many years, service offerings have recently expanded to include network-based storage and network-based computing. These new services are being offered both to corporate and individual end users. Services of this type have been generically called Bcloud computing

The cloud computing service model involves the provision, by a service provider, of large pools of high performance computing resources and high-capacity storage devices that are shared among end users as required. There are many cloud service models, but generally, end users subscribing to the service have their data hosted by the service, and have computing resources allocated on demand from the pool. The service provider's offering may also extend to the software applications required by the end user. To be successful, the cloud service model also requires a high-speed network to provide connection between the end user and the service provider's infrastructure.

Cloud computing potentially offers an overall financial benefit, in that end users share a large, centrally managed pool of storage and computing resources, rather than owning and managing their own systems. Often using existing data centers as a basis, cloud service providers invest in the necessary infrastructure and management systems, and in return receive a time-based or usage-based fee from end users. Since at any one time, substantial numbers of end users are inactive, the service provider reaps the benefits of the economies of scale and from statistical multiplexing, and receives a regular income stream from the investment by means of service subscriptions. The end user in turn sees convenience benefits from having data and services available from any location, from having data backups centrally managed, from the availability of increased capacity when needed, and from usage-based charging

III. Cloud Layers

Cloud computing can be described as the new era in the world of computing. It is composed of several layers, all of which can be accessed by users connected to it. Understanding what each layer comprises of, the functions of each layer, how these layers interact with each other, including the need for diverse technological skills to make the elements work together, are all essential.

Cloud computing demands a mix of technology skills, negotiating skills, and people skills and business acumen. By simplifying the cloud computing concept into layers, it is easier to define the roles and skills needed within the overall structure to see where your business fits into the model.

There are the four key layers of a cloud environment and the technological skills required to better understand the aspects of cloud computing.

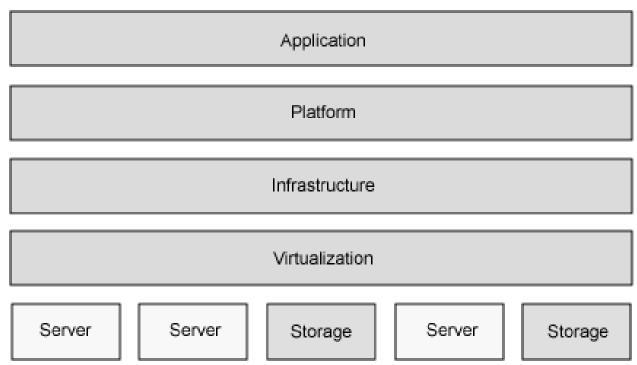

Fig 3a: Cloud Computing Layers

A. *The Virtualization Layer*

This layer forms the foundation of cloud technology. This enables user request for computing resources by accessing appropriate resources and deploy large numbers of virtual machines (VMs) on hardware.

The most important skill needed is understanding virtualization management principles, such as load balancing. Other necessary skills are having knowledge of the virtualization platform, storage, connecting storage to a virtualization host, and allocating storage properly.

Networking knowledge is also needed to configure hosts properly.

B. The Networking Layer

It is in this layer that solid understanding of network protocols such as TCP/IP and domain name server, including switching and routing principles are needed. The ability to rework the entire network on the fly is also essential, especially in network that features numerous ISP connections and devices.

C. The OS Layer

The core skills required are ensuring that the system is properly tuned for its role, setting up a server with correct applications and settings, and maintaining optimal performance settings. To ensure that cloud services are optimally deployed, delivered and maintained, networking skills are also vital in this layer.

D. The Application Layer

This is the most utilized layer of cloud computing. The cloud provided needs responsibility in the management of the software and databases, including installation, updates and removal. Cloud developers should have knowledge in JavaScript, XML and Perl languages, as well as back-end infrastructure applications like Apache, Tomcat and SQL.

As more functionality moves to the internet cloud, every provider and user is needs to develop set of skills required. As time progresses, these layers will shift, blur or might even disappear entirely. As business move into the cloud, it is vital that thorough understanding is involved as to what elements, skills and changes are involved in the process.

IV. GREEN CLOUD COMPUTING

A. Basic Definitions and Notations

This section provides the definitions that will be used in the rest of the paper.

Definition 1: Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Definition 2: Cloud is a ubiquitous model that enables the internet resources and processes all the requests and provides the services

B. Cloud Computing Architecture

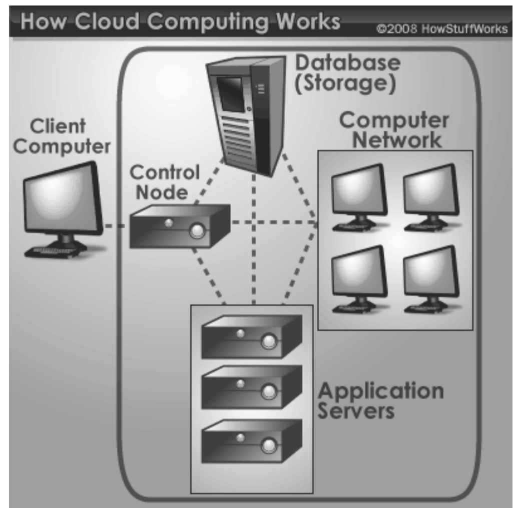

Fig 4.2a: Cloud Architecture

Cloud computing architectures can be either public or private. A private cloud is hosted within an enterprise, behind its firewall, and intended only to be used by that enterprise. In such cases, the enterprise invests in and manages its own cloud infrastructure, but gains benefits from pooling a smaller number of centrally maintained high-performance computing and storage resources instead of deploying large numbers of lower performance systems. Further benefits flow from the centralized maintenance of software packages, data backups, and balancing the volume of user demands across multiple servers or multiple data center sites. In contrast, a public cloud is hosted on the Internet and designed to be used by any user with an Internet connection to provide a similar range of capabilities and services. A number of organizations are already hosting and/or offering cloud computing services.

Examples: Google Docs, Amazon's Elastic Compute Cloud and Simple Storage services], Microsoft's Windows Azure Platform, IBM's Smart Business Services, Salesforce.com, and Webex.

But while its financial benefits have been widely discussed, the shift in energy usage in a cloud computing model has received little attention. Through the use of large shared servers and storage units, cloud computing can offer energy savings in the provision of computing and storage services, particularly if the end user migrates toward the use of a computer or a terminal of lower capability and lower energy consumption. At the same time, cloud computing leads to increases in network traffic and the associated network energy consumption. In this paper, we explore the balance between server energy consumption, network energy consumption, and end-user energy consumption, to present a fuller assessment of the benefits of cloud computing.

C. Management of Energy Consumption

The issue of energy consumption in information technology equipment has been receiving increasing attention in recent years and there is growing recognition of the need to manage energy consumption across the entire information and communications technology (ICT) sector cloud computing will involve increasing size and capacity of data centers and of networks, but if properly managed, cloud computing can potentially lead to overall energy savings.

The management of power consumption in data centers has led to a number of substantial improvements in energy efficiency. Cloud computing infrastructure is housed in data centers and has benefited significantly from these advances. Techniques such as, for example, sleep scheduling and virtualization of computing resources in cloud computing data centers improve the energy efficiency of cloud computing.

V. SERVICE MODELS OF CLOUD

It provides three services: software as a service, platform as services and processing as a service.

A. Software as a Service

Consumer software is traditionally purchased with a fixed upfront payment for a license and a copy of the software on appropriate media. When a new version is released, users are required to make a further payment to use the new version of the software. In this clients are charged a monthly or yearly fee for access to the latest version of software.

B. Storage as a Service

Users can outsource their data storage requirements to the cloud. All processing is performed on the user's PC, which may have only a solid state drive and the user's primary data storage is in the cloud. To make a modification to a file, it must first be downloaded, edited using the user's PC and then the modified file uploaded back to the cloud.

C. Processing as Service

One example of processing as a service is the Amazon Elastic Compute Cloud service vice provides users with the resources of a powerful server for specific large computational tasks. the user's computer is not used for large computationally intensive tasks and so there is scope to reduce its cost and energy consumption, relative to a standard consumer PC, by using a less powerful computer.

VI. EXISTING SYSTEM

A. *Traditional Computing System*

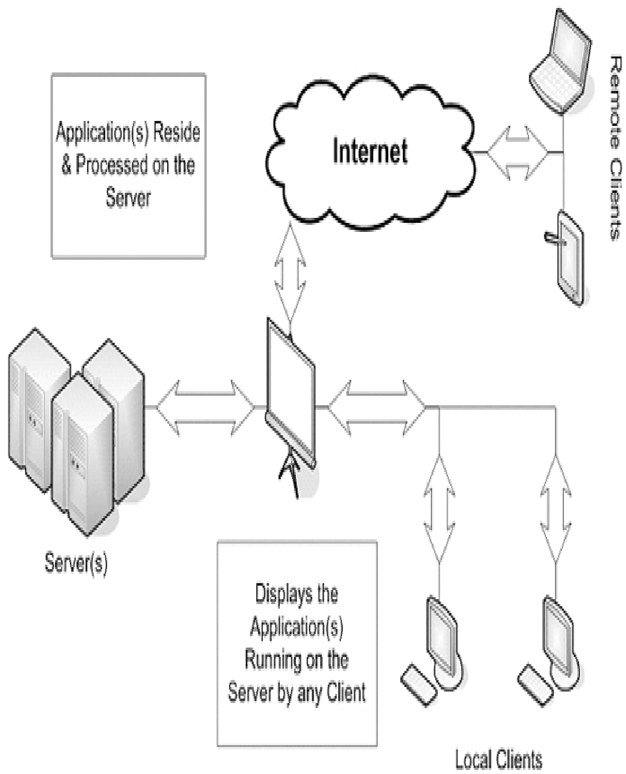

Fig 6.1.a: Traditional Computing Environment

Traditional computing environment characteristics are classified as follows:

- The purchase of a database server is required as well as probably an Exchange Server for email. Costs in relation to installation, maintenance and support will be additional
- Upgrading of existing hardware infrastructure after purchase of Exchange server
- Replacement of servers and PC every 3 or 4 years
- Third party software costs, license key, validation and limited number of user access is necessary other than Microsoft office packages
- Hardware purchase and lead time and installation costs/time prior to access to the software
- It has to be set up and would only work from pre-defined locations. Costs incurred would include Servers, Third Party Software and communication links
- Downtime of server is possible when accessed over multiple datacenters
- Dependent on quality of local firewall and availability of man power to monitor. Wide open if hardware stolen
- Unexpected expenses arises due to hardware failure

VII. PROPOSED SYSTEM

A. *Implementation of Cloud Environment using EyeOS*

In this work, I have implemented cloud computing environment using EyeOS-opensource software which supports all the services of cloud. The analysis of energy consumption is compared using CloudSim simulator.

B. *EyeOS*

A server based centralized service that is implemented in java web services technology is used to implement the application logic for Quotes, Books, News, Graphs and Forecast using utility computing and Grid Computing.

EyeOS is a ‘web desktop’. It is a sort of operating System that runs completely inside the web browsers, which means it can access it anywhere. EyeOs is released under the AGPLV3 license and only needs Apache, PHP5, MySQL to run. With EyeOS we can build a private cloud environment. Each part of the desktop has is its own application, using java script to drive server commands as the user interacts. As actions are performed using Ajax (such as launching an application), it sends resulting information to the server. The server then sends back tasks for the client to do in XML format. On the server, e yeOS XML files to store information. This makes it trouble-free for a user to set up on the server, as it requires nil configurations other than the account information for the first user, making it simple to deploy. To avoid bottlenecks that flat files present, each user's information and settings are stored in diverse files, preventing resource starvation.

a. Supporting Packages of EyeOS

There are couples of packages/software that are required for EyeOS to run smoothly; these are listed as follows

- Recol:Needed for document indexation. It is a personal full text desktop search tool based on Xapian. It provides an easy to use, feature-rich, easy administration interface with a Qt-based GUI. Text, HTML, PDF, PostScript, MS Word, OpenOffice, Wordperfect, KWord, Abiword, maildir, and mailbox mail folder formats are supported, along with their compressed versions
- ExifTool is a platform-independent command-line application for reading, writing, and editing meta information that is contained by image, audio and video files.
- OpenOffice Daemon(OOD) is used on server-side for different tasks such as file transforms (e.g., to PDF) or other advanced tasks.
- Kaazing Gateway:A WebSocket Gateway connects hundreds of thousands of concurrent users directly to the real-time data flowing through an organization and eliminates the overhead and latency inherent in HTTP by extending the use of any TCP-based messaging format to any browser, delivering ultra high performance bi-directional communication over the Web.
- Apache ActiveMQ Daemon is the most popular and powerful open source messaging and Integration Patterns provider. Apache ActiveMQ is fast, supports many Cross Language Clients and Protocols, it comes with easy to use Enterprise Integration Patterns and many advanced features while fully supporting JMS 1.1 and J2EE 1.4. Apache ActiveMQ is released under the Apache 2.0 License.

C. Implementation

The implementation consists of two phase, the first phase compares the cloud computing system with traditional office computing system. Here we will provide the user with all access to the cloud services namely software as service, processing as service and storage as service. The second phase is the Cloud simulation phase where energy consumption comparison is done between public and private cloud. Energy consumption graph is drawn plotting total energy consumed in hertz along x-axis and number of host machine connected along y-axis.

The energy consumption is the measured in terms of total amount of data required to transfer from one network to another network. Energy consumed is simulated in cloud Analyst simulator toolkit and results are shown in figure 7.3 c.

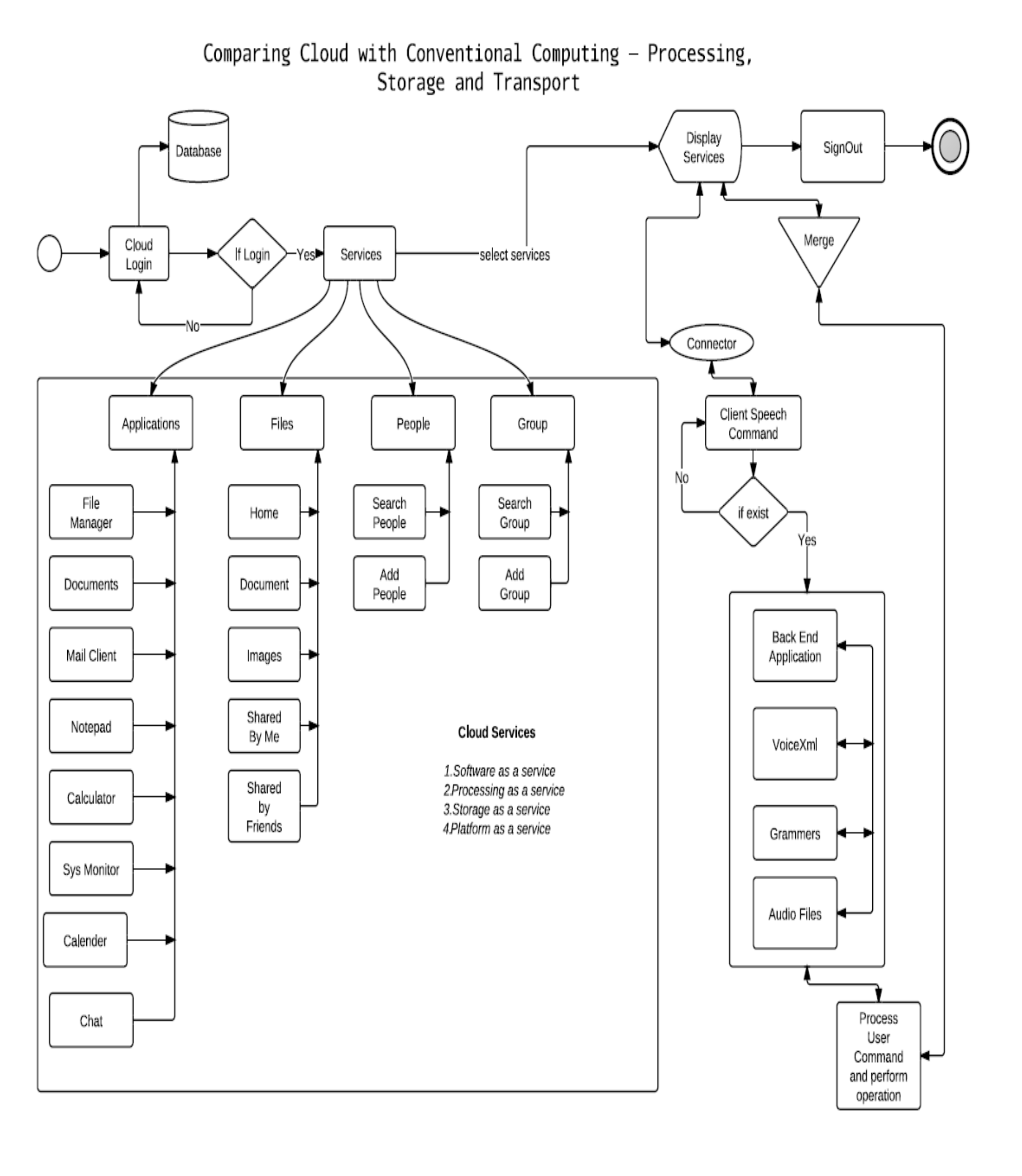

Fig 7.3 a: Comparing Cloud with Traditional System

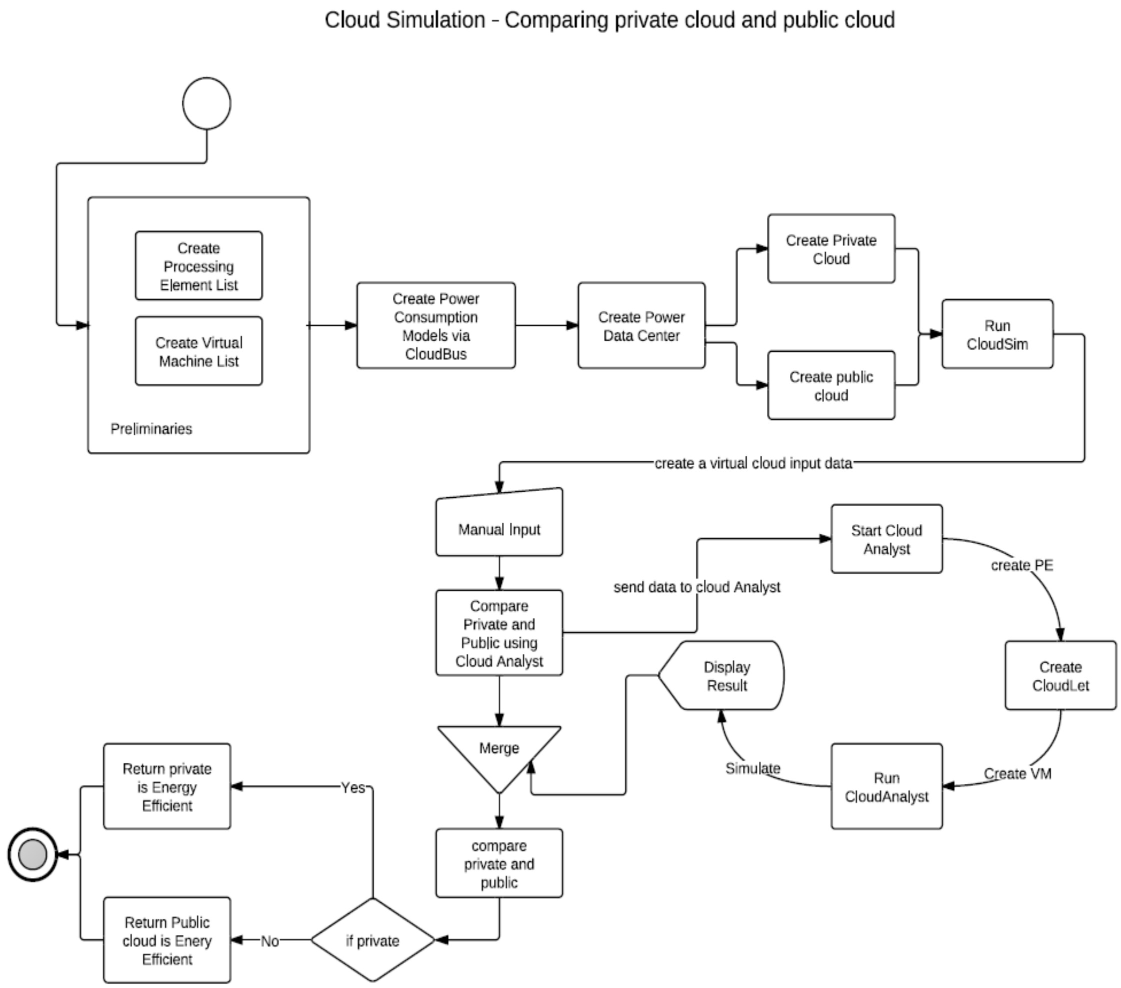

Fig 7.3 b: Cloud Simulation-Comparing Public and Private Cloud

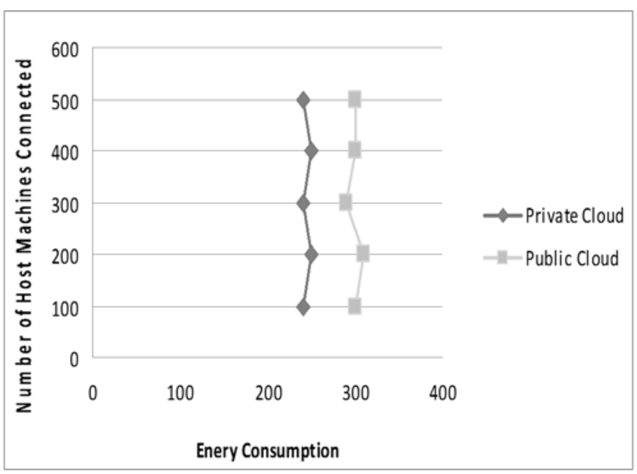

Fig 7.3 c: Energy Consumption-Private and Public Cloud

VIII. Conclusion

In this paper, we presented a comprehensive energy consumption analysis of cloud computing. The analysis considered both public and private clouds and included energy consumption in switching and transmission as well as data processing and data storage. We have evaluated the energy consumption associated with three cloud computing ser- vices, namely storage as a service, software as a service, and processing as a service. Any future service is likely to include some combination of each of these service models. Power consumption in transport represents a signify cant proportion of total power consumption for cloud storage services at medium and high usage rates. For typical networks used to deliver cloud services today, public cloud storage can consume of the order of three to four times more power than private cloud storage due to the increased energy consumption in transport. Nevertheless, private and public cloud storage services are more energy efficient than storage on local hard disk drives when files are only occasionally accessed. However, as the number of file downloads per hour increases, the energy consumption in transport grows and storage as a service consumes more power than storage on local hard disk drives. The energy savings from cloud storage are minimal.

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