

## Green Cloud Operating System (GCOS)

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### ABSTRACT

Computers are used in almost every field of our life. We use computer to perform our large amount of tasks daily. On one hand computer is making our life easier but on the other hand it is also effecting our environment. Computers produce large amount of heat and consume a lot of electricity these things effect our environment badly. Many green computing techniques have been introduced that help us to make our computers environment friendly. But there are very few techniques introduced to make our software environment friendly. Cloud computing is the process of using a network of remote servers presented on the internet to manage, store and process data rather than on a local server or personal computer. Green computing is the ecologically accountable and eco-friendly use of computers and their resources. In this research paper we will discuss those techniques and introduce a technique that will help to make our operating system environment friendly using concept of cloud computing.

**Keywords**—Cloud computing; green computing; operating System; Eco-Friendly

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### 1. INTRODUCTION

Information technology is back born of modern world. Computers are used everywhere in every field of life, like in education, medical, business etc. we can also say that advancement in technology and in modern world is all about of computer. Computer is not a simple machine, it is highly complex calculator it can perform millions of calculations accurately at very high speed. Computer makes our everyday business and educational tasks very easy. Major advantage of computer is in medical field where computer is used to diagnose and treat many deadliest diseases. Modern society completely rely on computers they need computers for their safety, for their business, for their education, for entertainment, for communication. [1]

Computer perform its every task by using some sort of software or collection of software. Software is a collection of computer instructions that tells computer how to perform certain job [18]. We daily use some kind of computer software like MS-office, web browser, games etc. [2]

Software are of two types:

- 1) Application software.
- 2) System software.

Application software are those software which are designed to enable users to perform their daily tasks. Those tasks for which user have bought computer. Like calculations, office work etc.

System software are those software which provide user a platform to use application software and enable user to Communicate with computer hardware and manage computer. Like operating system is a system software. [3]

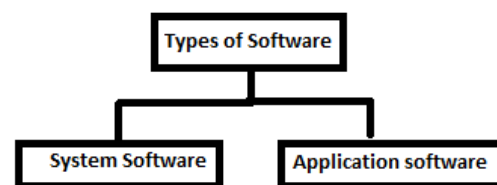
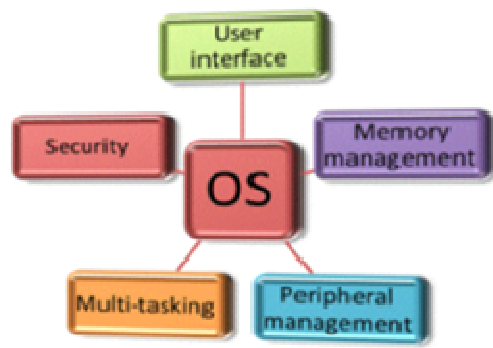


Figure 1. Types of Software

Operating system is the first program which we see when we start our computer, it is loaded into the computer by boot program. It provide a platform to user to communicate with computer and manage its operations and application programs to perform every task. There are many types of operating systems like windows, Linux, android etc. each with its own features. [4]. Operating system performs different type of functions, major ones are shown in figure below.[5]



**Figure 2. Functions of Operating System**

Computers and computer software's make our lives very easy but somehow they are also responsible for causing harmful problems to our environment like computer manufacturing process and computer waste is harmful for natural resources and our environment. It is polluting our environment day by day. When computer waste is discarded in landfills, it release toxic materials and potentially dangerous levels of lead, mercury, and flame retardants. These materials are very harmful for living things and environment. [6]

Similarly today's complex and high performance software are also harmful for environment because for performing complex tasks these high performance software consume a lot of electricity which produce large amount of heat, that harms environment badly. High performance software also consumes too much money because they need large storage capacity and electricity.

Now-a-days many operating systems are being used, each with its own unique features. These highly featured operating systems also consume a lot of electricity. Many researches have been take place to reduce the harmful effects of computers and software's on environment. This concept of making computers environment friendly is called green computing. There are a lot of methods have been introduced in past years which can help us to decompose computer waste properly but we do not have much methods that help us to make environment friendly software or how to make already existing software's environment friendly. In this research paper we will focus on some techniques to make computer software's, especially operating system environment friendly.

## 2. LITERATURE REVIEW

The power usage from the past has been extremely amplified by the everyday increase in the quantity of systems. Founded on dissimilar functionalities, an amount of operating system connected services have been made, but now there lies a bigger requirement of a little power consuming operating system. About 225 Watts of power is swallowed by a classic Linux server, which means that nearly 5 million tons of carbon discharges yearly, is blamable on the millions of operational

Linux servers. Moreover, Springboard investigation newly testified that carbon impression of a mid-size four-wheel- drive automobile is similar to an ordinary -size server.

There should be a method which should emphasize on to decrease the power intake in desktops. As far as a solo Personal Computer is concerned, it might not save abundant power but on an extensive measure, it saves a vast volume of power. Our research work would also be prolonged to mobile Operating systems such as Android operating systems and Apple IOS, so that charging your mobile phone becomes a weekly routine, instead of a daily business.

Previously a huge amount of research has been done by numerous researchers working on little power consuming hardware but minor work has been done in the field of creating low power operating system and low power green software's.

### **Concept of Green Software:**

Software can also help in making computer systems environment friendly. Software can play an important role in reducing power consumed by computers and mobile phones. There are some techniques that can be used to make green software's and operating systems.

Software developers should have a strong knowledge of CPU internal structure and working so that they can make energy efficient software's. it is understood that if CPU is not keenly processing information or performing calculations then it should be consuming low power [7][22]. CPU have two states, C-state and P-state. C-state is that state in which CPU is sleeping and P-state or performance state is defined as frequency at which CPU processor is running. If we make software's that can efficiently switch between C-state and P-state then we can save energy consumed by software's. [7] Deeper the CPU sleep more amount of energy we can save.

### **Energy Saving Software Techniques:**

**Computation efficiency:** computation efficiency means getting the work done quickly, if software developer can make software's that can do their work or task quickly then they can not only save time but also energy. Faster the performance of software the more amount of energy we can save. I.e. if software complete workload quickly faster it can come in idle or sleep state. We can achieve computation efficiency by designing efficient algorithms, multi-threading. [9][7]

**Data efficiency:** data efficiency can make software's green by managing and minimizing data movement efficiently. We can achieve data efficiency by designing. Software algorithms that minimize data movement, memory hierarchies that keep data close to processing elements, application software that efficiently uses cache memories [7][22].

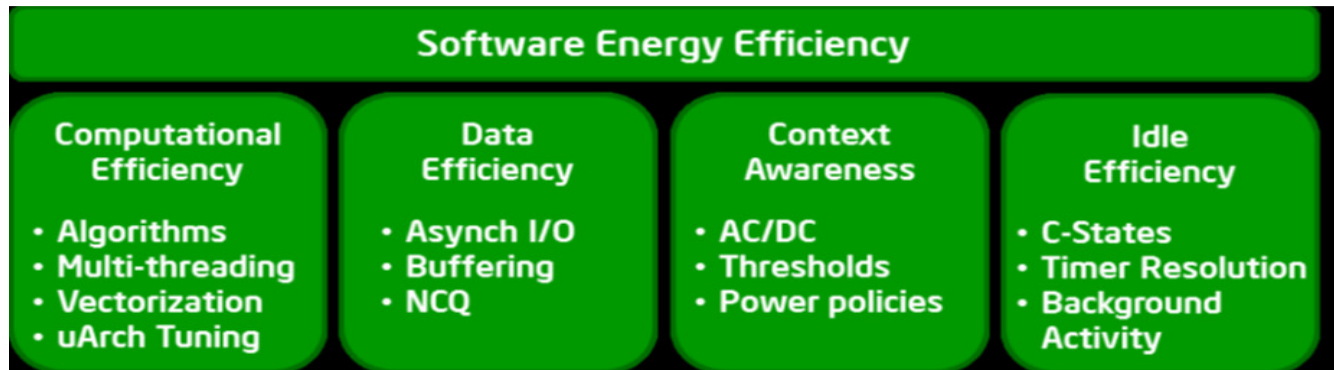


Figure 3. Software Energy Efficiency

**Context awareness:** To save energy through software's another technique is called context awareness. It was introduced by Schilit in 1994. Context awareness means to make software that can reply to deviations in the environment. It requires sensors to detect environment and then respond to that behavior.[10] Like new smartphones have sensors that automatically dim display when battery is low. Many notebook computers also have this feature that saves energy when battery is low. Some software may write cached data to flash when the battery is getting critically low [22].

**Idle efficiency:** idle efficiency means that software has sense when to work and when to sleep. Like messaging application in our mobile runs when we send or receive message when we are not send and receiving message then it should sleep to save power consumption. [11]

#### **Green Operating System:**

Operating system is that system software which almost every computer system and mobile uses. It is the first program that runs when we start computer and mobile. It provides us a platform to use other software and communicate with hardware. If we can make operating system green or environment friendly then we can save a lot of energy that computer consumes because operating system is that software which is running all the time. There are some operating systems which are made to save some energy but there is still a lot of room in this area to make computer green.

IBM introduced Big Green edge in August 2007, with a mission to assist its customers incorporate Linux into an enterprise to decrease charges and energy ingesting by Structuring chiller data Hubs [21].

A slice of Plan Big Green is Big Green Linux, which is alternative edge to decrease energy consumption both for its data hubs and clients. Intel is another organization which is working separately from IBM, in the field of green revolutions in the computer science. [8] [21].

### **3. CONCEPT OF CLOUD COMPUTING.**



Figure 4. Cloud Computing Idea [23]

Cloud computing is the concept in which we can share computer resources, software etc. with other computers through networking (WAN) or by using internet. Cloud users are the person which are included in the cloud who can access resources by using computers, mobiles, pads and other devices. Cloud server manages applications in cloud computing, data is also manages and stored remotely by cloud configuration. Users do not download and install applications on their own device or computer.



Figure 5: Structure of Cloud Computing [23]

#### A. Architecture of cloud computing

Architecture of cloud OS is shown in figure below. [15]

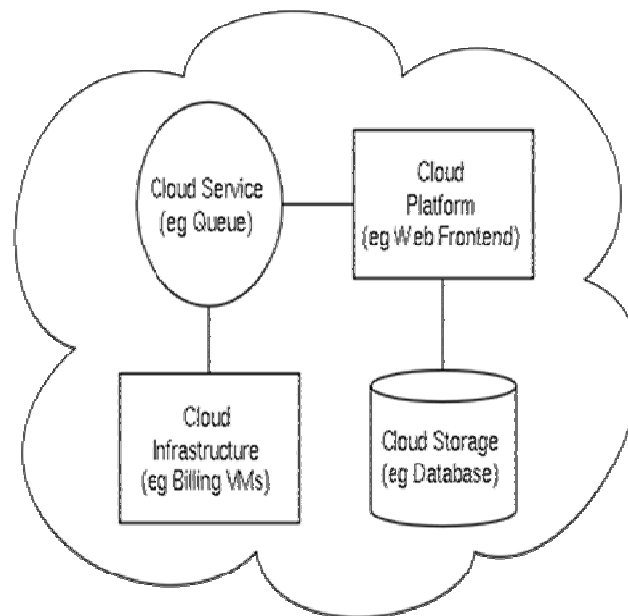


Figure 6. Architecture of Cloud Computing

#### 4. CONCEPT OF CLOUD OPERATING SYSTEM:

Cloud operating system is Internet-based operating system where your data and the software are placed on the Web, and the application is used as a service rather than a standalone software [16].

##### *Different types of cloud operating systems:*

- Glide
- Amoeba
- My goya
- Kohive
- Zimdesk
- Ghost
- Joli
- Cloudo
- Ghost
- Joli
- Cloudo
- Corneli
- Lucid
- Eye os
- Startforce

[12][13][14]

##### *Benefits of cloud operating system:*

- Worldwide availability.
- Requires only browser.
- Remote storage facility.
- Browser and platform independent.

In this research paper we will tell how cloud operating system helps in making computers more environment friendly.

#### 5. MOBILE OPERATING SYSTEMS EFFORTS IN GREEN COMPUTING



Figure 7. Information of application on android

#### **Mobile operating systems efforts in green computing:**

Android with over 650,000 apps and counting on the Play Store, there are many applications which run in the background without the permission of the user, making the phone much slower and also sometimes, by collecting some data in the background etc.

##### *Battery consumption and Process stats*

To start with, to know the background processes which are running at the moment and how much power they are eating, especially in regard to influence on battery and processing power. There are three monitoring options built-in Android [19].

By going to Settings you can Enable Developer options. From Settings scroll down to About Device and to activate Developer Options start tapping the Build number until you get the notification [19].

To know which applications are in process currently and continually we go to Process Stats. Some of the apps should run continually e.g. system apps that are necessary but others shouldn't.

- Go to Process Stats. For this you need to go to **Settings > Select Developer Options** and proceed to **Process Stats** to find out for how long your apps have been on the run. RAM consumption of any app can be found by simply tapping on the app.
- Next, select **Battery from Settings** to find out how much battery each app is consuming by simply tapping on it [19].

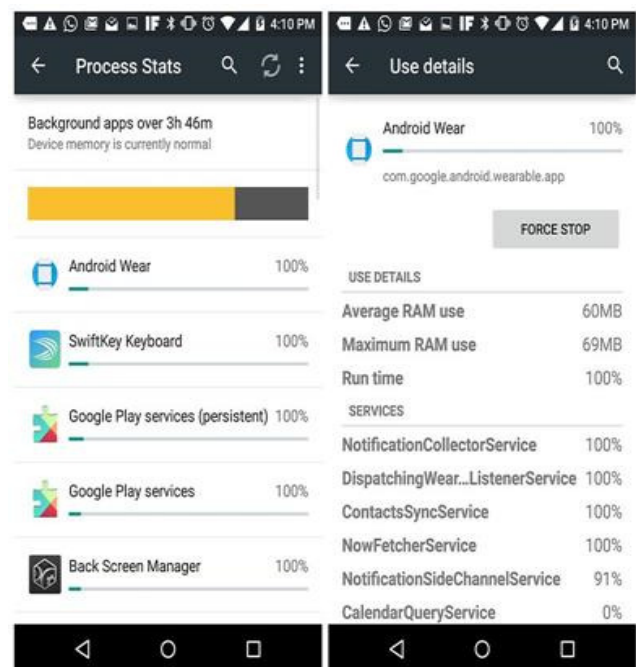


Figure 8. Detail of any process on android

## Greenify

There is a hibernation app called Greenify, which allows you to put unused apps or non-running apps to sleep. This app is mainly used to disable apps or exit them by force when they are not in use and they are switched on when you open them again. And all of this is done beautifully in an automated way [19]. Indeed it's a stress doing this manually.

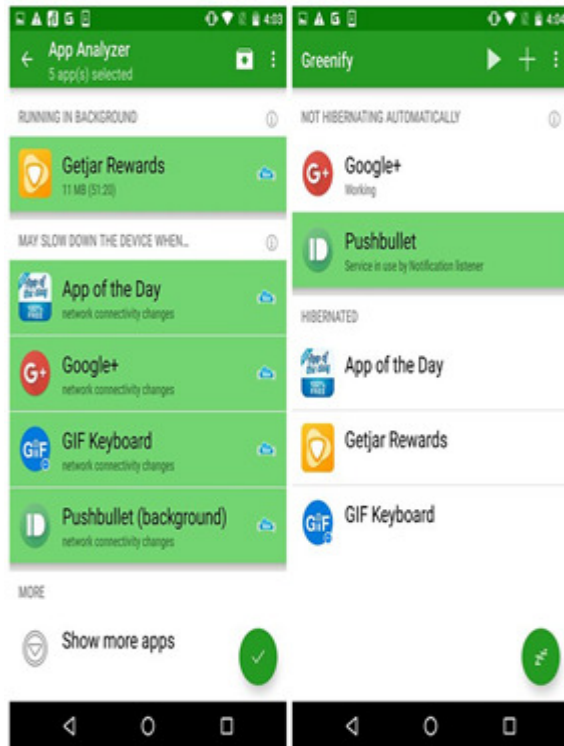


Figure 9. Greenify application on android

### C. Cloud Storage for Android (Play Store) and Apple (App Store)

Cloud storage was once a unclear technology revolution but more and more data saving is being done through online storage instead of outdated hard drives or USB's. While many people might be aware with Google Drive, the online cloud storage front-runner, there are a number of other Android apps that do similar jobs. The shift to cloud storage is going from severely files saved on a hard drive to maintaining photos and apps from smartphones. Some of the top cloud apps for Android phones and tablets comprise: Dropbox, Box, Drive, Sugar Sync, Amazon Cloud Drive, Sky Drive, and Google Drive [20].

## 6. PROPOSED METHODOLOGY/IDEA

Now there are numerous cloud storage applications/software's available. If you take a snap on your mobile phone you can instantly access it on your laptop or desktop personal computer without attaching any wire. It can be done wirelessly and within seconds. All you have to do is open that cloud storage software on your PC and sign in. That's it, there you have it. All your data available to you.

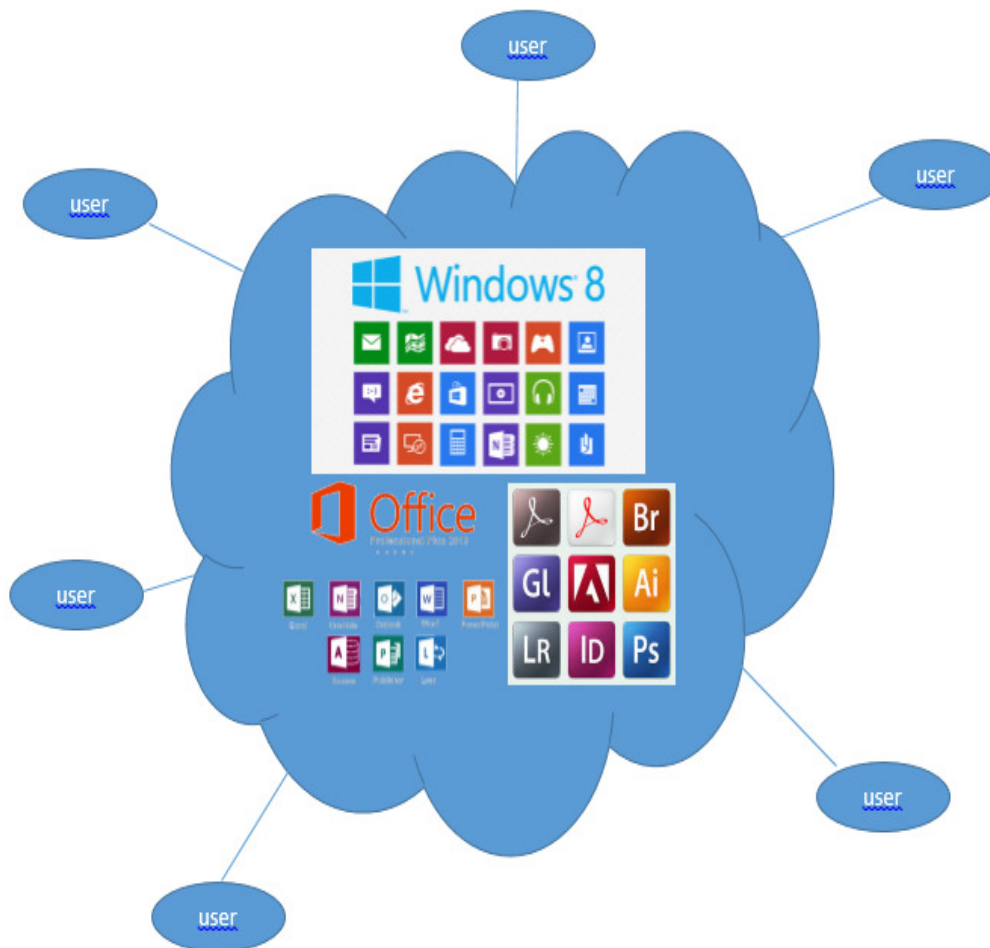
Now these applications can be used to a whole new level. Their scope can be increased significantly. If we save other software's all within this software instead of downloading and saving them on our PC or smart phone we can save enormous amount of memory. These applications were originally developed as a backup resource but their use can be enhanced.

For example if we are using dropbox application. Instead of downloading and installing Microsoft Office on your computer you download and save it in your dropbox account. And when you are on your phone you save the mobile version of Microsoft Office on your dropbox account. Dropbox offers 2GB of free memory which can be extended to 16 GB and instead of dropbox there are many other apps.

This is the clever part, whenever you need to use Microsoft Office on your phone or your PC you simply log in to your dropbox account first to be able to use everything that is available there. Now when you open any word file or excel sheet it can be accessed by the software stored in your dropbox. And this is applicable to all other application software.

This saves hard disk memory, RAM processing, caches memory to be used less and makes the device usage smoother. If the device is not overused its life and performance increases. Wouldn't it be simpler that all these cloud storage apps have these essentials application software's already installed in them and they don't even occupy your free space on your account? Yes you would have to pay for the original software's but the free ones can already be there waiting for you to just sign up and they are available to use. For example: Adobe Reader, Google Chrome, Media players and many others.

Similarly for smart phones there are tons of apps every user has to install whenever he/she gets a new phone. If apps like Facebook, viber, WhatsApp, twitter etc. are already installed in any cloud storage app then all you have to do is install this cloud app and you are ready to go. So we can see that cloud storage software can help in making or systems and smartphones more green.

**A. Cloud operating system****Figure 10. Cloud Operating System****B. Cloud operating system idea for green computing:**

Now as we have seen what cloud operating system is and what are its advantages, now we can use this idea of cloud operating system to make our systems more environment friendly and reduce energy consumption. Now a days every university and large organizations uses large servers to fulfill their organizational needs. If they install cloud operating systems on these servers and then install all the basic apps and software on these servers and allow all their employees and students to access those apps and software from anywhere in the world. By using this idea we can make our systems less heat producing, few techniques introduced to make our software environment friendly.

In this research paper we have discussed those techniques and introduced a technique that will help to make our operating system environment friendly. We have not yet physically implied the methodology presented so no such comparison or performance evaluation is given yet. So we leave that to the future work.

**7. CONCLUSION**

Computers produce large amount of heat and consume a lot of electricity these things effect our environment badly. Many green computing techniques have been introduced that help us to make our computers environment friendly. But there are very

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