

CybrOS: Virtual Cloud Operating System

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ABSTRACT

Existing models of cloud computing are well suited for well trained and technical users but not at all practical for non-technical users. This is because it is annoyingly difficult for a non-technical internet user to setup a cloud based personal computing system. We cannot expect everyone can create a virtual machine, install OS, configure servers and then use that cloud machine for personal computing. The CybrOS uses a new approach thereby making cloud computing accessible to everyone. CybrOS Virtual Cloud Operating System is an operating system running on a cloud platform which can remotely be accessed by users over a network such as internet by means of a user friendly SaaS app. The CybrOS concept uses a highly structured setup of SaaS, PaaS and IaaS to deliver the computing power to the user in a very user friendly manner. The SaaS app allows a user friendly cross-platform front end that is user to access and operate the CybrOS which is installed remotely in PaaS which runs on IaaS. For each new user, IaaS hardware resources are allocated to create a virtual machine, the CybrOS with some default applications and settings is installed to the virtual machine and an account for the SaaS app is created. This allows everyone to very easily have an instance of powerful, scalable personal computer that can be accessed from anywhere and from any device thereby enabling the concept of personal-computer-as-a-service. The CybrOS concept is the future of personal computing for the growing mobile-first cloud-first world.

General Terms:

Cloud Computing, Online Cloud Operating System

Keywords:

Web OS, Remote Virtual Desktop, Virtual Machine, personal-computer-as-a-service, operating-system-as-a-service, Microsoft azure

1. INTRODUCTION

People use personal OS like Ubuntu, Windows etc. in their personal computers. Sometimes a virtual OS is installed over the existing (main) OS. In both these cases, the OS runs on the personal computer's hardware which has limited computing resources.

Servers use server OS like Ubuntu Server, Windows Server etc. These operating systems are used for a variety of jobs like serving websites over HTTP protocol, running computing jobs like data parsing, data scraping and web crawling, file storage that can be accessed over FTP, SFTP, and SCP etc.

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CybrOS is an application that serves servers computing resources to end users. The CybrOS is a virtual cloud OS present in a remote location at a large distributed datacentre which will be served over web using a graphical interface. It operates like a powerful scalable virtual OS that can be operated using a SaaS app that runs in the browser in the form of a web app, in the desktop in the form of an application software or in smartphones in the form of a mobile app. The existing solutions to do such computing remotely requires proper technical background of internet, operating systems, cloud computing, virtual machines, DNS, networking, communication protocols etc. and hence is used only by technocrats like sysadmins, developers, cloud engineers, application developers and server administrators.

1.1 Sample Use: Practical Examples

The following examples demonstrate how CybrOS can be used by non-technical users to solve modern computing usage problems. These examples highlight how CybrOS on a whole is a solution to revolutionize computing experience.



Fig. 1. Delivering personal-computer-as-a-service

1.1.1 Download huge data to access later. A user is accessing web on a slow network on a slow computer but he/she wants to download some huge important files (few GBs or TBs). Obviously, the user cannot download the file(s) to the computer he is using because of slow network. A CybrOS user can simply login to OS through the SaaS app and request CybrOS to download these files to the remote file system i.e. cloud blob storage. This will be done within few minutes as the download happens through the cloud infrastructures network and local computer or network is not involved at all. Now even if these files are removed from the source website, the user can download to his/her local computer from file system of CybrOS.

1.1.2 Heavy data processing work. A user wants to download few UHD videos from internet and convert them to Full HD videos. The user can simple first download videos to CybrOS file system, install a video conversion application on the os and start converting videos. Since the underlying hardware is distributed and can be scaled either automatically or manually, the conversion is several times faster. TBs of UHD videos can be processed, converted etc. within seconds and this process will take hours or days on normal computers! Hence, on employing this concept, we get a very high processing and storage capacity whenever required.

2. BACKGROUND AND RELATED WORK

In this section, we will discuss about solutions that have made cloud computing easier for the common man up to some extent. Also we will be emphasising on the advancements CybrOS will bring to the existing mobile-first cloud-first world.

2.1 Cloud Storage SaaS Applications

Advancements have been made to make cloud storage simple for non-technical users. Some popular examples of such solutions are Dropbox[9], OneDrive[10] and Google Drive[11]. These products provide storage-as-a-service by providing a part of storage, usually few GBs to users from their cloud datacentre. These services can very easily be used by a non-technical person. Whenever a new account is requested using the SaaS app, a certain amount of storage is mounted to the users account from the cloud blob storage. The amount of storage can be scaled on-demand very easily. However, this concept is limited to use of storage only and allow only file operations like upload, download, sync, edit, share etc. Unlike CybrOS, they do not offer a personal computer with processing capabilities where user can carry out computing tasks and run application software. People have been using online storage but CybrOS will introduce them to online personal computing.

2.2 Virtual Machines on a remote cloud infrastructure or platform and Remote Desktop Connections

There are many cloud providers today like Microsoft Azure[1], Amazon Web Services (AWS)[5], Google App Engine[6], Google Compute Engine[7], Heroku[8] etc. who provide infrastructure and/or platform to run Virtual Machine (VM) instances. Any virtual machine or cloud instance created on a PaaS/IaaS of a cloud provider can be used for installation of any operating system and a server. A remote desktop connection can then be established to access the desktop GUI or terminal CLI through which application software can be installed, files can be uploaded and computing can be done. However, this involves a complex systematic procedure of creating a new virtual machine instance from cloud providers, installing and configuring the operating system and a web server, configuring DNS, IP, ports, sockets and communication protocols and/or software like remote desktop, SSH, FTP, SFTP, SCP etc. Thus, such cloud systems are only used for special operations like app deployment by a fraction of world's population. Hence till date, basic internet or computer users have never experienced cloud and its advantages. CybrOS introduces people to personal cloud computing by making it as easy as signing up for an email account.

3. APPLICATION MODEL

CybrOS is designed with the philosophy of elegant outside, versatile inside. CybrOS is built with a unique goal of making cloud computing easier for mainstream computer users. This provides a platform where people can use cloud computing in their day to day activities.

CybrOS Virtual Cloud Operating System is basically a remote cloud OS which runs on a Cloud VM instance and can be accessed from a web, mobile or desktop application. The OS resides in PaaS level and is built to be tightly coupled with entities (apps and virtual machines) existing on other cloud service layers IaaS and SaaS. We should say this Cloud OS concept basically enables the following concepts- PCaaS (personal computer as a service) OSaaS (operating system as a service)

For each new user, a new system is created which requires all three service models IaaS, PaaS and SaaS, thereby harnessing the complete potential of cloud computing technology. Hence, whenever a new account is created, the following cloud service layers are used to create new private entities (VM and OS) for the user.

3.1 IaaS (infrastructure-as-a-service)

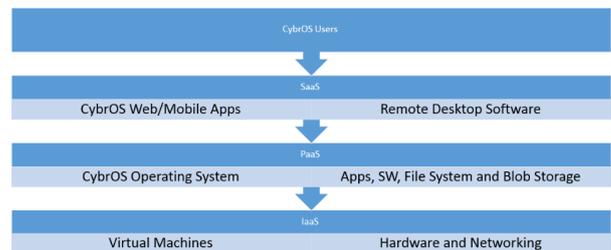


Fig. 2. Separation of Responsibility among the Different Layers

Creates a new virtual machine with limited system resources. However, the computing power, storage etc. can automatically or man-

ually be scaled whenever needed. IaaS is responsible for managing all hardware resources and virtual machines.

3.2 PaaS (platform-as-a-service)

Installs CybrOS cloud operating system to this virtual machine. This OS will already contain some built in applications and software. The user can install more software either by manual RDP/SSH login or through SaaS app interface. At PaaS level, the OS is defined which acts as a bridge between IaaS and SaaS, i.e. connects the VM/hardware with SaaS app.

3.3 SaaS (software-as-a-service)

A new account for the SaaS application is created. The user can login to CybrOS web app, mobile app, or desktop application to manage the IaaS and PaaS easily. It acts like a control panel, desktop or dashboard and provides a GUI/CLI for end users where they can install, upload, manage and process data, software, files etc. After user logins, SaaS app always stays connected with the OS using SSH/RDP. The user controls OS from the app itself. Every button click or keyboard events are mapped to corresponding os commands by the app backend which are then executed in the remote CybrOS using the SSH/RDP connection already established between the app and OS.

4. COMPONENTS OF THE SYSTEM

This section describes the components of the system that we have proposed. It comprises of Microsoft Azure[1], the SaaS application and the protocols used in the communication and network. This section gives the actual and in detail information about the components of the system.

4.1 Microsoft Azure (Cloud IaaS/PaaS Provider)

We are here using Microsoft Azure[1], a leading cloud computing platform and infrastructure provider that powers more than half of Fortune 500 companies. It offers both IaaS and PaaS services and supports many popular programming languages for building, deploying and managing applications and services. It provides tools and frameworks from Microsoft as well as other third-party providers. It provides a rich dashboard to manage everything like DNS, VMs, Storage, and Computing Resources etc. on a single portal.

4.2 The SaaS Application

The CybrOS Application which can be in the form of a web app, a mobile app or a desktop software will basically constitute the following three parts.

4.2.1 Front End (Design and Interfaces). Apps can be developed for various platforms like iOS, Android, Windows etc. The design should be minimal and easy to use as we are targeting the concept for non-technical users. HTML, CSS, Javascript is used for front end of web app. GUI for desktop software can be developed using cross platform UI framework like Qt. This front end provides GUI (graphical user interface) and CLI (command line interface) opportunities to the user.

4.2.2 Mid End (Human Computer Interactions and Experiences). Rich Internet Applications (RIAs) and Single Page Applications (SPAs) are possible using web application framework like AngularJS[2]. AngularJS is an open source project maintained by

Google and web community. It provides client-side modelviewcontroller (MVC) capability thereby making it easier to create a rich user interface and user experience. It also provides features like template system, 2-way data binding, communication with server etc. which improves performance and reduces development time.

4.2.3 Back End (Logic, Databases and File System). The logic, data and files will always reside on the cloud servers itself. The application needs to communicate with the server whenever any request for back-end logic or databases is made. The user issues a request to do some operation on the remote OS from the SaaS app GUI which can be done from the web, desktop or phone. This request is converted into os command using the SaaS apps backend and is executed on the OS by the SaaS app. The SaaS app keeps an active SSH connection with the OS and executes the generated (based on user actions) command on this SSH connection thereby controlling the OS based on user actions.

4.3 Communication and Network Protocols

Whatever be the form of application web, mobile or desktop, it requires communication with the web server and virtual machine that reside in the cloud datacentres. This is communication is possible over one of the several communication/network protocols.

The web app can be served using the HTTP or HTTPS protocol. To login to the virtual machine and executing commands and carrying out operations, the web app can internally use SSH protocol. To upload and download files and directories, applications use FTP, SFTP, SCP protocols. Desktop software can use RDP protocol to establish a remote desktop connection for a rich view of the virtual OS.

5. CURRENT SCENARIO - PROBLEMS IN CONVENTIONAL COMPUTING

Conventional personal computing since many decades is based only on personal hardware and a personal computer operating system like Ubuntu or windows or DOS. Here are the few shortcomings of this system that must be addressed

5.0.1 One Experience. Today a single person owns a variety of devices PCs, notebooks, tablets, smartphones etc. CybrOS make it easy to have a centralized pool for data, applications and settings that can be sync across all these devices for a consistent user experience.

5.0.2 Backups. In traditional personal computers user the user has to manually configure and manage backups and at his/her own risk. In cloud, all such standard processes like file versioning and backups can run automatically in background.

5.0.3 Maintenance. Personal computers require regular maintenance which is nothing but wastage of time and money.

5.0.4 Remote Access. Personal computers in general provide no or poor remote-access support. No one can simply access personal computers software and files on another device such as smartphone or tablet.

5.0.5 Cost. The initial setup cost of quality hardware (to run advanced application and do data processing) is high. There is nothing like pay-as-you-go or pay when using a local hardware. Using CybrOS that can be accessed from any basic device can be used to run applications on a remote high performance cloud hardware.

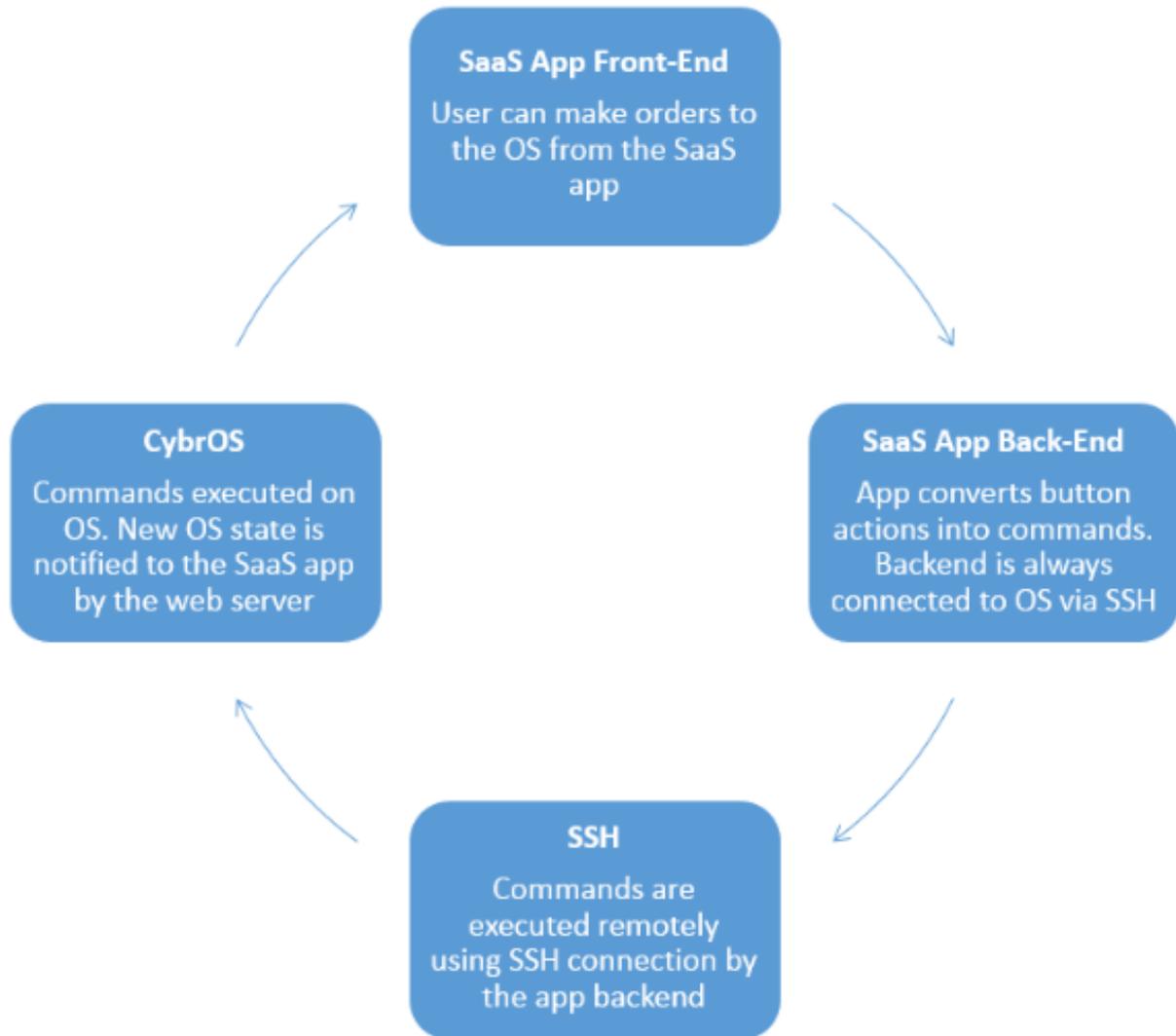


Fig. 3. Connection between SaaS App and CybrOS

5.0.6 Scalability. The initial setup cost of quality hardware (to run advanced application and do data processing) is high. There is nothing like pay-as-you-go or pay when using a local hardware. Using CybrOS that can be accessed from any basic device can be used to run applications on a remote high performance cloud hardware.

6. ADVANTAGES

6.1 Advantages over cloud computing using traditional VMs and Remote Desktop

6.1.1 Easier Setup. CybrOS is targeted for every personal computer user irrespective of his technical knowledge. Getting started with CybrOS is as easier as signing up for a website. All required instances are automatically created which is unlike existing VMs of cloud providers that need to be manually configured.

6.1.2 Support for more platforms and devices. The power of CybrOS is delivered through the SaaS app backend. This app can be developed for a variety of platforms like web, desktop and mobile and hence the remote OS can be accessed from a variety of devices. In traditional VM based cloud computing, there is SaaS app and the OS can be accessed only from SSH Shell or a Remote Desktop Software which are difficult to configure for a majority of population.

6.2 Advantages over conventional PCs (computing on local hardware)

6.2.1 Immense power with scalability. User can do heavy processing on cloud, no need of working on slow and limited PCs. Processing that requires hours on normal PC will be done in seconds.

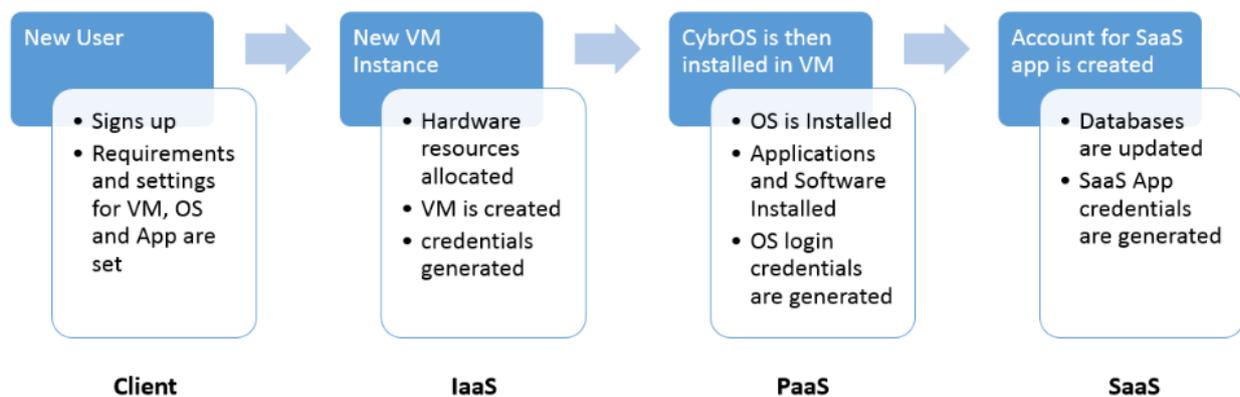


Fig. 4. Processes and Events involved

6.2.2 *Immense Storage Capacity.* User can store immense amount of data in cloud, and can access the same stuff from different locations or devices. Since the data is centralized and always kept in sync with devices.

6.2.3 *Dedicated and Personalized.* It will be one dedicated virtual OS for each user. Hence user can fully customize, add or remove apps and software and do everything possible in a powerful way.

6.2.4 *Easy Maintenance.* As the OS is managed at the datacentre level itself. User can request reinstallation, migration, backup and restore operations whenever required through the control panel. No technical knowledge is required thereby making it easier than maintaining a regular PC.

7. CONCLUSION

The objective of this concept was to deliver cloud computing services to everyone. Cloud computing is now evolving like never before. Today we live in a mobile-first cloud-first world. Today's modern world needs a personal computer that runs on cloud while being easy to setup, understand and use. In this paper, we introduced the concept of personal-computer-as-a-service and operating-system-as-a-service. We found the CybrOS concept to be completely feasible, practical and reliable because of our newly proposed cloud system architecture that connect users with hardware by smartly employing all three service layers of cloud IaaS, PaaS and SaaS. We believe, through such solutions, Cloud computing can touch more lives and hence make a bigger impact on the society. Hence, we propose CybrOS as a solution to cloud easier and practical for everyone.

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