OwnCloud Solution for Small Businesses

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Abstract: *Cloud technologies are modern solutions for storing, accessing and processing synchronized data from anywhere on any device connected to the Internet. There are currently many cloud computing providers, including the largest online players such as Google, Microsoft, Dropbox, etc. Although cloud technology offers countless advantages, deployment costs may be an impediment for small businesses. For small businesses, there is the possibility of implementing custom cloud solutions at insignificant costs. In this article I will present a solution that I tested in laboratory conditions. This solution is dedicated to a small-scale deployment. The advantage of the proposed solution is the low cost without affecting the quality of the services.*
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Introduction

We are currently using more and more Internet-connected equipment. Besides desktop and laptop, we are increasingly accessing the internet from mobile smartphones and tablets. But other intelligent devices such as smart TVs, internet access printers, data storage devices, vehicles, surveillance systems, home automation, and even smart refrigerators can make online orders.

This suite of Internet-connected equipment adds a variety of Internet connection types. Currently, besides broadband connections, we have mobile internet connections at unimaginable speeds over the past decade and with high geographic coverage.

So we can use more and more online services from mobile devices at increasingly affordable costs. With this Internet expansion, our current activities have become more and more concentrated around Internet-connected devices.

The Internet is an inexhaustible informational resource. The Internet now provides information in the form of a wide range of services. Besides the well-known web service, we currently use social networks, watch video on demand, read the online press, navigate with gps and digital maps, etc. All through a variety of increasingly portable equipment. All of our activities are concentrated around these equipments, which is why there has been a need to synchronize them with each other.

The interconnection of the equipment we use everyday has become a necessity. Through the Internet, it is possible to connect the equipment to each other. For example, we can order automated home automation from our mobile phone, watch surveillance cameras live, print a document to a printer on another continent, share photos with friends, work with and share with other colleagues, we read and we send emails or socialize on social networks ... possibilities have become virtually limitless.

The interconnection of the equipment we use can be done in what is called cloud computing. Practically, with this technology, equipment becomes extensions of cloud-managed internet services. Cloud services are managed by a server that connects all the devices. Thus, information resources can be accessed from anywhere, anytime and from any equipment. At the same time, any equipment can bring new information into the system, process existing information, or manage it.

This way we can control our information. Another issue that arises is the one about the security of these services. The security issue has been and is very serious. Current computing systems can only guarantee a high level of security if they are properly exploited. Permanent maintenance of a system can guarantee a high level of security, which is why we have not addressed the issue of security very much.

Another aspect of the approach is cost-related. I will continue to present different solutions, each with its cost and I will propose a variant that I tested and which is focused on low cost.

1. Cloud Computing Solutions

In the acquisition of a computing system, the purchaser most often wants a "performance" that "needs to face" a long period of time as the Acquisition process so not to repeat very soon. This approach, in terms of costs, generate an increase in financial efforts required for acquisitions, but increasing the time until a new renewal plan is a reduction in cost per unit of time.

From my point of view, this approach may be flawed because in the first part of the product life-cycle, its performances are oversized, system resources being used at very low levels, which leads to an inefficient allocation of the costs.

Over time, software applications increasingly require more hardware resources, which is why towards the end of the normal duration of use, the system becomes overloaded and eventually replaced by a new acquisition.

In accounting, this depreciation is recorded in amortization. For IT equipment it is used accelerated depreciation method precisely because these assets have a quick depreciation. From this point of view, accounting assign higher costs in the first period of use and lower, towards the end of the period so as to allocate the entire amount of purchases made.

I believe that this approach is not very effective because in the first period of use of the system, when high costs are allocated, while the level of resource utilization is the lowest. It is true that there is an offset in the second half of their life cycles, but inefficient hardware resource allocation remains a problem.

Replacement cost of equipment is another problem of inefficiency. Thus, at the end of life of a product, its value is very low, in many cases without the possibility capitalization. Most purchasers, at the end of life of equipment are forced to quash old equipment without recovering anything and make a new purchase. The cycle repeats as described above.

What if a computer or any other equipment "antiquated" can be used long after the expiry of its life cycle?

The answer may be the dream of every IT purchaser. It will allow him at least two variants for cost effectiveness:

1. Allows to extend the life of existing equipment without making renewals, leading to a decrease in cost per unit of usage time
2. Allows to realize acquisitions at low cost, without having to invest in performance, in which case is solved and the inefficient allocation of resources over the life of the product.

Both scenarios are in favor of cost efficiency. At first glance it appears to be a cost savings that generate a decrease in quality. Computer users should raise a new question: Systems "underperforming" or "outdated" can meet the demands of modern software?

The answer is YES. Just as here comes the "magic" of virtualization. Through this technique systems less efficient can use the processing power of a single high-performance system thus solving two problems of costs described above: use a high level of hardware resources during the entire operation of the host system and increasing duration of use guest systems.

2. Hardware and Software Needs

Above I have presented some aspects of the cost efficiency through virtualization. In the following I want to present concrete implementation process with all the actual costs involved in this endeavor. In this experiment, besides cost efficiency by implementing virtualization solutions, I tried other cost reductions so finally to get the most efficient model possible with the lowest cost and the maximum performance.

Implementing virtual laboratory implies, like any IT solution, a strict correlation between hardware and software applications used. Hardware used in the implementation is divided into two categories:

- Server system - supplied by the company
- Networking equipment - provided by the university

The server used to create virtual laboratory has a number of key features including:

- HP ProLiant chassis SE316M1
- Processing Unit - two Intel Xeon L5630 2.13 GHz Quad Core with hyper-threading technology which together provide 16 cores

- RAM - 48GB
- Storage - 2 x 1TB HDD arranged in RAID

The acquisition cost of the system was about 400 Euro, considering buying a refurbished system.

Choosing a refurbished system was made precisely in the context of cost reduction. A similar system at the time of acquisition, if it was new product could reach values of approximately 2000 Euro.

Even in the refurbished system case, the product has a 2 year warranty, all components have been reconditioned and tested. Hardware requirements for supporting software applications are fully satisfied, which is why I think it was a successful purchase.

Analyzing computer market with the 400 euro could be made acquisitions such as this:
- 1 to 2 laptops or
- 2 to 3 desktops

Any of the above with limited hardware performance.

Network equipment used in implementation were provided by George Bacovia University in Bacau, all the infrastructure is already in place for many years, so no additional costs were incurred.

If there is a need for an acquisition of the network equipment, the cost of this varies depending on network topography, but these costs are insignificant.

On the user side, the virtual laboratory does not require any additional investment in hardware. Basically, the technology used for connecting to a virtual laboratory allows the use of any type of computer, access can be achieved even with mobile devices such as smartphones or tablets. Because of this fact I add this as a new cost-saving implementation of laboratory basically increasing the lifespan of existing equipment is diminish the cost per unit of usage time.

The software component used to implementation has been chosen keeping the same direction mitigation costs. In this sense I had in mind an approach oriented to concept of open source software.

The host operating system for virtual lab is Linux Ubuntu 14.04.3[1]. I did this choice because an operating system based on Linux kernel is very stable, secure and free to use. Ubuntu distribution was chosen because of its popularity. The chosen solution is not exclusive, it can be easily replaced by any other operating system, even Windows.

Considering the fact that the host system is going to run multiple different operating systems, I preferred a solution based on Linux because it requires very few hardware resources, it can be installed without a GUI, and thus managing to allow operating systems virtualized more hardware resource.

Another aspect needed to implement is virtualization software. I chose to use the VirtualBox[2] primarily because it can be installed directly from the Ubuntu software repository without complications on the installation of additional software. Also, Ubuntu community provides generous support for installation, configuration and use of this application. There are other similar applications, one such example being VMWare[3].

Another software component required is represented by the operating system and applications that will run on VMs. I chose open source operating systems based on different Linux distributions. The chosen solution is free, so do not generate license fees, but also offers a number of further advantages:
- Linux-based operating systems have pre-installed all the necessary applications for using a computer (utilities, office suite, Internet applications etc.);
- Linux-based operating systems do not require additional security applications (antivirus, Internet protection, etc.) which allows a more efficient use of hardware resources;
- Linux-based operating systems are well known for stability and security;

[1] http://www.ubuntu.com/server
[2] https://www.virtualbox.org/
[3] http://www.vmware.com/

- Linux-based operating systems use hardware resource more efficiently.

I must say that VirtualBox allows installing any type of operating system that can run on virtual resources allocated. For example, in the experiment I installed three kinds of Windows operating systems:
- Windows XP
- Windows 8.1
- Windows 10

I also tested in the same conditions operating systems like Android and Google Chromium. In this sense, I can confirm that a virtual machine software can run any operating system.

When using a proprietary operating system, it should be noted that the operating system license costs and the additional applications add to the overall cost of implementation.

For example, considering the rates charged by Microsoft for Windows operating systems and Office applications, the cost can increase by several hundred Euros. To these must also add prices of antivirus applications and other commercial applications. These are multiplied with the number of VMs deployed, reaching cost-cutting effort to become ineffective.

3. Implementation of Virtual Lab

The first step of the implementation process was the commissioning of the server and installing the operating system. As stated above, I used Linux Ubuntu Server 14.04.3. System image can be downloaded for free from site www.ubuntu.com, where you can choose the desired version. Version 14.04 is the latest with long-term support, it was launched in April 2014 and is maintained by Canonical for 5 years.

After completing the installation of the OS, I installed VirtualBox application. The Linux distributions based on Debian, which includes Ubuntu Linux, installing applications from software repository is achieved by a simple command such as: sudo apt-get install virtualbox.

I installed a series of server applications including: openssh server, apache, proftpd, webmin etc. The purpose of these applications is to facilitate access to the system. I note that the server must be able to be controlled remotely accessing its resources from anywhere in the world.

In VirtualBox application I created a virtual machine with the following characteristics:
- One processing core
- 2048 MB RAM
- Optical drive CD / DVD
- 10GB HDD
- 3D accelerated graphics adapter with 128MB RAM
- Network adapter

On this configuration I installed Ubuntu Linux 15.10[4] operating system, the latest version at the time. This operating system comes with all necessary user' applications.

Hardware configuration specified above is sufficient for running the system and its applications in optimal conditions. On the same configuration I tested the Windows operating systems and I can say that behaved well.

After updating the operating system and its applications I have prepared virtual machine cloning. Before cloning it, I saved an instance which can help recover damaged systems. By cloning a virtual machine is provided a copy with the same hardware configuration and the same information stored on its hard drive. The process is fast and avoid the time and effort required to installing a new operating system.

Applying elementary arithmetic in hardware resource allocation I thought that the host system can handle 10 virtual machines simultaneously:
- A processing core of 16 available
- 2 GB RAM per machine of 48 GB RAM
- 10GB HDD available in 1,000 GB HDD

[4] http://www.ubuntu.com/desktop

In these conditions, running 10 virtual machines simultaneously, these resources will be allocated to hardware:

- 10 cores
- 20 GB RAM
- 100 GB HDD

It should be noted that these parameters are maximal, in reality system dynamically allocates physical resources so that they can streamline the use of resources.

Host system, given that the 10 virtual machines simultaneously operate at full capacity, still has the necessary hardware resources for operation:

- 6 cores
- 28 GB RAM
- 900 GB HDD

For a Linux operating system, the above resources are more than enough, which is why there are reserves for at least five virtual machines.

Each virtual machine has connectivity to the network through the host system. Basically host system share the network connection with each virtual machine in part by offering the possibility to access their remote desktop type techniques. If the virtual machine network is connected to the Internet, it is possible to access virtual machines through the internet. Thus becomes mobile virtual lab.

Linux operating systems can be accessed remotely through various communication protocols, even through those offered by Windows operating systems. Thus, from any operating system (Windows, Linux, Android, iOS, etc.) can be make a connection to the virtual machines. In this context, the virtual laboratory is available on any platform, anywhere in the world.

Conclusions

I believe that virtualization is a technology that can streamline costs in IT departments. I noticed that an "investment" of 10 400 euro can sustain computing systems, so an average of 40 euros per system. This cost can be reduced up to 25 per system if we consider the reserve of hardware resources available on the server configuration used.

I must say that running 10 operating systems on a single server achieved a reduction in energy costs. If a computer consume several hundred watts on average, 10 computers will consume 10 times more than a server. Related to the number of hours of use of the 10 virtual machines can be record a significant saving of electricity.

Using virtual laboratory in education requires a specific maintenance. The variant using traditional computing systems, maintenance activities are great time consuming. Time is another important resource for the organization. This can be streamlined into a virtual laboratory.

Basically, if a virtual machine fails, it can be easily removed and replaced by a clone without reinstalling system or other remedial activities. If you want a change of hardware resources, a simple change in the configuration of virtual machines achieved this goal without physical changes in system architecture.

Upgrade the host system allows immediate development of all virtual machines. For example, if you want more storage space, but the host system is no longer available, it can be install new storage devices thus providing the necessary space upgrade.

The scalability of Linux operating systems allows more than upgrade the system. In case you want a virtual laboratory development can be introduce a new host system. It can be interconnected with first one and work together as a single system.

Technology provided by Ubuntu for such situations is called MAAS - Metal as a service[5]. Through its many physical systems can work together as one. This technology enables scaling a virtual laboratory without technical

[5] http://www.ubuntu.com/cloud/maas

limitations. Basically in such a cluster can be entered as many systems allowing scaling virtual machines laboratory.

In the context of public-private partnership in which I conducted this experiment has opened a new local market for online services - renting virtual machines. At a price of 5 euros per month per virtual machine investment can be recovered in less than 12 months.

To simplify access to virtual machines, remote desktop system can be implemented via a web browser. This would be much easier to access virtual machines, especially through mobile devices.

I think that this experiment is successful because it led to a substantial reduction in costs of upgrading a computer lab. Also, through the partnership between the university and the private sector can develop new services in the local market, services to support organizations interested in controlling costs related to information technology.

Supplementary recommended readings

Dan Kusnetzky, (2011), *Virtualization: A Manager's Guide*, O'Reilly Media, Inc.

Norma Carroll, (2013), *Server Virtualization 21 Success Secrets - 21 Most Asked Questions On Server Virtualization - What You Need To Know*, Emereo Publishing

Virtual Box Manual - *https://www.virtualbox.org/manual/UserManual.html*