PXES Thinclients: Conquering corporate desktops

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Zusammenfassung

Using Linux Thin Clients presents a clear alternative to proprietary operating systems that are now common in corporate desktops. PXES Universal Linux Thin Client is an Open Source thin client implementation that could provide the solution even to comapnies where all the applications run on proprietary operating systems. This solution is full of technical an economical benefits and provides a way to dramatically reduce Total Cost of Ownership and simplify IT infrastructure.

Outline: I've divided my presentation into sections, featuring topics like, what is a thin client, thin clients brief history, solutions benefits, solution components and implementation details.

1 Conquering the Corporate Desktop

In the last time we have heard a lot about Linux conquering the desktop mainly in the corporate field. Although, there is a big number of companies where this approach is not yes possible because the dependency on Windows applications is very high.

The approach presented here shows a way to keep those applications running while freeing the desktop from the proprietary operating system and as a starting point of the final liberation that will take place in the years to come.. It is based on the deployment of Linux thin clients using PXES Universal Linux Thin Client software.

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2 PXES Universal Linux Thin Client

PXES Universal Linux Thin Client is ans Open Source project providing a common Linux micro distribution to run on thin clients or to convert old PCs, not suitable to run other desktop operating system, into fully functional thin clients.

2.1 The TCO problem

Labor and management costs rise up to 70% of the Total Cost of Ownership of a typical networked PC, accordingly to studies carried on by Gartner Group.

As a side effect, the deployment of thin clients and server centric software will drive the reduction of your TCO.

2.2 What is a thin client ?

This is the first question we should ask ourselves.

A thin client is a *small desktop computer* which has the following properties:

2.2.1 Boots-off the network

The thin client hardware has the embedded capacity of booting-off the network, requesting its IP address and other network parameters from a server to configure its protocol stack being able to initiate a transfer of the bootstrap program that finally load the operating system.

2.2.2 Diskless and deviceless

Usually the thin client has no local storage devices, hence the name: thin client or diskless workstation.

Having no local devices makes the network-boot an imperative requirement. Additionally, this commonly implies no moving or rotating mechanical parts, which among other benefits results in:

- no noise (it's totally quiet)
- less power consumption
- and fewer failures

And these property lead us again to an important TCO reduction.

2.2.3 Little intrinsic value

The processing power required in thin client is minimum as well as memory needed to run the software. This combination produces a desktop computer with low or no intrinsic value at all, preventing robbery when installed in semi-public places.

2.3 Brief history

There have been many attempts in the past at designing successful thin clients and no one has completed the journey towards desktop domination.

2.3.1 Citrix Winframe in 1995

Citrix in cooperation with Microsoft launched Winframe which evolved becoming the current Metaframe. This was a truly Server Centric solution as all of the processes run on the server and the network traffic is only composed of screenshots and input events.

2.3.2 Wyse Winterm in late 1995

Wyse was a leading manufacturer of characters terminals.

Foreseeing a shift in the market they had the insight to adopt thin clients at an earlier stage, perhaps even before people got to understanding the concept very well. Their main idea was to support the Citrix initiative and recover the market they were loosing since the PC had been introduced more than 10 years before.

2.3.3 Larry Ellison's Network Computer in mid 1996

Larry Ellison, best known for being Oracle CEO, promised a change in the corporate and home desktop, replacing PC by Network Computers priced around USD $500 and using the Internet as a vast repository of applications and data.

To get the concept off the ground, however, Larry promised more than the NC was capable of delivering, leaving an array of disappointed people behind.

While the product ultimately failed, the NC had a great impact and forever changed the computer industry and the way we buy PCs.

After this failure, the company behind the NC tried to reinvent itself as the New Internet Computer (NIC), but failed once again.

2.3.4 Sun Javastation between 1997 and 2000

During its life, the Sun's Javastation, went from desktop terminal to single-app desktop device to browser based desktop to finally extinction. This evolution clearly proves that Sun was more interested in Java than conquering the desktop with thin clients.

Sun changed its plans and is now selling the Sun Ray, a kind of Javastation evolution without the JavaOS, but due to its high network bandwidth requirements it is very probable that we are not going to be seeing Sun Rays anywhere but in some corporate LANs.

Bearing these examples in mind, we can conclude that there was a lot of fruitless implementations in the past and we can consider the "green text terminal, that plagued the first desktops, the last successful thin client.

And, as everyone knows today the desktop is dominated by fat clients.

PXES presents a clear alternative to this model and is ready for mission critical enterprise use providing the much awaited thin client successful solution.

2.4 Solution benefits

We can analyze the benefits from different perspectives.

2.4.1 Technical

From the technical point of view the benefits that thin clients yield, arise from one simple concept: centralization.

By centralizing we can put together all of the computing power, storage, applications and data. This is called Server Centric computing.

Server Centric computing is defined as the concept where all of the processes run on the server and the thin clients are only showing the screen and sending input events. The applications can be run on a server cluster to minimize service disruption.

As it has a single point of administration at the servers, this centralization becomes more efficient than the distributed solution. There's only one point to:

- change configurations
- do updates
- do backups and any other administrative tasks, and...
- control the security

This is a totally scalable solution and when more resources are needed they are added to the servers.

Let's take a look at,

Desktop virtualization, another feature provided by this model. It is the ability to untie the desktop session from the device where the session is used.

Thanks to its virtual behavior and a stateless nature, the desktop can be accessed through Internet.

As we can envision this is a clear path into the future.

2.4.2 Economical

From the economical point of view the benefits are many and the solution is cost effective.

For example:

There's now a single point of investment in the server and the solution could be built on the existing assets.

It significantly reduces the budget spent on individual desktop maintenance and dramatically reduces the Total Cost of Ownership.

Remember what we said about Larry Ellison's NC ?

The objective, that couldn't be reached at that time, was to build an NC costing around USD $500. Now we can afford much more powerful and feature full thin clients for as little as USD $200.

As showed in research conducted by the Gartner Group the yearly TCO of a networked desktop PC can be around USD $8000. And can be reduced, using the thin client solution, to between 45 and 54% over a five-year period.

The savings are even greater, as thin clients outperform the life expectancy of a typical desktop computer by many years, at least twice as long.

Additionally, other benefits we can analyze are for

2.4.3 Administrators

As mentioned before, having only one administration point greatly simplifies the daily tasks.

Software updates will not be a headache anymore. A group of servers could be upgraded and tested and once the tests are passed the server appointed by the thin clients is changed instantly. The whole company or institution will be using the new software at the same time increasing service availability.

Remote locations, branch offices or stores can be cleaned up and all remote servers can be eliminated reducing TCO even more than mentioned. It is a well known fact that Wells Fargo Bank reduced its branch offices TCO up to a 75% using thin clients and centralizing servers.

Furthermore, the server centralization is a great step towards implementation of some useful technologies such as Directory Services and Single Sign On, that are often left aside because of the problems involved in deploying these in a huge installed desktop base.

2.4.4 Users

Adding to the many advantages presented previously, the thin client deployment should be unnoticeable for the end user, apart from the enhancements the user will realize.

The thin client looks and acts as a traditional desktop computer and presents some considerable improvements to the working place.

One of the most appreciable enhancements is the totally quiet and cool operation.

On the other hand the user's working environment is not disrupted, something that as unbelievable as it appears, cannot be achieved using native tools. With this solution there's no need for the user to change back and forth between environment. There's only one.

The performance seen in running applications knows no precedents, the user accustomed to dealing with slow and swapping local applications will soon perceive the benefit of the same application running on really powerful servers.

An additional gain is the user's desktop virtualization that enables access not only from the desktop computer but also from any location on Internet.

The stateless nature of the virtual session allows the user to close a session while the launched programs are running and later in the same or another location, reconnect to the same session where those programs have continued to run immutably.

2.5 Solution components

There are four major solution components:

- The network
- The servers
- The thin clients
- The software

2.5.1 The network

In this setup the network becomes the most crucial (critical) component. Inefficiencies and problems that were tolerable before are now evident and disruptive to the normal operating process.

Most network links and services now have to be backed-up. The situation now is "all or nothing (not network, no net work).

VPNs are suitable for those backup links, because as a differentiating key feature PXES doesn't mount the root filesystem over NFS.

The small bandwidth requirement of thin clients, which lies in the range of 30 to 70 Kbps per session, enables the use of dial up lines, ADSL or ISDN.

On the other hand the network is implicitly cleaned up, as a side effect. Problematic or inefficient protocols that have survived for ages can now be removed completely.

2.5.2 The servers

This is the second most crucial (critical) component.

High availability and fault tolerance are required features, as they are responsible for the authentication and users desktop presentation.

A thin client with no server to access is totally useless.

Servers are usually placed in server farms while accessing Storage Area Networks.

Those servers are also placed closer to other servers, optimizing communication paths.

They are easily scalable adding more servers to the farm.

2.5.3 The thin clients

We have already talked about thin clients characteristics, so little is left to be said.

One concept that we can add is that everything connected to the server using the server's protocol could be considered a kind of thin client.

This means that we can convert fat clients into thin clients even temporarily.

It is useful when we are migrating progressively or testing the environment.

2.5.4 The software

The software involved in the solution has two components:

- server software
- thin client software

The server software Any software permitting multiuser access trough a specific protocol could be used.

As you can see the complete list of servers and protocols is on the slide, so we are going to mention just the main ones.

Citrix ICA This is a highly evolutioned Server Centric implementation but, unfortunately it is very costly and can not be included in most company budgets.

Microsoft RDP In light of the the Citrix Metaframe success in the past, Microsoft became aware that they couldn't ignore the Server Centric market any longer, and started to introduce Terminal Services features reaching its maturity in W2K3.

Unix/Linux XDM Unix and Linux boxes have had these services available for many years, long before anyone even imagined a multi-session platform.

Unfortunately, it has never achieved a great success, perhaps due to its heavy network requirements and sensitivity to latency.

2.6 Implementation details

As I mentioned before, there are some points that have to be taken into account to build a successful thin client solution.

2.6.1 Linux based thin clients

Much has been said about the reasons why Linux is the best option over other operating systems, so we are not going to go deeper into the subject.

PXES is totally based on Red Hat distribution, except for a few components, greatly simplifying the development process. Standard components are built or extracted from original RPM packages.

The kernel is configured accordingly to thin client demands.

Automatic hardware discovery and configuration It provides full automatic discovery and configuration for the wide range of hardware PXES supports.

This feature, that is becoming more common in today's distributions, was not fully supported, even by the major ones, a couple of years ago when PXES came into being.

This led to achieve one of the PXES main goals which is: one image fits all.

This means that building only one initial ramdisk image you can support a wide range of thin clients from different vendors and with different capabilities, greatly reducing administrative efforts.

All of these differences are handled at boot time and the thin client auto-configures itself.

The way of managing differences in thin client functionality is by means of a method called Remote configuration. After booting the thin client, it searches a remote server to obtain generic and particular configuration files.

This leads us to yet another of the main project's objectives which allows Companies running 100% Microsoft products [yes, they still exist] (where there's no Linux box to build ram disk images and no NFS server to mount) to enjoy the benefits of Linux thin clients too.

The only thing they need to do is to download a pre-built PXES image, configure the DHCP and TFTP server and to boot the thin clients.

Small footprint By creating a really small distribution, we can call it a micro distribution, many aspects of the thin client environment are improved.

The network boot time is dramatically reduced.

As it is RAM resident after booting, the memory needs are also greatly reduced.

Although, it is not the main project boot method, you can easily burn eeproms or flashes to boot from.

Just for the record, the average PXES initial ramdisk image is about 5 Mb.

In these 5 Mb you get:

- Linux (although the kernel is not part of the ram disk image)
- Auto-configuration tools, with all the supported hardware drivers
- System tools, such as sh, sed, grep, etc., provided by Busybox.
- Network tools, such as ip, ifconfig, etc.
- an X Windows system
- Selected client sessions
- Local web server for remote monitoring
- Local telnet server for remote administration
- Local session shadowing tools

So, it's pretty small, isn't it ?

A fast machine connected to a fast network can boot off the network and show the graphical login session in about 10 seconds.

Additionally, you can obtain a local session with a simplified customizable desktop and local window manager. All of these in the small ram disk.

In this simple desktop the icons employed to launch applications can be customized. These icons provide the users with a powerful yet simple way for performing their tasks.

Now, we'll take a look at...

2.6.2 The GUI configuration tool

To help the process of image building a Graphical User Interface is provided.

Creating an image is as easy as going through the pages of a Gnome Druid, a wizard like tool, and completing the requested values.

Bearing in mind that no thorough Linux knowledge is required (remember the Companies running 100% Microsoft products that we mentioned previously) and that the default values are a very good starting point, anyone can try it.

Once the druid has finished the configuration, the images are created and ready to be dropped into the TFTP server, which could be Microsoft if you like, and be duly booted by the thin client.

This greatly simplifies the process and prompts people not normally acquainted with Linux to have a go at it.

2.7 Conclusions

As we have seen, the maturity reached by the thin client and the server software ensures a scalable and robust solution for mission critical enterprise use.

Server Centric computing combined with thin clients can dramatically cut hardware investment, maintenance and upgrade costs, providing better control over application software and data, and reducing end user problems.