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by Ben Elliot

Introduction

A thin client is a computer which acts as a remote keyboard, video, and mouse terminal for another machine. The terminal server performs all computation and stores all data. Multiple thin clients can access simultaneously. Together, the clients and server make up the thin client computing model. Key differences between this model and traditional computing is that a thin client model can better utilize resources, improve centralization and integrity of data, and reduce total hardware costs.

Startup Process

A typical thin client only needs enough memory to power its display and a network card to communicate with the server. Most computers manufactured since 1998 are Preboot Execution Environment (PXE) capable, meaning that they can use their network card as a boot media, similar to starting up from a CD or hard drive. The server is set up to recognize the PXE startup signal and will send enough software to allow the computer to act as a thin client. Once fully booted, users can log into the thin client, and can use the Operating System and Applications installed on the server.
Thin clients will usually be set up on their own private network, separate from other machines. One network card of the server will be on the thin client network, and the other network card will connect to the regular network as usual. It is important that the two network cards are not switched; the card on the private network will have usually have a DHCP service running, which will interfere with the regular network which will already have DHCP service.

**Resource Utilization**

All of the computing power, memory, and hard drive space is on the server side. These resources will be shared among all thin clients. These resources are easier to allocate due to their centralized location.

On a thin client server, programs only need to be loaded into memory once, regardless of the number of people using the program at the time. A web browser in operation on 16 different workstations will have a total memory footprint of 16 times the ordinary amount since it was
loaded in 16 different locations. If this same web browser were on a thin client server, the program itself would only be in memory once, only requiring additional space to hold user specific data.

Similarly, other resources such as the CPU can be more fully utilized when all of the power is in a central location.

**Data Centralization**

The server will have direct access to all hard drives in the system. Instead of having data spread among a number of workstations like in the traditional computing model, all user data will be stored on the server. This makes the process of finding and making backup copies of the data much simpler, improving data integrity. If any single workstation's hard drive fails in a traditional computer lab, data loss is much more likely since workstations are not backed up as often as servers. A server can survive such an incident through redundant hard drives (RAID arrays) and automated backups, both of which are easier to implement in one location than in many.

If a hardware failure occurs on a thin client, no saved data is lost; the client can easily be replaced with another machine set up for network booting. In the meantime, the user can log into another thin client and be able to access the same environment they had on the previous machine.

**Hardware Costs**

A good server can easily cost about six times as much as a typical workstation, but that cost includes multiple CPUs, along more ram and hard drive space than any workstation. However, with these resources, a thin client server can serve more clients for less total cost than buying each workstation separately. This is made possible due to the economy of scale provided by resource centralization.

The thin clients, due to the low hardware requirements of terminal software, can be machines near the end of their life cycle that are unable
to comfortably run modern software. With no hard drive required for these operations, it is not necessary to trust aging hard drives with important data. Ideally suitable thin clients will already be on hand, making the cost of redeployment very low. The largest expense for these workstations will probably be a new monitor if needed.

**Further Information**

Here are several links for further basic information about thin client networks:

General introduction:
https://help.ubuntu.com/community/EdubuntuDocumentation/EdubuntuCookbook/

ThinClient Background information:
https://help.ubuntu.com/community/EdubuntuDocumentation/EdubuntuCookbook/

Background A wiring guide:
https://help.ubuntu.com/community/UbuntuLTSP/LTSPWiring