



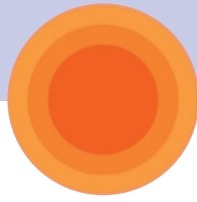
LTSP

Extending the Life of Older Computer Hardware in Your Library

How to Set Up a Linux Terminal Server Project Installation

The Birzeit University Library Experience by Dr. Wasel Ghanem, Head of Computer Systems Engineering Department
and Mrs. Diana Sayej-Naser, Library Director, Birzeit University

2009



INTRODUCTION

Libraries can now re-cycle apparently obsolete computers and transform these aging PCs into high-speed multi-purpose library terminals using open source software.

A few old computers, some freely available open source software, and a little knowledge was all it took to create a high-speed network that pleased staff and astonished students at Yusuf Ahmed Al-Ghanim Library, the Main Library at Birzeit University in Palestine's West Bank.

The system was tested in different locations. In the library and in different schools in Palestine the feedback about the performance of the system was excellent.

eIFL.net¹ submitted stories from its Spotlight² series, which highlights achievements from its participating countries, in response to the 2008 UNESCO Information for All Programme (IFAP)³ call to share stories and good practices in using information for development in all parts of the world. The stories

collected provide practical examples to inspire others and raise the visibility of the critically important role that information plays in development.

The eIFL.net Spotlight from Birzeit University: "Open Source Software brings a new lease of life to libraries in Palestine" was selected by the Bureau of the Information for All Programme to receive project funding in order to replicate the story. Five stories, out of a total of 34 submissions, were selected to represent each UNESCO region (Africa, Arab States, Europe and North America, Latin America and the Caribbean, Asia and the Pacific).

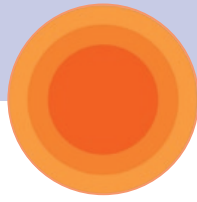
With this *HowTo* guide we aim to help libraries in other developing countries benefit from Birzeit University Library's experience in order to implement their own Linux Terminal Server Project (LTSP) installation. In order to reach more countries and encourage replication, this *HowTo* guide is available in Arabic, English, French, Portuguese, Russian and Spanish⁴.

¹ www.eifl.net

² <http://www.eifl.net/cps/sections/news/spotlight>

³ <http://www.unesco-ci.org/cgi-bin/ifapstories/page.cgi?g=;d=1>

⁴ All versions of the guide are available from <http://www.eifl.net/cps/sections/services/eiflfoss/ltsf>



BIRZEIT UNIVERSITY AND ITS MAIN LIBRARY

Birzeit University, situated just outside the town of Birzeit near Ramallah in the West Bank, was the first Arab university to be established in Palestine in 1923 and is widely considered the foremost third-level educational establishment in Palestine. Birzeit University's academic achievement and community orientation has earned it a well-deserved local and international reputation of academic excellence and societal relevance. The University has more than 800 faculty and staff members with a student body of over 8700 students.

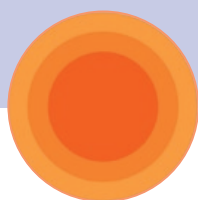
The University offers numerous undergraduate and graduate programs through its eight faculties: Arts, Commerce and Economics, Engineering, Sciences, Law & Public Administration, Information Technology, Nursing and Health Professions, and Graduate Studies. In addition to the eight faculties, the University operates community institutes, centers, and programs including the Institute of Community and Public Health, Institute of Law, Institute of Women Studies, Ibrahim Abu Lughod Institute of International Studies, Media Institute, Palestinian Institute of Archaeology, Institute of Water Studies, Center for Environmental and Occupational Health Sciences, Center for Continuing Education, Center of Development Studies and the Democracy and Human Rights Program.

The University's Computer Center provides services and support to continuously keep the university community up to date on the latest information technology.

Birzeit University has one main library and five special libraries; they are all under the direct technical supervision of the main library. They focus on specific fields of study and include the Institute of Law Library, the Institute of Women's Studies Library, the Institute of Community and Public Health Library, the Institute of International Studies Library and the Center of Development Studies Library. The Yousef Ahmed Alghanim Main Library accommodates more than 600 people and houses close to 147,000 volumes. The four-story building and the annex have expanded facilities for students and researchers, with seven study halls and a number of private rooms for individual work.

The mission of the University Library is to support the curriculum of Birzeit University. In addition, access to information on academic, scientific, technological, cultural and social issues is available to all members of the university community as well as other universities, high schools, research organizations and individuals within the larger Palestinian society.

Presently there is a computer lab equipped with 10 PCs using open source software for searching online databases and the on-line public catalogue (Minisis). Other PC's are distributed on the different floors (4 PCs per floor) except the main entrance where 6 PCs are available for the online catalogue. (These six were donated to the library by USAID through AED "Academy of Educational Development" in 2005.)



OPEN SOURCE SOFTWARE AT BIRZEIT UNIVERSITY MAIN LIBRARY: BACKGROUND

The increase in student numbers year after year and the opening of new faculties from time to time has required the addition of new e-resources.

Birzeit University Library has added the best online databases to its resources, offering the patrons up-to-date articles and e-books. It already subscribes to about 20 online databases, including one that is for e-books covering about 40,000 titles, plus a few others are available with free access through eIFL.net.

The online catalogue (OPAC) gives the library patrons the ability to search for everything in the library from articles to books to CDs and DVDs.

More online services require more computers to serve more students at the same time. In addition, faster PCs are needed. To meet this demand a few PC's were upgraded, and a few more were purchased but still the problem was not solved.

Cost is always the major barrier between you and your needs. The library lab had a few old PC's (Pentium I and II's) that had served well in the past. Unfortunately they do not have sufficient capacity for current software leading to obsolescence. Naturally students and other patrons prefer to use newer and faster PCs rather than slow ones.

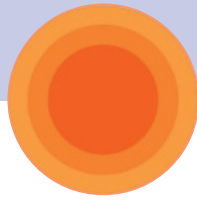
IMPLEMENTATION OF LTSP AT BIRZEIT UNIVERSITY MAIN LIBRARY

Library Director Diana Sayej-Naser was inspired to approach the University's Computer Systems Engineering Department, headed by Dr. Wasel Ghanem, on returning home from the eIFL.net General Assembly in Vilnius in October 2005. She had attended a workshop on "Open Source Software for Libraries" presented by Mark Leggott of the University of Prince Edward Island and Art Rhyno of the University of Windsor, both in Canada. On raising the issue with Dr. Ghanem she learned that the department was itself running a project on open source software. Together they explored the possibility of applying open source solutions in the library in order to achieve better results and quicker services.

The open source project at Birzeit University focuses on the ICT infrastructure required to support large-scale deployment and applications of technology in education. It uses Linux Terminal Server Project (LTSP), an add-on package for Linux that allows lots of low-powered PCs to function as thin client terminals connected to a Linux server. As well as the Main Library at the University, the system has been tested in Abu-Shkkaidem and Al-Saweyya schools and is being implemented in Lutheran Industrial school, Al-Biereh, and Al-Hashemeyya, the two biggest secondary schools in Ramallah.

Within a couple of months, the library transformed its old computers into a new high-speed network with access to the internet, online databases, the library catalogue and Ritaj, the university's academic web portal.

"The library terminals are always in high demand, so the students were delighted to have ten more computers available. At first it was hard to convince them to work with Pentium 1 and 2 computers which date back to 1993, because they expected them to be slow and unworkable," said Diana Sayej-Naser. However, the reaction of Nizar Khalil, a fourth year arts student, was typical, "I found no difference between this Pentium 2 and the Pentium 4 computer located in the main hall of the library. The speed is great! What have you done with them to become that fast?"



STUDENTS ARE HAPPIER!

They got 10 computers which gave them more chance to do their work. At first it was hard to convince them to work with Pentium one and Pentium two computers because they knew that these computers were slow enough to make them get bored. But they got surprised from the great internet speed which had let them do their work almost like if they were working with high speed computers.



233 MHz
32 MB Ram
Open Source
Software

MACHINE IS DIFFERENT BUT SPEED IS THE SAME!

It's really great!
Old and slow computers provide you with high speed internet and act like new computers. Thanks to Open Source Software.

3.4 GHz
504 MB Ram
Windows XP
Professional



10 computers running
Open Source Software

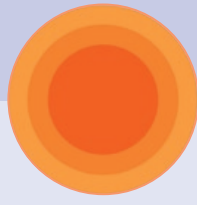


The answer is simple according to Dr. Wasel Ghanem, head of Computer Systems Engineering Department. "We switched to open source software. All the computers run Linux and their memory is upgraded. One Pentium 4 computer acts as a server to the ten older computers that operate as thin clients. Now they perform just as well as the new computers running standalone software".

Dr. Ghanem believes that open source software offers great potential especially for developing countries. "Up until now, ICT in Palestine has largely focused on proprietary solutions, mainly Microsoft. The typical lifetime of a PC computer network is three years, after which new versions of operating systems and applications become necessary. This is expensive and has hampered large-scale deploy-

ment of computer infrastructure in Palestine. Open source software can provide significant cost savings, especially in the education sectors. This solution would reduce deployment costs of hardware by up to 65% and extend the useable lifetime of hardware by 100%. It would reduce licensing fees to practically no cost because the software is available at no charge. It would reduce support costs and stimulate innovation and transfer of knowledge through providing Palestinian developers the possibility to contribute to the global development of open source systems and applications."

But for Dr. Ghanem it is not just about cost, it is also about quality. "Open source software is flexible and sometimes superior to proprietary solutions."



HOW TO SET UP A LINUX TERMINAL SERVER PROJECT INSTALLATION

SOFTWARE REQUIREMENTS

In order to install the Edubuntu 8.04, nicknamed *Hardy Heron*, classroom server you need to get two CDs. (Although these instructions are for Ubuntu 8.04, a similar set of instructions would apply for later versions of Ubuntu.)

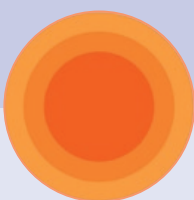
1. Ubuntu 8.04 Alternate CD

You can download this CD in many ways including via BitTorrent. Choose the download method that is most suitable for you. The file you will need is available at this url: <http://releases.ubuntu.com/releases/8.04/> You should select the PC (Intel x86) alternate install CD. Once you have downloaded the ISO image burn it to a CD.

Note: The Alternate CD does not include the Edubuntu LiveCD; it has only the command line installer.

2. Edubuntu 8.04 Add-ons

For the educational bundles that you will require, you need to download the Ubuntu educational add-on CD. Again, you can download this CD in many ways including via BitTorrent. The file you will need is available at this url: <http://releases.ubuntu.com/edubuntu/8.04/> You should select the PC (Intel x86) Ubuntu educational add-on CD. Once you have downloaded the ISO image, burn it to a CD.



HARDWARE REQUIREMENTS

Server Requirements:

One PC will function as the *server* in your LTSP installation. This should be the most powerful PC of those you have available. Here are the minimum hardware requirements for your LTSP server.

- RAM
Total RAM = 256MB + (50MB per terminal or thin client)

Example: If you wish to set an LTSP server with 10 terminals then your server needs 756MB of RAM, that is 256MB + 50 MB for each terminal, or 500MB.
- CPU
A CPU with 3000MHz could serve up to 30 terminals. A single terminal, or user, will use from 1% to 3% of the server's CPU.
- Hard Disk Drive
A SCSI drive is recommended for servers. A drive with at least 15K rpm is needed in order to support more than 20 terminals.
A SATA drive with Configuration RAID-1 would also be sufficient to server 10 to 20 terminals.

Thin Client, or Terminal, Requirements:

You may have as many terminals as you wish as long as you do not surpass the limits of your LTSP server. Here are the minimum hardware requirements for the LTSP terminal or thin client.

- RAM
128MB (Note: a terminal will function on less RAM, even as little as 32MB, but its performance will be significantly compromised.)
- Network boot facility
There should be a network boot facility present in the BIOS of the motherboard (Network Card) in each terminal.

NETWORK REQUIREMENTS

- The thin clients or terminals should be connected to a hub or switch (the recommended option) using Straight Through Cables.
- The server should also be connected to the hub or switch.
- You should consider using a 1GB connection between the server and the switch, and then use 100MB connections between the clients and the switch.

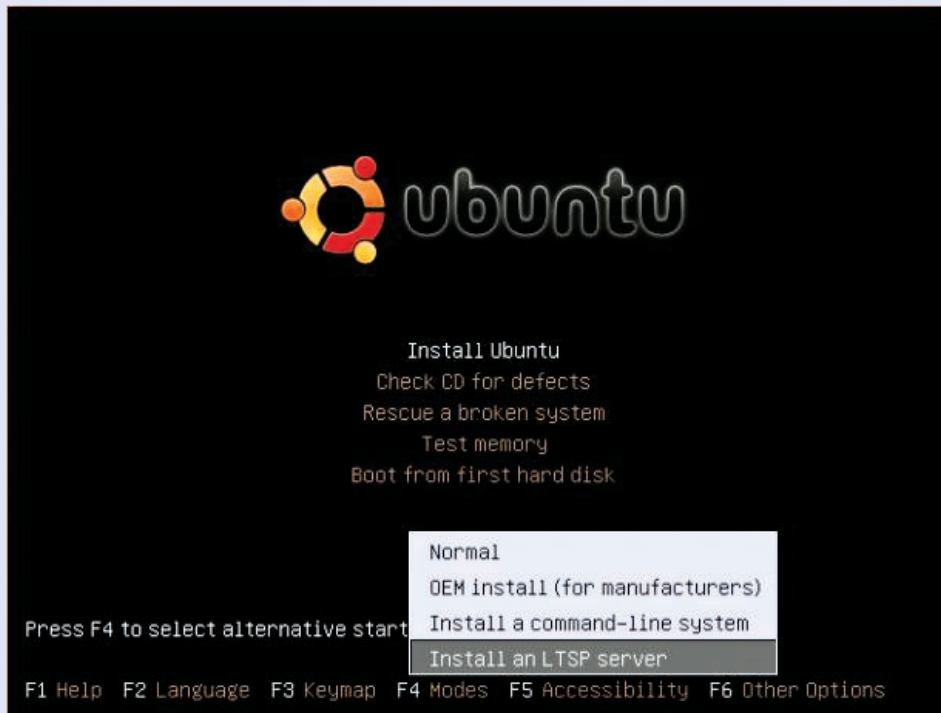
POWER REQUIREMENTS

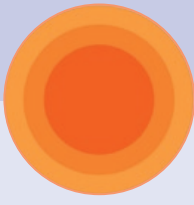
- All of the terminals and the server will need to be plugged into a power supply. It would be a good idea to have a backup power supply in case the power supply for the server goes down.



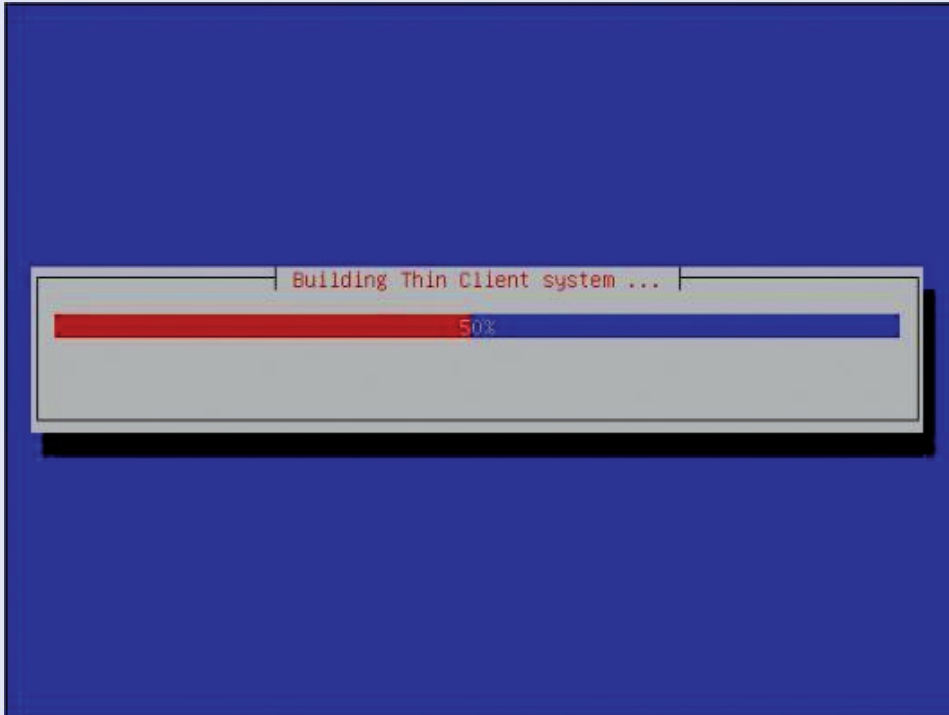
INSTALLATION

1. Boot the PC you have selected for your server from the alternate install CD.
2. A window will show up for choosing your Language.
3. After choosing your language, at the main install screen select F4 ("Modes") and choose the LTSP option. The installation from this point forward will be mostly automatic. Just follow the screens as they arise.





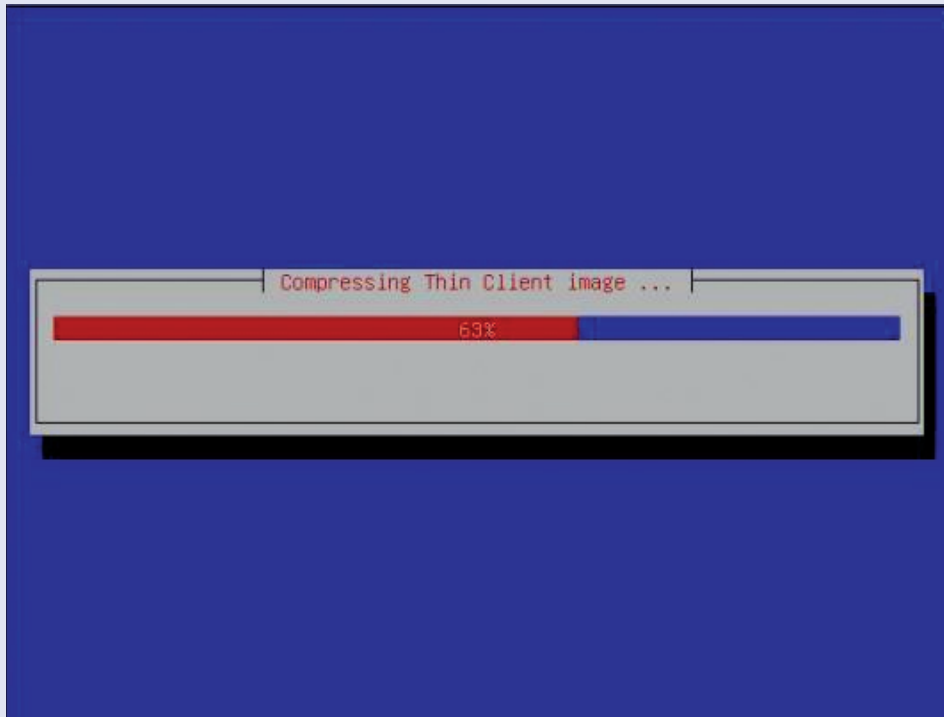
Building Thin Client System



Towards the end of the install the installer will start to build the client environment from the packages on the CD.



Compressing Thin Client Image



Which then will be compressed into an image...

If the installer is done and has rebooted into your new system you will be able to boot your first thin client or terminal right away. Just connect it into the same network the server is in.

Troubleshooting:

- If you had an error message about the DHCP connection, just continue your work and configure it manually later on.
- The DHCP issue will arise again when the system begins "Building the Thin Client", but it will tell you that you can configure it manually on this file `/etc/ltsp/dhcpd.conf`



RUNNING LTSP 5

If everything has been done right, and no error messages about the DHCP appeared to you, then you now can run your first thin client!

If you did have the DHCP error messages then you need to configure the DHCP, and the LTSP configuration files. The following should help:

1. Set a static IP for the server and change the IP inside `/etc/ltsp/dhcpd.conf`

Here is an example of what the `dhcpd.conf` file will look like (assuming the IP used is 192.168.0.1 for the server):

```
authoritative;
subnet 192.168.0.0 netmask 255.255.255.0 {
  range 192.168.0.5 192.168.0.200;
  option domain-name "";
  option domain-name-servers 192.168.0.1;
  option broadcast-address 192.168.0.255;
  option routers 192.168.0.1;

  option subnet-mask 255.255.255.0;
  option root-path "/opt/ltsp/i386";
  if substring( option vendor-class-identifier, 0, 9 ) = "PXEClient" {
    filename "/ltsp/i386/pxelinux.0";
  } else {
    filename "/ltsp/i386/nbi.img";
  }
}
```

2. Make sure you are configuring the same ethernet that is connected to the switch.
3. Make sure the range inside the `dhcpd.conf` file does not include the broadcasting IP! (i.e. 192.168.0.255)

INTERNET ACCESS

To give the thin clients Internet access you need to have 2 NIC (Network Interface Cards) on your LTSP server, in which one of them is configured to provide the LTSP functionality (DHCP providing IPs for thin clients, loading kernel ... etc.) and the other interface configured to use Internet access. When the server is able to connect to the Internet, the clients will also have the same access.



MANAGING USERS

On the server, open a terminal window and type:

```
$ sudo adduser username
```

Enter your password, and you should then see something like:

```
Adding user `<username>' ...
Adding new group `<groupname>' (1007) ...
Adding new user `<username>' (1004) with group `<groupname>' ...
Creating home directory `/home/<username>' ...
Copying files from `/etc/skel' ...
Enter new UNIX password:
```

Type in a password for the new user, and retype it when prompted. You should then see:

```
passwd: password updated successfully
Changing the user information for <username>
Enter the new value, or press ENTER for the default
Full Name [ ]:
```

Type in the user's full name (if desired). You may hit <Enter> through any prompts you do not wish to fill in. Hit Y to finish the creation of the new user when prompted if the information you entered was correct.

To add the newly created user to a group simply type:

```
$ sudo addgroup <username> <groupname>

sudo addgroup <username> <groupname>
Adding user `<username>' to group `<groupname>' ...
Adding user <username> to group <groupname>
Done.
```

You can also simply add a new group to the system by typing:

```
sudo addgroup <groupname>
Adding group `<groupname>' (GID 1007) ...
Done.
```



Troubleshooting:

- If you change the IP data after you have done the initial setup, please run the command `sudo ltsp-update-sshkeys` to make the ssh server aware of the change.
- If you receive the error message on the client that “This workstation isn't authorized to connect to server”, please run commands

```
sudo ltsp-update-sshkeys
```

and

```
sudo ltsp-update-image
```

(in that order; see reference:

<https://bugs.launchpad.net/ubuntu/+source/ltsp/+bug/144296> for an explanation of this bug).

- For more comprehensive documentation of LTSP 5 that's available in Ubuntu, please see the Edubuntu Handbook at <http://doc.ubuntu.com/edubuntu/edubuntu/handbook/C/>
- A beginner's working example of an LTSP server using 2 NIC cards can be found at <http://ubuntuforums.org/showthread.php?t=599166&highlight=ltsp>

FURTHER LTSP RESOURCES

OSL Wiki

<http://osl.birzeit.edu>

Ubuntu Help

<http://help.ubuntu.com>

LTSP Website

<http://ltsp.org>

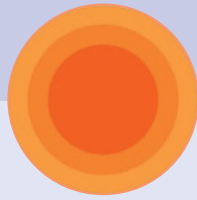
<https://help.ubuntu.com/community/UbuntuLTSP>

Server Requirements

<http://wiki.ltsp.org/twiki/bin/view/Ltsp/ServerSizing>

Client Requirements

http://wiki.ltsp.org/twiki/bin/view/Ltsp/Clients#What_s_the_minimum_client



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