

Linux Installation guide for labs running labcontrol

Chair of empirical and experimental economics

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1 Introduction

We use Ubuntu 10.04 LTS in our lab. Support for this Version will be provided until April 2013. You can download Ubuntu at <http://www.ubuntu.com/getubuntu/download>.

In this Document we want to explain the specific configuration with which labcontrol and zTree work fine. We will not illustrate how to generally install Ubuntu Linux. If you need general help with Ubuntu you can find a lot of information on the internet, i.e. <https://help.ubuntu.com/10.04/index.html> (english) or <http://wiki.ubuntuusers.de/Startseite> (german).

Assumptions names: client01-client18 private subnet, no internet required

General proceeding Due to the fact that we have 18 similar client computers, we only install and configure Ubuntu 10.04 at one client (see section 3) and afterwards distribute it to the other clients (distribution see section 4).

Hints Text which is printed in blue color explain special requirements or settings only according to our lab. For external readers this hints may be useful to understand the given commands better.

2 Configuration of the experimenter-computer (Server)

2.1 Hints according to installation

2.1.1 Partitions

The Server contains two 320-GB hard disks, which are used with a software-RAID.

Partition	Size	Description
sda1 / sdb1	1 GB	old /boot, not used
sda2 / sdb2 (RAID0 → md0)	2 GB	Linux-SWAP
sda5 / sdb5 (RAID1 → md1)	10 GB	Linux-System (Ubuntu 10.4 LTS)
sda6 / sdb6 (RAID1 → md2)	10 GB	old Linux-System (Ubuntu 9.04)
sda7 / sdb7 (RAID1 → md3)	100 GB	/home-Partition
sda8 / sdb8 (RAID1 → md4)	175 GB	/archive-Partition for images, backups etc.

2.1.2 Username

We use experimenter as username.

2.1.3 additional packages

We installed the following packages with all dependencies:

```
mc
auctex
texlive
texlive-lang-german
r-base
kde-full
ssh
wine
bluefish
vim-gtk
gstreamer0.10-*
dhcp3-server
wireshark
zenmap
anjuta
glade-gnome
doxygen-gui
libgnet2.0-0
wakeonlan
libgtop2-dev
libgnet-dev
liboobs-1-dev
```

Furthermore, we removed the following packages with all dependencies:

```
network-manager
network-manager-pptp
software-center
libgnome-bluetooth7
bluez*
```

2.2 Printer

For the printing of receipts a printer should be installed. Ubuntu 10.4 LTS configured our printer automatically.

2.2.1 Network

We did a static network configuration without network manager. eth0 is the connection to the lab and eth1 is the connection to the internet. Our `/etc/network/interfaces` looks like:

```
# This file describes the network interfaces available on your system
```

and how to activate them. For more information, see `interfaces(5)`.

```
# The loopback network interface
```

```
auto lo
iface lo inet loopback
```

```
# The primary network interface
```

```
auto eth1
iface eth1 inet dhcp
```

```
auto eth0
iface eth0 inet static
address 192.168.53.100
netmask 255.255.255.0
```

Because our clients get network addresses over DHCP from the server, you have to set up `dhcpcd`. Our `/etc/dhcp3/dhpcd.conf` contains:

```
option subnet-mask 255.255.255.0;
option broadcast-address 192.168.53.255;
option domain-name "ewflab";
option domain-name-servers 141.35.1.16, 141.35.1.80;
option routers 192.168.53.100;
max-lease-time 7200;
ddns-update-style none;
default-lease-time 600;
subnet 192.168.53.0 netmask 255.255.255.0 {
    range 192.168.53.21 192.168.53.50;
    default-lease-time 14400;
    max-lease-time 172800;
host client01 {
hardware ethernet 00:17:31:5F:7E:21;
fixed-address 192.168.53.1;
option host-name client01;
}
host client02 {
hardware ethernet 00:17:31:5F:7E:30;
fixed-address 192.168.53.2;
option host-name client02;
}
host client03 {
hardware ethernet 00:17:31:5F:84:C8;
fixed-address 192.168.53.3;
option host-name client03;
}
```

```
host client04 {
hardware ethernet 00:17:31:5F:84:C6;
fixed-address 192.168.53.4;
option host-name client04;
}
host client05 {
hardware ethernet 00:17:31:5f:84:c1;
fixed-address 192.168.53.5;
option host-name client05;
}
host client06 {
hardware ethernet 00:17:31:5c:68:89;
fixed-address 192.168.53.6;
option host-name client06;
}
host client07 {
hardware ethernet 00:17:31:5f:79:b1;
fixed-address 192.168.53.7;
option host-name client07;
}
host client08 {
hardware ethernet 00:17:31:5f:84:b8;
fixed-address 192.168.53.8;
option host-name client08;
}
host client09 {
hardware ethernet 00:17:31:5f:7d:78;
fixed-address 192.168.53.9;
option host-name client09;
}
host client10 {
hardware ethernet 00:17:31:5f:84:c7;
fixed-address 192.168.53.10;
option host-name client10;
}
host client11 {
hardware ethernet 00:17:31:5F:7D:86;
fixed-address 192.168.53.11;
option host-name client11;
}
host client12 {
hardware ethernet 00:17:31:5f:7e:14;
fixed-address 192.168.53.12;
option host-name client12;
```

```

}
host client13 {
hardware ethernet 00:17:31:5C:68:65;
fixed-address 192.168.53.13;
option host-name client13;
}
host client14 {
hardware ethernet 00:17:31:5f:79:ab;
fixed-address 192.168.53.14;
option host-name client14;
}
host client15 {
hardware ethernet 00:17:31:5f:80:01;
fixed-address 192.168.53.15;
option host-name client15;
}
host client16 {
hardware ethernet 00:17:31:5f:7d:39;
fixed-address 192.168.53.16;
option host-name client16;
}
host client17 {
hardware ethernet 00:17:31:5f:84:9d;
fixed-address 192.168.53.17;
option host-name client17;
}
host client18 {
hardware ethernet 00:17:31:5f:84:b3;
fixed-address 192.168.53.18;
option host-name client18;
}
}

```

Routing (Network Address Translation) can be enabled by uncommenting `net.ipv4.ip_forward=1` in `/etc/sysctl.conf` and adding

```

/sbin/iptables -P FORWARD ACCEPT
/sbin/iptables --table nat -A POSTROUTING -o eth1 -j MASQUERADE

```

to `/etc/rc.local`. After a restart all clients should be connected to the internet what is useful for updates.

It is required for labcontrol that `/etc/hosts` contains all client names and an labserver-entry, i. e.:

```
127.0.0.1 localhost
```

```

# The following lines are desirable for IPv6 capable hosts
::1          localhost ip6-localhost ip6-loopback
fe00::0      ip6-localnet
ff00::0      ip6-mcastprefix
ff02::1      ip6-allnodes
ff02::2      ip6-allrouters
ff02::3      ip6-allhosts

141.35.47.200   ewf-pNF1.b67.uni-jena.de ewf-pnf1
192.168.53.100  ewf-pNF1.b67.uni-jena.de labserver
192.168.1.51    ewf-pNF1.b67.uni-jena.de ewf-pNF1
192.168.53.1   client01
192.168.53.2   client02
192.168.53.3   client03
192.168.53.4   client04
192.168.53.5   client05
192.168.53.6   client06
192.168.53.7   client07
192.168.53.8   client08
192.168.53.9   client09
192.168.53.10  client10
192.168.53.11  client11
192.168.53.12  client12
192.168.53.13  client13
192.168.53.14  client14
192.168.53.15  client15
192.168.53.16  client16
192.168.53.17  client17
192.168.53.18  client18
141.35.47.201  kamera webcam

```

2.3 RAM-Disk

The ramdisk is needed for labcontrol and —if selected— for zTree’s temporary files. You have at least create the folder `/ramdisk` in your root filesystem. A ramdisk (with a maximum size of the half RAM) can be configured by adding

```
none    /ramdisk    tmpfs    defaults,size=50%    0 0
```

to `/etc/fstab`.

2.4 install zLeafs

Every needed version of zTree has to be copied to `/opt`. The name of the folder have to begin with `zTree_`, otherwise labcontrol will not detect the version. Do not forget to copy `riched20.dll` and `riched32.dll` to each folder.

2.5 Install labcontrol

Simply do everything mentioned in chapter 3 of the labcontrol-install manual.

3 Configuration of the clients

3.1 Hints according to installation

3.1.1 Partitions

Every client has a 320 GB hard disk. The partitions are used for a few operating systems:

partition	size (MB)	used for
sda1	20973.42	preinstalled Windows Vista
sda5	2155.03	openSuSE 10.2 for maintenance purposes
sda6	2155.03	Linux-Swap
sda7	10742.22	Ubuntu 10.04 LTS for normal operation
sda8	10742.22	Ubuntu 9.04 prior used system as backup
sda9	107381.04	/home for normal operation
sda10	165920.35	archive partition for images etc.

3.1.2 Home directory and username

To install Ubuntu 10.04 we used partition sda7 as Root-Directory and sda9 as home-Directory. sda9 was also home-Directory for the old Ubuntu 9.04. Since we do not want any interference between both versions we used the user `ewf` on the old system and `ewfuser` for the new system.

3.1.3 Bootloader

We installed GRUB 2 with the new Ubuntu to the Master Boot Record. In our case it detected all other (old) operating systems.

3.2 software management

3.2.1 synaptic setting and sources

In synaptic, go to Settings → Preferences → Files and set “Delete downloaded packages after installation”. This saves disk space and make the distribution to other clients faster.

Then go to Settings → Repositories and activate main, universe, restricted and multiverse. Source code can be disabled. In the tab “Updates” we disabled automatic updates because we do not want any update manager or slow-down while we run zTree. Do not forget to sometimes install updates manually then.

3.2.2 removed packages

Due to the fact that we do not need programs like OpenOffice or Firefox on the client, we removed them. Otherwise they need to be updated which is a waste of time. However, this is not necessary. We removed the following packages, each with all dependencies:

```
aisleriot, app-install-data-partner, apport-gtk, apport-symptoms,
apport, aspell-en, aspell, avahi-autoipd, avahi-daemon, avahi-utils,
bluez-alsa, bluez-cups, bluez-gstreamer, bluez, bogofilter-bdb,
bogofilter-common, bogofilter, brasero-common, brasero, brltty-x11,
brltty, cdparanoia, compiz-core, compiz-fusion-plugins-main,
compiz-gnome, compiz-plugins, compiz, compizconfig-backend-gconf,
computer-janitor-gtk, computer-janitor, couchdb-bin, cups-bsd,
cups-client, cups-common, cups-driver-gutenprint, cups,
desktopcouch, dictionaries-common, dvd+rw-tools, ed, empathy-common,
empathy, eog, espeak-data, espeak, evince, evolution-common,
evolution-couchdb, evolution-data-server, evolution-exchange,
evolution-indicator, evolution-plugins, evolution-webcal,
evolution, example-content, f-spot, firefox-branding,
firefox-gnome-support, firefox, foo2zjs, foomatic-db-engine,
foomatic-db, gbrainy, genisoimage, ghostscript-cups, ghostscript-x,
ghostscript, gnome-bluetooth, gnome-games-common, gnome-mag,
gnome-mahjongg, gnome-orca, gnome-screensaver, gnome-sudoku,
gnome-user-guide-de, gnome-user-guide-en, gnome-user-guide,
gnome-user-share, gnomine, gvfs-backends, gwibber-service,
gwibber, hpijs, hplip-data, hplip, hunspell-de-at, hunspell-de-ch,
hunspell-de-de, hunspell-en-ca, hunspell-en-us, language-support-en,
language-support-writing-de, language-support-writing-en,
launchpad-integration, libbluetooth3, libbrasero-media0,
libcdio-cdda0, libcdio-paranoia0, libcompizconfig0, libcupscgi1,
libcupsdriver1, libcupsimage2, libcupsmime1, libcupspdc1,
libdesktopcouch-glib-1.0-2, libespeak1, libgnome-pilot2, libgs8,
libjs-jquery, liblaunchpad-integration1.0-cil, liblouis-data,
liblouis0, libnss-mdns, libpisock9, libpisync1, libpurple-bin,
libpurple0, libspectre1, libubuntuone-1.0-1, memtest86+,
modemmanager, myspell-en-au, myspell-en-gb, myspell-en-za,
nautilus-sendto-empathy, nautilus-share, network-manager-gnome,
network-manager-pptp-gnome, network-manager-pptp, network-manager,
nvidia-173-modaliases, nvidia-96-modaliases, nvidia-common,
obex-data-server, obexd-client, openoffice.org-base-core,
openoffice.org-calc, openoffice.org-common, openoffice.org-core,
openoffice.org-draw, openoffice.org-emailmerge,
openoffice.org-gnome, openoffice.org-gtk, openoffice.org-help-de,
openoffice.org-help-en-gb, openoffice.org-help-en-us,
openoffice.org-hyphenation-de, openoffice.org-hyphenation-en-us,
```

openoffice.org-hyphenation, openoffice.org-impress,
openoffice.org-l10n-common, openoffice.org-l10n-de,
openoffice.org-l10n-en-gb, openoffice.org-l10n-en-za,
openoffice.org-math, openoffice.org-style-human,
openoffice.org-thesaurus-de-ch, openoffice.org-thesaurus-de,
openoffice.org-thesaurus-en-au, openoffice.org-thesaurus-en-us,
openoffice.org-writer, openprinting-ppds, pitivi, pnm2ppa,
popularity-contest, ppp, pppconfig, pppoeconf, pptp-linux,
pulseaudio-module-bluetooth, pxljr, python-desktopcouch-records,
python-desktopcouch, python-louis, python-speechd, python-ubuntuone,
python-uno, quadrapassel, rdesktop, rhythmbox-plugin-cdrecorder,
rhythmbox-plugins, rhythmbox-ubuntuone-music-store,
rhythmbox, samba-common-bin, samba-common, sane-utils,
screensaver-default-images, simple-scan, smartdimmer,
smbclient, software-center, speech-dispatcher, splix,
telepathy-butterfly, telepathy-gabble, telepathy-haze,
telepathy-idle, telepathy-mission-control-5, telepathy-salut,
tomboy, totem-mozilla, totem-plugins, transmission-common,
transmission-gtk, tsclient, ttf-indic-fonts-core, ttf-kacst-one,
ttf-khmeros-core, ttf-lao, ttf-punjabi-fonts, ttf-takao-pgothic,
ttf-thai-tlwg, ttf-unfonts-core, ttf-wqy-microhei, ubufox,
ubuntu-artwork, ubuntu-desktop, ubuntu-docs, ubuntu-sounds,
ubuntu-standard, ubuntu-wallpapers, ubuntuone-client-gnome,
ubuntuone-client, usb-creator-common, usb-creator-gtk, vinagre,
vino, wamerican, wbritish, wireless-tools, wngerman, wodim,
wogerman, wpasuplicant, wswiss, xscreensaver-data, xscreensaver-gl,
xserver-xorg-input-all, xserver-xorg-input-synaptics,
xserver-xorg-input-vmouse, xserver-xorg-input-wacom, yelp

3.2.3 additional installed packages (with dependencies)

installed package(s)	purpose
openssh-server	to perform some client actions with labcontrol
wine1.2, wine, wine1.2-gecko, ttf-mscorefonts-installer, ttf-symbol-replacement	wine is needed for zTree
wmctrl	wmctrl is needed to lift the calculator in front of zTree (see subsection 3.4.4 for details)
blackbox	a much faster window manager than Gnome
numlockx	is needed to activate Numlock when blackbox start
xbindkeys	to create hot keys with blackbox (see subsection 3.4.7 for details)
x11vnc	if you want to show the client's desktop in labcontrol
libgnet2.0-0	is needed to execute labcontrol-get-help-client
gststreamer-tools, gststreamer0.10-plugins-ugly, gststreamer0.10-plugins-ugly-multiverse, gststreamer0.10-plugins-bad, gststreamer0.10-plugins-bad-multiverse, gststreamer0.10-ffmpeg, gststreamer0.10-fluendo-mp3, sox, libsox-fmt-all	audio codex to make sound with zTree possible (see subsection 3.4.6 for details)
mc	if you think it is useful ;)

3.3 System environment settings

3.3.1 fstab

In the `/etc/fstab` the home-Partition is adressed with an UUID instead of a device name. Since this make trouble at distributing to other clients, you have to replace e.g. `UID=943f92d1-dd8f-4824-af98-843c69a4659c` by `/dev/sda9` there.

3.3.2 Bootloader configuration

We think it is useful to not show GRUB while booting and not to list recovery mode because of security reasons. This settings can be done by commenting out `GRUB_DISABLE_LINUX_RECOVERY="true"` and change `GRUB_TIMEOUT=0` in the `/etc/default/grub-File`.

3.3.3 static network configuration

To keep the client as small as possible we abstain from Network Manager. However, we have to enable the clients' network interface with DHCP at `/etc/network/interfaces` by adding

```
auto eth0
iface eth0 inet dhcp
```

It is useful to copy the `/etc/hosts` from the server to the clients, too. It is required for `labcontrol-get-help-client` that at least the name `labserver` points to the ip running `labcontrol`.

3.3.4 enable Root account

We think it is useful for our laboratory to use the “normal” user (`ewfuser`) only for running `zLeaf` and for no administrative tasks. We want to use `root` as administrative account.

However, in Ubuntu `root` is disabled by default. It is easy to enable `root` by setting his UNIX-Password (i.e. execute `sudo passwd` as normal user).

If you are sure that you can login as `root`, you can disable `sudo` access for the normal user. This can be done by take the normal user out of the `admin-Group`, i.e. by deleting `ewfuser` after `admin:x:119:` in `/etc/group`. Please consider that the group `adm` is not the `admin` group. Users in `adm` group have the opportunity to view logfiles.

3.3.5 SSH

SSH is a core element in our lab. `labcontrol` performs many tasks like starting `zLeaf` and shutdown over SSH. The authentication is done with private keys hence it is required that the servers pubkeys are added to the `/.ssh/authorized_keys`-file. This is required for both `root` and the normal user.

For security issues we disabled password authentication over SSH by setting the key `PasswordAuthentication` in the file `/etc/ssh/sshd_config` to the value `no`.

Second you have to update the `/etc/ssh/ssh_known_hosts` of the server (see `labcontrol` installation manual).

3.3.6 allow users to shutdown

We think that an “ordinary” experimenter should not have access to the private key granting `root` rights at the clients. However, shutdown with `halt` requires `root` privileges and should be done by all experimenters. Hence, `labcontrol` execute the command `sudo halt` on the client to shutdown. Because `ewfuser` is not allowed to get `root` privileges with `sudo` (see subsection 3.3.4) you have to add `ewfuser ALL=NOPASSWD: /sbin/halt` to `/etc/sudoers`. Please consider that this should be done with the `visudo`-command and that the last line in the `/etc/sudoers` file has to be empty.

3.4 Desktop settings

3.4.1 configure Blackbox

Blackbox requires two files to run according to our needs. `/.blackboxrc` is the main blackbox configuration files and should contain:

```
session.styleFile: /usr/share/blackbox/styles/Blue
session.menuFile: ~/.blackbox/menu
```

The second file is `/.blackbox/menu`. This file is needed, otherwise blackbox provide a full menu with all installed applications to the experiment participants. The file only covers:

```
[begin] (Menu)
[restart] (Restart)
[end]
```

3.4.2 auto-start additional programs when blackbox starts

You have to add the possibility to select `xsession` at GDM. Create `/usr/share/xsessions/xsession.desktop`, which is a modified copy of `/usr/share/xsessions/xterm.desktop`, with the following content

```
[Desktop Entry]
Encoding=UTF-8
Name=xsession
Comment=Use .xsession to determine what to do
Exec=/etc/X11/Xsession
TryExec=/etc/X11/Xsession
Icon=
Type=Application
X-Ubuntu-Gettext-Domain=gdm
```

The Desktop Environment with all needed tools will be startet with `/home/ewfuser/.xsession`:

```
#!/bin/sh
x11vnc -forever -safer -nopw -viewonly -display :0 & # Start des VNC-Servers
setxkbmap de # deutsches Tastaturlayout
numlockx on # Numlock immer aktivieren
alsactl restore # Lautstärkeinstellungen laden
~/calcexe_aktivieren.sh & # Taschenrechner aktivieren
exec blackbox
```

3.4.3 add zLeafs

First you have to copy the files `zleaf.exe`, `riched20.dll` and `riched32.dll` to a folder in the user's home directory. For the different versions of zTree use the same folder names as at the server, otherwise labcontrol will not be able to start a zleaf. A folder name always begins with `zTree_..`

Second you have to create a Skript `/home/ewfuser/start_zLeaf.sh` which contains the following:

```
#!/bin/bash
#start a zLeaf
cd ~/$1
/usr/bin/wine zleaf.exe /server 192.168.53.100 &
exit
```

To be able to synchronize media files it is recommended that you create a directory `media4ztree` in the user's home directory.

3.4.4 activate calculator

Create the skript `/home/ewfuser/calcexe_aktivieren.sh` with the following content:

```
#!/bin/bash

while [ 0=0 ]
do
wmctrl -a Rechner
sleep 0.5
done
```

This script tries to take the calculator-window (called "Rechner") into foreground every half second. If you press the calculator-button in ztree and click beside the calculator-window, you have no chance to get the calculator window back to foreground otherwise.

3.4.5 Help-Button

Users can get help when pressing a special key at the clients (labcontrol then reports that the client needs help). You have to copy the `labcontrol-get-help-client` from the labcontrol package to the user's home directory.

3.4.6 play audio files with zLeaf

You have to execute the following command on the client:

```
sudo chmod a+rw /var/lib/alsa/asound.state
```

Then you should set the Master channel to 77 und PCM to 100 with `alsamixer`. At last you should save the settings with `sudo alsactl store`.

Due to the fact that audio playback does not work with `zleaf` and `wine` you have to create the scripts `/home/ewf/play_audio_sox.sh`

```
#!/bin/bash
```

```
sox $1 -d > sox.out 2>&1
```

```
and /home/ewf/play_audio_gstreamer.sh
```

```
#!/bin/bash
```

```
gst-launch-0.10 playbin uri=file://$1 > gst.out 2>&1
```

which can be started as external program with `zTree`. One script would be sufficient but with both you have a second chance if one way do not work in a special case.

3.4.7 set hot keys

Create the file `/home/ewfuser/.xbindkeystrc` with the following content to activate hot keys:

```
# Lautstärke erhöhen
"amixer set Master 3%+"
    Mod2 + XF86AudioRaiseVolume

# Lautstärke verringern
"amixer set Master 3%-"
    Mod2 + XF86AudioLowerVolume

# Hilfe rufen
"/home/ewfuser/labcontrol-get-help-client"
    Mod2 + Pause
```

3.4.8 Abschalten des Bildschirmschoners

will follow if we solved the problem

4 Distributing the clients basic configuration to all other clients

clients klonen

auf dem neuen client (quelle), einmalig: `dd if=/dev/sda7 — gzip -c | /home/sda7.zip`

auf dem server, einmalig: `sftp root@client01 get /home/sda7.zip exit`

auf dem alten client (ziel): nc -l -p 30000 — gunzip -c — dd of=/dev/sda7

auf dem server, einmal pro Klonvorgang (jetzt quelle):

cat sda7.zip — netcat client03 30000 scp ewfuser.zip root@client06:/home/ewfuser.zip /home-
VErzeichnis des neues USers kopieren

anpassungen auf jedem alten client (ziel)

```
cd /home; tar -xpf ewfuser.zip; mount /dev/sda7 /media/sda10 nano /me-  
dia/sda10/etc/hostname anpassen nano /media/sda10/etc/hosts hostname nach 127.0.0.1  
anpassen nano /media/sda10/etc/udev/rules.d/70-persistent-net.rules MAC anpassen mount -  
o bind /dev /media/sda10/dev; mount -t proc /proc /media/sda10/proc; chroot /media/sda10  
grub-install /dev/sda; exit reboot
```