Ubuntu 16.04 Mastersolution

for

Linux4Afrika

and

# STBA / STALCA e.V.

1

Directory

2

1.0 Linux4Afrika PXE Classroom Setup
Author: Florian Auer

Network based installation

Preparations

- Make sure network cable is plugged in
- Turn on the computer and enter the BIOS menu (depends on manufacturer)
- In the BIOS, go to boot configuration
- Set hard disk as primary and network to secondary boot device (setting options depend on BIOS manufacturer, see example image below)
- Save changes and restart the computer
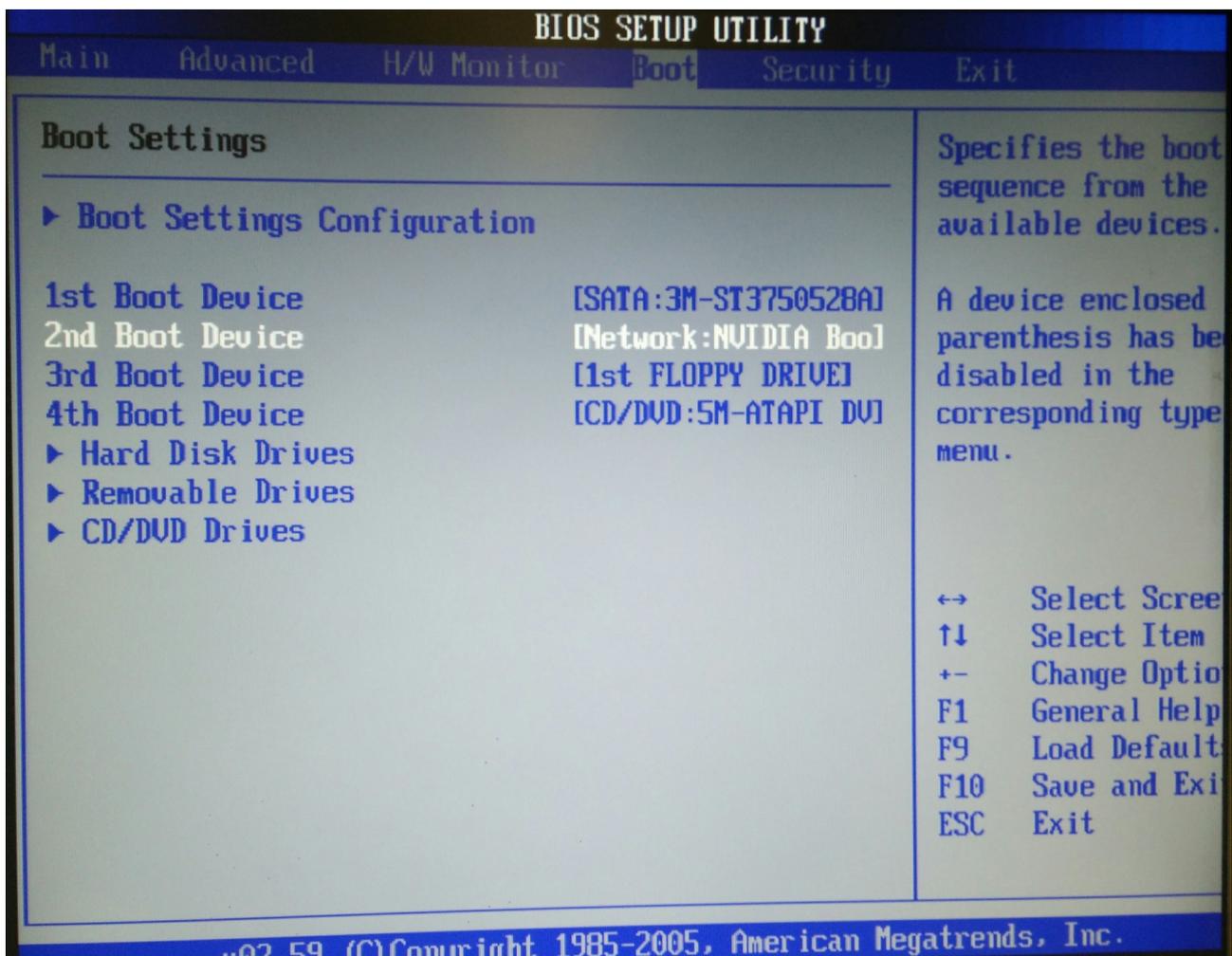
The computer will try to connect to the server and fetch setup data. This looks similar to this:

```
Intel UNDI, PXE-2.1
PXE Software Copyright (C) 1997-2000 Intel Corporation
Copyright (C) 2010 Oracle Corporation

CLIENT MAC ADDR: 08 00 27 05 88 3E   GUID: 8FC03372-1342-404B-B9D5-34A]
CLIENT IP: 192.168.0.147   MASK: 255.255.255.0   DHCP IP: 192.168.0.250
GATEWAY IP: 192.168.0.250
!PXE entry point found (we hope) at 9DDC:0104 via plan A
UNDI code segment at 9DDC len 199E
UNDI data segment at 9C59 len 1830
Getting cached packet  01 02 03
My IP address seems to be C0A80093 192.168.0.147
ip=192.168.0.147:192.168.0.250:192.168.0.250:255.255.255.0
BOOTIF=01-08-00-27-05-88-3e
SYSUUID=8fc03372-1342-404b-b9d5-34aecbc7deff
TFTP prefix: /ltsp/rescue/
Trying to load: pxelinux.cfg/default                              o]
_
```

The system boots and the Ubuntu boot screen is shown. Hint: You can switch to system output view by using Alt+Tab keys.

```
        Ubuntu 14.04

           .   .   .   .
```

After the boot process is completed, a terminal prompt will be shown:

```
Intel UNDI, PXE-2.1
PXE Software Copyright (C) 1997-2000 Intel Corporation
Copyright (C) 2010 Oracle Corporation

CLIENT MAC ADDR: 08 00 27 05 88 3E   GUID: 8FC03372-1342-404B-B9D5-34AECBC7DEFF
CLIENT IP: 192.168.0.147   MASK: 255.255.255.0   DHCP IP: 192.168.0.250
GATEWAY IP: 192.168.0.250
!PXE entry point found (we hope) at 9DDC:0104 via plan A
UNDI code segment at 9DDC len 199E
UNDI data segment at 9C59 len 1830
Getting cached packet  01 02 03
My IP address seems to be C0A80093 192.168.0.147
ip=192.168.0.147:192.168.0.250:192.168.0.250:255.255.255.0
BOOTIF=01-08-00-27-05-88-3e
SYSUUID=8fc03372-1342-404b-b9d5-34aecbc7deff
TFTP prefix: /ltsp/rescue/
Trying to load: pxelinux.cfg/default                              ok
Welcome to Ubuntu 14.04 LTS (GNU/Linux 3.13.0-29-generic i686)

 * Documentation:  https://help.ubuntu.com/
ubuntu@ubuntu:~$ _
```

Start setup script

```
$ sudo su
# install.sh
```

Important: Do not run the install.sh script via sudo (sudo install.sh). Always switch to *root* via `sudo su` first. Note: this might take some time (approx. 20 minutes, depending on hardware).

4

```
Intel UNDI, PXE-2.1
PXE Software Copyright (C) 1997-2000 Intel Corporation
Copyright (C) 2010 Oracle Corporation

CLIENT MAC ADDR: 08 00 27 05 88 3E   GUID: 8FC03372-1342-404B-B9D5-34AECBC7DEFF
CLIENT IP: 192.168.0.147  MASK: 255.255.255.0  DHCP IP: 192.168.0.250
GATEWAY IP: 192.168.0.250
!PXE entry point found (we hope) at 9DDC:0104 via plan A
UNDI code segment at 9DDC len 199E
UNDI data segment at 9C59 len 1830
Getting cached packet  01 02 03
My IP address seems to be C0A80093 192.168.0.147
ip=192.168.0.147:192.168.0.250:192.168.0.250:255.255.255.0
BOOTIF=01-08-00-27-05-88-3e
SYSUUID=8fc03372-1342-404b-b9d5-34aecbc7deff
TFTP prefix: /ltsp/rescue/
Trying to load: pxelinux.cfg/default                          ok
Welcome to Ubuntu 14.04 LTS (GNU/Linux 3.13.0-29-generic i686)

 * Documentation:  https://help.ubuntu.com/
ubuntu@ubuntu:~$ sudo su
root@ubuntu:/home/ubuntu# install.sh_
```

Before the setup process starts, you will be asked to confirm to wipe all data from the harddisk. Note: This cannot be undone! Select „Yes" to continue.
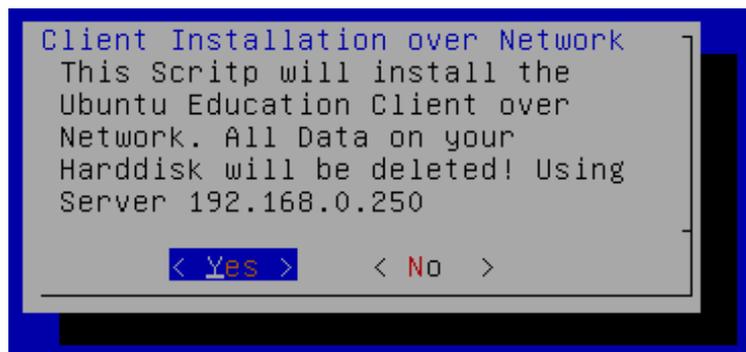
In the next step, you are asked to select a number for this client. The number will be used later to identify this computer in the network. Note: This number must not be used twice - make sure every number is only used once!

As a last step, you are asked what to do after installation is finished. You can select between the following options:

Shutdown
Computer will be shut down after installation is finished. This is a convenient way to make sure the system is powered off after everything has been set up. You could use this if you start the setup before leaving the office.

Reboot
Choose this option if you would like to continue working with the computer after everything has been set up.

Shell
If you would like to use the terminal after setup has been completed, select this option. However, it is recommended to reboot the system first.

5
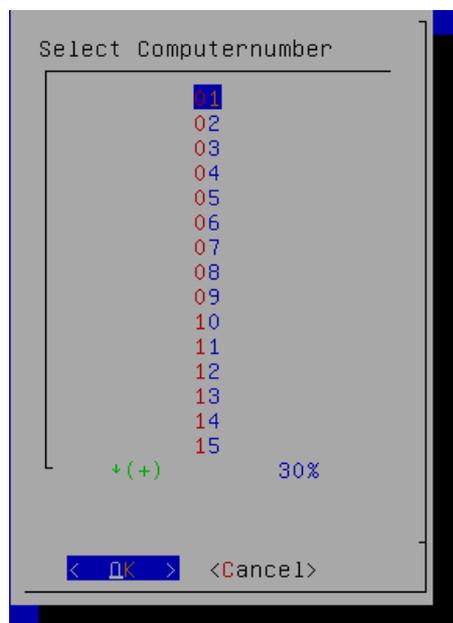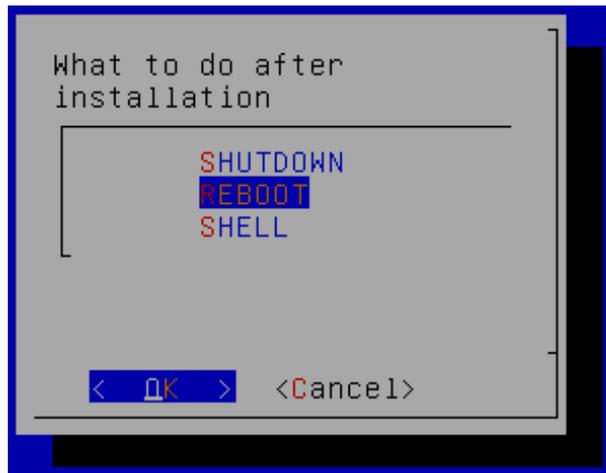
When the system the setup is complete
The system is booted and the login screen is shown. You can now log in with the username `user` and the password `edubuntu`.

6

Start the system

```
        GNU GRUB  version 2.02~beta2-9ubuntu1

*Ubuntu 14.04 Client
 Rescue System
 gPXE Network Boot




     Use the ↑ and ↓ keys to select which entry is highlighted.
     Press enter to boot the selected OS, `e' to edit the commands
     before booting or `c' for a command-line.
```

Rescue System

Backup & Restore the system partitions

It is recommended to create a backup of the system partitions. This can be easily done with the *diskmanager* tool. Note: You must be *root* in order to use this command.

The syntax for *diskmanager* is very simple:

```
# diskmanager help
# diskmanager <action> <partitionname>
```

Action can be either „help", „backup" or „restore". The help action shows how to use *diskmanager*. The backup action can be used to create a backup. The restore action can be used to restore a previously created backup.

Partition Name	System Path	Backup File
educlient	/dev/sda1	/media/images/1_educlient.img
rescue	/dev/sda1	/media/images/2_rescue.img

7

Create a backup of the system

Backup the Edubuntu Client partition

```
$ sudo su
# diskmanager backup educlient
```

Backup the Rescue partition

```
$ sudo su
# diskmanager backup rescue
```

Restore a back of the system

Restore the Edubuntu client partition

```
$ sudo su
$ diskmanager restore educlient
```

Restore the Rescue partition

```
$ sudo su
$ diskmanager backup rescue
```

8

HOWTO generate a local *.lkrn ROM file to boot from a network card
<mark>NOTE: THIS STEP MIGHT BE OBSOLETE DUE TO THE POSSIBILITY TO USE THE GENERIC PXE DRIVER!</mark>

Get root permissions

$ sudo su

Password: linux

Search from pci bus installed Ethernet card

lspci | grep Ethernet

Example output:
02:0f.0 Ethernet controller: Realtek Semiconductor Co., Ltd. RTL-8110SC/8169SC Gigabit Ethernet (rev 10)

Find PCI vendor code and PCI device code from network card

lspci -n | grep **02:0f.0**

Example output:
02:0f.0 0200: **10ec**:**8167** (rev 10)

In this example, the PCI vendor code is **10ec** and the PCI device code is **8167**.

Create network card specific LKRN image

1. Go to http://rom-o-matic.net/gpxe/gpxe-git/gpxe.git/contrib/rom-o-matic/
2. Choose output format „Linux kernel (SYSLINUX/GRUB/LILO) loadable image (.lkrn)"
3. Choose NIC type „All drivers"
4. Enter PCI vendor code and PCI device code
5. Click „Get Image"

This will create a custom image file and start the download.

9

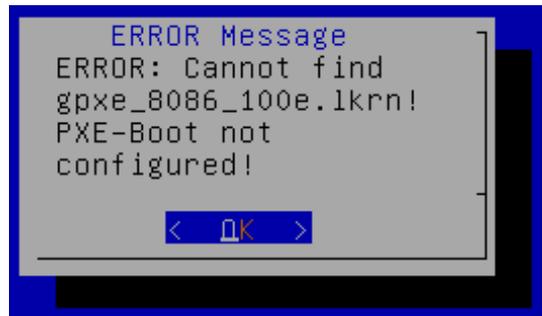## Install LKRN image

- Got to the downloads folder (or the place where you downloaded the file)
- Rename the file you dowloaded to „gpxe_<VENDOR CODE>_<DEVICE CODE>.lkrn
- In our example above, the file name would be gpxe_**10ec_8167**.lkrn
- Copy the file to /mirror/pxe_client/rom-o-matic/ on the server
- Reboot the client

10

Error message due to missing PXE driver

- Select „OK"

- Hit Enter

System should reboot now

Select „Rescue System" in boot menu

NOTE: THIS ISSUE COULD BE SOLVED BY USING THE GENERIC PXE DRIVER!

Suggestions for improvements (L4A Team Only)

- Florian: Check setup is run as root at the very beginning, point out to switch to root rather than doing „sudo install.sh"

- Florian: Prefix all L4A specific scripts/tools with l4a, e. g. „l4a-setup"?

Install generic PXE boot driver

Go to ROM-O-MATIC website

Use settings from screenshot below

- Use output format `*.kpxe`

- Use NIC type „All drivers"

- Do not enter any vendor or device code

- Click „Get Image"

- Save file in „Downloads" folder

- Rename downloaded file to `gpxe_universal_driver.kpxe`

- Copy downloaded file to tftp boot folders on the server

  - For 192.168.0.0/24 subnet
    `/var/lib/tftpboot/ltsp/rescue`

  - For 192.168.1.0/24 subnet
    `/var/lib/tftpboot/ltsp/rescue2`

- Add new *filename* entries to dhcp.conf

  - For 192.168.0.0/24 subnet
    `filename „/ltsp/rescue/gpxe_universal_driver.kpxe"`

  - For 192.168.1.0/24 subnet
    `filename „/ltsp/rescue2/gpxe_universal_driver.kpxe"`

11

ROM-o-matic.net for gPXE 1.0.1+ - Mozilla Firefox

ROM-o-matic.net fo...   ×   romburning:qemu - ...   ×   pxechaining - Etherb...   ×

rom-o-matic.net/gpxe/gpxe-git/gpxe.git/contrib/rom-o-matic/   ▾ C   Search

ROM-o-matic.net dynamically generates gPXE images

If this site helps you, please   Donate   to help us continue to make Free, Open Source, State-of-the-art network booting software. Thanks!

To create an image:

1. Choose an output format: PXE bootstrap loader keep [Keep PXE stack method 1] (.kpxe)

2. Choose a NIC type: all-drivers

3. **(optional — for binary ROM image format only)**

   If you choose *Binary ROM image* as your output format, you must enter **4 hex digits** below for *PCI VENDOR CODE* and *PCI DEVICE CODE* that match the NIC device for which you are making this image.

   Information on how to determine NIC PCI IDs may be found here.

   PCI VENDOR CODE: [   ]   PCI DEVICE CODE: [   ]

   Please note for ROM images:

   ○ If you enter PCI IDs, we will attempt to determine the correct driver to support them, and will ignore any NIC type entered above.

   ○ gPXE does not support all possible PCI IDs for supported NICs.

4. Generate and download an image: Get Image

5. (optional) Customize image configuration options: Customize

Resources:

12

Linux4afrika default server uses 3 Network cards:

- eth0 goes to main switch for network 192.168.0.0/24

- eth1 goes to additional (or stays open) switch for same network 192.168.0.0/24

- eth2 might be connected to any Internet router or stays open

eth0 should be 1 GB NIC and should always be onboard NIC. Eth1 should be an additional 1 GB NIC in PCI(e) slot. eth2 can be any 100 MBit NIC in PCI slot.

`cat /etc/udev/rules.d/70-persistent-net.rules`

```
root@server:/home/teacher# cat /etc/udev/rules.d/70-persistent-net.rules
# This file was automatically generated by the /lib/udev/write_net_rules
# program, run by the persistent-net-generator.rules rules file.
#
# You can modify it, as long as you keep each rule on a single
# line, and change only the value of the NAME= key.




# PCI device 0x8086:0x10de (e1000e)
SUBSYSTEM=="net", ACTION=="add", DRIVERS=="?*", ATTR{address}=="00:23:24:02:22:41", ATTR{
dev_id}=="0x0", ATTR{type}=="1", KERNEL=="eth*", NAME="eth0"

# PCI device 0x10ec:0x8168 (r8169)
SUBSYSTEM=="net", ACTION=="add", DRIVERS=="?*", ATTR{address}=="00:1f:1f:50:73:ed", ATTR{
dev_id}=="0x0", ATTR{type}=="1", KERNEL=="eth*", NAME="eth1"

# PCI device 0x8086:0x107c (e1000)
SUBSYSTEM=="net", ACTION=="add", DRIVERS=="?*", ATTR{address}=="00:1b:21:86:7d:a8", ATTR{
dev_id}=="0x0", ATTR{type}=="1", KERNEL=="eth*", NAME="eth2"
root@server:/home/teacher# █
```

eth0 and eth1 are running in bridged mode. This ensures that both NICs provide DHCP to all clients attached to both switches.

`cat /etc/network/interfaces`

13

```
root@server:/home/teacher# cat /etc/network/interfaces
# interfaces(5) file used by ifup(8) and ifdown(8)
auto lo
iface lo inet loopback


auto eth0
iface eth0 inet manual

auto eth1
iface eth1 inet manual


# Default network settings:  1 Classroom up to 2 switches
# attached to eth0 which is always onboard GB NIC
auto br0
iface br0 inet static
    address 192.168.0.250
    netmask 255.255.255.0
    bridge_ports eth0 eth1
    bridge_fd 5
    bridge_stp no


# PCI NIC (normally 100 MBit) goes to internet access via DHCP
auto eth2
iface eth2 inet dhcp
```

14

2.1 Server: Harddrives
Author: Hans-Peter Merkel

Linux4Afrika mastersolution comes with 2 harddrives (currently 750 GB SATA)

`cat /etc/fstab`

```
root@server:/tmp# cat /etc/fstab
# /etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name devices
# that works even if disks are added and removed. See fstab(5).
#
# <file system> <mount point>   <type>  <options>       <dump>  <pass>
# / was on /dev/sda1 during installation
#UUID=f4332b50-d5d8-4245-8b6a-90508abfd551 /            ext4    errors=remount-ro 0       1
/dev/sda1        /              ext4    errors=remount-ro 0       1
# /media/images was on /dev/sda7 during installation
#UUID=b853d98a-7d5e-4fa8-8439-064f02703587 /media/images  ext4    defaults        0       2
/dev/sda8        /media/images  ext4    defaults        0       2
# /mirror was on /dev/sda6 during installation
#UUID=a3c119d5-01e8-4249-b569-3ff5f27269af /mirror        ext4    defaults        0       2
/dev/sda6        /mirror        ext4    defaults        0       2
# /var/www was on /dev/sda5 during installation
#UUID=0e60e18b-ad9f-4e3f-8599-0f2c924f352d /var/www       ext4    defaults        0       2
/dev/sda5        /var/www       ext4    defaults        0       2


# swap was on /dev/sda3 during installation
#UUID=93ed98df-9c87-4570-90a9-23ee1abe6f9d none           swap    sw              0       0
/dev/sda3        none           swap    sw              0       0
# Remove 4 Linux4Afrika:
#/dev/sdb1        /media/forensics               ext4    defaults        0       0

/dev/sda7        /media/data    ext4    defaults        0       2

/media/data/pxe_client/pxe_client.iso    /opt/ltsp/rescue udf,iso9660 user,loop 0 0
```
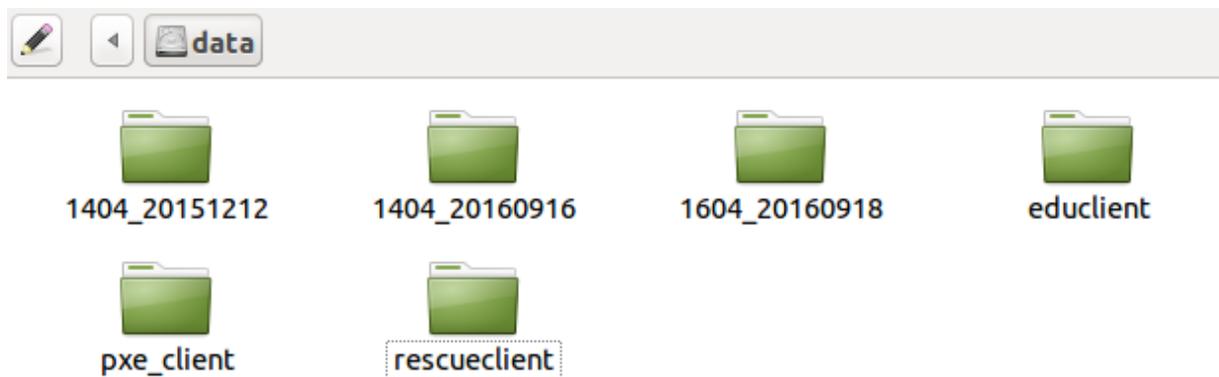
15

Up to 2016 Ubuntu 14.04 was default client OS. In 2016 an update for 14.04 took place before migrating to 16.04. Since September 2016 Ubuntu 16.04 will be default client OS.

There are several client OS located in /media/data:

- educlient
- pxe_client
- rescueclient

Additionally some folders with educlient backup are stored here:

- 1404_20151212 (rollout in Nairobi)
- 1404_20160916 (last update of 14.04)
- 1604_20160918 current default

If you want to change client OS, you can erase all files from educlient and rsync the one you need into educlient folder (advanced Admins only !)

Never change the folders pxe_client and rescueclient. This should only be exchanged by the developers!

16

So far, students did not have a chance to exchange data. To cirumvent this situation the mailsystem was used. Starting with 16.04 a **Samba filesserver** was included. It holds 2 shares:

- 4all   (Read/Write access for everybody)
- samples   (Read only for students, full access for teacher from classroom server)
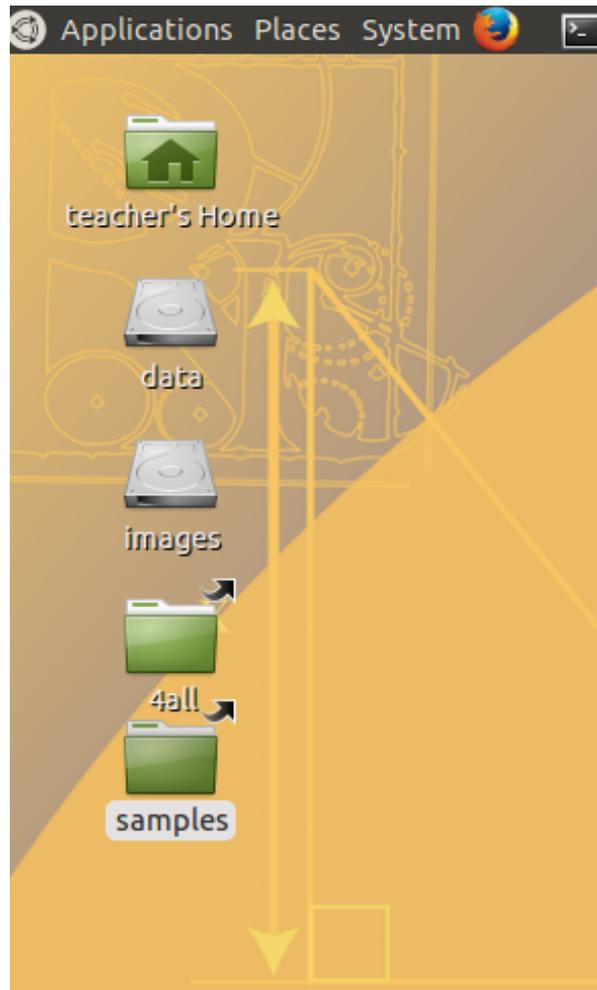
Those shares can also being accessed from any notebook temporary in this LAN. Windows PCs use:

```
net use //192.168.0.250/4all
```

or use their GUI.

17

2.4 Server: 1604 Local Mirror
Author: Hans-Peter Merkel

Clients originally installed their packages from German repository. A local mirror (repository) is located on the server to be able to install software in African classrooms without internet access.

You can use aptitude install to install any package located in the mirror. However those programs are lost after restoring any image.

Example:

`aptitude install yourprogram`

```
root@client01:...  ✕  root@client01:...  ✕  root@client01:...  ✕  root@client01:...
root@client01:/home/user# cat /etc/apt/sources.list
deb http://192.168.0.250/ubuntu xenial main universe multiverse restricted
deb http://192.168.0.250/ubuntu xenial-security main universe multiverse restricted
deb http://192.168.0.250/ubuntu xenial-updates main universe multiverse restricted
```

To make them permanent you need to create an new distribution image in educlient folder. This is NOT recommended for unexperienced admins !

2.5 Server: Webserver
Author: Hans-Peter Merkel

Linux4Afrika classroom server holds an Apache Webserver on 192.168.0.250

18
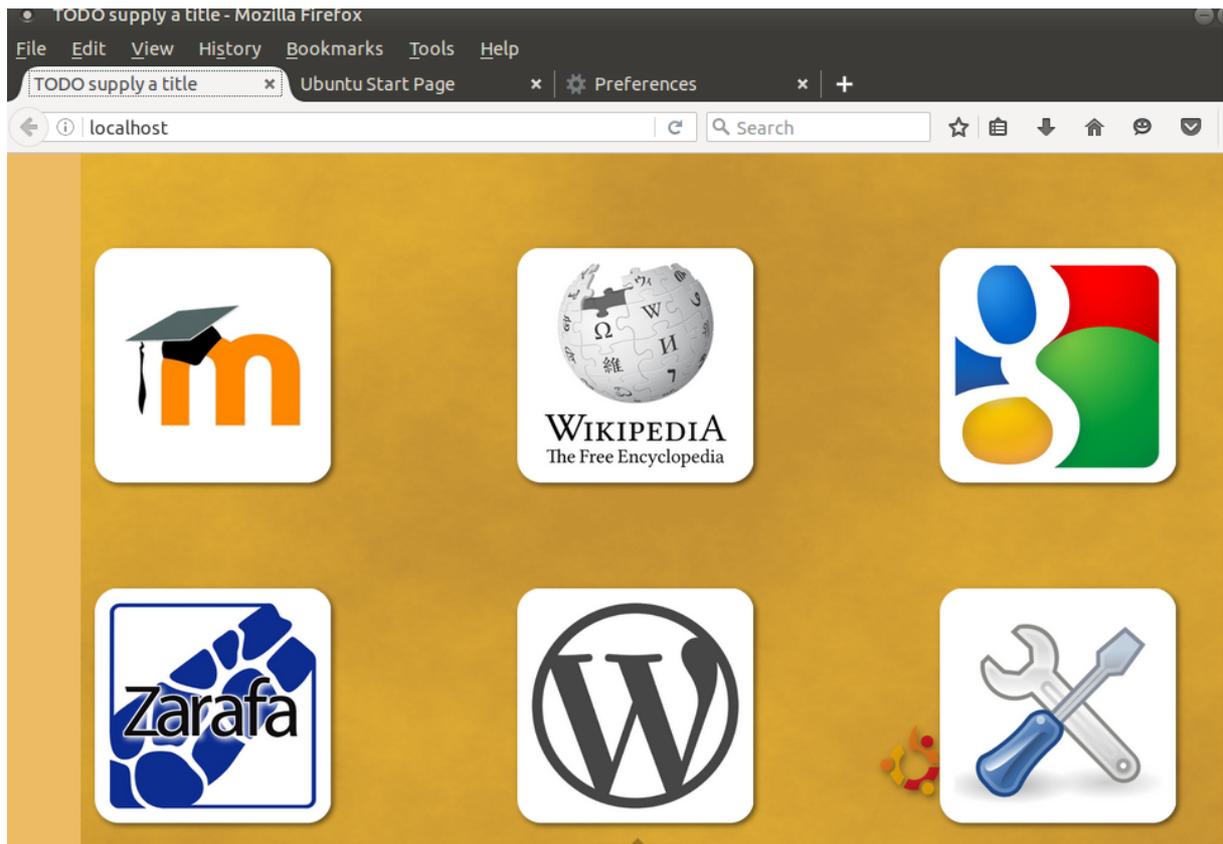
This is the homepage for all clients and stored in Firefox browser.
The main components are (left to right):

- Moodle E-Learning Platform
- Offline Wikipedia
- Gate to Internet with Google as starting page (if server has online connection)
- Zarafa Mailserver
- Wordpress
- Admin Tools

Those components to be described by somebody else !!

19

2.6 Server: Mailserver with Zarafa
Author: Hans-Peter Merkel

Linux4Afrika server holds a Postfix Mailserver only for local training. It will not send any mails to the outside without reconfiguration. To be independent from Mailclient configuration, the webbased solution ZARAFA is used.
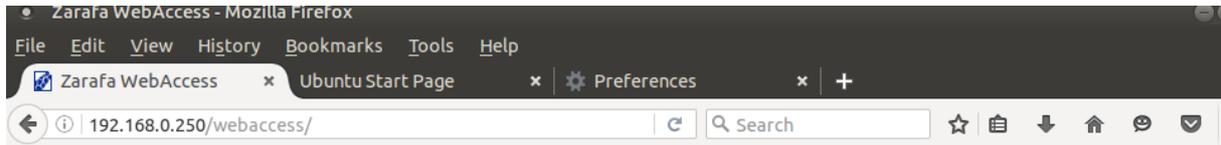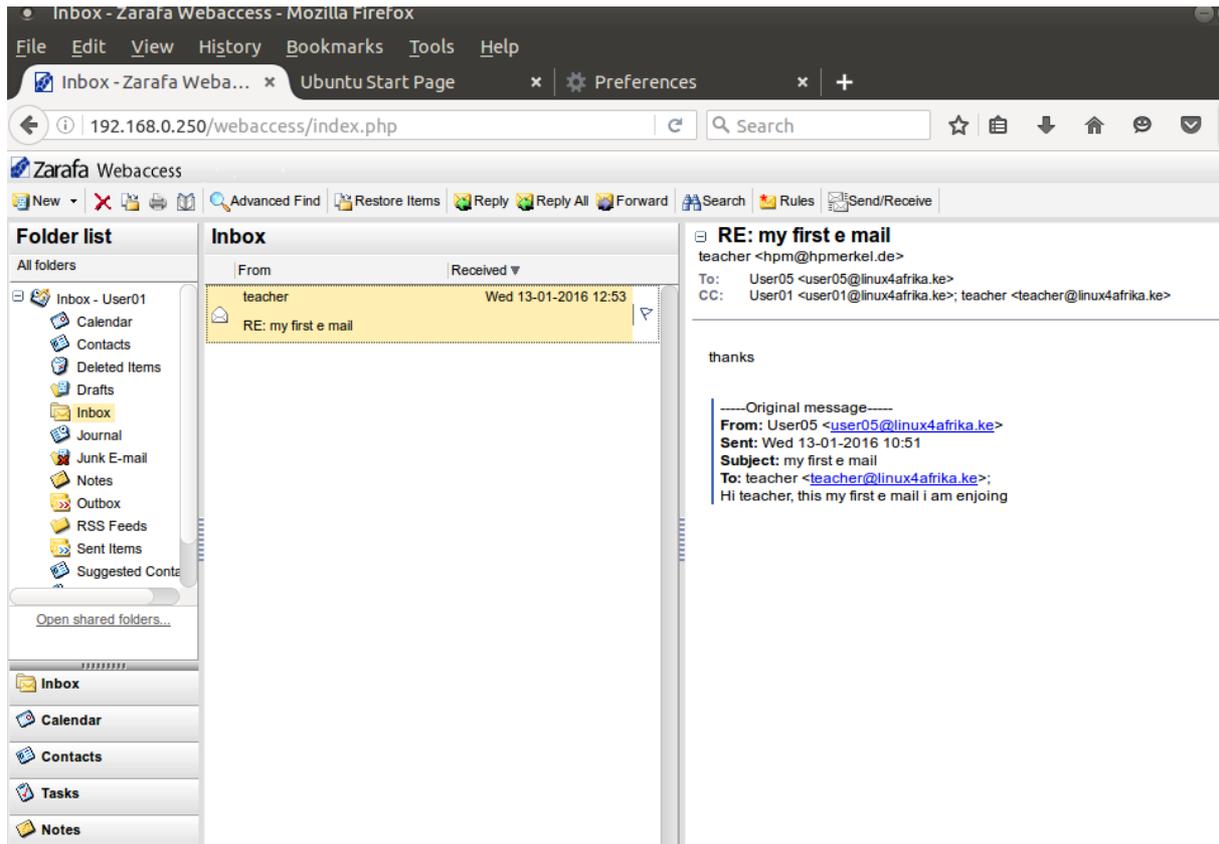
2.7 Server: Epoptes
Author: Hans-Peter Merkel

Linux4Afrika server comes with epoptes installed. This software enables the teachers, to monitor each individual client PC and take full control.
See: http://www.epoptes.org/ for details.

All clients have epoptes client software preinstalled. They automatically connect to 192.168.0.250

21
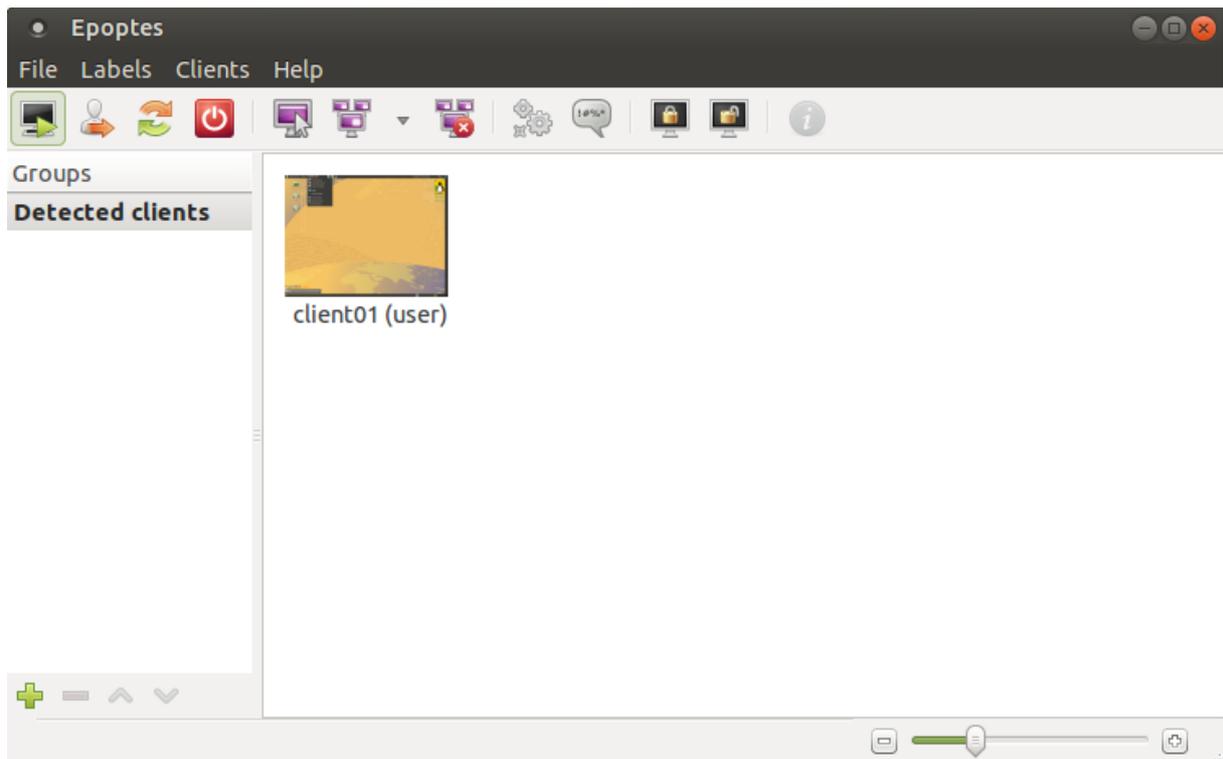
2.8 Server: Tranparent Proxy
Author: Hans-Peter Merkel

Since 2016 the Mastersolution uses a transparent proxy. The clients therefore no longer need a confiured Proxy setting. All outgoing requests (except local connections to 192.168.0.250) will be redirected via iptables to squid which now runs a a transparent proxy.

cat /etc/rc.local

```
#
# By default this script does nothing.
ethtool -s eth0 wol g

/usr/local/sbin/myservices

sleep2
iptables-restore < /etc/fw.conf

exit 0
```

22

```
cat /etc/squid/squid.conf | grep http_port
```

```
#

# Squid normally listens to port 3128
# HPM NEU: Transparenter Proxy 24.09.2016
http_port 192.168.0.250:3128 transparent
```
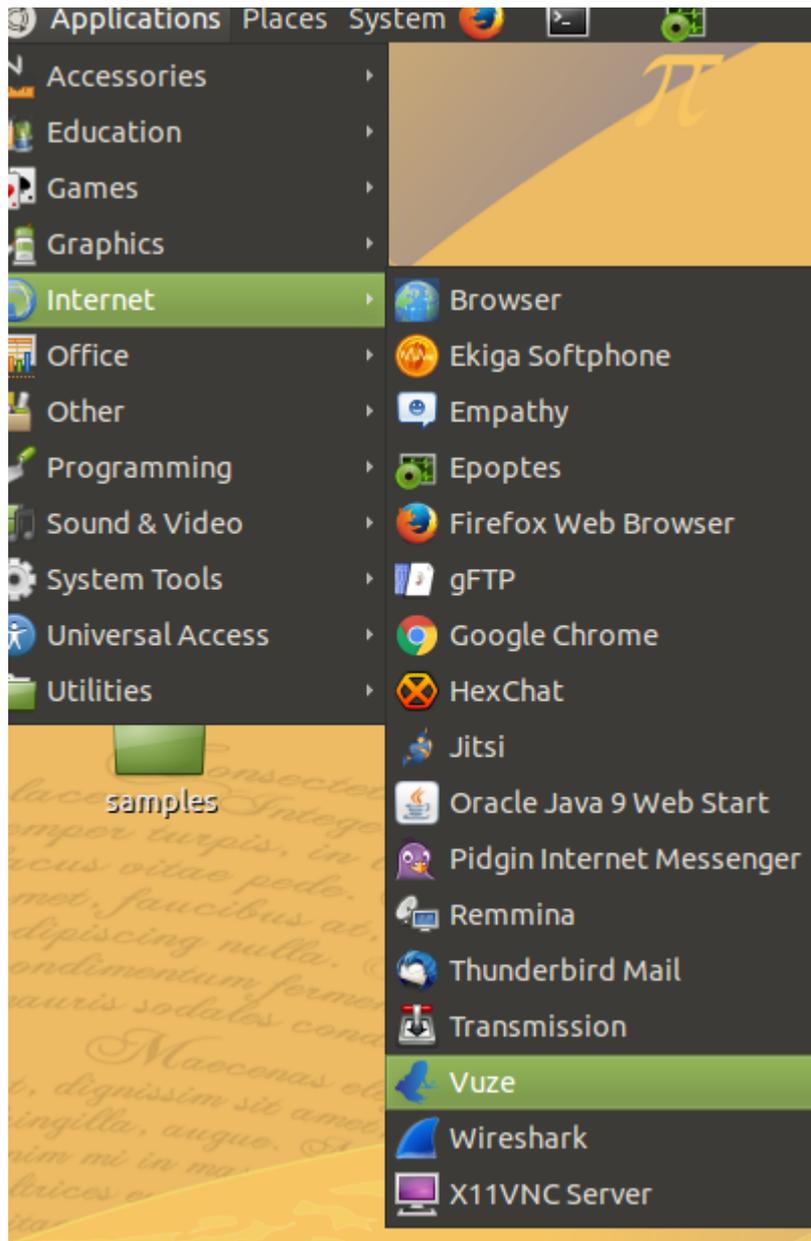
```
tail -f /var/log/squid/access.log
```
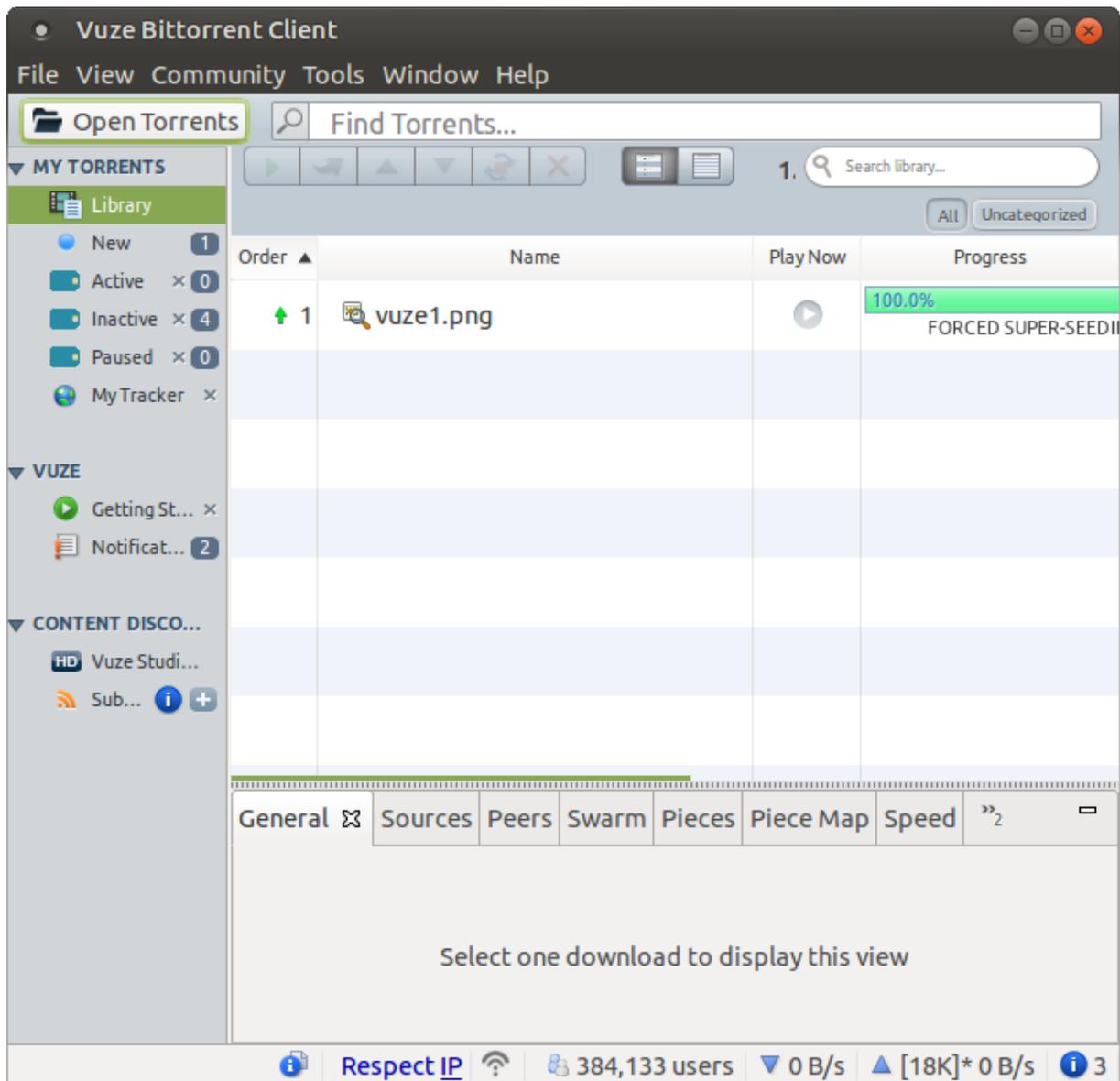

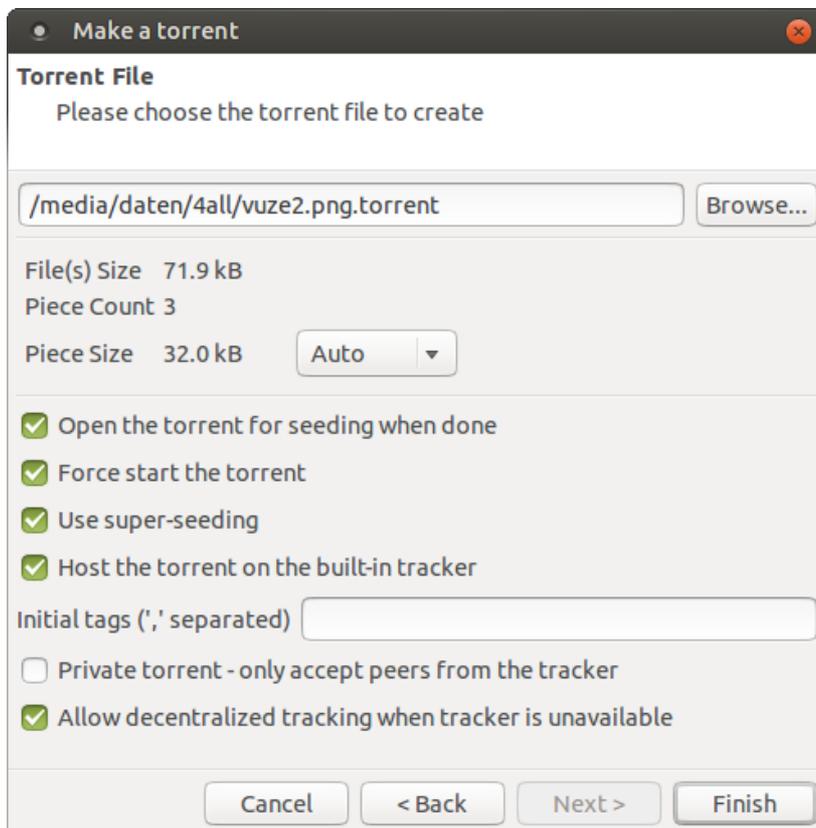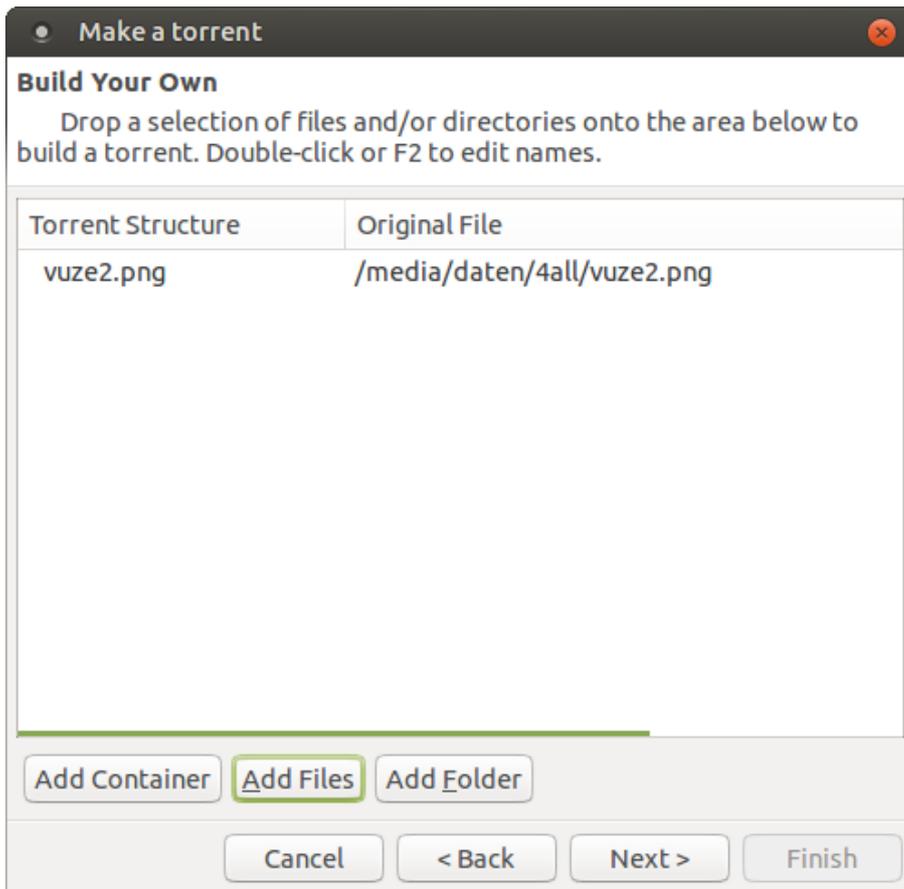## 2.9 Server: VUZE Torrent Server
Author: Hans-Peter Merkel

If a teacher needs to deliver huge files to all clients, a Samba File server might not be suitable. For this reason a torrent server has been installed on the Server:

Applications → Internet → Vuze

23

Make a torrent

Build Your Own

Drop a selection of files and/or directories onto the area below to build a torrent. Double-click or F2 to edit names.

Torrent Structure	Original File
vuze2.png	/media/daten/4all/vuze2.png

Add Container   Add Files   Add Folder

Cancel   < Back   Next >   Finish

Make a torrent

Torrent File

Please choose the torrent file to create

/media/daten/4all/vuze2.png.torrent   Browse...

File(s) Size   71.9 kB
Piece Count 3

Piece Size   32.0 kB   Auto ▼

☑ Open the torrent for seeding when done
☑ Force start the torrent
☑ Use super-seeding
☑ Host the torrent on the built-in tracker

Initial tags (',' separated)

☐ Private torrent - only accept peers from the tracker
☑ Allow decentralized tracking when tracker is unavailable

Cancel   < Back   Next >   Finish

26

Client can access this torrent servia via Browser:

http://192.168.0.250:6969 (or use preset bookmark)

3.0 Clients: Creating ISO images for distribution
Author: Hans-Peter Merkel

All Linux4Africa clients have now Pinguy Builder installed. It can be used to create your own custom ISO images for being burned on DVD or installed on USB stick.
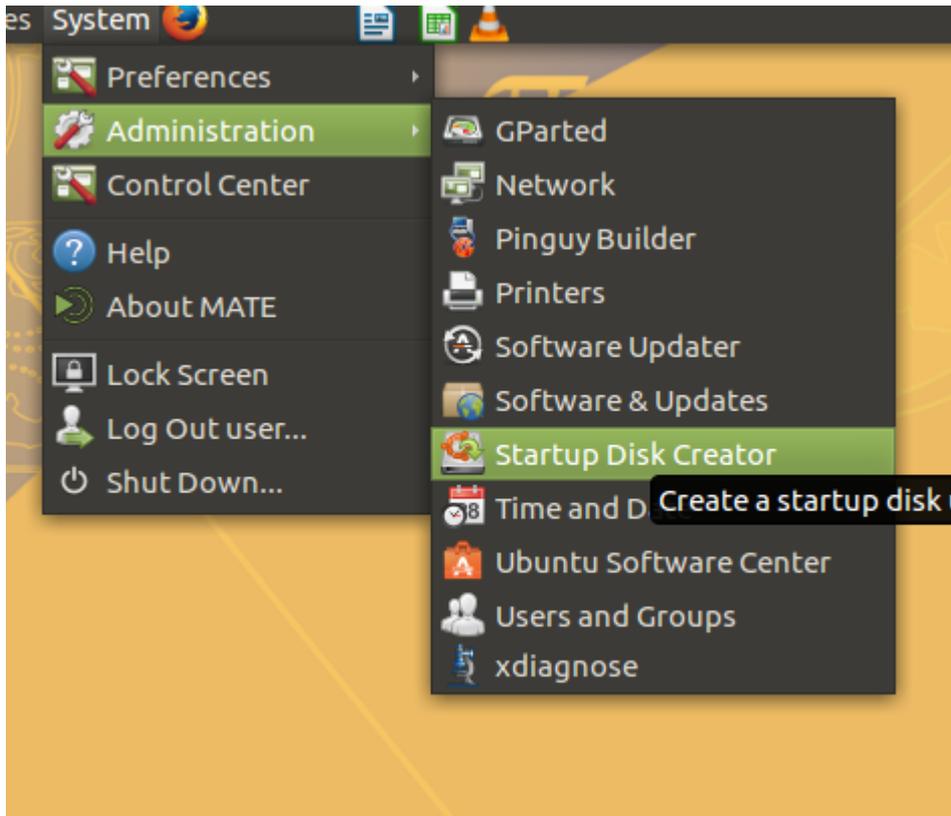

28
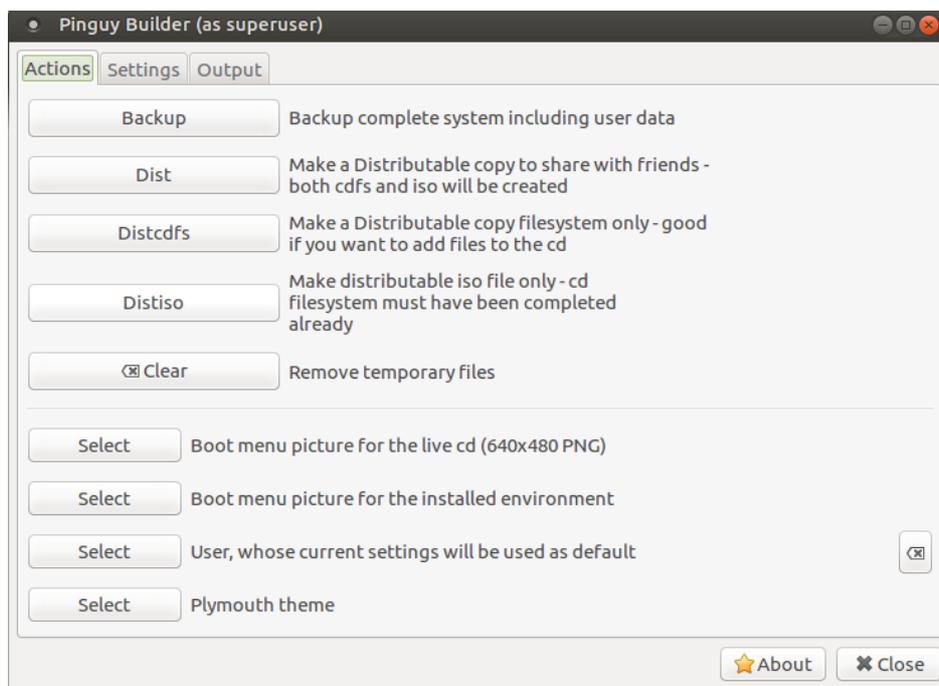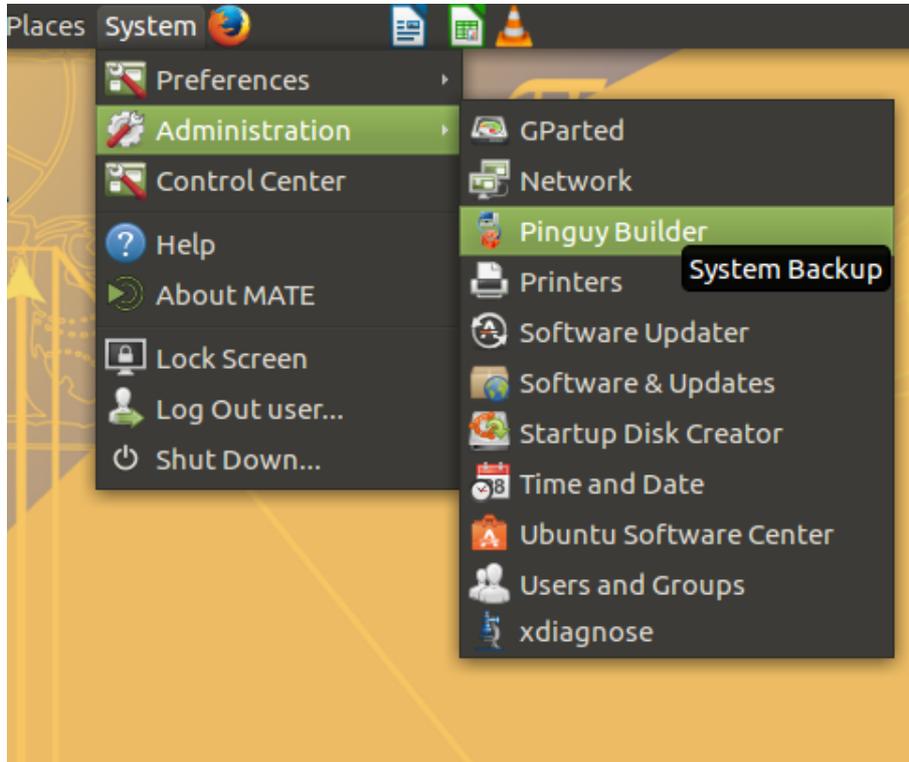
3.1 Clients: Creating bootable USB sticks
Author: Hans-Peter Merkel

If you need a bootable USB stick instead of an installtion DVD, you can create one with **Startup Disk Creator**.
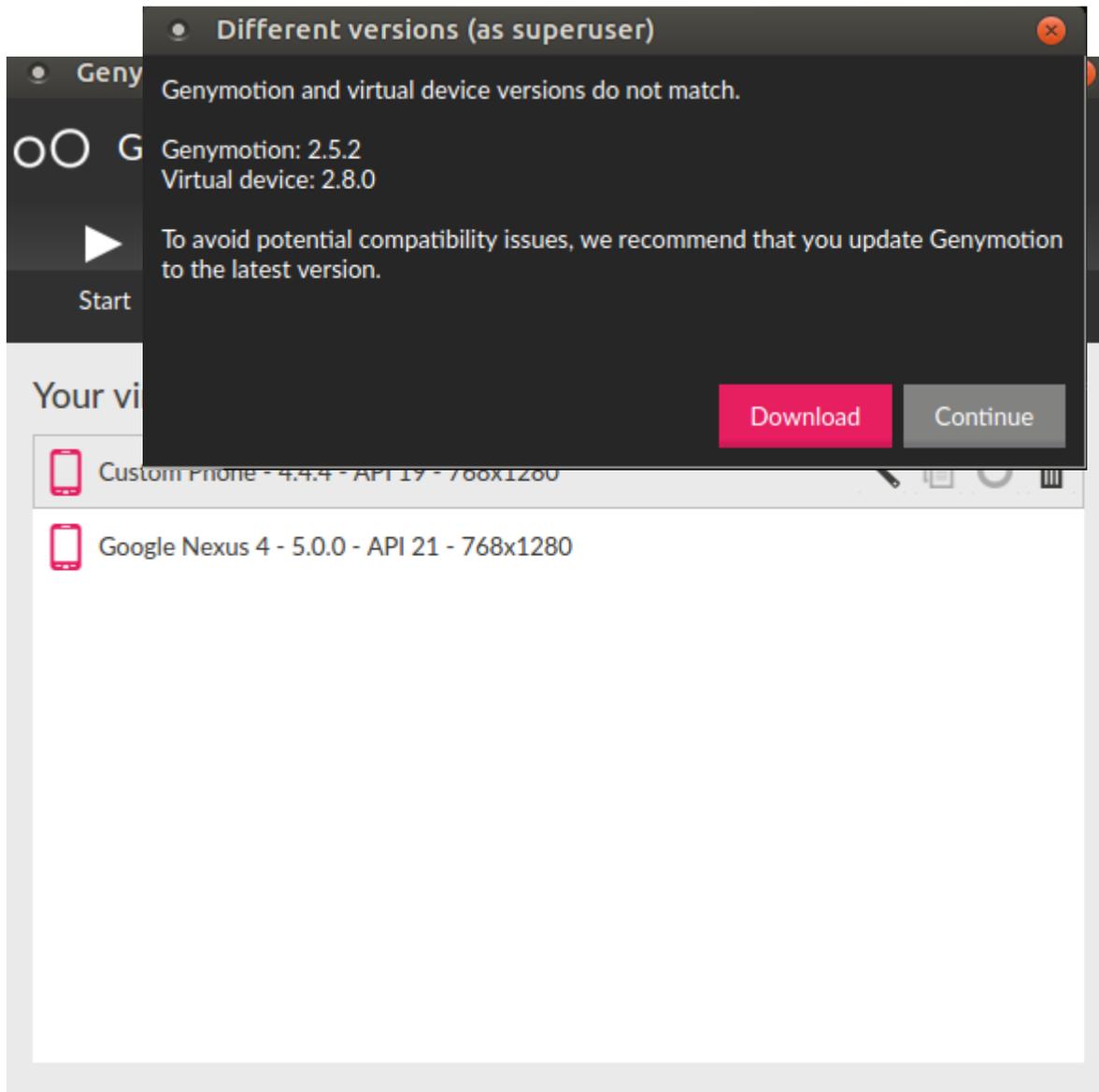
It is also preinstalled on each Linux4Afrika client.

3.2 Clients: Playing with Android
Author: Hans-Peter Merkel

Genymotion is a program which nicely emulates Android smartphones. Unfortunately newer versions do not support 32 Bit clients anymore. Last available 32 Bit version is 2.5 which is now installed. It collides with GT libraries and can only run as root.

29

`/opt/genymotion/genymotion`

Use Continue and not Download !