Debian Live Netboot on Top

Deploying Debian with almost no Modifications on existing Infrastructure

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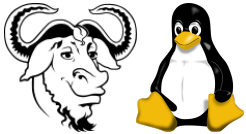
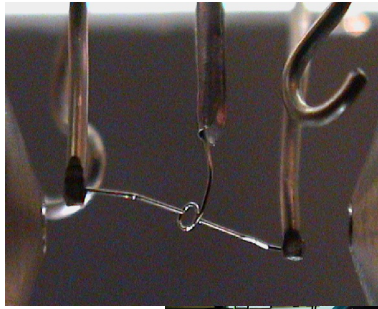
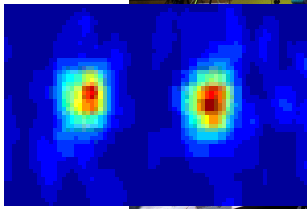
MiniDebConf Regensburg

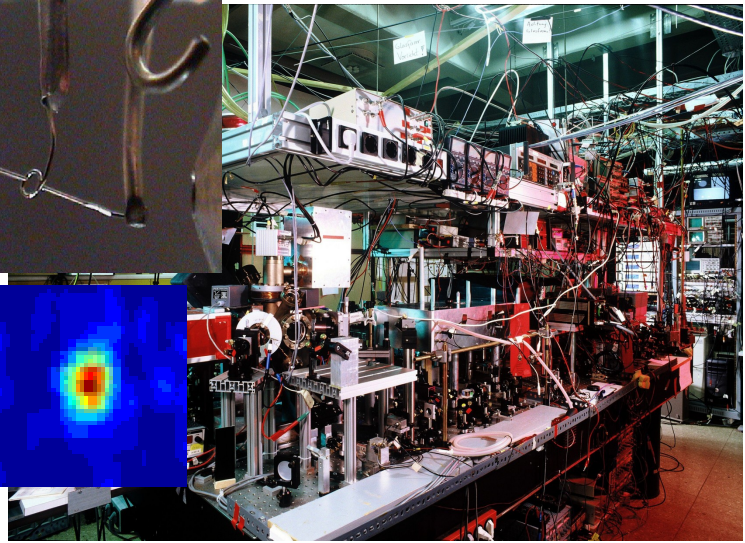
2. Oktober 2021



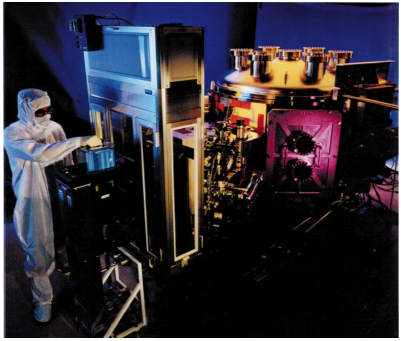
About me: . . . Physics . . .







About me: ... Optical Lithography ... Teaching ...



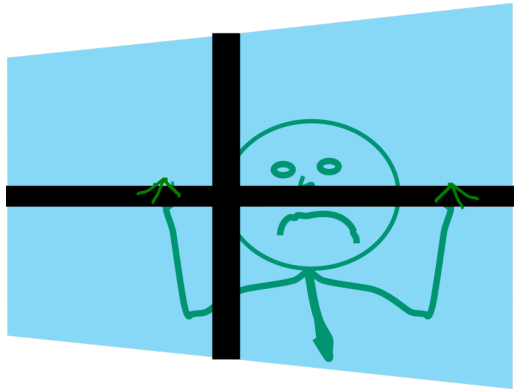
- R&D in Lithography Optics (EUV)

- Highschool Teaching: Maths, Physics, IT

[1]

[1] Picture: Wikipedia, © Jorge Royan / http://www.royan.com.ar / CC BY-SA 3.0

THE PROBLEM



- school uses windows
- „Network Lab“ with GNU/Linux, but badly maintained
- → existing infrastructure must not be modified

Problem and Solution
Components
di-netboot-assistant
Debian Live
home (sshfs) and smb
Some Details
Show me the Desktop ...
Education
Further Goals
Sources and Summery

Outlook and Introduction

1. The Problem and its Solution
2. Components
3. Some Technical Details
4. Show me the Desktop ...
5. Education
6. Further Goals

The Idea

Situation:

- OS is provided by imaging
- 'never change a running system' strategy
- $\rightarrow$ ~~dual boot~~?

But:

- today's hardware is powerfull: $\rightarrow$ 16 GB RAM
- idea: Why use a hard disk, when you have RAM for several operating systems?

The Idea

Situation:

- OS is provided by imaging
- 'never change a running system' strategy
- $\rightarrow$ ~~dual boot~~?

But:

- today's hardware is powerfull: $\rightarrow$ 16 GB RAM
- idea: Why use a hard disk, when you have RAM for several operating systems?
  - no installation needed, existing infrastructure stays untouched
  - no maintainance at the local PC necessary
  - $\rightarrow$ very flexible
  - $\rightarrow$ no interference with locally installed systems
  - $\rightarrow$ use existing infrastructure for user administration and authentication

Live Systems

- USB-Sticks → tiresome, complicated
- Better: PXE boot over the network
- → scaleable

Implementation

At PXE boot, we fetch (TFTP) the Grub (bootloader).

boot menu:

- boot from local disk / exit grub → the existing system is started as before
- start the Live System →
  - fetch a Live System over the Network (TFTP, HTTP)
  - authenticate user through existing infrastruktur (LDAP)
  - mount existing shares of the user
  - mount the user's home directory

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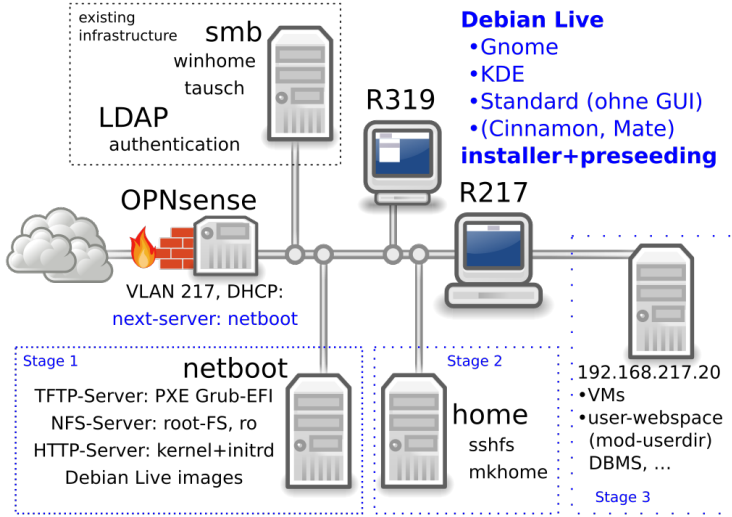
Implementation



Introduction

1 The Problem and its Solution

2 Components
- di-netboot-assistant
- Debian Live
- home (sshfs) and smb

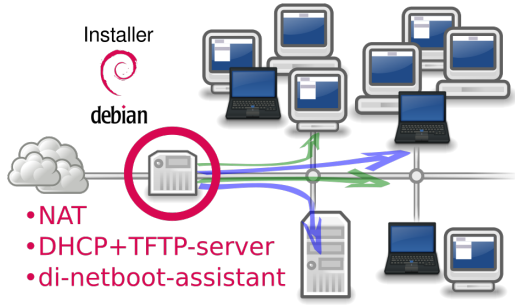
3 Some Technical Details

4 Show me the Desktop ...

5 Education

6 Further Goals

TFTP server: `di-netboot-assistant`



- client → PXE boot, client requests an IP Address and configuration (DHCP)
- DHCP server → next TFTP server and *Network Bootstrap Program (NBP)*
- client fetches `pxelinux.0` (legacy BIOS) resp. `bootnetx64.efi` (UEFI)
- client fetches kernel, initramfs and ... from the TFTP server ...

$\Longrightarrow$ installation can start!

Debian Live and di-netboot-assistant

`di-netboot-assistant` can provide Debian Live ISO images over the network[2]:

1. download des ISO image of your interest
2. mount des ISO image into the TFTP directory
3. generate Grub/pxelinux menu entry:

```
di-netboot-assistant -v rebuild-menu
```

[2] Details siehe README:
`https://salsa.debian.org/installer-team/netboot-assistant/-/blob/master/README`

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```

some tuning:

- use HTTP/TCP instead of TFTP/UDP to download kernel, initrd, squashfs.img
- mount the squashfs.img read only over the network (NFS)

[2] Details siehe README:
`https://salsa.debian.org/installer-team/netboot-assistant/-/blob/master/README`

Debian Live

Projekt:

- `https://www.debian.org/CD/live/`
- `https://wiki.debian.org/DebianLive`

Images:

- `https://cdimage.debian.org/cdimage/unofficial/non-free/cd-including-firmware/current-live/amd64/iso-hybrid/`

Dokumentation:

- `https://live-team.pages.debian.net/live-manual/`
  - 4.6 Building a netboot image
  - 4.7 Webbooting
  - ...

Customize Debian Live

- modifications applied to the Live Image:
  - desktop environment
  - configure authentication (`sssd`) and PAM-mount
  - education: VM template and script for user's VMs
- extra packages
- hooks:
  - customize VM template (MAC-addresses)
  - permissions `libvirtd`

home (sshfs) and smb

goals:

- after login: access to existing network shares without another authentication
- persistent home directories with all Unix/POSIX features

realisation:

- PAM mount on the Live System
- PAM mkhomedir on the server which provides the home directories

home (sshfs) and smb

goals:

- after login: access to existing network shares without another authentication
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realisation:

- `PAM mount` on the Live System
- `PAM mkhomedir` on the server which provides the home directories

Live System: login → auth LDAP (sssd) → PAM mount → sshfs from home server
→ PAM mount → smb shares

home server: → auth LDAP (sssd) → PAM mkhome → creates home directory

some technical details

- depending on the configuration, users can have full root permissions → VLAN
- unused hard drives should be protected → boot parameter
- `sshfs` limitation: no hard links (as seen from the client) → problem for `gnome-keyring-daemon`[3]
- user's VMs on extra USB stick → bind-mount skript

[3] Bug report and patch: `https://bugs.debian.org/995023`

Boot-Parameter

grub.cfg.HEAD: Gnome NFS

```
[...]
linux   (http)/d-i/n-live/gnome-desktop/live/vmlinuz hostname=$oct4$oct5$oct6
   boot=live components splash locales=de_DE.UTF-8 keyboard-layouts=de swap=true
   netboot=nfs nfsroot=192.168.1.15:/srv/nfs/debian-live/gnome-desktop/
   libata.force=disable noautologin live-config.timezone=Europe/Berlin
   live-config.user-default-groups=audio,cdrom,dip,floppy,video,plugdev,netdev,wireshark

initrd  (http)/d-i/n-live/gnome-desktop/live/initrd.img
[...]
```

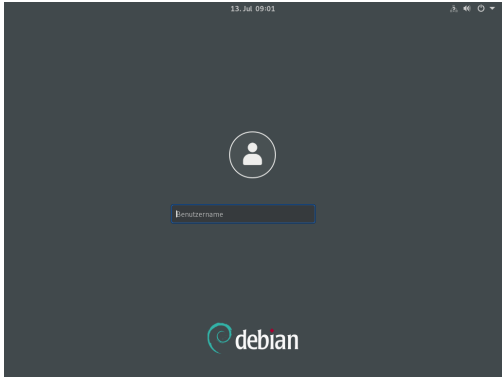
grub.cfg.HEAD: Standard RAM

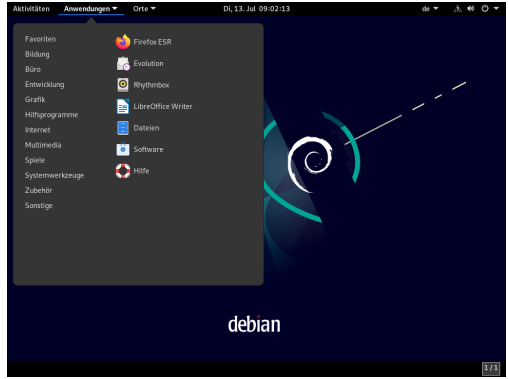
```
[...]
linux   (http)/d-i/n-live/standard/live/vmlinuz boot=live components splash
   locales=de_DE.UTF-8 keyboard-layouts=de swap=true
   fetch=http://192.168.1.15/d-i/n-live/standard/live/filesystem.squashfs
   libata.force=disable live-config.timezone=Europe/Berlin

initrd  (http)/d-i/n-live/standard/live/initrd.img
[...]
```

Screenshots: Grub PXE Boot

Screenshots: Login



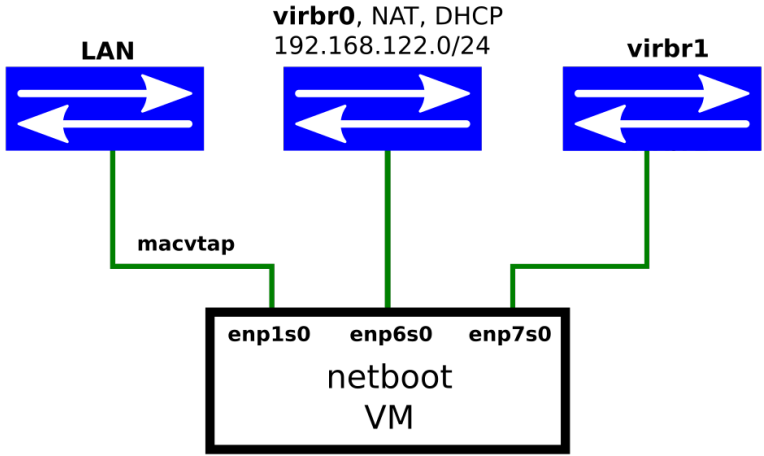


Education: Networking and Protocols

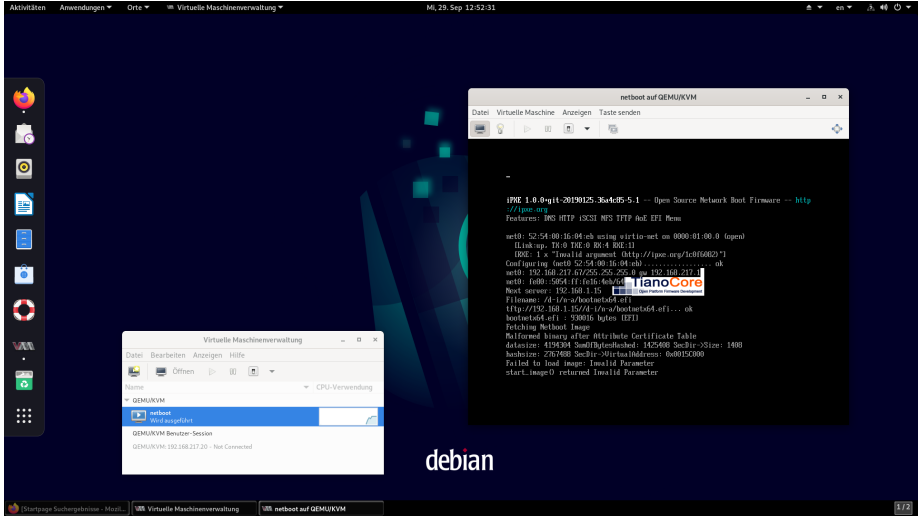
- watch and study network protocols, routing, NAT, ...
- $\rightarrow$ build small (virtual) networks
- $\rightarrow$ tap the network
- $\rightarrow$ tcpdump/wireshark

How can this be done without extra storage for VMs?

Education: VM Template



Screenshots: Netboot VM



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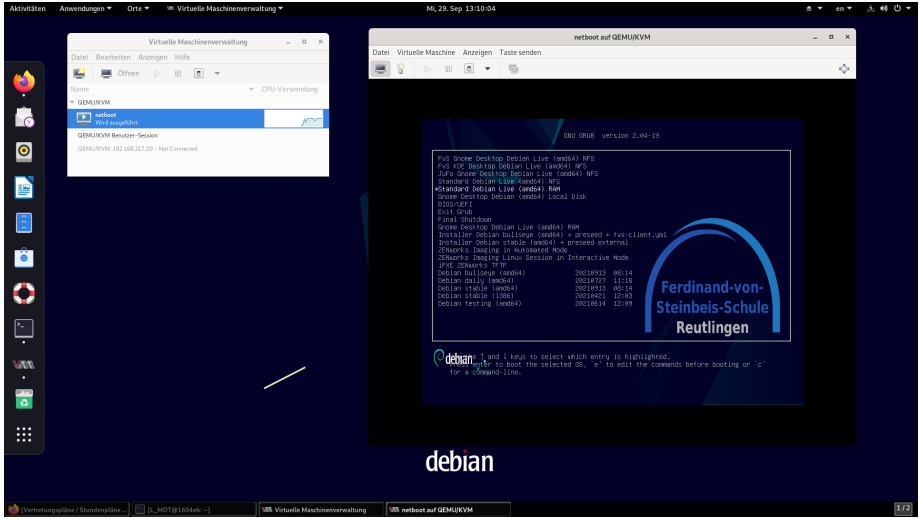

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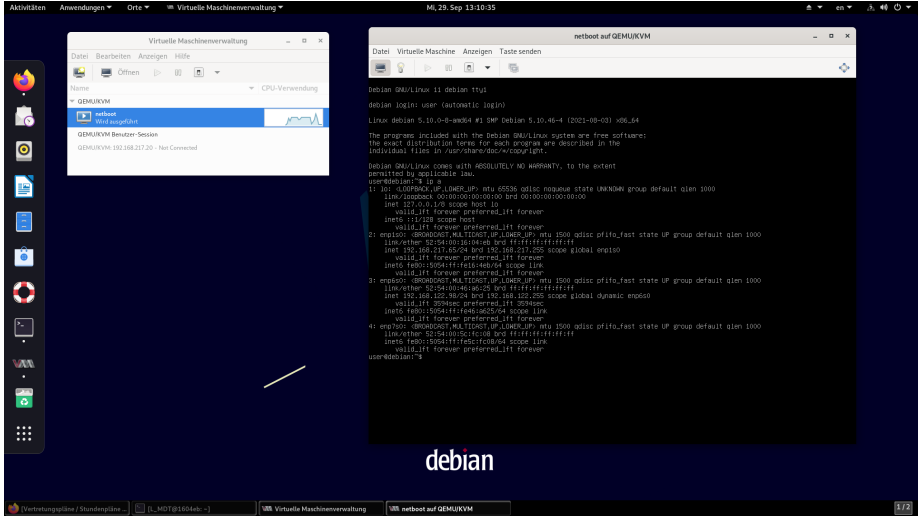

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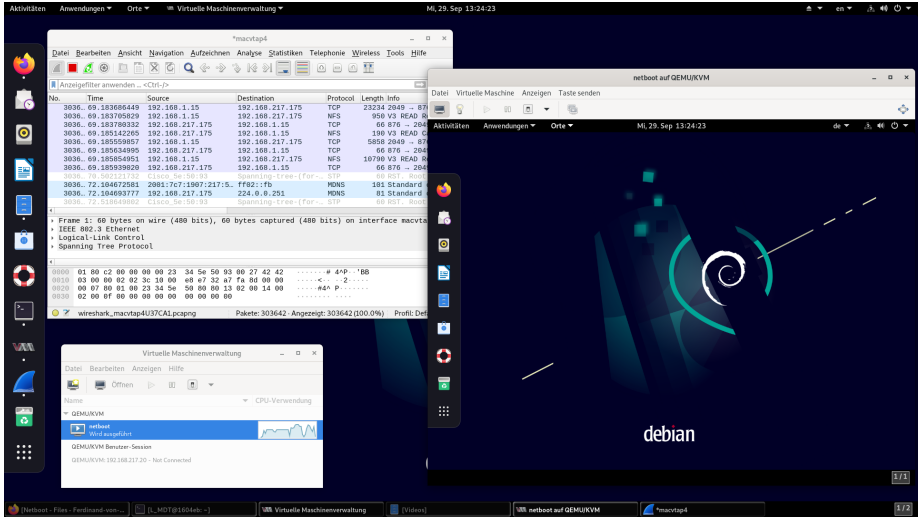

Screencasts TFTP

wiresharkTFTP

Screencasts squashfs → RAM

wiresharkRAM

Further Goals

- PC labs in VLANs
- inclusion in existing TFTP server
- → system available everywhere as alternative
- GPU pass through → windows in VM with dedicated graphics card
- → replace window images by Debian installation on the hard disk and provide windows-VM
- Secure Boot → include HTTP module in grub core[4]

[4] https://bugs.debian.org/920610

More information and resources

- https://wiki.debian.org/DebianInstaller/NetbootAssistant
- https://people.debian.org/~andi/Chemnitz2020_canceled.pdf
- https://live-team.pages.debian.net/live-manual
- https://gitlab.steinbeisschule-reutlingen.de/L_MDT/debianlive4fvs
- https://salsa.debian.org/andi/debian-lan-ansible
- https://gitlab.steinbeisschule-reutlingen.de/L_MDT/debian-lan4fvs

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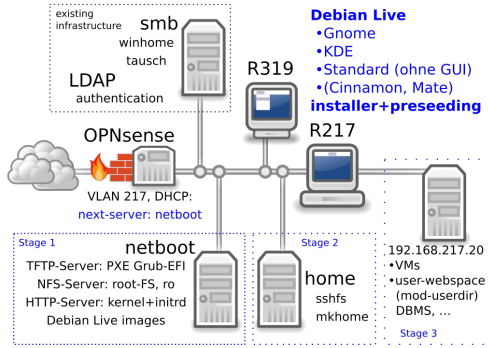

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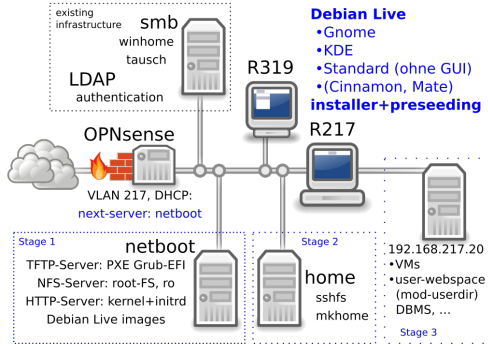

Thanks!