

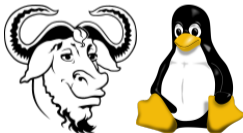
Debian Live Netboot on Top

Deploying Debian with almost no Modifications on existing Infrastructure

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MiniDebConf Regensburg

2. Oktober 2021



Debian Live
Netboot on
Top

Andreas
B. Mundt

Problem and
Solution

Components

di-netboot-
-assistant
Debian Live
home (sahfs) and
smb

Some Details

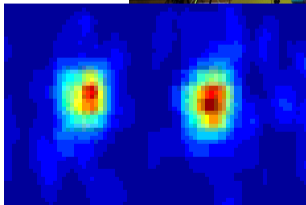
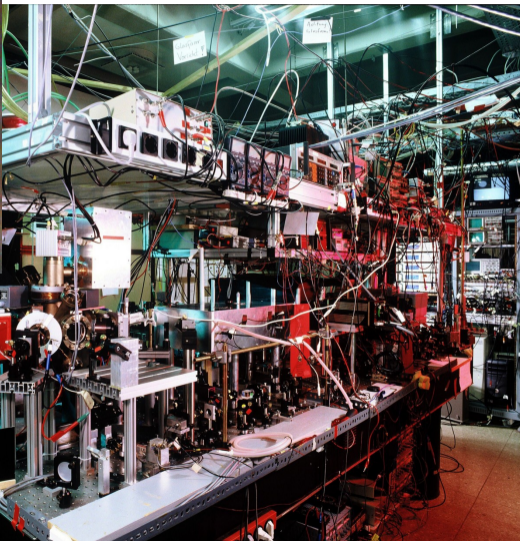
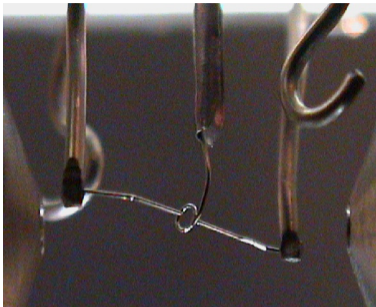
Show me the
Desktop ...

Education

Further Goals

Sources and
Summery

About me: ... Physics ...



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

...

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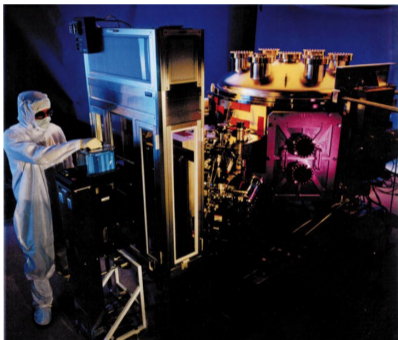
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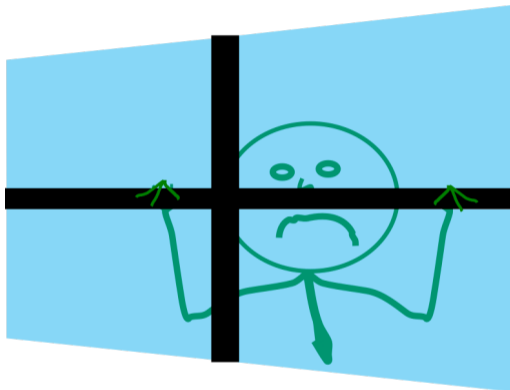


- R&D in Lithography Optics (EUV)

- Highschool Teaching: Maths, Physics, IT



THE PROBLEM



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

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
- → ~~dual boot~~?

But:

- today's hardware is powerfull: → 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
- → ~~dual boot?~~

But:

- today's hardware is powerfull: → 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
 - → very flexible
 - → no interference with locally installed systems
 - → use existing infrastructure for user administration and authentication

Live Systems

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

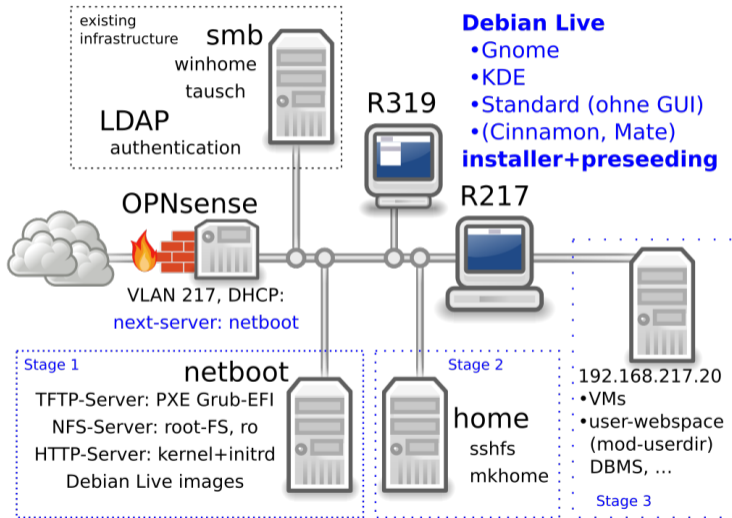
Implementation

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

Implementation



Introduction

1 The Problem and its Solution

2 Components

di-netboot-assistant

Debian Live

home (sshfs) and smb

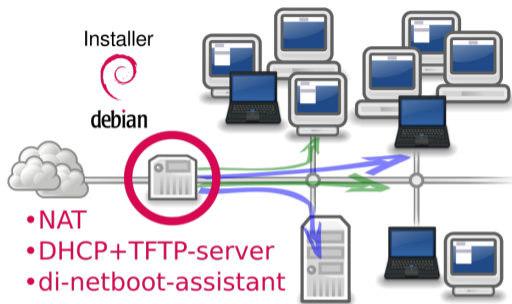
3 Some Technical Details

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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 ...

⇒ installation can start!

Debian Live and `di-netboot-assistent`

`di-netboot-assistent` can provide Debian Live ISO images over the network²:

- 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-assistent -v rebuild-menu
```

²Details siehe README:

Debian Live and di-netboot-assistant

```
GNU GRUB version 2.04-12

Debian daily (amd64) + pkg-cache
Debian daily (amd64) + preseed
Debian buster (amd64) + preseed
*Debian GNU/Linux Live
  Boot from local disk..
Debian bullseye (amd64)           20210313  18:54
Debian buster (amd64)            20201121  15:21
Debian buster (i386)             20201120  23:04
Debian daily (amd64)            20210517  20:46
Debian stable (amd64)           20201121  15:26
Debian 10 (buster) 20190702+deb10u9 amd64/gtk
Debian 10 (buster) 20190702+deb10u9 amd64/text

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.
```

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```
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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)

²Details siehe README:

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 libvirt

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 `mkhomedir` → 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

³Bug 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

GNU GRUB version 2.04-19

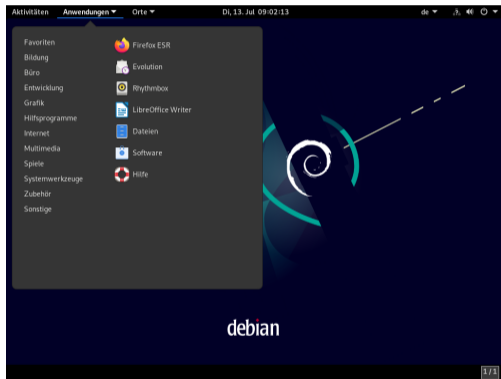
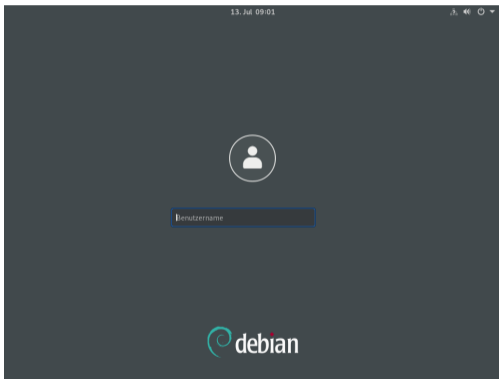
```
*FvS Gnome Desktop Debian Live (amd64) NFS
FvS KDE Desktop Debian Live (amd64) NFS
JuFo Gnome Desktop Debian Live (amd64) NFS
Standard Debian Live (amd64) NFS
Standard Debian Live (amd64) RAM
Gnome Desktop Debian (amd64) Local Disk
BIOS/UEFI
Exit Grub
Final Shutdown
Gnome Desktop Debian Live (amd64) RAM
Installer Debian bullseye (amd64) + preseed + fvs-client.yml
Installer Debian stable (amd64) + preseed external
ZENworks Imaging in Automated Mode
ZENworks Imaging Linux Session in Interactive Mode
iPXE ZENworks TFTP
Debian bullseye (amd64)           20210913  08:14
Debian daily (amd64)             20210727  11:18
Debian stable (amd64)            20210913  08:14
Debian stable (i386)             20210421  12:03
Debian testing (amd64)           20210614  12:09
```

**Ferdinand-von-Steinbeis-Schule
Reutlingen**

 **debian**

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.

Screenshots: Login

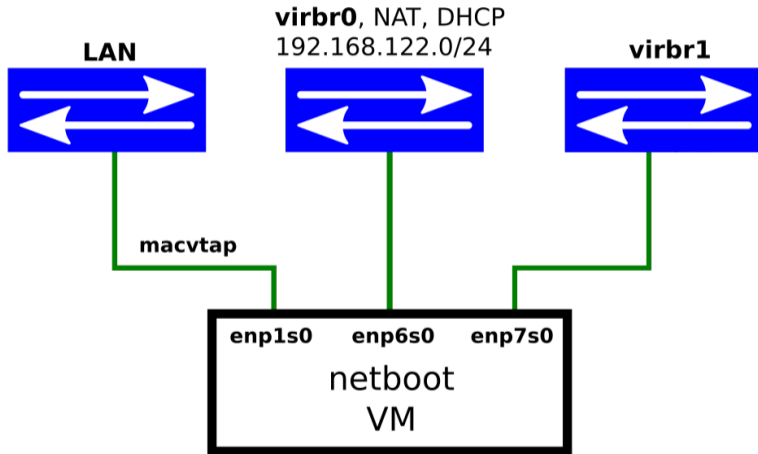


Education: Networking and Protocols

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

How can this be done without extra storage for VMs?

Education: VM Template

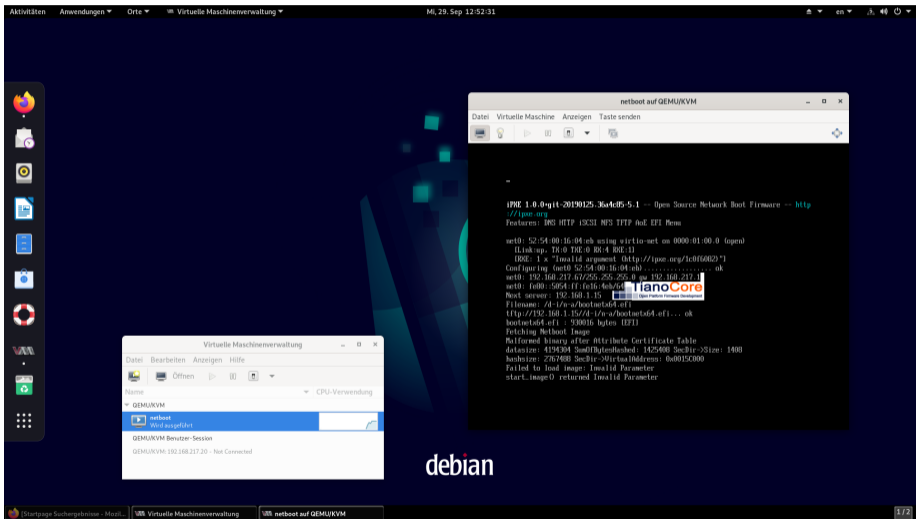


di-netboot-
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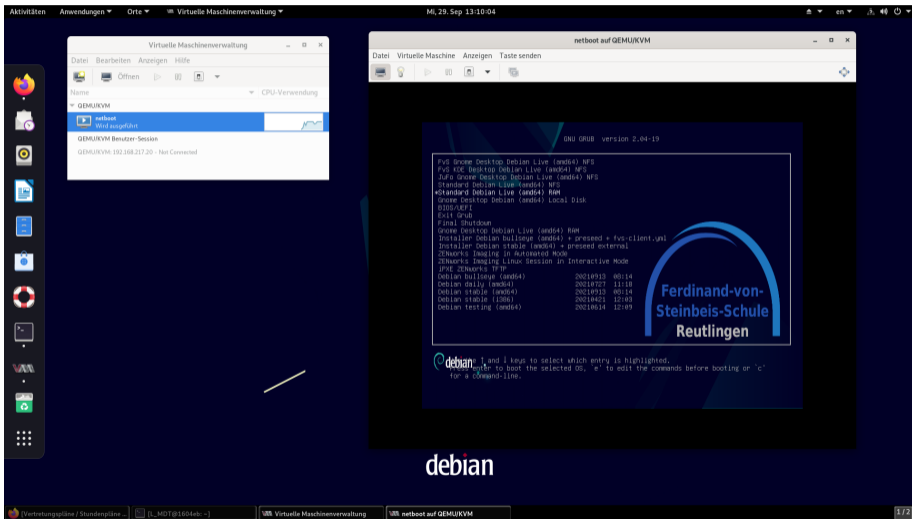
Debian Live

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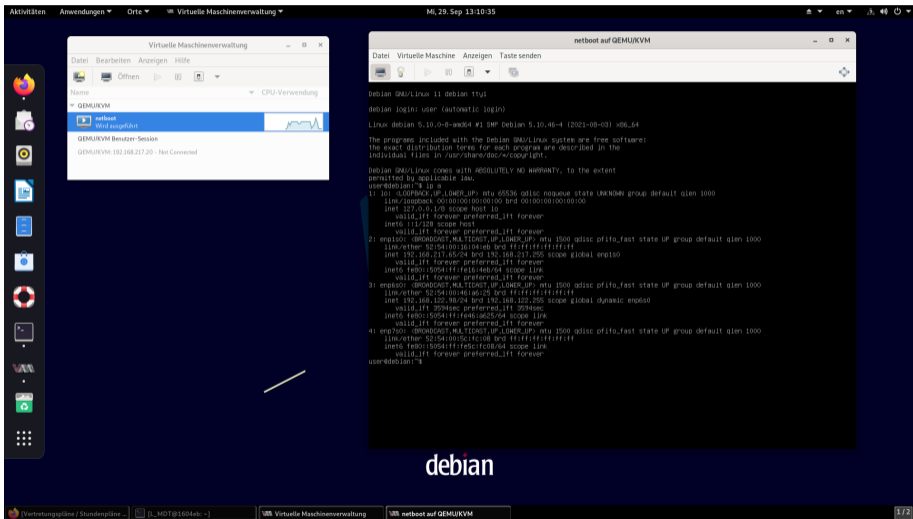
Screenshots: Netboot VM



Screenshots: Netboot VM



Screenshots: Netboot VM



Screenshots: Netboot VM

The screenshot displays a virtual machine environment. In the foreground, a window titled "netboot auf QEMU/KVM" shows the Debian logo and the text "netboot auf QEMU/KVM". In the background, a window titled "macvtap4" shows a Wireshark packet capture. The packet capture table is as follows:

No.	Time	Source	Destination	Protocol	Length	Info
3036.	69.1837086449	192.168.1.15	192.168.217.175	TCP	23234	2949 → 87...
3036.	69.183705829	192.168.1.15	192.168.217.175	NFS	950	V3 READ 0...
3036.	69.183780332	192.168.217.175	192.168.1.15	TCP	66	876 → 284...
3036.	69.185142265	192.168.217.175	192.168.1.15	NFS	190	V3 READ C...
3036.	69.185559857	192.168.1.15	192.168.217.175	TCP	5858	2949 → 87...
3036.	69.185634955	192.168.217.175	192.168.1.15	TCP	66	876 → 284...
3036.	69.185854951	192.168.1.15	192.168.217.175	NFS	10790	V3 READ 0...
3036.	69.185939820	192.168.217.175	192.168.1.15	TCP	66	876 → 284...
3036.	70.592231732	Cisco_Se:59:93	Spanning-tree (for...	STP	60	RST, Root...
3036.	72.104672581	2081:7c71:907:217:5	ff02::fb	MDNS	181	Standard...
3036.	72.104693777	192.168.217.175	224.0.0.251	MDNS	81	Standard...
3036.	72.518649862	Cisco_Se:59:93	Spanning-tree (for...	STP	60	RST, Root...

The packet details for the selected STP packet are:

- Frame 1: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface macvtap4
- IEEE 802.3 Ethernet
- Logical-Link Control
- Spanning Tree Protocol

The hex dump shows the raw bytes of the packet:

```
0000 01 00 c2 00 00 00 00 23 34 5e 50 93 00 27 42 42 .....# 4P...f85
0010 03 00 00 02 00 18 00 00 67 32 47 fa 8d 00 00 .....<...2...
0020 00 07 00 81 06 23 34 5e 50 80 00 13 02 00 14 00 .....#A P.....
0030 02 00 0f 00 00 00 00 00 00 00 00 00 00 00 00 00
```

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Screencasts TFTP

wiresharkTFTP

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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 core⁴

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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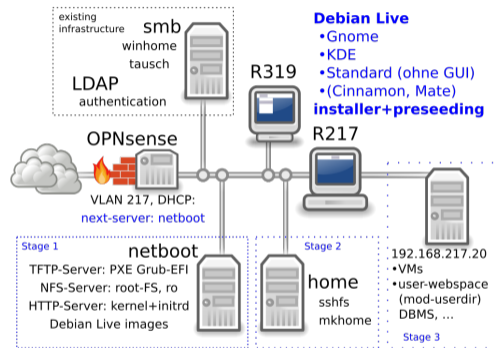
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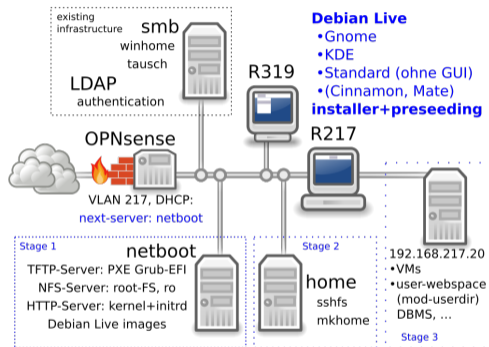
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Thanks!