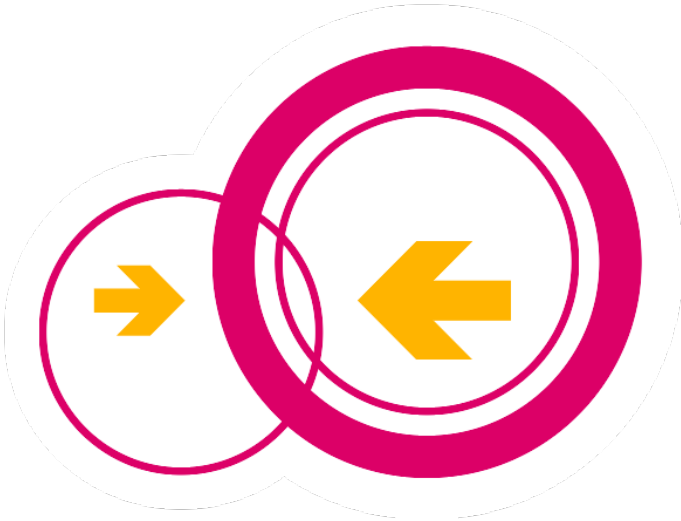
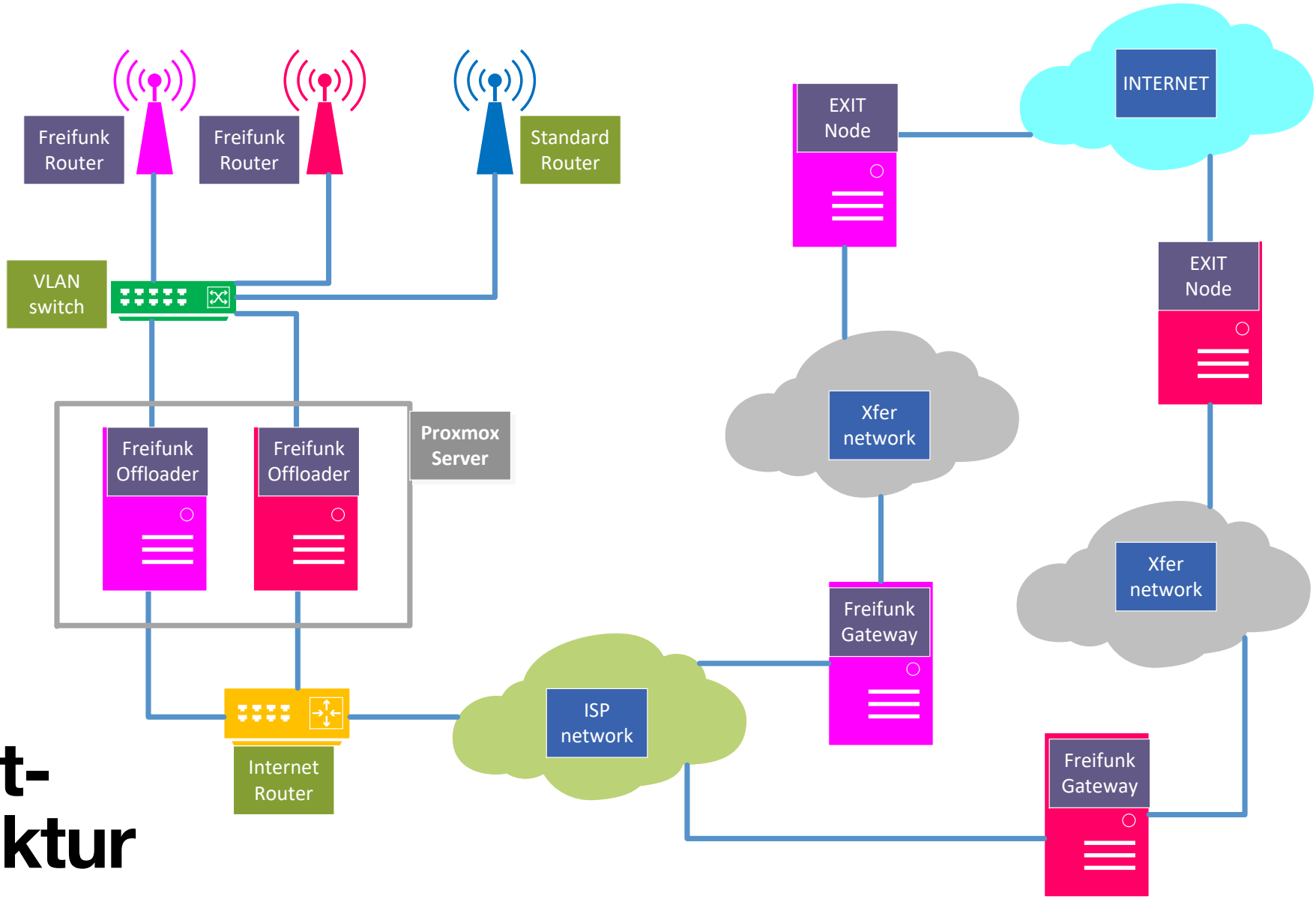
Freifunk-Offloader in Proxmox PVE-7.3

Kabel und Hardware sparen mit VLAN-Switches (802.1q)



LinuxTag 2023 der AG µC

Gesamt-Architektur



Hardware für den Versuchsaufbau

- 1x Intel NUC5i3 (Proxmox PVE-7.3)
  - 8GB Memory
  - 500GB SSD (M.2 NVMe)
  - 1 NIC: 1 Gbit/s
- Internet-Router
  - Vorgabe des NFH-Rahnenhof
- 2x Web managed 802.1q Switches
  - 5-port TP-Link & 8-port Netgear
- 1x unmanaged Desktop Switch
  - 8-port D-Link
- 5x WLAN-Router / Access Points
  - TP-Link; Edimax; NoName (JCG)
  - OpenWRT-LEDE; Freifunk-Node

Was sind VLANs?

Und was kann man damit machen?

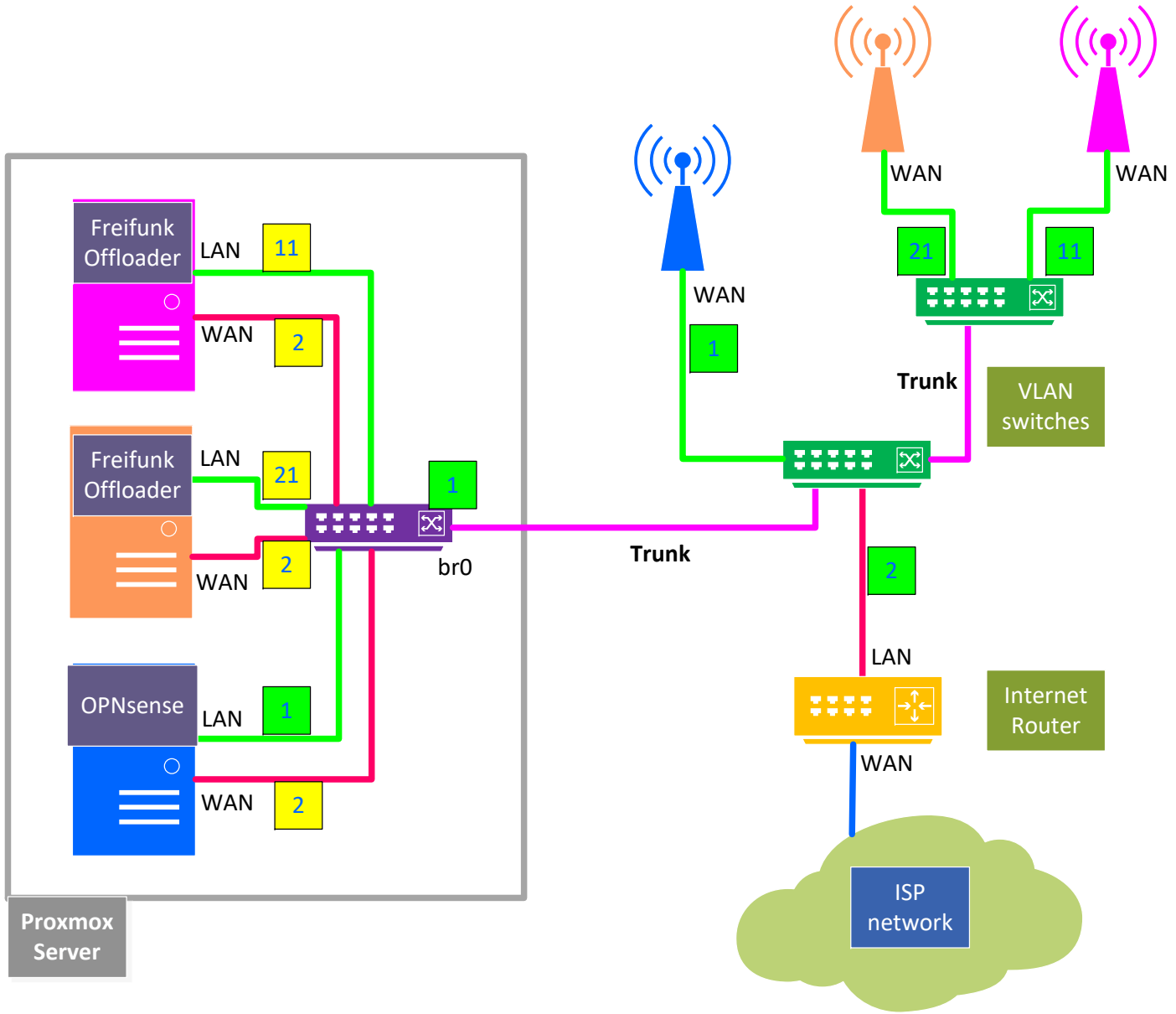
- Mit Hilfe von **VLANs** können Netzwerke *logisch* voneinander separiert werden, obwohl *physikalisch* die gleiche Infrastruktur (Rechner, Kabel, Switches) verwendet wird.
- Dazu werden Ethernet-Pakete um die **VID**-Bytes verlängert: die sog. **Tags**.
- Es gibt verschiedene VLAN-Versionen; aber nur Geräte die nach dem Standard **802.1q** arbeiten, sind miteinander interoperabel.

- **Beispiel**: der NUC-Rechner hat nur eine Netzwerkschnittstelle; für unsere Versuche werden aber mehrere, verschiedene LANs benötigt:
  - separate Netzwerke für LAN und WAN (bzw. DMZ)
  - Vermeidung von Störungen durch die verschiedenen Adressbereiche der einzelnen Freifunk-Netzwerke
  - pro LAN nur ein DHCP-Server

Versuchs-aufbau

untagged **VID**

tagged **VID**



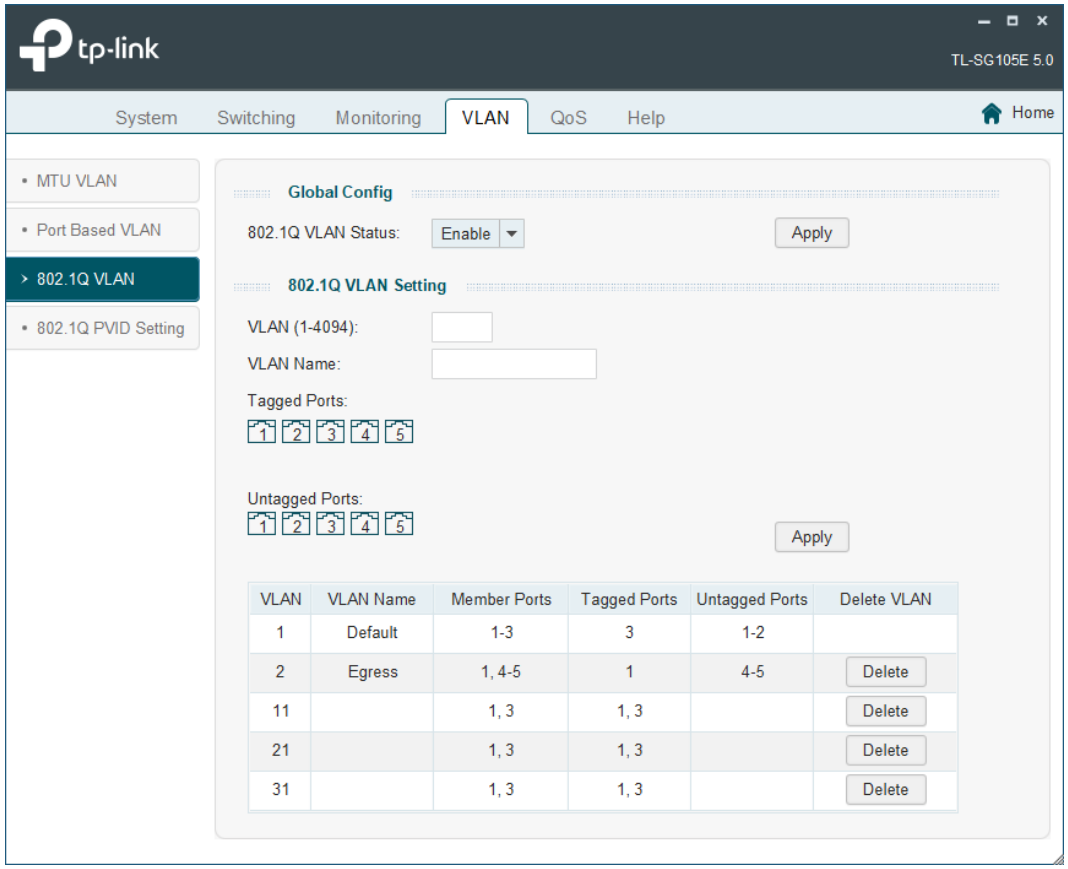
Planung der Netzwerk-Segmente

Verwendung	VID	IPv4 Adress-Bereiche	Geräte
***Default* Client-LAN**	1	192.168.**103**.0/24	nuc3, **opnsns-nuc3**, laptop, jcg-ap
DMZ Netzwerk	2	192.168.**178**.0/24	**router-nfh-rahnenhof**, opnsns-nuc3, opnwrt-nuc3, ffsw-nfh-rahnenhof, ffmuc-nfh-rahnenhof, ffws-duew-ap
FF-sw LAN	11	10.210.48.0/20	ffsw-nfh-rahnenhof, edimax-ap
FF-muc LAN	21	10.80.200.0/21	ffmuc-nfh-rahnenhof, tplink-ap
OpenWRT LAN	31	192.168.**223**.0/24	**opnwrt-nuc3**, dlink-sw08, lede-ap
Trunk1 NUC3—SG105	1, 2, 31, 11, 21	— —	nuc3-vmbr0, tl-sg105-p1
Trunk2 SG105—GS108	2, 31, 11, 21	— —	tl-sg105-p3, ng-gs108-p8

Konfiguration TP-Link SG105E

via Web-Browser und interner Web-App

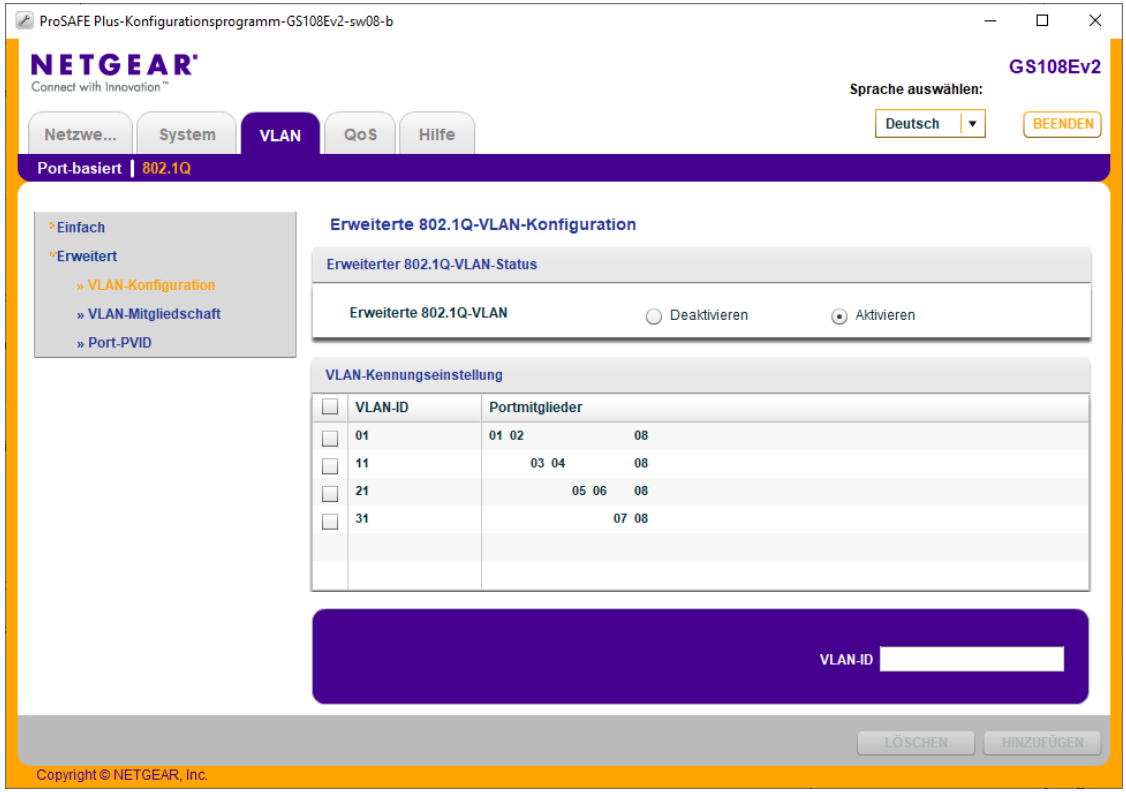
Ports	Untagged	Tagged	PVID	Device
1	1	2, 31, 11, 21	1	nuc3-vmbr0
2	1		1	laptop
3		1, 31, 11, 21	1	ng-gs108-p8
4	2		2	ffws-ap
5	2		2	rtr-nfh



Konfiguration Netgear ProSafe+ GS108E

via Windows-Application

Ports	Untagged	Tagged	PVID	Device
1, 2	1		1	jcg-ap
3, 4	11		11	edimax-ap
5, 6	21		21	tplink-ap
7	31		31	dlink-sw08
8		1, 31, 11, 21	1	tl-sg105-p3

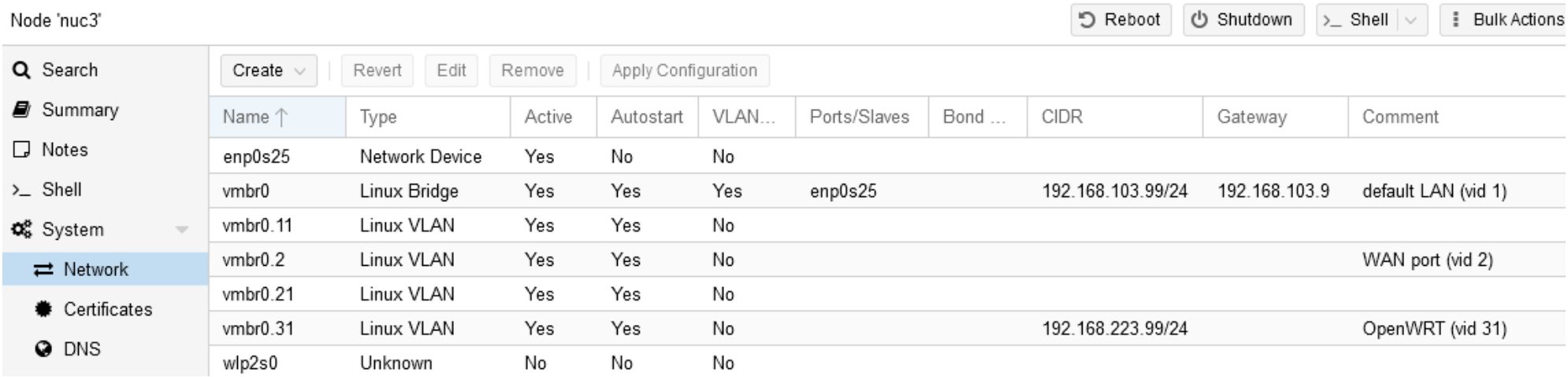


Konfiguration *NUC3*: Bridge *vmbr0*

via Web-Browser und PVE-GUI

Ports	Untagged	Tagged	Device	VM
vmbr0	1		—	*nuc3*, opnsns
vmbr0.2		2	—	opnsns, opnwrt, ffvp, ffmuc
enp0s25	1	2, 31, 11, 21	tl-sg105-p1	—

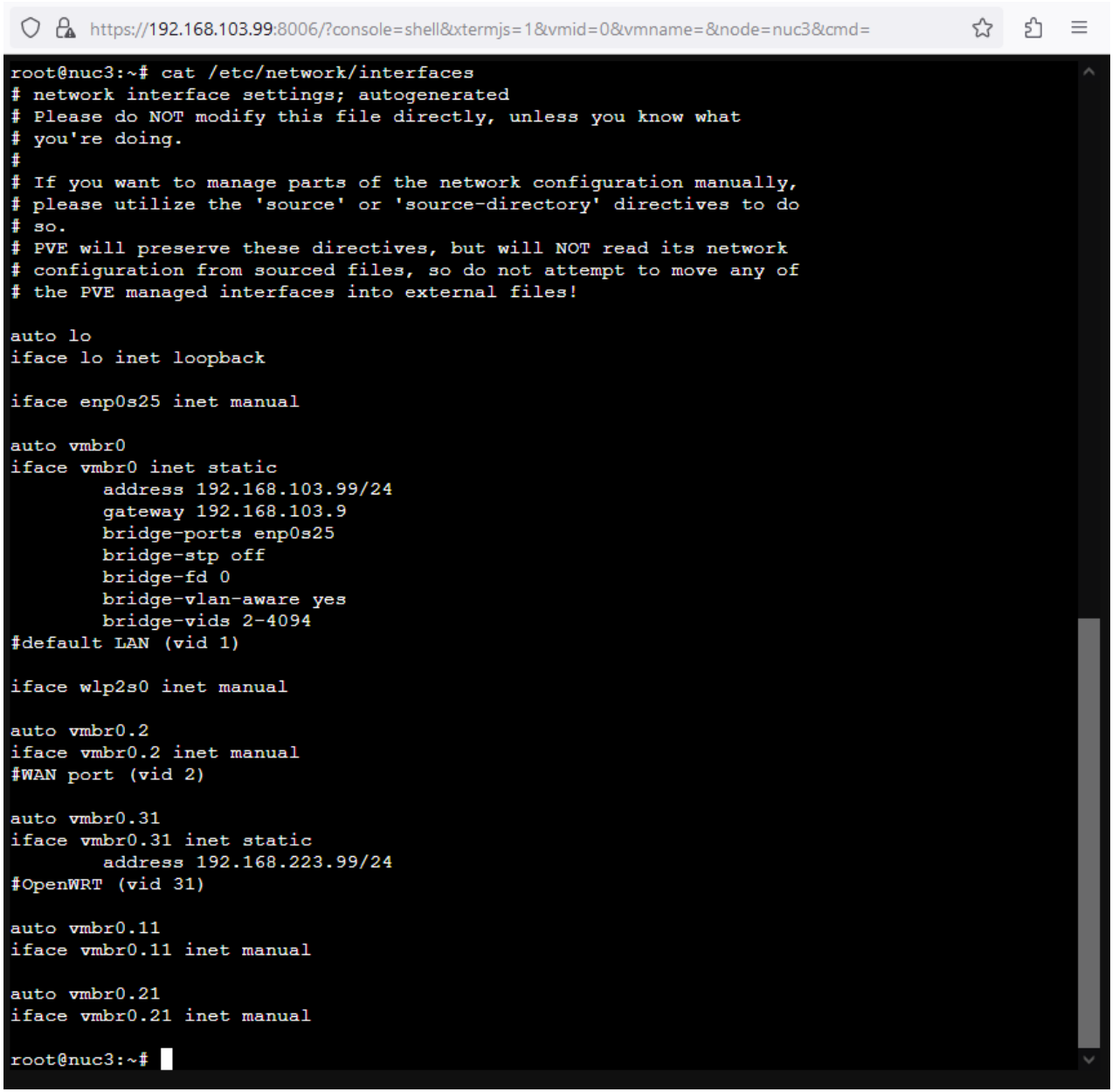
Ports	Untagged	Tagged	Device	VM
vmbr0.11		11	—	ffvp-nfh
vmbr0.21		21	—	ffmuc-nfh
vmbr0.31		31	—	opnwrt



Details der Netzwerk-Konfiguration

Proxmox basiert auf Debian: das PVE-GUI erstellt die Datei

`/etc/network/interfaces`

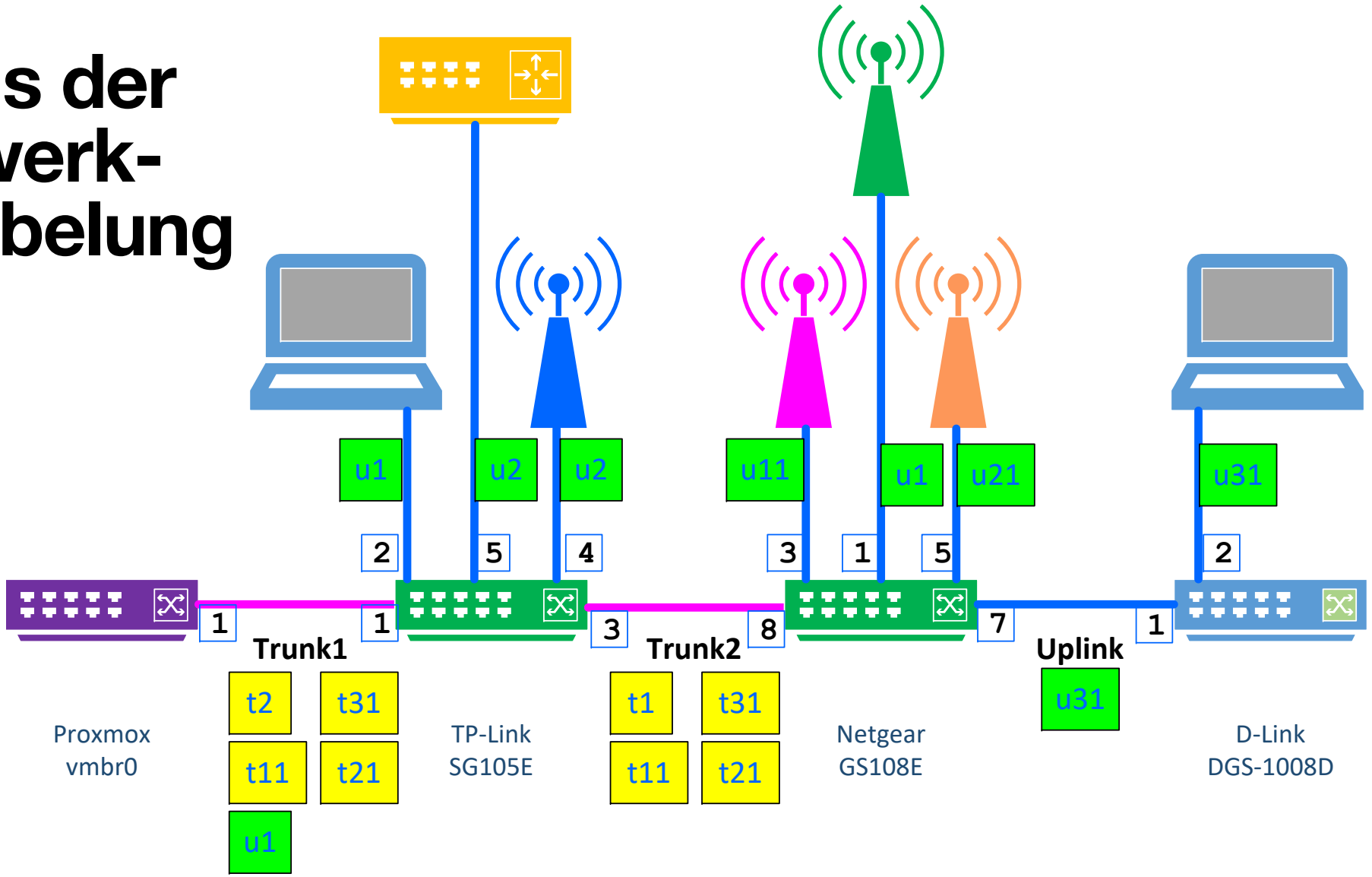


IP-Adressen und Hosts

Hostname	IPv4 Adresse
nuc3	192.168.103.99
opnsns-nuc3	192.168.103.9
tl-sg105-a	192.168.103.3
ng-gs108-b	192.168.103.4
jcg-ap	192.168.103.5
laptop	DHCP (192.168.103.x/24)
ffvp-nfh-rahnenhof	DHCP (10.210.48.x/20)
edimax-ap	DHCP (10.210.48.x/20)
lx1-client	DHCP (10.210.48.x/20)
opnwrt-nuc3	192.168.223.9
nuc3	192.168.223.99

Hostname	IPv4 Adresse
router-nfh-rahnenhof	192.168.178.1
opnsns-dmz	DHCP (192.168.178.x/24)
opnwrt-dmz	DHCP (192.168.178.x/24)
ffvp-nfh-dmz	DHCP (192.168.178.x/24)
ffmuc-nfh-dmz	DHCP (192.168.178.x/24)
ffws-duew-ap	DHCP (192.168.178.x/24)
ffmuc-nfh-rahnenhof	DHCP (10.80.200.x/21)
tplink-ap	DHCP (10.80.200.x/21)
lx2-client	DHCP (10.80.200.x/21)
lede-ap	DHCP (192.168.223.x/24)
lx3-client	DHCP (192.168.223.x/24)

Details der Netzwerk-Verkabelung

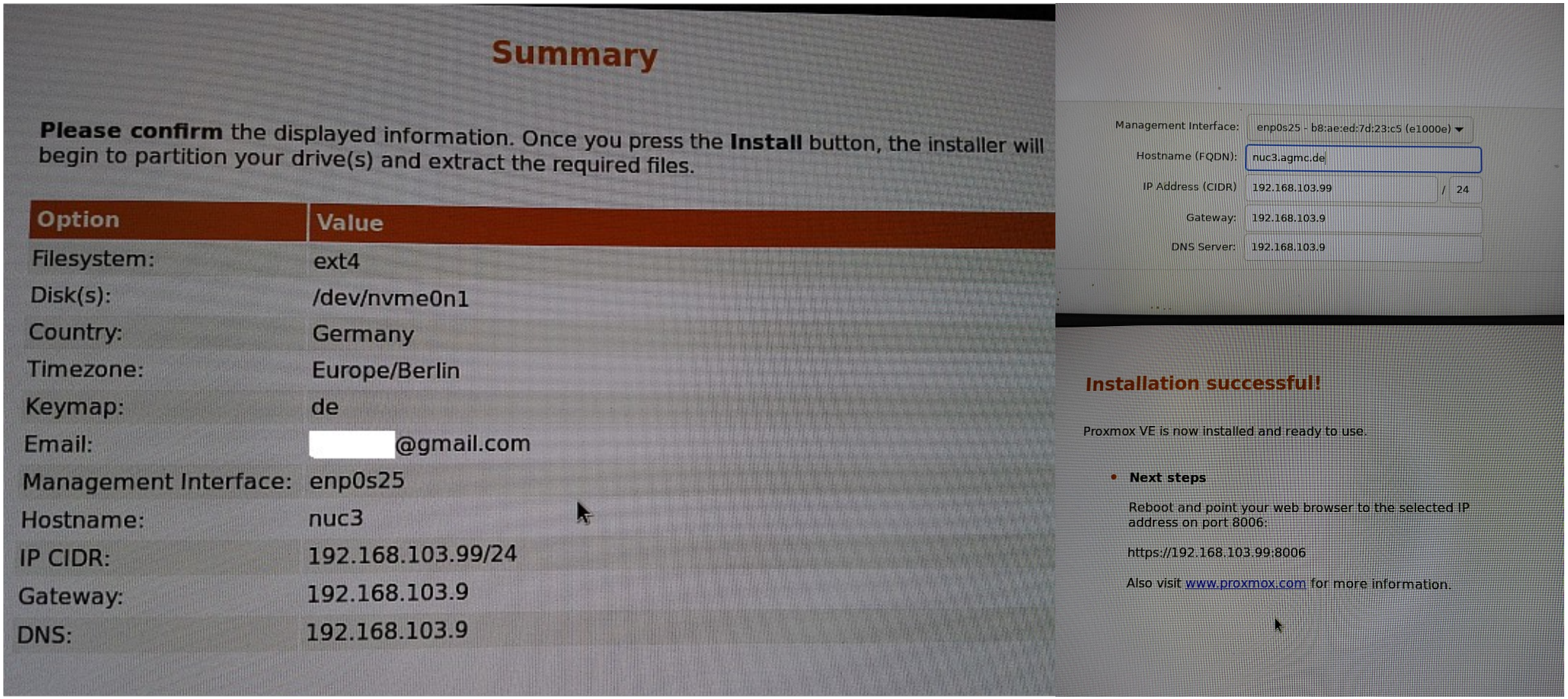


Vorbereitung des Workshops

Was wurde vorab gemacht?

- Installation **NUC5i3** mit PVE-7.3
  - https://pve.proxmox.com/wiki/Installation
- Konfiguration der VLAN-Switches
  5-port TP-Link SG105E
  8-port Netgear ProSafe+ GS108E
- Upgrade PVE auf neueste Patches
- Upload von Freifunk-Gluon- und OpenWRT-Images auf *NUC3*
- Installation VM OPNsense-23.1
  - https://www.sunnyvalley.io/docs/network-security-tutorials/opnsense-installation
  - https://schulnetzkonzept.de/opnsense
- Einrichtung DHCP und DNS auf LAN
  Einrichtung IPv6 auf WAN und LAN
- Upgrade auf OPNsense-23.1.3

Installation von Proxmox PVE-7.3 auf NUC5i3



Durchführung des Workshops

Was ist bereits erledigt?

- Installation VM OpenWRT 22.03.3
  - OpenWRT Tutorials: https://hoerli.net/category/openwrt/ https://www.youtube.com/playlist
- Konfiguration der 5 WLAN-Router als Access Points (APs)
- Installation Linux-Client VM

Was ist noch zu tun?

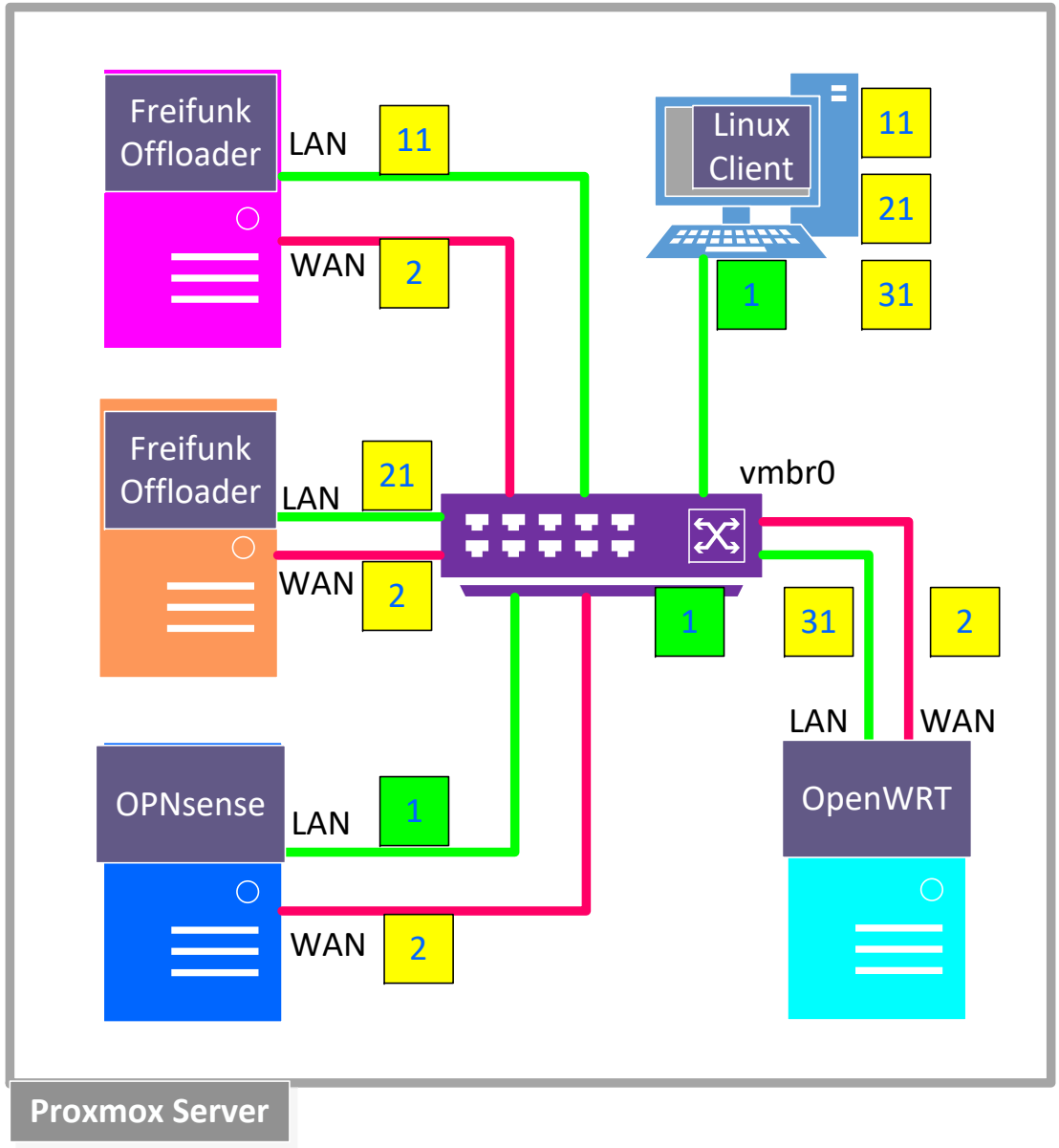
- Einrichtung der VLANs **11** & **21**
- Freifunk-Offloader VMs installieren:
  - Freifunk-Weinstrasse (ffsw-nfh)
  - Freifunk-München (ffmuc-nfh)
  - weitere Freifunk-Communities?
- Tests der Freifunk-Netzwerke mit Linux-, Windows-, MacOS-Clients

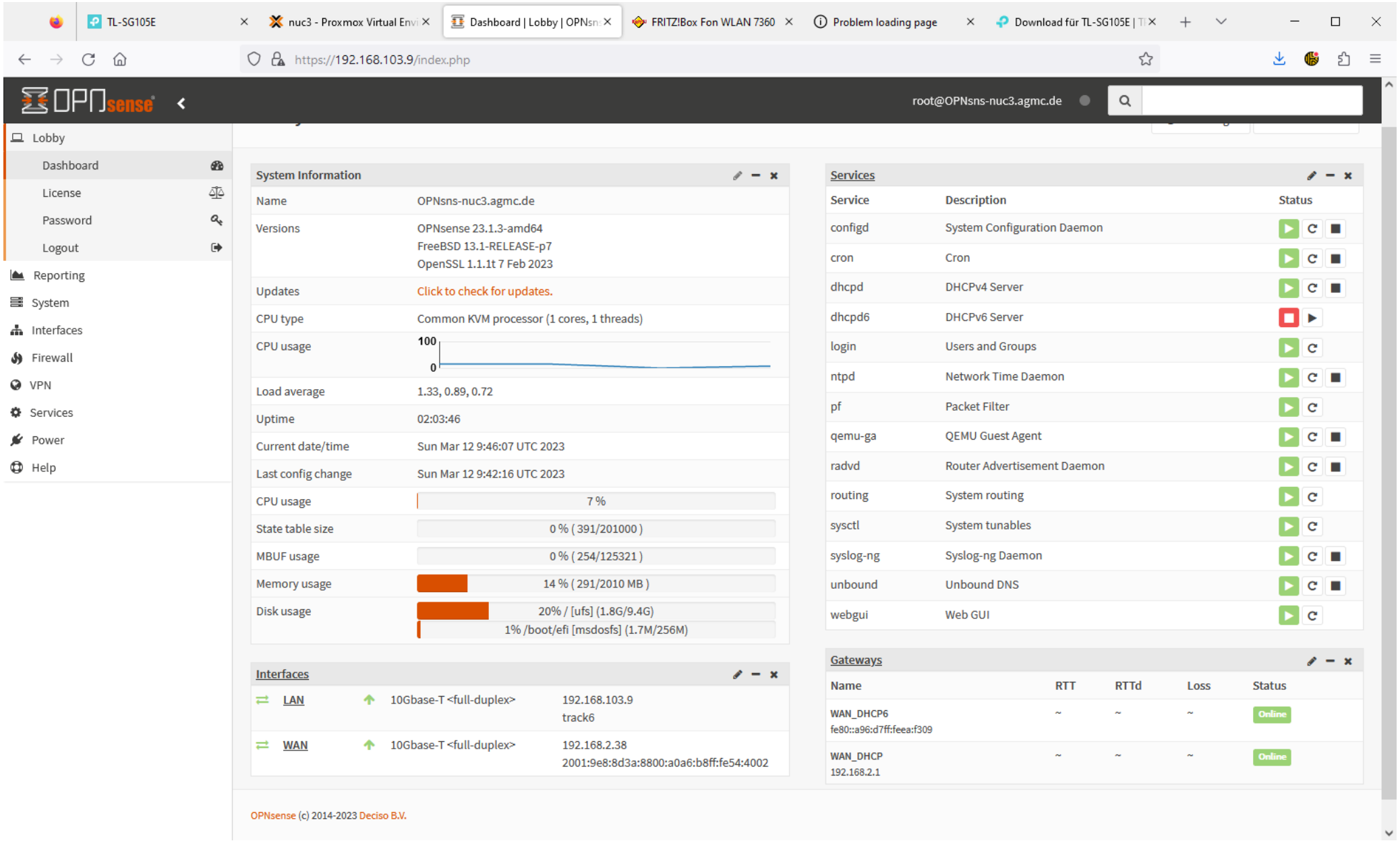
Proxmox im Überblick:

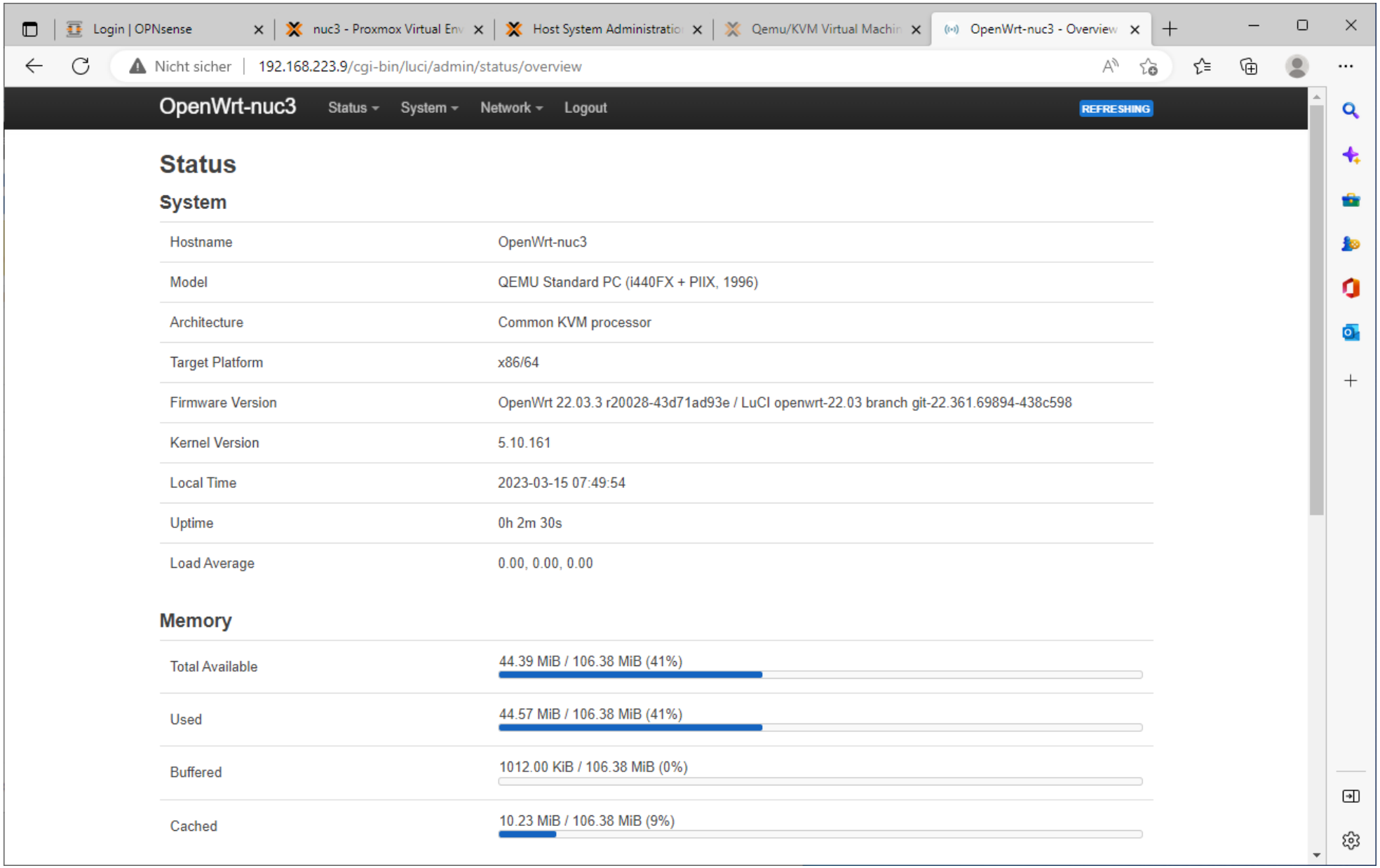
1 Linux Bridge

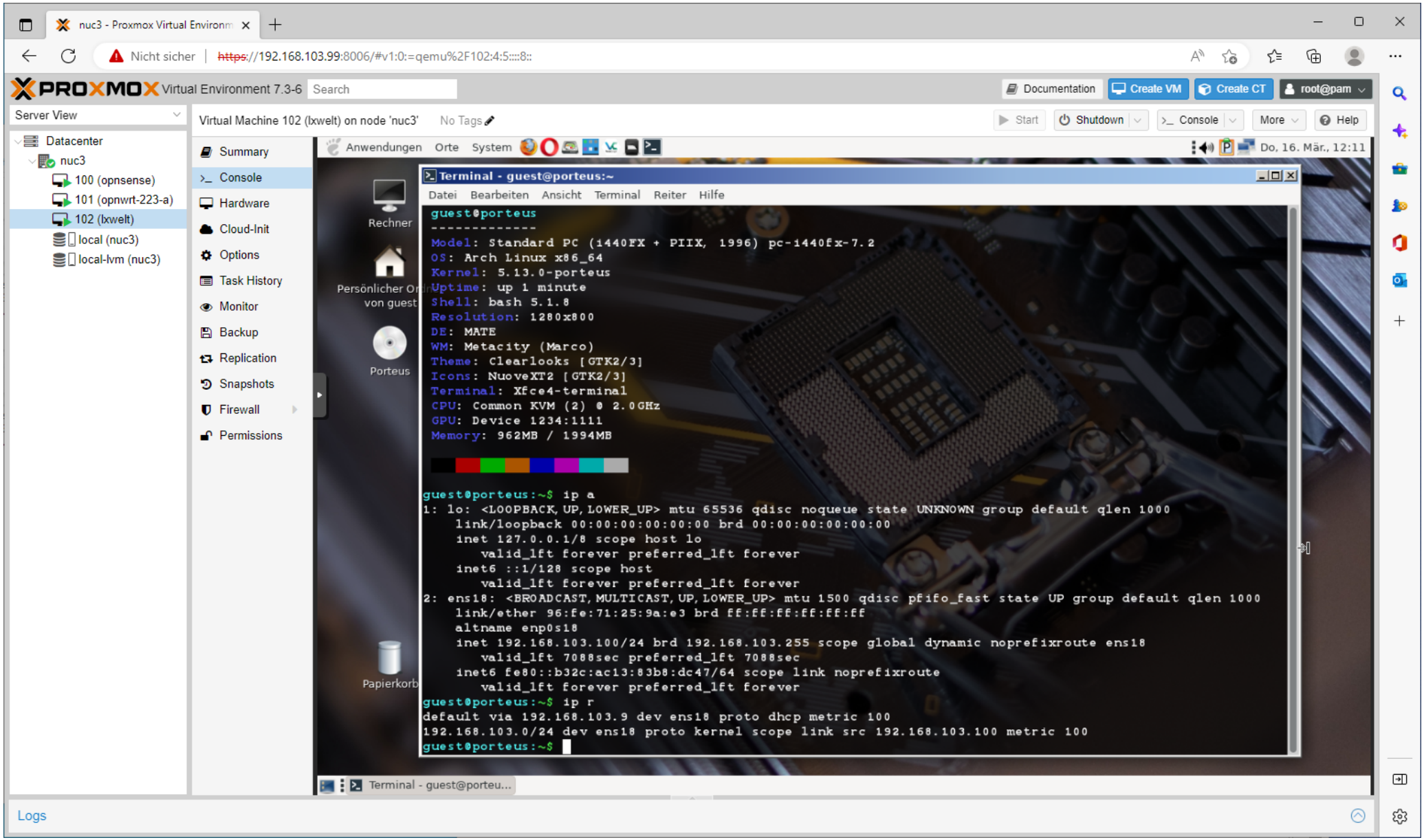
5 Linux VLANs

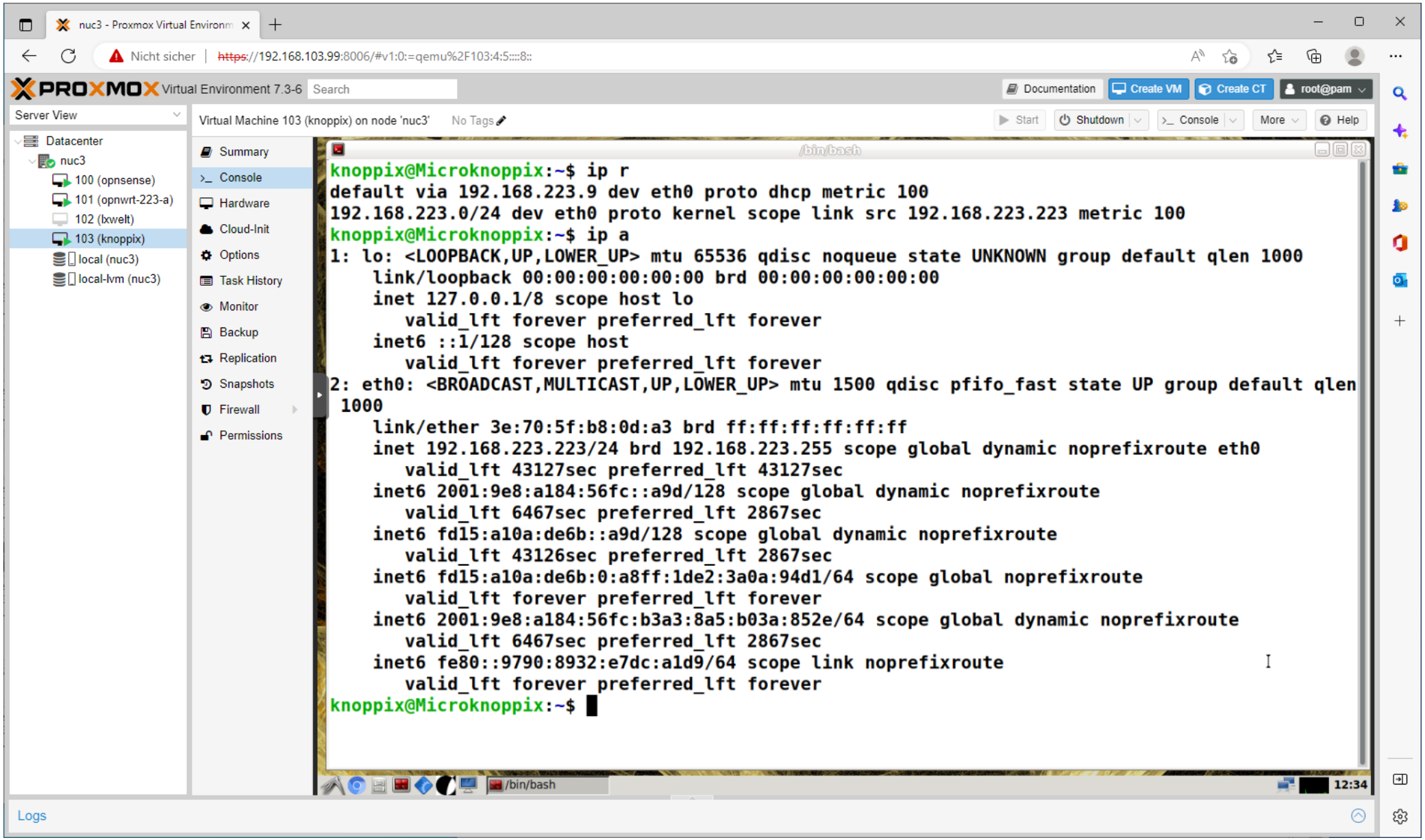
~ 6 VMs:
- 2x Firewall
- 2x Linux-Client
- 2x FF-Offloader




TL-SG105E
nuc3 - Proxmox Virtual Envi
Dashboard | Lobby | OPNsns
FRITZ!Box Fon WLAN 7360
Problem loading page
Download für TL-SG105E | TI
https://192.168.103.9/index.php
OPNsense
root@OPNsns-nuc3.agmc.de
Lobby
Dashboard
License
Password
Logout
Reporting
System
Interfaces
Firewall
VPN
Services
Power
Help
System Information
Name
OPNsns-nuc3.agmc.de
Versions
OPNsense 23.1.3-amd64
FreeBSD 13.1-RELEASE-p7
OpenSSL 1.1.1t 7 Feb 2023
Updates
Click to check for updates.
CPU type
Common KVM processor (1 cores, 1 threads)
CPU usage
100
0
Load average
1.33, 0.89, 0.72
Uptime
02:03:46
Current date/time
Sun Mar 12 9:46:07 UTC 2023
Last config change
Sun Mar 12 9:42:16 UTC 2023
CPU usage
7 %
State table size
0 % (391/201000)
MBUF usage
0 % (254/125321)
Memory usage
14 % (291/2010 MB)
Disk usage
20% / [ufs] (1.8G/9.4G)
1% /boot/efi [msdosfs] (1.7M/256M)
Interfaces
LAN
10Gbase-T <full-duplex>
192.168.103.9
track6
WAN
10Gbase-T <full-duplex>
192.168.2.38
2001:9e8:8d3a:8800:a0a6:b8ff:fe54:4002
Services
Service
Description
Status
configd
System Configuration Daemon
cron
Cron
dhcpd
DHCPv4 Server
dhcpd6
DHCPv6 Server
login
Users and Groups
ntpd
Network Time Daemon
pf
Packet Filter
qemu-ga
QEMU Guest Agent
radvd
Router Advertisement Daemon
routing
System routing
sysctl
System tunables
syslog-ng
Syslog-ng Daemon
unbound
Unbound DNS
webgui
Web GUI
Gateways
Name
RTT
RTTd
Loss
Status
WAN_DHCP6
fe80::a96:d7ff:feea:f309
~
~
~
Online
WAN_DHCP
192.168.2.1
~
~
~
Online
OPNsense (c) 2014-2023 Deciso B.V.


Login | OPNsense
nuc3 - Proxmox Virtual Env
Host System Administratio
Qemu/KVM Virtual Machin
OpenWrt-nuc3 - Overview
Nicht sicher
192.168.223.9/cgi-bin/luci/admin/status/overview
OpenWrt-nuc3
Status
System
Network
Logout
REFRESHING
Status
System
Hostname
OpenWrt-nuc3
Model
QEMU Standard PC (i440FX + PIIX, 1996)
Architecture
Common KVM processor
Target Platform
x86/64
Firmware Version
OpenWrt 22.03.3 r20028-43d71ad93e / LuCI openwrt-22.03 branch git-22.361.69894-438c598
Kernel Version
5.10.161
Local Time
2023-03-15 07:49:54
Uptime
0h 2m 30s
Load Average
0.00, 0.00, 0.00
Memory
Total Available
44.39 MiB / 106.38 MiB (41%)
Used
44.57 MiB / 106.38 MiB (41%)
Buffered
1012.00 KiB / 106.38 MiB (0%)
Cached
10.23 MiB / 106.38 MiB (9%)


nuc3 - Proxmox Virtual Environm
Nicht sicher
https://192.168.103.99:8006/#v1:0:=qemu%2F102:4:5::::8::
PROXMOX Virtual Environment 7.3-6
Search
Documentation
Create VM
Create CT
root@pam
Server View
Datacenter
nuc3
100 (opnsense)
101 (opnwrt-223-a)
102 (lxwelt)
local (nuc3)
local-lvm (nuc3)
Virtual Machine 102 (lxwelt) on node 'nuc3'
No Tags
Start
Shutdown
Console
More
Help
Summary
Console
Hardware
Cloud-Init
Options
Task History
Monitor
Backup
Replication
Snapshots
Firewall
Permissions
Anwendungen
Orte
System
Do, 16. Mär., 12:11
Rechner
Porteus
Papierkorb
Terminal - guest@porteus:~
Datei
Bearbeiten
Ansicht
Terminal
Reiter
Hilfe
guest@porteus
Model: Standard PC (i440FX + PIIX, 1996) pc-i440fx-7.2
OS: Arch Linux x86_64
Kernel: 5.13.0-porteus
Uptime: up 1 minute
Shell: bash 5.1.8
Resolution: 1280x800
DE: MATE
WM: Metacity (Marco)
Theme: Clearlooks [GTK2/3]
Icons: NuoveXT2 [GTK2/3]
Terminal: Xfce4-terminal
CPU: Common KVM (2) @ 2.0GHz
GPU: Device 1234:1111
Memory: 962MB / 1994MB
guest@porteus:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever
inet6 ::1/128 scope host
valid_lft forever preferred_lft forever
2: ens18: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether 96:fe:71:25:9a:e3 brd ff:ff:ff:ff:ff:ff
altname enp0s18
inet 192.168.103.100/24 brd 192.168.103.255 scope global dynamic noprefixroute ens18
valid_lft 7088sec preferred_lft 7088sec
inet6 fe80::b32c:ac13:83b8:dc47/64 scope link noprefixroute
valid_lft forever preferred_lft forever
guest@porteus:~$ ip r
default via 192.168.103.9 dev ens18 proto dhcp metric 100
192.168.103.0/24 dev ens18 proto kernel scope link src 192.168.103.100 metric 100
guest@porteus:~$
Terminal - guest@porteu...
Logs


nuc3 - Proxmox Virtual Environm
Nicht sicher
https://192.168.103.99:8006/#v1:0:=qemu%2F103:4:5::::8::
PROXMOX Virtual Environment 7.3-6
Search
Documentation
Create VM
Create CT
root@pam
Server View
Datacenter
nuc3
100 (opnsense)
101 (opnwrt-223-a)
102 (lxwelt)
103 (knoppix)
local (nuc3)
local-lvm (nuc3)
Virtual Machine 103 (knoppix) on node 'nuc3'
No Tags
Start
Shutdown
Console
More
Help
Summary
Console
Hardware
Cloud-Init
Options
Task History
Monitor
Backup
Replication
Snapshots
Firewall
Permissions
/bin/bash
knoppix@Microknoppix:~$ ip r
default via 192.168.223.9 dev eth0 proto dhcp metric 100
192.168.223.0/24 dev eth0 proto kernel scope link src 192.168.223.223 metric 100
knoppix@Microknoppix:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever
inet6 ::1/128 scope host
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether 3e:70:5f:b8:0d:a3 brd ff:ff:ff:ff:ff:ff
inet 192.168.223.223/24 brd 192.168.223.255 scope global dynamic noprefixroute eth0
valid_lft 43127sec preferred_lft 43127sec
inet6 2001:9e8:a184:56fc::a9d/128 scope global dynamic noprefixroute
valid_lft 6467sec preferred_lft 2867sec
inet6 fd15:a10a:de6b::a9d/128 scope global dynamic noprefixroute
valid_lft 43126sec preferred_lft 2867sec
inet6 fd15:a10a:de6b:0:a8ff:1de2:3a0a:94d1/64 scope global noprefixroute
valid_lft forever preferred_lft forever
inet6 2001:9e8:a184:56fc:b3a3:8a5:b03a:852e/64 scope global dynamic noprefixroute
valid_lft 6467sec preferred_lft 2867sec
inet6 fe80::9790:8932:e7dc:a1d9/64 scope link noprefixroute
valid_lft forever preferred_lft forever
knoppix@Microknoppix:~$
/bin/bash
12:34
Logs

Anleitungen von Freifunk München

zur Installation und Konfiguration eines Freifunk-Knotens

- Kurzanleitung
  https://ffmuc.net/router-konfigurieren/
- Ausführliche Anleitung
  https://ffmuc.net/wiki/doku.php?id=knb:gui
- Kommandozeile via SSH
  https://ffmuc.net/wiki/doku.php?id=knb:ssh

- Diverse Artikel zu sicherem DNS

  https://ffmuc.net/wiki/doku.php?id=knb:dohdot

  https://ffmuc.net/wiki/doku.php?id=knb:dnscrypt

  https://ffmuc.net/wiki/doku.php?id=knb:dns

DANKE für Euer Interesse!