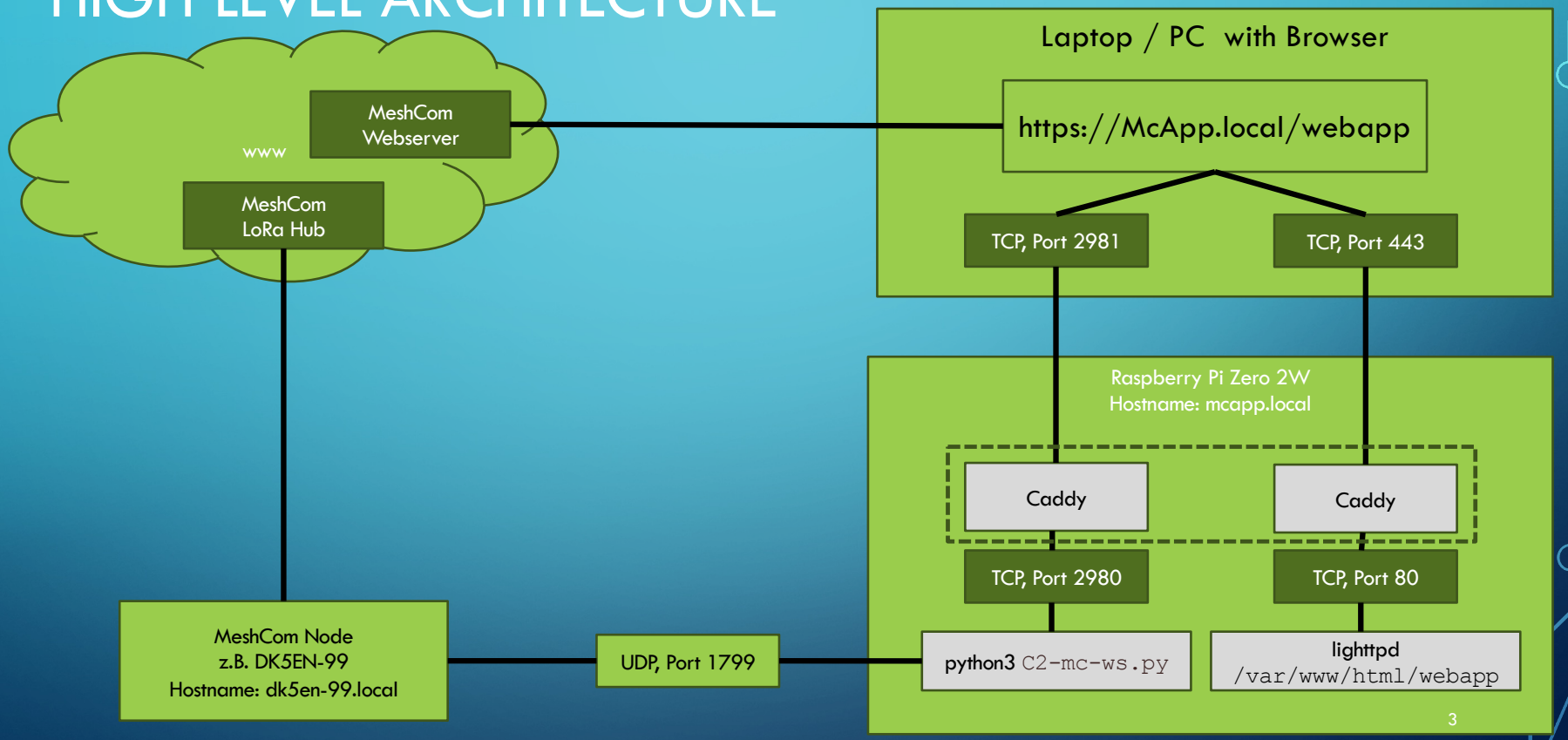
MESHCOM MCAPP INSTALLATION

VORWORT

- Die Kommunikation zwischen Browser und Server Komponente kann nur TLS-verschlüsselt erfolgen, weil die modernen Browser dies erzwingen
- Offizielle Zertifikate werden von Let's Crypt nur für offizielle Domains ausgestellt. Wenn man mit mDNS „.local" (auf MacOS oder Windows mit iTunes installiert) oder Fritz!Box .fritz.box arbeitet, dann gibt es keine SSL-Zertifikate, die Gegen ein getrustete Root-Zertifikat laufen
- Das ist für den geübten Admin kein Problem, denn Caddy bringt eine PKI mit Zertifikatsrotation mit sich. x.509 Zertifikate sind trotzdem komplex
- Wir müssen uns das self-signed Root Zertifikat der Caddy PKI importieren
- Das bei SSL-Zertifikaten immer der Hostname überstimmen muss, ist es nicht möglich mit IP-Adressen im lokalen Netz zu arbeiten. Es muss alles zwingend über DNS-Namen laufen, die auch dem cn= Eintrag im Zertifikat entsprechen müssen

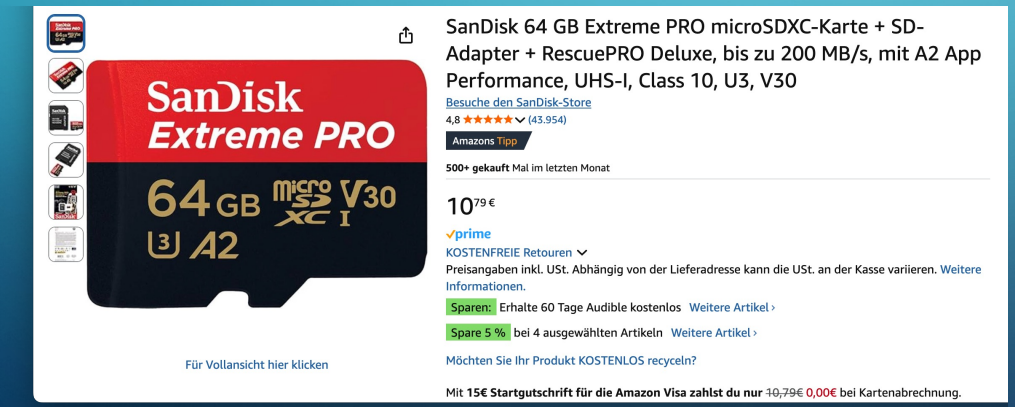
- Die Server Komponente ist ein Python Script, das die Messages per UDP mit dem MeshCom Node austauscht und alles über einen websocket weiterleitet. Der WebSocket wird TLS verschlüsselt durch Caddy, unseren Reverse Proxy
- Der lighttpd Webserver wird ebenso durch Caddy TLS verschlüsselt
- Wer seinen MeshCom Knoten nur über IP-Adresse erreicht, kann dies im `C2-mc-ws.py` Skript entsprechend anpassen.
- Zum Abschluss nicht vergessen auf dem MeshCom Knoten extudp zu konfigurieren und einzuschalten

HIGH LEVEL ARCHITECTURE



SD CARD & RPI ZERO

- Insert your at least 32GB SD Card into your card reader
- Please only use SD Cards with 100MBit/s like SanDisk
- Have your Raspberry Pi Zero 2W at Hand

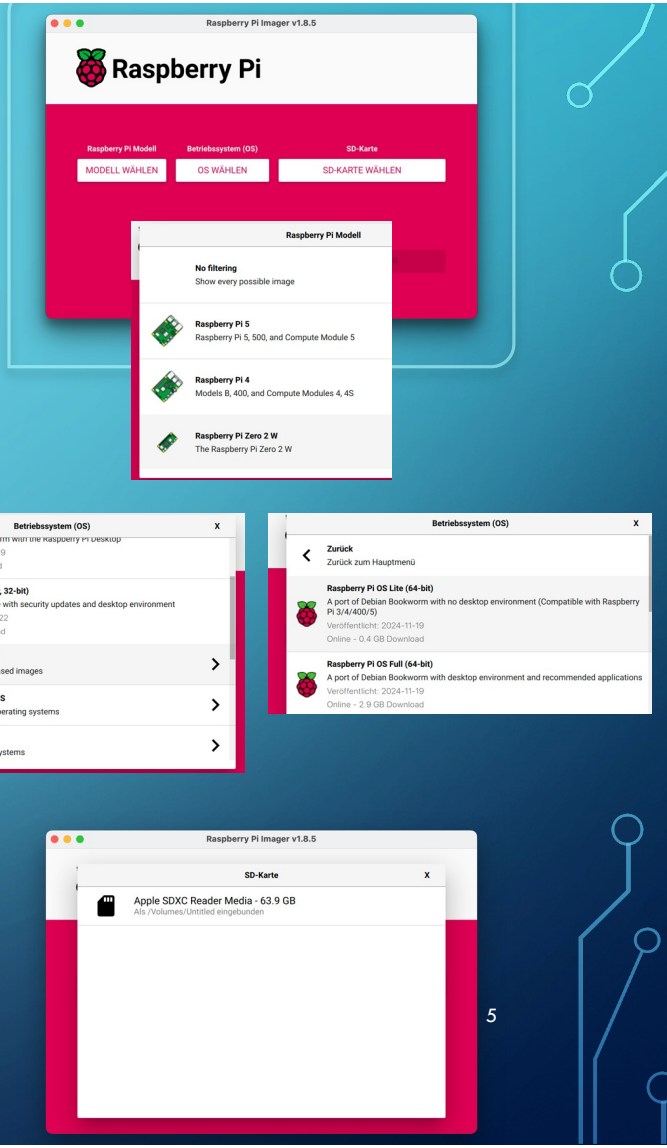


OS CUSTOM INSTALLATION

We want to install a headless, 64Bit Debian Bookwork

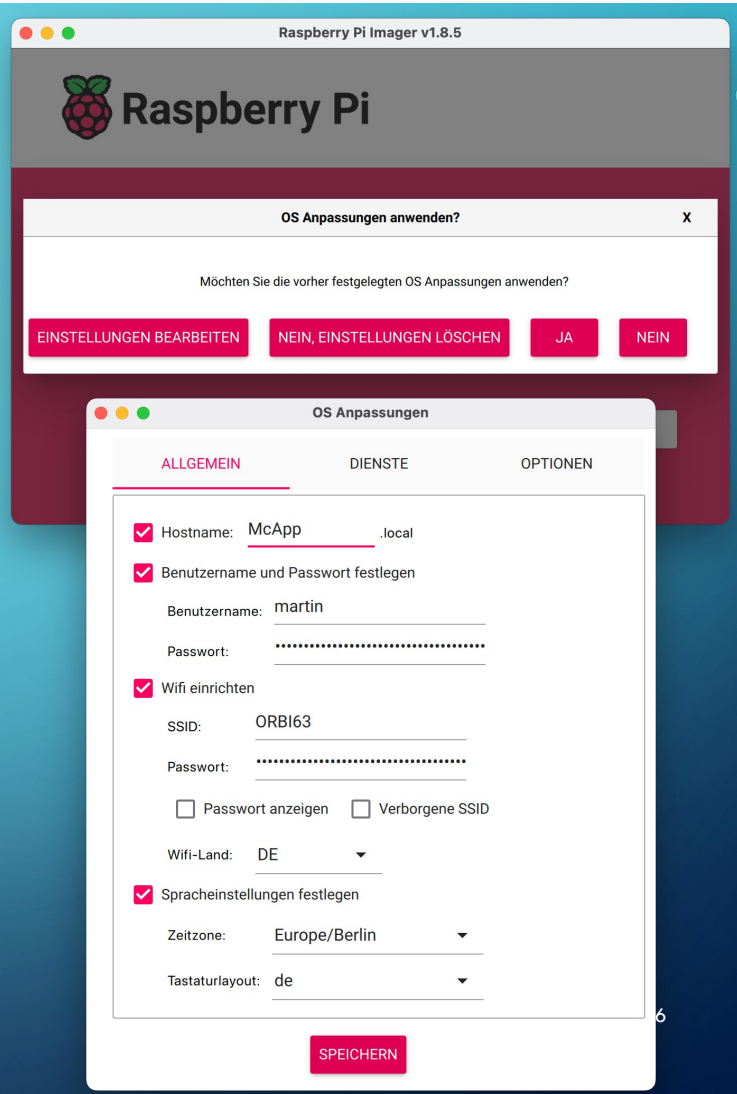
- Select your Model: Raspberry Pi Zero 2 W
- For OS, select “other“ – „Raspberry Pi OS Lite (64-bit), with no desktop, approx. 0,4GB
- Select your SD Card

.. And click next



IMPORTANT CUSTOMIZATIONS

- Choose your hostname: McApp in our example
- Choose what ever username, you want. I do not recommend to setup a standard „pi“ user, as this is a security risk
- Choose your login password, which should later be changed to a pre-shared ssh key.
- Make sure you have your WiFi Settings correct, because otherwise you will not be able to access your headless system

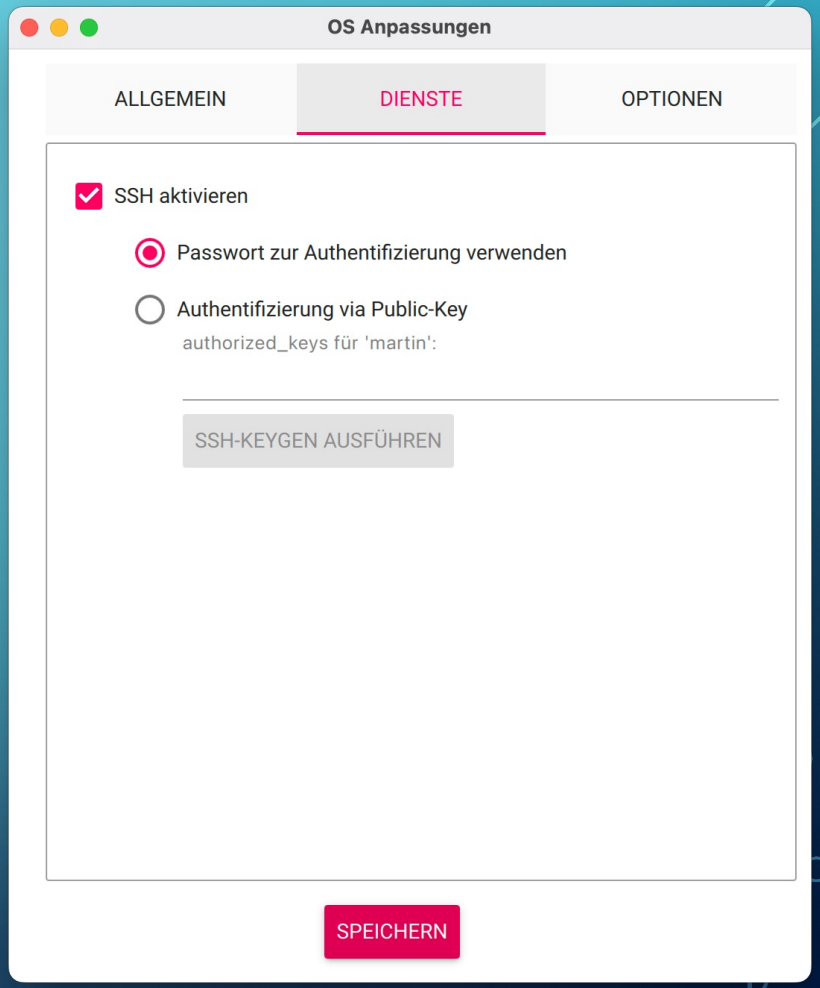


ACTIVATE SSH

Make sure that ssh is activated.

For the initial setup, we start with password Authentication.

If you are experienced, you can also set a pre-shared key.



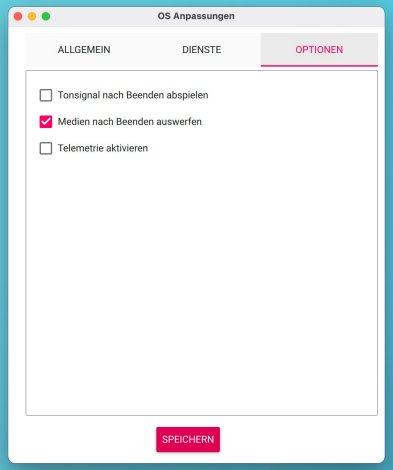
OPTIONS

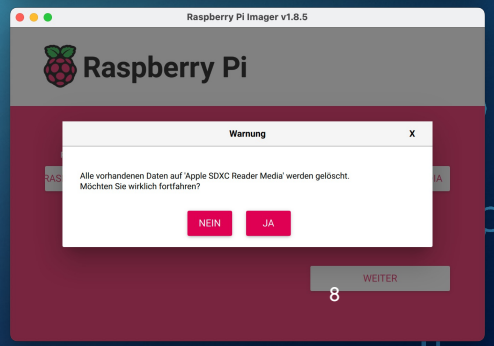
Nothing to change here, everything standard.

Now click save

Then click yes to apply custom settings

Now agree to erase everything on the SD card.





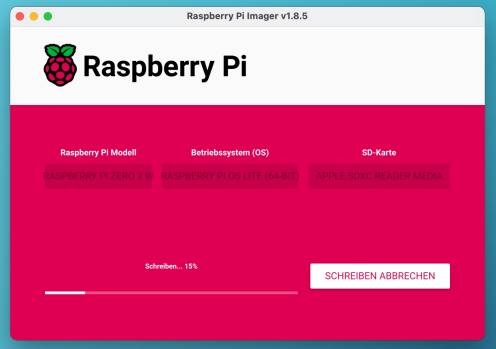
FLASHING THE SD CARD

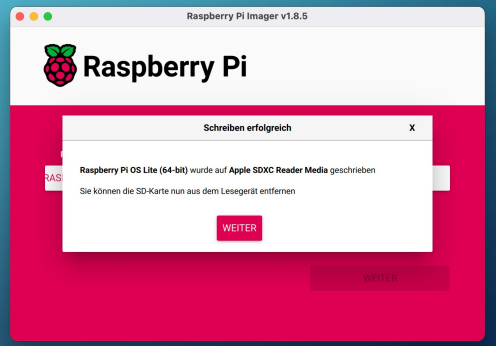
Now wait for the flashing to be finished.

On MacOS you get asked about your Admin password, as this is a low level write, that needs more privileges.

After a short while you should see the success message.

Close Raspberry Pi Imager, eject your SD card.



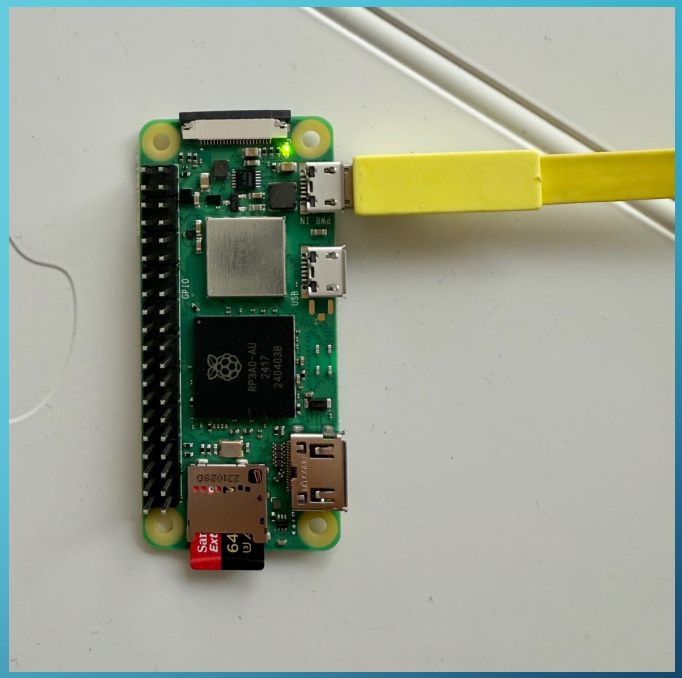


FIRST TIME BOOT UP

- Insert your SD card into Raspberry Pi 2 Zero
- Attach 5V via Mini USB Jack
- The greenlight starts flashing now

Raspberry Pi is now booting and expanding the filesystem. Depending on your SD card, this takes at least 2 Minutes.

- If you have mDNS, then you simply can start to ping your Raspberry Pi
- Otherwise check your WiFi Router for the IP of the new device

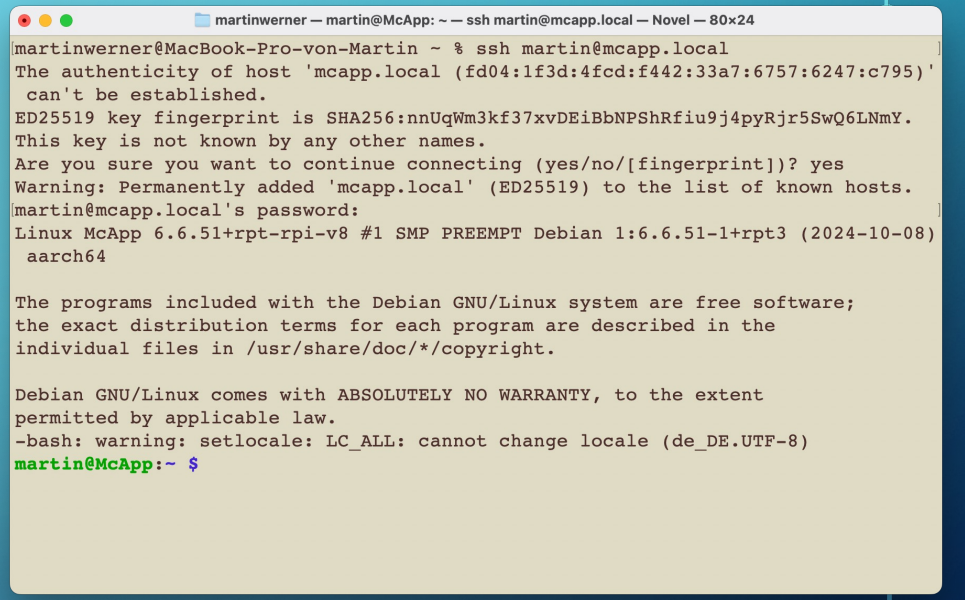


```
martinwerner@MacBook-Pro-von-Martin .ssh % ping mcapp.local
ping: cannot resolve mcapp.local: Unknown host
martinwerner@MacBook-Pro-von-Martin .ssh % ping mcapp.local
PING mcapp.local (192.168.68.70): 56 data bytes
64 bytes from 192.168.68.70: icmp_seq=0 ttl=64 time=121.193 ms
64 bytes from 192.168.68.70: icmp_seq=1 ttl=64 time=11.150 ms
64 bytes from 192.168.68.70: icmp_seq=2 ttl=64 time=8.156 ms
64 bytes from 192.168.68.70: icmp_seq=3 ttl=64 time=3.976 ms
64 bytes from 192.168.68.70: icmp_seq=4 ttl=64 time=8.038 ms
64 bytes from 192.168.68.70: icmp_seq=5 ttl=64 time=15.590 ms
```

TIME TO ACCESS YOUR RASPI

Use putty on Windows or Term on MacOS

- Make sure to use your username
- Accept the new ssh fingerprint
- Enter your password
- You should now have ssh access to your raspi



TIME TO DO SOME CHECKS

- uname -a as we want to see, that we have installed the right Linux
- uname -m as we want to see that we are in a 64 bit environment

```
martin@McApp:~ $ uname -a
Linux McApp 6.6.51+rpt-rpi-v8 #1 SMP PREEMPT Debian
1:6.6.51-1+rpt3 (2024-10-08) aarch64 GNU/Linux
martin@McApp:~ $ uname -m
aarch64
```

TIME TO UPDATE YOUR APT CACHE

sudo apt update

```
martin@McApp:~ $ sudo apt update
Get:1 http://deb.debian.org/debian bookworm InRelease [151 kB]
..
Get:25 http://deb.debian.org/debian bookworm-updates/main Translation-en [360 B]
Fetched 25.6 MB in 17s (1550 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
104 packages can be upgraded. Run 'apt list --upgradable' to see them.
N: Repository 'http://deb.debian.org/debian bookworm InRelease' changed its 'Version' value from '12.8' to
'12.10'
```

CADDY INSTALLATION

Caddy is our TLS reverse proxy. It also has a PKI on board and it does automatic certificate rotation for us.

```
sudo apt install -y debian-keyring debian-archive-keyring curl apt-transport-https
```

```
martin@McApp:~ $ sudo apt install -y debian-keyring debian-archive-keyring curl apt-transport-https
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
..
```

NOW ADD CADDY REPO

```
martin@McApp:~ $ curl -1sLf 'https://dl.cloudsmith.io/public/caddy/stable/gpg.key' | sudo gpg --dearmor -o /usr/share/keyrings/caddy-stable-archive-keyring.gpg

martin@McApp:~ $ echo "deb [signed-by=/usr/share/keyrings/caddy-stable-archive-keyring.gpg] \

https://dl.cloudsmith.io/public/caddy/stable/deb/debian all main" | \

sudo tee /etc/apt/sources.list.d/caddy-stable.list

deb [signed-by=/usr/share/keyrings/caddy-stable-archive-keyring.gpg]
https://dl.cloudsmith.io/public/caddy/stable/deb/debian all main
```

NOW RETRIEVE CADDY UPDATES

Update the apt cache again to have caddy included

We ignore the Repo Error, it works anyway

```
martin@McApp:~ $ sudo apt update
Hit:1 http://deb.debian.org/debian bookworm InRelease
Hit:2 http://archive.raspberrypi.com/debian bookworm InRelease
Hit:3 http://deb.debian.org/debian-security bookworm-security InRelease
Hit:4 http://deb.debian.org/debian bookworm-updates InRelease
Ign:5 https://dl.cloudsmith.io/public/caddy/stable/deb/debian all InRelease
Err:6 https://dl.cloudsmith.io/public/caddy/stable/deb/debian all Release
  404  Not Found [IP: 108.138.36.64 443]
Reading package lists... Done
E: The repository 'https://dl.cloudsmith.io/public/caddy/stable/deb/debian all Release' does not have a
Release file.
N: Updating from such a repository can't be done securely, and is therefore disabled by default.
N: See apt-secure(8) manpage for repository creation and user configuration details.
```

INSTALLING OUR TLS REVERSE PROXY AND OUR WEBSERVER

```
martin@McApp:~ $ sudo apt install caddy lighttpd screen
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
After this operation, 43.2 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

Click Y to install, then check caddy for installation success

```
martin@McApp:~ $ caddy version
2.6.2
```

EDITION CADDY CONFIG

```
martin@McApp:~ $ hostname

McApp

martin@McApp:~ $ sudo vi /etc/caddy/Caddyfile
```

You can use nano as well as your text editor.

- Delete everything in Caddyfile and replace it
- Make sure that you use your hostname
- Make sure to use your domain.
- .local for mDNS enabled environments (MacOS / Apple)
- .fritz.box for Fritz!Box WLAN Router (Windows w/o iTunes)

```
{
        auto_https disable_redirects
        log {
                #level DEBUG
                level INFO
                format console
        }
}
mcapp.local {
        tls internal
        reverse_proxy 127.0.0.1:80
        encode gzip
}


mcapp.local:2981 {
        tls internal
        reverse_proxy 127.0.0.1:2980
}
```

MAKING SURE THAT CADDY LIKES OUR CONFIGURATION

- Change to caddy config directory
- Let caddy format the input
- Then validate the caddy file

- Most important: „Valid configuration“

```
martin@McApp:~ $ cd /etc/caddy/
martin@McApp:/etc/caddy $ sudo caddy fmt --overwrite
martin@McApp:/etc/caddy $ sudo caddy fmt
martin@McApp:/etc/caddy $ sudo caddy validate
2025/04/17 07:54:48.715 INFO using adjacent Caddyfile
2025/04/17 07:54:48.728 INFO tls.cache.maintenance started
background certificate maintenance {"cache": "0x400035a3f0"}
2025/04/17 07:54:48.730 WARN http automatic HTTP->HTTPS
redirects are disabled {"server_name": "srv0"}
2025/04/17 07:54:48.730 INFO http server is listening only on
the HTTPS port but has no TLS connection policies; adding one
to enable TLS {"server_name": "srv1", "https_port": 443}
2025/04/17 07:54:48.731 WARN http automatic HTTP->HTTPS
redirects are disabled {"server_name": "srv1"}
2025/04/17 07:54:48.732 INFO tls.cache.maintenance stopped
background certificate maintenance {"cache": "0x400035a3f0"}
Valid configuration
```

CADDY STARTEN, LIGHTTPD CHECKEN

```
martin@McApp:/etc/caddy $ sudo systemctl restart caddy

martin@McApp:/etc/caddy $ sudo systemctl enable --now caddy

martin@McApp:/etc/caddy $ ps uax|grep caddy

caddy       2348  0.5  8.6 1415176 36736 ?       Ssl  10:06   0:00
/usr/bin/caddy run --environ --config /etc/caddy/Caddyfile

martin@McApp:/etc/caddy $ ps uax |grep lighttpd

www-data    2131  0.0  0.5   4116  2560 ?        Ss   09:43   0:00
/usr/sbin/lighttpd -D -f /etc/lighttpd/lighttpd.conf
```

PROVISION ROOT CERTIFICATE
CHECK ACCESS VIA BROWSER

Copy the 10 years root certificate to our web browser, so that we can import it on our Client Machine.

Remark: no new lines on the cp command

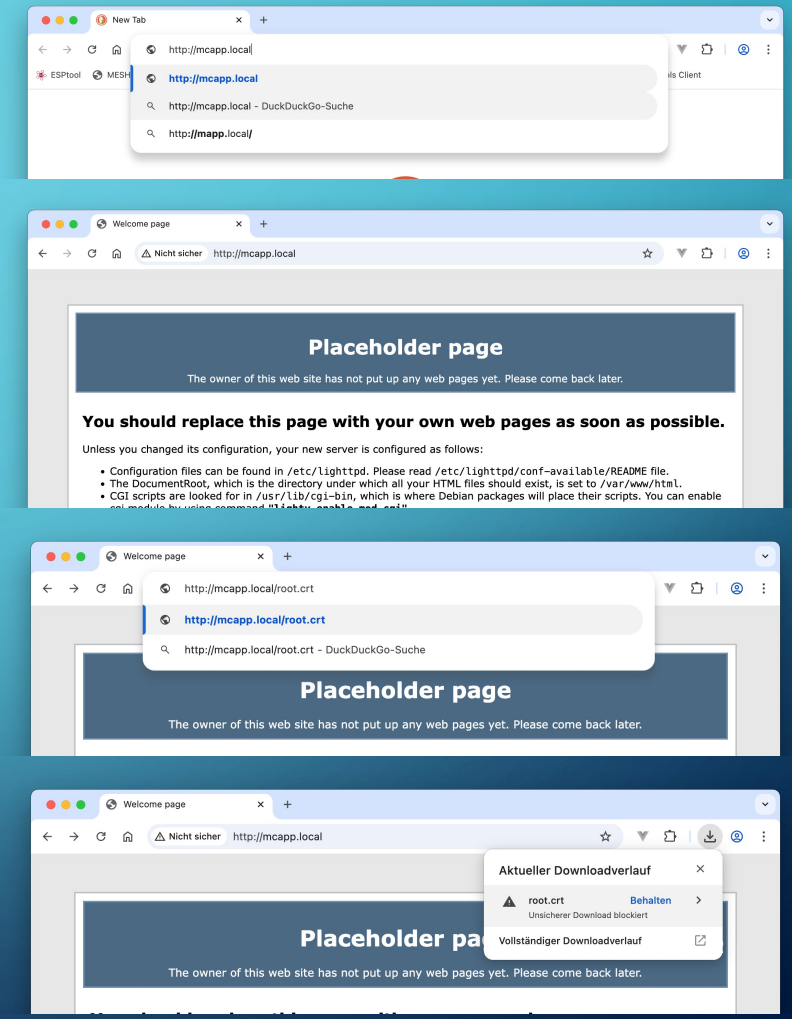
```
martin@McApp:~ $ sudo cp /var/lib/caddy/.local/share/caddy/pki/authorities/local/root.crt /var/www/html/
martin@McApp:~ $ sudo chmod a+r /var/www/html/root.crt
martin@McApp:~ $ ls -l /var/www/html
total 8
-rw-r--r-- 1 root root 3388 Apr 17 09:43 index.lighttpd.html
-rw-r--r-- 1 root root  627 Apr 17 10:22 root.crt
```

CHECK THE WEBSERVER DOWNLOAD SSL CERTIFICATE

http://mcapp.local

http://mcapp.local/root.crt

Make sure to accept the blocked download



INSTALL THE SSL CERTIFICATE

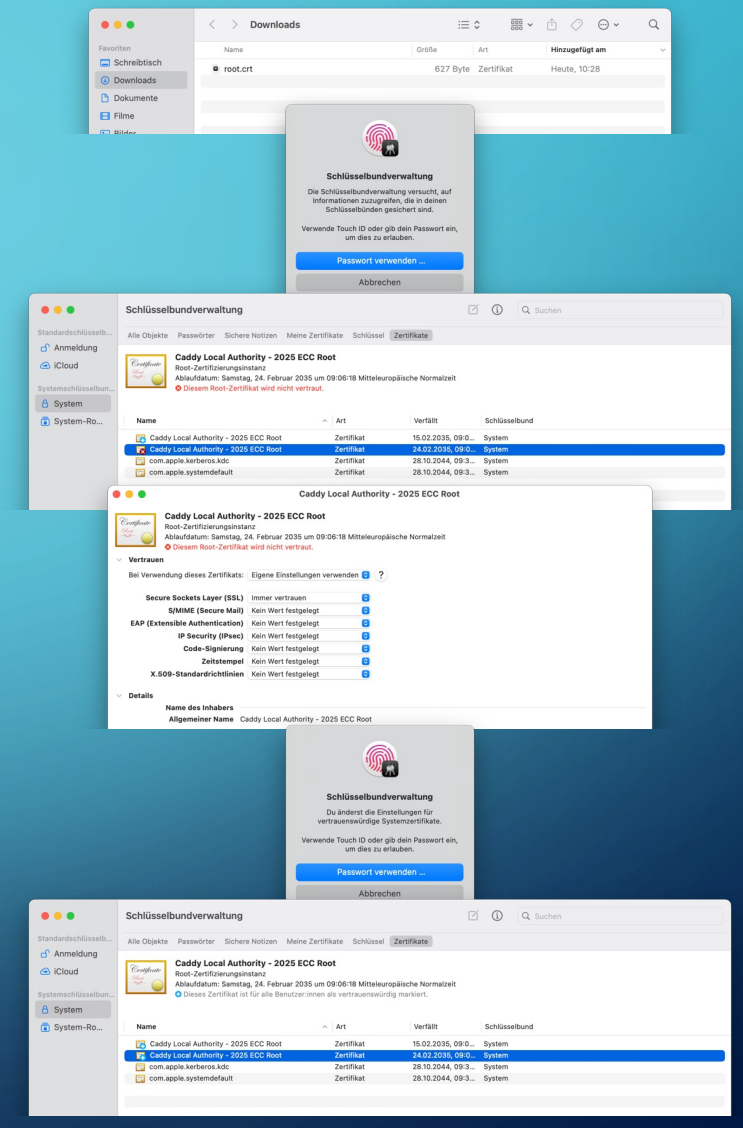
Locate your root.crt in your download folder

Double clock root.crt

Enter your password

Now locate the newly installed certificate

Trust the certificate for TLS encryption

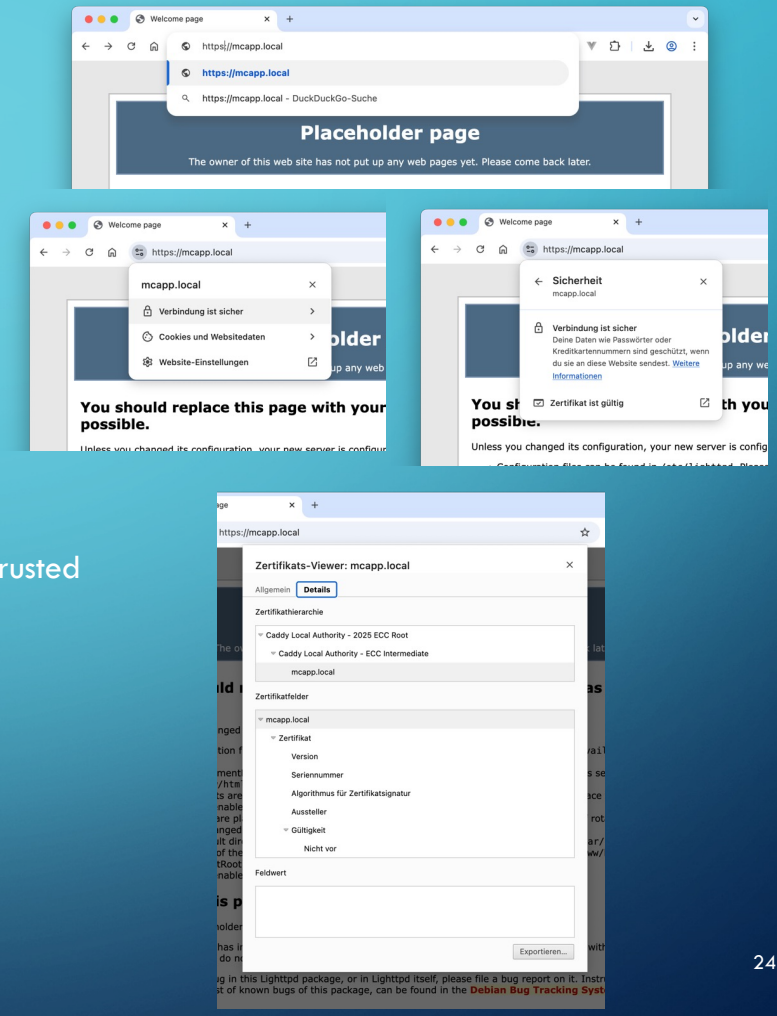


TESTING SSL ACCESS

Go to your web browser

https://mcapp.local

If everything worked out, as expected, you should see a fully trusted root chain.



SOFTWARE PACKAGE CONTAINS TWO FILES, COPY IT TO YOUR NEW RASPBERRY PI

`mc-screen`

`C2-mc-ws.py`

mc-screen is a wrapper for setting up python virtual environment and executing C2-mc-ws.py

NOW INSTALL THE WEBAPP

```
martin@McApp:~ $ sudo mkdir /var/www/html/webapp
martin@McApp:~ $ sudo chown martin:www-data /var/www/html/webapp
martin@McApp:~ $ ls -l /var/www/html/
total 12
-rw-r--r-- 1 root   root     3388 Apr 17 09:43 index.lighttpd.html
-rw-r--r-- 1 root   root      627 Apr 17 10:22 root.crt
drwxr-xr-x 2 martin www-data 4096 Apr 17 12:48 webapp
```

Now copy the webarchive over

```
martin@McApp:/var/www/html $ ls -l
insgesamt 12
-rw-r--r-- 1 root   root     3388 17. Apr 09:43 index.lighttpd.html
-rw-r--r-- 1 root   root      627 17. Apr 10:22 root.crt
drwxr-xr-x 4 martin www-data 4096 17. Apr 13:12 webapp
martin@McApp:/var/www/html $ ls -l webapp/
insgesamt 28
drwxr-xr-x 2 martin martin 4096 17. Apr 13:12 assets
-rwxr-xr-x 1 martin martin 2580 17. Apr 13:12 favicon.ico
-rw-r--r-- 1 martin martin 4286 17. Apr 13:12 favicon-ren.ico
drwxr-xr-x 2 martin martin 4096 17. Apr 13:12 img
-rwxr-xr-x 1 martin martin  699 17. Apr 13:12 index.html
-rwxr-xr-x 1 martin martin  284 17. Apr 13:12 manifest.json
martin@McApp:/var/www/html $
```

ACTIVATE REDIRECT IN LIGHTTPD

```
martin@rpiZero:/etc/lighttpd $ sudo vi /etc/lighttpd/lighttpd.conf
```

unten anfügen

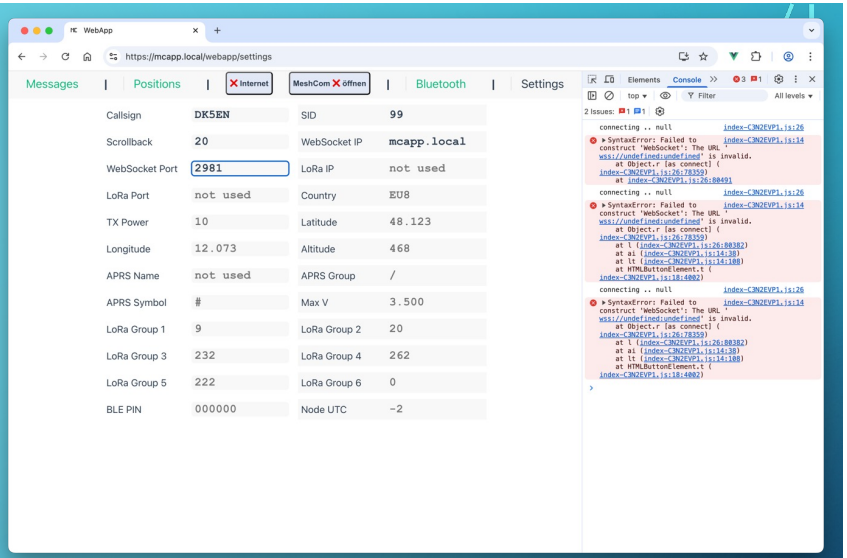
```
$HTTP["url"] =~ "^/webapp/" {
  url.rewrite-if-not-file = (
    "^/webapp/(.*)" => "/webapp/index.html"
  )
}
```

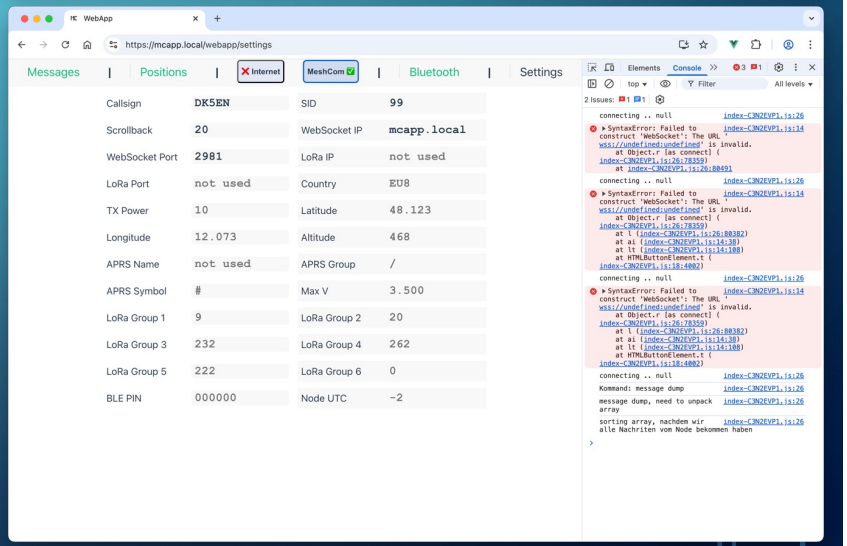
CREATE PYTHON ENVIRONMENT
INSTALL WEBSOCKETS
FIRE UP UDP PROXY

```
martin@McApp:~ $ python3 -m venv venv

martin@McApp:~ $ source venv/bin/activate

(venv) martin@McApp:~ $ pip install websockets


(venv) martin@McApp:~ $ python3 C2-mc-ws.py

Dump geladen: 0 Nachrichten (0.00 KB)

Nach dem Prune verbleiben 0 Nachrichten

WebSocket-Server läuft auf ws://0.0.0.0:2980

UDP-Proxy läuft auf Port 1799, Weiterleitung an ('dk5en-
99.local', 1799)

Drücke 'q' + Enter zum Beenden und Speichern
```

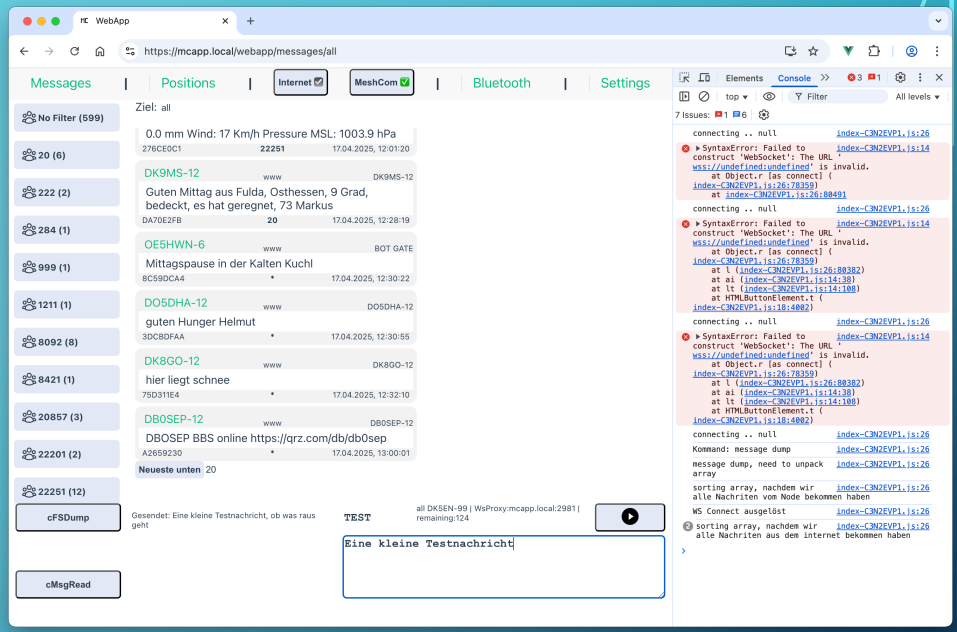
OPEN WEBBROWSER

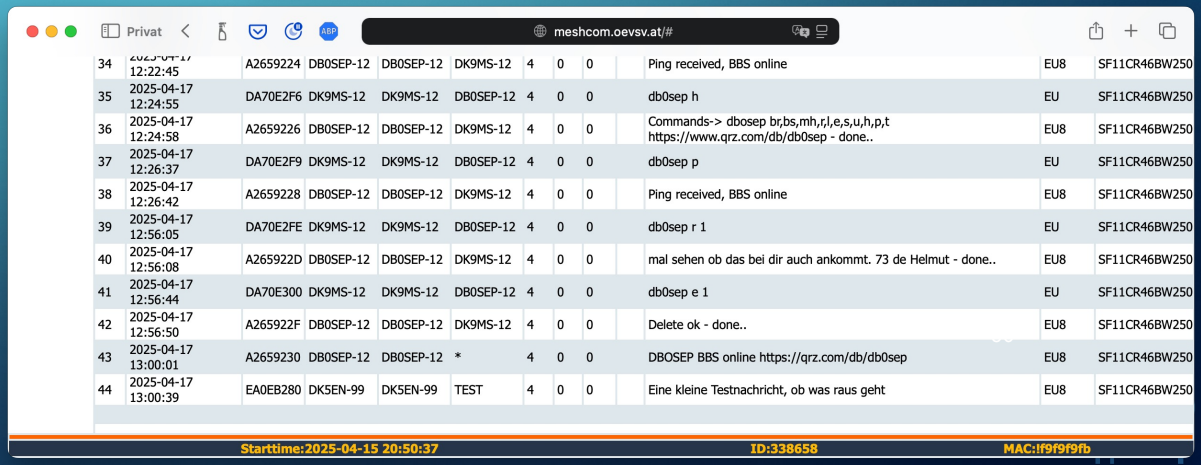
- Click option command J for Debug Output
- Go to url: https://mcapp.local/webapp/
- Click on Settings
- Enter your Callsign
- Your SID
- 20 for scroll back buffer
- Mcapp.local for your UDP Proxy server
- 2981 for the secure socket of the UDP Proxy that runs in python
- Click Connect MeshCom





- Go to https://meshcom.oevsv.at/#
- Click on Test
- Now enter a test Message
- Check on MeshCom Test page





34	12:22:45	A2659224	DB0SEP-12	DB0SEP-12	DK9MS-12	4	0	0		Ping received, BBS online	EU8	SF11CR46BW250
35	2025-04-17 12:24:55	DA70E2F6	DK9MS-12	DK9MS-12	DB0SEP-12	4	0	0		db0sep h	EU	SF11CR46BW250
36	2025-04-17 12:24:58	A2659226	DB0SEP-12	DB0SEP-12	DK9MS-12	4	0	0		Commands-> dbosep br,bs,mh,r,l,e,s,u,h,p,t https://www.qrz.com/db/db0sep - done..	EU8	SF11CR46BW250
37	2025-04-17 12:26:37	DA70E2F9	DK9MS-12	DK9MS-12	DB0SEP-12	4	0	0		db0sep p	EU	SF11CR46BW250
38	2025-04-17 12:26:42	A2659228	DB0SEP-12	DB0SEP-12	DK9MS-12	4	0	0		Ping received, BBS online	EU8	SF11CR46BW250
39	2025-04-17 12:56:05	DA70E2FE	DK9MS-12	DK9MS-12	DB0SEP-12	4	0	0		db0sep r 1	EU	SF11CR46BW250
40	2025-04-17 12:56:08	A265922D	DB0SEP-12	DB0SEP-12	DK9MS-12	4	0	0		mal sehen ob das bei dir auch ankommt. 73 de Helmut - done..	EU8	SF11CR46BW250
41	2025-04-17 12:56:44	DA70E300	DK9MS-12	DK9MS-12	DB0SEP-12	4	0	0		db0sep e 1	EU	SF11CR46BW250
42	2025-04-17 12:56:50	A265922F	DB0SEP-12	DB0SEP-12	DK9MS-12	4	0	0		Delete ok - done..	EU8	SF11CR46BW250
43	2025-04-17 13:00:01	A2659230	DB0SEP-12	DB0SEP-12	*	4	0	0		DBOSEP BBS online https://qrz.com/db/db0sep	EU8	SF11CR46BW250
44	2025-04-17 13:00:39	EA0EB280	DK5EN-99	DK5EN-99	TEST	4	0	0		Eine kleine Testnachricht, ob was raus geht	EU8	SF11CR46BW250

ANNOYANCES

```
martin@McApp:~ $ sudo raspi-config
```

- 5 Localization -> L1 locale -> select de_AT.UTF-8 -> OK -> C.UTF-8 -> OK
- Finish

```
martin@McApp:~ $ sudo apt-get update
martin@McApp:~ $ sudo apt-get dist-upgrade
martin@McApp:~ $ sudo reboot
```