-
  -
  -
  -
    -
    -
-
  -
    -
  -
    -

-
  - https://www.docker.com/blog/how-docker-desktop-networking-works-under-the-hood/
  -
    - https://agill.xyz/tunneling-can
    -
      - https://gitlab.com/chgans/can4docker
      -
      -
        - [Docker network plugin za vxcan](#)
  -
-
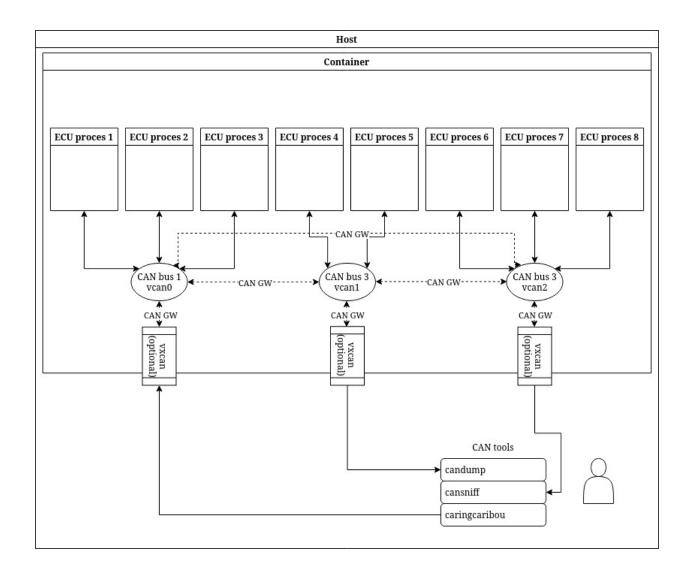 - https://blogs.igalia.com/dpino/2016/04/10/network-namespaces/
  - https://blog.scottlowe.org/2013/09/04/introducing-linux-network-namespaces/
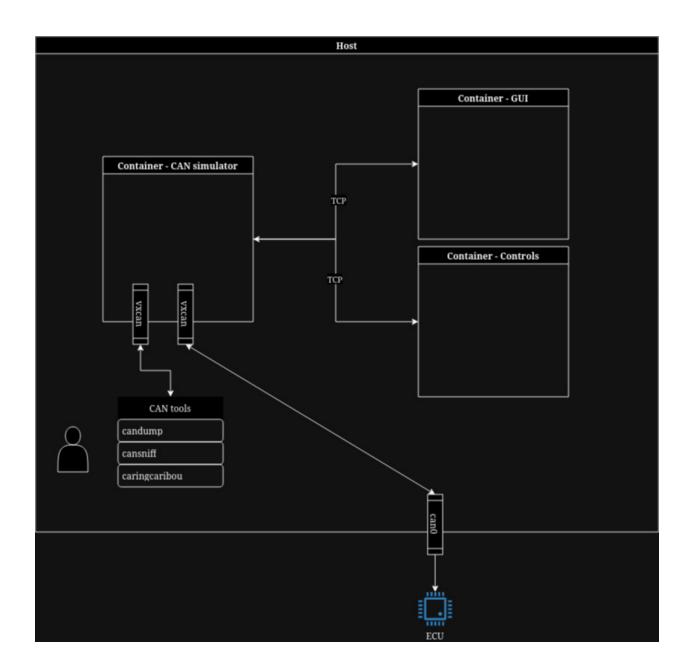 - http://www.opencloudblog.com/?p=66
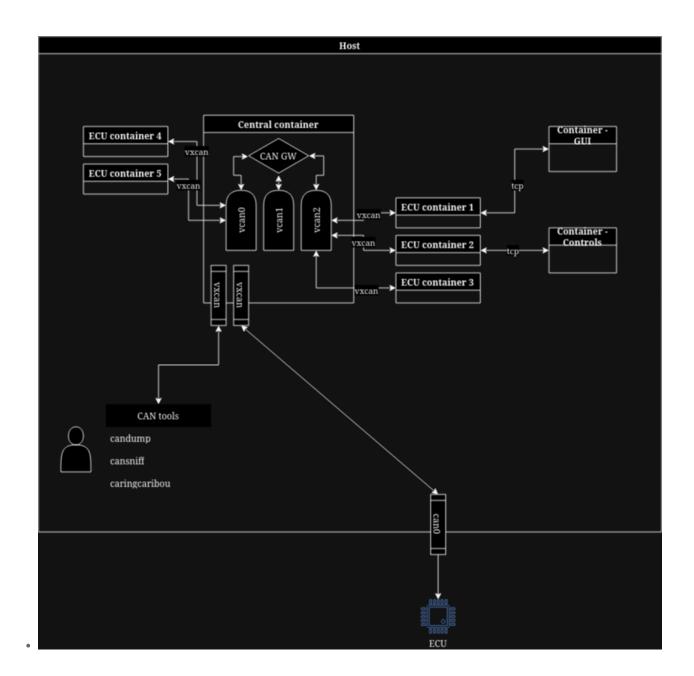 - https://marc.info/?l=linux-can&m=149046502301622&w=2
  - https://developers.redhat.com/blog/2018/10/22/introduction-to-linux-interfaces-for-virtual-networking#vxcan
  -

-
-
-

-
-
-
  -

Host

Container - GUI

Container - CAN simulator

Container - Controls

TCP

TCP

vxcan

vxcan

CAN tools

candump

cansniff

caringcaribou

can0

ECU

-
-
  -
  -

https://stackoverflow.com/questions/42964839/what-is-the-most-light-weight-base-image-i-can-use-to-build-a-dockerfile

`apk`

https://pkgs.alpinelinux.org/packages?name=can-utils

```
sudo docker pull alpine
docker run -dit alpine
docker attach <ime-containera>
```

```
apk add can-utils
```

```
ip link add dev vcan0 type vcan
ip link set dev vcan0 up
```

```
ip link set dev vcan0 up
ip link delete dev vcan0
```

```
b535ea53f8b0:/# sudo ip link add dev vcan0 type vcan
ip: RTNETLINK answers: Operation not permitted
```

- https://docs.docker.com/engine/reference/run/#runtime-privilege-and-linux-capabilities
- `--privileged` `--cap-add=NET_ADMIN`

```
lsns --type=net
```

```
sudo ip link add vxcan2 type vxcan peer name vxcan3
sudo ip link set vxcan2 up
sudo ip link set vxcan3 up
```

```
ip link set vxcan2 down
ip link delete vxcan2
```

```
sudo ip link set vxcan3 netns <namespace_id>
```

```
sudo nsenter -t <namespace_id> -n ip link set vxcan3 up
```

```
❯ docker attach ecu_containers_poc-ecu1-1
362481e92ae3:/# ip link add vxcan2 type vxcan peer name vxcan3
362481e92ae3:/# ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: vxcan0@vxcan2: <NOARP,M-DOWN> mtu 72 qdisc noop state DOWN qlen 1000
    link/[280]
3: vxcan2@vxcan0: <NOARP,M-DOWN> mtu 72 qdisc noop state DOWN qlen 1000
    link/[280]
76: eth0@if77: <BROADCAST,MULTICAST,UP,LOWER_UP,M-DOWN> mtu 1500 qdisc noqueue state UP
    link/ether 02:42:ac:16:00:04 brd ff:ff:ff:ff:ff:ff
362481e92ae3:/# ip link set vxcan2 up
362481e92ae3:/# ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: vxcan0@vxcan2: <NOARP> mtu 72 qdisc noop state DOWN qlen 1000
    link/[280]
3: vxcan2@vxcan0: <NO-CARRIER,NOARP,UP,M-DOWN> mtu 72 qdisc noqueue state LOWERLAYERDOWN qlen 1000
    link/[280]
76: eth0@if77: <BROADCAST,MULTICAST,UP,LOWER_UP,M-DOWN> mtu 1500 qdisc noqueue state UP
    link/ether 02:42:ac:16:00:04 brd ff:ff:ff:ff:ff:ff
362481e92ae3:/# ip link set vxcan3 up
ip: ioctl 0x8913 failed: No such device
362481e92ae3:/# ip link set up vxcan0
362481e92ae3:/# ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: vxcan0@vxcan2: <NOARP,UP,LOWER_UP> mtu 72 qdisc noqueue state UP qlen 1000
    link/[280]
3: vxcan2@vxcan0: <NOARP,UP,LOWER_UP> mtu 72 qdisc noqueue state UP qlen 1000
    link/[280]
76: eth0@if77: <BROADCAST,MULTICAST,UP,LOWER_UP,M-DOWN> mtu 1500 qdisc noqueue state UP
    link/ether 02:42:ac:16:00:04 brd ff:ff:ff:ff:ff:ff
362481e92ae3:/# ip link set vxcan2 netns 148991
ip: RTNETLINK answers: No such process
362481e92ae3:/# ps ux
PID   USER     TIME  COMMAND
    1 root      0:00 /bin/bash
   15 root      0:00 ps ux
362481e92ae3:/#
```

1. `ip link add vxcan2 type vxcan peer name vxcan3`
   1.
   2.
2.
   1.
      •

```
$ sudo ip link add gw_vxcan type vxcan peer name ecu_vxcan
$ sudo ip link set ecu_vxcan netns 236978 // pid ecu containera
```

```
$ sudo ip link set gw_vxcan netns 236955 // pid gateway containera
$ sudo nsenter -t 236955 -n ip link set host_vxcan up
$ sudo nsenter -t 236978 -n ip link set ecu_vxcan up
```

```
99344ffdde4c:/# cangw -A -X -s gw_vxcan1 -d vcan1
netlink error -95 (Not supported)
```

```
> modprobe can-gw
modprobe: FATAL: Module can-gw not found in directory /lib/modules/6.7.3-arch1-2
```

```
35f0d2b85988:/# cangw -L
cangw -A -s vcan0 -d ecu_vxcan # 0 handled 0 dropped 0 deleted
```

```
cangw -A -s gw_vxcan1 -d vcan1 # 0 handled 0 dropped 0 deleted
```

[Docker network plugin](https://gitlab.com/chgans/can4docker)
https://gitlab.com/chgans/can4docker
https://github.com/wsovalle/docker-vxcan/tree/master

- https://github.com/linux-can/can-utils/issues/337

```
35f0d2b85988:/# cangw -L
cangw -A -s vcan0 -d ecu_vxcan -X -e -i# 0 handled 0 dropped 0 deleted
```

```
cangw -A -s gw_vxcan1 -d vcan1 -X -e -i # 0 handled 0 dropped 0 deleted
```

```
^Cfecef03ba967:/# cangw -L
cangw -A -s ecu_vxcan -d vcan0 -X -e -i # 19 handled 0 dropped 113 deleted
cangw -A -s vcan0 -d ecu_vxcan -X -e -i # 338 handled 0 dropped 19 deleted
```

```
^Cad4387e1acd5:/# cangw -L
cangw -A -s vcan1 -d gw_vxcan1 -X -e -i # 0 handled 0 dropped 113 deleted
cangw -A -s gw_vxcan1 -d vcan1 -X -e -i # 420 handled 0 dropped 0 deleted
```

```
ad4387e1acd5:/# cangw -L
cangw -A -s gw_vxcan1 -d vcan1 -X -e -i # 0 handled 0 dropped 0 deleted
cangw -A -s vcan1 -d gw_vxcan1 -X -e -i # 0 handled 0 dropped 569 deleted
cangw -A -s vcan1 -d gw_vxcan2 -X -e -i # 0 handled 0 dropped 569 deleted
cangw -A -s gw_vxcan2 -d vcan1 -X -e -i # 569 handled 0 dropped 0 deleted
```

- https://marc.info/?l=linux-can&m=137752245213501&w=2

```
❯ modinfo can-gw
filename:       /lib/modules/6.7.4-arch1-1/kernel/net/can/can-gw.ko.zst
alias:          can-gw
author:         Oliver Hartkopp <oliver.hartkopp@volkswagen.de>

...

parm:           max_hops:maximum can-gw routing hops for CAN frames (valid values: 1-6 hops, default: 1)
(uint)
```

```
sudo modprobe can-gw max_hops=6
```

-
  - https://www.inovex.de/de/blog/docker-plugins/
  - https://docs.docker.com/engine/extend/plugins_network/
  -
    - https://github.com/moby/moby/blob/master/libnetwork/docs/remote.md
    - https://github.com/moby/moby/blob/master/libnetwork/docs/design.md
    - https://test-dockerrr.readthedocs.io/en/latest/userguide/networking/dockernetworks/
    - https://test-dockerrr.readthedocs.io/en/latest/extend/plugins_network/
  - https://github.com/docker/go-plugins-helpers/blob/master/network/api.go
  - https://github.com/tugbadm/docker-network-plugin/tree/master/example
-

  -
    - https://agill.xyz/tunneling-can
    -
      - https://www.spinics.net/lists/linux-can/msg00297.html
      - https://www.spinics.net/lists/linux-can/msg00306.html
    -
      - https://gitlab.com/chgans/can4docker
      - https://github.com/wsovalle/docker-vxcan/tree/master

https://github.com/wsovalle/docker-vxcan/tree/master

```
$ docker plugin install wsovalle/vxcan
```

```
        +-------+
        |       |                          +-------+
        |       |>vxcan0.1----vxcan0.0<| cont1 |
vcan0<| CANGW |                          +-------+
        |       |                          +-------+
        |       |>vxcan1.1----vxcan1.0<| cont2 |
        +-------+                          +-------+
```

-

```
    〉 cangw -L
cangw -A -s vcane1e3a60a -d vcana928f613 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcana928f613 -d vcane1e3a60a -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcane1e3a60a -d can_host1 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s can_host1 -d vcane1e3a60a -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcan2afcccd6 -d can_host0 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s can_host0 -d vcan2afcccd6 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcan40b79052 -d vcan2afcccd6 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcan2afcccd6 -d vcan40b79052 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcan40b79052 -d can_host0 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s can_host0 -d vcan40b79052 -X -e # 0 handled 0 dropped 0 deleted
```

```
cangw -A -s vcana928f613 -d can_host1 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s can_host1 -d vcana928f613 -X -e # 0 handled 0 dropped 0 deleted
```

-
  -
    -
      -
    -
    -

HOST

```
<instruction>:<canfd_frame-elements>:<can_id>.<flags>.<len>.<can_data>
  <instruction>  is one of 'AND' 'OR' 'XOR' 'SET'
  <canfd_frame-elements> is _one_ or _more_ of 'I'd 'F'lags 'L'ength 'D'ata
  <can_id>  is an u32 value containing the CAN FD Identifier
  <flags>  is an u8 value containing CAN FD flags (CANFD_BRS, CANFD_ESI)
  <len>  is an u8 value containing the data length in hex (0 .. 40)
  <can_data>  is always 64(!) u8 values containing the CAN FD frames data
The max. four modifications are performed in the order AND --> OR --> XOR --> SET

Supported CRC 8 profiles:
 Profile '1' (1U8)      add one additional u8 value
 Profile '2' (16U8)     add u8 value from table[16] indexed by (data[1] & 0xF)
 Profile '3' (SFFID_XOR) add u8 value (can_id & 0xFF) ^ (can_id >> 8 & 0xFF)

Examples:
cangw -A -s can0 -d vcan3 -e -f 123:C00007FF -m SET:IL:333.4.1122334455667788

❯ cangw -L
cangw -A -s vcane1e3a60a -d vcana928f613 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcana928f613 -d vcane1e3a60a -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcane1e3a60a -d can_host1 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s can_host1 -d vcane1e3a60a -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcan2afcccd6 -d can_host0 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s can_host0 -d vcan2afcccd6 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcan40b79052 -d vcan2afcccd6 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcan2afcccd6 -d vcan40b79052 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcan40b79052 -d can_host0 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s can_host0 -d vcan40b79052 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s vcana928f613 -d can_host1 -X -e # 0 handled 0 dropped 0 deleted
cangw -A -s can_host1 -d vcana928f613 -X -e # 0 handled 0 dropped 0 deleted
❯ candump can_host1
^[[B^[[A^C
❯ candump can_host0
  can_host0  01A  [01]  AA
  can_host0  01A  [01]  AA
  can_host0  01A  [01]  AA
  can_host0  01A  [01]  AA
  can_host0  01A  [01]  AA
  can_host0  01A  [01]  AA
  can_host0  01A  [01]  AA
  can_host0  01A  [01]  AA
  can_host0  2DF  [05]  F4 54 01 10 93
  can_host0  40F  [64]  77 1E 20 69 1D 0A 17 69 77 1E 20 69 1D 0A 17 69 77 1E 20 69 1D 0A 17 69 77 1E 20 69 1D 0A 1
7 69 77 1E 20 69 1D 0A 17 69 77 1E 20 69 1D 0A 17 69 77 1E 20 69 1D 0A 17 69
  can_host0  67E  [08]  3B 48 98 29 8B CA 30 09
  can_host0  1F6  [64]  9F 27 E8 7B 36 BE 97 14 9F 27 E8 7B 36 BE 97 14 9F 27 E8 7B 36 BE 97 14 9F 27 E8 7B 36 BE 9
7 14 9F 27 E8 7B 36 BE 97 14 9F 27 E8 7B 36 BE 97 14 9F 27 E8 7B 36 BE 97 14
  can_host0  4CA  [01]  60
  can_host0  33E  [06]  0F D6 DE 14 FD B7
  can_host0  1C2  [32]  F6 6F CC 62 8C ED 96 41 F6 6F CC 62 8C ED 96 41 F6 6F CC 62 8C ED 96 41 F6 6F CC 62 8C ED 9
6 41
  can_host0  7AD  [20]  C9 5B C6 74 8C E2 05 20 C9 5B C6 74 8C E2 05 20 C9 5B C6 74
  can_host0  410  [32]  20 3D 4B 6C 1F B0 06 14 20 3D 4B 6C 1F B0 06 14 20 3D 4B 6C 1F B0 06 14 20 3D 4B 6C 1F B0 0
6 14
  can_host0  71C  [07]  3C BA 1D 7D 9A 2D 58
_
```

ECU 1

```
                 (fixed CAN data payload and length)
cangen vcan0 -D 11xx3344DEADBEEF -L 8
                 (fixed CAN data payload where 2. byte is randomized, fixed length)
cangen vcan0 -I 555 -D CCCCCCCCCCCCCCCC -L 8 -g 3.75
                 (generate a fix busload without bit-stuffing effects)
cangen vcan0 -g 0 -i -x
                 (full load test ignoring -ENOBUFS)
cangen vcan0 -g 0 -p 10 -x
                 (full load test with polling, 10ms timeout)
cangen vcan0
                 (my favourite default :)

b76ccd230fec:/# cangen -f can_docker0
b76ccd230fec:/# cangen -f can_docker0
(failed reverse-i-search)'': ^Cngen -f can_docker0
b76ccd230fec:/# ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
23: can_docker0@if24: <NOARP,UP,LOWER_UP,M-DOWN> mtu 72 qdisc noqueue state UP qlen 1000
    link/[280]
30: eth0@if31: <BROADCAST,MULTICAST,UP,LOWER_UP,M-DOWN> mtu 1500 qdisc noqueue state UP
    link/ether 02:42:ac:1a:00:02 brd ff:ff:ff:ff:ff:ff
b76ccd230fec:/# exit
exit
/ # exit
△ # ~                                              ⏳ 36m 0s ◔ 14:38:41
❯ docker exec -it vxcandocker_test-app_can1-1 /bin/sh_
```

ECU 2

```
{data}:
  0..8 (0..64 CAN FD) ASCII hex-values (optionally separated by '.')
{len}:
  an optional 0..8 value as RTR frames can contain a valid dlc field
_{dlc}:
  an optional 9..F data length code value when payload length is 8
<flags>:
  a single ASCII Hex value (0 .. F) which defines canfd_frame.flags

Examples:
  5A1#11.2233.44556677.88 / 123#DEADBEEF / 5AA# / 123##1 / 213##311223344 /
  1F334455#1122334455667788_B / 123#R / 00000123#R3 / 333#R8_E

219bff8aaa16:/# cansend can_docker0 01a##aaa
219bff8aaa16:/# cansend can_docker0 01a##aaa
219bff8aaa16:/# cansend can_docker0 01a##aaa
219bff8aaa16:/# cansend can_docker0 01a##aaa
219bff8aaa16:/# cansend can_docker0 01a##aaa
219bff8aaa16:/# cansend can_docker0 01a##aaa
219bff8aaa16:/# cansend can_docker0 01a##aaa
219bff8aaa16:/# cansend can_docker0 01a##aaa
219bff8aaa16:/# cansend can_docker0 01a##aaa
219bff8aaa16:/# cangen -f can_docker0
^C219bff8aaa16:/# read escape sequence
△ # ~                                              ⏳ 43m 12s ◔ 14:38:34
❯ docker exec -it vxcandocker_test-app_can0-1 /bin/sh_
```

-
-