How to setup and work with ESP-IDF and ESP-Matter

URL: https://github.com/mozolin/matter-thread

Windows Powershell (with Administrator rights):

~~~
systeminfo
~~~

OS Name: Microsoft Windows 10 Pro
OS Version: 10.0.19045 N/A Build 19045
Works successfully in this version of Windows!

~~~
systeminfo
~~~

OS Name: Microsoft Windows 10 Enterprise
OS Version: 10.0.19045 N/A Build 19045
Works without sharing COM-ports in this version of Windows!

 # 1. How to install Ubuntu on Windows with WSL

Recommended Ubuntu 22.04…
https://learn.microsoft.com/en-us/windows/wsl/install
Check Ubuntu version:

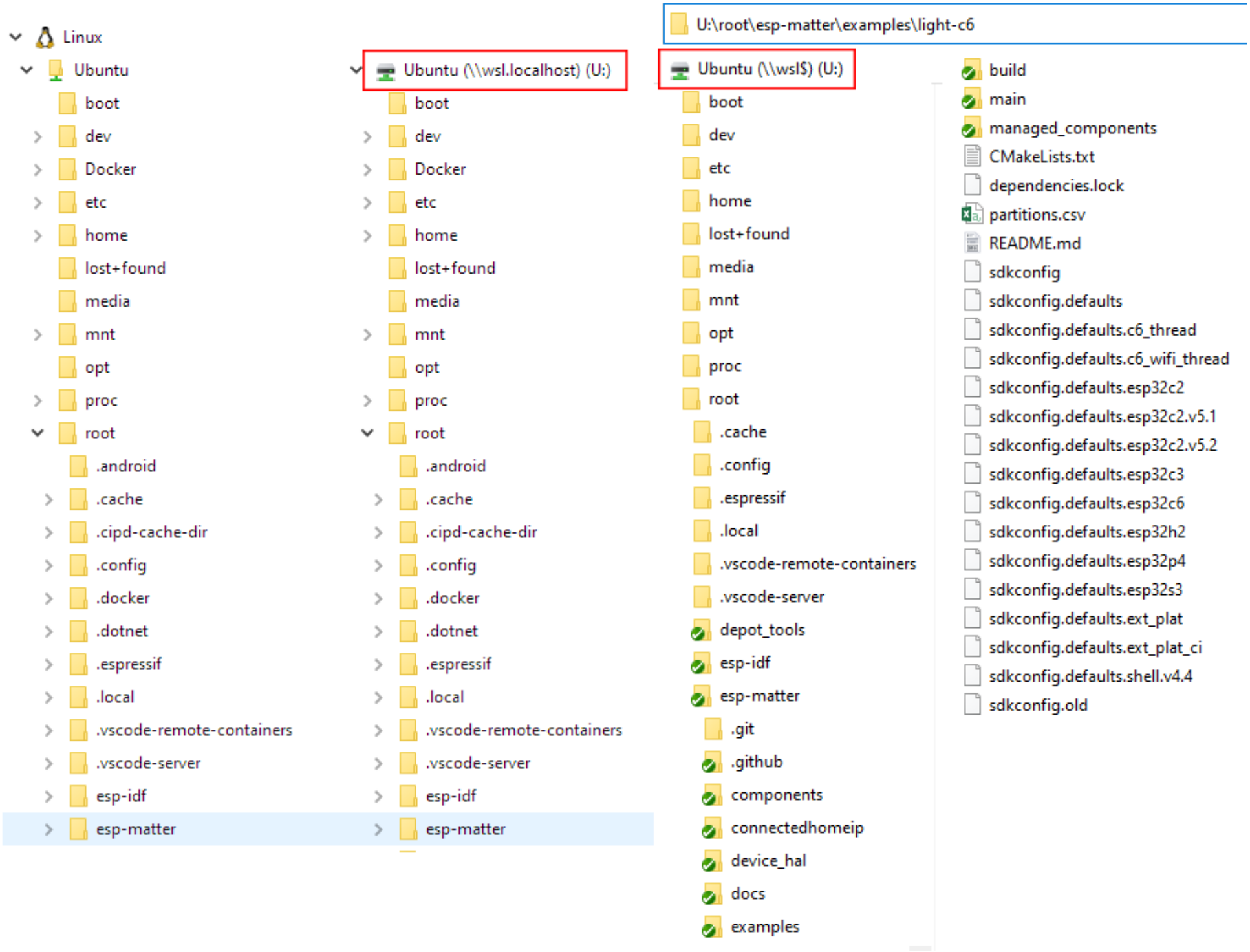
~~~
lsb_release -a
~~~

If asked to add a new user, just do it, but after that we should switch to root.
Windows Powershell:

~~~
ubuntu config --default-user root       #-- default instance
ubuntu2204 config --default-user root   #-- another instance
~~~

 # 2. Ubuntu on Windows App Store

https://apps.microsoft.com/search?query=ubuntu&hl=en-us&gl=US
Map network resource **\\wsl.localhost\Ubuntu** or **\\wsl$\Ubuntu** on disk **U** (for instance). So, the project examples can be found in **U:\root\esp-matter\examples** folder. If we are using another WSL instance, then the path should be something like **\\wsl$\Ubuntu-22.04**



ubuntu_wsl.png

 # 3. ESP-IDF Prerequisites (Ubuntu only)
https://docs.espressif.com/projects/esp-idf/en/latest/esp32/get-started/linux-macos-setup.html
https://wiki.seeedstudio.com/xiao_idf/
~~~
```
sudo apt update
sudo apt upgrade
sudo apt-get install git wget flex bison gperf python3 python3-pip python3-venv cmake ninja-build ccache libffi-dev libssl-dev dfu-util libusb-1.0-0
```
~~~

 # 4. ESP-IDF Setup (Windows and Ubuntu)
https://docs.espressif.com/projects/esp-matter/en/latest/esp32/developing.html
Windows Powershell (with Administrator rights):
~~~
```
D:
cd /
mkdir Espressif
cd Espressif
```
~~~
Both, Windows and Ubuntu (esp-idf v5.2.4 is recommended):
~~~
```
git clone --recursive https://github.com/espressif/esp-idf.git
cd esp-idf
git checkout v5.2.4
git submodule update --init --recursive
./install.sh
source ./export.sh
#./install.bat          #-- Windows instance
#./export.bat           #-- Windows instance
```
~~~
To /root/.bashrc add (Ubuntu only):
~~~
```
#-- Alias for setting up the ESP-IDF environment
alias get_idf='. ~/esp-idf/export.sh'
```
~~~
Than run:
~~~
```
source ~/.bashrc
```
~~~
Now it is possible to run `get_idf` to set up or refresh the esp-idf environment in any terminal session.

 # 5. Matter Prerequisites (Ubuntu only)
https://github.com/project-chip/connectedhomeip/blob/master/docs/guides/BUILDING.md#prerequisites

https://wiki.seeedstudio.com/xiao_esp32_matter_env/

~~~
sudo apt-get install git gcc g++ pkg-config libssl-dev libdbus-1-dev libglib2.0-dev libavahi-client-dev ninja-build python3-venv
python3-dev python3-pip unzip libgirepository1.0-dev libcairo2-dev libreadline-dev default-jre
~~~

 # 6. ESP Matter Setup (Ubuntu only)
https://docs.espressif.com/projects/esp-matter/en/latest/esp32/developing.html#esp-matter-setup
https://wiki.seeedstudio.com/xiao_esp32_matter_env/
~~~
cd esp-idf
source ./export.sh
cd ..

git clone --depth 1 https://github.com/espressif/esp-matter.git
cd esp-matter
git submodule update --init --depth 1
cd ./connectedhomeip/connectedhomeip
./scripts/checkout_submodules.py --platform esp32 linux --shallow
cd ../..
./install.sh
cd ..

cd esp-idf; source ./export.sh; cd ..
cd esp-matter; source ./export.sh; cd ..

export IDF_CCACHE_ENABLE=1
~~~
To /root/.bashrc add:
~~~
#-- Alias for setting up the ESP-Matter environment
alias get_matter='. ~/esp-matter/export.sh'

#-- Enable ccache to speed up compilation
alias set_cache='export IDF_CCACHE_ENABLE=1'
~~~
Than run:
~~~
source ~/.bashrc
~~~
Now it is possible to run `get_matter` and `set_cache` to set up or refresh the esp-matter environment in any terminal session.

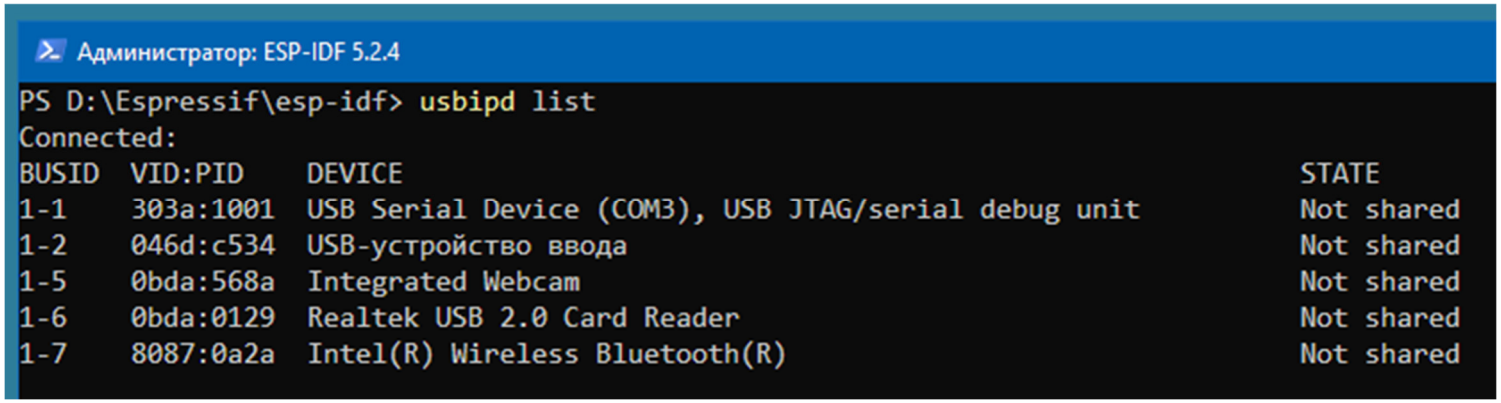
Note:

"A complete installation of Ubuntu, ESP-IDF and ESP-Matter takes up about 20 GB of disk space on drive C."

 # 7. Install Visual Studio Code
https://code.visualstudio.com/

 # 8. Install Remote WSL extension in Visual Studio Code
https://docs.espressif.com/projects/vscode-esp-idf-extension/en/latest/additionalfeatures/wsl.html#install-remote-wsl-extension-in-visual-studio-code

 # 9. Install usbipd-win
https://github.com/dorssel/usbipd-win/releases
https://docs.espressif.com/projects/vscode-esp-idf-extension/en/latest/additionalfeatures/wsl.html#usbipd-win-in-wsl
Windows Powershell:
~~~
usbipd list
usbipd list –u
usbipd bind --busid 1-3
usbipd attach --wsl --busid 1-3
~~~



usbipd_01.png

```
Администратор: ESP-IDF 5.2.4
PS D:\Espressif\esp-idf> usbipd list -u
Connected:
BUSID  VID:PID    DEVICE                                                        STATE
1-1    303a:1001  Unknown device                                                Not shared
1-2    046d:c534  Logitech, Inc., Nano Receiver                                 Not shared
1-5    0bda:568a  Realtek Semiconductor Corp., Unknown device                   Not shared
1-6    0bda:0129  Realtek Semiconductor Corp., RTS5129 Card Reader Controller   Not shared
1-7    8087:0a2a  Intel Corp., Bluetooth wireless interface                     Not shared
```

usbipd_02.png

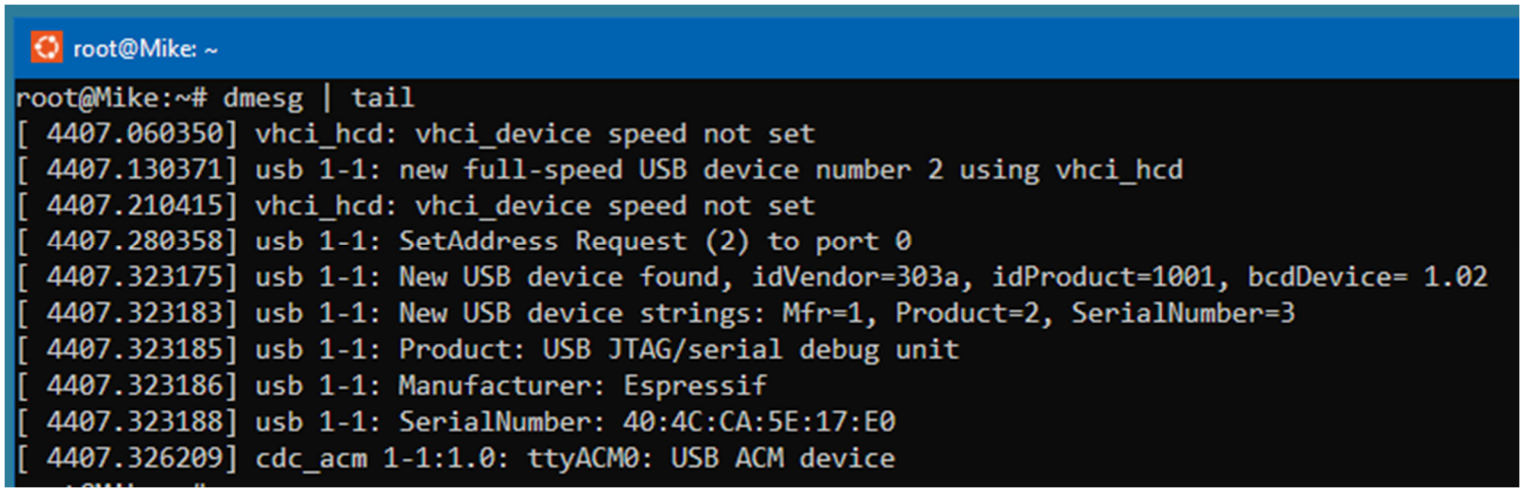
```
Администратор: ESP-IDF 5.2.4
PS D:\Espressif\esp-idf> usbipd bind --busid 1-1
PS D:\Espressif\esp-idf> usbipd list
Connected:
BUSID  VID:PID    DEVICE                                                        STATE
1-1    303a:1001  USB Serial Device (COM3), USB JTAG/serial debug unit          Shared
1-2    046d:c534  USB-устройство ввода                                          Not shared
1-5    0bda:568a  Integrated Webcam                                            Not shared
1-6    0bda:0129  Realtek USB 2.0 Card Reader                                   Not shared
1-7    8087:0a2a  Intel(R) Wireless Bluetooth(R)                               Not shared
```

usbipd_03.png

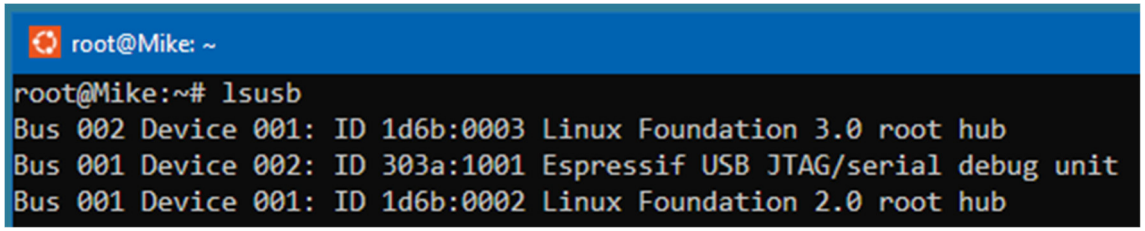
```
Администратор: ESP-IDF 5.2.4
PS D:\Espressif\esp-idf> usbipd attach --wsl --busid 1-1
usbipd: info: Using WSL distribution 'Ubuntu' to attach; the device will be available in all WSL 2 distributions.
usbipd: info: Detected networking mode 'nat'.
usbipd: info: Using IP address 172.18.160.1 to reach the host.
PS D:\Espressif\esp-idf> usbipd list
Connected:
BUSID  VID:PID    DEVICE                                                        STATE
1-1    303a:1001  USB Serial Device (COM3), USB JTAG/serial debug unit          Attached
1-2    046d:c534  USB-устройство ввода                                          Not shared
1-5    0bda:568a  Integrated Webcam                                            Not shared
1-6    0bda:0129  Realtek USB 2.0 Card Reader                                   Not shared
1-7    8087:0a2a  Intel(R) Wireless Bluetooth(R)                               Not shared
```

usbipd_04.png

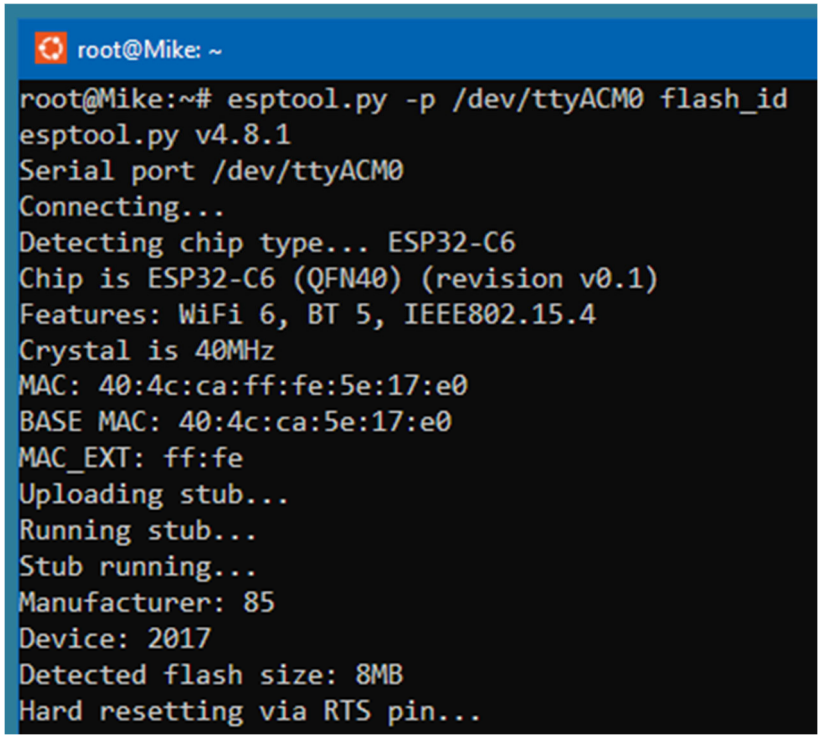
Ubuntu:
~~~
```
dmesg | tail
lsusb
```
~~~



usbipd_05.png

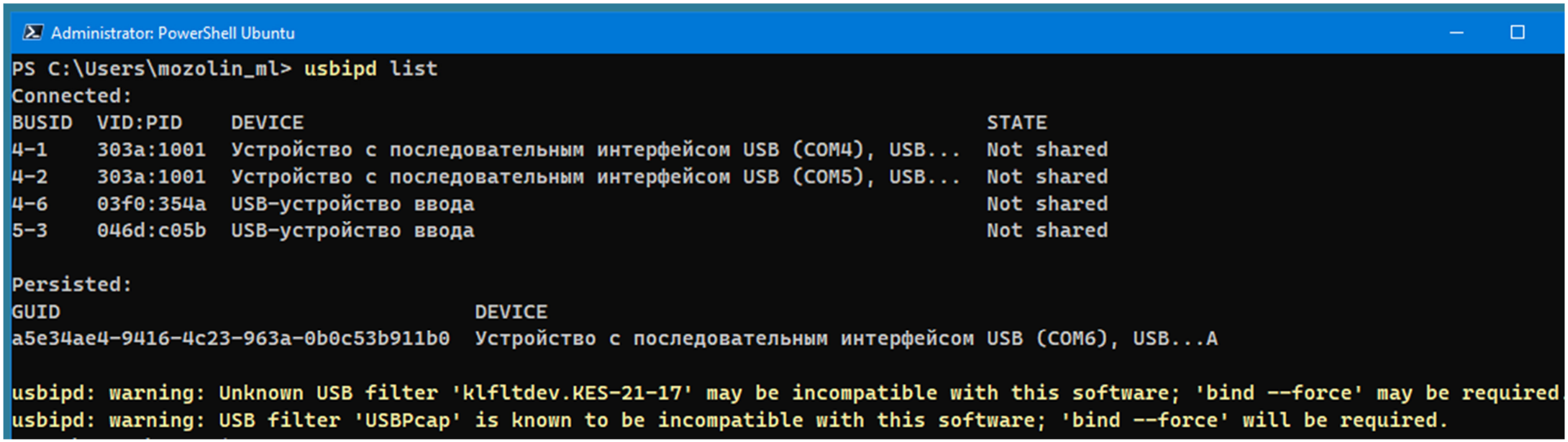


usbipd_06.png

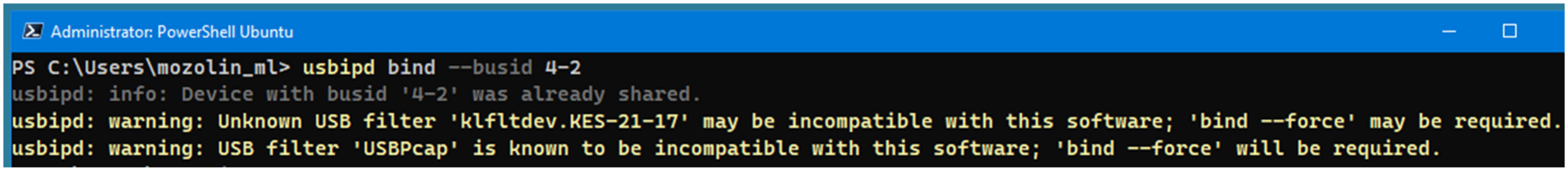


usbipd_07.png

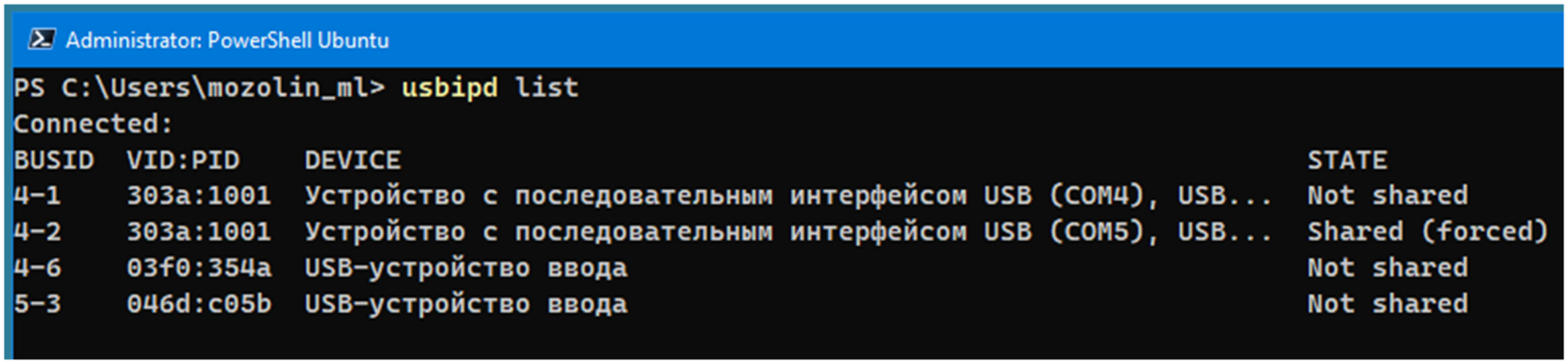
There may be issues with shared access to COM ports in Windows 10 Enterprise. Therefore, it will not be possible to use Ubuntu ports for flashing and monitoring the firmware. In this case, we should make a build in VSCode using a remote WSL or in Ubuntu, and then use a shared drive (**U**). Here are a couple of examples of BAT files for flashing and monitoring: **/D/Espressif/idf_build_c6.cmd** and **/D/Espressif/idf_build_h2.cmd**



usdipd_error_01.png



usdipd_error_02.png



usdipd_error_03.png

```
Administrator: PowerShell Ubuntu
PS C:\Users\mozolin_ml> usbipd attach --wsl --busid 4-2
usbipd: info: Using WSL distribution 'Ubuntu' to attach; the device will be available in all WSL 2 distributions.
usbipd: error: Unable to run 'usbip' client tool. Please report this at https://github.com/dorssel/usbipd-win/issues.
```

usdipd_error_04.png

 # 10. Make an example project (all the settings are made for ESP32-C6 development board, Ubuntu only)
- Make a copy of /root/esp-matter/examples/**light** folder to ../**light-c6**
- Open this folder in VSCode using a remote WSL or in Ubuntu

~~~
cd /root/esp-matter/examples/light-c6    #-- Navigate to the light example directory
rm -rf build/                            #-- Clean previous build files
idf.py set-target esp32c6                #-- Set the build target to ESP32-C6
idf.py menuconfig                        #-- Enter the configuration menu
~~~

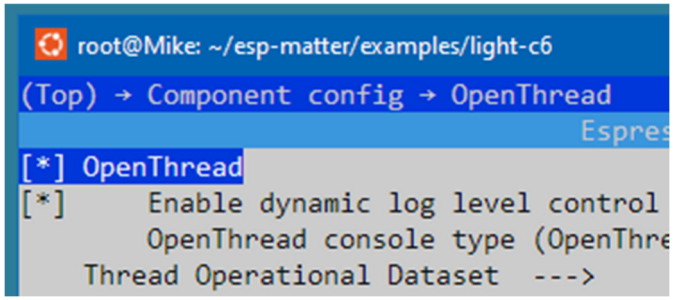
*CONFIG_OPENTHREAD_ENABLED=**y***
*CONFIG_ENABLE_WIFI_STATION=**n***
*CONFIG_USE_MINIMAL_MDNS=**n***

```
root@Mike: ~/esp-matter/examples/light-c6
(Top) → Serial flasher config → Flash size
                                Espressif
( ) 1 MB
( ) 2 MB
(X) 4 MB
( ) 8 MB
```

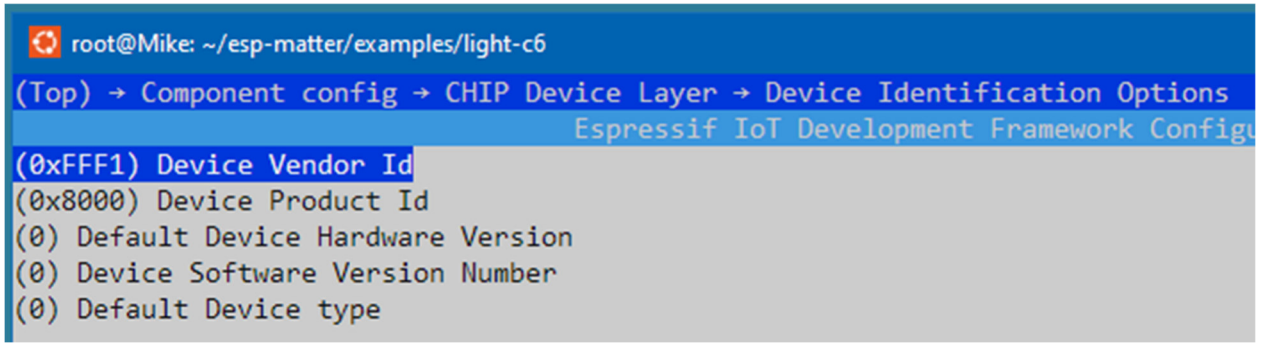
esp_menuconfig_01.png

```
root@Mike: ~/esp-matter/examples/light-c6
(Top) → Component config → ESP System Settings → Channel for console output
                           Espressif IoT Development Framework Config
( ) Default: UART0
(X) USB Serial/JTAG Controller
( ) Custom UART
```

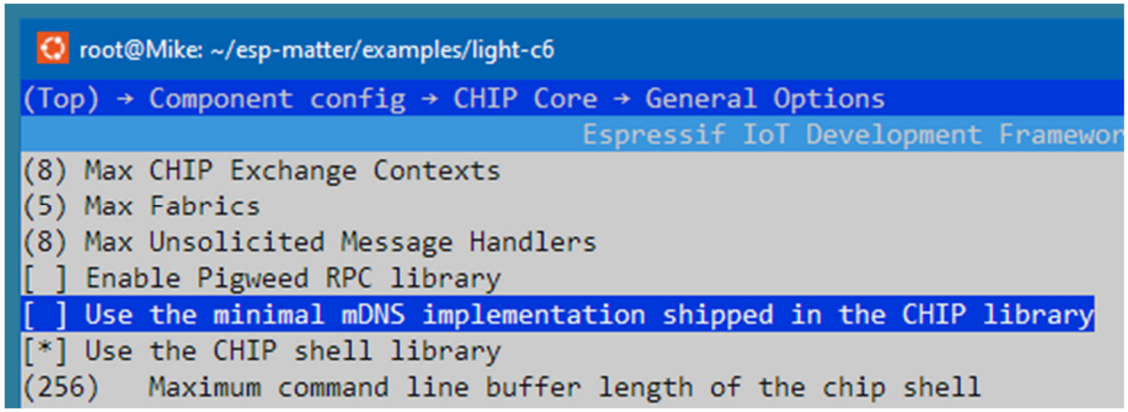
esp_menuconfig_02.png



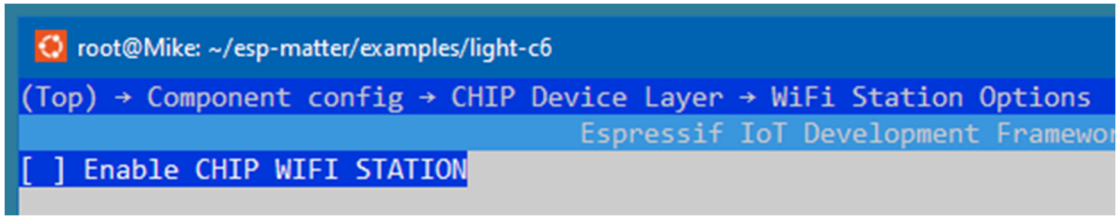
esp_menuconfig_03.png



esp_menuconfig_04.png



esp_menuconfig_05.png



esp_menuconfig_06.png

~~~
idf.py -p /tty/ACM0 build flash monitor  #-- Building, flashing and monitoring
~~~

JOIN THE THREAD NETWORK VIA NETWORKKEY

OpenThread Border Router (see: “How_to_setup_and_work_with_OpenThread_Border_Router.docx”):

~~~
dataset active -x
~~~

0e080000000000010000000300000154a03000017350600040001fffe00208def5e21b6165cc560708fde61aeab400413105100011223344556677889aabbccddeeff030f4f70656e5468726561642d32326339010222c90410a5e0c5822c1e723956af6b1ee43f084e0c0402a0f7f8

Done

~~~
networkkey
~~~

00112233445566778899aabbccddeeff

Done

Thread End Device:

~~~
matter esp ot_cli dataset set active 0e080000000000010000000300000154a03000017350600040001fffe00208def5e21b6165cc560708fde61aeab400413105100011223344556677889aabbccddeeff030f4f70656e5468726561642d32326339010222c90410a5e0c5822c1e723956af6b1ee43f084e0c0402a0f7f8
~~~

Error 7: InvalidArgs

Why so? There is the difference between results of this command:

Here:

```
> matter esp ot_cli dataset set active 0e080000000000010000000300000154a03000017350600040001fffe00208def5e21b6165cc560708fde61aeab400413105100011223344556677889aabbccddeeff030f4f70656e5468726561642d32326339010222c90410a5e0c5822c1e723956af6b1ee43f084e0c0402a0f7f8
```

Example "Join the OTBR network" (https://openthread.io/codelabs/openthread-border-router):

```
> matter esp ot_cli dataset set active 0e080000000000010000000300001235060004001fffe002083d3818dc1c8db63f0708fda85ce9df1e662005101d81689e4c0a32f3b4aa112994d29692030f4f70656e5468726561642d35326532010252e204103f23f6b8875d4b05541eeb4f9718d2f40c0302a0ff
```

The second one is shorter for 12 symbols!

~~~
matter esp ot_cli dataset networkkey 00112233445566778899aabbccddeeff
matter esp ot_cli dataset commit active
matter esp ot_cli ifconfig up
matter esp ot_cli thread start
matter esp ot_cli state
~~~

```
matter esp ot_cli dataset networkkey 00112233445566778899aabbccddeeff

Done
```

esp_join_openthread_01.png

```
matter esp ot_cli dataset commit active

Done
```

esp_join_openthread_02.png

```
matter esp ot_cli ifconfig up

Done
```

esp_join_openthread_03.png

```
matter esp ot_cli thread start

I(82652) OPENTHREAD:[N] Mle-----------: Role router -> detached
I(82652) OPENTHREAD:[I] Mle-----------: Attempt to become router
I(82652) OPENTHREAD:[I] Mle-----------: Send Link Request (ff02:0:0:0:0:0:0:2)
Done
```

esp_join_openthread_04.png

```
> matter esp ot_cli state

router
Done
```

esp_join_openthread_05.png

```
> matter esp ot_cli dataset networkkey 00112233445566778899aabbccddeeff

Done
Done
> matter esp ot_cli dataset commit active

I(281397) OPENTHREAD:[I] Settings------: Saved ActiveDataset
I(281397) OPENTHREAD:[I] DatasetManager: Active dataset set
Done
I(281397) OPENTHREAD:[I] Notifier------: StateChanged (0x10040100) [KeySeqCntr NetworkKey ActDset]
Done
> matter esp ot_cli ifconfig up

Done
I(294547) OPENTHREAD:[I] Notifier------: StateChanged (0x01001009) [Ip6+ LLAddr Ip6Mult+ NetifState]
I (294547) OT_STATE: netif up
I (294547) chip[DL]: Posting ESPSystemEvent: IP Event with eventId : 3
I (294547) chip[DL]: Posting ESPSystemEvent: IP Event with eventId : 3
Done
> matter esp ot_cli thread start
```

matter_esp_ot_cli.png

 # 11. ??? Test Setup (CHIP Tool)
https://docs.espressif.com/projects/esp-matter/en/latest/esp32c6/developing.html#test-setup-chip-tool

 # 12. ??? Working with the CHIP Tool
https://github.com/project-chip/connectedhomeip/blob/master/docs/development_controllers/chip-tool/chip_tool_guide.md

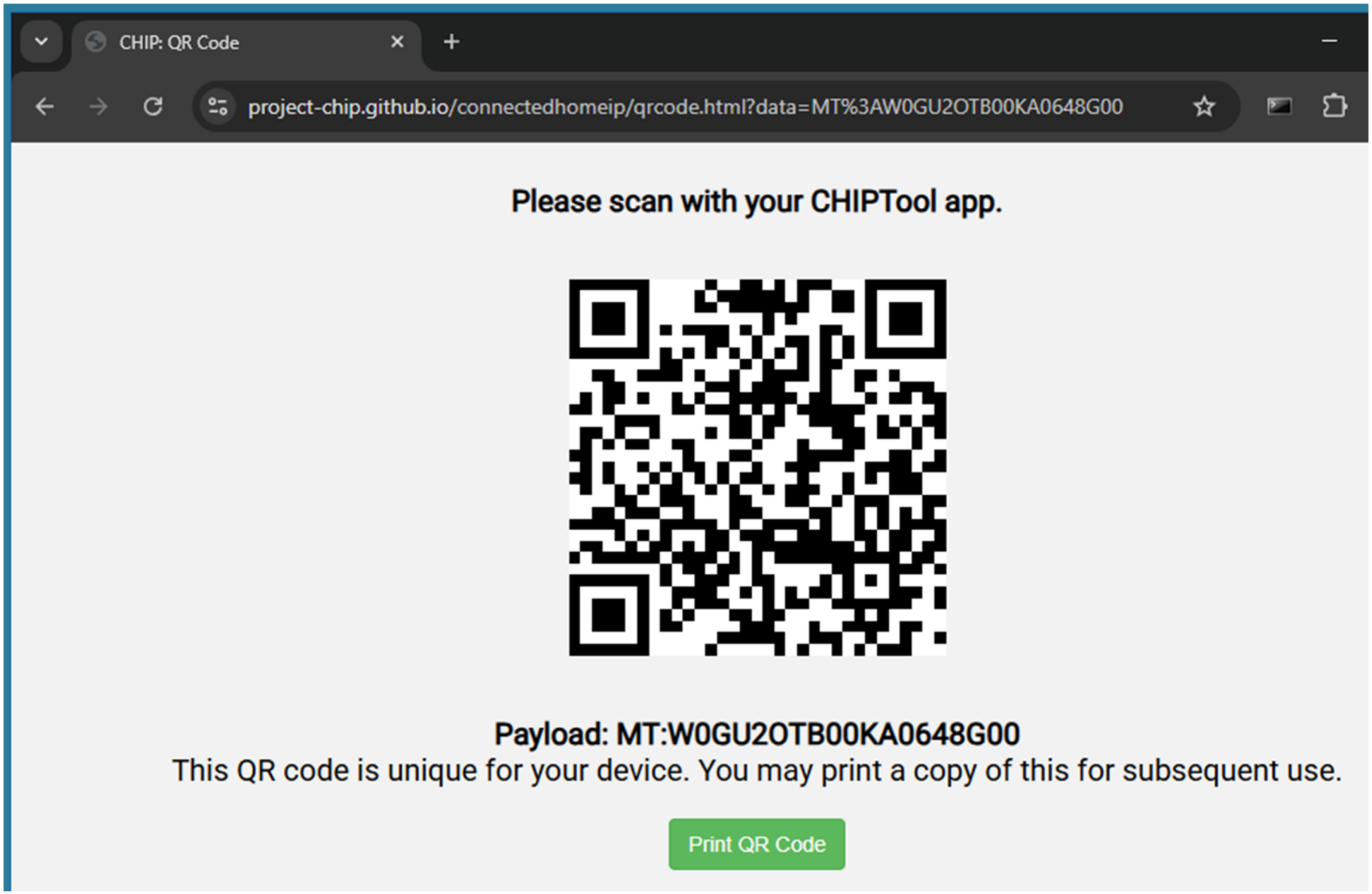
 # 13. Matter Shell Reference
https://project-chip.github.io/connectedhomeip-doc/examples/chef/README_SHELL.html
https://docs.espressif.com/projects/esp-matter/en/latest/esp32/developing.html#device-console

```
matter config

VendorId:        65521 (0xFFF1)
ProductId:       32768 (0x8000)
HardwareVersion: 0 (0x0)
PinCode:         20202021
Discriminator:   f00
Done
```

esp_matter_01.png

```
matter onboardingcodes none

QRCode:            MT:Y.K90-Q000KA0648G00
QRCodeUrl:         https://project-chip.github.io/connectedhomeip/qrcode.html?data=MT%3AY.K90-Q000KA0648G00
ManualPairingCode: 34970112332
Done
```

esp_matter_02.png

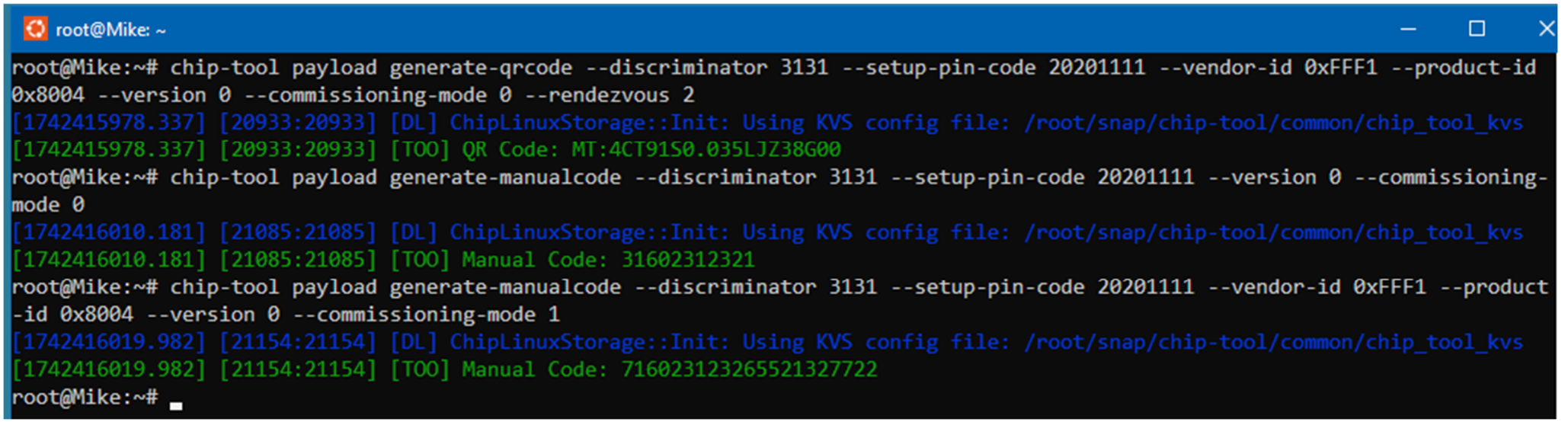


qrcode_01.png

```
matter dataset set active 0e080000000000010000000300000154a0300001735060004001fffe00208def5e21b6165cc560708fde61aeab4004131
0510001122334455667788899aabbccddeeff030f4f70656e5468726561642d32326339010222c90410a5e0c5822c1e723956af6b1ee43f084e0c0402a0
f7f8

Error: 47
```

esp_matter_03.png

 # 14. How to generate Matter Onboarding Codes (QR Code and Manual Pairing Code)
https://docs.espressif.com/projects/esp-matter/en/latest/esp32/faq.html#a1-9-how-to-generate-matter-onboarding-codes-qr-code-and-manual-pairing-code
~~~
```
#-- Generate the QR Code
chip-tool payload generate-qrcode --discriminator 3131 --setup-pin-code 20201111 --vendor-id 0xFFF1 --product-id 0x8004 --version 0 --commissioning-mode 0 --rendezvous 2

#-- Generates the short manual pairing code (11-digit)
chip-tool payload generate-manualcode --discriminator 3131 --setup-pin-code 20201111 --version 0 --commissioning-mode 0

#-- To generate a long manual pairing code (21-digit) that includes both the vendor ID and product ID, --commissioning-mode parameter must be set to either 1 or 2, indicating a non-standard commissioning flow
chip-tool payload generate-manualcode --discriminator 3131 --setup-pin-code 20201111 --vendor-id 0xFFF1 --product-id 0x8004 --version 0 --commissioning-mode 1
```
~~~



esp_chiptool_qrcode.png