

Teil I

Kernel

Kernel

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Ziele

Neuer **kernel** auf **BeagleBoneGreen**

- ▶ Download
- ▶ Setup
- ▶ Konfiguration
- ▶ Kompilation
- ▶ Installation

The Big Picture

grosses Projekt

Gegeben Eine grosse Anzahl *source* Files

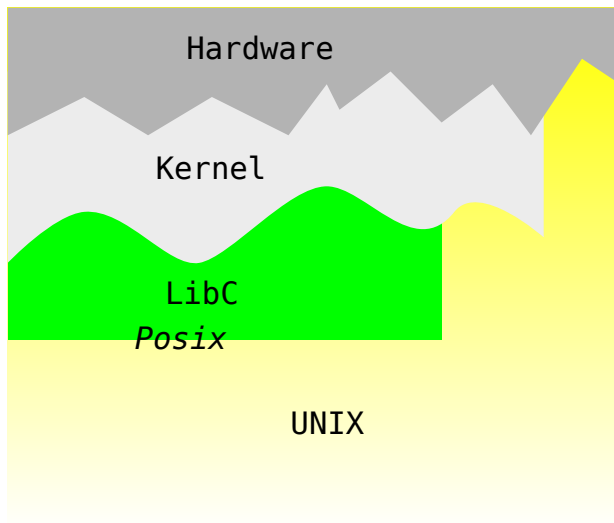
Gesucht 2 Files:

- ▶ das **Kernellimage**
- ▶ der *Devicetree*

Lösung Klassisches Verfahren

- ▶ Toolchain
- ▶ Makefile

Die Schichten



Kernel

Grosses Projekt

Was ist einfach ?

- ▶ **kernel** hängt nicht von anderen Software Komponenten ab
 - ▶ stand alone
- ▶ Braucht nur `make` und *toolchain*

Was ist schwierig ?

- ▶ Konfiguration
 - ▶ Wahl der richtigen *source* Files für das Image

`github.com/beagleboard/linux`

Mehrere Möglichkeiten

- ▶ das ganze git repository
- ▶ → nur die letzten n Versionen `--depth= n`
 - ▶ `git clone -b4.19 --depth=4 path_to_repository`
 - ▶ `git clone -b5.4 --depth=4 path_to_repository`
- ▶ zip File

Tools

toolchain sourceforge.net/projects/fhnw-tinl/files

- ▶ Download: → `tc-tinl-gcc-9.2.0-2019.10.09.tar.gz`
- ▶ Prefix: `arm-linux-gnueabihf-`
 - ▶ beschreibt:
 - ▶ Architektur: `armv7`
 - ▶ **A**pplication **B**inary **I**nterface: `gnueabihf`

make Normales `make`

- ▶ **kernel** Herstellung:
 - ▶ `make cmd`

Wo ist was ?

```
tinL
├── 5-kernel
│   ├── build ..... generated kernel files
│   │   ├── .config ..... die aktuelle Konfiguration
│   ├── tools ..... for making
│   │   ├── kernel.sh ..... wrapper to kernel Makefile
│   ├── config
│   │   ├── config.sh ..... for kernel.sh
│   │   ├── kernel.config ..... 'gute' kernel Konfiguration
│   ├── tc ..... link to toolchain
├── resources
│   ├── beaglebone-black
│   │   ├── linux ..... the source tree
```

Erste Konfiguration

- ▶ Hilfe
 - ▶ `./tools/kernel.sh help`
- ▶ Vordefinierte Konfiguration
 - ▶ `./tools/kernel.sh bb.org_defconfig`
- ▶ Anpassung der Konfiguration
 - ▶ `./tools/kernel.sh menuconfig`
 - ▶ `./tools/kernel.sh xconfig`

Kompilation

- ▶ `./tools/kernel.sh zImage`
 - ▶ erzeugt `build/arch/arm/boot/zImage`
- ▶ `./tools/kernel.sh dtbs`
 - ▶ erzeugt `build/arch/arm/boot/dts/am335x-boneblack-wireless.dtb`
Devicetree

Remark: *Devicetree* später behandelt

Installation auf SD-Card

► Kopiere

Image build/arch/arm/boot/zImage

Devicetree build/arch/arm/boot/dts/am335x-boneblack-wireless.dtb
auf

► SD-Card Partition 2:Root File System

```
/ ..... Partition 2
├── boot
│   ├── zImage
│   └── am335x-boneblack-wireless.dtb
```

Workflow

schrittweise Herstellung

0 Setup der Toolchain

1 Default Konfiguration (falls vorhanden)

▶ `sh tools/kernel.sh bb.org_defconfig`

2 Herstellung

▶ `tools/kernel.sh zImage`

3 Transfer/Start/Test auf **BeagleBoneGreen**

▶ Partition 2 `/boot/`

4 (Re)Konfiguration

▶ `sh tools/kernel.sh menuconfig`

→ 2 `ev. cp build/.config config/kernel.config`

Workflow

▶ **BeagleBoneGreen** *default* Konfiguration

- ▶ herstellen
- ▶ auf SD-Karte
- ▶ ausprobieren

▶ Die *default* Konfiguration ändern:

- ▶ Internet über USB:

Device Drivers

└─ USB support

└─ USB Gadget Support

└─ USB Gadget Drivers

- ▶ nur eine CPU
- ▶ keine ALSA Soundkarte
- ▶ ...

Die beteiligten Files

- ▶ `zImage` der *kernel*
- ▶ `am335x-boneblack-wireless.dtb` der *device tree*

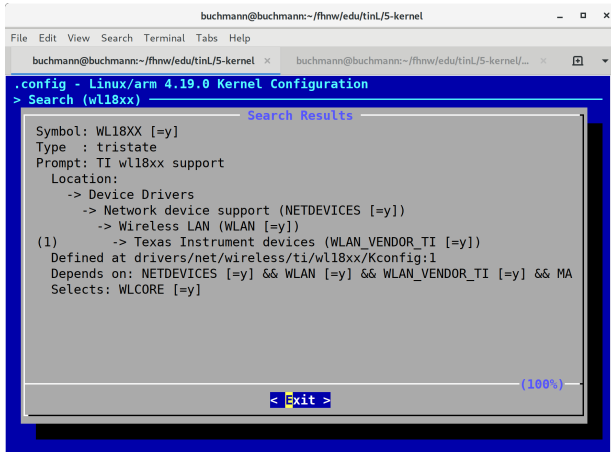
Teil II

WiFi-Kernel

Konfiguration für WiFi

- ▶ Kern konfigurieren
 - ▶ firmware
- ▶ WiFi aufsetzen
 - ▶ Siehe **3-network** Wi-Fi

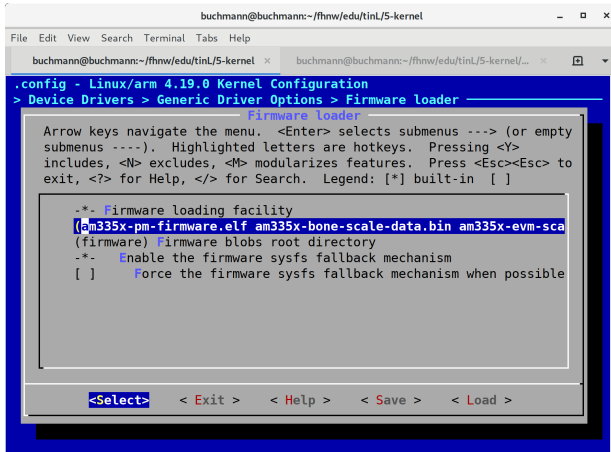
Konfiguration Driver



The screenshot shows a terminal window titled "buchmann@buchmann: ~/fhnw/edu/tinL/5-kernel". The terminal is running the "Linux/arm 4.19.0 Kernel Configuration" tool. The user has entered the search term "wl18xx". The search results are displayed in a box with a "Search Results" header. The results show the symbol "WL18XX" is a tristate option located under "Device Drivers" -> "Network device support (NETDEVICES [=y])" -> "Wireless LAN (WLAN [=y])" -> "Texas Instrument devices (WLAN_VENDOR_TI [=y])". It is defined at "drivers/net/wireless/ti/wl18xx/Kconfig:1", depends on "NETDEVICES [=y] && WLAN [=y] && WLAN_VENDOR_TI [=y] && MA", and selects "WLCORE [=y]". At the bottom of the search results box, there is a "(100%)" indicator and a "< Exit >" button.

```
buchmann@buchmann: ~/fhnw/edu/tinL/5-kernel
File Edit View Search Terminal Tabs Help
buchmann@buchmann: ~/fhnw/edu/tinL/5-kernel x buchmann@buchmann: ~/fhnw/edu/tinL/5-kernel/... x
.config - Linux/arm 4.19.0 Kernel Configuration
> Search (wl18xx)
Search Results
Symbol: WL18XX [=y]
Type : tristate
Prompt: TI wl18xx support
Location:
-> Device Drivers
-> Network device support (NETDEVICES [=y])
-> Wireless LAN (WLAN [=y])
(1) -> Texas Instrument devices (WLAN_VENDOR_TI [=y])
Defined at drivers/net/wireless/ti/wl18xx/Kconfig:1
Depends on: NETDEVICES [=y] && WLAN [=y] && WLAN_VENDOR_TI [=y] && MA
Selects: WLCORE [=y]
(100%)
< Exit >
```

Konfiguration Firmware



The screenshot shows a terminal window titled "buchmann@buchmann: ~/fhnw/edu/tinL/5-kernel". The terminal displays the "Linux/arm 4.19.0 Kernel Configuration" menu. The navigation path is "> Device Drivers > Generic Driver Options > Firmware loader". The "Firmware loader" sub-menu is open, showing instructions and configuration options. The option "am335x-pm-firmware.elf am335x-bone-scale-data.bin am335x-evm-sca" is highlighted. The bottom of the window shows navigation buttons: "< Select >", "< Exit >", "< Help >", "< Save >", and "< Load >".

```
buchmann@buchmann: ~/fhnw/edu/tinL/5-kernel
File Edit View Search Terminal Tabs Help
buchmann@buchmann: ~/fhnw/edu/tinL/5-kernel x buchmann@buchmann: ~/fhnw/edu/tinL/5-kernel/... x
.config - Linux/arm 4.19.0 Kernel Configuration
> Device Drivers > Generic Driver Options > Firmware loader
    Firmware loader
    Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty
    submenus ----). Highlighted letters are hotkeys. Pressing <Y>
    includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to
    exit, <?> for Help, </> for Search. Legend: [*] built-in [ ]

    -* Firmware loading facility
    [am335x-pm-firmware.elf am335x-bone-scale-data.bin am335x-evm-sca
    (firmware) Firmware blobs root directory
    -* Enable the firmware sysfs fallback mechanism
    [ ] Force the firmware sysfs fallback mechanism when possible

    < Select >  < Exit >  < Help >  < Save >  < Load >
```

Wi-Fi aufsetzen

- ▶ target-root-2018.10.24.tar.gz auf Partition 2 der SD Karte
- ▶ eigener *kernel* auf Partition 2 der SD Karte `/boot`
- ▶ Siehe **3-network**

Wi-Fi

Basics

- ▶ **3-network** Seite 14

Connect

- ▶ **3-network** Seite 15

Internet

- ▶ **3-network** Seite 16: `udhcpc -i wlan0`
- ▶ **3-network** Seite 12: route, DNS