

# „Open- Source“ embedded GNU/Linux Plattformen

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# Roter Faden

- Das Thema
- Anwendungsgebiete
- Der Wandel / Der Boom
- Anforderungen
- Mikrocontroller Schnittstellen
- Projekte / Boards

# Das Thema

„Open- Source“

embedded

GNU/Linux

Plattformen

# Open-Source

- HW vs. SW
- Produktionen
- Firmen / Gründer / Community
- Gemeinnützig
- Lizenzen?
- Layout / Daten
- Eigenbau Versionen?

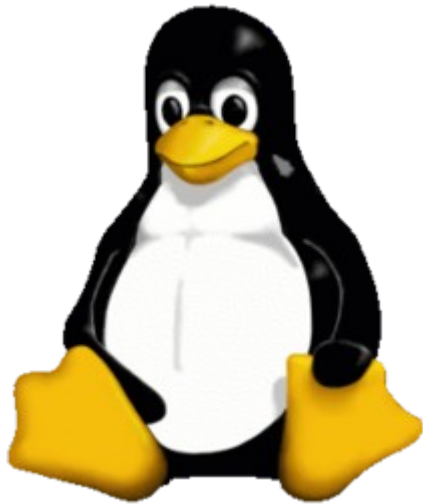


# embedded



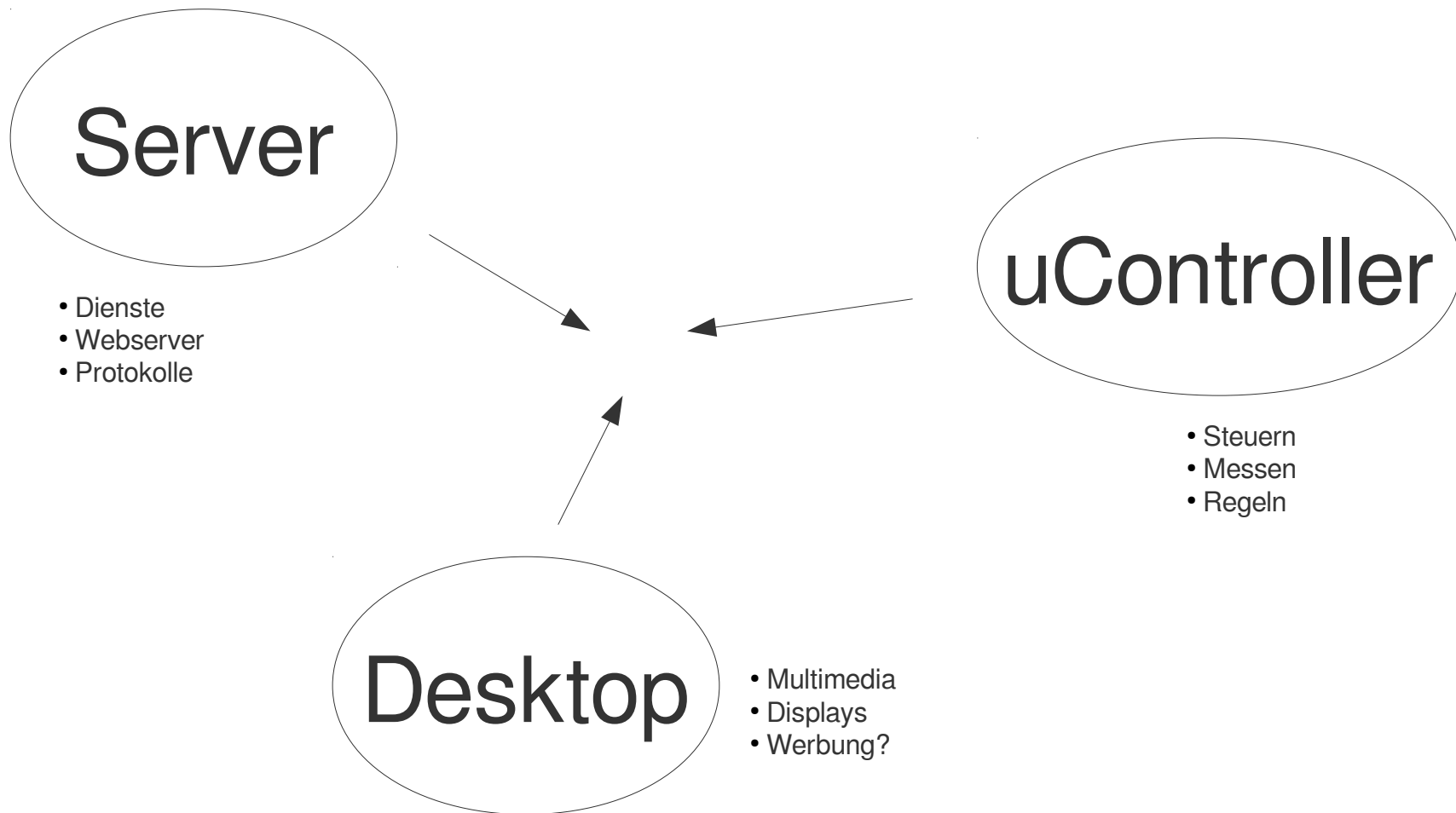
- Im Gerät verbaut
- eingebettet
- Im Hintergrund
- Typischer Mikrocontroller

# GNU/Linux



- Früher 32 Bit / ARM7
- Ethernet / 8-Bit mit Netzwerk
- ca. bis zu 100 MHz
- UcLinux
- „RTOS“ Ersatz
- Vorteil bei grafischen Displays

# Anwendungsgebiete



# Der Wandel: Beginn

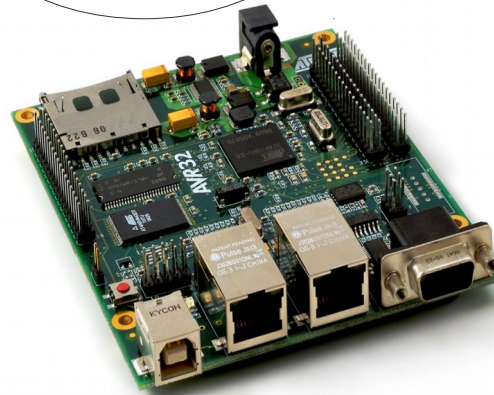
ARM9

OpenMoko

OpenWrt

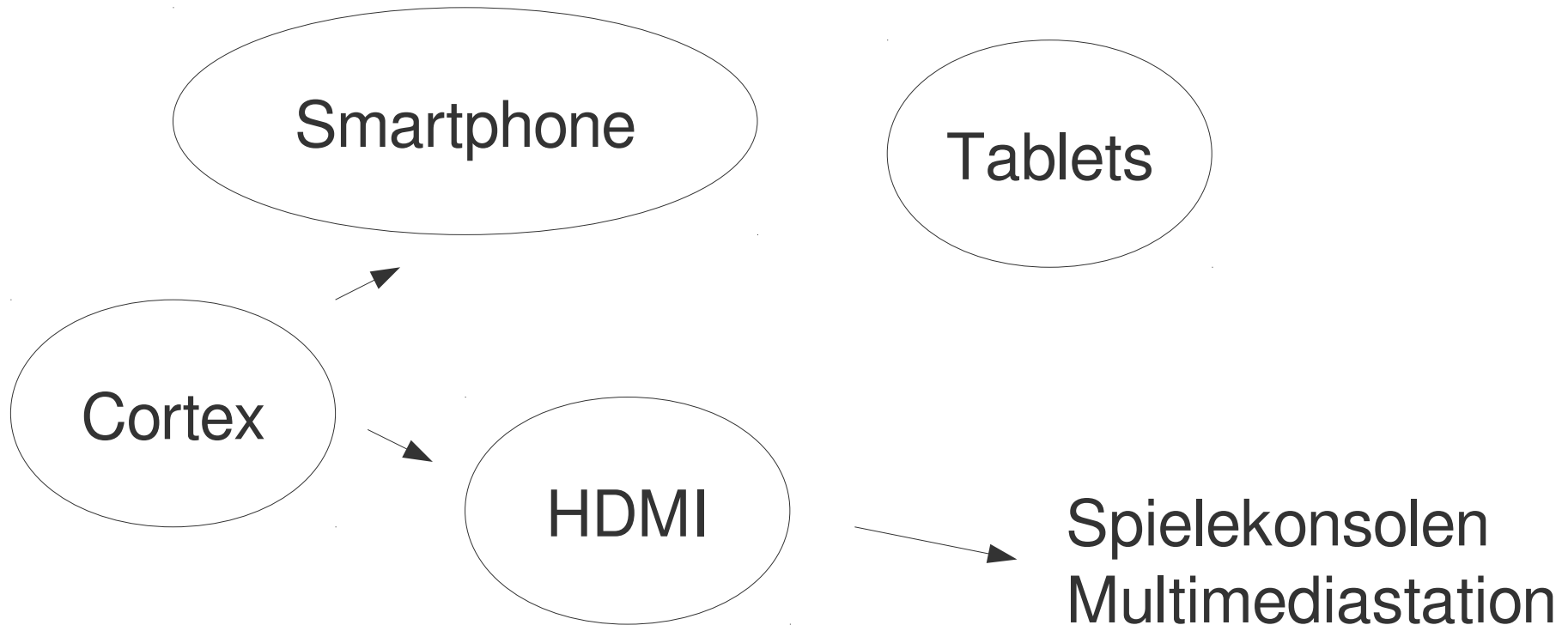
Grasshopper

NGW100





# Der Boom



**Wohnzimmer PC** stirbt aus → Dafür Embedded System

# Anforderungen

- Multicore
- 3D Grafik
- HDMI
- RAM, RAM, RAM
- ...

➔ Performance

- GPIO
- AD-Wandler
- I2C, SPI
- CAN
- Stromverbrauch

➔ Stabilität

(Widerspruch?)

# Mikrocontroller vs. Desktop?

- MMU
- Virtualisierung
- Multicore
- Power-Management
- ...

# Prozessor Hersteller

- Freescale
- ST
- Texas Instruments
- Atmel
- NXP
- Infineon
- Allwinner
- ...

# Komponenten

- Prozessor
- SRAM / Cache
- Arbeitsspeicher / SDRAM / DDRx / z.T. 3D
- NAND / NOR
- Reset Controller
- Spannungen 3.3V 1.8V 1.2V (z.T. inkl. Akku)
- Schnittstellen: RJ45, USB, HDMI, SATA, ..
- Industrial (CAN, Realtime Ethernet, ...)
- Serielle Konsole
- JTAG
- ...

BOM, BOM, BOM, ...

# Boards

- Open-Source Hardware → Marktanalyse
- Status Quo - aktueller Hype – Warum?
- RaspberryPi & Co. → Erfolge? Woher?

# Marktübersicht

- Cubieboard
- Wandboard
- BeagleBlack Bone
- RaspberryPI
- GNUBLIN
- Gumstix
- Olimex
- PcDuino
- Chumby Hack Board

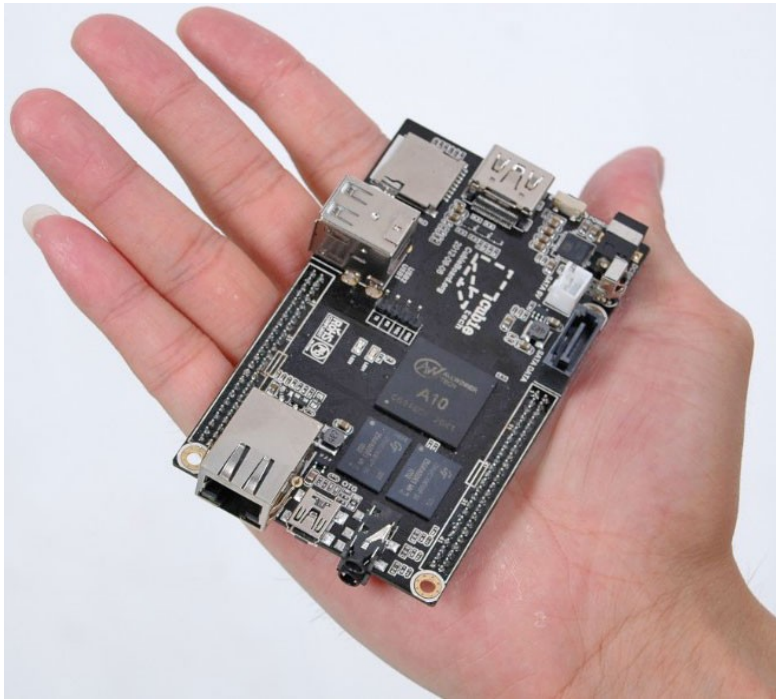


Cheap Hardware



Open-Source Hardware

# Cubieboard



- 1G ARM cortex-A8 processor, NEON, VFPv3, 256KB L2 cache
- Mali400, OpenGL ES GPU
- 512M/1GB DDR3 @480MHz
- HDMI 1080p Output
- 10/100M Ethernet
- 4Gb Nand Flash
- 2 USB Host, 1 micro SD slot, 1 SATA, 1 ir
- 96 extend pin including I2C, SPI, RGB/LVDS, CSI/TS, FM-IN, ADC, CVBS, VGA, SPDIF-OUT, R-TP..
- Running Android, Ubuntu and other Linux distributions



# Cubieboard

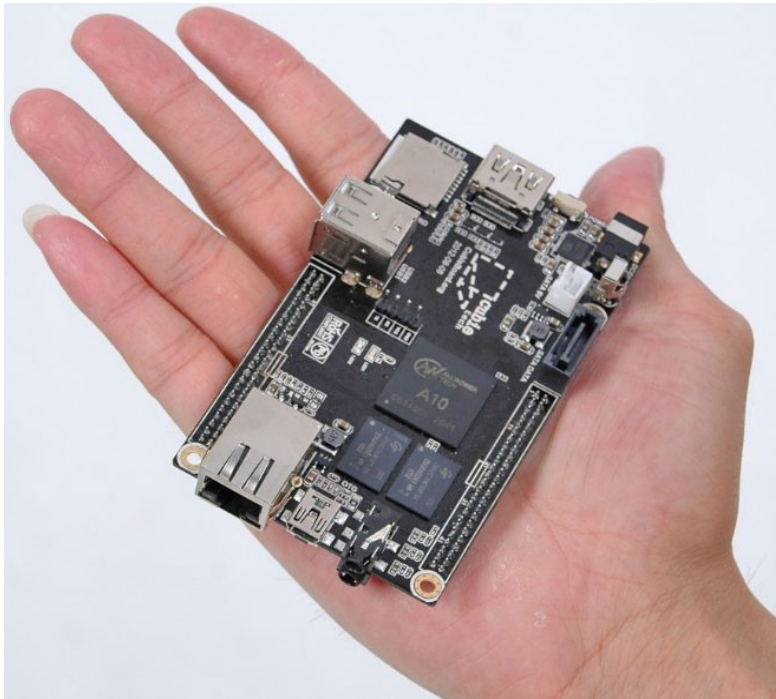


Bild von <http://www.tonymacx86.com/>

- **Produktionen**  
Shenzhen, China
- **Firmen / Gründer / Community**  
Tom Cubie and some of his friends.
- **Gemeinnützig**  
Cubietech Limited
- **Lizenzen**  
????????
- **Layout / Daten → Wohl nicht**
- **Eigenbau Versionen? → Nein**

<http://cubieboard.org/>

ca. 60 EUR

# Wandboard



Freescale i.MX6 Solo

Cortex-A9 Single core

Cortex-A9 Dual core

512 MB DDR3

1 GB DDR3

<http://www.wandboard.org/>

70-90 EUR

Certainly. Feel free to design your project around the Wandboard.  
You can either use the Wandboard module + the interface board or you can create a custom interface/connector board to fit into your enclosure



# RaspberryPi



- ARM11 700 MHz
- 35 Dollar
- Netzwerk / HDMI / USB
- Nachteil: Kein Netzteil
- Firma Broadcom
- Farnell / RS-Component
- GPU / Datenblatt NDA

<http://www.raspberrypi.org>

# pcDunio



pcDunio is a mini PC platform that runs PC like OS such as Ubuntu and Android ICS. It outputs screen to HDMI. Moreover, it has hardware headers interface compatible with Arduino. pcDunio can be used to teach Python, C and more interesting stuff.

A Mini PC with Arduino type Interface powered by ARM Pro  
Spec: CPU: 1GHz ARM Cortex  
A8 GPU: OpenGL ES2.0,  
OpenVG 1.1 Mali 400 core

<http://www.pcdunio.com/>

Lizenz?

# Allwinner

- Cortex A8
- Allwinner A10 bzw. A13 (SATA, HDMI)
- China-based fabless semiconductor company
- Hackberry
- pcDuino
- Marsboard
- OLinuxXino

# BeagleBlack Bone

AM335x 1GHz ARM® Cortex-A8



## Hardware Specs and Materials

Browse the [BeagleBone Black wiki](#) to find all available hardware specifications such as:

- Bill of Materials
- PCB Files
- MFG Files
- Schematic (PDF)
- Schematic (OrCAD)
- System Reference Manual

[Rev A5A](#)

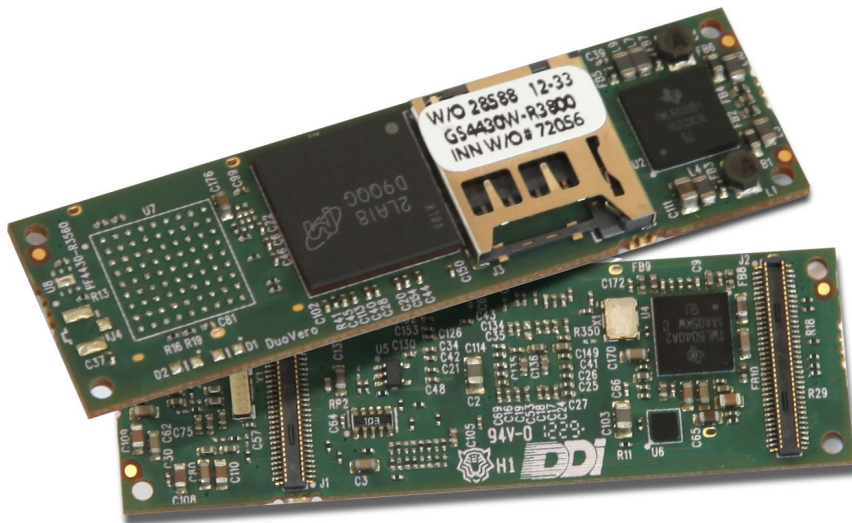
[Rev A4](#)

<http://beagleboard.org/>



# Gumstix

- Bekannte Boards
- Moderne Prozessoren
- Steckkontakte
- Höhere Preisklasse



<http://www.gumstix.com>

# Chumby Hacker Board



- Embedded System
- Gute Beschriftung
- 2.54 Raster Stiftleisten
- Freescale Prozessor

## Schematics

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[Hackerboard Schematics \(PDF\)](#) 

[Updated hackerboard schematics \(PDF\)](#) 

## Layout Files

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[Hackerboard Gerbers](#) 

[Hackerboard Source](#)  in the preferred form for modification by the designer (Altium DXP)

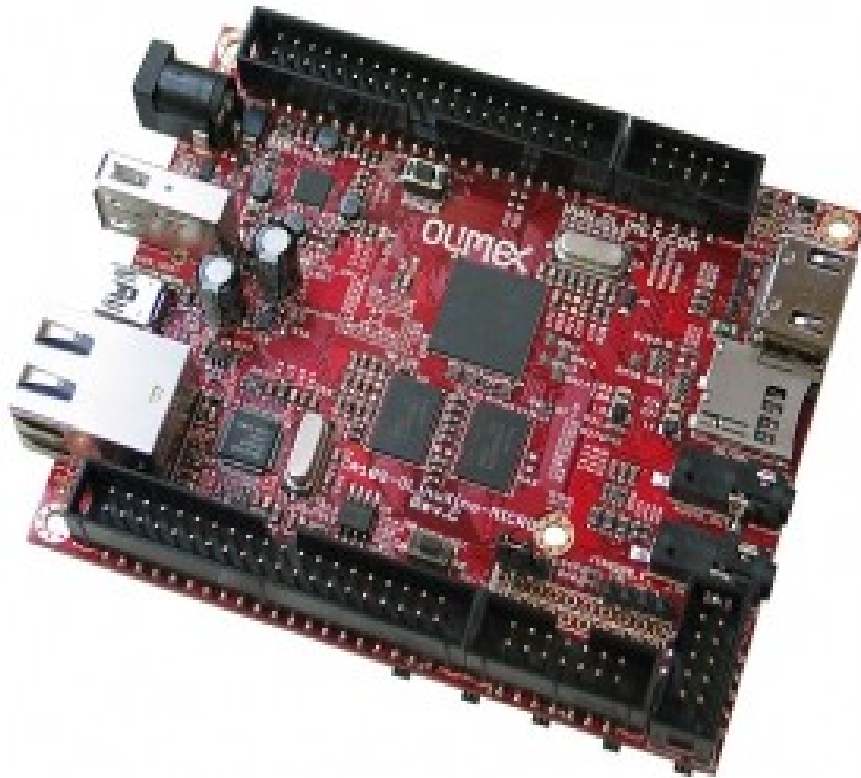
[Hackerboard Source \(updated\)](#) 



[http://wiki.chumby.com/index.php?title=Chumby\\_hacker\\_board](http://wiki.chumby.com/index.php?title=Chumby_hacker_board)



# Olimex

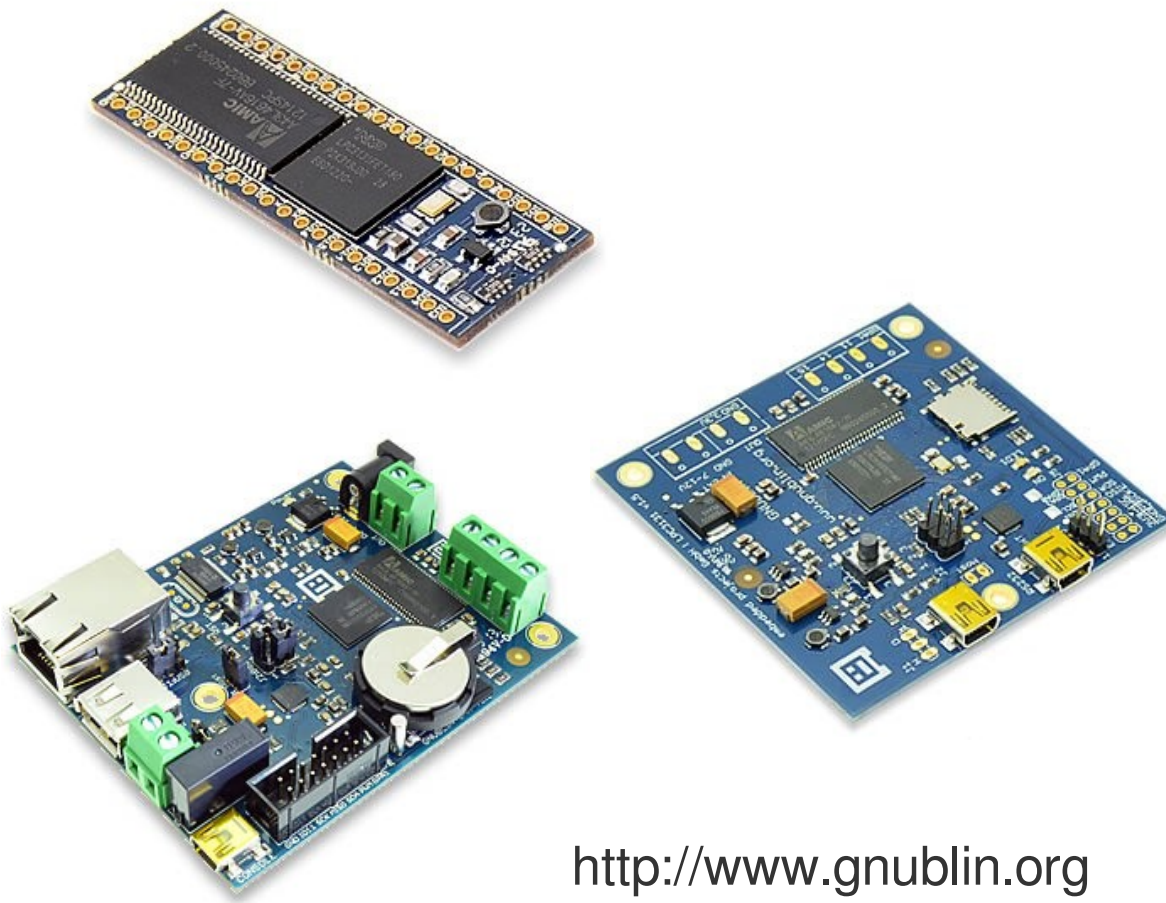


- Bekannte Firma
- Bulgarien mit eigener Produktion
- Offene Schaltpläne
- Eagle Dateien z.T.

<http://www.olimex.com>



# GNUBLIN



- Mikrocontroller Ersatz
- Ausbildung
- Eagle Layouts
- Produktion Augsburg
- Kundenspezifische

<http://www.gnublin.org>



# Zusammenfassung

- Geschichte / Leute hinter dem Board nicht vergessen!
- Produktion
- Open-Source Ethik ....
- Fragen?