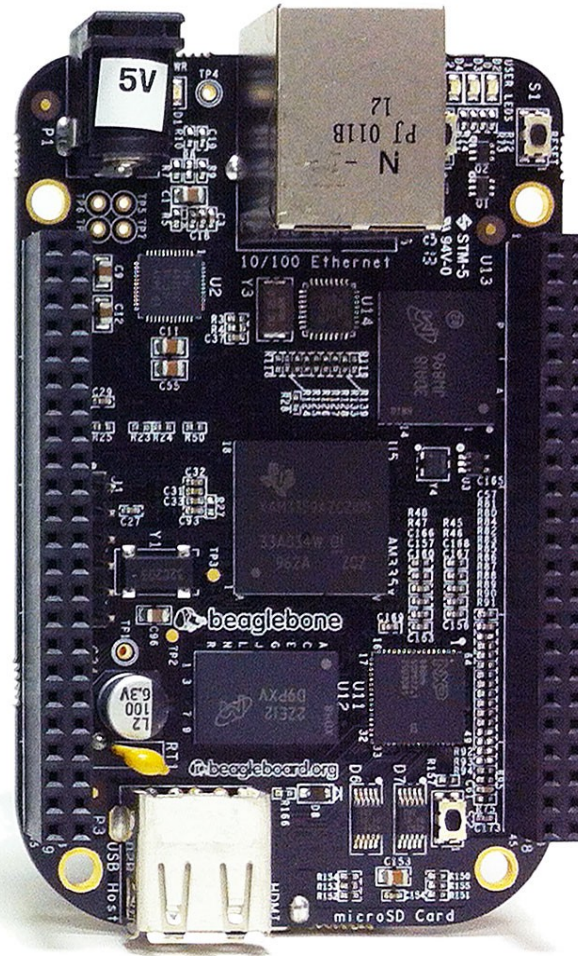
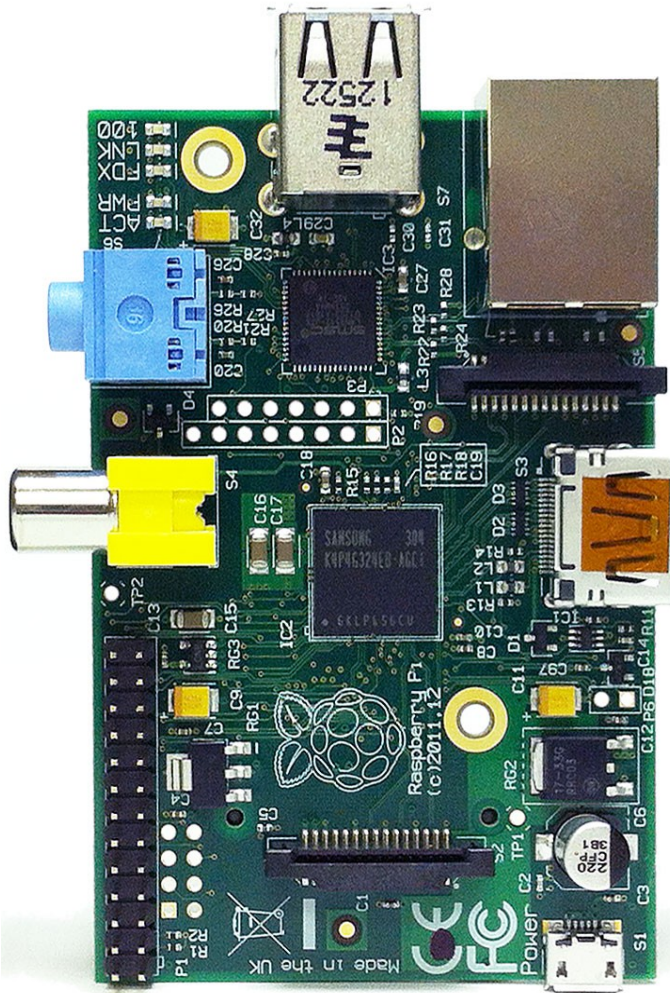


Raspberry Pi & Co



Die Konkurrenten

	Raspberry Pi	Beaglebone Black	Ricomagic MK802 II
Prozessor	700 MHz ARM1176JZFS (ARMv6) + Videocore	1GHz TI Sitara AM3359 ARM Cortex A8 (ARMv7)	CPU 1GHz Cortex-A8 (ARMv7)
Speicher	SD extern	2 GB intern eMMC, MicroSD extern	4GB intern, MicroSD extern
RAM	512 MB SDRAM	512 MB DDR3	1024 MB DDR3
Video / max. Auflösung	1 HDMI, 1 Composite 1920×1200	1 Micro-HDMI 1280×1024	1 HDMI 1090p (HDTV)
Betriebssystem mitgeliefert	Raspbian (Debian)	Angstrom (OpenWRT)	Android
GPIO-Pins	16	65	-
Peripherie	2 USB Hosts, 1 Micro-USB Power, 1 10/100 Mbps Ethernet, RPi camera connector	1 USB Host, 1 Mini-USB Client, 1 10/100 Mbps Ethernet	2 USB WiFi 802.11 b/g/n
Preis €:	34	50	59 (31 China)
Anmerkungen:	riesige Community	der Schnellste	Linux auf MicroSD möglich, aber schlecht gewartet

Ausgangssituation

Für Anwender...

~~RS232-Interface, Parallelport, USB~~

Betriebssystem verbirgt Hardware

Software grafikorientiert

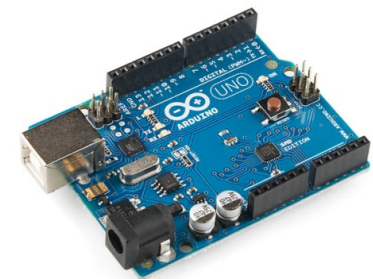


Für Entwickler ...

Digitale/analogue I/O-Ports

Direkter Hardwarezugriff

Software textbasiert



7 Reasons To Get A Raspberry Pi

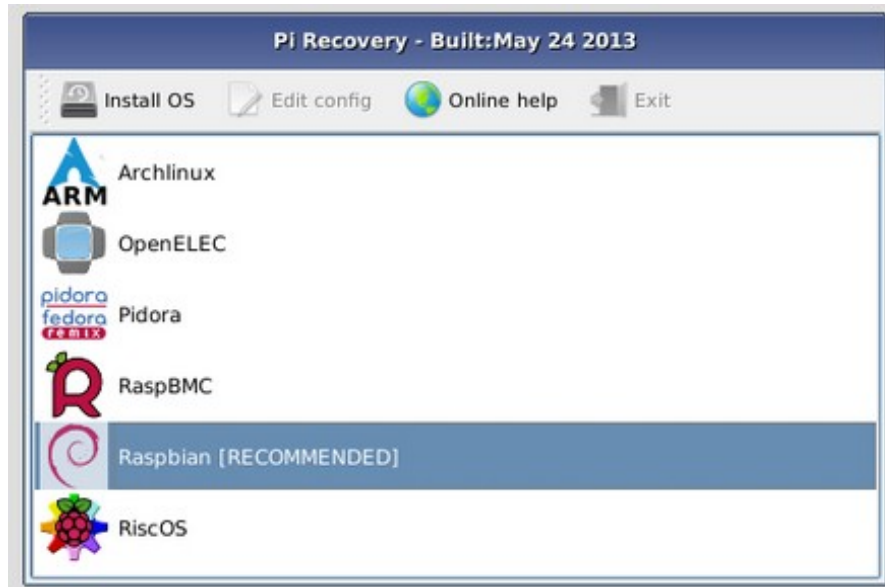
1. It's Cheap!
2. It's Tiny
3. The Pi Can Run A Variety Of Operating Systems
4. The Raspberry Pi Is Really Versatile
5. Play Video And View Photos With The Pi
6. You Can Overclock It
7. You Can Play Games



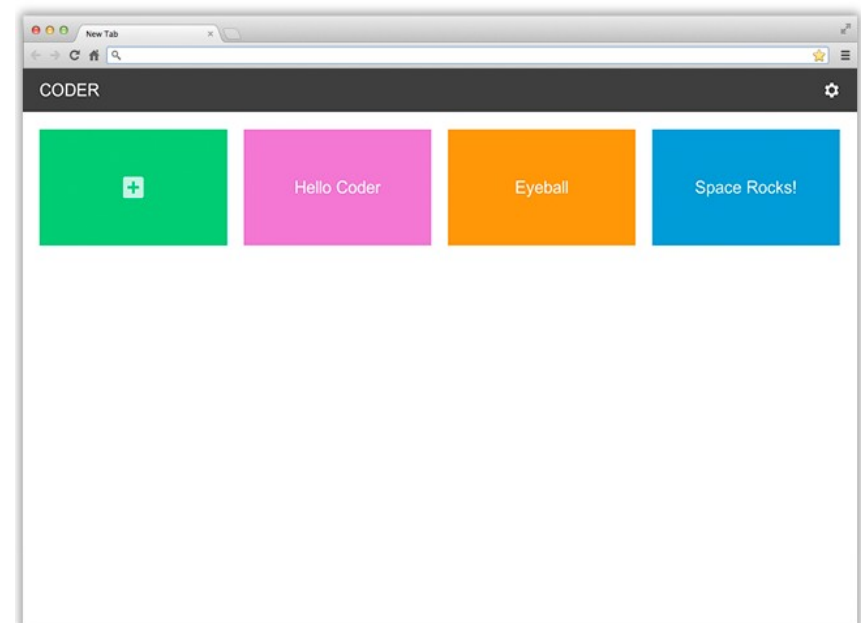
(Quelle: <http://www.makeuseof.com/>)

Linux-Distributionen

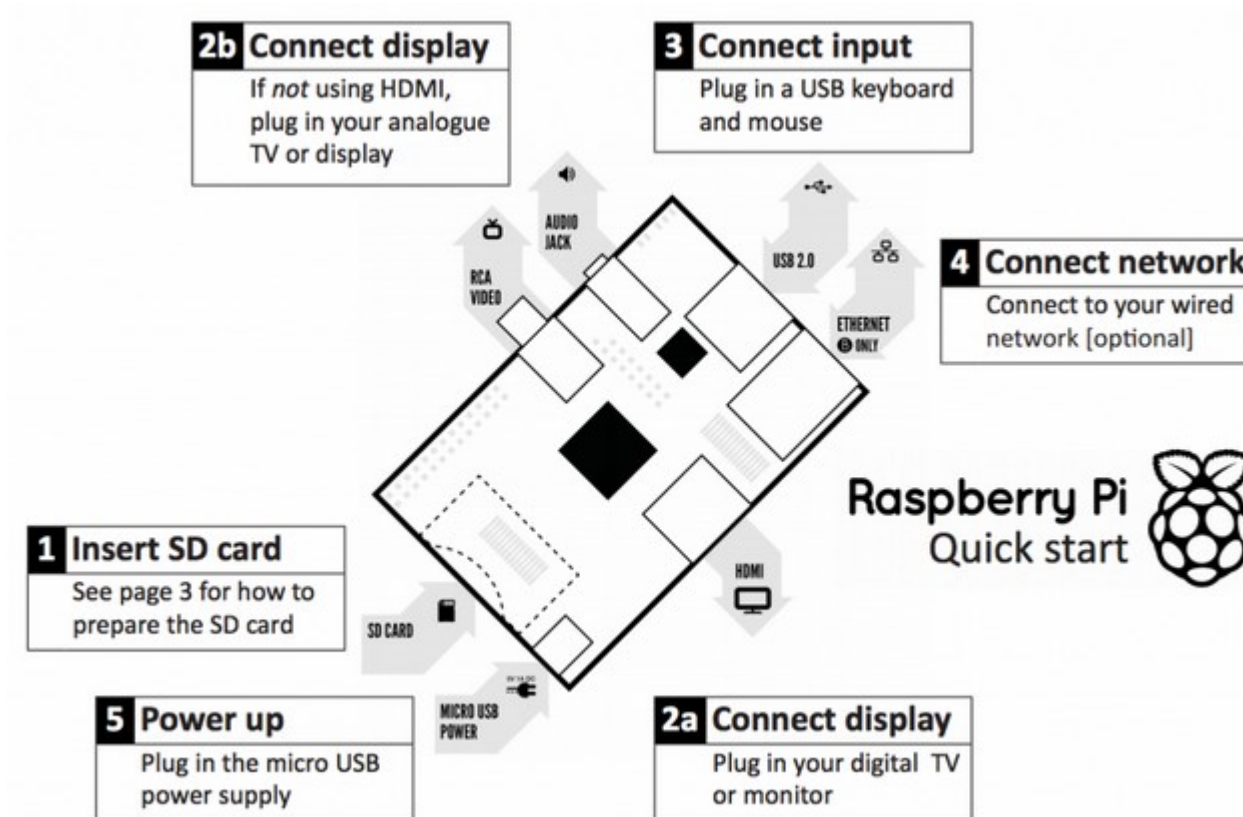
- NOOBS (New Out of Box Software)



- Einzel-Images:
Raspbian, Arch, RISC OS, Pidora
Multimedia: RaspBMC, OpenELEC
HTML, CSS, JS: Google Coder



Auf die Plätze, fertig, los...



raspi-config

```
Raspberry Pi Software Configuration Tool (raspi-config)
Setup Options

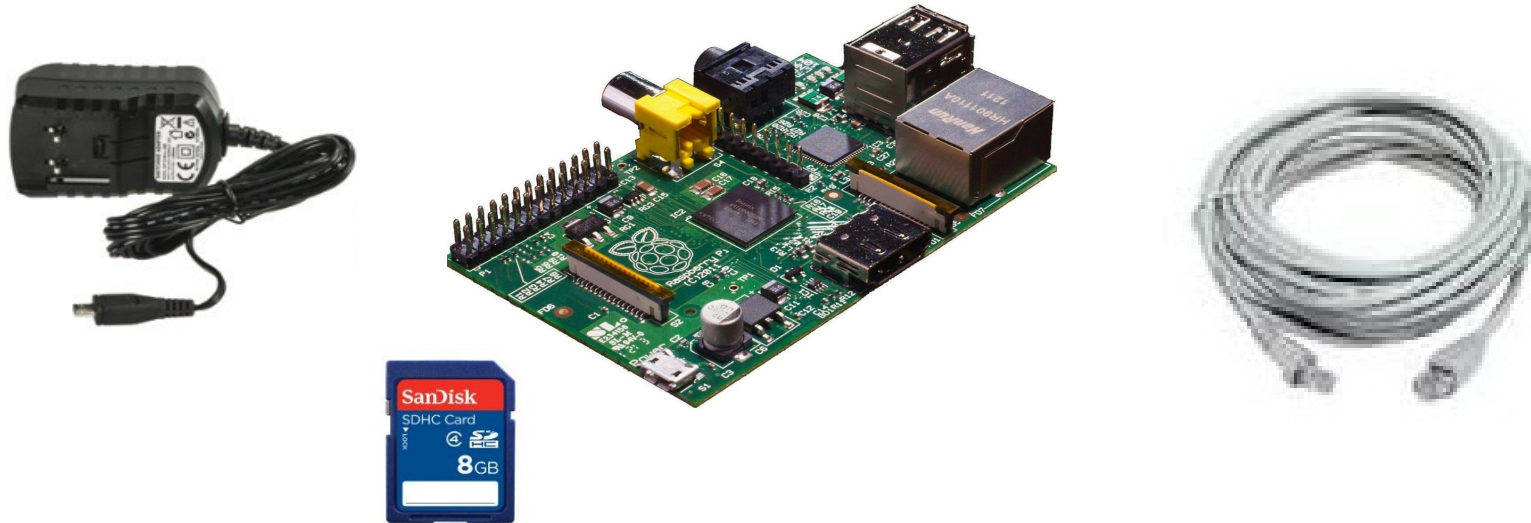
1 Expand Filesystem          Ensures that all of the SD card sto
2 Change User Password       Change password for the default use
3 Enable Boot to Desktop     Choose whether to boot into a deskt
4 Internationalisation Options Set up language and regional settin
5 Enable Camera              Enable this Pi to work with the Ras
6 Add to Rastrack            Add this Pi to the online Raspberry
7 Overclock                  Configure overclocking for your Pi
8 Advanced Options           Configure advanced settings
9 About raspi-config         Information about this configuratio

<Select>                    <Finish>
```

Einstellungen: Login, Rechnername, grafisch/Textmodus, Tastaturlayout, SSH-Server, Übertakten ...



Raspi-Betrieb „kopflos“



geringer Platzbedarf
wenig Serviceaufwand
ideal im Klassenzimmer
aber ...



...wie finde ich meinen Raspi?

- SSH-Server läuft auf Raspbian:

```
nmap 172.16.63.0/24 -p 22 *
```

- hostname neu setzen:

```
raspi-franzl.ads.bulme.intern **
```

- avahi-daemon (Zeroconf/Bonjour)

```
raspi-franzl.local *
```

- Serielle Konsole (Adapterkabel USB-Raspi-UART)

* Linux, MacOS – auf Windows Extrainstallation

** /etc/dhcp/dhclient.conf modifizieren: fqdn.fqdn=gethostname()

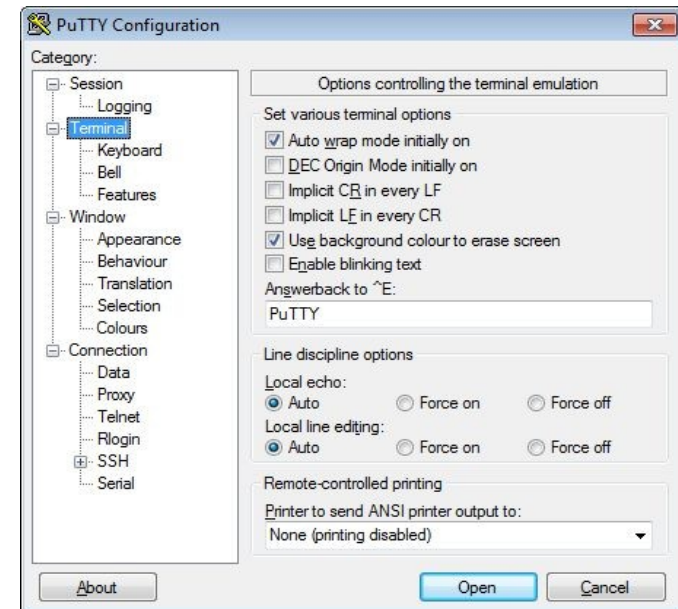


Remote-Verbindung übers Netz

- Textbasiert:

SSH-Client putty (Windows)

Terminal (Linux, Apple)



- Grafischer Desktop:

Remote Desktop (Windows)

VNC (plattformübergreifend)



Programmiersprachen onboard

- bash

```
grep 't=' /sys/bus/w1/devices/w1_bus_master1/10-000802906658/w1_slave\  
| awk -F 't=' '{print $2/1000}'
```

- Python

```
def read_temp_raw():  
    f = open(device_file, 'r')  
    lines = f.readlines()  
    f.close()  
    return lines
```

- C/C++

```
for (;;) {  
    digitalWrite (OK_LED, HIGH) ;           // On  
    delay (500) ;                           // mS  
    digitalWrite (OK_LED, LOW) ;            // Off  
    delay (500) ;  
}
```

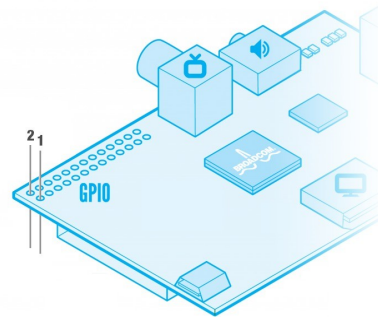
GPIO-Pins

120

GLK

Clock signals are used to provide a pulse that can synchronise different parts of a system that perform actions which are time sensitive to each other.

GPCLK0 is a general purpose clock that generates a square-wave clock signal up to a maximum frequency of around 75MHz.



		3V3	1	2	5V0			
	I ² C	GPIO 2	SDA0	3	4	5V0		
		GPIO 3	SCL0	5	6	GND		
<i>Original (Rev 1) Raspberry Pi users:</i> The original Raspberry Pi had slightly different GPIO pin numbering. GPIO 2 was GPIO 0, GPIO 3 was GPIO 1, and GPIO 27 was GPIO 21.	CLK	GPIO 4	GPCLK0	7	8	TXD	GPIO 14	
					9	RXD	GPIO 15	
				GND	10			
			GPIO 17	P17	11	12	PWM	GPIO 18
			GPIO 27	P27	13	14	GND	
			GPIO 22	P22	15	16	P23	GPIO 23
		3V3	17	18	P24	GPIO 24		
	SPI	GPIO 10	MOSI	19	20	GND		
		GPIO 9	MISO	21	22	P25	GPIO 25	
		GPIO 11	SCLK	23	24	CE0	GPIO 8	
		GND	GND	25	26	CE1	GPIO 7	

On very quickly, typically thousands of times a second.

Often used to read more complicated sensors, displays, or communicate between devices.

Serial Peripheral Interface Bus (SPI) is a synchronous (two way) serial connection. Communication between a master device and slave device with device providing synchronisation.

The data is transmitted on the MOSI (master-out) and MISO pins (master-in, slave-out) pins. Each

Original (Rev 1) Raspberry Pi users:
The original Raspberry Pi had slightly different GPIO pin numbering. GPIO 2 was GPIO 0, GPIO 3 was GPIO 1, and GPIO 27 was GPIO 21.

The data is transmitted on the MOSI (master-out, slave-in) and MISO pins (master-in, slave-out) pins. Each transmission is synchronised by a clock pulse on SCLK.

Beispiel: Kompassmodul

I2C-Bus Kompassmodul HDMM01

Treiber laden:

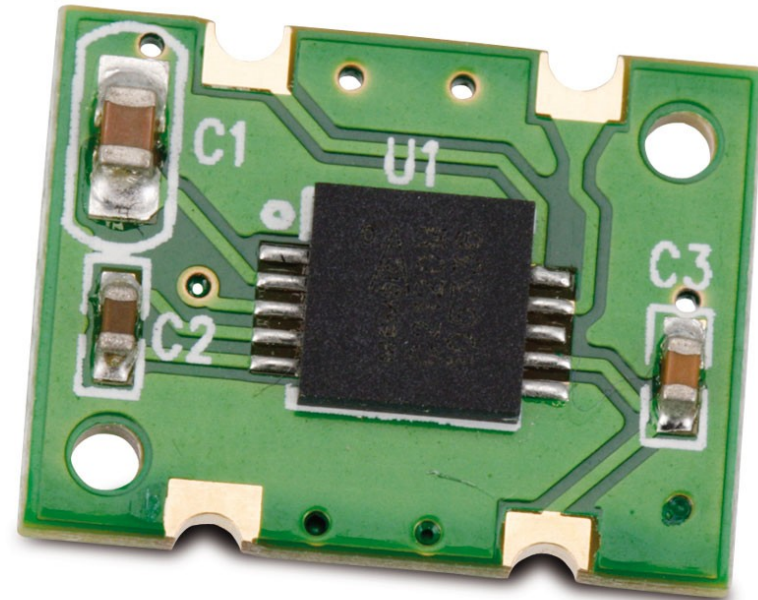
```
modprobe i2c-bcm2708  
modprobe i2c-dev
```

Wo ist mein Modul (i2c-tools)?

```
i2cdetect -y 1
```

Koordinaten auslesen:

```
i2cset -y 1 0x30 0x00  
i2cset -y 1 0x30 0x00 0x01  
sleep 0.1  
i2cset -y 1 0x30 0x00  
dummy=$(i2cget -y 1 0x30)  
xh=$(i2cget -y 1 0x30)  
xl=$(i2cget -y 1 0x30)  
yh=$(i2cget -y 1 0x30)  
yl=$(i2cget -y 1 0x30)
```

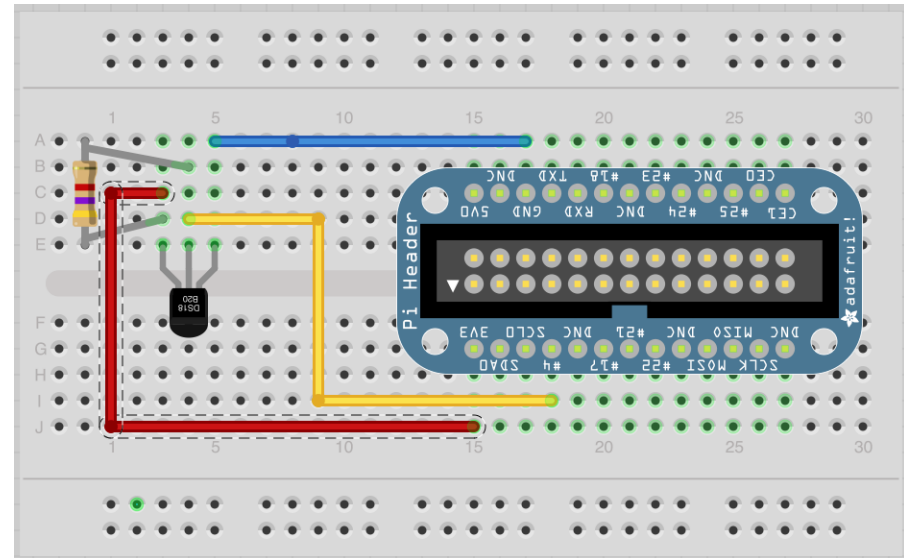


Beispiel: Temperaturmessung

1-Wire Temperatursensor DS18S20

Hardwaremäßig nicht
direkt unterstützt

Steuerung des GPIO4-Pins
mittels Kernelsreiber (Bit-
Banging)



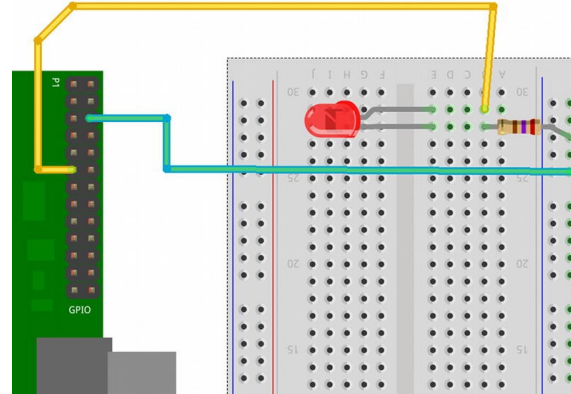
```
sudo modprobe modprobe w1_gpio w1_therm

find /sys/devices/w1_bus_master1/ -name "w1_slave"
/sys/devices/w1_bus_master1/10-000802906658/w1_slave

cat /sys/devices/w1_bus_master1/10-000802906658/w1_slave
2d 00 4b 46 ff ff 06 10 22 : crc=22 YES
2d 00 4b 46 ff ff 06 10 22 t=22375
```

Beispiel: LEDs blinken lassen

GPIO Ausgang:
3,3V / max. 50 mA



wiringPi Pin-Nummern:

P1: The Main GPIO connector						
WiringPi Pin	BCM GPIO	Name	Header	Name	BCM GPIO	WiringPi Pin
		3.3v	1 2	5v		
8	Rv1:0 - Rv2:2	SDA	3 4	5v		
9	Rv1:1 - Rv2:3	SCL	5 6	0v		
7	4	GPIO7	7 8	TxD	14	15
		0v	9 10	RxD	15	16
0	17	GPIO0	11 12	GPIO1	18	1
2	Rv1:21 - Rv2:27	GPIO2	13 14	0v		
3	22	GPIO3	15 16	GPIO4	23	4
		3.3v	17 18	GPIO5	24	5
12	10	MOSI	19 20	0v		
13	9	MISO	21 22	GPIO6	25	6
14	11	SCLK	23 24	CE0	8	10
		0v	25 26	CE1	7	11
WiringPi Pin	BCM GPIO	Name	Header	Name	BCM GPIO	WiringPi Pin



LEDs blinken lassen

Ansteuerung mit C-Programm (wiringPi Library)

```
#include <stdio.h>
#include <wiringPi.h>
#define LED 0 //wiringPi pin0: BCM_GPIO 17

int main (void)
{
    wiringPiSetup();
    pinMode(LED, OUTPUT) ;
    for(;;){
        digitalWrite(LED,HIGH);
        delay(500);
        digitalWrite(LED, LOW);
        delay(500);
    }
    return 0;
}
```

Kompilieren und starten:

```
gcc -Wall -o blink blink.c -lwiringPi
sudo ./blink
```



Beaglebone Black

BeagleBone Black 1 GHz performance ready to use for \$45

10/100 Ethernet

USB Host

Easily connects to almost any everyday device such as mouse or keyboard

microHDMI

Connect directly to monitors and TVs

microSD

Expansion slot for additional storage

512MB DDR3

Faster, lower power RAM for enhanced user-friendly experience

Serial Debug

DC Power

Power Button

LEDs

Reset Button

USB Client

Development interface and directly powers board from PC

2GB on-board storage using eMMC

- Pre-loaded with Ångström Linux Distribution
- 8-bit bus accelerates performance
- Frees the microSD slot to be used for additional storage for a less expensive solution than SD cards

1 GHz Sitara AM335x ARM® Cortex™-A8 processor

Provides a more advanced user interface and up to 150% better performance than ARM11

Expansion headers

Enable cape hardware and include:

- 65 digital I/O
- 7 analog
- 4 serial
- 2 SPI
- 2 I2C
- 8 PWMs
- 4 timers
- And much much more!

Boot Button

Included in price:

- Power supply ~ \$10
- USB network cable ~ \$3

- 2GB on-board storage \$5-\$10
- PRU for real-time tasks typically on FPGA ~ \$20

BeagleBone Black

„Profi-Liga“:

- mehr I/O, 8 Analog Inputs (max. 1.8 V, 12 Bit)
- Effizienterer ARMv7-Befehlssatz
- Komfortables Setup (USB verbinden, Browser)
- Interner + externer Speicher (microSD)
- Displays (capes) verfügbar: 3, 4, 7"



BeagleBone Betriebssysteme

Mitgeliefert: Angstrom

- optimiert auf Hardware
- Packagemanager opkg (siehe OpenWRT)
- Meine Erfahrung: leider einige „dependency issues“ mit opkg

Ebenfalls getestet: Debian Wheezy

- Linux-Desktopanwendungen (vlc, rtl_sdr...) problemlos installierbar

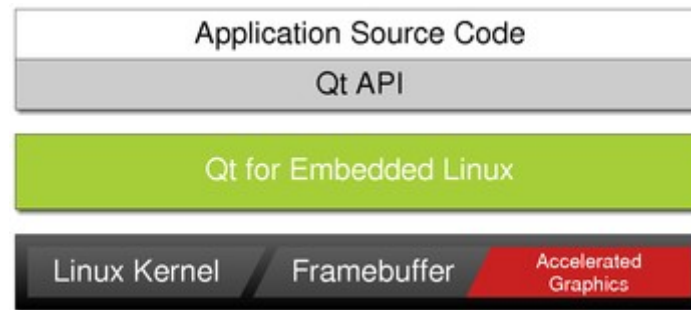


Angstrom - „Schmankerl“

qt4-embedded

Tutorials:

<http://www.youtube.com/user/DerekMolloyDCU/videos>



qt Library in C++, platformübergreifend

```
QTimer *timer = new QTimer(this);  
connect(timer, SIGNAL(timeout()), this, SLOT(update()));  
timer->start(1000);
```

was ich noch zu sagen hätte ...

Vielen Dank für Ihre Aufmerksamkeit!

Es folgen:
Demos



Android MiniPC

Anschlüsse: HDMI, USB

Originalsystem: Android

Via microSD card: angepasstes Linux (linaro)

Kein funktionierender Linux-Treiber für MK802II

Netz via USB-Wifi-Dongle oder USB-Ethernet

Einsatzszenarien:

Klassen-Cloud / NAS

Webserver

Infoscreen

