

# Firmware - Architektur

- frei laufender Loop
- Zeitsteuerung mit SysTick
- Interrupt / Event gesteuert ←
- „Multitasking“ mit Threads (RTOS)

ADC: max 200kS/s für 16 Signale  $\Rightarrow$  12.5kS/s pro Signal  
 effektiv 128kS/s @ 8-fach Oversampling = 16kS/s total  
 1kS/s pro Signal  $\rightarrow$  1ms Looptime

PWM: Timer @ 1MHz mit 100 Schritten = 10kHz PWM  
 Aktualisierung alle 10 Perioden  $\rightarrow$  1ms Looptime

PWM:



repeats = 2

playback\_count = 2

ADC - Umrechnungen:

$$\frac{V_{ADC}}{V_{cell}} = \frac{4.7k}{4.7k + 22k} \cdot \frac{4.7k}{4.7k} = \frac{4.7k}{26.7k} = \frac{47}{267} = 0.176$$

$$V_{ADC} = V_{cell} \cdot \frac{47}{267} = \frac{ADC\_value}{ADC\_range} \cdot 825mV$$

$$V_{cell} = \frac{ADC\_value \cdot 825mV \cdot 267}{(47 \cdot ADC\_range)}$$

$$\max 12bit + \approx 18bit = 30bit$$

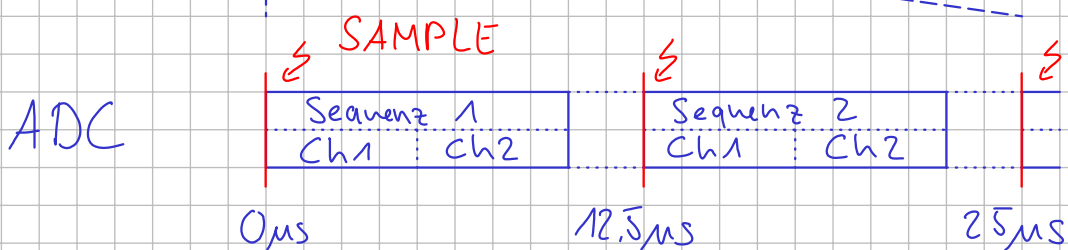
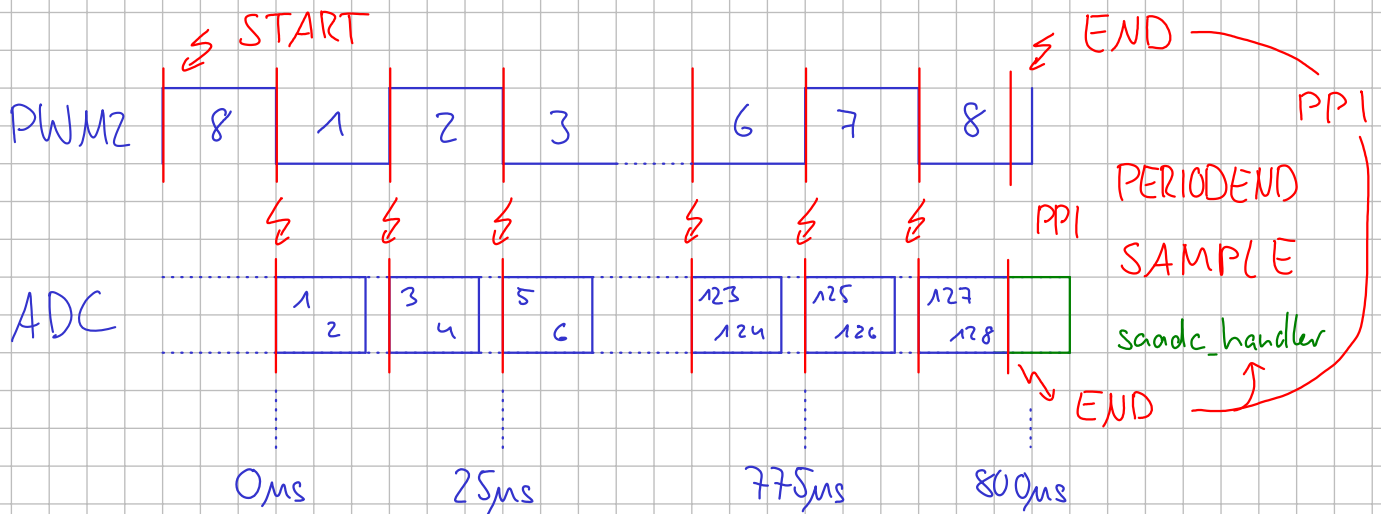
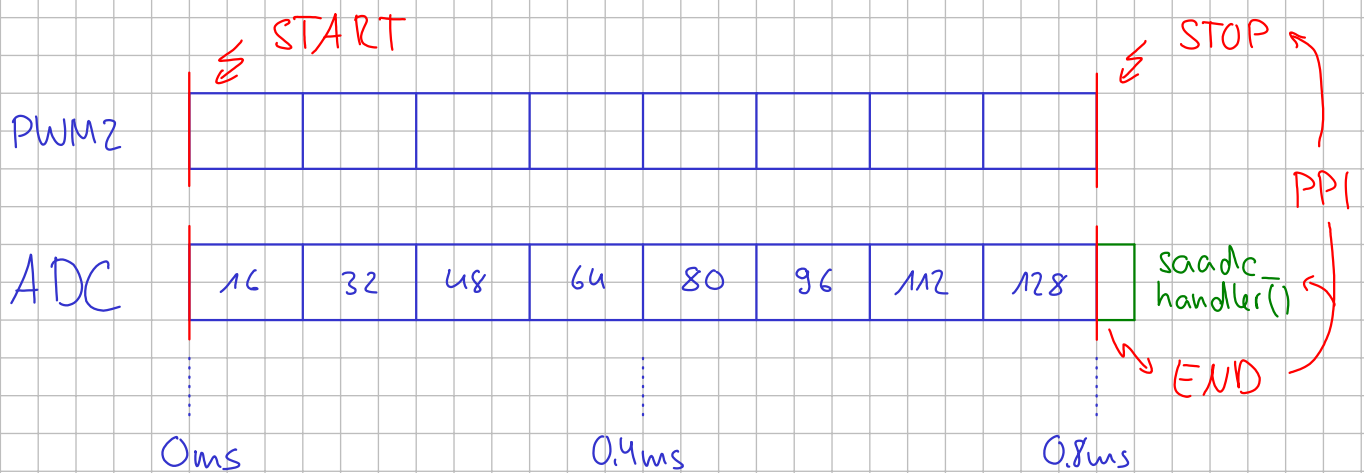
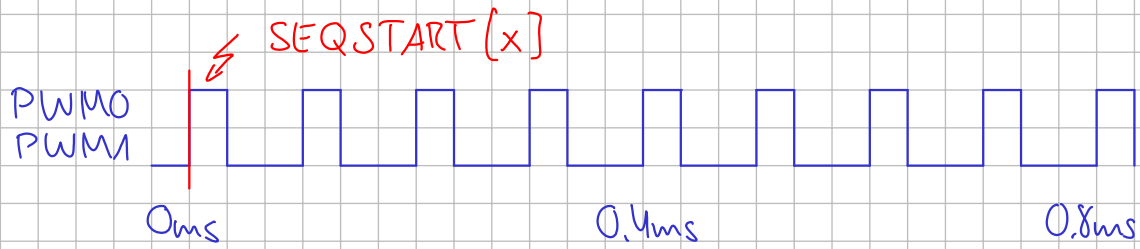
$t_{ACQ}$	$t_{sample}$	$f_{sample}$
3	5 $\mu s$	200k
5	7	142.9k
10	12	83.3k
15	17	58.8k
20	22	45.5k
40	42	23.8k

$$\frac{V_{ADC}}{I_{bal}} = \frac{0.1 \cdot 4.7k}{620} = \frac{470}{620} = \frac{47}{62} \Omega = 0.758 \Omega$$

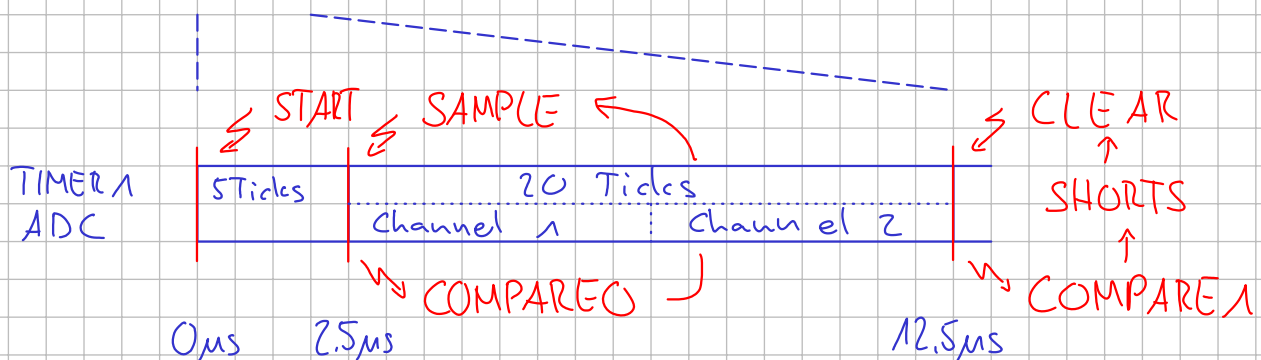
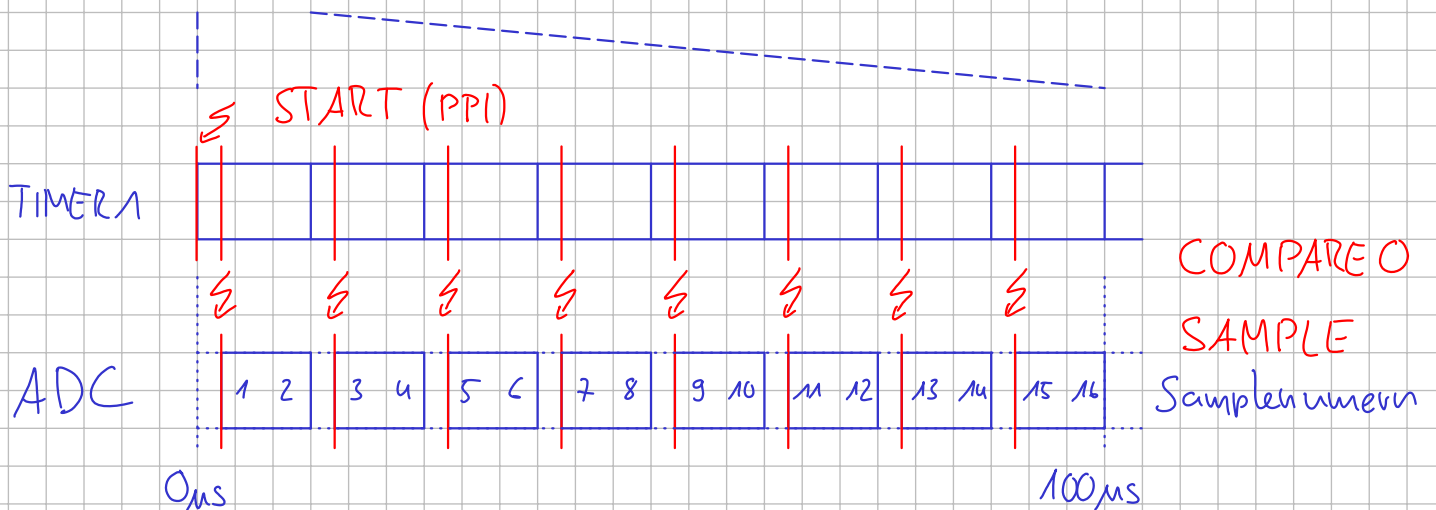
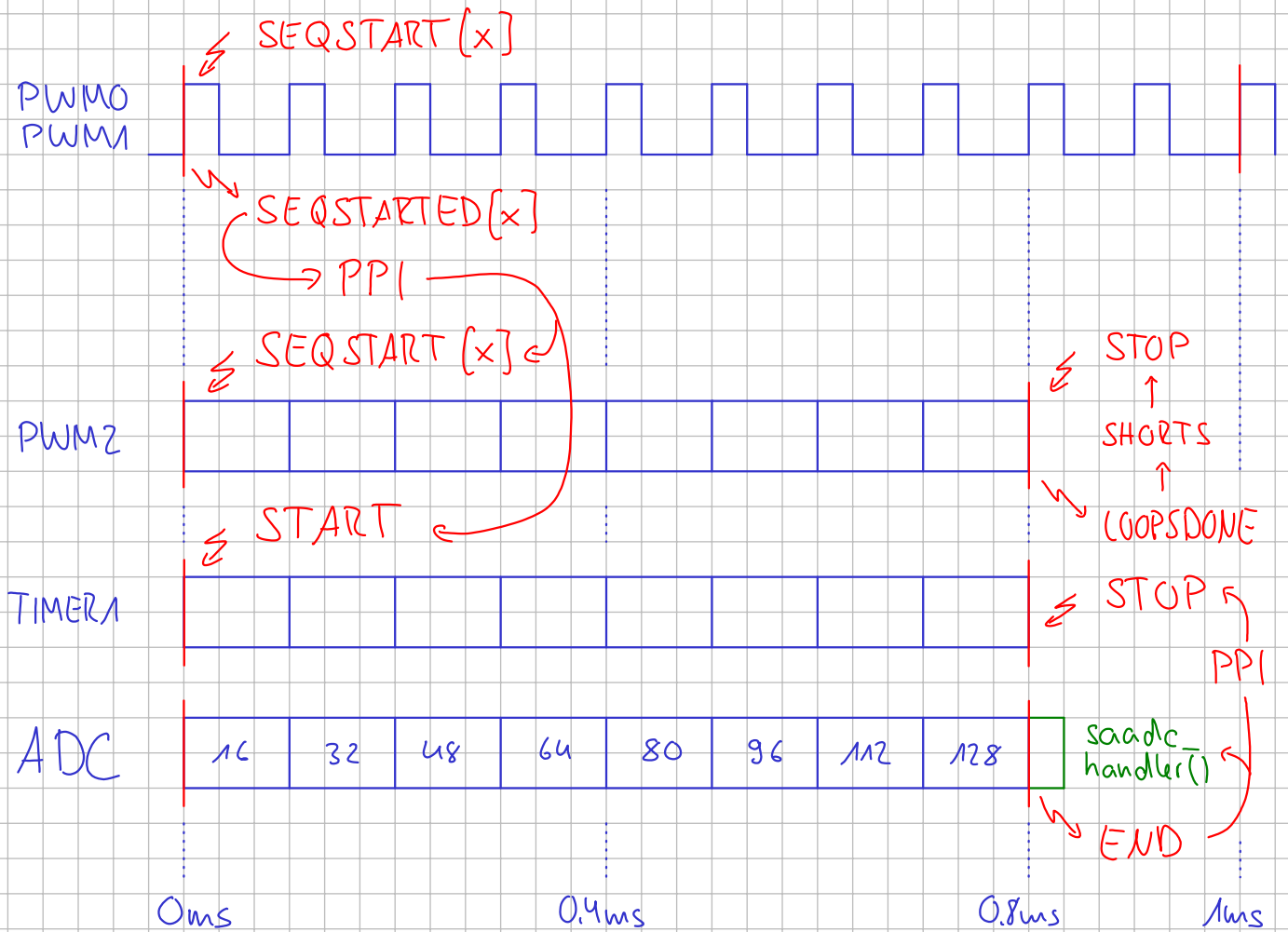
$$V_{ADC} = I_{bal} \cdot \frac{47}{62} \Omega = \frac{ADC\_value}{ADC\_range} \cdot 825mV$$

$$I_{bal} = \frac{ADC\_value \cdot 825mV \cdot 62 \Omega}{(47 \cdot ADC\_range)}$$

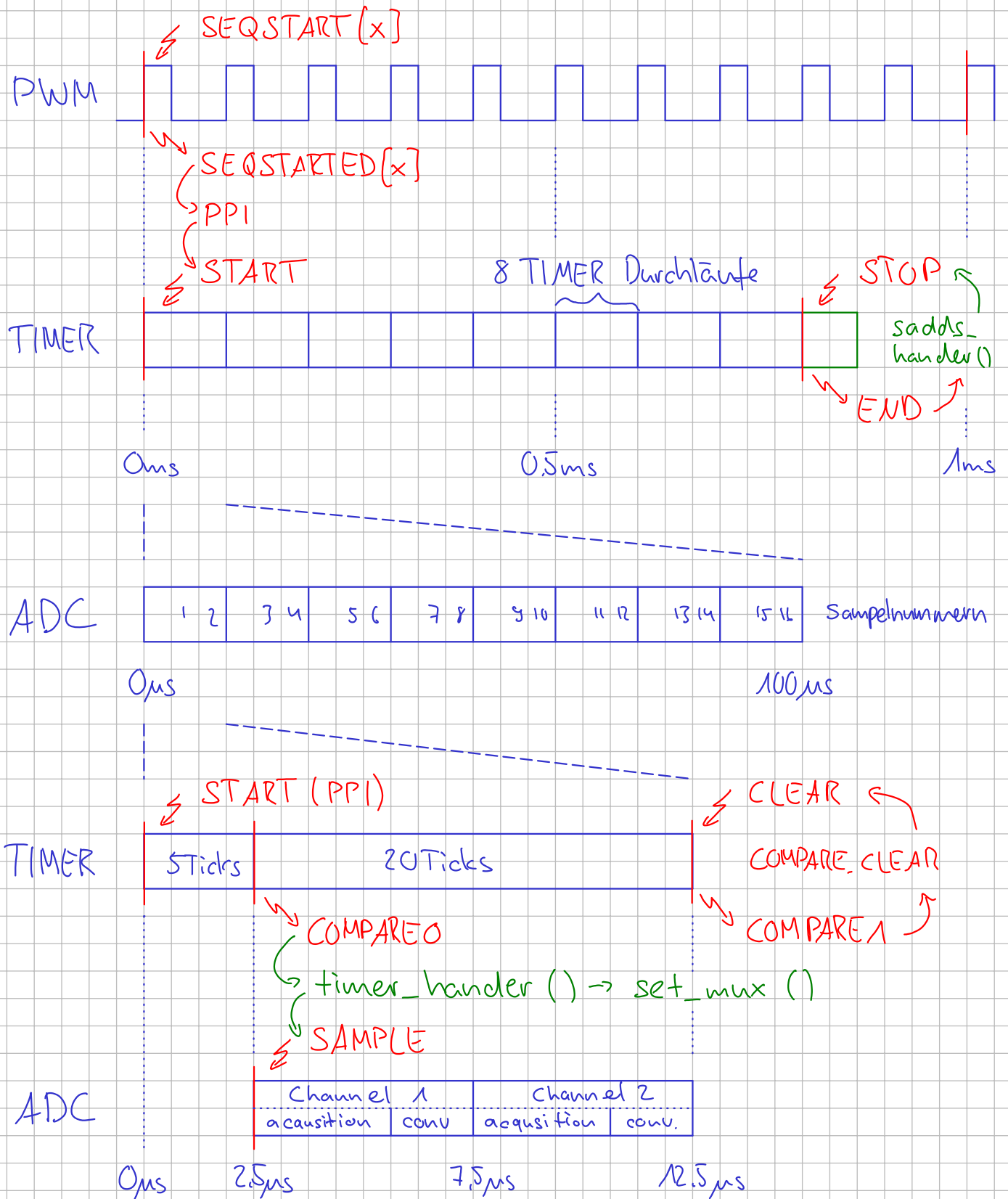
Ablaufplan: Asynchrone ADC-Bursts, immun gegen BLE-Interrupts  
 Überzähliges PERIODEND erfordert ADC-Reinit



# Ablaufplan (alt): BLE-Interrupts verzögern saadc\_handler

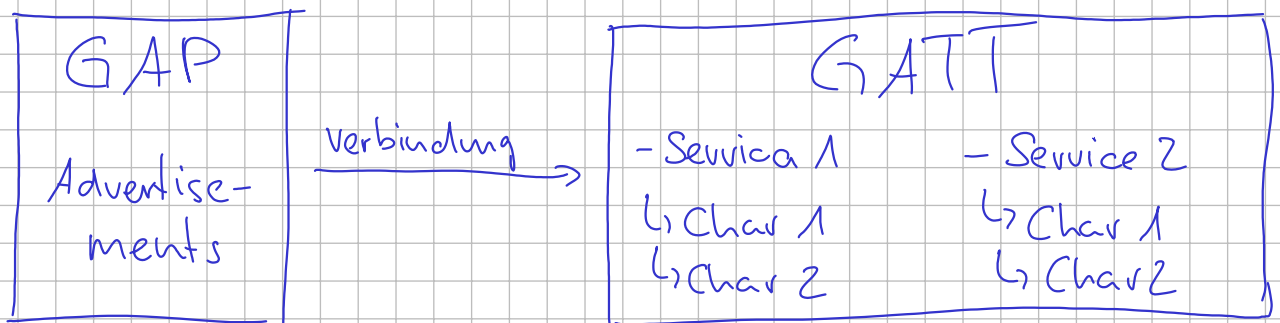


# Ablaufplan (alt-alt): BLE-Interrupts verzögern MUX-Ansteuerung



# BLE - Protokoll:

MCU  $\Rightarrow$  Peripheral Device, PC  $\Rightarrow$  Central



Operationen an characteristics

- ↳ Lesen (Read)
- ↳ Schreiben (Write)
- ↳ Benachrichtigen (Notify)