Tutorial 6: software architectures (part 4)

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Next deadline: component order (4/12)

Just a kind reminder. If you have questions, ask them!

Exercise 1: What is the best software architecture for this problem?

We want to program the firmware of a two-channel digital oscilloscope. The following tasks have to be performed:

- Starting a new measurement on the ADC peripheral of the microcontroller. Since there is only one such peripheral in the microcontroller, measurements should alternate between the two channels. A new measurement is triggered by setting an appropriate flag in the registers of the ADC. When the measurement is ready (a conversion takes about 0.1 ms), an interrupt is triggered by the ADC, to tell that this measurement is available in a specific register. Measurements should be made as often as possible.
- Refreshing the screen. First, a new frame content has to be computed. This is done by processing the last N measurements taken (on each channel), where N is a parameter that depends on the horizontal scale set by the user. Computing a frame is costly and can take up to 100 ms. The result has to be sent over a serial communication channel. This is done by writing the content of the screen byte per byte in a buffer of a peripheral. This peripheral triggers an interrupt when it has sent a byte. The channel can operate at 500 kB/s and a whole frame is composed of 10 kB.
- Display parameters can be updated by the user via a keypad. This keypad should be scanned 20 times per second. Each scan takes 0.5 ms.

Exercise 2: Implement a solution to the following problem, in pseudocode

We want to program the firmware of a two-channel digital oscilloscope. The following tasks have to be performed:

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- Refreshing the screen. First, a new frame content has to be computed. This is done by processing the last N measurements taken (on each channel), where N is a parameter that depends on the horizontal scale set by the user. Computing a frame is costly and can take up to 100 ms. The result has to be sent over a serial communication channel. This is done by writing the content of the screen byte per byte in a buffer of a peripheral. This peripheral triggers an interrupt when it has sent a byte. The channel can operate at 500 kB/s and a whole frame is composed of 10 kB.
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