ICG: Exercise Sheet 3

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Assignment 2.2

Consider a display with a UHD resolution (3840 x 2160 pixels), with a refresh rate of 60 Hz

Q: How much time may the generation of a single pixel at most take? For the sake of simplicity, ignore any potential overhead in the process of the pixel generation.

A:

$$\begin{aligned}\text{Time for frame} &= \frac{1}{60\text{ Hz}} \\ &\approx 0.017 \\ \text{Time for single pixel} &\approx \frac{0.017}{3840 \cdot 2160} \\ &\approx 2.01 \times 10^{9}\end{aligned}$$

Q: For the signal transmission from the graphics card to the monitor, assume a data load of 24 bit per pixel, and shortly explain why this assumption is meaningful. Afterwards, determine the bandwidth (in GB/s) of a cable that connects such a monitor

A: A color is contained in $3 \cdot 8$ bit: 255 values for each (r, g, b) channel.

$$\begin{aligned}\text{Pixel/s} &= 3840 \cdot 2160 \cdot 60\text{ Hz} \\ &= 49,766,400 \cdot \text{s}^{-1} \\ \text{GB/s} &= 24\text{bit} \cdot 49,766,400 \cdot \text{s}^{-1} \\ &\approx 1.19 \times 10^{10}\text{ bit/s} \\ &\approx 1.49\text{ GB/s}\end{aligned}$$