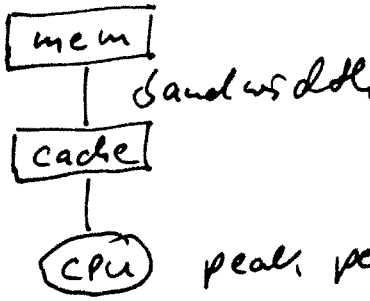
Roofline Model

Goals:
- precise definition of compute/memory bound
- visualization and identification of optimization opportunities

Machine model:

Core 2:



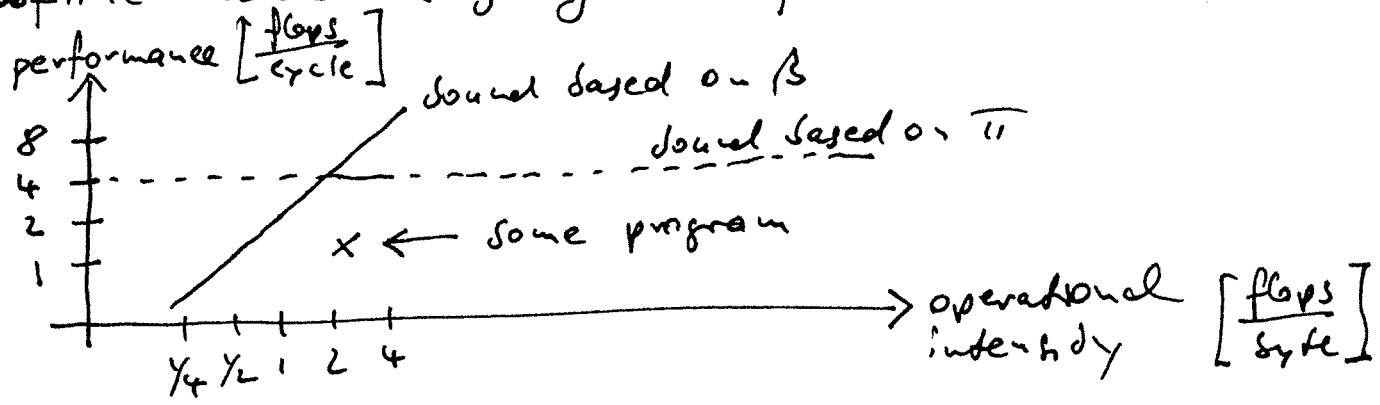
2

2 scalar
4 vec

Program model:

operational intensity $I = \frac{\#\text{flops}}{\text{data } \$ \leftrightarrow \text{mem}}$ $\left[\frac{\text{flops}}{\text{byte}}\right]$

Roofline model: (log-log scale), example Core 2



bound based on β?

assume a program has $I = x$ flops/byte

the program gets at most β bytes/cycle

$\Rightarrow$ performance $= y \leq \beta x$

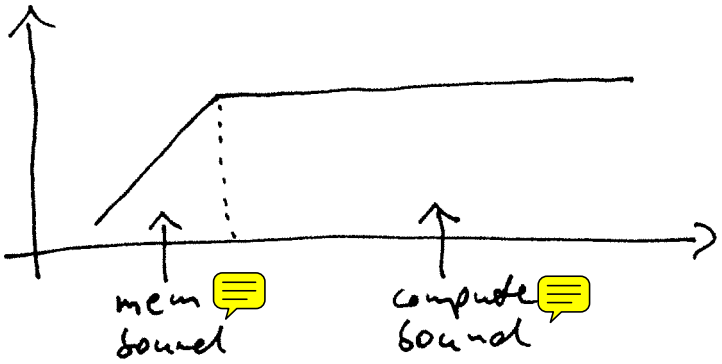
$\log_2(y) \leq \log_2(x) + \log_2(\beta)$

(line with slope 1)

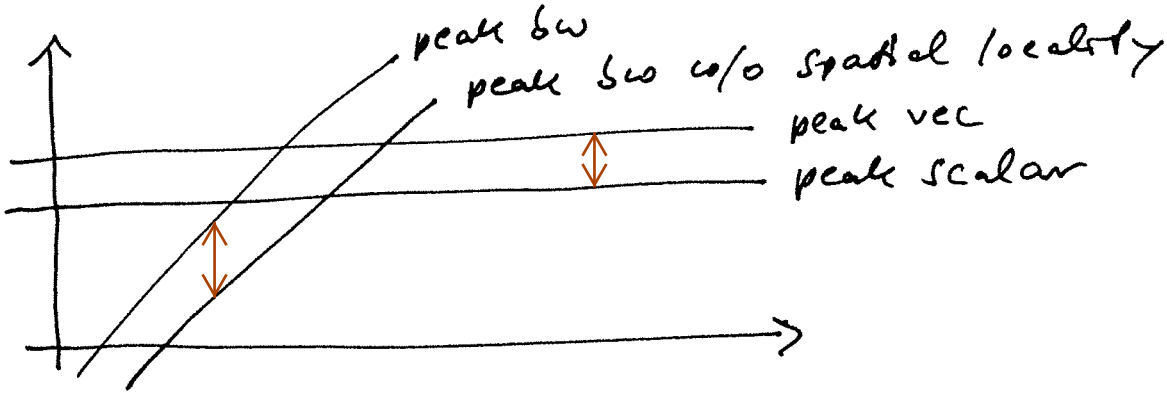
$x = 1 \Rightarrow y \leq \beta$

What can you do with it?

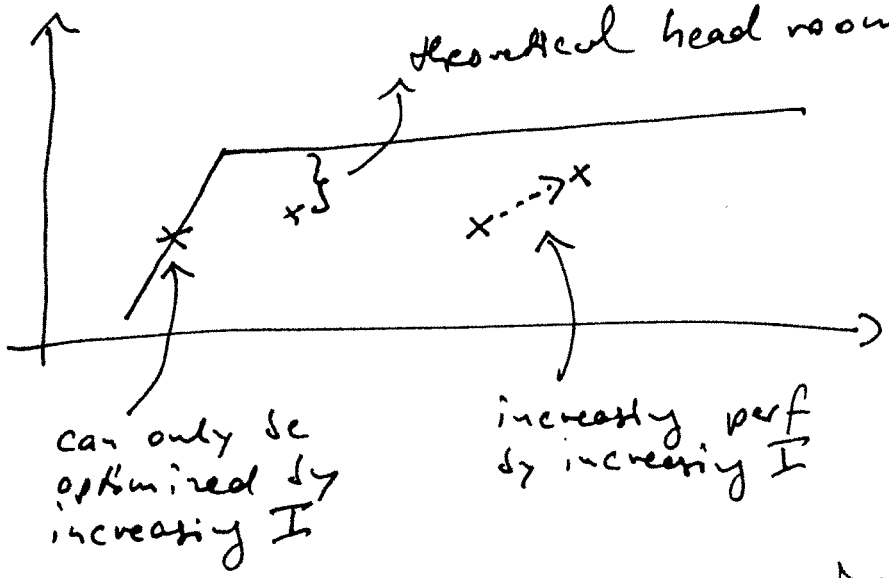
1.) memory / compute bound:



2.) more bounds



3.) program optimization



How to get roofline plot? Measure!