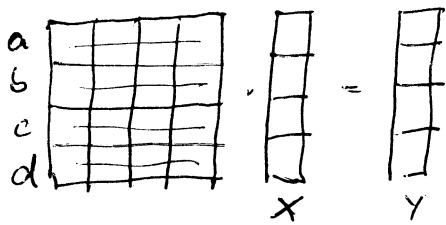


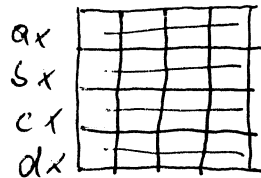
4x4 Matrix-vector multiplication



$$\text{Scalar: } \begin{array}{r} 16 \text{ mults} \\ 12 \text{ adds} \\ \hline 28 \text{ ops} \end{array}$$

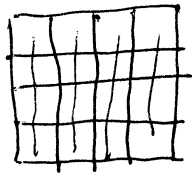
1. step: 4x-mm-mul-ps to compute pointwise products ax, bx, cx, dx

Result:



SSE

2. step: transpose MM-TRANPOSE4-PS (8 instructions)
Result



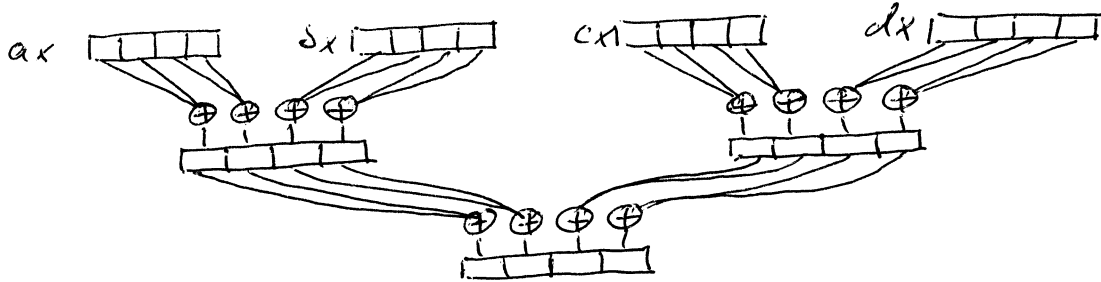
3. step: 3x-mm-add-ps to add columns

Total: 15 instructions

Vectorization efficiency: $\frac{28}{15} \approx 1.87$

SSE3

2 step: tree reduction with 3x-mm-hadd-ps



Total: 7 instructions

Vectorization efficiency: $\frac{28}{7} = 4$ perfect!

SSE4

has dot product but yields still 7 instructions