CSC 411

Computer Organization (Fall 2024)
Lecture 20: SIMD instructions

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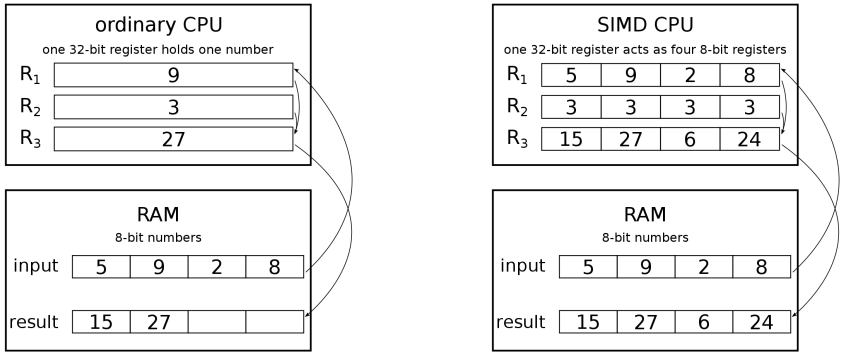
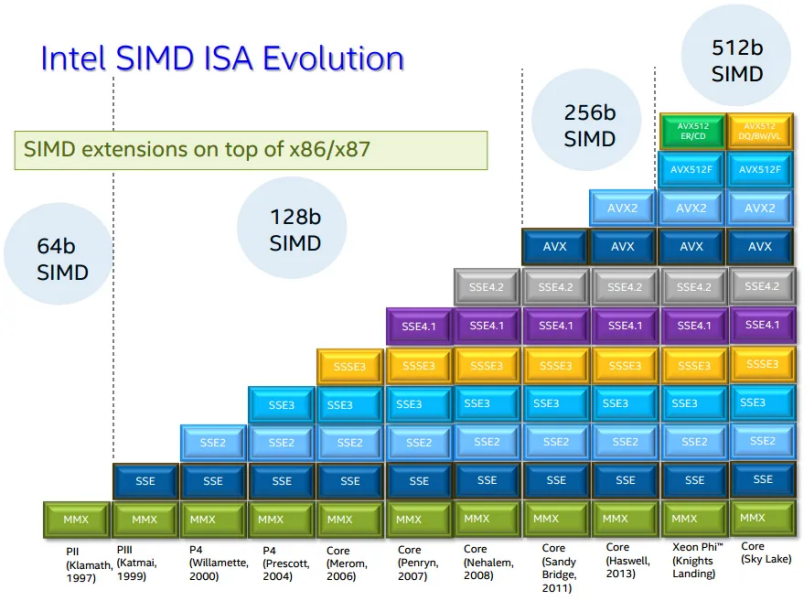
SIMD instructions

- Graphics and media processing operate on values of 8-bit and 16-bit lengths
  - can use a 128-bit adder (with partitioned carry chain) and perform operations in **parallel** — e.g. sixteen 8-bit operations, eight 16-bit operations, or four 32-bit operations
- SIMD **(single-instruction, multiple-data)**
  - a.k.a. data level parallelism, vector parallelism

Tripling four 8-bit numbers



https://en.wikipedia.org/wiki/Single_instruction,_multiple_data

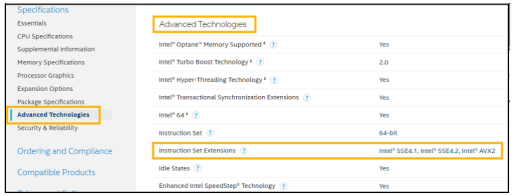


https://en.algorithmica.org/hpc/simd/

How to check for instruction set extensions?

- **Identify** your Intel® Processor and note the processor number.
- **Go to** the product specification page and **enter** the number of the Intel Processor in the search box.
- **Look** in the *Advanced Technologies* section and **look for** *Instruction Set Extensions*

EXample:



https://www.intel.com/content/www/us/en/support/articles/000090473/processors/intel-core-processors.html

C code

```c
#include <stdio.h>
#include <immintrin.h>

int main() {
    if (__builtin_cpu_is("intel")) printf("Intel CPU\n");
    if (__builtin_cpu_is("amd")) printf("AMD CPU\n");

    if (__builtin_cpu_supports("avx512f")) printf("AVX-512 supported\n");
    if (__builtin_cpu_supports("avx2")) printf("AVX2 supported\n");
    if (__builtin_cpu_supports("avx")) printf("AVX supported\n");
    if (__builtin_cpu_supports("sse2")) printf("SSE2 supported\n");
    if (__builtin_cpu_supports("sse")) printf("SSE supported\n");

    return 0;
}
```