Parallel computing platforms

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plan for the day

- Naive Bayes assignment updates (40min + 5min break)
- parallel computer organization (40min + 5min break)
- classes of parallel computation (40min + 5min break)
- our first parallel algorithms (40min + 5min break)

Naive Bayes in C

parallel computer organization

parallel computer organization

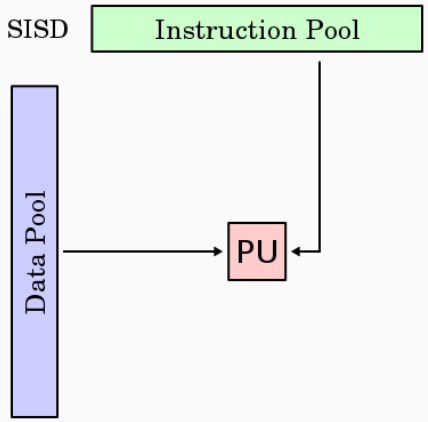
- control mechanism

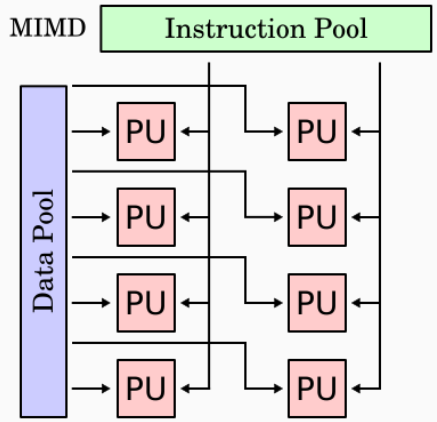
parallel computer organization

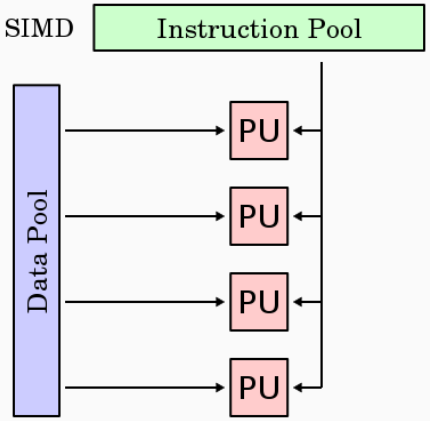
- control mechanism
- communication model

flynn's taxonomy

- based on the number of instruction streams and data streams available in the architecture

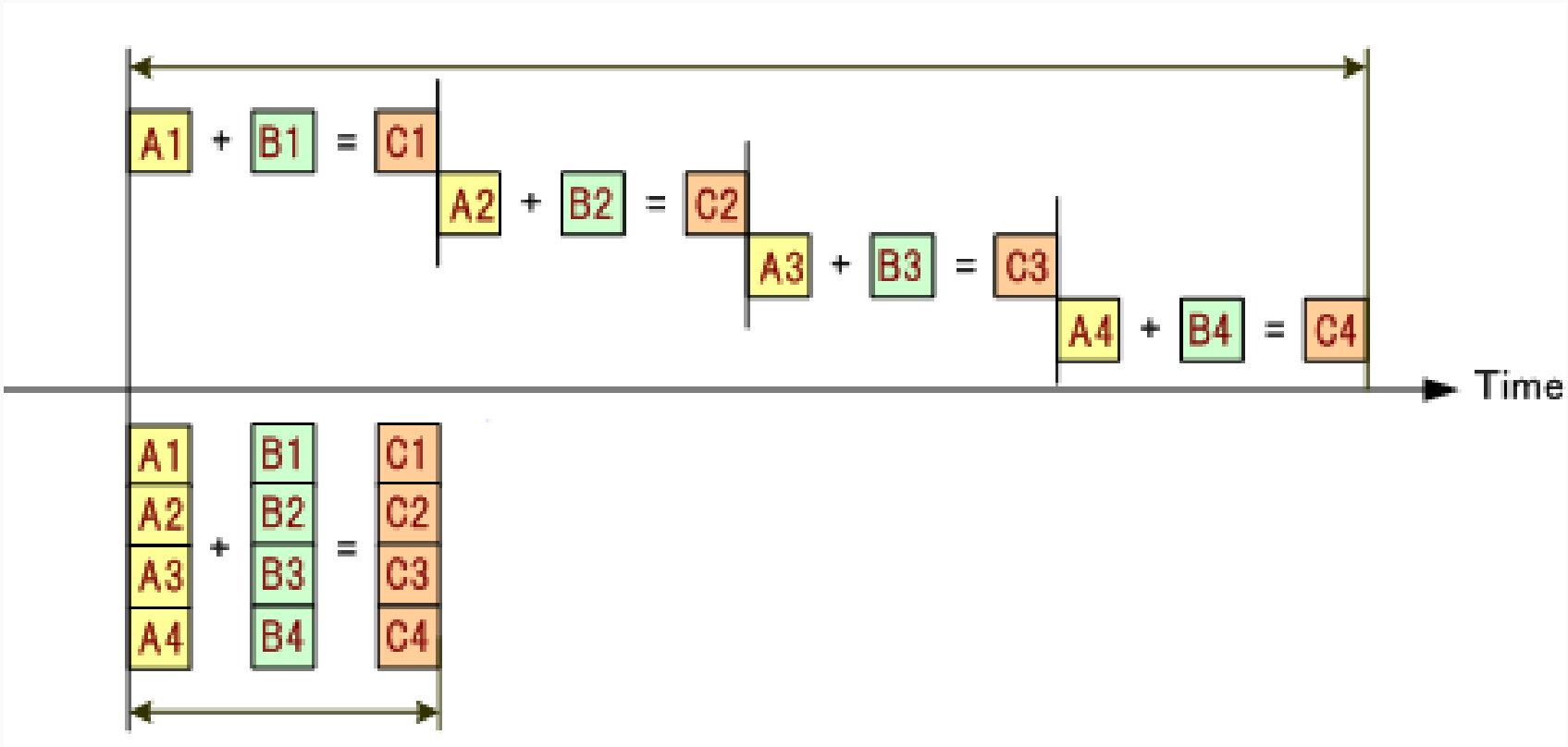






Flynn's taxonomy by Cburnett / CC BY 3.0 / presenting the four together

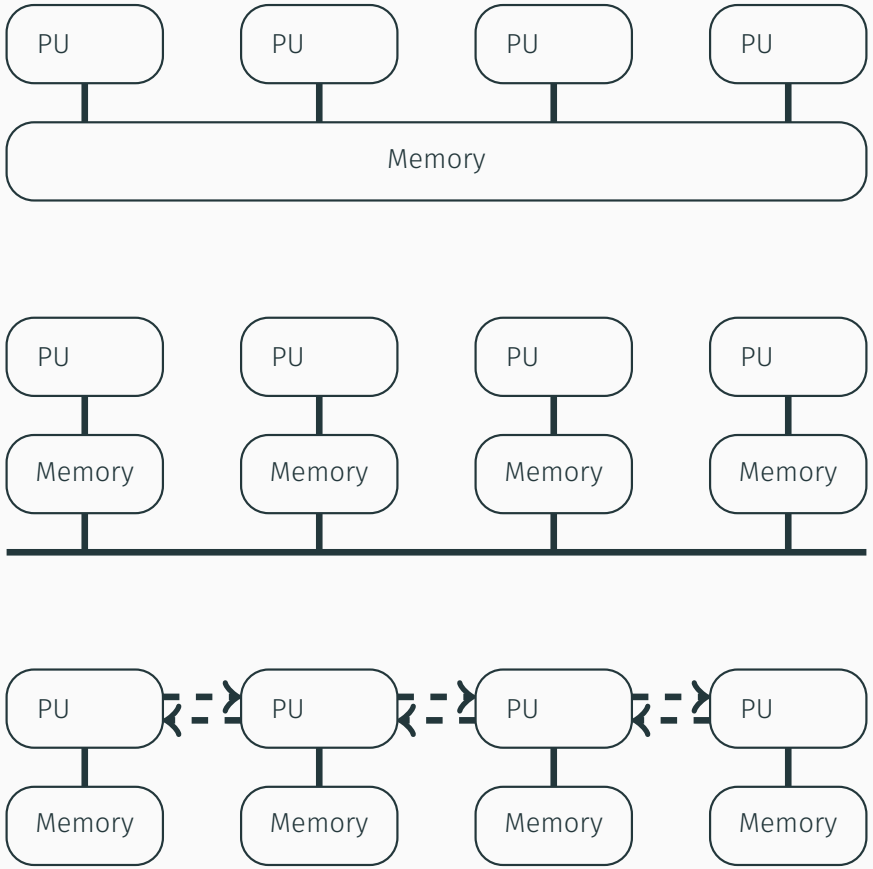
simd



SIMD / cropped from original

communication models

- shared-address space
- message-passing



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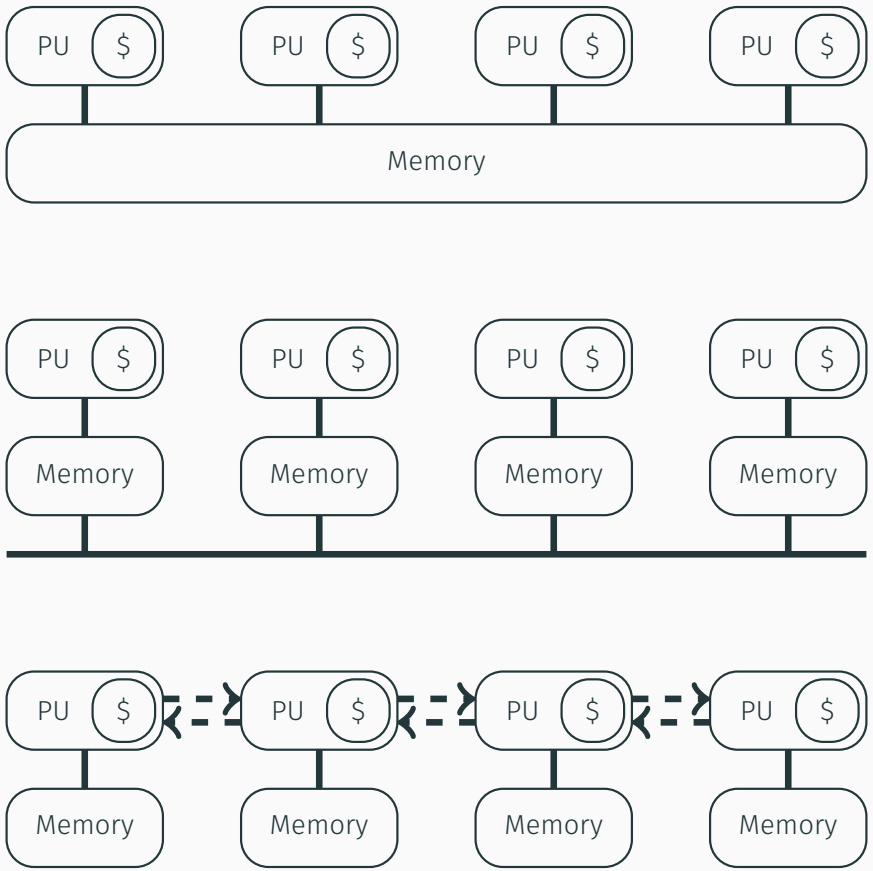

classes of parallel computation

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- Each chef works on N/P meals independently of the others.
- Each chef works on a different task related to the preparation of a meal, i.e., cutting carrots, cooking soup, icing cake, etc.

classes of parallel computation

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- *data parallelism*
- *task parallelism*

y := a*x + y

```
1  void
2  saxpy(size_t const n,
3        float  const a,
4        float  const * const x,
5        float        * const y)
6  {
7    for (size_t i = 0; i < n; i++) {
8      y[i] = a * x[i] + y[i];
9    }
10 }
```

reduction

```
1  float
2  min(size_t const n,
3      float * const x,
4  {
5    /* x[0] will always contain the current
6     * minimum */
7    for (size_t i = 0; i < n; i++) {
8      if (x[i] < x[0]) {
9        x[0] = x[i];
10     }
11   }
12   return x[0];
13 }
```

reduction cont'd

```
1  float
2  min(size_t const n,
3      float * const x,
4  {
5    for (size_t i = 1; i < n; i *= 2) {
6      /* x[j] will always contain the current
7       * minimum in interval [j,j+2i)*/
8      for (size_t j = 0; j < n; j += 2 * i) {
9        if (x[j + i] < x[j]) {
10         x[j] = x[j + i];
11       }
12     }
13   }
14   return x[0];
15 }
```

sorting

```
count = array of k+1 zeros
for x in input do
    count[x] += 1

total = 0
for i in 0, 1, ... k do
    counti = count[i]
    count[i] = total
    total += counti

for x in input do
    output[count[x]] = x
    count[x] += 1

return output
```