

Tools for Easing your Work in Numerical Simulations



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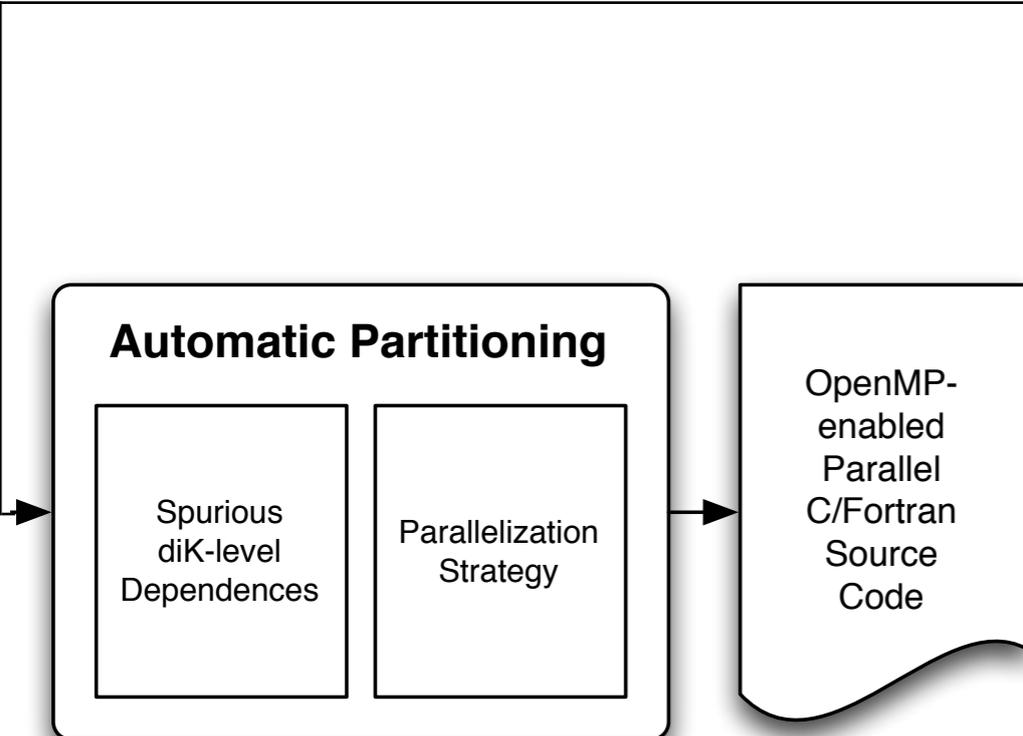
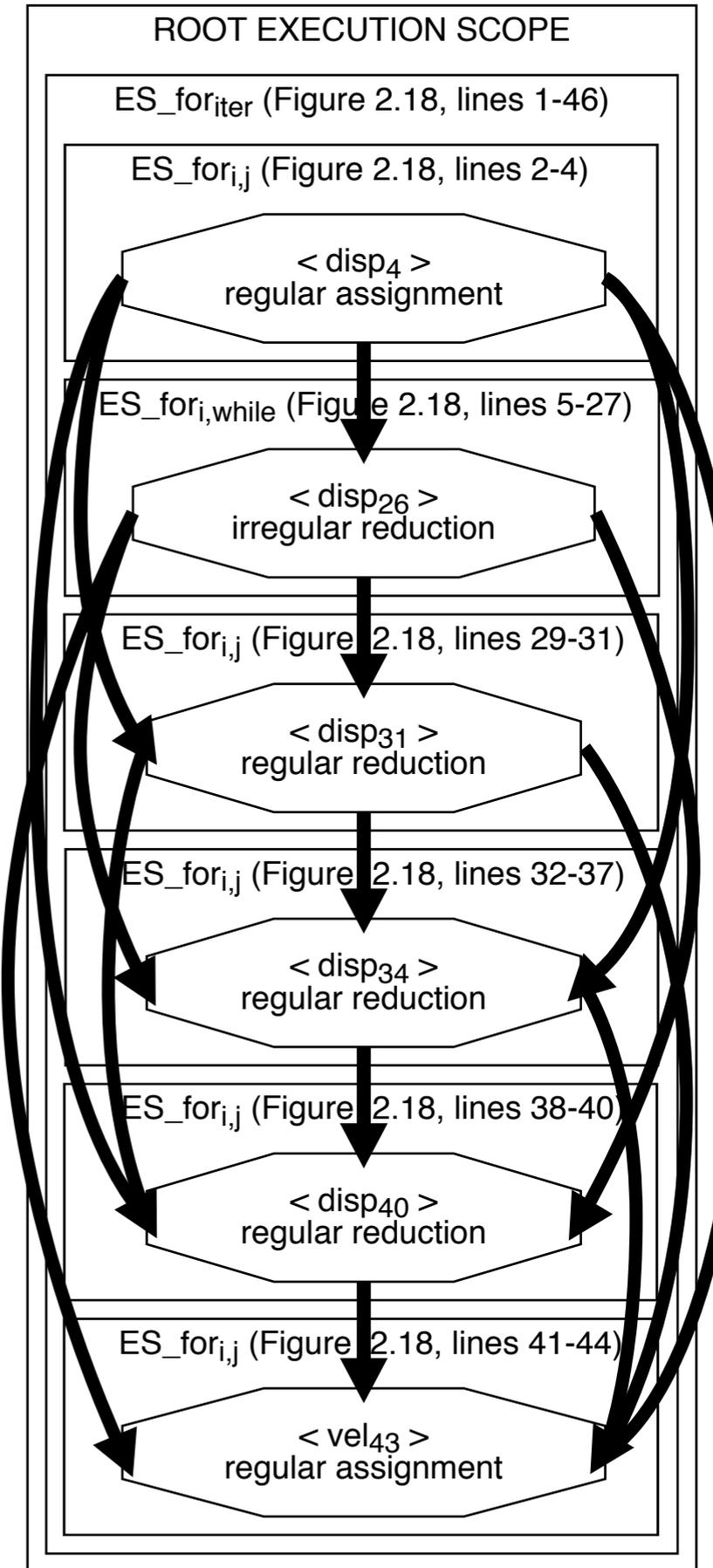
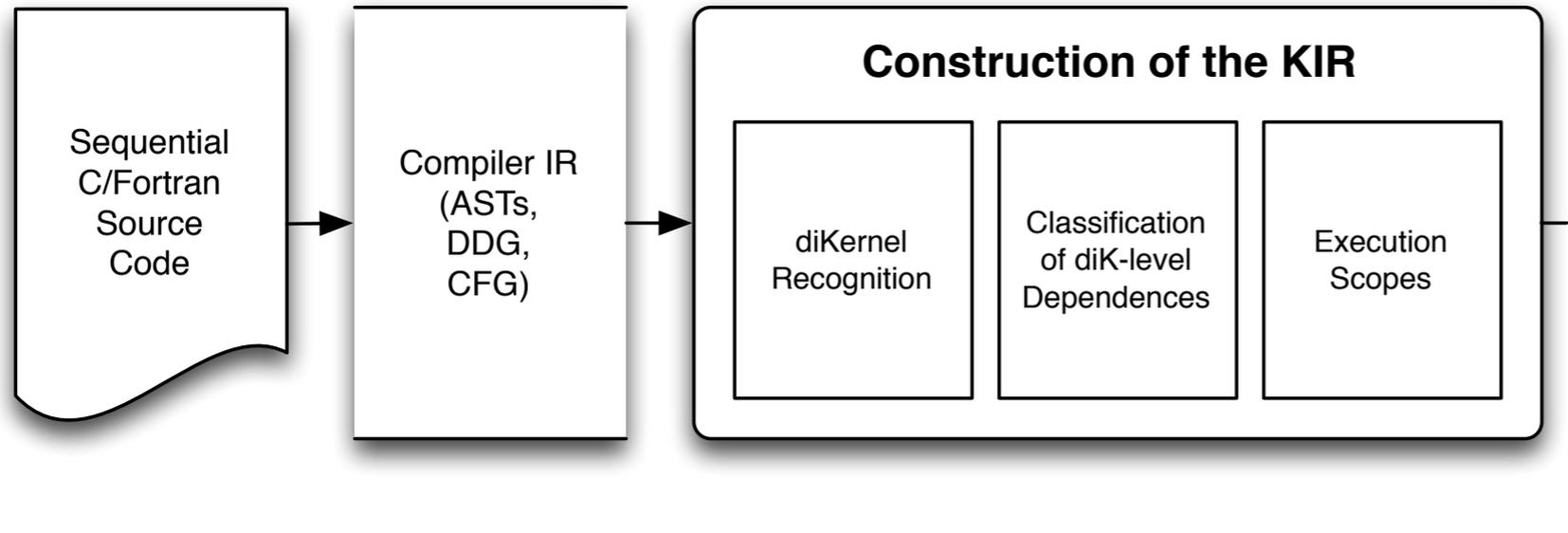
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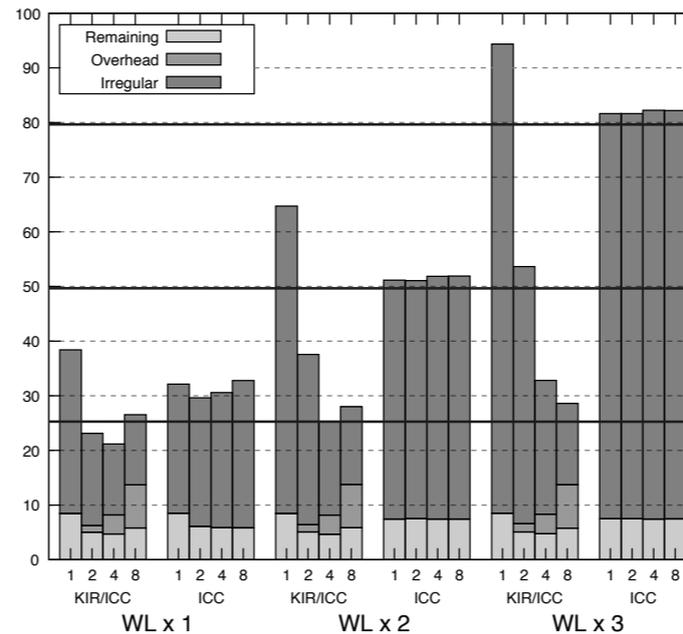
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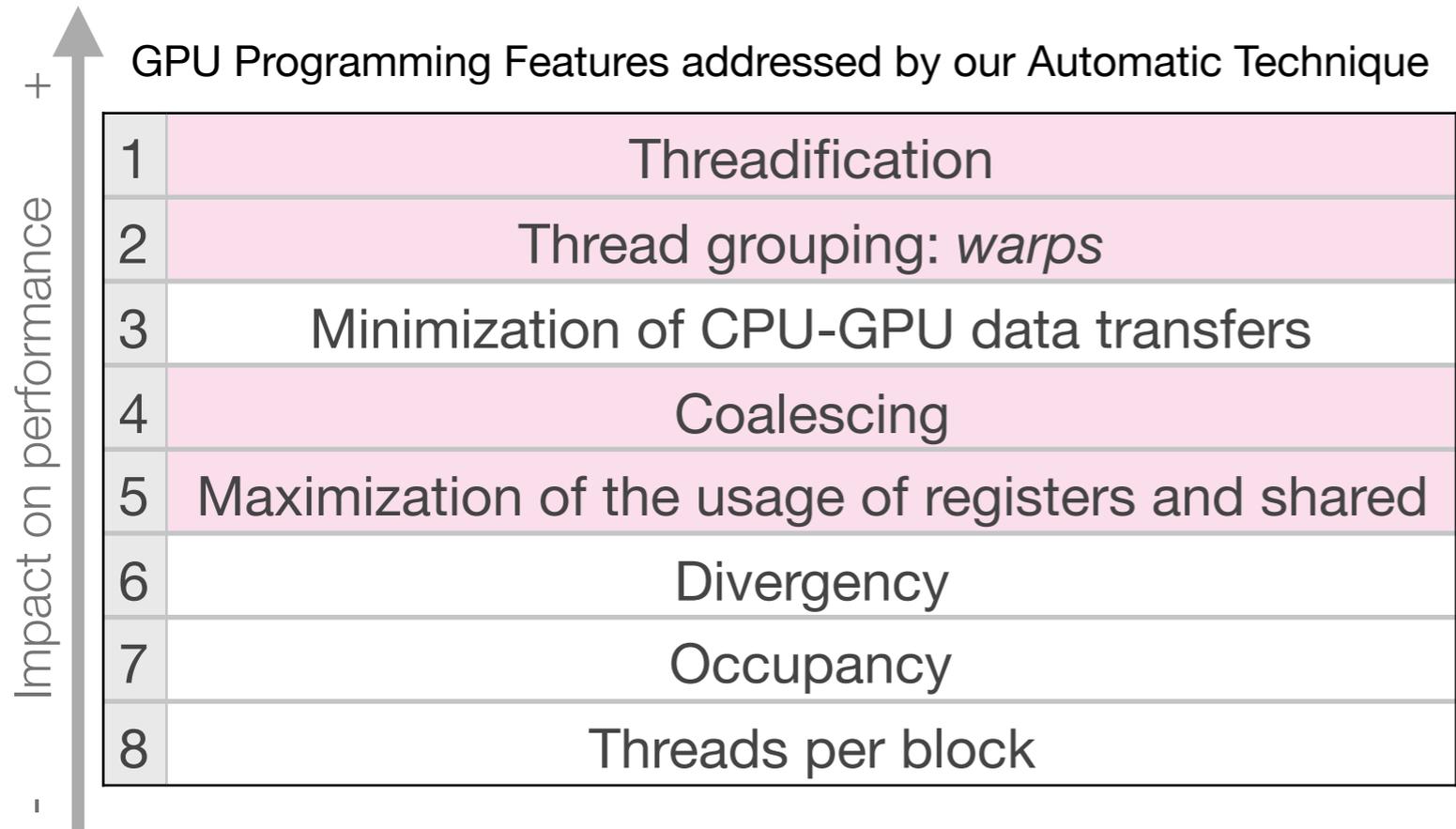
Automatic Parallelization: Multicore Systems



EQUAKE from SPEC CPU2000



Automatic Parallelization: Manycore Systems



appentra make code parallel

PARALLELWARE TRAINER

PARALLELWARE ANALYZER BETA

Definition 3.3.1. Given a constant $\phi \in \mathbb{Z}$, a function $g : \mathbb{N}^0 \rightarrow \mathbb{Z}$, and the operator $+$, the *chrec* $f = \{\phi, +, g\}$ is defined as a function $f : \mathbb{N}^0 \rightarrow \mathbb{Z}$ such that:

$$\{\phi, +, g\}(i) = \phi + \sum_{j=0}^{i-1} g(j)$$

- Useful for representing the iterations of a loop and array access patterns
- We instantiate (particularize) them for each GPU thread



Trace-based Reconstruction of Affine Codes



```

1 | 0x1e2d140
2 | 0x1e2d140
...
30 | 0x1e2d140
31 | 0x1e2d240
32 | 0x1e2d248
33 | 0x1e2d240
34 | 0x1e2d248
...
88 | 0x1e2d248
89 | 0x1e2d340
90 | 0x1e2d348
91 | 0x1e2d350
92 | 0x1e2d340
93 | 0x1e2d348
94 | 0x1e2d350
...

```



```

1. for (i = 0; i <= 29; i++) {
2.   for (j = 0; j <= 29-i; j++) {
3.     for (k = 0; k < i; k++) {
4.       ... A[i][k] ...
5.     }
6.   }
7. }

```

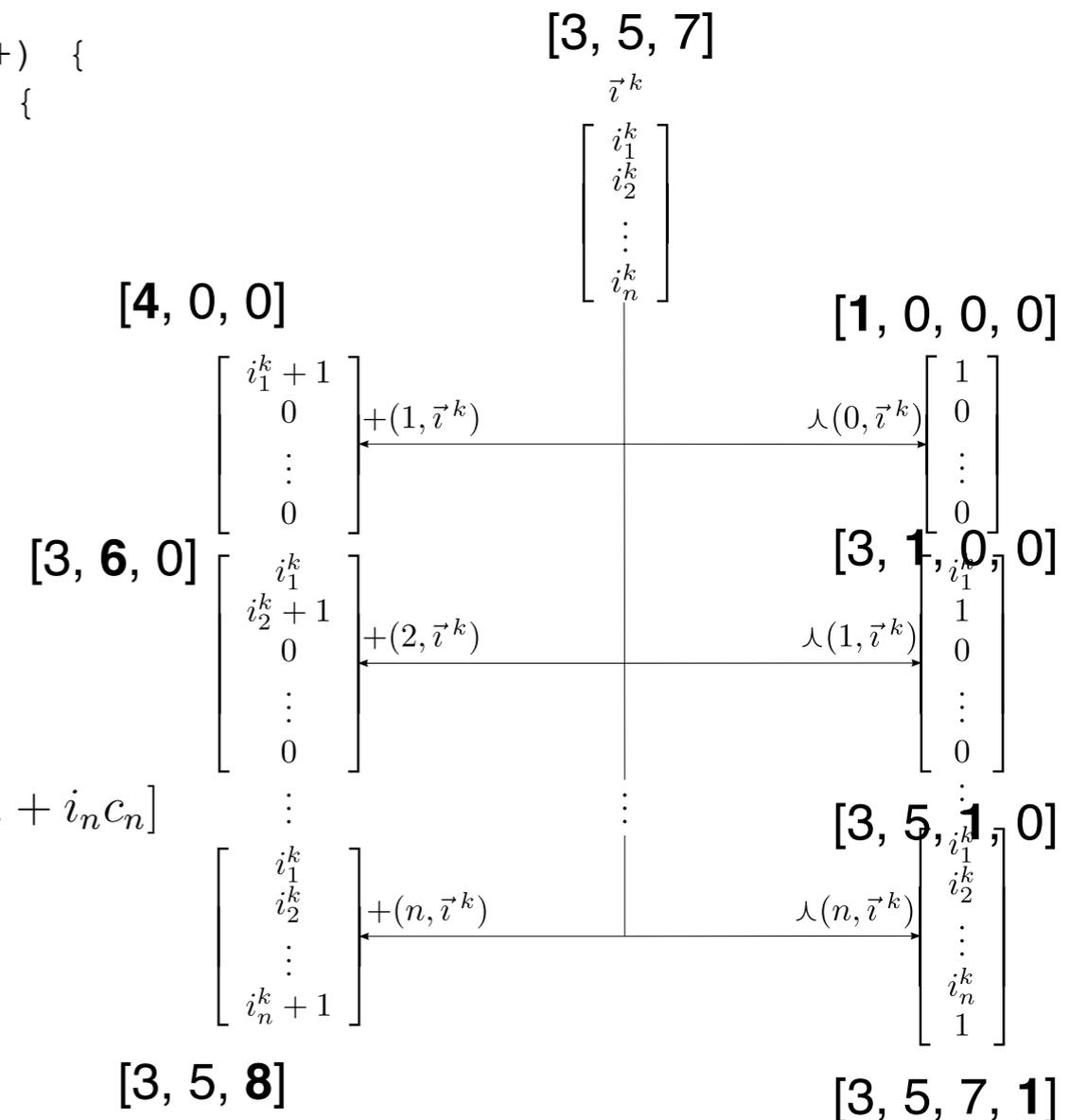
```

DO i1 = 0, u1(v)
...
DO in = 0, un(v)
  V[f1(v)] ... [fm(v)]

```

$$V[f_1(\vec{v})] \dots [f_m(\vec{v})] = V[c_0 + i_1 c_1 + \dots + i_n c_n]$$

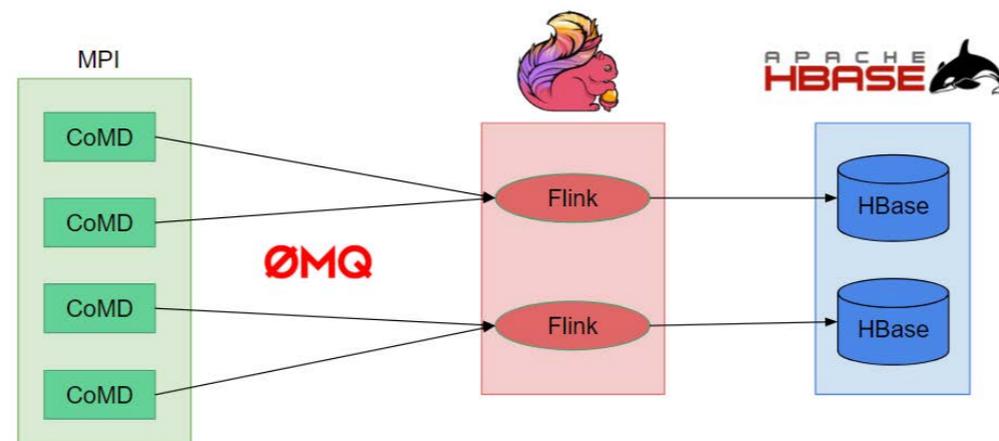
$$\sigma^k = V(\vec{v}^{k+1}) - V(\vec{v}^k)$$



- ◆ Hardware and software prefetching
- ◆ Data placement
- ◆ Dependence analysis
- ◆ Design of embedded memories
- ◆ Trace compression

Future Project: Breaking the Traditional Analysis of the Results of Computational Simulations

- It typically starts after the simulation has finished: I/O subsystem evolves slowly, so it is a new bottleneck
- We want to use Apache Flink, a distributed streaming dataflow engine, to process the data from the simulation in the same cluster. Tested with molecular dynamics!



- Automatic real-time resource scaling platform for Big Data