VAMPIR

Virtualized Non-Functional Memory Properties for Data-Pipeline Scheduling

Vision

```
void *buffer = vmalloc(buffer_size,
      MP_PERSISTENT |
      MP_THROUGHPUT_HIGH |
      MP_FAULT_TOLERANT,
      WP_READ_90,
      usage_time(0, 30));
```

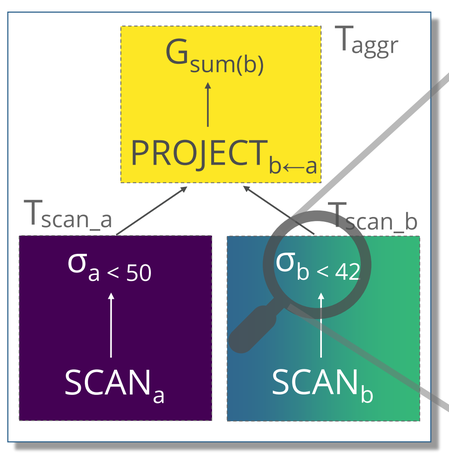
Expectations

- Requested Memory Properties and
- Expected Workload Properties

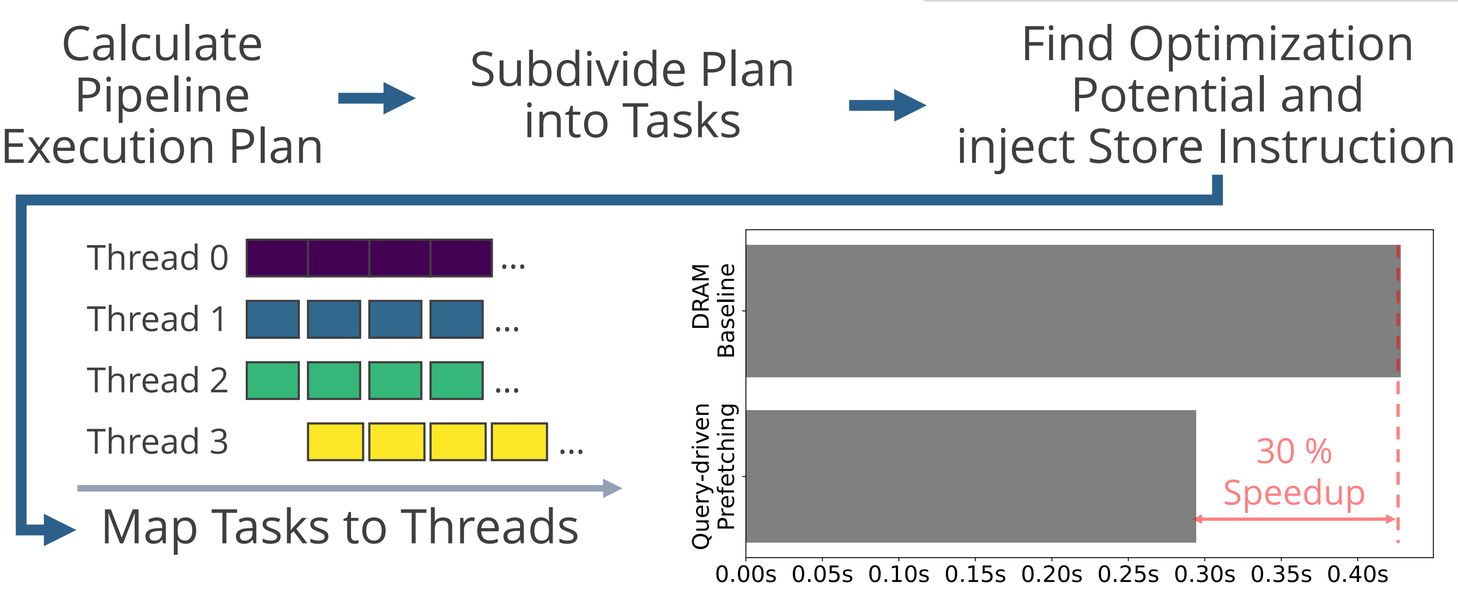
→ Interface allocates best suited available memory

Intra-Pipeline Optimization – Query-driven Prefetching

```
SELECT sum(b)
FROM r
WHERE a < 50
AND b < 42;
```



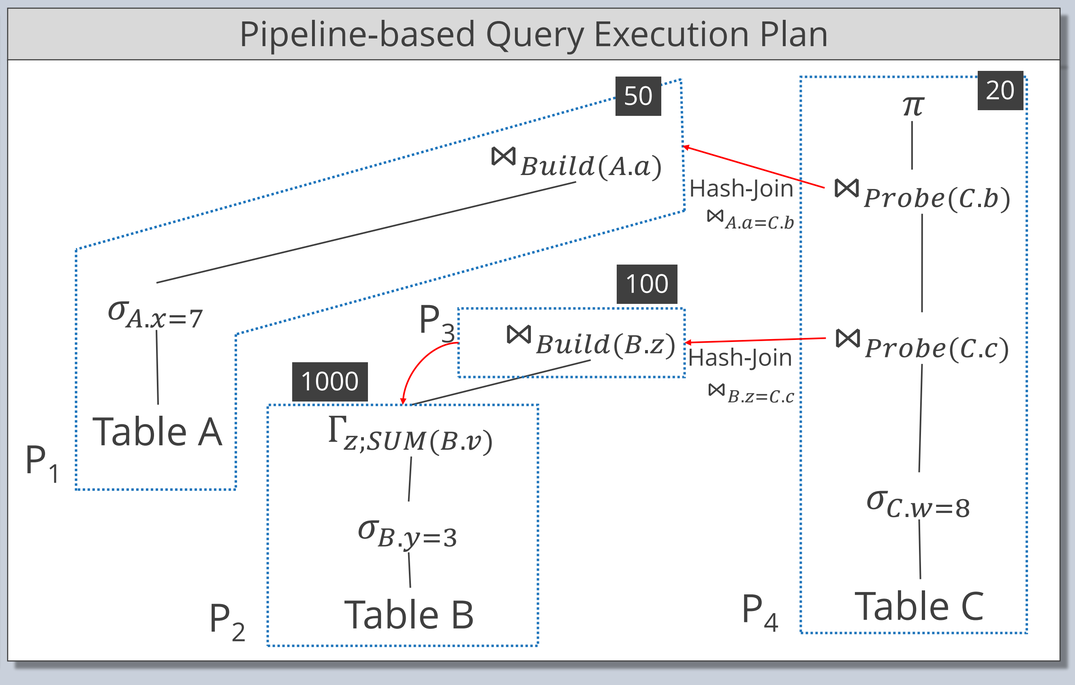

```
label:
value a = load(source);
bool r = compare(a, 42);
store->ddr(r);
store->hbm(a);
goto label;
```

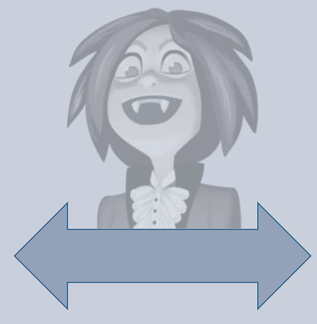


SQL Query

```
SELECT *
FROM A, C,
   (SELECT B.z, sum(B.v)
    FROM B
    WHERE B.y = 3
    GROUP BY B.z) B
WHERE
   A.x = 7 AND
   C.w = 8 AND
   A.a = C.b AND
   B.z = C.c
```

Pipeline-based Query Execution Plan





Disruptive Memory Technologies

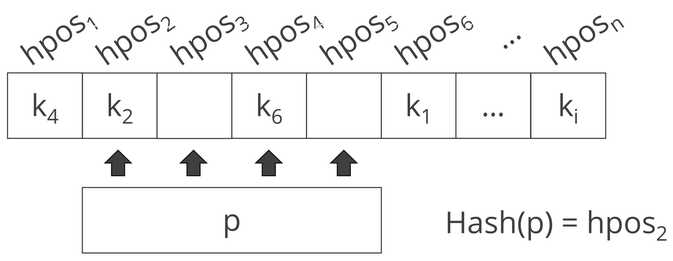
Central Problem

How to make disruptive memories easily accessible?

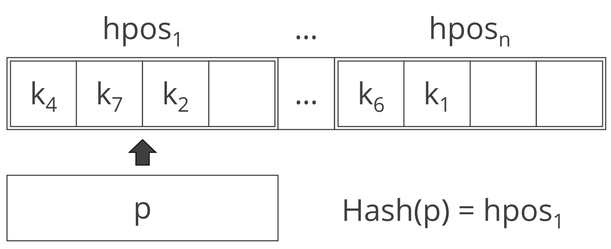
Pipeline-Breaker Optimization – Hashing

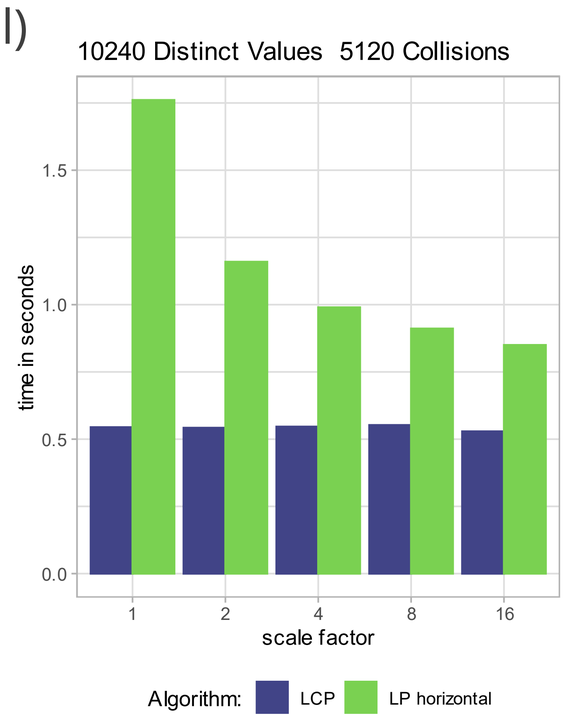
Accelerating Open Addressing with SIMD

SIMDified Data Access (LP horizontal)



SIMDified Data Structure (LCP)





New System under Test

- **2x Intel Xeon CPU Max 9468**

per Socket:

- 48 cores (96 threads)
- 8 channel DDR 5-DRAM
- 4 HBM2e-devices
- 4 DSA-devices (DMA-engines)

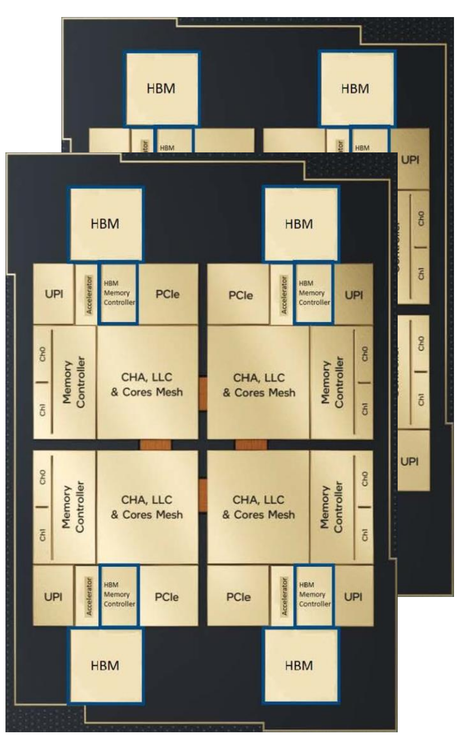


Image reference:
P. Kennedy, "*Intel Xeon Max CPU is the Sapphire Rapids HBM Line*". servethehome.com. https://www.servethehome.com/intel-xeon-max-cpu-is-the-sapphire-rapids-hbm-line/. (accessed Aug. 13, 2023)

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