GPU Memory Hierarchy

Outline

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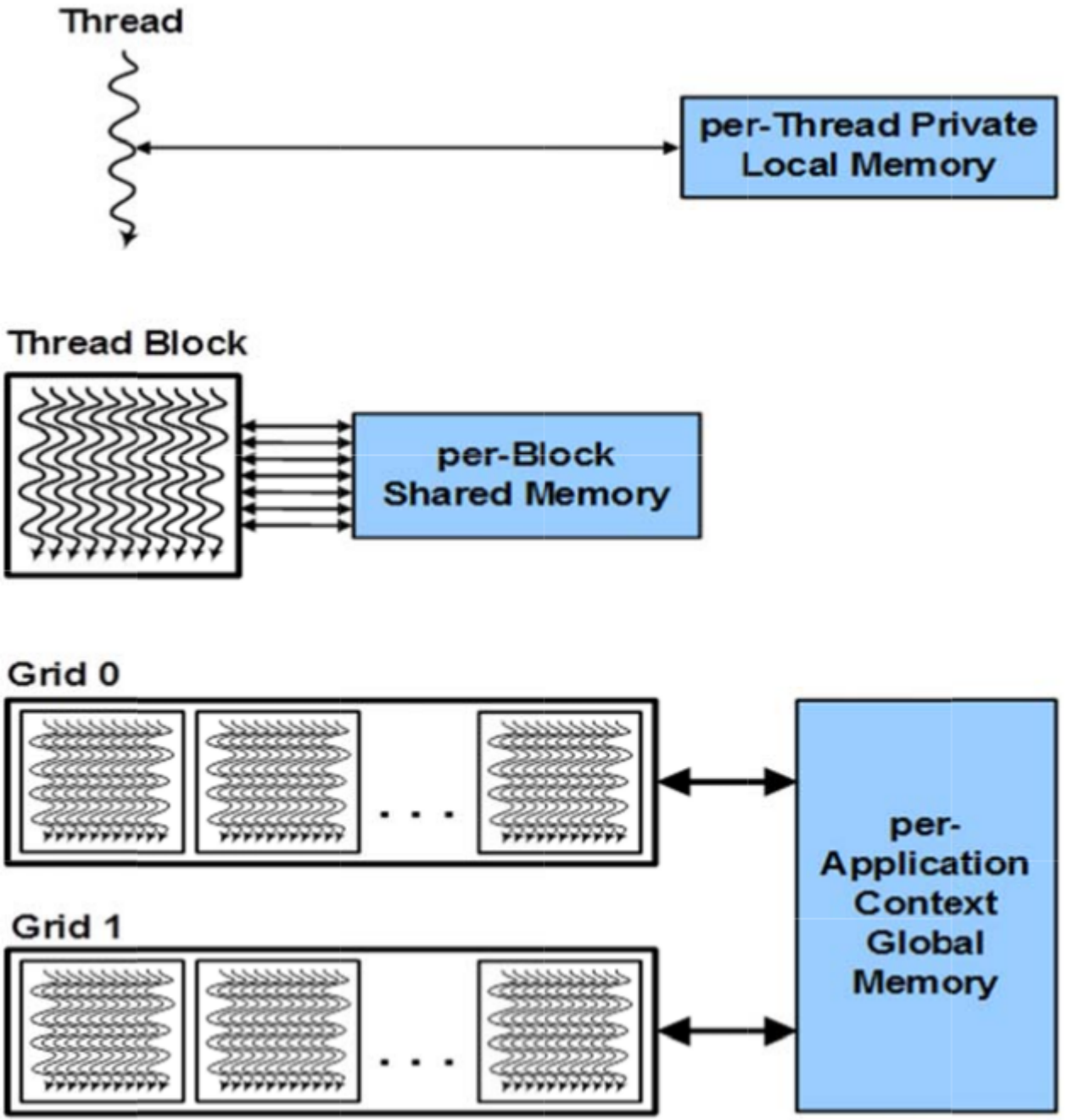
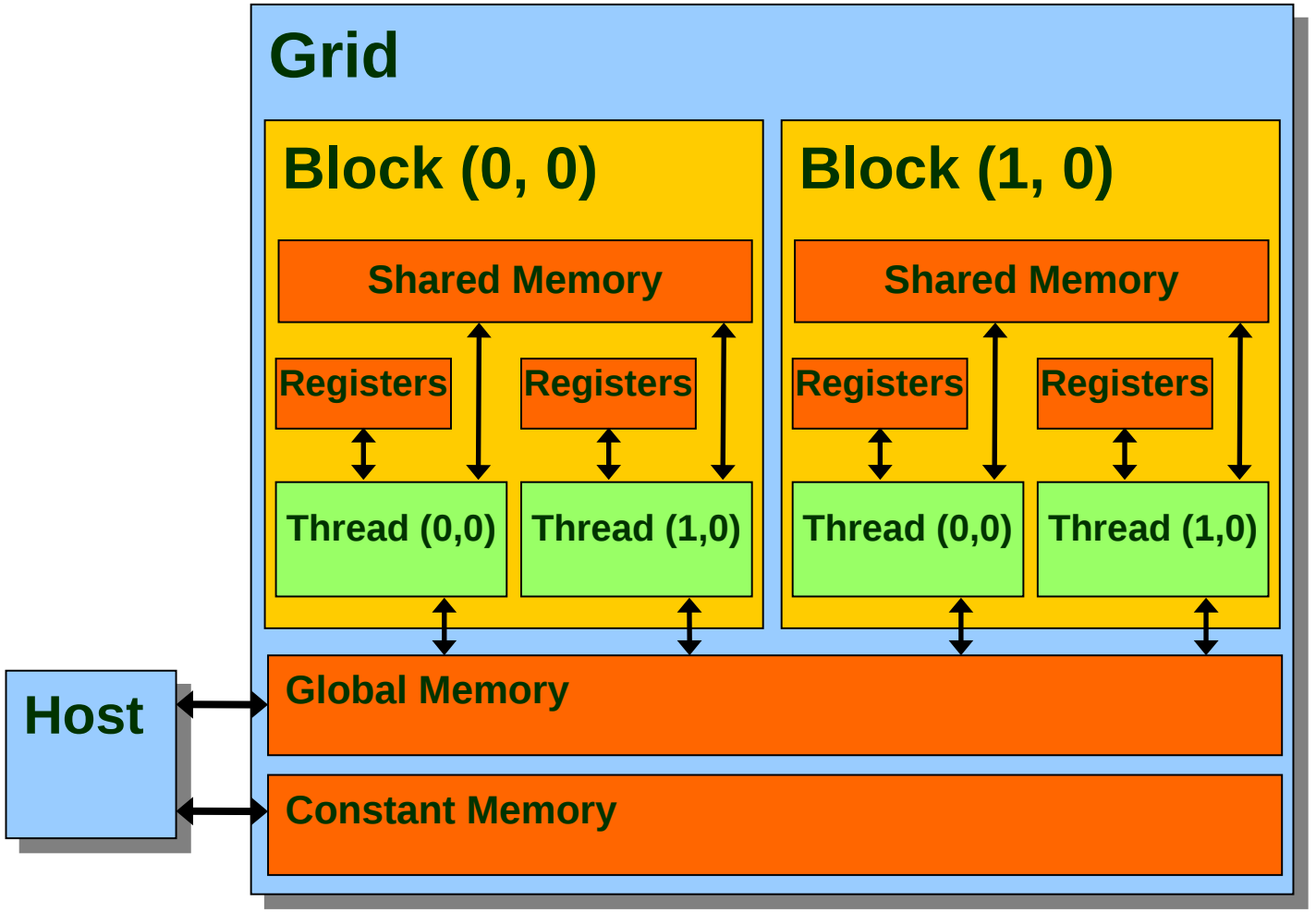
- To magnify memory bandwidth for parallel execution

Thread & Memory Hierarchy



Programmer View of CUDA Memories



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Variable declaration	Memory	Scope	Lifetime
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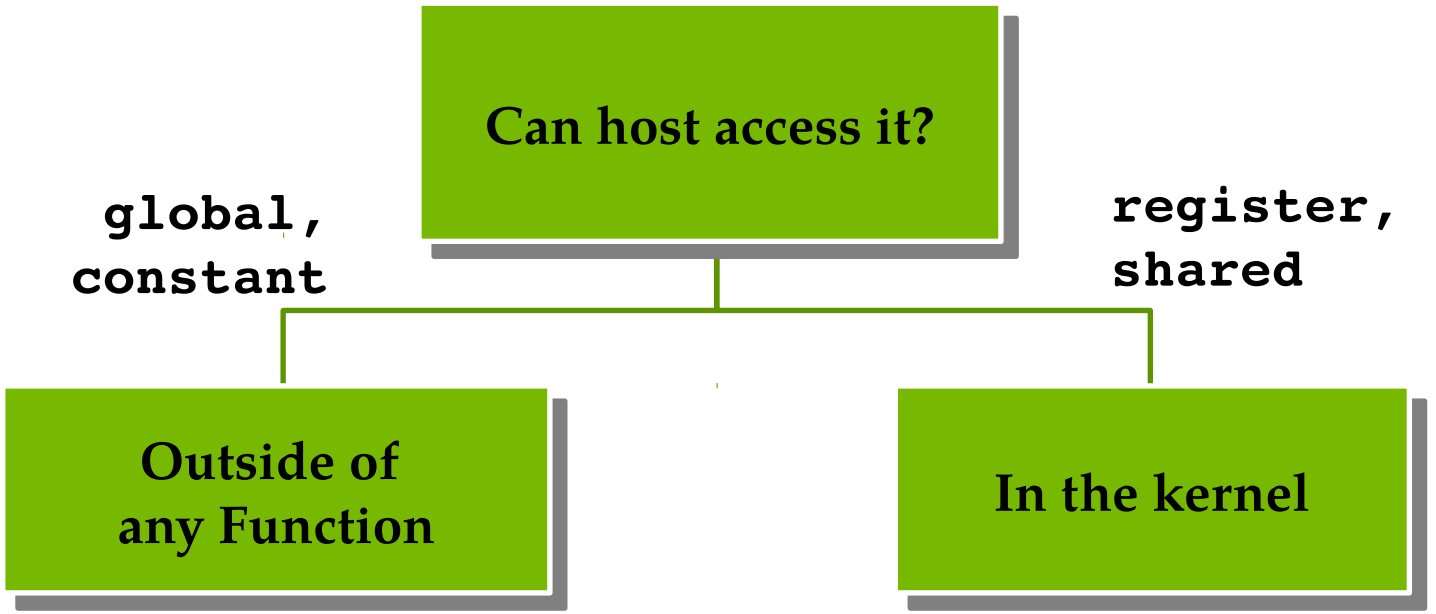
- Automatic variables reside in a **register**
  - Except per-thread arrays that reside in global memory

Where to declare variables?



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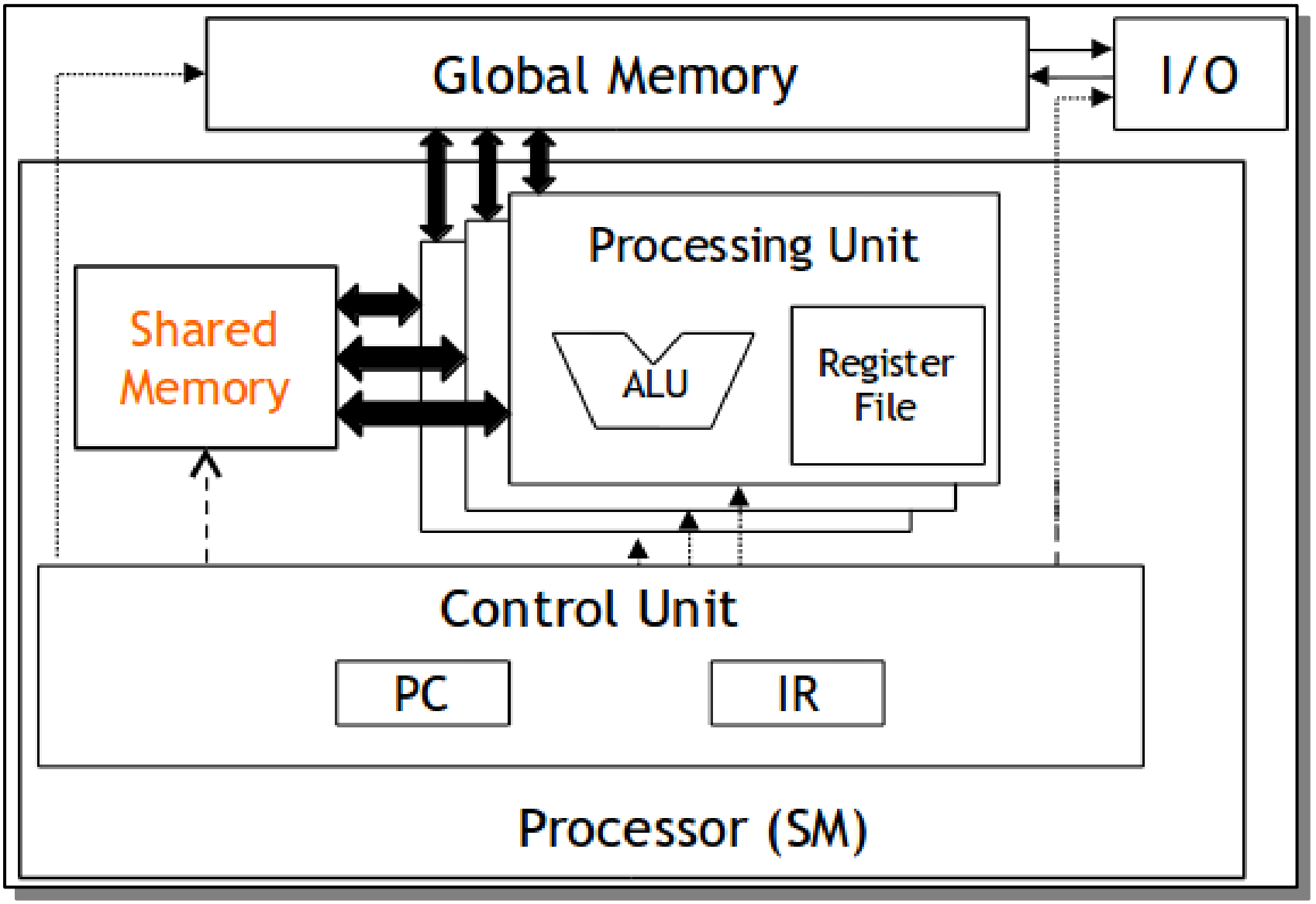
- Accessed by memory load/store instructions

Hardware View of CUDA Memories



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- Use one thread block to handle each tile
  - Load the tile from global memory to shared memory, in parallel (using multiple threads)
  - Perform computation on the subset in shared memory
    - (Reduces traffic to the global memory)

Programming Strategy

- Partition data into subsets or tiles that fit into shared memory
- Use one thread block to handle each tile
  - Load the tile from global memory to shared memory, in parallel (using multiple threads)
  - Perform computation on the subset in shared memory
  - Upon completion, write results from shared memory to global memory

Shared Memory Variable Declaration

```
__global__
void MatrixMulKernel(int m, int n, int k, float* A,
float* B, float* C)
{
   __shared__ float ds_A[TILE_WIDTH][TILE_WIDTH];
   __shared__ float ds_B[TILE_WIDTH][TILE_WIDTH];

}
```

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```
cudaDeviceProp is a built-in C structure type
dev_prop.dev_prop.maxThreadsPerBlock
Dev_prop.sharedMemoryPerBlock
```