alpaka Parallel Programming – Online Tutorial

Lecture 20: Thread Parallelism in alpaka

Lesson 24: Computing π – Part II

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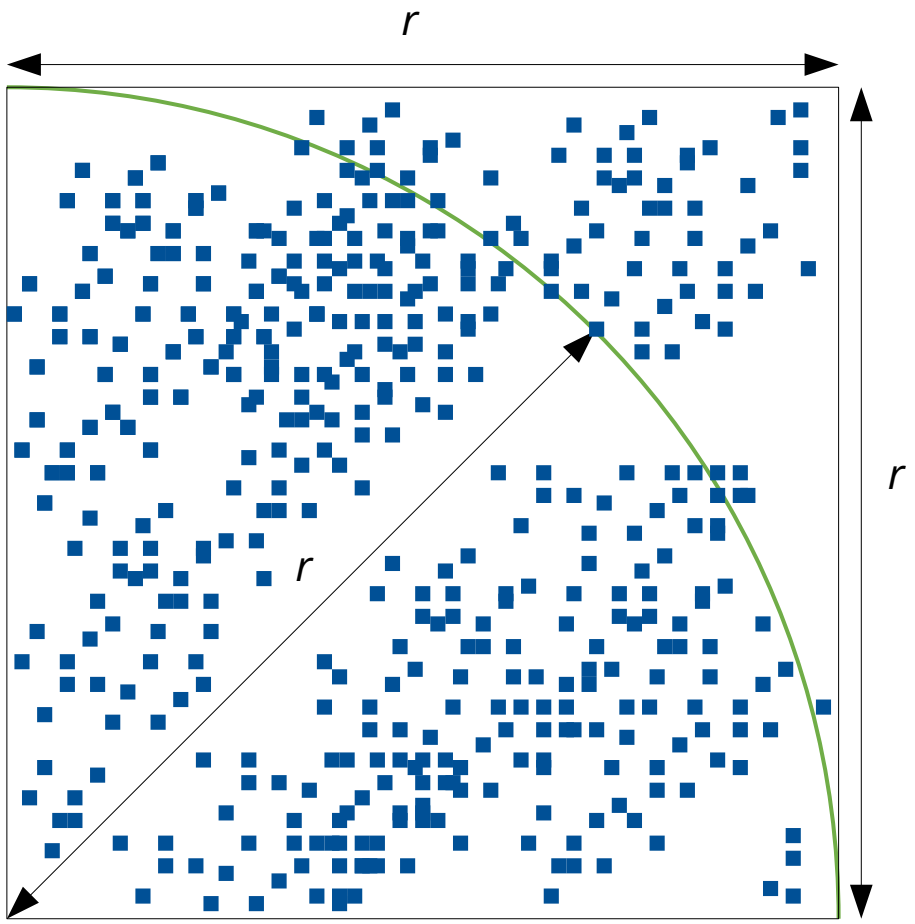
Recap

- Introduced goal: Compute π in parallel
- Introduced initial algorithm: find points in circle
- Introduced kernel requirements
- Introduced parameter passing
- Next: Find the points!



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Grid dimensionality

- No spatial relationship between points
- Points can be evaluated independently
- This makes a multi-dimensional grid unnecessary

```
struct PixelFinderKernel
{
    template <typename Acc>
    ALPAKA_FN_ACC void operator()(Acc const & acc, Points points, float r) const {

        using namespace alpaka;

        uint32_t gridThreadIdx = idx::getIdx<Grid, Threads>(acc)[0];
        /* … */
```

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Accessing memory

- Iterating over a buffer works differently in alpaka
- `for` loop: One thread accesses elements sequentially
- Thread index: Threads access elements in parallel
- If required, you can mix both approaches!

```
// Using a for loop for buffer access
for(std::size_t i = 0; i < n; ++i)
{
    float x = points.x[i];
    float y = points.y[i];
}
```

```
// Using the thread index for buffer access
float x = points.x[gridThreadIdx];
float y = points.y[gridThreadIdx];
```

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Computing the distance

- Use Pythagoras' theorem for computing the distance
- Use `math::sqrt()` for computing the square root
  - Requires the `acc` parameter!

```
        /* … */
        float d = math::sqrt(acc, x * x + y * y);

        bool isInside = (d <= r);

        points.inside[gridThreadIdx] = isInside;
    }
};
```

Lesson 23: Computing π – Part I

The complete Kernel

```
struct PixelFinderKernel
{
    template <typename Acc>
    ALPAKA_FN_ACC void operator()(Acc const & acc, Points points, float r) const {

        uint32_t gridThreadIdx = idx::getIdx<Grid, Threads>(acc)[0];

        float x = points.x[gridThreadIdx];
        float y = points.y[gridThreadIdx];
        float d = math::sqrt(acc, x * x + y * y);

        bool isInside = (d <= r);

        points.inside[gridThreadIdx] = isInside;
    }
};
```

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