Distributed Computing and Introduction to High Performance Computing

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Solving poisson equation

Solving the Poisson's equation discretized on the [0,1]x[0,1] domain using the finite difference method and a Jacobi's iterative solver.

$\Delta u = f(x, y) = 2 * (x * x - x + y * y - y)$

- u equal 0 on the boudaries.
- The exact solution is $u = x * y * (x - 1) * (y - 1)$

The u value is :

- $coef(1) = (0.5 * hx * hx * hy * hy)/(hx * hx + hy * hy)$
- $coef(2) = 1./(hx * hx)$
- $coef(3) = 1./(hy * hy)$
- $u(i,j)(n+1) = coef(1) * (coef(2) * (u(i+1,j) + u(i-1,j)) + coef(3) * (u(i,j+1) + u(i,j-1)) - f(i,j))$

On each process, we need to:

1. Split up the domain
2. Find our 4 neighbors
3. Exchange the interface points
4. Calculate u

Solving poisson equation

- The green color represent the interior cells.
- The black color represent the ghost cells.

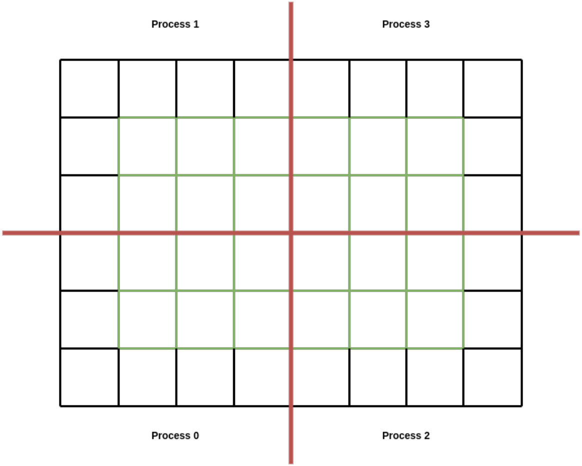

Figure: [6,4] domain divided into 4 sub-domains

Solving poisson equation

- The blue color represent the hello cells.

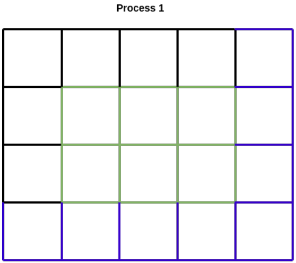

Figure: The local grid of Process 1