

The Sieve of Eratosthenes using MPI

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Outline

1. Parallel Programming
2. Message Passing Interface (MPI)
3. The Sequential Algorithm
4. The Parallel Algorithm
5. Sequential vs. Parallel Comparison

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Introduction

- **Parallel Computing** is the use of multiple computers or processors to reduce the time needed to solve a single computational problem.
- A **task** is a single program including local memory and a collection of input/output ports.
- A **channel** is a message queue between two tasks used for communication

Ian Foster's Design Methodology

1. **Partitioning** - the process of dividing the computations and data into pieces.
2. **Communication** - channels between tasks allow communication between them
 - Local - a task's computation requires values from a small number of other tasks
 - Global - many tasks must contribute values to perform a computation
3. **Agglomeration** - grouping tasks in order to improve performance and reduce overhead.
4. **Mapping** - assigning processes or tasks to specific processors or computers

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Message Passing Interface (MPI)

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The Sequential Algorithm

The Sieve of Eratosthenes

Summary: Finds all primes between 2 and n , inclusive

Create a list of natural numbers 2, 3, ... , n , none of which are marked

Set k equal to the first prime number, 2

while $k^2 \leq n$ **do**

 Mark all multiples of k between k^2 and n

 Set k to the smallest unmarked number greater than the current k

end while

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The Parallel Algorithm: Block Allocation

- The main question is how to break up the problem into multiple tasks

Developing the Algorithm

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Sequential vs. Parallel

References