



# Parallel Phase Model for Manycore Parallel Machines

**Zhaofang Wen**, Sandia National Labs

Junfung Wu, Syracuse University

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## HW Architecture for high-end machines:

- cluster of nodes, each with some manycore processors
- Parallelism: node (shared memory) + cluster(distributed memory)

## HPC Applications:

- sparse matrix, simulations, informatics (lots of **random fine-grained parallelism**)

## Parallel Phase Model

1. **Shared-memory abstraction**: ordinary array syntax (global shared, node shared)
2. **Implicit synchronization** (global phase, node phase)
3. **virtual processors** (unbounded # of threads)

### Note:

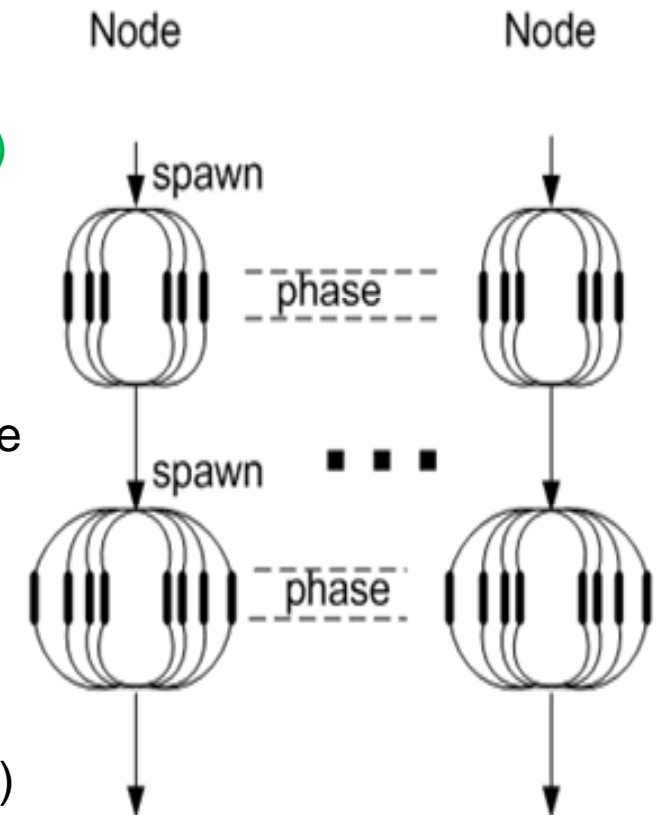
- Simple extensions to C language
- Easy to program (free from low-level details)
- Easy to verify correctness and analyze performance

## Good Performance on Real Machines

- Smart scheduler for communication (and work loads)
- Fine-grained parallelism → coarse-grained

**Status:** software ready, initial applications (CG, MD, etc.)

## Parallel Phase Model



# Relationship to Theory

## Background and related work

- PRAM, BSP, Multi-BSP, ...

## Remark

- PPM can express algorithms that exploit one or two levels of parallelism.  
(Easily extensible to more levels)

## How Theory Can Help

- **Re-design parallel algorithms to exploit parallelism at two or more levels.**
- **How to design such algorithms?**