

# NSIM-ACE: A Simulator for Evaluating RDMA on Interconnection Networks

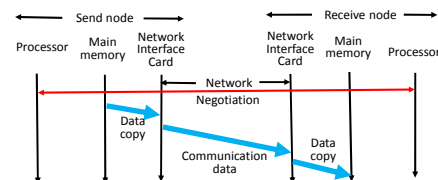
## Why Interconnection Network Simulator?

- Communication has great impact on performance of large-scale parallel applications
- We need performance of interconnection network and communication library at design stage

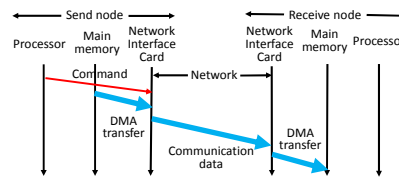
- Also we need to analyze internal behavior in interconnection network of real machine
- Mathematical model is inaccurate if communication contention frequently occurs

## RDMA (Remote Direct Memory Access)

### Send-receive type communication



### RDMA

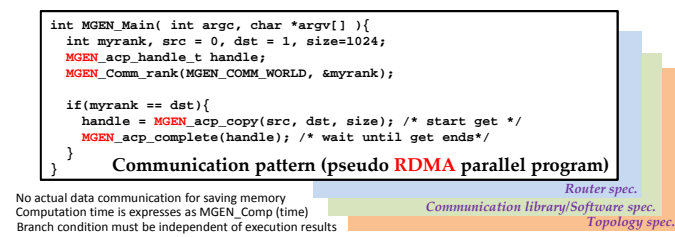


### RDMA advantages

- **Low communication latency**  
Direct data transfer from memory to memory
- **Overlap of computation and communication**  
DMA transfer without processor
- **Minimum memory consumption**  
No communication data buffer

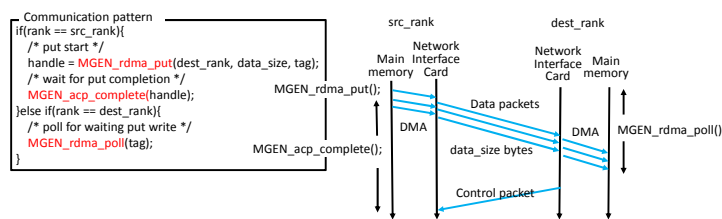
No existing simulators support RDMA!

## NSIM-ACE Simulator

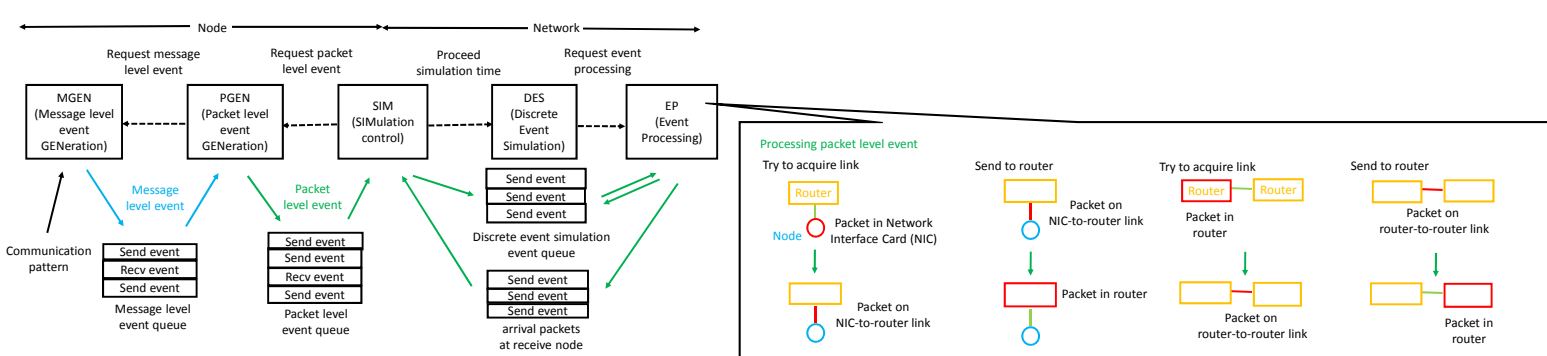


Packet/bit level simulation  
Latency through put etc. of communication pattern

### Put operation

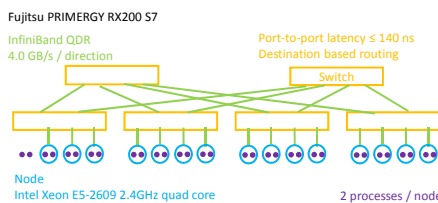


## Simulation Flow



## RDMA Simulation Results

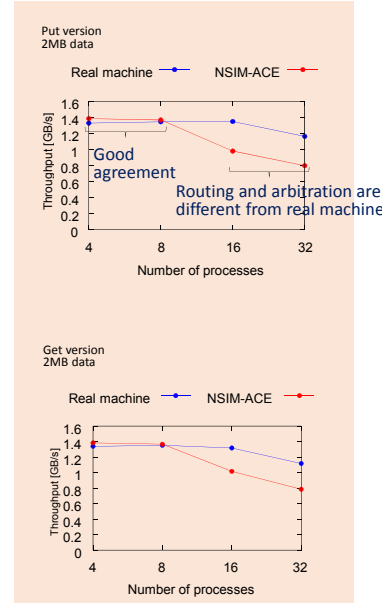
### Real machine



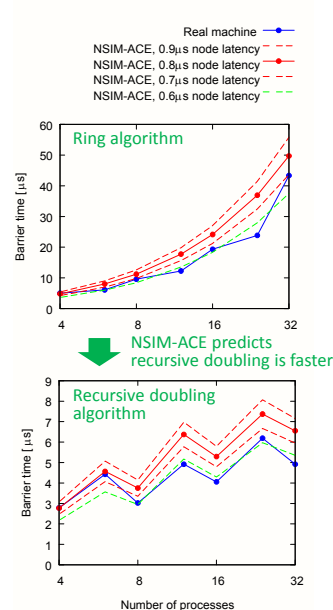
### NSIM-ACE configuration parameters

Router	
Maximum theoretical communication speed of network	4.0 GB/s
Switch throughput	4.0 GB/s
Routing calculation time	4.0 ns
Virtual channel allocation time	4.0 ns
Switch allocation time	4.0 ns
Switch Latency	128 ns
Cable latency	0.6 ns
Node	
DMA transfer speed	2.8 GB/s (real measurement)
Memory bandwidth	∞
Communication library overhead	0.8μs (real measurement) 0.6-0.9μs (calibration)
Number of processes	1 process / node (NSIM-ACE emulates 2 processes / node)

### HPCC random ring benchmark



### Barrier synchronization



### N-body simulation

