

# Active Pebbles:

## A Programming Model For Highly Parallel Fine-Grained Data-Driven Computations

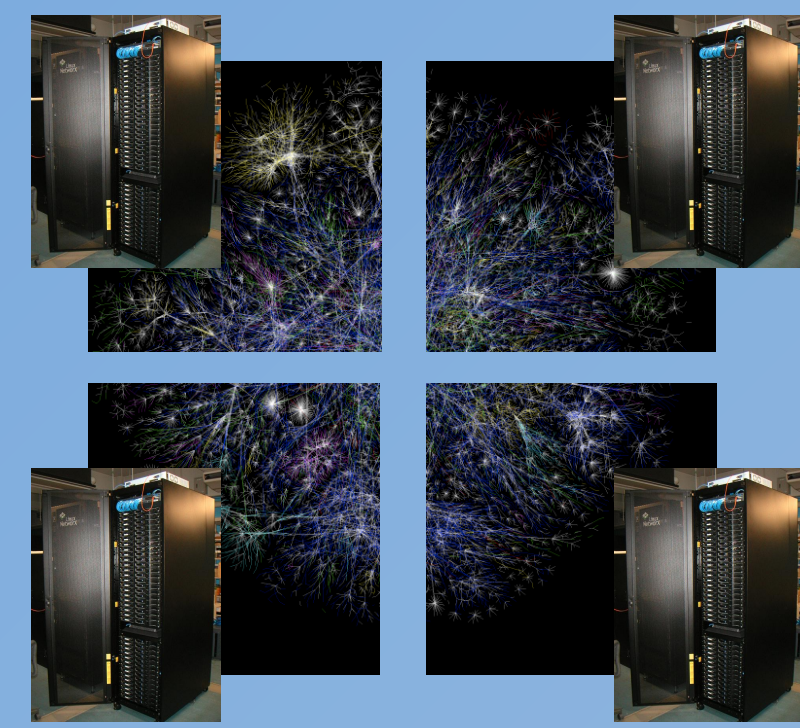
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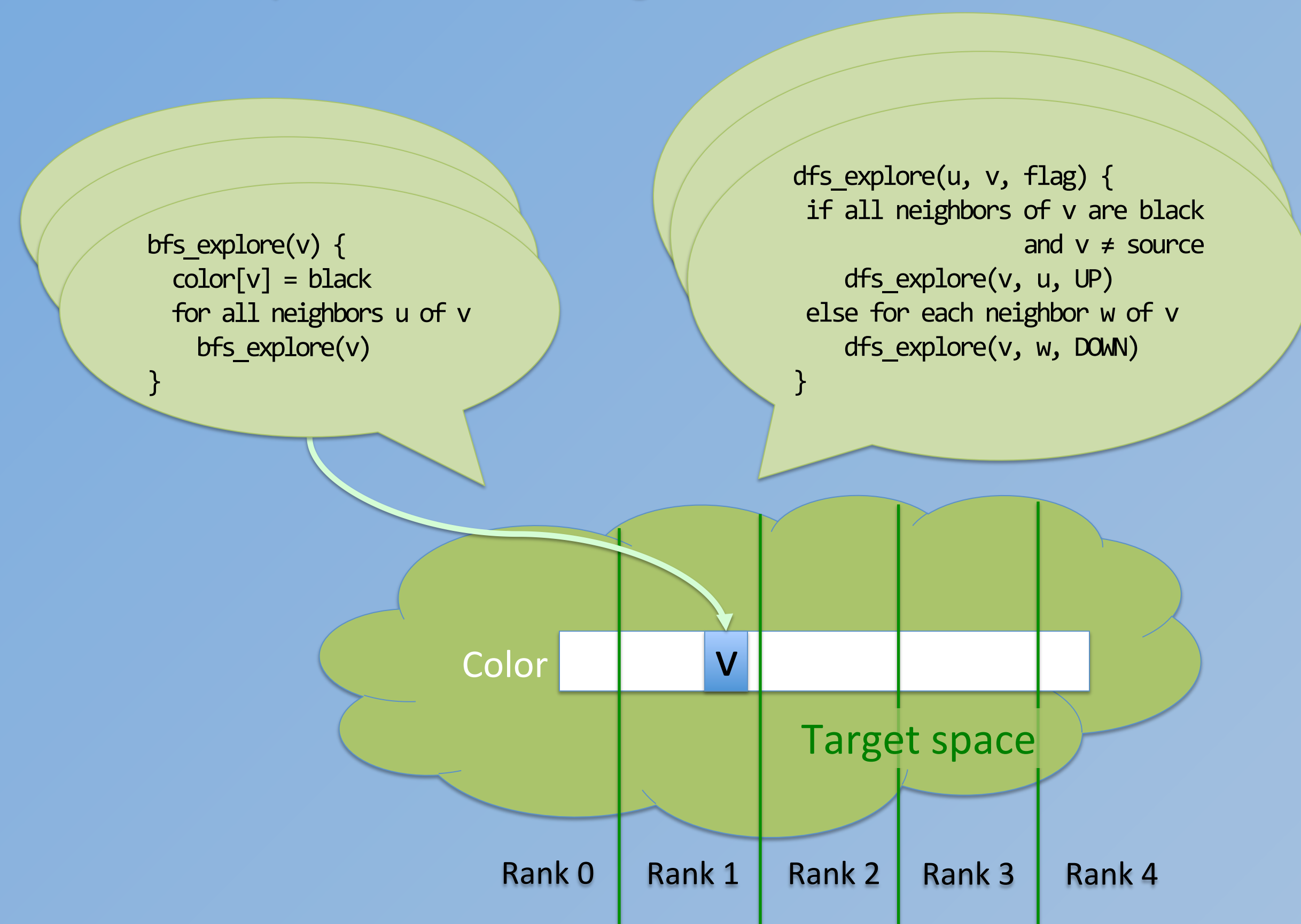
### Programming model

#### Target applications

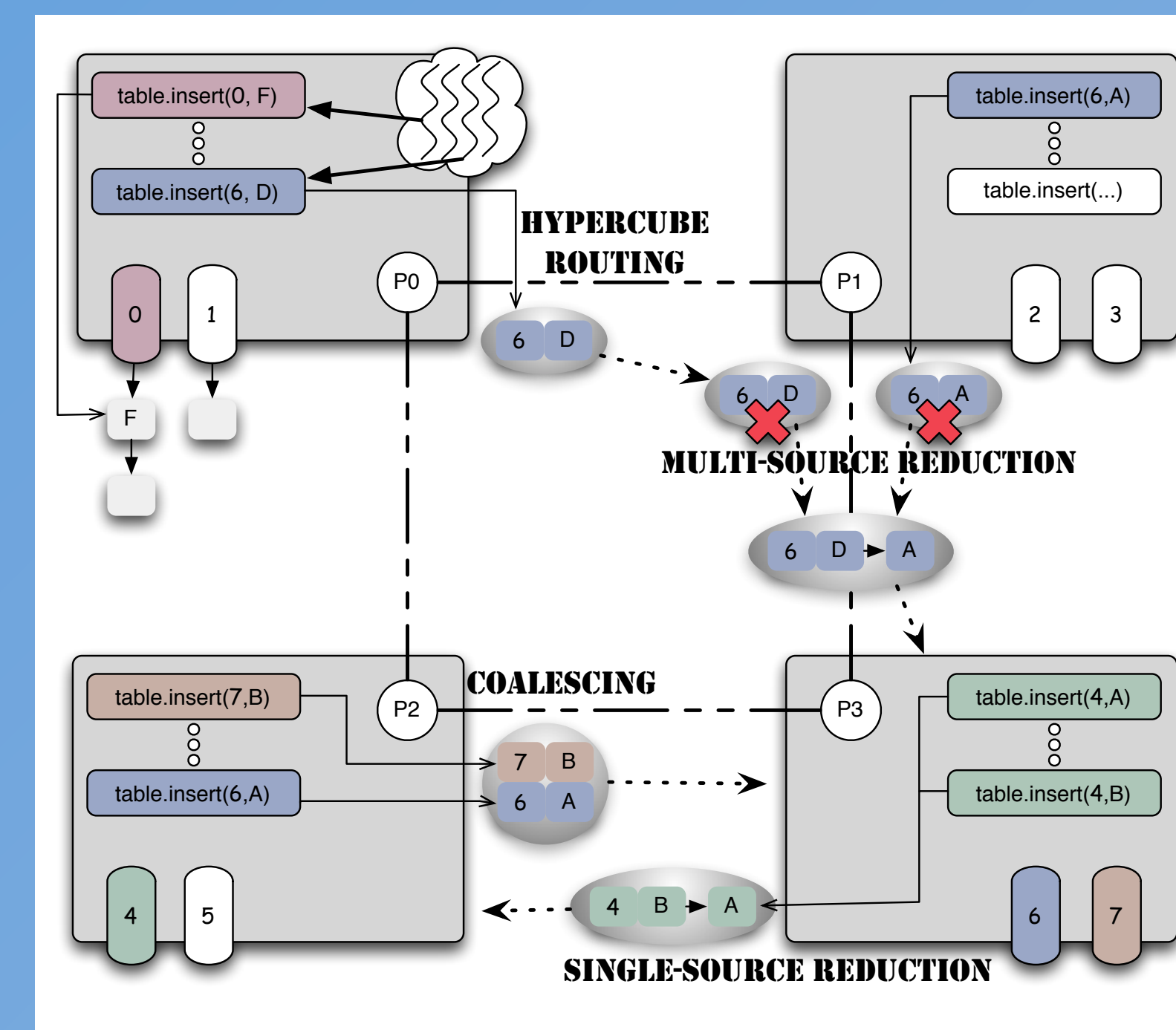
- Data-driven, fine-grained
- Large-scale, distributed-memory computers
- Heterogeneous systems



- Captures dependency structure of fine-grained applications
  - No need to artificially coarsen object granularity
- Transparent addressing
  - Local and remote data treated identically
- Bulk, anonymous handling of messages and targets
- Static and dynamic addressing



### Execution model



#### Termination detection

- Message handlers send messages
- Detects quiescence
- Configurable by user
  - Specialized algorithms for limited depth

#### Message reductions

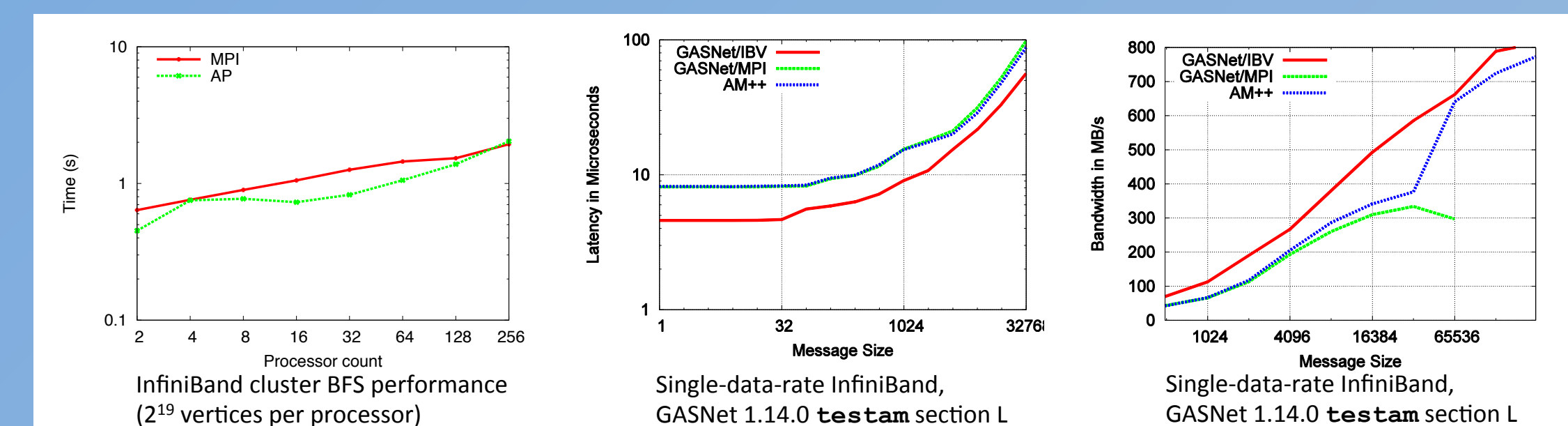
- Messages to same target can sometimes be combined
- Synthesizes reduction tree in network using cache

#### Message coalescing

- Coarsens granularity of parallelism
- Reduces messaging overheads
- Dynamically configurable at run-time

#### Active routing

- Maps virtual network topology onto physical topology
- Improves scalability



Implementation using AM++: J. Willcock, T. Hoefler, N. Edmonds, and A. Lumsdaine. "AM++: A Generalized Active Message Framework." *Parallel Architectures and Compilation Techniques*, Sep. 2010.

