

Berkeley UPC Compiler

http://upc.lbl.gov

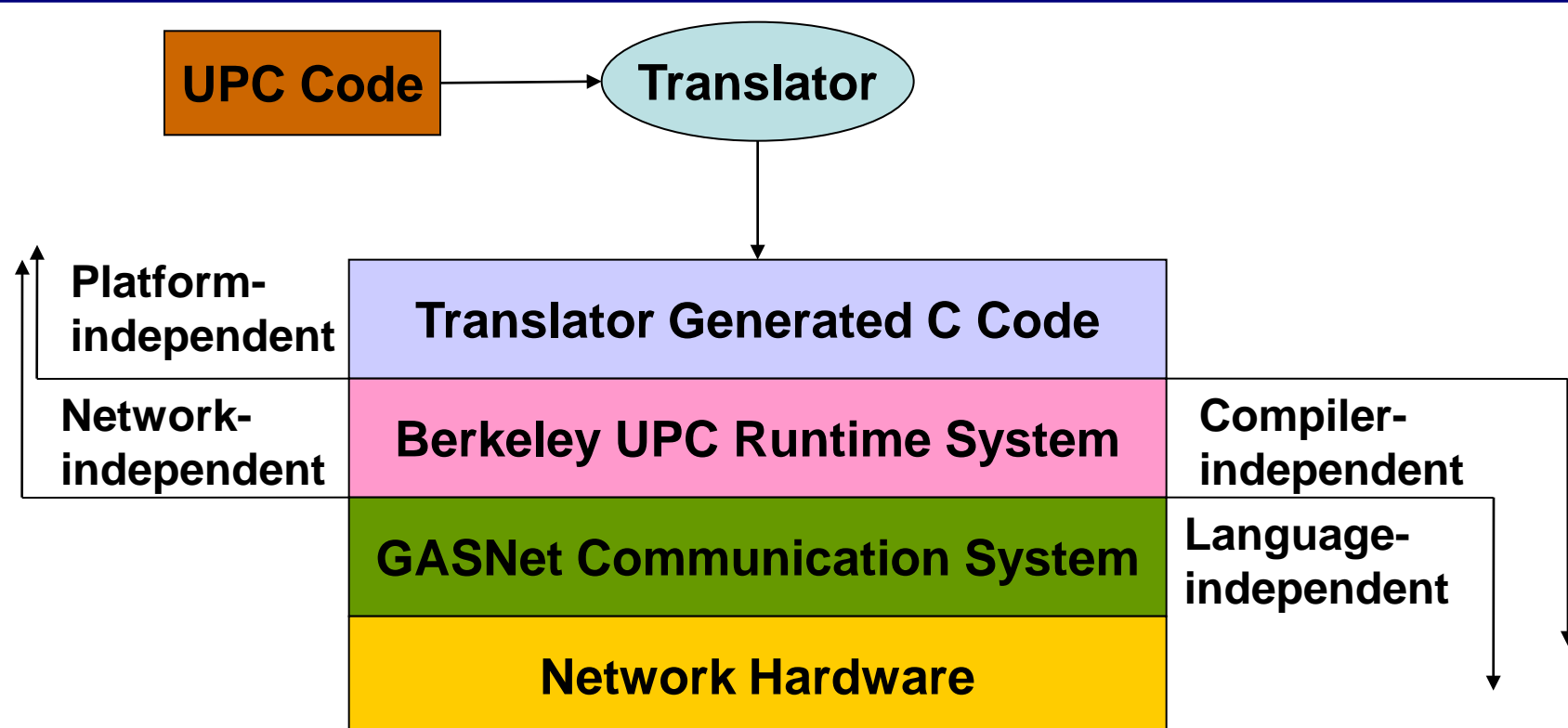


Overview

- A portable and high-performance UPC implementation
- Fully compliant with UPC 1.2 specification
 - Includes UPC Collectives, UPC I/O
- Many extensions for performance and programmability
 - Non-blocking memcpy functions
 - Semaphores and signaling put
 - Fine granularity timers
 - Value-based collectives
 - Atomic memory operations
 - Hierarchical layout query
- Entirely free & open source
 - Windows/Mac/UNIX CD available at UPC booth



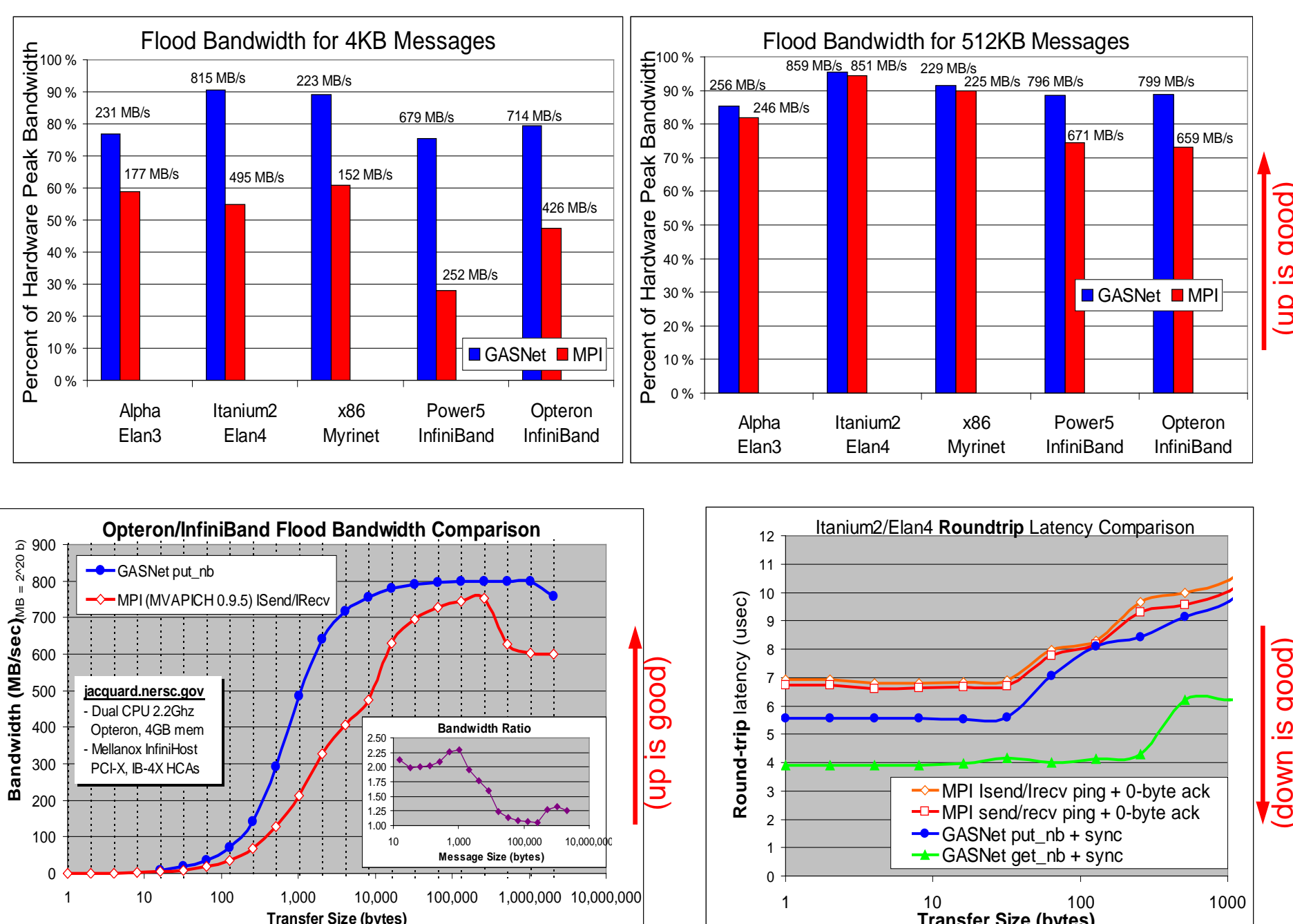
Portable Design



- Layered design, platform-independent code gen
- Supports wide range of SMPs, clusters and MPPs
 - x86, Itanium, Opteron, Athlon, Alpha, PowerPC, MIPS, PA-RISC, SPARC, T3E, X1, SX-6, XT3, Blue Gene, ...
 - Linux, FreeBSD, NetBSD, Tru64, AIX, IRIX, HPUX, Solaris, MS Windows, Mac OS X, Unicors, SuperUX, ...

BUPC Runtime + GASNet

- Well-documented runtime interface
 - Supports multiple UPC compilers (Berkeley UPC and Intrepid GCC/UPC)
- Performance Instrumentation Support (GASP)
 - Supports Parallel Performance Wizard (PPW)
- Detailed Communication tracing support
 - GASNet trace & stats
- Etnus TotalView debugger support
- Provides app interoperability:
 - UPC calls to/from C, C++, Fortran, MPI
- Berkeley GASNet used for communication:
 - Portability from layered design
 - Performance from inline functions, macros, and network-specific implementations
 - Support SMP, Myrinet, Quadrics Elan 3/4, Infiniband, IBM LAPI, Dolphin SCI, MPI, Ethernet, Cray X1 / SGI Altix shmem, Cray XT3 Portals
- Optimized Collective ops (SC poster session)
- High-performance communication
 - Consistently matches or outperforms MPI
 - One-sided, lightweight semantics

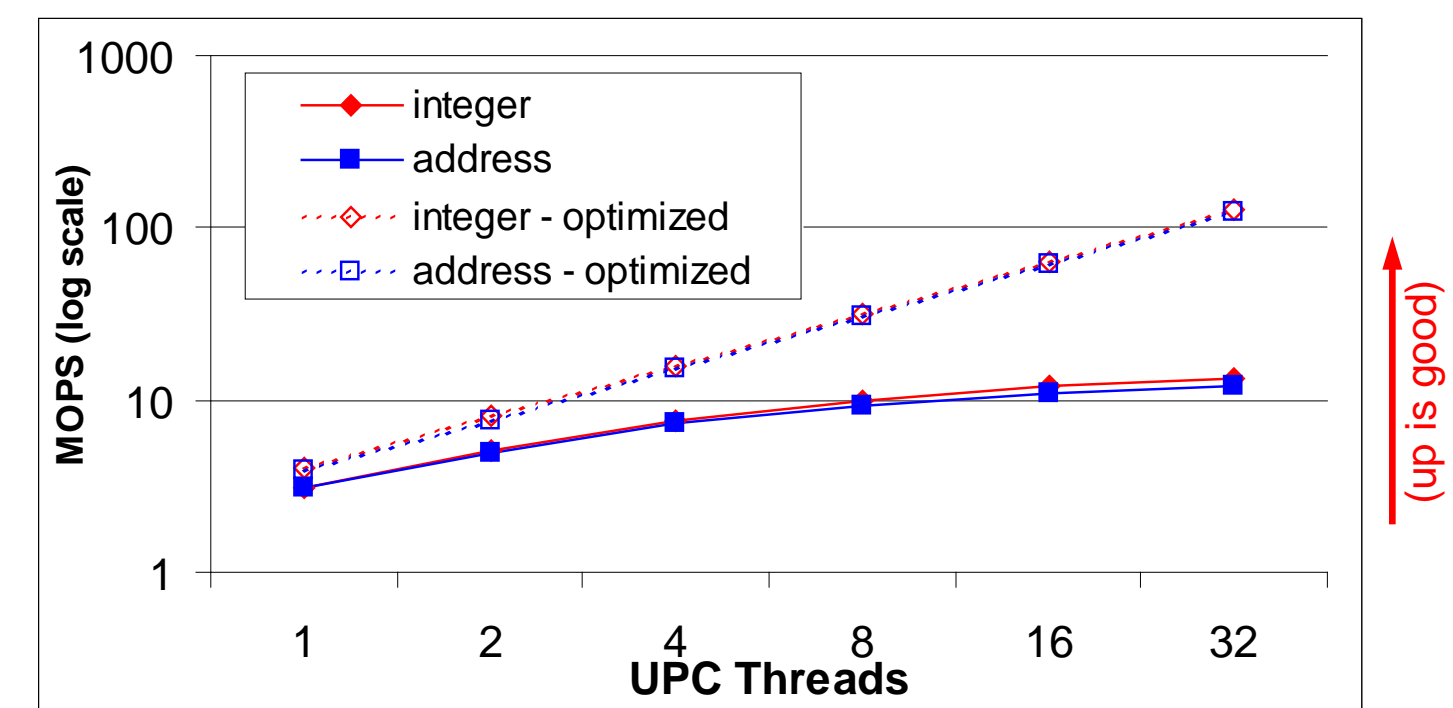


UPC-to-C Translator

- Based on Open64
- Translate UPC into C with calls to runtime
- Platform for experimenting with UPC-specific optimizations:

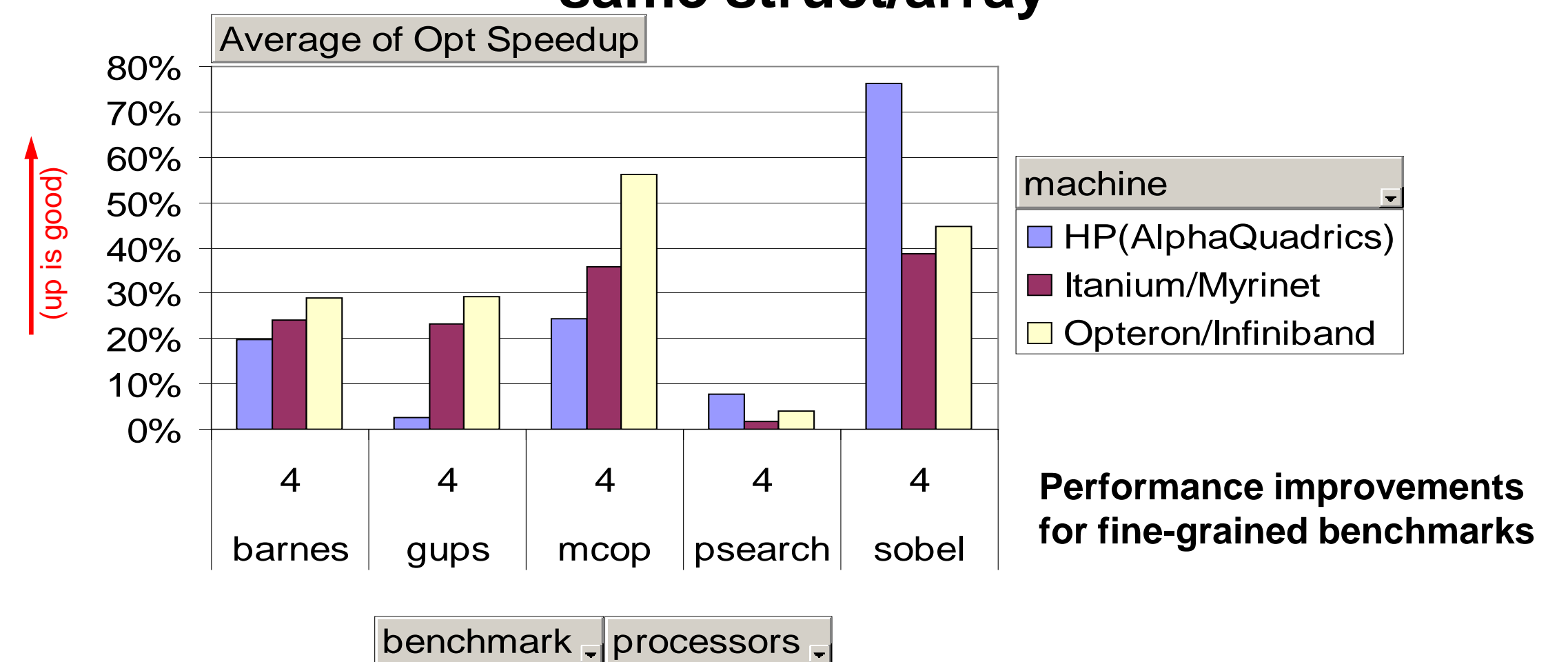
upc_forall Loop Optimization

- Removes runtime branch from upc_forall loops
- Privatize array accesses that must be local by analyzing affinity exp.
- Works for affine cyclic/indefinite arrays



PRE & Split-Phase Access

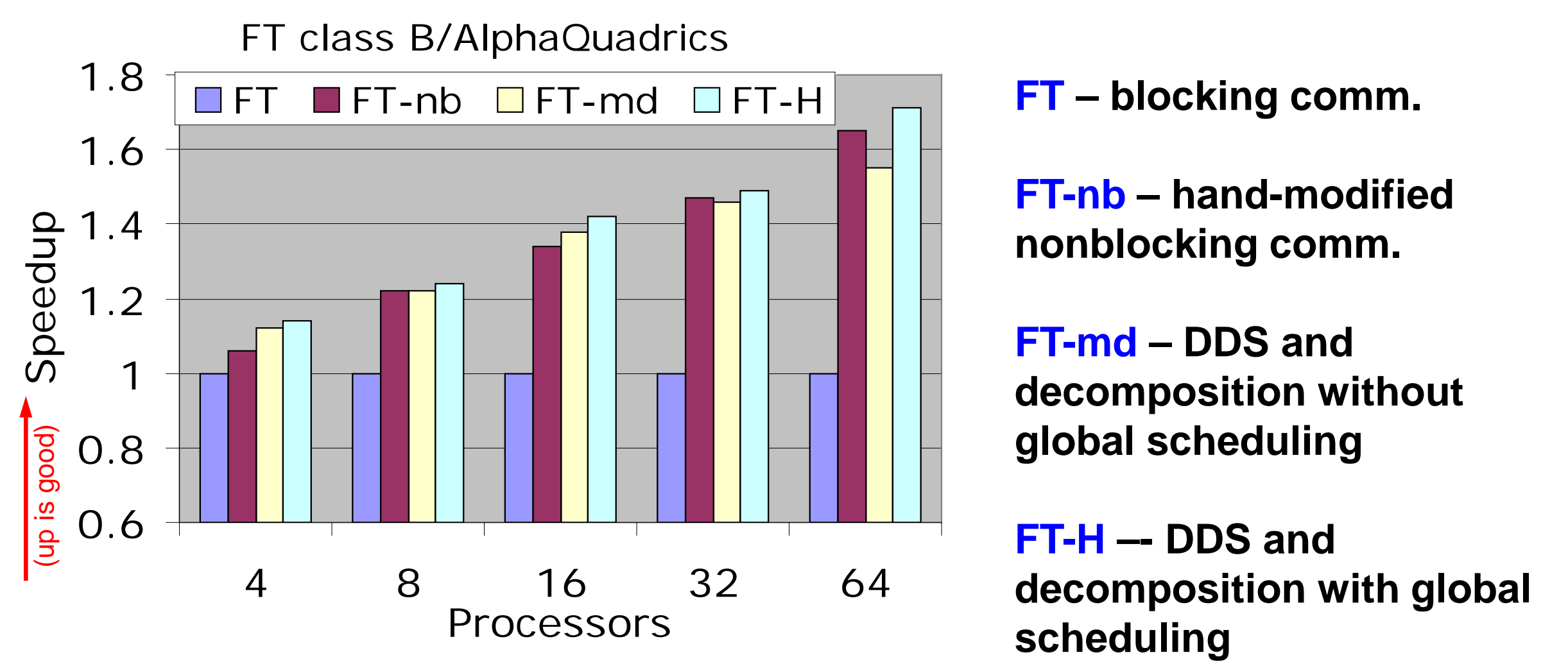
- Partial-Redundancy Elim. on shared ptrs
 - pointer add, load, and store
- Split-phase comm. – moves read initiations up, write completions down
- Coalesces fine-grained accesses to same struct/array



VM-based Communication Overlap

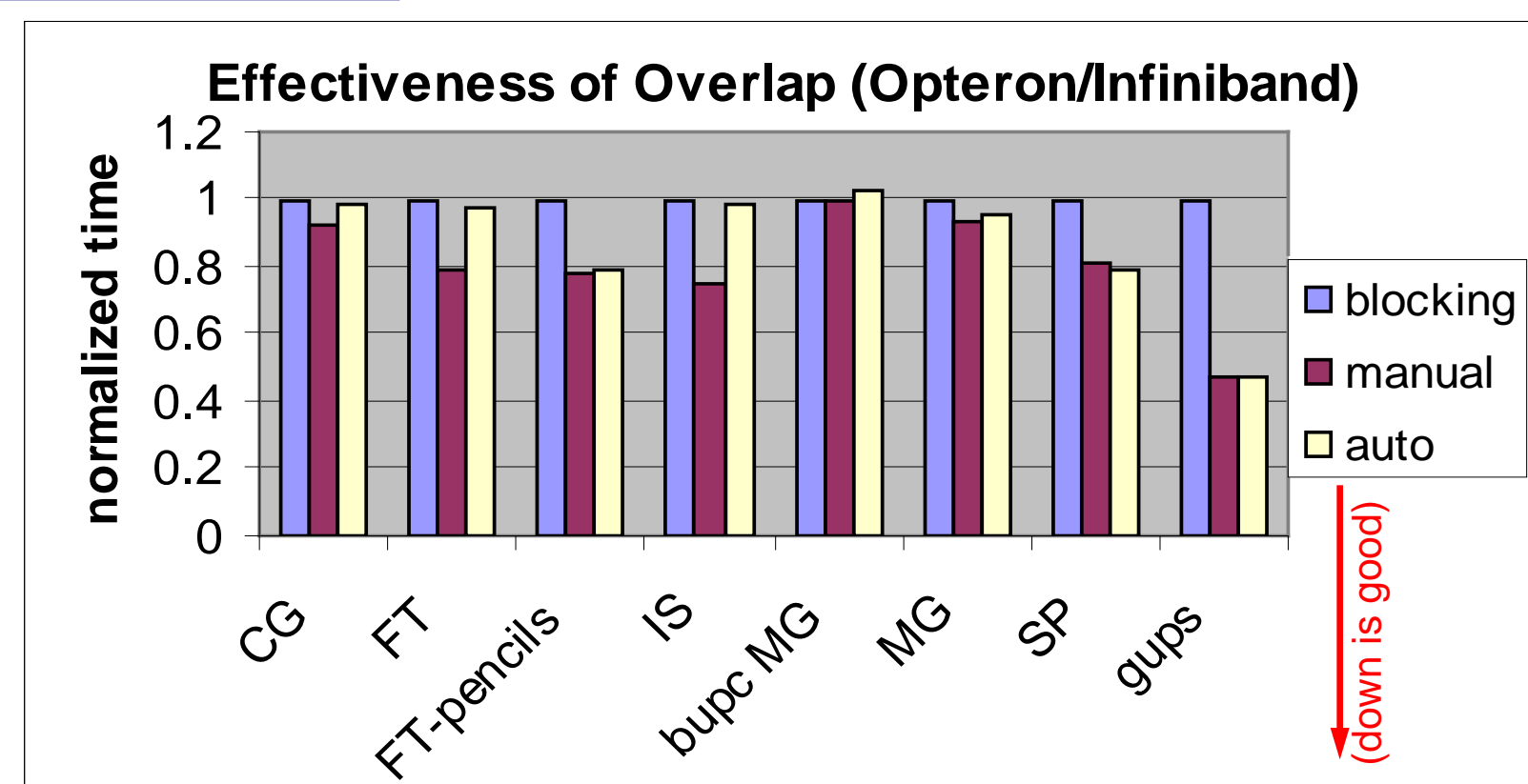
- VM support for demand-driven comm. synchronization
- Message decomposition and scheduling for bulk comm.

Performance of Demand-Driven Synchronization (DDS)



Automated Communication Scheduling

- Delay synchronization of memputs
- Prefetching of memgets
- Portable – no VM support required



Serial Performance

- High level representation for good serial performance
- Preserve restrict qualifiers and optimization pragmas

