



Berkeley UPC Compiler



<http://upc.lbl.gov>

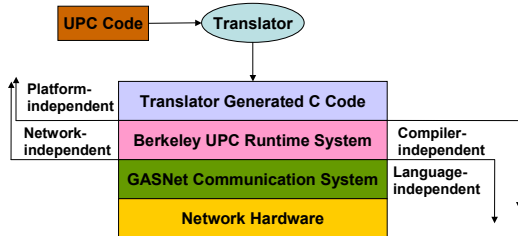


Overview

- Goal: a portable and high-performance UPC implementation
- Fully compliant with UPC 1.2 spec.
- Many extensions for performance and programmability
 - Non-blocking memcpy functions
 - Semaphores for one-side comm.
 - Fine granularity timers
- Entirely open source
- Windows/Mac/UNIX CD available at UPC booth



Portable Design



- Multi-layer design, platform independent code generation
- Supports large-scale multiprocessors, SMPs and clusters
 - x86, Itanium, Opteron, Athlon, Alpha, PowerPC, MIPS, PA-RISC, SPARC, T3E, X1, SX-6, XT3(new), Blue Gene(new)

Runtime + GASNet

- Well-documented interface
 - Supports multiple UPC compilers (Berkeley UPC and Intrepid GCC/UPC)
- Etnus TotalView debugger support
- Communication tracing 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, X1/Altix shmem

UPC-to-C Translator

- Based on Open64
- Translate UPC into C with calls to runtime
- High-level representation to get good serial performance
- Platform for experimenting with UPC 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

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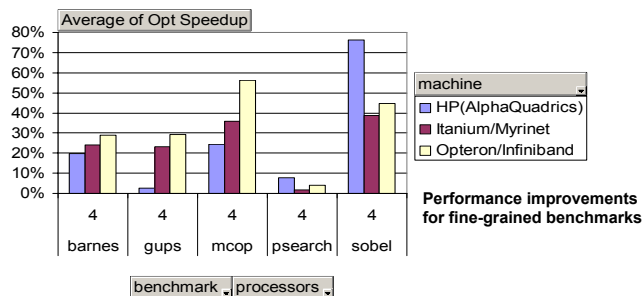
shared int a[N];
upc_forall(i = L; i <U; i++; i)
  accum += a[i];
  
```

```

int ofst = (MYTHREAD-L) % THREADS;
int *la = (int *) &a[L+ofst];
for(i=L+ofst, j=0; i <U; i+=THREADS, j++)
  accum += la[j];
  
```

PRE & Split-Phase Access

- PRE on shared expressions (ptr 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)

