Omni Compiler

Omni XcalableMP Compiler

- XcalableMP (XMP) is a PGAS language for distributed memory system, which is a directive-based language extension of C and Fortran
- XMP supports typical parallelization under global-view programming model
  - XMP global-view model enables parallelizing the original sequential code using minimal modification with simple directives, like OpenMP
  - The directives can describe data mapping, work mapping, and inter-node communication
  - Many ideas on global-view programming are inherited from High Performance Fortran
- XMP includes Coarray Fortran syntax as local-view programming model

Example of the HIMENO Benchmark in XMP/Fortran

```
real p(minmax, mjmmax, mkmmax)
!$xmp node s (N, R)
!$xmp template t (minmax, mjmmax, mkmmax)
!$xmp distribute t(*, block, block) onto n
!$xmp align (*, j, k) with t(*, j, k) = y
!$xmp shadow y (0, 1, 1)
!$xmp reflect (y)
!$xmp loop (Z, X) on t(*, J, X) reduction (+=GOA)
do K = 2, kmjmax-1
d o J = 2, jmmax-1
end do c = 2, jmmax-1
end do K = 2, kmjmax-1
end do I = 2, jmmax-1
GOA = GOA + XS
end do
end do
```

Note: The HIMENO Benchmark is a typical stencil benchmark.

Performances of the HIMENO Benchmark & the HPC Challenge Benchmarks on the K computer


Omni OpenACC Compiler

- OpenACC is a directive-based programming model for accelerators
- We have been designing and implementing an open source OpenACC compiler
  - To implement our OpenACC compiler, we use the Omni compiler-infrastructure of C source code analysis and translations
  - Target language is C language
  - Target accelerator is NVIDIA GPUs
- The proposed compiler is a source-to-source compiler that translates an OpenACC program into a C program with CUDA library calls
- This approach enables to leave detailed machine-specific code optimization to the mature CUDA compiler by NVIDIA

Performances on Cray XK6m-200 (AMD Opteron 6277 2.1GHz, NVIDIA X2090 (MatMul, N-body), K20 (NPB-CG))


These compilers are free. You can download them from http://www.hpcs.cs.tsukuba.ac.jp/omni-compiler/