



IBM Systems Technology Group

Application development for Blue Gene / P

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Agenda

- Introduction
- Cross Compiler choices
- MPI compiler wrappers
- Common XL compiler options
- Conclusion

Cross Compiler choices

- IBM XL Compilers (C/C++ and FORTRAN)
 - ▶ bgxlc, bgxIC, and bgxlf
 - ▶ Various standards supported directly through command line invocation:
 - ▶ bc89, bgc99, gxlc, gxIC, xlc++, bgf77, bgf90, bgf95, bgf2003 are but a few of the supported invocations.
 - ▶ Thread safe versions of the compilers, invoked with `_r` extension
 - ▶ Give you access to the SIMD (Single Instruction Multiple Data) vector instructions and access to both floating point units.
 - ▶ C/C++ found in `/opt/ibmcmp/vacpp/bg/9.0/bin`
 - ▶ FORTRAN found in `/opt/ibmcmp/xf/bg/11.1/bin`

Cross Compiler choices (2)

- GNU Compiler collection
 - ▶ gcc, gfortran, g++
 - ▶ Standard GNU compilers, based on gcc 4.1.2
 - ▶ All gnu compilers found in:
 - /bgsys/drivers/ppcfloor/gnu-linux/powerpc-bgp-linux/bin

MPI Compiler wrappers

- Located in /bgsys/drivers/ppcfloor/comm/bin
- All wrappers start with mpi
- GNU compilers:
 - ▶ mpicc, mpicxx, mpif77, and mpif90
- IBM Compilers
 - ▶ mpixlc, mpixlcxx, mpixlf77, mpixlf90, mpixlf95, mpixlf2003
 - ▶ Thread safe versions of the compiler use ‘_r’ extensions in the macros.

Common XL Compiler options

- OpenMP codes require the following additional options:
 - ▶ If using mpixl* scripts
 - -qsmp on the compilation line
 - -qsmp=omp on the link line
 - ▶ If using bgxl* compilers directly
 - -qsmp -I/opt/ibmcmp/xlsmp/bg/1.7/include
 - -qsmp=omp -L/opt/ibmcmp/xlsmp/bg/1.7/bglib -lxsmp
- Run-time required environmental variables:
 - ▶ OMP_NUM_THREADS=n (n <= 4)
 - ▶ XLSMPOPTS=optionA:optionB (documented in manuals)
 - ▶ Passed to BlueGene on the command line as -env “variables”

Common XL Compiler options (con't)

- `-qarch=450d -qtune=450`
 - ▶ Tells compiler to generate specifically for double floating point and tune for the 450 specific hardware
- `-qsource`
 - ▶ Generates a source code listing (default to `-qnosource`)
- `-qstaticlink`
 - ▶ BG/L was all statically linked, BG/P support dynamic libraries and defaults to doing so. If you don't want dynamic libraries, use this option during link
- `-qplic=[small|large]` for shared library generation
 - ▶ If just `-qplic`, then equivalent of `-qplic=small`
 - ▶ `-qplic=small` equivalent to GNU `-fpic`, `-qplic=large` equivalent to `-fPIC`

Common XL Compiler options (con't)

- When comparing results against Intel generated baselines, we have found that the powerpc machine instruction maf (Multiply Add Float) generates more accurate results then when generating a Multiply instruction followed by an Add. This may throw your off your expected results.
- To prevent this, use:
 - ▶ `-qfloat=nomaf`

Conclusion

- gcc and XL compilers are both available
- Use the IBM XL Compilers to leverage the SIMD (Single Instruction Multiple Data) vector instructions and the second floating point unit
- Remember that you're compiling using a cross compiler.
 - ▶ Running './configure' on Open Source code using either of the above compilers will most likely fail.
- See IBM TechRef for compiling Open Source Software:
 - ▶ <http://www.ibm.com/support/techdocs/atmastr.nsf/WebIndex/WP101152>