IBM XL C/C++ for Linux, V13.1.2

Improve application performance and developer productivity using the latest IBM XL C/C++ compiler for Linux

Highlights

IBM® XL C/C++ for Linux, V13.1.2:
- Delivers an XL C/C++ compiler to support little endian Linux distributions
- Leverages the capabilities of the latest POWER®8 architecture
- Maximizes application performance through industry leading optimization technology
- Eases application migration to Power Systems™ through conformance to the C99, C++03, and C11 standards (little endian), and a majority of the C++11 standard (little endian)
- Improves developer productivity with full support for OpenMP 3.1 and partial support for OpenMP 4.0
- Integrates with Rational® Developer for AIX® and Linux, C/C++ Edition for improved developer productivity and team collaboration

Delivers an XL C/C++ compiler to support the little endian Linux distributions

IBM XL C/C++ for Linux contains two C/C++ compilers that support:
- Big endian Linux distributions and Power® servers configured for big endian mode
- Little endian Linux distributions and Power servers configured for little endian mode

The XL C/C++ compiler for the little endian architecture supports POWER®8 distributions including Ubuntu 14.04 and 14.10, Red Hat Enterprise Linux 7.1, and SUSE Linux Enterprise Server 12.

The XL C/C++ Linux compiler for the little endian architecture leverages the Clang infrastructure from the open source community for a portion of its compiler frontend. Clang is a component of the LLVM open source compiler and toolchain project and provides the C and C++ language family front end for LLVM. The XL C/C++ compiler combines the Clang front-end infrastructure with IBM advanced optimization technology and code generation.

The XL C/C++ compiler for the big endian architecture supports RHEL 6, RHEL 7, and SLES 11.

The XL C/C++ for Linux compiler for little endian Linux distributions also provides a greater level of GNU source compatibility.

Leverages the capabilities of the latest POWER®8 architecture

XL C/C++ for Linux, V13.1.2 generates code that leverages the capabilities of the latest POWER®8 architecture. Compiler suboptions for architecture and tuning specify code generation on the POWER®8 processor architecture. -qarch=pwr8 instructs the compiler to produce code that can fully exploit the POWER®8 architecture.

-qtune=pwr8 enables optimizations, such as instruction scheduling, that maximize performance on POWER®8 systems, while allowing for binary compatibility with previous POWER® processors.

XL C/C++ provides built-in functions for direct programmer access to the POWER architecture. While most programmers will rely on the compiler to exploit processor features automatically, built-in functions give you an easy way to access specific instructions or processor features using C or C++ function call syntax and C or C++ variables. XL C/C++ for Linux, V13.1.2 provides built-in functions supporting new POWER®8 features such as vector processing, cryptography, cache management and transactional memory.

The Mathematical Acceleration Subsystem (MASS) libraries contain frequently used math intrinsic functions that enable improved performance over the corresponding standard
system library functions. These highly tuned MASS libraries are enhanced to support the POWER8 technology:

- The vector MASS library contains vector functions that are tuned for the POWER8 architecture.
- XL C/C++ ships with a single-instruction, multiple-data (SIMD) MASS library tuned specifically for the POWER8 processor.

Maximizes application performance through industry-leading compiler optimization technology

The optimization and hardware exploitation features in IBM XL C/C++ help improve programming productivity. The XL C/C++ compiler generates code that delivers leading-edge performance from existing and new hardware, often with no source code changes.

XL C/C++ for Linux, V13.1.2 implements the GCC symbol visibility attributes, pragmas, and option which describe whether and how an entity that is defined in one module can be referenced or used in other modules. Using the visibility attributes for entities, you can get the following benefits:

- Decreasing the size of shared libraries
- Reducing the chance of symbol collision
- Allowing more optimization for the compile and link phases
- Improving the efficiency of dynamic linking

XL C/C++ provides faster compile time for large applications. In addition, the use of machine resources is improved by reducing the amount of memory required by the compiler, such as for pointer analysis and alias computation. Header files, which are repeatedly used in applications, are cached within the compiler to speed up overall processing during compile time. The compiler and optimizer use the greater addressability of the 64-bit process space, thereby allowing significantly larger programs to be optimized.

Profile directed feedback (PDF) optimization collects information about an application run with typical input data and then applies transformations to the program based on that information. PDF can ensure that the performance of the application is optimized for its important inputs. Application profile monitoring and profile directed feedback capabilities minimize the need for manual tuning to achieve desirable performance on large, complex applications.

SHOWPDF reports provide profiling information that includes block-counter and call-counter profiling information and cache-miss profiling and value profiling information. SHOWPDF reports identify opportunities to improve code performance thereby simplifying the effort of hand tuning applications.

Improves developer productivity

The compiler simplifies your programming tasks by providing installation enhancements as well as new and enhanced compiler options.

New and enhanced options

The following options are added or updated in XL C/C++ for Linux. For a complete list of new and changed options and directives, see the Getting Started guides for the XL compilers.

- The \texttt{-qfloat=nosubnormals} suboption asserts to the compiler that the code does not use denormalized floating point values.
- The \texttt{-qfuncsect} option places instructions for each function in a separate section. Placing each function in its own section might reduce the size of your program because the linker can collect garbage per function rather than per object file.
- The following suboptions are added to \texttt{-std (-qlanglvl)} suboption:
  - \texttt{extendedly}
  - \texttt{stdc11}
  - \texttt{c++11 | c++0x}
  - \texttt{gnu++11 | gnu++0x}
  - \texttt{gnu++03}
  - \texttt{c11 | c1x | iso9899:2011}
  - \texttt{gnu11}
- The \texttt{-qlistfmt} option creates an XML or HTML report to assist with finding optimization opportunities.
- The \texttt{-qstrict=guards} suboption offers improved protection against malicious code exploits.
- The \texttt{-qlxcompatmacros} option and its complement make it easier to migrate applications from both previous XL C/C++
compiler versions (for example, on AIX) and from other compilers or other vendor platforms.

**Installation enhancements**
The compiler now installs to its own location without needing to replace the version that is already installed.

**Eases application migration to IBM Power Systems**
Make your applications portable with the XL compilers, which offer industry compliant programming languages and extensions. XL compilers help programmers easily maintain and run their applications on IBM systems.

IBM XL C/C++ conforms to the following programming language specifications for C/C++: C89, C99, C++ 98, C++03, and C11 (little endian) and supports a majority of the C++11 standards (little endian).

Augmenting the standardized language levels, the XL C/C++ compiler has implemented C and C++ language extensions to support vector programming and a subset of GNU C and C++ language extensions. In addition, the XL C++ compiler maintains close support of Boost C++ library releases.

**C11 and C++11 features**
XL C/C++ for Linux, V13.1.2, for little endian distributions is C11 compliant and supports a majority of the C++11 features. In V13.1.2, the following C11 and C++11 features are added for little endian distributions:

- Alignment support
-constexpr
- Explicit overrides and final
- Generalized attributes
- Inheriting constructors
- Local and unnamed types as template arguments
- Monomorphic lambdas expressions
- New character types
- New definitions of POD types
- noexcept
- Nonstatic data member initializers
- Range-based for
- Raw string literals
- ref.qualifiers
- Template aliases
- Unicode names (UCN) and unicode literals
- Uniform initialization
- Unrestricted unions
- User-defined literals
- Complex type initializations
- Composite types for variable length arrays
- Conversions between pointers and floating types
- Generic selection
- Temporary lifetime extensions
- typedef redeclarations
- Unicode and UTF-8 literals

**Full support of OpenMP 3.1 and partial support of OpenMP 4.0**
XL C/C++ for Linux provides full support for OpenMP 3.1 so programmers can automate parallel programming and take advantage of multiprocessor systems. Some of the features include finer control of the number of threads used in nested parallelism, full control of where a thread can switch from one task to another task, and more types of atomic operation to better synchronize parallel code.

XL C/C++ for Linux also supports the following OpenMP 4.0 features:

- Atomic update, capture, and swap
- OMP_DISPLAY_ENV environment variable

**Integrates with Rational tools**
XL C/C++ readily integrates with IBM Rational Developer for AIX and Linux, C/C++ Edition, an Eclipse-based integrated development environment (IDE) for creating, maintaining and porting of applications to IBM Power Systems. Rational Developer for AIX and Linux improves programmer productivity by providing a rich user interface (UI) to replace older text-based, command-line development tools. This will help accelerate application development and maintenance in the AIX and Linux operating environments.

IBM Rational Team Concert™ (RTC) software is a Jazz-based offering that provides integrated team collaboration through such features as project
dashboards, work items, source control, builds
and reports. Rational Developer for AIX and
Linux ships a client that readily integrates with
Rational Team Concert. It improves overall
application lifecycle management and the
efficiency of the entire development organization.
Organizations can also leverage this modern
development environment to attract and retain
new talent. The familiarity of many new
graduates with Eclipse tools can help lower
training costs.

Summary

IBM compilers allow applications to take
advantage of virtually all the hardware
exploitation features provided by IBM processors
including POWER8. By utilizing leading-edge
optimization technologies in IBM compilers,
organizations can improve their return on
investment in hardware assets, while increasing
programmer productivity.

Organizations often wait until they upgrade their
hardware to upgrade their compilers. However,
given that the compilers can deliver significant
improvements in application performance and
programmer productivity, compilers offer a
cost-effective way to get more out of existing
technology. By periodically upgrading compilers,
programmers can take advantage of new
language, usability and optimization features, and
stay ahead of competitors on the technology
curve.

For more information

To learn more about the IBM XL C/C++ for Linux
compiler, contact your IBM representative, IBM
Business Partner, or visit: XL C/C++ for Linux at
www.ibm.com/software/products/en/xlcpp-
linux/.

Get started today by downloading a trial version
of the XL C/C++ for Linux compiler at:
xlclpluslinux/.

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