

New, high-performance compiler delivered for Linux on z Systems

IBM® XL C/C++ for Linux on z Systems, V1.1 is a new XL C/C++ compiler for application development that takes advantage of the latest IBM z Systems servers that run on select Linux distributions. This XL C/C++ compilation technology for Linux on z Systems strengthens the platform, exploits the z Systems environment, and provides superior performance. A key strength of XL C/C++ for Linux on z Systems is its ability to generate highly optimized code for execution on IBM z Systems. It is the newest member of the IBM XL compiler family and is built on the performance gains from many years of IBM compiler optimization experience with existing XL C/C++ compilers that are available for IBM z/OS®, IBM z/VM®, IBM AIX® and Linux on IBM Power Systems™. With XL C/C++ for Linux on z Systems, you can create and port applications for execution on the next generation of IBM systems supporting select Linux distributions built on IBM z/Architecture® technology designed for development of high-performing business applications and system programs, while maximizing hardware utilization with fast application performance.

Highlights

XL C/C++ for Linux on z Systems, V1.1 delivers the following features:

- Supports generation of highly optimized code exploiting z Systems servers.
- Supports programming language standards, including partial support for the latest C11 and C++11 standards.
- Provides a high level of source compatibility with GNU Compiler Collection (GCC) while providing binary coexistence.
- Includes Automatically Tuned Linear Algebra Software (ATLAS) library.
- Includes IBM Mathematical Acceleration Subsystem (MASS) library.
- Includes Basic Linear Algebraic Subprograms (BLAS) functions.

Generation of highly optimized code

As the newest addition to the IBM compiler family, IBM XL C/C++ for Linux on z Systems, V1.1 brings mature IBM compiler experience to Linux distributions running on IBM z Systems servers. XL C/C++ supports generation of highly optimized code exploiting the z Systems servers, adheres to the latest programming standards partially, and provides GNU Compiler Collection

(GCC) compatibility that allows you to easily port your applications to Linux distributions running on z Systems servers.

The Clang infrastructure

XL C/C++ for Linux on z Systems leverages the Clang infrastructure from the open source community for a portion of its compiler front end. 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. XL C/C++ for Linux on z Systems combines the Clang front end infrastructure with the advanced optimization technology in the IBM compiler back end.

New architecture and tune compiler options for the z Systems technology

XL C/C++ for Linux on z Systems, V1.1 supports the new generation of z Systems hardware running SUSE Linux Enterprise Server 11 (SLES 11), SLES 12, Red Hat Enterprise Linux 6 (RHEL 6), and RHEL 7.

The `-qarch` compiler option specifies the processor architecture for which code is generated. The `-qtune` compiler option tunes instruction selection, scheduling, and other architecture-dependent performance enhancements to run best on a

specific hardware architecture. With XL C/C++ for Linux on z Systems, V1.1, architecture and tune compiler suboptions are available to specify code generation for the new IBM z13.

In the XL C/C++ for Linux on z Systems compiler, `-qarch=arch11` instructs the compiler to produce code that can exploit the new instructions in the z13 processors and `-qtune=arch11` enables optimizations specifically for the z13 processors.

Optimization capabilities

One of the key strengths of the XL C/C++ for Linux on z Systems is optimization. This compiler offers the benefit of optimization technology, which evolved at IBM since the late 1980s combining extensive knowledge of the hardware with a comprehensive understanding of compiler technology and what users look for in a compiler when building user applications, especially for new workloads, such as big data, cloud, mobile, and social. The optimizations can decrease execution time and make your applications run faster, producing code that is highly tuned for execution on z Systems. The optimizer includes three base optimization levels, which allow you to choose from minimal optimization to intense program analysis that range from local basic block to subprogram unit scopes, file-level, and whole-program analysis. The higher the optimization level, the more intense the program analysis becomes. Sophisticated optimization techniques such as interprocedural analysis can also be applied to your code.

Levels of optimization include:

- O0** Provides minimal optimization, which is best for debugging.
- O2** Provides strong low-level optimization and benefits most programs.
- O3** Provides intense low-level optimization analysis and base-level loop analysis.

In addition, `-qipa` can be used for aggressive optimization of the whole program, including aggressive data flow analysis and loop transformations.

Programming language standards

XL C/C++ for Linux on z Systems, V1.1 strives to maximize performance and functionality of your scientific, technical, and commercial applications through standards compliance. With representation from the IBM compiler development team on the ISO/ANSI C and C++ committees, IBM is in a position to understand and influence the latest updates, clarifications, and recommendations to the C and C++ standards. XL C/C++ for Linux on z Systems, V1.1 conforms with the following language standards:

- Information Technology - Programming Languages - C, ISO/IEC 9899:1990 (also known as C90)
- Information Technology - Programming Languages - C, ISO/IEC 9899:1999 (also known as C99)
- Information Technology - Programming Languages - C++, ISO/IEC 14882:1998 (also known as C++98)
- Information Technology - Programming Languages - C++, ISO/IEC 14882:2003(E) (also known as C++2003)
- Information Technology - Programming Languages - Extensions for the programming language C to support new character types, ISO/IEC RT 19769
- Draft Technical Report on C++ Library Extensions, ISO/IEC TR 19768:2007
- Information Technology - Programming Languages - C, ISO/IEC 9899:2011 (partial support for C11)
- Information Technology - Programming Languages - C++, ISO/IEC 14882:2011 (partial support for C++11)

GNU compatibility

XL C/C++ for Linux on z Systems, for select Linux distributions, provides for a greater level of GNU source compatibility. With the higher level of GNU source compatibility, porting of applications, originally developed with gcc and g++ compilers, is easier than ever before. There is also binary compatibility with GNU-built objects, archives, and shared objects. You now have the versatility to use the IBM compiler to build parts of your application that will benefit from the

higher performance offered and still bind the IBM and GNU compiled parts together in a single application.

Automatically Tuned Linear Algebra Software (ATLAS)

XL C/C++ for Linux on z Systems includes the ATLAS libraries, which consist of numerical linear algebra operations, that are specifically tuned for optimum performance on the z Systems architecture.

IBM Mathematical Acceleration Subsystem (MASS)

XL C/C++ for Linux on z Systems includes the IBM MASS libraries, which consist of mathematical intrinsic functions, that are specifically tuned for optimum performance on

the z Systems architecture. MASS includes scalar and vector libraries, and can be used by C and C++ applications. You can call scalar and vector libraries explicitly in your programs.

Basic Linear Algebra Subprograms (BLAS)

BLAS is included in XL C/C++ for Linux on z Systems and provides high-performance, algebraic functions that are used to perform combined matrix multiplication and addition on general matrices or their transposes, as well as to compute the matrix-vector product for a general matrix or its transpose.

System requirements

The following table presents the system requirements for XL C/C++ for Linux on z Systems, V1.1:

Operating system	Hardware
XL C/C++ for Linux on z Systems, V1.1 supports the following operating systems: <ul style="list-style-type: none">• Red Hat Enterprise Linux for IBM System z® 6.3• Red Hat Enterprise Linux for IBM System z 7• SUSE Linux Enterprise Server for System z 11 SP3• SUSE Linux Enterprise Server for System z 12	XL C/C++ for Linux on z Systems, V1.1 runs on the following servers: <ul style="list-style-type: none">• IBM z13 (z13)• IBM zEnterprise® EC12 (zEC12) or IBM zEnterprise BC12 (zBC12)• IBM zEnterprise 196 (z196) or IBM zEnterprise 114 (z114)• IBM System z10™ Enterprise Class (z10 EC) or IBM System z10 Business Class (z10 BC)

For more information

To learn more about IBM XL C/C++ for Linux on z Systems, contact your IBM representative or IBM Business Partner, or visit: XL C/C++ for Linux on z Systems at www.ibm.com/software/products/en/czlinux/

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