

IBM Open XL C/C++ for Linux on Power  
17.1.1

*Optimize application performance and  
fully exploit Power10 architecture with  
IBM's next-generation C/C++ compiler*



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# IBM Open XL C/C++ for Linux on Power 17.1.1

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## Highlights

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IBM® Open XL C/C++ for Linux® on Power® 17.1.1 delivers the following features and benefits:

- Adoption of the open-source LLVM compiler infrastructure.
- Support for IBM Power8, Power9, and Power10 servers.
- Support for C and C++ programming language standards, including C++17, that provide increased functionality and easier portability for your source code.
- Inclusion of the optimized IBM Mathematical Acceleration Subsystem (MASS) libraries that give you frequently used mathematical procedures.
- Addition of the monthly pricing metric for more flexibility, especially when using the compiler in the cloud.
- Enterprise-level IBM service and support over the extended lifecycle of the offering.

## Adoption of the LLVM infrastructure

The IBM Open XL C/C++ for Linux on Power 17.1.1 compiler replaces the existing IBM XL C/C++ compiler infrastructure with the LLVM infrastructure from the open-source compiler and toolchain project. LLVM is an open-source compilation technology framework that is actively maintained by a large development community and supports multiple architectures and programming languages. The Clang (C language) component provides the C and C++ language family front end in the latest language standards for LLVM. LLVM provides a common back end to all Open XL compilers.

As an active sponsor and strong supporter of the LLVM open-source project, IBM is contributing code for IBM Power in the areas of code generation and exploitation, portability, usability enhancements, toolchain support, and code quality and performance for IBM Power solutions. Recently, IBM increased participation in the LLVM project by adding AIX and Linux on Power support and enhancing loop optimizations.

IBM XL C/C++ has a rich tradition of providing enterprise-level offerings with advanced optimization technology. In the more recent versions of the IBM C/C++ offerings, IBM has integrated parts of the Clang subproject to provide C11, C17, C++11, C++14, and C++17 support on the AIX and Linux on Power platforms.

Implementing IBM Open XL C/C++ for Linux on Power with the LLVM compiler infrastructure brings the following benefits:

- Simplifying cross-platform development for applications containing new C and C++ language features, including C11, C17, C++11, C++14, and C++17
- Accelerating support for emerging C and C++ language standards that are planned to be made available in IBM offerings more promptly
- Optimizing return on investment with full hardware exploitation of your Linux on Power platform, which can result in optimal application performance delivered through advanced optimization technology
- Capability to build higher quality code and reduce development time with access to Clang and LLVM diagnostic and reporting capabilities
- Integration with various LLVM open source tools and utilities to help with developers' productivity
- Greater support through the LLVM community
- Enterprise-level service and support from IBM

## C11, C17, C++11, C++14, and C++17 standards support

Adoption of the LLVM technology in IBM Open XL C/C++ for Linux on Power 17.1.1 enables support of the C11 and C17 programming language standards in the C compiler component and the C++11, C++14, and C++17 programming language standards (as well as the C++11, C++14, and C++17 standard libraries) in the C++ compiler component. IBM Open XL C/C++ for Linux on Power 17.1.1 gives you the flexibility to compile your source code with a choice of the following two compiler invocations:

- **ibm-clang** or **ibm-clang\_r** - invokes the new LLVM-based XL C compiler that supports the C11 and C17 standards
- **ibm-clang++** or **ibm-clang++\_r** - invokes the new LLVM-based XL C++ compiler that supports the C++11, C++14, and C++17 standards

## Support for the latest IBM Power technology

IBM Open XL C/C++ for Linux on Power 17.1.1 takes full advantage of the Power10 architecture. You can use the provided Power10 architecture option and built-in functions including functions for Power10 Matrix Multiply Accelerator (MMA) to leverage Power10 architecture and maximize your hardware ROI.

### New architecture compiler option

The **-mcpu** compiler option specifies the processor architecture for which code is generated and automatically tuned. With IBM Open XL C/C++ for Linux on Power 17.1.1, the **-mcpu=power10** option is available to specify code generation explicitly for the Power10 architecture. This option instructs the compiler to produce code that can capitalize on the Power10 architecture. This option also automatically tunes the optimizations for the Power10 architecture. Compiling your applications with **-mcpu=power10** enables you to automatically exploit and tune for the capabilities in the Power10 architecture without having to rewrite your code.

The following **-mcpu** options continue to be available to generate code for previous IBM Power processor architectures:

- **-mcpu=power8**, which generates code that executes on both the Power8 and Power9 architectures
- **-mcpu=power9**, which generates code that executes on the Power9 architecture

### New built-in functions, including functions for Power10 MMA

A number of new built-in functions are delivered in this release to unlock Power10 architecture instructions. These built-in functions enable direct access to Power10 features at the application level.

For example, the MMA built-in functions can be used to directly exploit the new MMA in the Power10 processor. MMA is embedded into the Power10 processor and is designed to achieve faster artificial intelligence (AI) inference for FP32, BFloat16, and INT8 calculations, which can improve performance for enterprise AI inference workloads.

Two new built-in types are introduced to support the Power10 MMA technology:

- **\_\_vector\_pair**, which supports the 32-byte vector type
- **\_\_vector\_quad**, which supports the 64-byte vector type

In addition, a number of new instructions are introduced to support the MMA built-in types. For example, **MMA\_LXVP** is introduced to perform paired vector load, and **MMA\_STXVP** is introduced to perform paired vector store.

## Inclusion of the optimized IBM Mathematical Acceleration Subsystem (MASS) libraries

IBM Open XL C/C++ for Linux on Power 17.1.1 includes the optimized IBM Mathematical Acceleration Subsystem (MASS) libraries; an accelerated set of frequently used mathematical functions that can provide improved performance over the default system math library. This release includes MASS scalar,

**2** IBM Open XL C/C++ for Linux on Power 17.1.1: Optimize application performance and fully exploit Power10 architecture with IBM's next-generation C/C++ compiler

single instruction, multiple data (SIMD), and vector libraries optimized for Power8, Power9, and Power10 processors.

## New monthly pricing metric to accelerate your shift to the hybrid cloud model

Organizations across all industries are investing in cloud technologies for innovation, growth, and efficiency. Many of these organizations are seeking a blend of public cloud, private cloud, and traditional IT platforms. IBM solutions can help organizations achieve this hybrid cloud integration.

IBM Open XL C/C++ for Linux on Power 17.1.1 is available with a new monthly pricing option to provide more flexibility for cloud-based use cases; on the IBM Cloud®, your private cloud, or on other cloud service provider environments.

The drive to cloud-based use cases creates a need for a simplified, monthly subscription type license. To satisfy this need, Virtual Processor Core is a simplified metric that is available for a monthly license charge.

All technical capabilities available in the existing one-time license charge version of this compiler are available in the IBM Open XL C/C++ for Linux on Power 17.1.1 monthly term offering.

Benefits and uses of the monthly term offering:

- Ability to license compilers for short-term needs
- Test a proof of concept for new software, especially in a cloud environment
- Use in production upgrades and migration projects, for example, when you are moving to the cloud
- Use an operating expense budget rather than a capital expense budget, where you may avoid lengthy approval cycles
- Inclusion of IBM Service and Support with each license
- Use the traditional term charge metric of the cloud for pay as you go

## Summary

IBM Open XL compilers allow applications to take advantage of virtually all the hardware exploitation features provided by IBM processors. By utilizing leading-edge optimization technologies in IBM Open XL 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 IBM Open XL C/C++ for Linux on Power or to download the Community Edition of IBM Open XL C/C++ for Linux on Power, visit <https://www.ibm.com/products/open-xl-cpp-linux-compiler-power>.





