

## IBM XL Fortran for Linux on Power 17.1.1

*Develop complex, computationally intensive programs and optimize application performance with IBM's next generation Fortran compiler*



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# IBM Open XL Fortran for Linux on Power 17.1.1

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## Highlights

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IBM® Open XL Fortran 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 Fortran programming language standards 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 Fortran for Linux on Power 17.1.1 compiler replaces the existing IBM XL Fortran 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. 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.

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

- 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 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

## Fortran 2018, Fortran 2008, Fortran 2003, Fortran 95, Fortran 90, and FORTRAN 77 programming language standards support

Support for programming language standards can provide you with significant functionality and enable optimal portability of your source code among a variety of compiler implementations.

IBM Open XL Fortran for Linux on Power continues to support the latest Fortran programming language standards, including the following:

- Fortran 2018 (partial)
- Fortran 2008 (partial)
- Fortran 2003

- Fortran 95
- Fortran 90
- FORTRAN 77

## Support for the latest IBM Power technology

IBM Open XL Fortran for Linux on Power 17.1.1 leverages Power10 architecture. You can use the provided Power10 architecture option and built-in functions including functions for Power10 Matrix Multiply Accelerator (MMA) to exploit your Power10 architecture and maximize your hardware ROI.

### New architecture compiler option

The `-qarch` compiler option specifies the processor architecture for which code is generated and automatically tuned. There is no separate tuning option in this release.

A new architecture option, `-qarch=pwr10` is available in IBM Open XL Fortran for Linux on Power 17.1.1 to specify code generation explicitly for the Power10 architecture. It enables you to automatically exploit and tune for new capabilities in the Power10 architecture without having to rewrite your code.

The following `-qarch` options for generating code for previous IBM Power architectures are also available:

- `-qarch=pwr8` generates code that executes on both the Power8 and Power9 architectures.
- `-qarch=pwr9` generates code that executes on the Power9 architecture.

### New intrinsic procedures, including Power10 MMA intrinsic procedures

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

For example, the Matrix Multiply Accelerator (MMA) intrinsic procedures 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 intrinsic 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 intrinsic 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 Fortran 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, 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.

**2** IBM XL Fortran for Linux on Power 17.1.1: Develop complex, computationally intensive programs and optimize application performance with IBM's next generation Fortran compiler

IBM Open XL Fortran 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 Fortran 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 Fortran for Linux on Power or to download the Community Edition of IBM Open XL Fortran for Linux on Power, visit <https://www.ibm.com/products/open-xl-fortran-linux-compiler-power>.





