IBM XL Fortran for Linux, V15.1 delivers support for the POWER8 processor

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At a glance

IBM® XL Fortran for Linux™ is a standards-based, high-performance Fortran compiler with advanced optimizing features. It delivers a number of new features and enhancements:

- Support for the POWER8™ hardware architecture.
- Preliminary support for the OpenMP 4.0 industry specification
- New and enhanced compiler options, directives, and intrinsics.

Overview

IBM XL Fortran for Linux is designed to optimize and tune your applications for execution on IBM Power Systems™ to help you unleash the full power of your IT investment, to create and maintain critical business and scientific applications, to maximize application performance, and to improve developer productivity. The performance gain from years of compiler optimization experience is seen in the continuous release-to-release compiler improvements that include exploitation of the latest IBM POWER8 processor.

With this release, XL Fortran for Linux, V15.1 introduces the following features:

- New arch and tune compiler options are made available to help make use of the POWER8 processor architecture.
- Intrinsics and directives to give you direct access to the latest POWER8 features:
  - Intrinsic procedures for vector processing, cryptography functions, and transactional memory functions
  - Directive and intrinsic procedures for prefetch functions
- Mathematical Acceleration Subsystem (MASS) libraries that are tuned for the POWER8 architecture.

With the support of the latest POWER8 processor chip, IBM will have advanced a more than 20-year investment in the XL compilers for Power® series and PowerPC® series architectures.

IBM has a long history of delivering innovative, high-quality compiler products to the marketplace. Over the course of multiple releases, the XL family of compilers has invested in new functions, enhancements, and standards conformance to deliver the tools needed to develop and maintain smarter applications to meet
critical business needs. This release of XL Fortran for Linux, V15.1 also includes the following enhancements:

- Further support for the Fortran 2008 programming language standard to give you more function and to enable maximum portability of your source code.
- Partial support for Fortran Technical Specification 29113 for further interoperability with C.
- Partial support for OpenMP V4.0.
- Improved MASS library interfaces for better optimization and error checking.
- New and enhanced compiler options and directives to give you even more flexibility

**Key prerequisites**

IBM Power System servers that support the following:

- Red Hat Enterprise Linux 6.4 (RHEL 6.4), or later
- RHEL 7.0, or later
- SUSE Linux Enterprise Server 11 Service Pack 2 (SLES 11 SP2), or later

Required hard disk space: 250 MB

**Planned availability date**

June 6, 2014

**Description**

XL Fortran for Linux continues to deliver additional function and enhancements including support for the latest POWER8 processor architecture to help improve application performance and capability.

**Taking advantage of the POWER8 processor architecture**

A key strength of the XL Fortran for Linux is its ability to optimize and tune generated code for execution on Power platforms. The performance gain from years of IBM compiler optimization experience can be seen in the release-to-release compiler improvements from the development of the POWER4 processors through to the POWER4+, POWER5, POWER5+, POWER6®, and POWER7® processors. With XL Fortran for Linux, V15.1, compiler support now includes exploitation of the latest POWER8 processor.

**New arch and tune compiler options**

New arch and tune compiler options are added to specify code generation for the POWER8 processor architecture:

- `-qarch=pwr8` produces object code containing instructions that will run on the POWER8 hardware platforms.
- `-qtune=pwr8` tunes instruction selection, scheduling, and architecture-dependent performance enhancements for the POWER8 hardware platforms.

**Compiler hardware directives and intrinsics for new POWER8 features**

New hardware directives and intrinsics unlock POWER8 processor instructions to enable direct access to POWER8 features at the application level.

New hardware directives and intrinsics support the following POWER8 features:
• Vector processing functions
• Cryptography functions
• Transactional memory functions
• Prefetch directives
• Prefetch intrinsic procedures

**MASS library enhancements**

XL Fortran is shipped with a set of MASS libraries for high-performance mathematical computing. These libraries contain an accelerated set of frequently used math intrinsic functions that enable improved performance over the corresponding standard system library functions.

The scalar, vector, and SIMD MASS libraries are now tuned specifically for the POWER8 architecture.

The MASS library interfaces are improved for better optimization and error checking by the compiler:

• The vector, scalar, and SIMD libraries are marked pure and can be called from pure procedure.
• The vector and scalar libraries now have generic interfaces that can be called with REAL(4) or REAL(8) arguments.
• In addition, the scalar functions that are marked elemental can be called with an array argument and applied to all the array elements.

**Fortran 2008 Programming Standard (partial support)**

The implementation of the Fortran 2008 programming language standard began with selected features that were made available with XL Fortran 14.1. With XL Fortran V15.1, additional features of the Fortran 2008 standard are implemented:

• BACK= arguments in the MAXLOC and MINLOC intrinsic procedures
  You can specify the search direction in the MAXLOC and MINLOC intrinsic procedures with the BACK= argument keyword.

• Double colon separators in PROCEDURE statements
  You can optionally use a double colon separator (::) in PROCEDURE and MODULE PROCEDURE statements inside interface blocks.

• Intrinsic procedures for bit manipulations
  You can use the following intrinsic procedures for manipulating bits through combined shifting, merging, masking, or shifting:
  - DSHIFTL
  - DSHIFTR
  - MASKL
  - MASKR
  - MERGE_BITS
  - SHIFTA
  - SHIFTL
  - SHIFTR

• Extensions to the generic resolution rules
  The Fortran 2008 standard extends the generic resolution rules to distinguish between allocatable and pointer dummy arguments and between procedure and data dummy arguments.

• FINDLOC intrinsic procedure
The FINDLOC intrinsic procedure locates the element of an array whose value equals the target value under the condition that is specified by parameters. It returns the subscript of the element using positive integers.

- **Impure elemental procedures**
  Elemental procedures are no longer required to be pure in Fortran 2008. You can explicitly declare procedures with the IMPURE prefix specifier.

- **Separate module subprograms**
  A separate module subprogram defines a separate module procedure that is declared by a corresponding module procedure interface body.

- **Submodules**
  A submodule extends a module or another submodule. You can declare a module procedure interface body in a module and implement it as a separate module procedure in one of the descendant submodules. The submodule feature provides the following benefits:
  - If only the implementation of a separate module procedure is changed, but the interface remains the same, you do not need to recompile the file that contains the module in which the corresponding module procedure interface body is declared.
  - Two submodules of different modules can access the ancestor module of each other through use association without causing circular dependency.
  - You can put entities in the intermediate submodule level so that the entities are shared by the descendant submodules. If some of the entities are changed, the interpretation of anything that is accessible from the ancestor module by use association is not affected. This also prevents cascades of reprocessing and testing.

- **The MODULE prefix specifier**
  To declare a module procedure interface body or define a separate module procedure, specify the MODULE prefix specifier for the FUNCTION or SUBROUTINE statement.

- **Type specification in the FORALL statement and construct**
  You can optionally include type specifications for index variables in the FOR ALL statement and construct.

**Language interoperability features**

XL Fortran implements selected language interoperability features that accept programs that contain parts written in Fortran and parts written in the C language. This version of XL Fortran provides support for the following language interoperability features as specified in Technical Specification 29113:

- **Assumed-rank objects**
  Assumed-rank objects are introduced to facilitate the interoperability with C functions that accept arguments of arbitrary rank

- **Assumed-type objects**
  Assumed-type objects are introduced to facilitate the interoperability with formal parameters of type void* in C functions.

- **Interoperable procedures with allocatable, optional, and pointer dummy arguments**
  You can specify ALLOCATABLE, OPTIONAL, and POINTER attributes for a dummy argument in a procedure interface that has the BIND(C) attribute.

- **Interoperable variables in asynchronous communication**
  Asynchronous communication for a Fortran variable can occur when procedures that are defined by means other than Fortran are called. You must specify the
ASYNCHRONOUS attribute for the variables that are used for the asynchronous communication.

- The ISO_Fortran_binding.h header file
  By using a C descriptor whose type is defined in the ISO_Fortran_binding.h header file, you can pass a Fortran data object to C. By using functions that are defined in the ISO_Fortran_binding.h header file, you can also manipulate a header file, you can pass a Fortran data object to C. By using functions that are defined in the ISO_Fortran_binding.h header file, you can also manipulate a Fortran data object in C.

**OpenMP 4.0 (partial support)**

The OpenMP API supports multiplatform, shared-memory parallel programming in Fortran, C, and C++ on many architectures including UNIX™ and Microsoft™ Windows™ platforms. OpenMP is a portable, scalable programming model that gives programmers a simple and flexible, standard interface for developing parallel applications for platforms ranging from the desktop to the supercomputer.

The specification is defined by the OpenMP organization, a group of computer hardware and software vendors, that includes IBM. You can find more information about OpenMP specifications at

http://www.openmp.org

XL Fortran for Linux, V15.1 supports the following OpenMP 4.0 features:

- Capture clause enhancements
  The capture clause of the atomic construct is extended to support more syntax forms.
- OMP_DISPLAY_ENV environment variables
  You can use the OMP_DISPLAY_ENV environment variable to display the values of the internal control variables (ICVs) associated with the environment variable and the build-specific information about the runtime library.

**New intrinsic procedures to help you access POWER8 features**

As an alternative to managing hardware registers through assembly language, XL Fortran intrinsic procedures offer access to the optimized Power instruction set and allow the compiler to optimize the instruction scheduling, to help improve the performance of your code. New intrinsic procedures in XL Fortran for Linux, V15.1, include:

**Intrinsics for POWER8 vector processing procedures**

- The following vector built-in functions are added:
  - Vector gather bits by bytes doubleword procedure
  - Vector count leading zeros procedure
  - Vector population count procedure
  - Extended vector logical operations procedure
  - 128-bit integer add and subtract procedures
- The following intrinsic procedures are extended to support doubleword types:
  - Vector pack procedures
  - Vector unpack procedures
  - Vector add and subtract procedures
  - Vector max and min procedures
  - Vector shift and rotate procedures
  - Vector compare procedures
Intrinsic functions for POWER8 cryptographic procedures

- The following intrinsic procedures are added to perform cryptographic operations:
  - Advanced Encryption Standard (AES) procedures
  - Secure Hash Algorithm (SHA) procedures
  - Miscellaneous cryptographic procedures

Intrinsic functions to support POWER8 transactional memory procedures

- Transactional memory is a model for parallel programming. In this model, you can designate a block of instructions or statements to be treated atomically. You can use the following intrinsic procedures to mark the beginning or end of transactions, and to diagnose the reasons for failure:
  - Transaction begin and end procedures
  - Transaction abort procedures
  - Transaction inquiry procedures

Directive and intrinsic procedures to support POWER8 prefetch functions

- The following directives display the problem state control of the Data Stream Control Register (DSCR) in an intuitive, portable, and optimization-friendly way:
  - Transient attribute enable directives
  - Unit count enable and set directives
  - Prefetch depth directives
  - Load stream enable and disable directives
- The following intrinsic procedures can be used to get or set the value of the DSCR:
  - PREFETCH_GET_DSCR_REGISTER
  - PREFETCH_SET_DSCR_REGISTER

POWER8 directives and intrinsic procedures are valid only when -qarch is set to target POWER8 processors.

New and enhanced compiler options for more flexibility

Compiler options can be specified on the command line or through directives embedded in your application source files. The following additional new or changed compiler options are available with this release of the compiler:

- The -I option is extended to support submodules. You can use it to add a directory to the search path for submodule symbol (.smod) files.
- The -M or -qmakedep options produce a dependency output file containing targets suitable for inclusion in a description file for the make command.
- The -MF option is used to specify the name or location for the dependency output files that are generated by the -qmakedep or -M option.
- The -MT option is used to specify the target name of the object file in the make rule in the dependency output file that is generated by the -qmakedep or -M option.
- The -qarch option default is updated to pwr5. Suboptions denoting previous hardware families are silently upgraded to newer architectures. The following -qarch suboptions are added or updated:
  - -qarch=pwr7 produces object code containing instructions that run on the POWER7, POWER7+™, or POWER8 hardware platforms.
  - -qarch=pwr8 produces object code containing instructions that run on the POWER8 hardware platforms.
- New suboptions are added or update for -qcheck:
  - -qcheck=all enables all suboptions
- `-qcheck=bounds` checks each reference to an array, array section, or character substring to ensure that the reference stays within the defined bounds of the entity.
- `-qcheck=stackclobber` detects a certain type of stack corruption in your programs.
- `-qcheck=unset` checks for automatic variables that are used before they are set at run time

- `-qdbgfmt=dwarf4` suboption generates debugging information in DWARF 4 format
- `-qfunctrace` is extended to support submodules
- `-qhelp` displays the man page of the compiler
- The following suboptions are added or updated to `-qinfo`:
  - `-qinfo=HOSTASSOCIation` notifies you about entities that are accessed by host association.
  - `-qinfo=mt` suboption notifies you about potential places where synchronization is needed.
  - `-qinfo=unset` suboption detects automatic variables that are used before they are set, and flags them with informational messages at compile time.
- `-qmoddir` option is extended to support submodules. You can use it to specify the location for any submodule (.smod) symbol files.
- `-qpath` option specifies locations for compiler components. You can specify a different path for each component.
- `-qpdf1=unique` suboption creates a unique PDF file for each process during run time.
- `-qprefetch=dscr` suboption helps to improve the runtime performance of your applications. You can specify a value for dscr depending on your system architecture.
- `-qsimd=auto` suboption controls the autoSIMDization, which was performed by deprecated `-qhot=simd` option.
- The following suboptions are added or updated for `-qtune`:
  - `-qtune=pwr7` specifies that optimizations are tuned for the POWER7 or POWER7+ hardware platforms.
  - `-qtune=pwr8` specifies that optimizations are tuned for the POWER8 hardware platforms.
  - The new `-qtune simultaneous multithreading (SMT)` suboptions allow you to specify a target SMT to direct optimization for best performance in that mode.
- `-qunroll=n` suboption hints to the compiler to unroll loops by a factor of n. If the loop has fewer than n iterations, it is fully unrolled. The compiler may silently limit unrolling to a value lower than n.
- `-WL` suboption specifies additional options for the IPA link step.

**Other XL Fortran updates**

The `XLF_POSIX_BINDINGS` module includes interfaces to many POSIX and XSI functions and named constants.

**Accessibility by people with disabilities**

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at


**Section 508 of the US Rehabilitation Act**

XL Fortran for Linux, V15.1 is capable as of June 6, 2014, when used in accordance with associated IBM documentation, of satisfying the applicable requirements of Section 508 of the Rehabilitation Act, provided that any assistive technology used with the product properly inter-operates with it. A US Section 508 Voluntary Product Accessibility Template (VPAT) can be requested on the following website
Product positioning

At a basic level, compilers are a bridge between your applications and the hardware architectures on which you run your business. IBM compilers are designed to unleash the full power of IBM processors that include those for the different architectures shipped in the popular IBM Power Systems.

IBM compilers are designed to improve programmer productivity. The state-of-the-art compilation technology enables programmers to exploit leading-edge performance of the new hardware without source code changes. Developers need to focus only on the logic of the applications and let the compiler figure out the best way to transform and optimize the code generation for the system the application will run on.

Harness the power of parallel computing

Parallel programming with XL Fortran exploits the advantages of multiprocessor systems, while maintaining full binary compatibility with existing single-processor systems. With XL Fortran you can use any of the following to develop your parallelized applications:

- An extensive range of OpenMP directives and non-OpenMP SMP directives
- Message passing interface (MPI)
- The POSIX threads (Pthreads) library module

For high-bandwidth data processing and algorithmic-intensive applications, XL Fortran can make use of VMX and VSX instructions and automatic SIMDization to improve program performance. By processing multiple pieces of data at once, the speed of executed code can increase, with the added benefit that the source code may not need to be rewritten.

Powerful, no-hassle performance optimization

Well-written and thoroughly debugged code that is fully conformant to its language standard can take maximum advantage of the optimizing technology in XL Fortran and may provide an increase in performance. The optimization and hardware features in XL Fortran help improve developer productivity. The compiler is able to generate code that exploits the leading-edge performance in existing and new hardware, often with minimal source code changes.

XL Fortran supports several levels of increasingly aggressive code transformations. Advanced optimization techniques such as inter-procedural analysis (IPA) and profile-directed feedback (PDF) are available only at high levels of optimization but can result in increased performance improvements. IPA analyzes and optimizes your application as a whole, rather than on a file-by-file basis. PDF generates information that instructs the optimizer to focus on trade-offs that favor code that executes more frequently.

Get more performance from the POWER® platform with minimal or no source code changes. Upgrade to the latest XL Fortran compiler, which incorporates the latest advances in optimization and hardware technology support.

Multiple-Platform XL C/C++ and Fortran

IBM XL Fortran for Linux, V15.1 is part of a larger family of IBM Fortran, C, and C++ compilers which supports multiple platforms such as AIX®, z/OS® (C/C++), z/VM® (C/C++), IBM Power Systems, Linux on Power, and Blue Gene/Q™.

The modular structure of these compilers delivers optimizations and functionality on all platforms and to all languages. Further, each product derives from a common
code base, so features and optimizations are tested in multiple languages and on multiple platforms. A common code base, along with compliance with international standards, make source-level portability of applications between IBM platforms easier.

Built on a common architecture XL Fortran, XL C, and XL C/C++ compilers promote consistency and reliability on many IBM platforms.

Programming language standards, industry specifications, and other language influences

Programming language standards
XL Fortran supports the Fortran 77, 90, and 95 standards. With Version 13.1, XL Fortran supports the full Fortran 2003 standard including the object-oriented programming model. With Version 15.1, XL Fortran makes available partial support for the latest Fortran 2008 standard.

XL Fortran consists of the following:

- The full American National Standard Fortran 90 language (Fortran 90) as defined in:
  - Information technology: Programming languages - Fortran, ISO/IEC 1539-1:1991(E)
- The full ISO Fortran 95 language standard (Fortran 95) as defined in:
- Extensions to the Fortran 95 standard:
  - Common industry extensions that are found in Fortran products from various compiler vendors
  - Extensions that are specified in SAA Fortran
- The full Fortran 2003 language standard that includes full support of the object-oriented programming model with parameterized derived-types.
- Partial support for the Fortran 2008 language standard.

Industry specifications and other language influences
The IBM XL family of compilers plays an important role in parallel computing and high-performance computing. The XL compilers implement both the AltiVec/VMX programming interface and the OpenMP 3.1 specification for shared memory programming model. With the Version 13.1 release, the Vector Scalar Extension (VSX) instruction set within the POWER7 architecture is also supported. With the Version 15.1 release, implementation of OpenMP 4.0 commences.

IBM is a member of the Standard Performance Evaluation Corporation (SPEC). The mission of SPEC is to identify and maintain standardized benchmarks that will drive high-performance computing for many years. SPEC released SPEC CPU2006 in 2006. CPU2006 is a benchmark focused on a system’s processor, memory subsystem, and compiler. IBM continues to participate in the SPECCOMP suite which measures the performance of parallel benchmarks using OpenMP.

Support of programming language standards allows for portability of your source code among a variety of compiler implementations.

Statement of direction

IBM intends to make XL C/C++ and XL Fortran compilers available to complement new Linux only based Power Systems built with POWER8 technology that support the latest Linux distributions such as Ubuntu Server.
IBM also intends to update its integrated development environments (IDEs) to support new Linux distributions and the planned XL C/C++ compiler for the Linux only based Power Systems. Specifics:

- IBM intends to update the server components of IBM Rational® Developer for AIX and Linux to support new Linux on Power distributions. (The key server components are the debugger agent and the Remote Systems Explorer agent).
- IBM intends to update the Rational Agent Controller component, which enables the IDEs to connect to and instrument remote WebSphere® Application Server instances, to support WebSphere Application Server running on new Linux on Power distributions. The Remote Agent Controller is packaged as part of these IDEs, all of which support Java/Java EE and Web development for workloads that might be deployed to WebSphere
- Application Server on Linux on Power Systems:
  - Rational Application Developer for WebSphere Software
  - Rational Developer for AIX and Linux
  - Rational Developer for i RPG and COBOL + Modernization Tools Java™ Edition
  - Rational Developer for the Enterprise
- IBM intends to update certain capabilities of the IDEs that are designed to be run either in interactive mode by a developer, or in command line (aka "headless") mode as part of automated build and test processes, to support new Linux on Power distributions. Such capabilities may include, but are not guaranteed to include:
  - line level code coverage analysis
  - static code analysis (rule-based detection of logical coding errors and best-practice deviations)
  - application profiling (performance, memory, and thread analysis)

The general intent is that when used in combination with a planned XL C/C++ compiler for the Linux only based Power Systems, the Rational IDEs will serve as key elements of a comprehensive application development, porting, and optimization solution that is optimized for Linux on Power Systems

For complete information about the Integrated Development Environments including capabilities, value proposition, system requirements, pricing, and access to trial versions, visit


Navigate from there to detailed information about the IDEs that interest you.

IBM’s statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code, or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

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Offering Information

Product information is available via the Offering Information website

http://www.ibm.com/common/ssi

Also, visit the Passport Advantage® website

http://www.ibm.com/software/passportadvantage

Publications

No hardcopy publications are shipped with this program.

The IBM Publications Center

http://www.ibm.com/shop/publications/order

The Publications Center is a worldwide central repository for IBM product publications and marketing material with a catalog of 70,000 items. Extensive search facilities are provided. Payment options for orders are via credit card (in the U.S.) or customer number for 20 countries. A large number of publications are available online in various file formats, and they can all be downloaded by all countries, free of charge.

Business Partner information

If you are a Direct Reseller - System Reseller acquiring products from IBM, you may link directly to Business Partner information for this announcement. A PartnerWorld® ID and password are required (use IBM ID).

Technical information

Specified operating environment

Hardware requirements

• For XL Fortran for Linux, V15.1
  – System: IBM Power Systems servers supported by SLES 11 SP2, RHEL 6.4, and RHEL 7.0
  – Disk space: 250 MB

Software requirements

• For XL Fortran for Linux, V15.1
  – One of the following operating systems:
    -- RHEL 6.4, or later
    -- RHEL 7.0, or later
    -- SLES 11 SP2, or later
  – Required software for documentation:
    -- HTML browser to access HTML documentation
    -- Portable Document Format (PDF) viewer to view PDF files

The program’s specifications and specified operating environment information may be found in documentation accompanying the program, if available, such as a readme file, or other information published by IBM, such as an announcement letter. Documentation and other program content may be supplied only in the English language.

Planning information

Web information

For information regarding XL Fortran, visit

  http://www.ibm.com/software/awdtools/fortran

For information regarding IBM Application Development, visit

  http://www.ibm.com/software/awdtools/

Packaging

The XL Fortran for Linux, V15.1 package contains:

• One DVD-ROM containing the XL Fortran for Linux, V15.1 product
• XL Fortran for Linux, V15.1 Quickstart Guide
• Passport Advantage customer letter
• Passport Advantage media pack pointer sheet

This program, when downloaded from a website, contains the applicable IBM license agreement and License Information, if appropriate, and will be presented for acceptance at the time of installation of the program. For future reference, the license and License Information will be stored in a directory such as LICENSE.TXT.

Security, auditability, and control

XL Fortran for Linux, V15.1 uses the security and auditability features of the host hardware or software. The customer is responsible for evaluation, selection, and
implementation of security features, administrative procedures, and appropriate controls in application systems and communication facilities.

Software Services

IBM Software Services has the breadth, depth, and reach to manage your services needs. You can leverage the deep technical skills of our lab-based, software services team and the business consulting, project management, and infrastructure expertise of our IBM Global Services team. Also, we extend our IBM Software Services reach through IBM Business Partners to provide an extensive portfolio of capabilities. Together, we provide the global reach, intellectual capital, industry insight, and technology leadership to support a wide range of critical business needs.

To learn more about IBM Software Services or to contact a Software Services sales specialist, visit

http://www.ibm.com/software/sw-services/

Ordering information

Product Group: IBM XL Fortran

Product Identifier Description: IBM XL Fortran for Linux

PID: 5765-J10 and 5725-C75

Product Category: XL Fortran

Passport Advantage

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Passport Advantage trade-up

Customers who have originally acquired licenses for Authorized User can trade-up their Authorized User licenses to an equivalent or appropriate number of Concurrent User licenses (previously known as Floating User).

Below is a list of precursor products and their associated Authorized User part numbers for which you must have already acquired a license, in order to be eligible to acquire the equivalent Concurrent User licenses using the trade-up part number.
Precursor product    Trade-up product    Trade-up part number
XL Fortran for Linux  XL Fortran for Linux  D0DEYLL to trade-up from
Authorized User      Concurrent User      single Authorized User
single entitlement   single entitlement   to single Concurrent User

Consult your IBM representative if you have any questions.

Passport Advantage Customer: Media Pack Entitlement Details

Customers with active Maintenance or Subscription for the products listed below are entitled to receive the corresponding media pack.

Entitled Maintenance Offerings
Description
XL Fortran for Linux

Media pack
description                      Part number
XL Fortran for Linux, V15.1 Media Pk Multilingual   BA182ML

Basic License: To order the programs described in this announcement for 5765-J10 specify the type-model number and the applicable features from the tables below. The medium feature (DVD-ROM) need only be specified as required. To request the media package (DVD-ROM), specify media supply features 5809 and 3435.

When placing an ESD order in econfig specify following ESD only features: 3450, 3453, 3470, 3471.

<table>
<thead>
<tr>
<th>Description</th>
<th>Program number</th>
<th>Medium number</th>
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<tbody>
<tr>
<td>XL Fortran for Linux, V15.1</td>
<td>5765-J10</td>
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OTC with 1 Year SW S&S
- per Authorized User          0001
- per Concurrent User           0002

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<tr>
<th>Media supply</th>
<th>DVD-ROM</th>
<th>5809</th>
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<tbody>
<tr>
<td>Media type</td>
<td>DVD-ROM</td>
<td>3435</td>
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</tbody>
</table>

Customization features:
- Electronic software delivery
  - 3450
  - 3453
- Do not ship pubs
  - 3470
- Do not ship media
  - 3471


Electronic Software Update Orders

Entitled Software Update (ESU) is a way for customers to self order their POWER software release upgrades via the Entitled Software Support (ESS) website without the need to go to their seller to place the upgrade order. Entitled Software Update (ESU) orders for Electronic Software Delivery (ESD), will now be available in all countries. ESU orders for POWER software including XL Fortran for Linux, V15.1 will be placed on the Entitled Software Support (ESS) website
Customers should generally select electronic delivery when ordering via ESU, but do have the ability to select physical delivery. Programs ordered for ESD will have the same download images provided as provided on the DVD-ROM media shipped for physical orders.

ESU customers placing ESD software orders will receive an email with software order information. The ESU customer will be able to immediately proceed to the "Downloads" website support for program access, instead of waiting for delivery of a physical package shipped from IBM.

Customers choosing physical delivery will also have the electronic images available for ESD download.

ESD help (instructions on how to use)


ESD sign-in (must have customer number and POWER software entitlements to enter)


List of POWER software products that are available for electronic download


**Maintenance Offering customer: Media supply entitlement details**

Customers with active Software Maintenance for XL Fortran for Linux or XL Fortran Enterprise Edition for Linux are entitled to receive the media supply corresponding to XL Fortran for Linux, V15.1 or a previous level of the program as long as the level of the program continues to be active.

Eligible customers should add the applicable DVD-ROM media supply feature number from the following table to their existing maintenance record. To request the media package (DVD-ROM), specify the media supply features 5809 and 3435.

**Entitled maintenance offerings description**

<table>
<thead>
<tr>
<th>Description</th>
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<tr>
<td>XL Fortran for AIX</td>
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<tr>
<td>Description</td>
<td>DVD-ROM Media Supply</td>
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<tr>
<td>XL Fortran for Linux, V15.1 for PID 5765-J10</td>
<td>5809</td>
</tr>
<tr>
<td>DVD-ROM Media Supply</td>
<td>3435</td>
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</table>

**Customization features:**

- Electronic software delivery: 3450
- Electronic software delivery: 3453
- Do not ship pubs: 3470
- Do not ship media: 3471

<table>
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<td>CD-ROM Media Supply</td>
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<td>CD-ROM Media Supply</td>
<td>6658</td>
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<td>CD-ROM Media Supply</td>
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</table>

**Customization features:**

- Electronic software delivery: 3450
- Do not ship pubs: 3470
Trade-up from Authorized User to Concurrent User

Customers who have originally acquired licenses for Authorized User can trade-up their Authorized User licenses to an equivalent or appropriate number of Concurrent User licenses.

Below is a list of precursor products and their associated Authorized User part numbers for which you must have already acquired a license, in order to be eligible to acquire the equivalent Concurrent User licenses using the trade-up feature code.

<table>
<thead>
<tr>
<th>Precursor product</th>
<th>Trade-up product</th>
<th>Trade-up feature code</th>
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<tr>
<td>XL Fortran for Linux Authorized User</td>
<td>Concurrent User</td>
<td>Is used to trade-up from single Authorized User to single Concurrent User</td>
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<tr>
<td>single entitlement</td>
<td>single entitlement</td>
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</tr>
</tbody>
</table>

Consult your IBM representative if you have any questions.

This software license includes Software Subscription and Technical Support, previously referred to as Software Maintenance.

Extending coverage for a total of three years from date of acquisition may be elected. Order the program number, feature number, and quantity to extend coverage for your software licenses. If maintenance has expired, specify the after license feature number.

<table>
<thead>
<tr>
<th>Program number</th>
<th>Feature description</th>
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<tr>
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<td>IBM XL Fortran for Linux, V15.1</td>
<td>0001</td>
</tr>
<tr>
<td></td>
<td>Per Authorized User with 1 Year SW S&amp;S</td>
<td>0002</td>
</tr>
<tr>
<td>5765-J10</td>
<td>IBM XL Fortran for Linux</td>
<td>5809</td>
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<tr>
<td></td>
<td>Multilingual, DVD-ROM</td>
<td>3435</td>
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<tr>
<td>5648-F55</td>
<td>IBM XL Fortran for Linux</td>
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<tr>
<td></td>
<td>Per Authorized User SW S&amp;S</td>
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<td></td>
<td>- 1 Year Renewal</td>
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<tr>
<td></td>
<td>Per Concurrent User SW S&amp;S</td>
<td>0003</td>
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<tr>
<td></td>
<td>- NoCharge Registration</td>
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5648-F57 IBM XL Fortran for Linux
Per Authorized User SW S&S 1 Year After License 0001
Per Concurrent User SW S&S 1 Year After License 0002

5648-F59 IBM XL Fortran for Linux
Per Authorized User SW S&S 3 Year Registration 0001
Per Concurrent User SW S&S 3 Year Registration 0002

5648-F56 IBM XL Fortran for Linux
Per Authorized User SW S&S 3 Year Renewal 0001
Per Concurrent User SW S&S 3 Year Renewal 0002

5648-F58 IBM XL Fortran for Linux
Per Authorized User SW S&S 3 Year After License 0001
Per Concurrent User SW S&S 3 Year After License 0002

Charge metric

<table>
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<th>PID number</th>
<th>Charge metric</th>
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</thead>
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<td>XL Fortran for Linux, V15.1</td>
<td>5765-J10</td>
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<tr>
<td>For build to plan</td>
<td>XL Fortran for Linux, V15.1</td>
<td>5725-C75</td>
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<tr>
<td>For build to plan</td>
<td>XL Fortran for Linux, V15.1</td>
<td>BA182ML</td>
</tr>
</tbody>
</table>

This Program is licensed and charged based upon either the Authorized User or Concurrent User charge metric.

Authorized User

Authorized User is a unit of measure by which the program can be licensed. An Authorized User is a unique person who is given access to the program. The program may be installed on any number of computers or servers and each Authorized User may have simultaneous access to any number of instances of the program at one time. Licensee must obtain separate, dedicated entitlements for each Authorized User given access to the program in any manner directly or indirectly (for example, via a multiplexing program, device, or application server) through any means. An entitlement for an Authorized User is unique to that Authorized User and may not be shared, nor may it be reassigned other than for the permanent transfer of the Authorized User entitlement to another person.

Note: Some programs may be licensed where devices are considered users. In that case, the following applies. Any computing device that requests the execution of or receives for execution a set of commands, procedures, or applications from the program or that is otherwise managed by the program is considered a separate user of the program and requires an entitlement as if that device were a person.

Concurrent User

Concurrent User is a unit of measure by which the program can be licensed. A Concurrent User is a person who is accessing the program at any particular point in time. Regardless of whether the person is simultaneously accessing the program multiple times, the person counts only as a single Concurrent User. The program may be installed on any number of computers or servers, but licensee must obtain entitlements for the maximum number of Concurrent Users simultaneously accessing the program. Licensee must obtain an entitlement for each simultaneous Concurrent User accessing the program in any manner directly or indirectly (for
example, via a multiplexing program, device, or application server) through any means.

**Note:** Some programs may be licensed where devices are considered users. In that case, the following applies. Any computing device that requests the execution of or receives for execution a set of commands, procedures, or applications from the program or that is otherwise managed by the program is considered a separate user of the program and requires an entitlement as if that device were a person.

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The information provided in this announcement letter is for reference and convenience purposes only. The terms and conditions that govern any transaction with IBM are contained in the applicable contract documents such as the IBM International Program License Agreement, IBM International Passport Advantage Agreement, and the IBM Agreement for Acquisition of Software Maintenance.

**Licensing**

IBM International Program License Agreement including the License Information document and Proof of Entitlement (PoE) govern your use of the program. PoEs are required for all authorized use. Part number products only, offered outside of Passport Advantage, where applicable, are license only and do not include Software Maintenance.

This software license includes Software Subscription and Support (also referred to as Software Maintenance).

**Agreement for Acquisition of Software Maintenance**

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These programs are licensed under the IBM Program License Agreement (IPLA) and the associated Agreement for Acquisition of Software Maintenance, which provide for support with ongoing access to releases and versions of the program. IBM includes one year of Software Subscription and Support (also referred to as Software Maintenance) with the initial license acquisition of each program acquired. The initial period of Software Subscription and Support (also referred to as Software Maintenance) can be extended by the purchase of a renewal option, if available. These programs have a one-time license charge for use of the program and an annual renewable charge for the enhanced support that includes telephone assistance (voice support for defects during normal business hours), as well as access to updates, releases, and versions of the program as long as support is in effect.

**License Information number**

L-JYIP-9GQQE3

The program’s License Information will be available for review on the IBM Software License Agreement website


**Limited warranty applies**

Yes

**Limited warranty**

IBM warrants that when the program is used in the specified operating environment, it will conform to its specifications. The warranty applies only to the unmodified
portion of the program. IBM does not warrant uninterrupted or error-free operation
of the program or that IBM will correct all program defects. You are responsible for
the results obtained from the use of the program.

IBM provides you with access to IBM databases containing information on known
program defects, defect corrections, restrictions, and bypasses at no additional
charge. For further information, consult the IBM Software Support Handbook found at

http://www.ibm.com/support/handbook

IBM will maintain this information for at least one year after the original licensee
acquires the program (warranty period).

**Program technical support**

Technical support of a program product version or release will be available for
a minimum of five years from the general availability date, as long as your
Software Subscription and Support (also referred to as Software Maintenance) is
in effect. This technical support allows you to obtain assistance (via telephone or
electronic means) from IBM for product-specific, task-oriented questions regarding
the installation and operation of the program product. Software Subscription
and Support (Software Maintenance) also provides you with access to updates
(modifications or fixes), releases, and versions of the program. You will be notified,
via announcement letter, of discontinuance of support with 12 months' notice. If
you require additional technical support from IBM, including an extension of support
beyond the discontinuance date, contact your IBM representative or IBM Business
Partner. This extension may be available for a fee.

**Money-back guarantee**

If for any reason you are dissatisfied with the program and you are the original
licensee, you may obtain a refund of the amount you paid for it, if within 30 days of
your invoice date you return the program and its PoE to the party from whom you
obtained it. If you downloaded the program, you may contact the party from whom
you acquired it for instructions on how to obtain the refund.

For clarification, note that (1) for programs acquired under the IBM International
Passport Advantage offering, this term applies only to your first acquisition of the
program and (2) for programs acquired under any of IBM's On/Off Capacity on
Demand (On/Off CoD) software offerings, this term does not apply since these
offerings apply to programs already acquired and in use by you.

**Volume orders (IVO)**

Yes. Contact your IBM representative.

**Passport Advantage applies**

Yes, and through the Passport Advantage website at

http://www.ibm.com/software/passportadvantage

**Usage restriction**

Yes

For additional information, refer to the License Information document that is
available on the IBM Software License Agreement website

http://www.ibm.com/software sla/sladb nsf

**Software Subscription and Support applies**

Yes. Software Subscription and Support (also referred to as Software Maintenance),
is now included in the Passport Advantage Agreement. Installation and technical
support for the products announced in this announcement is provided by the
Software Subscription and Support offering of the IBM International Passport Advantage Agreement. This fee service enhances customer productivity by providing voice or electronic access into the IBM support organizations.

IBM includes one year of Software Subscription and Support with the initial license acquisition of each program acquired. The initial period of Software Subscription and Support can be extended by the purchase of a renewal option.

While your Software Subscription and Support is in effect, IBM provides you assistance for your routine, short duration installation and usage (how-to) questions, and code-related questions. IBM provides assistance via telephone and, if available, electronic access, only to your information systems (IS) technical support personnel during the normal business hours (published prime shift hours) of your IBM support center. (This assistance is not available to your end users.) IBM provides Severity 1 assistance 24 hours a day, every day of the year. For additional details, consult your IBM Software Support Handbook at

http://www.ibm.com/support/handbook

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Variable charges apply

No

Educational allowance available

Yes. A 15% education allowance applies to qualified education institution customers.

Statement of good security practices

IT system security involves protecting systems and information through prevention, detection, and response to improper access from within and outside your enterprise. Improper access can result in information being altered, destroyed, or misappropriated or can result in misuse of your systems to attack others. Without a comprehensive approach to security, no IT system or product should be considered completely secure and no single product or security measure can be completely effective in preventing improper access. IBM systems and products are designed to be part of a comprehensive security approach, which will necessarily involve additional operational procedures, and may require other systems, products, or services to be most effective. IBM does not warrant that systems and products are immune from the malicious or illegal conduct of any party.

Prices

Business Partner information
If you are an IBM Business Partner -- Distributor for Workstation Software acquiring products from IBM, you may link to Passport Advantage Online for resellers where you can obtain Business Partner pricing information. An IBM ID and password are required.

https://www.ibm.com/software/howtobuy/passportadvantage/paoreseller

Information on charges is available at

http://www.ibm.com/support

Select "United States" and then click on "IBMLink 2000"

<table>
<thead>
<tr>
<th>Description</th>
<th>Program number</th>
<th>Feature number</th>
<th>One-time charge</th>
<th>One-time charge</th>
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<tbody>
<tr>
<td>XL Fortran for Linux, V15.1 with 1 Year SW S&amp;S</td>
<td>5765-J10</td>
<td>0001</td>
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<tr>
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<td>- per Concurrent User</td>
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<tr>
<td>- trade up from single Authorized User entitlement to single Concurrent User entitlement</td>
<td>5765-J10</td>
<td>0002</td>
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<td>- per Concurrent User</td>
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