



IBM ESSL for Linux on POWER adds subroutines and enhances performance on IBM Power Systems running Linux

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At a glance

IBM® Engineering and Scientific Subroutine Library (ESSL) for Linux® on POWER V5.1 provides POWER7™ Vector Scalar Extension (VSX) (SIMD) versions of most BLAS and FFT subroutines and is tuned for performance on IBM POWER7 processor-based servers. In addition, new LAPACK and FFT subroutines are added.

For ordering, contact Your IBM representative or an IBM Business Partner. For more information contact the Americas Call Centers at 800-IBM-CALL (426-2255). Reference: RE001

Overview

ESSL¹ for Linux on POWER offers a collection of mathematical subroutines that are tuned for performance on IBM Power Systems™ servers, including POWER6™ and POWER7 processor-based servers and blades, running the Linux operating system.

1 Engineering and Scientific Subroutine Library

Subroutines are available in the following computational areas:

- Linear Algebra Subprograms
- Matrix Operations
- Linear Algebraic Equations
- Eigensystem Analysis
- Fourier Transforms, Convolutions, and Correlations, and Related Computations
- Sorting and Searching
- Interpolation
- Numerical Quadrature
- Random Number Generation

New subroutines available with ESSL V5:

- LAPACK
 - DSYGVX Selected Eigenvalues and Optionally, the Eigenvectors of a Positive Definite Real Symmetric Generalized Eigenproblem

- Fourier Transform
 - SRCFTD and DRCFTD: Multidimensional Real-to-Complex Fourier Transform
 - SCRFTD and DCRFTD: Multidimensional Complex-to-Real Fourier Transform

Support was added to the ESSL FFTW Wrappers Library corresponding to these new ESSL Fourier Transform subroutines.

For the list of FFTW subroutines supported, restrictions on their use, and instructions on how to build, install, and use the ESSL FFTW Wrappers Library, refer to the *ESSL Guide and Reference*.

Note: Version 5.1 is the last release to support specific subroutines in both ESSL for Linux on POWER and ESSL for AIX®. Refer to the Customer planning section for a list of subroutines.

Key prerequisites

- IBM Power Systems servers (POWER6 and POWER7)
- IBM BladeCenter® servers (JS22 and JS23 POWER6 blades and POWER7 blades)
- SUSE Linux Enterprise System (SLES) 11 Operating System

Planned availability date

October 22, 2010

Description

ESSL is a state-of-the-art collection of subroutines providing a wide range of mathematical functions for many different scientific and engineering applications. Its primary characteristics are performance, functional capability, and usability.

Performance and functional capability

All ESSL libraries provide high levels of performance for numerically intensive computing jobs on the respective processors. All versions provide mathematically equivalent results.

These mathematical subroutines are tuned for performance on IBM POWER6 and POWER7 technology-based processors.

ESSL provides the following runtime libraries:

- The ESSL Serial Library provides thread-safe versions of the ESSL subroutines for use on all processors. You may use this library to develop your own multithreaded applications. All libraries are designed to provide high levels of performance for numerically intensive computing jobs on these respective processors. All versions provide mathematically equivalent results.
- The ESSL Symmetric Multi-Processing (SMP) Library provides thread-safe versions of the ESSL subroutines for use on all SMP processors. In addition, a subset of these subroutines are also multithreaded versions; that is, they support the shared memory parallel processing programming model. You do not have to change your existing application programs that call ESSL to take advantage of the increased performance of using the SMP processors; you can simply re-link your existing application programs.

The ESSL Serial Library and the ESSL SMP Library contain a VSX (SIMD) version of selected subroutines for use on POWER7 processor-based servers and an AltiVec (SIMD) version of selected subroutines for use on POWER6 processor-based servers. These libraries support the following application environments:

- 32-bit integers and 32-bit pointers
- 32-bit integers and 64-bit pointers
- 64-bit integers and 64-bit pointers

The ESSL subroutines can be called from application programs written in Fortran, C, and C++ running the Linux operating system.

Usability

ESSL is designed for usability:

- Includes an easy-to-use call interface.
- Supports two 64-bit environments, LP64 and ILP64. The LP64 data model supports 32-bit integers and 64-bit pointers, and the ILP64 data model supports 64-bit integers and 64-bit pointers. In accordance with the LP64 data model, all ESSL integer arguments remain 32-bit except the 'iusadr' argument for ERRSET.
- If your existing application programs use the ESSL Serial library, you only need to re-link your program to take advantage of the increased performance of the ESSL SMP Library.
- Delivers informative error-handling capabilities, enabling you to calculate auxiliary storage sizes and transform lengths.
- Includes an online book that can be displayed using an HTML document browser is available for use with ESSL.
- Provides man pages of the subroutine descriptions are provided.

Areas of application

ESSL provides a variety of mathematical functions for many different types of scientific and engineering applications. Some of the industries using these applications are:

- Aerospace
- Automotive
- Electronics
- Petroleum
- Finance
- Utilities
- Research

Examples of applications in these industries are:

- Structural Analysis Time Series Analysis
- Computational Chemistry Computational Techniques
- Fluid Dynamics Analysis Mathematical Analysis
- Seismic Analysis Dynamic Systems Simulation
- Reservoir Modeling Nuclear Engineering
- Quantitative Analysis Electronic Circuit Design

The subroutines provided in ESSL fall into the following groups:

- Nine major areas of mathematical computation, providing the computations commonly used by the industry applications listed above
- Utilities, performing general-purpose functions

To help you select the ESSL subroutines that fulfill your needs for performance, accuracy, storage, and so forth, refer to the "Selecting an ESSL Subroutine" topic in the *ESSL Guide and Reference* .

Accuracy of the computations

ESSL is designed to provide accuracy comparable to libraries using equivalent algorithms with identical precision formats. Both short- and long-precision real versions of the subroutines are provided in most areas of ESSL. In some areas, short- and long-precision complex versions are also provided. The data types operated on by the short-precision, long-precision, and integer versions of the subroutines are ANSI/IEEE 32- and 64-bit binary floating-point format.

High performance of ESSL algorithms

The ESSL subroutines are designed to provide high performance. To achieve this performance, the subroutines use innovative algorithms tailored to specific operational characteristics of the hardware, such as cache size, Translation Lookaside Buffer (TLB) size, and page size.

Most subroutines use the following techniques to optimize performance:

- Managing the cache and TLB efficiently so the hit ratios are maximized; that is, data is blocked so it stays in the cache or TLB for its computation.
- Accessing data stored contiguously; that is, using stride-1 computations.
- Exploiting the large number of available floating-point registers.
- Using algorithms that minimize paging.

For details, refer to the "High Performance of ESSL" topic in the *ESSL Guide and Reference*.

The FORTRAN

language interface to the subroutines

- The ESSL subroutines follow standard FORTRAN calling conventions and must run in the FORTRAN runtime environment.
- When ESSL subroutines are called from a program in a language other than FORTRAN, such as C or C++, the FORTRAN conventions must be used. This applies to all aspects of the interface, such as the linkage conventions and the data conventions. For example, array ordering must be consistent with FORTRAN array ordering techniques.

Product positioning

Use ESSL when you need outstanding performance through simple subroutine calls from floating-point engineering and scientific applications running on IBM Power Systems servers or blades.

Program number

Program number	VRM	Program name
5765-L51	5.1.0	ESSL for Linux on POWER

Product identification number

Program PID number	Maintenance 1-year PID number	Maintenance 3-year PID number
5765-L51	5660-ELL 5661-ELL	5662-ELL 5663-ELL 5664-ELL

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) is now available in all countries.

ESU orders for software will be placed on the Entitled Software Support (ESS) website

<https://www.ibm.com/servers/eserver/ess/OpenServlet.wss>

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 on the CD media shipped for physical orders. Countries requiring physical delivery of License Information documentation will have these documents shipped separately. This physical shipment will not delay the immediate availability of the ESD images for customer download.

ESD customers placing ESD software orders will receive an email with the software order information. The ESU customer will be able to immediately proceed to the Downloads website 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)
http://www.ibm.com/systems/support/software/delivery/en_US/downloadinfo.html
- ESD sign-in (must have Customer number and Product software entitlements to get in)
<https://www.ibm.com/servers/eserver/ess/OpenServlet.wss>
- List of Power software products that are available for electronic download
http://www.ibm.com/systems/support/software/delivery/en_US/supportedproducts.html

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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).

<https://www.ibm.com/partnerworld/mem/sla.jsp?num=210-300>

Publications

No publications are shipped with this program.

The following publications are available on the web:

- IBM ESSL: Guide and Reference
- IBM ESSL for Linux on POWER Installation

To access ESSL documentation, refer to the IBM Cluster Information Center website. It contains the most recent ESSL documentation in PDF and HTML formats and is located at

<http://publib.boulder.ibm.com/infocenter/clresctr/index.jsp>

The IBM Publications Center

<http://www.ibm.com/e-business/linkweb/publications/servlet/pbi.wss>

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 50 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.

Technical information

Specified operating environment

Hardware requirements

Supported on all IBM POWER7 and POWER6 servers and blades.

Note: ESSL for Linux on POWER V5.1 is not supported on IBM System Blue Gene/P™.

Software requirements

Operating system

- SLES 11 SP™ 1

Software products

- For compiling (one of these):
 - IBM XL Fortran for Linux, V13.1
 - IBM XL C/C++ for Linux, V11.1
- For linking, loading, or running:
 - IBM XL Fortran for Linux, V13.1 Run-Time Environment provided with IBM XL Fortran for Linux, V13.1 or downloadable from
<http://www.ibm.com/support/docview.wss?rs=43&uid=swg21156900>
 - gcc 32-bit and 64-bit libraries provided with the Linux distro

Note: ESSL for Linux on POWER V5.1 is not supported running on SLES 10 or Red Hat 5.

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.

Companion products

If running parallel jobs, the following products are recommended:

- Parallel Engineering and Scientific Subroutine Library (Parallel ESSL) is a scalable mathematical subroutine library that can provide outstanding performance through simple subroutine calls for engineering and scientific MPI applications on clusters of IBM Power Systems servers and BladeCenter servers using the Parallel Environment MPI library for communications.
- IBM Tivoli® Workload Scheduler LoadLeveler® can be used for submission of batch parallel jobs. It can help assist with node allocation for job management.
- IBM Parallel Environment is a high-function development and execution environment for parallel MPI applications that can reduce the time and effort required to develop parallel applications.
- IBM General Parallel File System™ (GPFS™) is a high-performance cluster file system for AIX, Linux, Windows®, and mixed clusters that provides users with shared access to files spanning multiple disk drives. GPFS delivers multicenter support, superior scalability and performance, support for extremely large files, failure recovery, and ease of administration.

Compatibility

ESSL V5.1 is a functional enhancement and complete replacement of ESSL V4.4.

ESSL V5.1 contains the same calling sequences as ESSL V4.4. Existing applications will work without source code changes if you are migrating from ESSL V4.4 to ESSL V5.1.

For supported levels, compatibility, and limitations regarding InfiniBand switch support, refer to the README at the following URL:

<http://www14.software.ibm.com/webapp/set2/sas/f/networkmanager/home.html>

Planning information

ESSL V5.1 (AIX and Linux on POWER) is the last release to support the following Non-LAPACK-Conforming subroutines. For example,, those ESSL subroutines whose name is the same as an existing LAPACK subroutine, but whose calling-sequence arguments and functionality are different from that LAPACK subroutine:

- SGEEV, DGEEV, CGEEV, and ZGEEV - Eigenvalues and, Optionally, All or Selected Eigenvectors of a General Matrix
- SSPEV, DSPEV, CHPEV, and ZHPEV - Eigenvalues and, Optionally, the Eigenvectors of a Real Symmetric Matrix or a Complex Hermitian Matrix

- SSPSV, DSPSV, CHPSV, and ZHPSV - Extreme Eigenvalues and, Optionally, the Eigenvectors of a Real Symmetric Matrix or a Complex Hermitian Matrix
- SGEGV and DGEGV - Eigenvalues and, Optionally, the Eigenvectors of a Generalized Real Eigensystem, where A and B Are Real General Matrices
- SSYGV and DSYGV - Eigenvalues and, Optionally, the Eigenvectors of a Real Symmetric Generalized Eigenproblem

Direct customer support

For technical support or assistance, contact your IBM representative or visit

<http://www.ibm.com/support>

Packaging

ESSL for Linux on POWER is distributed as a single package available via CD-ROM media or electronic download with the following:

- IBM International Program License Agreement in multilanguage booklet (LC23-5090-00) and its License Information (L-RHAN-836HQD) in multiple languages
- Proof of Entitlement (POE)
- Product readme file that describes the program's specified operating environment and program specifications
- Program RPM's:
 - essl.license-5.1.0-0.ppc64.rpm
 - essl.common-5.1.0-0.ppc64.rpm
 - essl.rte.common-5.1.0-0.ppc64.rpm
 - essl.rte-5.1.0-0.ppc64.rpm
 - essl.3232.rte-5.1.0-0.ppc64.rpm
 - essl.3264.rte-5.1.0-0.ppc64.rpm
 - essl.6464.rte-5.1.0-0.ppc64.rpm
 - essl.msg-5.1.0-0.ppc64.rpm
 - essl.man-5.1.0-0.ppc64.rpm

Security, auditability, and control

ESSL for Linux on POWER uses the security and auditability features of the Linux operating system it is installed on. 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

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Ordering information

Charge metric

Program name	Part number or PID number	Charge metric
ESSL for Linux	5765-L51	Per processor - small, medium, or large processor tier including one year SWMA
1-year SWMA: Registration and Renewal	5660-ELL	Per processor - small, medium, or large processor tier
1-year SWMA: After-license	5661-ELL	Per processor - small, medium, or large processor tier
3-year SWMA: Registration	5662-ELL	Per processor - small, medium, or large processor tier
3-year SWMA: Renewal	5663-ELL	Per processor - small, medium, or large processor tier
3-year SWMA: After-license	5664-ELL	Per processor - small, medium, or large processor tier

Processor

A processor is the unit of measure by which this program is licensed. A *processor* (commonly called a CPU or core) is a functional unit within a computing device that interprets and executes instructions. A processor consists of at least an instruction control unit and one or more arithmetic or logic units. With multicore technology, each core is considered a processor.

5765-L51 - ESSL for Linux on POWER V5

Basic license one-time charge

Feature description	Feature number
Small per processor	0001
Medium per processor	0002
Large per processor	0003

This software license includes Software Maintenance.

System Program Order (SPO): An order for SPO 5692-LOP is mandatory for shipments of program distribution. The individual licensed program orders are for registration and billing purposes only. No physical deliveries occur as a result of those orders.

The SPO must contain the following feature to deliver a machine-readable copy of the product using the currently available media.

Program number	Program/Function name	Feature number
5692-LOP	ESSL for Linux on POWER V5.1	2270

Expedite feature for licensed programs and SWMA programs

Program number	Description	Feature number
5765-L51	Branch Office Expedite	3445

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License Information form number

L-RHAN-836HQD

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

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Limited warranty applies

Yes

Limited warranty

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Technical support of a program product version or release will be available for a minimum of three 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 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

No

Software Subscription and Support (Software Maintenance) applies

Yes. All distributed software licenses include Software Subscription and Support (also referred to as Software Maintenance) for a period of 12 months from the date of acquisition, providing a streamlined way to acquire IBM software and assure technical support coverage for all licenses. Extending coverage for a total of three years from date of acquisition may be elected.

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IBM Operational Support Services - SoftwareXcel

No

Other support

SWMA

System i Software Maintenance applies

No

Variable charges apply

No

Educational allowance available

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

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To learn how Electronic Services can work for you, visit

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Prices

Information on charges is available at

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Choose the option entitled Purchase/upgrade tools.

Program name: IBM ESSL for Linux on POWER
Program PID: 5765-L51

Basic license one-time charge (OTC)

Feature description	Feature number
Small per processor	0001
Medium per processor	0002
Large per processor	0003

PID	Description	US	List price
5765-L51	Small per processor	0001	\$250
5765-L51	Medium per processor	0002	700
5765-L51	Large per processor	0003	1,160

For additional information and current prices, contact your local IBM representative.

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Note: Shipments will begin after the planned availability date.

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