



IBM Parallel Environment Runtime Edition for Linux on Power Version 1.2 enables parallel application development and execution on select IBM Power Systems clusters

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At a glance

IBM® Parallel Environment (IBM PE) Runtime Edition for Linux™ on Power® V1.2 is designed to offer a user-friendly, runtime environment for the execution of parallel applications. The components of IBM PE Runtime Edition for Linux on Power are:

- Parallel Operating Environment
- IBM Message Passing Interface (IBM MPI)
- IBM Parallel Active Messaging Interface (PAMI)
- Low-level application programming interface (LAPI)
- Command line parallel debugger (pdb)

For ordering, contact your IBM representative, an IBM Business Partner, or IBM Americas Call Centers at 800-IBM-CALL (Reference: RE001).

Overview

IBM PE Runtime Edition for Linux on Power V1.2 provides a parallel runtime environment for a distributed cluster of select IBM Power Systems™ and IBM Flex Systems servers for technical computing workloads. It also provides the core components to enable a user to develop, debug, and execute parallel applications such as those using the industry-standard MPI.

IBM PE Runtime Edition for Linux on Power can be used on a single IBM Power Systems server to develop and test parallel applications through shared memory and TCP/IP User Datagram Protocol (UDP) and through simple runtime options deployed to a networked cluster of IBM POWER® servers.

IBM PE Runtime Edition supports a unique capability for the user to create a workflow via *subjob* support managed by the Parallel Operating Environment. Subjobs allow users the ability to run multiple parallel jobs within the initial static allocation of compute resources.

Communication implementation from IBM exploits an enhanced API, IBM PAMI, designed to increase parallel application performance on clusters made up of Power Systems servers running the Red Hat Enterprise Linux operating system.

Implemented on top of PAMI is an API written to the OpenSHMEM v1.0 specification. This API utilizes hardware features through PAMI.

Key prerequisites

- IBM Power Systems (POWER7®)
- IBM PureFlex Systems (POWER7)
- Red Hat Enterprise Linux (RHEL) 6.2

Planned availability date

May 25, 2012

Description

IBM PE Runtime Edition for Linux on Power, V1.2 is a capability-rich development and execution environment for parallel applications. IBM PE Runtime Edition offers parallel application programming interfaces, such as MPI and PAMI, and an execution environment for parallel applications.

The components of IBM PE Runtime Edition are:

- Multiple level support: IBM PE Runtime Edition allows multiple releases or updates, especially in the case of fixes, to be separately installed entities so that multiple releases of IBM PE Runtime Edition can be installed on the same cluster. When multiple releases are installed, IBM PE Runtime Edition allows for customers to switch from one release to another.
- Industry-standard MPI interface: IBM PE Runtime Edition for Linux delivers straightforward message-passing facilities by application developers familiar with distributed memory machines. This can also protect your software investment by allowing portability of applications. The goal of this interface is to deliver a standard for writing message-passing programs for practicality, portability, efficiency, and flexibility.
- IBM MPI: The IBM MPI is a complete MPI 2.2 implementation, designed to comply with the requirements of the MPI standard. IBM MPI supports the process creation and management scheme of the MPI-2.1. The IBM design is enabled using static resources allocated at job launch time.

The IBM MPI provides a number of nonblocking collective communication subroutines that are available for parallel programming. These subroutines are extensions of the MPI standard. Collective communications routines for 64-bit programs have been enhanced to use shared memory for better performance. The IBM MPI collective communication is designed to use an optimized communication algorithm according to job and data size.

The IBM MPI provides a high scalability and low memory usage implementation. The IBM MPI library minimizes its own memory usage so that an application program can maximize system resources. It is designed to support parallel job size of up to one million tasks.

IBM MPI runs over PAMI. This is achieved through exploiting the PAMI APIs.

- Parallel Operating Environment: Parallel Operating Environment is used to set up the environment for the user's parallel program, and to control and monitor job execution. Parallel Operating Environment provides:
 - Operating system Jitter (OS Jitter) mitigation through co-scheduling capability: Parallel Operating Environment provides services for periodically adjusting the dispatch priority of a user's task between set boundaries, giving the tasks improved execution priority. As an alternative to the priority adjustment coscheduler, Parallel Operating Environment provides a run queue-based

coscheduler for reducing OS Jitter. *OS Jitter* is operating system interference that is caused by the scheduling of daemon processes and the handling of asynchronous events such as interrupts. This interference can have adverse effects on parallel applications running on large-scale systems.

- Affinity support of processes to CPU and memory: IBM PE Runtime Edition provides the capability to control the placement of the tasks of a parallel job, using affinity to processor memory or CPU placement during its execution. As a result, applications may see improved performance if the processor, the memory it uses, and the I/O adapter it connects to are in close proximity, based on the affinity of the tasks to memory or CPUs it uses.
- User-controlled workflow/subjob support: IBM PE Runtime Edition for Linux provides support for launching and managing multiple parallel dynamic jobs (subjobs) using a single scheduler or resource management allocation of cluster resources.
- Lightweight core file support: The IBM PE Lightweight core file support is designed to save CPU time, network bandwidth, and disk space that would be required to generate standard core files. The lightweight format also provides the capability to easily examine the state of all threads in a parallel program at the time the event that caused the core file occurred.
- Serial and parallel job launch: Allows the Parallel Operating Environment to be used not only for launching traditional MPI or other message-passing programs, but also as a distributed shell to quickly obtain information about all nodes in the cluster, such as disk space and currently running jobs.
- Support running Single Process, Multiple Data (SPMD) and Multiple Process, Multiple Data (MPMD): SPMD and MPMD programs give users the flexibility to run the same program on all nodes (SPMD, most common) or different programs on each node (MPMD). The MPMD function is useful for master/worker programs where the master program will coordinate and synchronize the execution of all the worker tasks, and neither program could run without the other.
- Resource management: Parallel Operating Environment supports running without a separate scheduler or resource manager. If a scheduler or resource manager is not used or not available, Parallel Operating Environment can manage the node and adapter resources itself. The network resource tables will also be loaded by Parallel Operating Environment to establish the communication mechanism needed for message-passing programs.

The resource manager of choice may be used for submitting and managing batch or interactive parallel jobs. IBM PE Runtime Edition includes a set of resource management interfaces and data areas for configuring your resource manager to interact with the Parallel Operating Environment.

Integration with LoadLeveler® for Linux on Power: IBM PE Runtime Edition allows users to run Parallel Operating Environment jobs in interactive or batch mode with LoadLeveler managing the node, network, CPU, memory, and other key resources for optimum throughput and resource utilization.

- IBM PAMI: PAMI is a new and converged messaging API that covers both point-to-point and collective communications. PAMI exploits the low-level user space interface to the Host Fabric Interface (HFI) as well as TCP/IP using UDP sockets. PAMI has a rich set of collective operations designed to support MPI and pGAS semantics, multiple algorithm selection, and nonblocking operation. It supports nonblocking and ad hoc geometry (group/communicator) creation, and nonblocking collective allreduce, reduce, broadcast, gather (v), scatter (v), alltoall (v), reduce scatter, and (ex)scan operations. The geometry may support multiple algorithms, including hardware-accelerated (via HFI Collective Acceleration Unit, or Barrier Service Register) versions of broadcast, barrier, allreduce, and reduce.
- Command line parallel debugger: IBM PE Runtime Edition for Linux on Power offers a simple but powerful command line parallel debugger called *pdb*. The *pdb* debugger streamlines debugging of parallel applications, presenting the user with a single command-line interface that supports most dbx/gdb execution control commands and provides the ability to examine running tasks. In order to simplify

management of large numbers of tasks, dbx/gdb allows tasks to be grouped so that the user may examine any subset of the debugged tasks.

The pdb debugger also allows users to invoke a Parallel Operating Environment job or attach to a running Parallel Operating Environment job and place it under debug control. It does this by starting a remote dbx/gdb session for each task of the Parallel Operating Environment job put under debugger control. The pdb debugger also provides a unique capability of filtering the output to minimize the amount of data the user needs to see. It provides the capability for peer (more than one user) debugging through the multiple console sharing feature.

Accessibility by people with disabilities

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

http://www.ibm.com/able/product_accessibility/index.html

Section 508 of the US Rehabilitation Act

IBM IBM PE Runtime Edition for Linux on Power is capable as of May 25, 2012, 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 interoperates with it. A US Section 508 Voluntary Product Accessibility Template (VPAT) can be requested on the following website

http://www.ibm.com/able/product_accessibility/index.html

Product positioning

IBM PE Runtime Edition for Linux on Power, V1.2 is for technical computing customers who demand effective tools for developing, tuning, and running parallel applications that use the industry-standard MPI. Compared to other competitive options in the market, IBM PE allows applications to scale to a much larger number of cores and is optimized to deliver significant application performance improvements on IBM Power Systems clusters. It also supports a unique capability for the user to create a workflow that would allow users to run multiple parallel jobs within the initial static allocation of compute resources.

IBM PE Runtime Edition offers customers a differentiated set of features that allows them to improve resource utilization, increase application performance, and reduce time to solution for numerically intensive and demanding scientific, technical, and strategic business applications.

Program number

Program number	VRM	Program name
5765-PRP	1.2.0	IBM PE Runtime Edition for Linux on Power

Product identification number

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

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).

<https://www.ibm.com/partnerworld/mem/sla.jsp?num=212-018>

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-05.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

Offering Information

Product information is available via the Offering Information website

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

Publications

The following publications are available from the web for Parallel Environment Runtime Edition for Linux, V1:

- Installation, SC23-6780
- LAPI Programming Guide, SA23-2272
- Messages, SC23-6782

- MPI Programming Guide, SC23-6783
- MPI Subroutine Reference, SC23-6784
- NRT API Programming Guide, SC23-6785
- OpenSHMEM Programming Guide, SA23-1353
- Operation and Use, SC23-6781
- PAMI Programming Guide, SA23-2273

To access the above documentation, refer to the IBM Cluster Information Center website. For the most recent documentation in PDF and HTML formats visit

<http://publib.boulder.ibm.com/infocenter/clresctr/vxrx/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

- IBM PureFlex System p260 and p460 compute nodes (based on POWER7 technology) with PureFlex System IB6132 2-port QDR InfiniBand adapters interconnected using the PureFlex System IB6131 InfiniBand Switch and optionally the IBM QDR Mellanox external switch or
- Select stand-alone POWER7 clusters or POWER7 clusters connected with a LAN supporting IP

Note: For supported levels, compatibility, and limitations regarding InfiniBand switch support, refer to the README located under documentation and *IBM High Performance Computing Clusters Service Packs* at

<https://www.ibm.com/developerworks/wikis/display/hpccentral/HPC+Central>

Software requirements

Operating environment: Red Hat Enterprise Linux 6.2

For compiling, one of these:

- IBM XL Fortran Enterprise Edition V13.1 for Linux
- IBM XL C/C++ Enterprise Edition V11.1 for Linux
- C and C++: GNU (gcc, g++)
- Fortran: GNU (gfortran)

For running, one of these:

- IBM XL Fortran Run-Time Environment V13.1 for Linux provided with the IBM XL Fortran Enterprise Edition for Linux or downloadable from
<http://www.ibm.com/support/docview.wss?uid=swg24026634>
- GNU: gcc 64-bit libraries provided with the Linux distro

To run Parallel Operating Environment jobs, any job scheduler or LoadLeveler for Linux on Power V5.1 is recommended. A job scheduler is required to run batch jobs.

Note: The common resource manager interfaces used by Parallel Operating Environment allow the use of schedulers other than LoadLeveler if those schedulers utilize the LoadLeveler resource manager interfaces.

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

The following products could be purchased with this product:

1. IBM Parallel ESSL for Linux on Power V4.1 (5765-ESL)
2. IBM LoadLeveler for Linux on Power V5.1 (5765-LLP)
3. IBM General Parallel File System (GPFS™) for Linux on Power V3.4 (5765-G66)
4. IBM PE Developer Edition for Linux on Power V1.1.1 (5765-PDP)

Benefits to the customer:

1. Parallel Engineering and Scientific Subroutine Library (Parallel ESSL) is a scalable mathematical subroutine library that provides outstanding performance through simple subroutine calls for engineering and scientific MPI applications on clusters of Power Systems servers using the IBM MPI library for communication.
2. LoadLeveler can be used to manage parallel workload, maximize resource utilization, and minimize job completion time. LoadLeveler schedules jobs, and provides functions for building, submitting, and processing jobs quickly and efficiently in a dynamic environment.
3. GPFS is beneficial because MPI-IO depends on the underlying file system's ability to maintain file consistency when multiple tasks modify a file. An MPI job distributes tasks across many nodes, and these tasks commonly do large amounts of concurrent and even coordinated file I/O.
4. Integration with IBM PE Developer Edition provides the ability to perform static analysis and debug of the application, as well as analyze its performance.

Limitations

Support is not provided with IBM PE Runtime Edition for Linux on Power, V1.2 for:

- SUSE Enterprise Linux Server operating systems
- RHEL 5 operating systems
- POWER6® processor types
- Power System 775 servers
- Qlogic 9000 Series DDR InfiniBand switches
- Power 750/755 with DDR InfiniBand

Planning information

Installability

If you have the IBM Parallel Environment for Linux V4 or V5 product installed in your environment, you need to uninstall it prior to installing IBM PE Runtime for Linux on Power V1.

Packaging

IBM PE Runtime Edition for Linux on Power is distributed as a single package available via DVD media with the following:

- IBM International Program License Agreement in multilanguage booklet (LC23-5119-00) and its License Information (L-RHAN-8PRR3W) in multiple languages (ppe.loc.license)

- Proof of Entitlement (POE)
- Product readme file that describes the program's specified operating environment and program specifications
- Program RPMs:
 - IBM PE Runtime Edition filesets (ppe.rte, ppe.man, ppe.samples, ppe.loc.license)
 - Resource manager filesets (LoadL.resmgr.full)

Security, auditability, and control

IBM PE Runtime Edition for Linux on Power uses the security and auditability features of the Linux operating system on which it is running.

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

Charge metric

Program name	Part number or PID number	Charge metric
IBM PE Runtime Edition for Linux on PWR	5765-PRP	Per install - small, medium, or large server including one year SWMA
1-year SWMA: Registration and Renewal	5660-PRP	Per install - small, medium, or large server
1-year SWMA: After-license	5661-PRP	Per install - small, medium, or large server
3-year SWMA: Registration	5662-PRP	Per install - small, medium, or large server
3-year SWMA: Renewal	5663-PRP	Per install - small, medium, or large server
3-year SWMA: After-license	5664-PRP	Per install - small, medium, or large server

Install

Install is a unit of measure by which the program can be licensed. An install is an installed copy of the program on a physical or virtual disk made available to be

executed on a computer. Licensee must obtain an entitlement for each install of the program.

5765-PRP - IBM PE Runtime Edition for Linux on Power, V1.2

Basic license one-time charge

Feature description	Feature number
Small per install with 1-year SWMA	0001
Medium per install with 1-year SWMA	0002
Large per install with 1-year SWMA	0003

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

Extending coverage for a total of three years from the 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.

Software license includes 1 year Software Maintenance
5765-PRP - IBM PE Runtime Edition for Linux on Power

Program number	Program name	Feature number
5660-PRP	Maintenance no-charge 1-year registration	
	Small per install	1755
	Medium per install	1761
	Large per install	1765
5660-PRP	Maintenance 1-year 24 x 7 support	
	Small per install	1756
	Medium per install	1762
	Large per install	1766
5662-PRP	Maintenance 3-year registration	
	Small per install	0954
	Medium per install	0960
	Large per install	0964
5662-PRP	Maintenance 3-year 24 x 7 support	
	Small per install	0957
	Medium per install	0962
	Large per install	0966
5661-PRP	1-year Software Maintenance after-license	
	Small per install	0661
	Medium per install	0664
	Large per install	0666
DELETE		
5664-PRP	3-year Software Maintenance after-license	
	Small per install	0001
	Medium per install	0004
	Large per install	0006

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 shipment occurs under these orders.

To receive shipment of machine-readable materials the order needs to include SPO 5692-LOP for IBM PE Runtime Edition for Linux on Power. The individual

licensed program order (for example, 5765-PRP) must still be ordered but will be for registration and billing purposes only and will not result in shipment of materials.

Program number	Program/Function name	Feature number
5692-LOP	IBM PE Runtime Edit f Linux on Power V1.2	2372

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

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License Information form number

L-RHAN-8PRR3W

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

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

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

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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.

Other terms

Volume orders (IVO)

Yes. Contact your IBM representative.

Passport Advantage applies

No

Software Subscription and Support applies

Yes. All entitled 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.

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

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Software Subscription and Support does not include assistance for the design and development of applications, your use of programs in other than their specified operating environment, or failures caused by products for which IBM is not responsible under this agreement.

IBM Operational Support Services - SoftwareXcel

No

Other support

Power Systems 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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Prices

Information on charges is available at

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Choose the option entitled Purchase/upgrade tools.

Program name: IBM PE Runtime Edition for Linux on Power

Type-model number	Order type	Feature number
5765-PRP	Small per install with 1yr SWMA	0001
	Medium per install with 1yr SWMA	0002

Large per install with 1yr SWMA 0003

Type-model number	Order type	Feature number
5660-PRP	Maintenance no-charge 1-year registration	
	Small per install	1755
	Medium per install	1761
	Large per install	1765
5660-PRP	Maintenance 1-year 24 x 7 support	
	Small per install	1756
	Medium per install	1762
	Large per install	1766
5662-PRP	Maintenance 3-year registration	
	Small per install	0954
	Medium per install	0960
	Large per install	0964
5662-PRP	Maintenance 3-year 24 x 7 support	
	Small per install	0957
	Medium per install	0962
	Large per install	0966
5661-PRP	1-year Software Maintenance after-license	
	Small per install	0661
	Medium per install	0664
	Large per install	0666
DELETE		
5664-PRP	3-year Software Maintenance after-license	
	Small per install	0001
	Medium per install	0004
	Large per install	0006

DELETE

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