IBM Engineering and Scientific Subroutine Library
for Linux on POWER

Version 6.1

Installing ESSL

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Note
Before using this information and the product it supports, read the information in "Notices" on page 25.

This edition applies to Version 6 Release 1 of the IBM Engineering and Scientific Subroutine Library (ESSL) for Linux on POWER licensed program (product number 5765-L61) and to all subsequent releases and modifications until otherwise indicated in new editions.

Significant changes or additions to the text and illustrations are indicated by a vertical line (|) to the left of the change.

Contents

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About this document

This document explains how to install IBM® Engineering and Scientific Subroutine Library for Linux on POWER® (ESSL), Version 6.1

When performing each step of the installation, enter all commands as shown because commands are case sensitive.

Highlighting

The following tables describes the highlighting conventions that are used in this document.

Table 1. Conventions

Convention	Usage
bold	**bold** words or characters represent system elements that you must use literally, such as commands, flags, path names, directories, file names, values, and selected menu options.
bold underlined	**Bold underlined** keywords are defaults. These take effect if you do not specify a different keyword.
`constant width`	Examples and information that the system displays appear in `constant-width` typeface.
italic	• *Italic* words or characters represent variable values that you must supply. • *Italics* are also used for information unit titles, for the first use of a glossary term, and for general emphasis in text.
< *key*>	Angle brackets (less-than and greater-than) enclose the name of a key on the keyboard. For example, **<Enter>** refers to the key on your terminal or workstation that is labeled with the word *Enter*.
\	In command examples, a backslash indicates that the command or coding example continues on the next line.
{*item*}	Braces enclose a list from which you must choose an item in format and syntax descriptions.
[*item*]	Brackets enclose optional items in format and syntax descriptions.
<**Ctrl-*x***>	The notation <**Ctrl-*x***> indicates a control character sequence. For example, <**Ctrl-*c***> means that you hold down the control key while pressing <**c**>.
item...	Ellipses indicate that you can repeat the preceding item one or more times.
|	• In syntax statements, vertical lines separate a list of choices. In other words, a vertical line means *Or*. • In the left margin of the document, vertical lines indicate technical changes to the information.

Related information

To view the most recent Engineering and Scientific Subroutine Library documentation, see the IBM Knowledge Center website.

What's new in Installing ESSL Version 6.1

Read about new or significantly changed information for ESSL Version 6.1.

How to see what's new or changed

In this PDF file, you might see revision bars (|) in the left margin that identify new and changed information.

July 2018

ESSL Version 6.1 now supports the following items:

- IBM POWER8 servers
- IBM POWER9 servers

Note: The ESSL SMP CUDA Library is supported only on IBM Power® System AC922 (8335-GTG, 8335-GTC and 8335-GTW) servers with V100 with NVLink GPUs and IBM Power® System S822LC (8335-GTB) servers with NVIDIA P100 GPUs.

April 2018

The following information is a summary of the updates made to this topic collection:

- ESSL Version 6.1 supports IBM Power® System AC922 (8335-GTC and 8335-GTW) servers that are running Red Hat Enterprise Linux 7.5 for Power Little Endian (POWER9) with or without Tesla V100 with NVLink GPUs.
- Added information about upgrading in the "Upgrading from ESSL 5.5" on page 6 topic.
- Added information about installing ESSL Version 6.1 in the following topics:
  - "Install all ESSL 6.1 packages when any previous version of ESSL is installed, and upgrade all previous versions of ESSL to ESSL 6.1" on page 8
  - "Install all ESSL 6.1 packages when any previous version of ESSL is installed, and retain multiple releases (or program temporary fixes (PTFs)) of ESSL" on page 8
  - "Installing ESSL xCAT kits" on page 10
- Updated various information in the following topics:
  - "Software requirements" on page 1
  - "Disk space requirement" on page 3
  - Chapter 3, "Uninstalling ESSL," on page 13
  - Chapter 6, "List of product files," on page 19

Chapter 1. Planning the installation

Plan your installation according to the requirements that follow.

- "Supported operating system environments"
- "Software requirements"

Supported operating system environments

You must ensure that you are installing this product in a supported operating system environment, as listed in Table 2.

Table 2. Operating Systems Supported by ESSL

Product	Supported Environment (big endian mode)	Supported Environment (little endian mode)
ESSL for Linux on POWER	N/A	• For POWER8: Red Hat Enterprise Linux 7.5 (little endian mode) • For POWER9: Red Hat Enterprise Linux 7.5 for Power Little Endian (POWER9)

Software requirements

The following table lists the required software products for ESSL for Linux on POWER:

Table 3. Required Software Products for ESSL

	Required software	Supported levels
For Compiling	IBM XL Fortran for Linux	15.1.6 or 16.1.0 with the latest service
	IBM XL C/C++ for Linux	13.1.6 or 16.1.0 with the latest service
	gcc and g++	See [3]
For Linking, Loading, or Running [1]	IBM XL Fortran Runtime Environment for Linux [2]	15.1.6 or 16.1.0 with the latest service [2]
	gcc and g++ 64-bit libraries	See [3]
	CUDA Toolkit [4]	9.2

Notes:

[1] Additional software packages may be required for building applications. For details, consult the Linux and compiler documentation.

[2] The correct version of IBM XL Fortran Runtime Environment and Addons Library for Linux is automatically shipped with the compiler. You can download the latest version of IBM XL Fortran Runtime Environment and Addons Library for Linux from the Latest updates for supported IBM XL Fortran compilers website.

[3] Use the compilers and libraries provided with your Linux distribution. The ESSL SMP libraries require the XL OpenMP runtime. The gcc OpenMP runtime is not compatible with the XL OpenMP runtime. Therefore, the ESSL SMP libraries can only be used with other compilers if the program calling ESSL is a serial program (does not use OpenMP) because in this case only the XL OpenMP runtime is used.

[4] This product is required only to use the ESSL SMP CUDA library.

Chapter 2. Installing ESSL for RHEL in little endian mode

Disk space requirement

The following table lists the disk space and installation materials required for ESSL:

Table 4. Disk Space Requirements And Installation Materials for ESSL for RHEL

Type of Requirement	Requirement

Disk space	**RPM packages:** The following size of disk space is required for RPM packages:
	`essl.license 20 MB`
	`essl.common 6 MB`
	`essl.rte.common 1 MB`
	`essl.rte 1 MB`
	`essl.3264.rte 100 MB`
	`essl.3264.rtecuda 60 MB`
	`essl.6464.rte 100 MB`
	`essl.msg 1 MB`
	`essl.man 1 MB`
	
	ESSL xCAT Kits: 80 MB of disk space is required for the ESSL xCAT kit compressed tar file.

Installation materials	ESSL for Linux on POWER, CD-ROM LCD8-2482-00

Identifying product packages for installation

Based on your needs, use the table below to decide which ESSL packages to install.

Table 5. ESSL Product Packages for RHEL

Package (See Note)	Description	Other RPMs Required
ESSL Required RPMs:		
essl.license	Contains the electronic license agreement files.	**libxlf**
essl.rte.common	Contains common Run Time files.	**essl.license**
essl.msg	Contains the ESSL message catalog.	**essl.rte.common**
ESSL Optional RPMs:		
essl.common	Contains common files and programs that are used by both the serial and SMP libraries.	**essl.license**
essl.rte	Contains the Run Time files.	**essl.license**
essl.3264.rte	Contains the 32-bit integer, 64-bit pointer Run Time libraries.	**essl.rte.common**
essl.3264.rtecuda	Contains the 32-bit integer, 64-bit pointer Run Time libraries for SMP CUDA.	**essl.rte.common** **cuda-cublas-9-2** **cuda-cufft-9-2** **cuda-cudart-9-2**
essl.6464.rte	Contains the 64-bit integer, 64-bit pointer Run Time libraries.	**essl.rte.common**
essl.man	Contains manpages that describe each of the ESSL subroutines.	**essl.license**

Note: For a list of the individual files in each package, see Chapter 6, "List of product files," on page 19.

Identifying ESSL xCAT kits for installation

If you are installing using ESSL xCAT kits, use Table 6 to decide which ESSL xCAT kit components to install.

Note: xCAT 2.14 is required if you are installing ESSL using kits.

Table 6. ESSL Product xCAT Kits for RHEL

xCAT Kit Component	Description	Other Required xCAT kit components
ESSL Required Kit Components:		
essl-license	Contains the electronic license agreement files	**xlf.rte-compute**
ESSL Optional Kit Components:		
essl-loginnode	Contains all the ESSL product packages except the electronic license agreement files.	**essl-license**
essl-loginnode-nocuda	Contains all the ESSL product packages except the electronic license agreement files and the ESSL SMP CUDA Runtime libraries.	**essl-license**
essl-computenode	Contains all the ESSL product packages except the electronic license agreement files and manpage files.	**essl-license**
essl-computenode-nocuda	Contains all the ESSL product packages except the electronic license agreement files, manpage files and the ESSL SMP CUDA Runtime libraries.	**essl-license**
essl-computenode-3264rte	Contains only the common runtime files, message catalog files and the 32-bit integer, 64-bit pointer Runtime libraries.	**essl-license**
essl-computenode-3264rtecuda	Contains only the common Run Time files, message catalog files and the 32-bit integer, 64-bit pointer SMP CUDA Runtime libraries.	**essl-license**
essl-computenode-6464rte	Contains only the common Run Time files, message catalog files and the 64-bit integer, 64-bit pointer Runtime libraries.	**essl-license**

Installing ESSL on RHEL

You can install ESSL using either RPMs or ESSL xCAT kits. Use the following installation instructions:

Notes:

1. Ensure that you have the prerequisite software installed.
2. No application programs that use ESSL Libraries should be in progress while you perform the installation.
3. When performing each step of the installation, enter all commands as shown, as commands are case sensitive.
4. You must set the **IBM_ESSL_LICENSE_ACCEPT** environment variable for license acceptance mode. This is used to determine whether or not the ESSL license is accepted automatically or if the person doing the install of the product wishes to read the license agreement first and accept the license manually.

   The **IBM_ESSL_LICENSE_ACCEPT** environment variable must be set to one of the following values:

   - **yes** = Accept license automatically
   - **no** = Read the license agreement and accept manually

5. You can set the **IBM_ESSL_SYMBOLIC_LINK** environment variable to determine whether to create symbolic links in the **/usr** directory. It can be set to one of the following values:
   - **yes** = Automatically create symbolic links in the **/usr** directory for ESSL header files and runtime libraries. This is the default value.
   - **no** = No symbolic links will be created in the **/usr** directory so that multiple releases or PTFs for ESSL 6.1 can be installed on the same node.

Installing ESSL for Linux on RHEL by using RPMs

Use the instructions here to log in as root and install ESSL on Linux on RHEL little endian, one node at a time.

Follow the steps below to install ESSL on one node at a time:

1. Log in as root.
2. To find out how much space is available for the ESSL installation in the default installation location (`/opt/ibmmath`), enter the following command:

   ```
   df -h /opt
   ```

   Note: See "Disk space requirement" on page 3 for the amount of disk space that ESSL RPMs require.
3. Put the media in the drive and then enter the appropriate command:

   ```
   mount /dev/cdrom /mnt/cdrom
   ```
4. Install the ESSL packages by using the quick installation or detailed installation process.

Quick installation of packages

Use these quick-installation instructions if *all* of the following statements are true:

- You want to install the ESSL packages directly from the media.

  —**and**—
- There are no previously installed releases of ESSL on your system (either because it is the first time you have installed ESSL on this system or because you have uninstalled all previous releases from this system).

  —**and**—
- You want to accept the license automatically.

  —**and**—
- You want to install the RPMs in the default directory with automatic creation of symbolic links in the **/usr** directory.

If any of the preceding statements are *not* true, you cannot use the quick-installation instructions and must proceed to "Detailed Installation of Packages" on page 6.

Quick Installation

Note: The quick-installation instructions assume that you are installing the packages directly from local media. The *cdrom_path* is:

/media/cdrom/*dist*/*dist_release*/

where:

dist is the Linux distribution.

dist_release
is the release of the Linux distribution.

For example, for RHEL 7.5, the *cdrom_path* is as follows:

/media/cdrom/RHEL/RHEL7

Perform the following steps for quick-installation of packages:

1. Enter the following commands in the order shown:
   export IBM_ESSL_LICENSE_ACCEPT=yes
   rpm -ivh *cdrom_path*/**essl.*6.1.0-0***
2. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.

Detailed Installation of Packages

Notes:

1. You may want to install ESSL from a directory on your system rather than from a media source. To do so, first copy the ESSL packages from the media to the desired directory.

   cp -p *cdrom_path*/***.rpm** *path*

   Regardless of where you perform the install from, you'll need to keep the following values in mind:

   path is the directory (either on your system or on the install media) from which you are installing the ESSL packages.

   --prefix=*essl_path*
   is an optional flag indicating that your want to install the RPMs in a directory other than the default directory. The default directory is **/opt/ibmmath**.
2. On some Linux distributions, the uninstallation process may not be able to clean up the installed directories completely if the prefix is set with a directory which has more than three levels of directory.

Upgrading from ESSL 5.5:
Determine if you want to install all the ESSL 6.1 optional packages. See "Identifying product packages for installation" on page 3 for information about which ESSL packages are required and which are optional.

- For instructions about installing all the ESSL 6.1 packages, see "Install all ESSL 6.1 packages when any previous version of ESSL is installed, and upgrade all previous versions of ESSL to ESSL 6.1" on page 8.
- For instructions about installing all the ESSL 6.1 packages and retain the installation of ESSL 5.5, see "Install all ESSL 6.1 packages when any previous version of ESSL is installed, and retain multiple releases (or program temporary fixes (PTFs)) of ESSL" on page 8.
- If you do not want to install all the optional ESSL 6.1 packages, you must uninstall all previous version of ESSL before proceeding to the next section.

  To uninstall ESSL 5.5, execute the following commands:

```
rpm -e --nodeps essl.3264.rte-5.5.0
rpm -e --nodeps essl.3264.rtecuda-5.5.0
rpm -e --nodeps essl.6464.rte-5.5.0
rpm -e --nodeps essl.common-5.5.0
rpm -e --nodeps essl.man-5.5.0
rpm -e --nodeps essl.msg-5.5.0
rpm -e --nodeps essl.rte.common-5.5.0
rpm -e --nodeps essl.rte-5.5.0
rpm -e --nodeps essl.license-5.5.0
```

- Starting from ESSL version 5.5, coexistence of multiple releases (or PTFs) is supported. Depending on the release that must be set as default, you can determine whether to create the symbolic links in the `/usr` directory during the installation. As a best practice, you must create symbolic links in the `/usr` directory during the installation of the latest release of ESSL. For more information about how to use one of the installed ESSL releases, see Chapter 5, "Using ESSL 6.1 with multiple releases or PTFs," on page 17. To proceed with installation of the ESSL packages, choose one of the following steps:
  - To create symbolic links in the **/usr** directory, perform one of the installation scenarios below:
    - "Install ESSL Packages from a Directory (Automatic License Acceptance)"
    - "Install ESSL Packages from a Directory (Manual License Acceptance)"
    - "Install all ESSL 6.1 packages when any previous version of ESSL is installed, and upgrade all previous versions of ESSL to ESSL 6.1" on page 8
    - "Install all ESSL 6.1 packages except the runtime library for SMP CUDA" on page 9
  - To install ESSL packages **without** creating symbolic links, see "Install ESSL Packages from a Directory (Automatic License Acceptance) without Creating Symbolic Links in the /usr Directory" on page 9

Install ESSL Packages from a Directory (Automatic License Acceptance):

1. Copy the ESSL packages you want to install to *path*. See "Disk space requirement" on page 3 for information about which ESSL packages are required and which are optional.
2. Enter the following commands in the order shown:
   export IBM_ESSL_LICENSE_ACCEPT=yes
   rpm -ivh *path*/**essl.*6.1.0-0*.rpm [--prefix=***essl_path***]**
3. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.

Install ESSL Packages from a Directory (Manual License Acceptance):

1. Copy the ESSL packages you want to install to *path*. See "Identifying product packages for installation" on page 3 for information about which ESSL packages are required and which are optional.
2. Change to directory which contains the ESSL packages you want to install.
3. Enter the following commands in the order shown:
   export IBM_ESSL_LICENSE_ACCEPT=no
   rpm -ivh *path*/**essl.license-6.1.0-0*.rpm [--prefix=***essl_path***]**
   essl_path/**essl/6.1/lap/accept_essl_license.sh**
   Read through the license agreement and manually accept it.
4. Enter the following command:
   rpm -ivh --replacepkgs *path*/**essl.*6.1.0-0*.rpm**
5. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.

Install all ESSL 6.1 packages when any previous version of ESSL is installed, and upgrade all previous versions of ESSL to ESSL 6.1:
Choose one of the following license acceptance options:

- Automatic license acceptance
  1. Copy the ESSL packages you want to install to *path*. See "Identifying product packages for installation" on page 3 for information about which ESSL packages are required and which are optional.
  2. Enter the following command:
     export IBM_ESSL_LICENSE_ACCEPT=yes
  3. Enter the following command:
     rpm -Uvh *path*/**essl.license-6.1.0-0.ppc64le.rpm [--prefix=***essl_path***]**
  4. Enter the following command:
     rpm -Uvh --replacepkgs *path*/**essl.*6.1.0-0* [--prefix=***essl_path***]**
  5. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.
- Manual license acceptance
  1. Copy the ESSL packages you want to install to *path*. See "Identifying product packages for installation" on page 3 for information about which ESSL packages are required and which are optional.
  2. Enter the following command:
     export IBM_ESSL_LICENSE_ACCEPT=no
  3. Enter the following command:
     rpm -Uvh *path*/**essl.license-6.1.0-0.ppc64le.rpm [--prefix=***essl_path***]**
  4. Enter the following command:
     essl_path/**essl/6.1/lap/accept_essl_license.sh**
     Read through the license agreement and manually accept it.
  5. Enter the following command:
     rpm -Uvh --replacepkgs *path*/**essl.*6.1.0-0* [--prefix=***essl_path***]**
  6. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.

Install all ESSL 6.1 packages when any previous version of ESSL is installed, and retain multiple releases (or program temporary fixes (PTFs)) of ESSL:
Choose one of the following license acceptance options:

- Automatic license acceptance
  1. Copy the ESSL packages you want to install to *path*. See "Identifying product packages for installation" on page 3 for information about which ESSL packages are required and which are optional.
  2. Enter the following command:
     export IBM_ESSL_LICENSE_ACCEPT=yes
  3. If you want to automatically create symbolic link in the `/usr` directory for the ESSL 6.1 libraries, header files, man pages, and message catalog, then go to step 4. Otherwise, enter the following command:
     export IBM_ESSL_SYMBOLIC_LINK=no
  4. Enter the following command:
     rpm -ivh *path*/**essl.license-6.1.0-0.ppc64le.rpm [--prefix=***essl_path***]**
  5. Enter the following command:
     rpm -ivh --replacepkgs *path*/**essl.*6.1.0-0* [--prefix=***essl_path***]**
  6. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.
- Manual license acceptance

1. Copy the ESSL packages you want to install to *path*. See "Identifying product packages for installation" on page 3 for information about which ESSL packages are required and which are optional.
2. Enter the following command:
   export IBM_ESSL_LICENSE_ACCEPT=no
3. If you want to automatically create symbolic link in the `/usr` directory for the ESSL 6.1 libraries, header files, man pages, and message catalog, skip to step 4. Otherwise, enter the following command:
   export IBM_ESSL_SYMBOLIC_LINK=no
4. Enter the following command:
   rpm -ivh *path*/**essl.license-6.1.0-0.ppc64le.rpm [--prefix=***essl_path***]**
5. Enter the following command:
   essl_path/**essl/6.1/lap/accept_essl_license.sh**
   Read through the license agreement and manually accept it.
6. Enter the following command:
   rpm -ivh --replacepkgs *path*/**essl.*6.1.0-0* [--prefix=***essl_path***]**
7. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.

Install all ESSL 6.1 packages except the runtime library for SMP CUDA:
Choose one of the following license acceptance options:

- Automatic license acceptance
  1. Copy all the ESSL packages except **essl.3264.rtecuda*6.1.0-0*** to *path*. See "Identifying product packages for installation" on page 3 for information about which ESSL packages are required and which are optional.
  2. Enter the following command:
     export IBM_ESSL_LICENSE_ACCEPT=yes
  3. Enter the following command:
     rpm -Uvh *path*/**essl.license-6.1.0-0.ppc64le.rpm [--prefix=***essl_path***]**
  4. Enter the following command:
     rpm -Uvh --replacepkgs *path*/**essl.*6.1.0-0* [--prefix=***essl_path***]**
  5. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.
- Manual license acceptance
  1. Copy all the ESSL packages except **essl.3264.rtecuda*6.1.0-0*** to *path*. See "Identifying product packages for installation" on page 3 for information about which ESSL packages are required and which are optional.
  2. Enter the following command:
     export IBM_ESSL_LICENSE_ACCEPT=no
  3. Enter the following command:
     rpm -Uvh *path*/**essl.license-6.1.0-0.ppc64le.rpm [--prefix=***essl_path***]**
  4. Enter the following command:
     essl_path/**essl/6.1/lap/accept_essl_license.sh**
     Read through the license agreement and manually accept it.
  5. Enter the following command:
     rpm -Uvh --replacepkgs *path*/**essl.*6.1.0-0* [--prefix=***essl_path***]**
  6. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.

Install ESSL Packages from a Directory (Automatic License Acceptance) without Creating Symbolic Links in the /usr Directory:

1. Copy the ESSL packages you want to install to *path*. See "Disk space requirement" on page 3 for information about which ESSL packages are required and which are optional.
2. Enter the following commands in the order shown:
   export IBM_ESSL_SYMBOLIC_LINK=no
   export IBM_ESSL_LICENSE_ACCEPT=yes
   rpm -ivh *path*/**essl.*6.1.0-0*.rpm [--prefix=***essl_path***]**
3. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.

Installing ESSL xCAT kits

You may want to install ESSL from a directory on your system rather than from a media source. To do so, first copy the kit from the media to the desired directory.

cp -p *cdrom_path*/**essl-6.1.0-0*.tar.bz2** *path*

Regardless of where you perform the install from, you'll need to keep the following values in mind as you follow the steps below to install ESSL xCAT kits on a cluster:

path Represents the directory (either on your system or on the install media) from which you are installing the ESSL xCAT kits.

osimage_name
Represents the name of the operating system image where you want to install the ESSL product. For example, *osimage_name* might be:

rhels7.5-alternate-ppc64le-install-compute

node_list
Represents a list of a node or nodes where you want to install ESSL.

Notes: When you install ESSL 6.1 by using xCAT kits, ensure:

1. The license is always automatically accepted.
2. The **IBM_ESSL_SYMBOLIC_LINK** environment variable is set to yes.
3. ESSL packages are installed to the default directory **/opt/ibmmath**.

To install ESSL, follow the steps below:

1. If you want to install ESSL SMP CUDA Runtime library, please follow the instructions in xCAT_P8LE_cuda_installing to install CUDA Toolkit:
   `https://xcat-docs.readthedocs.org/en/latest/advanced/gpu/`
2. Copy the packages you wish to install to *path*. See "Identifying product packages for installation" on page 3 for information about which packages are required and which are optional.
3. Enter the following commands in the order shown:
   a. **addkit** *path*/**essl-6.1.0-0*.tar.bz2**
   b. **lsdef –t kitcomponent |grep essl** (validates installation of kit components)
   c. **addkitcomp –i** *osimage_name* **–n essl-license**
4. Decide if you want to install all ESSL libraries or a subset and then depending on which operating system image you are updating enter one of the following commands:
   - Login node:
     – All ESSL libraries:
       addkitcomp –i *osimage_name* **–n essl-loginnode**

- All ESSL libraries except the ESSLSMPCUDA library:
  addkitcomp –i *osimage_name* –**n essl-loginnode-nocuda**

- Compute node:
  - All ESSL libraries:
    addkitcomp –i *osimage_name* **–n essl-computenode**
  - All ESSL libraries except the ESSLSMPCUDA library:
    addkitcomp –i *osimage_name* –**n essl-computenode-nocuda**
  - All ESSL 32-bit integer/64-bit pointer libraries:
    addkitcomp –i *osimage_name* **–n essl-computenode-3264rte**
    addkitcomp –i *osimage_name* **–n essl-computenode-3264rtecuda**
  - All ESSL 32-bit integer/64-bit pointer libraries except the ESSLSMPCUDA library:
    addkitcomp –i *osimage_name* **–n essl-computenode-3264rte**
  - Only the ESSLSMPCUDA library:
    addkitcomp –i *osimage_name* **–n essl-computenode-3264rtecuda**
  - All ESSL 64-bit integer/64-bit pointer libraries:
    addkitcomp –i *osimage_name* **–n essl-computenode-6464rte**

    Note: If you want to add the xCAT kit component to other operating systems images that have a different **osdistroname** attribute, you can use the **-f** flag in the **addkitcomp** command. For example, if the **osdistroname** attribute is set to *rhels7.5.ppc64le* and you want to add a different operating system image, you can run the **addkitcomp -f -i** *osimage_name* **essl-computenode-6.1.0-0** command.

    In the ESSL xCAT kits, the default value for **osdistroname** attribute is *rhels7.5.ppc64le*. To identify the **osdistroname** attribute for the *osimage_name* object that you are installing, run the **lsdef -t osimage** *osimage_name* command.

    For more information about xCAT, see the xCAT Objects website.

5. Enter the following command to verify that the kit components have been installed to the specified operating system image:

   lsdef -t osimage *osimage_name*

6. Do one of the following if you want to install ESSL on diskfull node or nodes:
   - If the node is already defined and installed, enter the following command:
     updatenode *node_list*
   - If you need to define and install the node, enter the following commands in the order shown:
     nodeset *node_list* **osimage=***osimage_name*
     rpower *node_list* **reset**
     updatenode *node_list*

   If you receive the following error while performing this step, it indicates that you are trying to install ESSL before the CUDA Toolkit is installed:

   ```
   nodename: yum invocation failed.
   ```

   The installation fails without giving any further information about the failure - use the **updatenode -V** command to see helpful information about the problem:

   ```
   Error: Package: essl.3264.rtecuda-6.1.0-0.ppc64le (otherpkgs8)
             Requires: cuda-cudart-9-2 >= 9.2.35
   Error: Package: essl.3264.rtecuda-6.1.0-0.ppc64le (otherpkgs8)
             Requires: cuda-cufft-9-2 >= 9.2.35
   Error: Package: essl.3264.rtecuda-6.1.0-0.ppc64le (otherpkgs8)
   ```

```
           Requires: cuda-cublas-9-2 >= 9.2.35
 You could try using --skip-broken to work around the problem
 You could try running: rpm -Va --nofiles --nodigest
yum invocation failed.
```

To install CUDA Toolkit before installing the ESSL xCAT kit, follow the instructions in the xCAT Wiki page:

```
https://xcat-docs.readthedocs.org/en/latest/advanced/gpu/
```

Then add the ESSL xCAT Kit component (steps 3 on page 10 and 4 on page 10) and run the updatenote command again.

7. If you want to install ESSL on diskless node or nodes, enter the following commands in the order shown:
   a. **genimage** *osimage_name*
   b. **packimage** *osimage_name*
   c. **nodeset** *node_list* **osimage=***osimage_name*
   d. **rpower** *node_list* **reset**

   If you receive the following error while performing this step, it indicates that you are trying to install ESSL before the CUDA Toolkit is installed:

```
Error: Package: essl.3264.rtecuda-6.1.0-0.ppc64le (otherpkgs8)
           Requires: cuda-cudart-9-2 >= 9.2.35
Error: Package: essl.3264.rtecuda-6.1.0-0.ppc64le (otherpkgs8)
           Requires: cuda-cufft-9-2 >= 9.2.35
Error: Package: essl.3264.rtecuda-6.1.0-0.ppc64le (otherpkgs8)
           Requires: cuda-cublas-9-2 >= 9.2.35
 You could try using --skip-broken to work around the problem
 You could try running: rpm -Va --nofiles --nodigest
yum invocation failed.
```

   To install CUDA Toolkit before installing the ESSL xCAT kit, follow the instructions in the xCAT Wiki page:

```
https://xcat-docs.readthedocs.org/en/latest/advanced/gpu/
```

   Then add the ESSL xCAT Kit component (steps 3 on page 10 and 4 on page 10) and run the **genimage** command again.

8. Proceed to Chapter 4, "Running the ESSL Installation Verification Programs (IVPs) on Linux," on page 15.

Chapter 3. Uninstalling ESSL

You must use the Linux rpm utility to perform the uninstallation. When uninstalling ESSL, you must remove many of the packages in a specific order to avoid dependency uninstallation errors.

Uninstalling RPMs: If you installed only one version of ESSL by using RPMs, run the following commands in the following order:

```
rpm -e essl.3264.rte
rpm -e essl.3264.rtecuda
rpm -e essl.6464.rte
rpm -e essl.common
rpm -e essl.man
rpm -e essl.msg
rpm -e essl.rte.common
rpm -e essl.rte
rpm -e essl.license
```

Note: If you have installed multiple releases (or PTFs) of ESSL, specify the version of ESSL RPM packages that you want to uninstall. Otherwise, you might uninstall all the matching RPM packages from the system. For example, when you run the following command, the `essl.man` RPM package is removed only for version 6.1.0-0. The other versions of the `essl.man` RPM package are retained.

```
rpm -e essl.man-6.1.0-0
```

Uninstalling ESSL xCat kits: If you installed ESSL by using ESSL xCat kits, refer to the following xCAT kit information for how to uninstall:

```
https://xcat-docs.readthedocs.org/en/latest/advanced/kit
```

Chapter 4. Running the ESSL Installation Verification Programs (IVPs) on Linux

To test that the ESSL libraries have been properly installed, you must run the IVPs corresponding to the libraries you have installed and the language from which you will be calling ESSL.

Before you begin, note the following:

- The ESSL IVP scripts do not explicitly set the number of threads when running with the ESSL SMP libraries. If you see an error message indicating that an SMP runtime library error occurred due to a memory allocation failure, then your userid may not have ulimit set to unlimited memory. The message will show how many threads were created before the failure. You may reduce the number of threads to be used by setting the **XLSMPOPTS** or **OMP_NUM_THREADS** environment variables. The **OMP_NUM_THREADS** environment variable setting will take precedence over the **XLSMPOPTS** setting.
- If you installed the ESSL product without creating symbolic links in the **/usr** directory (by setting the **IBM_ESSL_SYMBOLIC_LINK** environment variable to no), you must set the **ESSLLIBDIR64** and **ESSLHEADERDIR** environment variables to specify where the ESSL product is installed to. For example, you might specify **ESSLHEADER=/opt/ibmmath/essl/6.1/include** and **ESSLLIBDIR64=/opt/ibmmath/essl/6.1/lib64**.
- If you installed CUDA SDK 9.2 in other directories without using the **rpm** command, you must set the **CUDASDKDIR** environment variable to specify where the CUDK SDK 9.2 library is installed. For example you might specify **CUDASDKDIR=/usr/local/cuda-9.2**.

To run the IVPs, follow the steps below:

1. Use the `cd` command to change to a writable directory.
2. Type the following command and press `Enter`.

   To run the 64-bit IVP:

   essl_path`/essl/6.1/ivps/esslivp64` *language library64*

   where:

   essl_path

   is the directory in which you installed ESSL.

   Note: If you installed ESSL in the default directory, specify `/opt/ibmmath` for *essl_path*.

   language

   is the language and compiler you want to verify. It can have one of the following values:

   fortran

   specifies that Fortran is the language you want to verify using the IBM XL Fortran compiler.

   The XL Fortran compiler does not have to be on your system to use this value. You may need to install the correct version of IBM XL Fortran Runtime Environment for Linux. You will also

need the XL Fortran for Linux Addons package. See “Software requirements” on page 1 for more details.

c specifies that C is the language you want to verify using the IBM C/C++ compiler.

The IBM C/C++ compiler must be installed on your system to use this value; see “Software requirements” on page 1.

C++ specifies that C++ is the language you want to verify using the IBM C/C++ compiler.

The IBM C/C++ compiler must be installed on your system to use this value; see “Software requirements” on page 1.

gcc specifies that C is the language you want to verify using the GNU C compiler, gcc.

The GNU C compiler, gcc, must be installed on your system to use this value; see “Software requirements” on page 1.

g++ specifies that C++ is the language you want to verify using the GNU C++ compiler, g++.

The GNU C++ compiler, g++, must be installed on your system to use this value; see “Software requirements” on page 1.

library64
is the ESSL library you are using the 64-bit IVP to test. It can have any of the following values:

essl Test the Serial Library for use in a 32-bit integer, 64-bit pointer environment. You must have essl.3264.rte installed.

essl6464
Test the Serial Library for use in a 64-bit integer, 64-bit pointer environment. You must have essl.6464.rte installed.

esslsmp
Test the SMP Library for use in a 32-bit integer, 64-bit pointer environment. You must have essl.3264.rte installed.

esslsmp6464
Test the SMP Library for use in a 64-bit integer, 64-bit pointer environment. You must have essl.6464.rte installed.

esslsmpcuda
Test the SMP CUDA Library for use in a 32-bit integer, 64-bit pointer environment. You must have essl.3264.rtecuda installed.

Chapter 5. Using ESSL 6.1 with multiple releases or PTFs

ESSL 6.1 supports the base release and multiple program temporary fixes (PTFs) coexisting on the same system, provided you install the base release and PTFs to an alternate directory and do not create symbolic links in the **/usr** directory.

In this case:

- Specify the alternate directory, for example:

  --prefix=/opt/ibmmathe6100
- Set the **IBM_ESSL_SYMBOLIC_LINK** environment variable to no:

  export IBM_ESSL_SYMBOLIC_LINK=no

This results in no symbolic links being created in the **/usr** directory, so you must identify the location of the ESSL libraries, header files, man pages and message catalog.

Fore example, if you install ESSL to the alternate directory **/opt/ibmmathe6100**, you must do the following to use ESSL:

- Add **-I/opt/ibmmathe6100/essl/6.1/include** to your C/C++ compiler command.
- Add **-L/opt/ibmmathe6100/essl/6.1/lib64 -R/opt/ibmmathe6100/essl/6.1/lib64** to your link command.
- Add **/opt/ibmmathe6100/essl/6.1/man** to your **MANPATH** environment variable.
- Add **/opt/ibmmathe6100/essl/6.1/msg/en_US** to your **NLSPATH** environment variable.

As an alternative, if your compiler supports environment variables **CPATH**, **LIBRARY_PATH** and **LD_LIBRARY_PATH**, you can set these environment variables instead of changing your compile and link commands. For example:

```
export CPATH=/opt/ibmmathe6100/essl/6.1/include:${CPATH}
export LIBRARY_PATH=/opt/ibmmathe6100/essl/6.1/lib64:${LIBRARY_PATH}
export LD_LIBRARY_PATH=/opt/ibmmathe6100/essl/6.1/lib64:${LD_LIBRARY_PATH}
```

Chapter 6. List of product files

The following table lists the files created in the file system after installing each ESSL package.

Notes: Table 7 assumes that:

1. You used the default installation directories. If you have any files that have the same full path name but that are not related to ESSL, you must rename them before installing that package.
2. The **IBM_ESSL_SYMBOLIC_LINK** environment variable is set to yes (which is the default) and therefore the table shows the **/usr** directory entries. (If you set **IBM_ESSL_SYMBOLIC_LINK** to no, then no symbolic links are created in the **/usr** directory.)

Table 7. ESSL Product Files

RPM	Description	File or Directory Name
All	README files for current release	/opt/ibmmath/essl/6.1/READMES
essl.license	Licensing files	/opt/ibmmath/essl/6.1/lap
essl.common	ESSL header file for C and C++	/opt/ibmmath/essl/6.1/include/essl.h /opt/ibmmath/essl/6.1/include/essl_lapacke.h /opt/ibmmath/essl/6.1/include/essl_lapacke_config.h /usr/include/essl.h /usr/include/essl_lapacke.h /usr/include/essl_lapacke_config.h
essl.common	Fortran, C, and C++ IVPs and related shell scripts	/opt/ibmmath/essl/6.1/ivps
essl.license	ILMT inventory signature file	See Note.
essl.common	FFTW version 3.1.2 Wrapper Library source, IVP, and related shell scripts	/opt/ibmmath/essl/6.1/FFTW3
essl.3264.rte	Serial library for use in a 32-bit integer, 64-bit pointer environment	/opt/ibmmath/essl/6.1/lib64/libessl.so.1.10 /opt/ibmmath/essl/6.1/lib64/libessl.so.1 /opt/ibmmath/essl/6.1/lib64/libessl.so /usr/lib64/libessl.so.1.10 /usr/lib64/libessl.so.1 /usr/lib64/libessl.so
essl.6464.rte	Serial library for use in a 64-bit integer, 64-bit pointer environment	/opt/ibmmath/essl/6.1/lib64/libessl6464.so.1.10 /opt/ibmmath/essl/6.1/lib64/libessl6464.so.1 /opt/ibmmath/essl/6.1/lib64/libessl6464.so /usr/lib64/libessl6464.so.1.10 /usr/lib64/libessl6464.so.1 /usr/lib64/libessl6464.so
essl.3264.rte	SMP library for use in a 32-bit integer, 64-bit pointer environment	/opt/ibmmath/essl/6.1/lib64/libesslsmp.so.1.10 /opt/ibmmath/essl/6.1/lib64/libesslsmp.so.1 /opt/ibmmath/essl/6.1/lib64/libesslsmp.so /usr/lib64/libesslsmp.so.1.10 /usr/lib64/libesslsmp.so.1 /usr/lib64/libesslsmp.so

Table 7. ESSL Product Files (continued)

RPM	Description	File or Directory Name
essl.6464.rte	SMP library for use in a 64-bit integer, 64-bit pointer environment	/opt/ibmmath/essl/6.1/lib64/libesslsmp6464.so.1.10 /opt/ibmmath/essl/6.1/lib64/libesslsmp6464.so.1 /opt/ibmmath/essl/6.1/lib64/libesslsmp6464.so /usr/lib64/libesslsmp6464.so.1.10 /usr/lib64/libesslsmp6464.so.1 /usr/lib64/libesslsmp6464.so
essl.3264.rtecuda	SMP CUDA library for use in a 32-bit integer, 64-bit pointer environment	/opt/ibmmath/essl/6.1/lib64/libesslsmpcuda.so.1.10 /opt/ibmmath/essl/6.1/lib64/libesslsmpcuda.so.1 /opt/ibmmath/essl/6.1/lib64/libesslsmpcuda.so /usr/lib64/libesslsmpcuda.so.1.10 /usr/lib64/libesslsmpcuda.so.1 /usr/lib64/libesslsmpcuda.so
essl.msg	Message catalog for default locale	/opt/ibmmath/essl/6.1/msg/en_US/essl.cat /usr/share/locale/en_US.UTF-8/essl.cat /usr/share/locale/en_US/essl.cat /usr/share/locale/en/essl.cat /usr/share/locale/C/essl.cat
essl.man	Manpages	/opt/ibmmath/essl/6.1/man All ESSL files in /usr/share/man/man3

Note: ILMT inventory signature files:

```
/opt/ibmmath/essl/6.1/iso-swid/ibm.com_ESSL_for_Linux_on_Power_Medium_processor-6.1.0.swidtag
/opt/ibmmath/essl/6.1/iso-swid/ibm.com_ESSL_for_Linux_on_Power_Small_processor-6.1.0.swidtag
```

Chapter 7. Enabling IBM License Metric Tool (ILMT) and Tivoli Asset Discovery for Distributed (TADd)

IBM License Metric Tool (ILMT) and Tivoli® Asset Discovery for Distributed (TADd) can help you manage software usage metering and license allocation services on supported systems. In general, ILMT and TADd recognize and monitor the products that are installed and in use on your system.

ILMT and TADd are enabled for ESSL for Linux on POWER Version 6.1 for inventory support only, which means that ILMT and TADd can detect product installation of ESSL for Linux on POWER but not its usage.

Note: ILMT and TADd are not a part of the ESSL for Linux on POWER offering, and must be purchased and installed separately.

Once installed and activated, ILMT and TADd scan your system for product inventory signatures that indicate whether a given product is installed on your system. ILMT and TADd also identify the version, release, and modification levels of the product. Inventory signature files are not updated after PTF installation.

If ESSL for Linux on Power is installed in the default location, the signature files are in the /opt/ibmmath/essl/6.1/ directory. For more information, see the following:

- ILMT at:

  `http://www.ibm.com/software/products/en/licensemetrictool`
- TADd at:

  `http://www.ibm.com/software/products/en/tivoassedist`

Accessibility features for ESSL

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use information technology products successfully.

Accessibility Features

The following list includes the major accessibility features in IBM ESSL. These features support:

- Keyboard-only operation that uses standard Microsoft Windows navigation keys.
- Interfaces that are commonly used by screen readers.
- Keys that are tactilely discernible and do not activate just by touching them.
- Industry-standard devices for ports and connectors.
- The attachment of alternative input and output devices.

The ESSL documentation that is located in the IBM Knowledge Center is accessibility-enabled. The accessibility features of IBM Knowledge Center are described in the Accessibility topic.

IBM and accessibility

For more information about the commitment that IBM has to accessibility, see IBM Accessibility.

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