Release Note for Arm Performance Libraries

24.04

Issue 01
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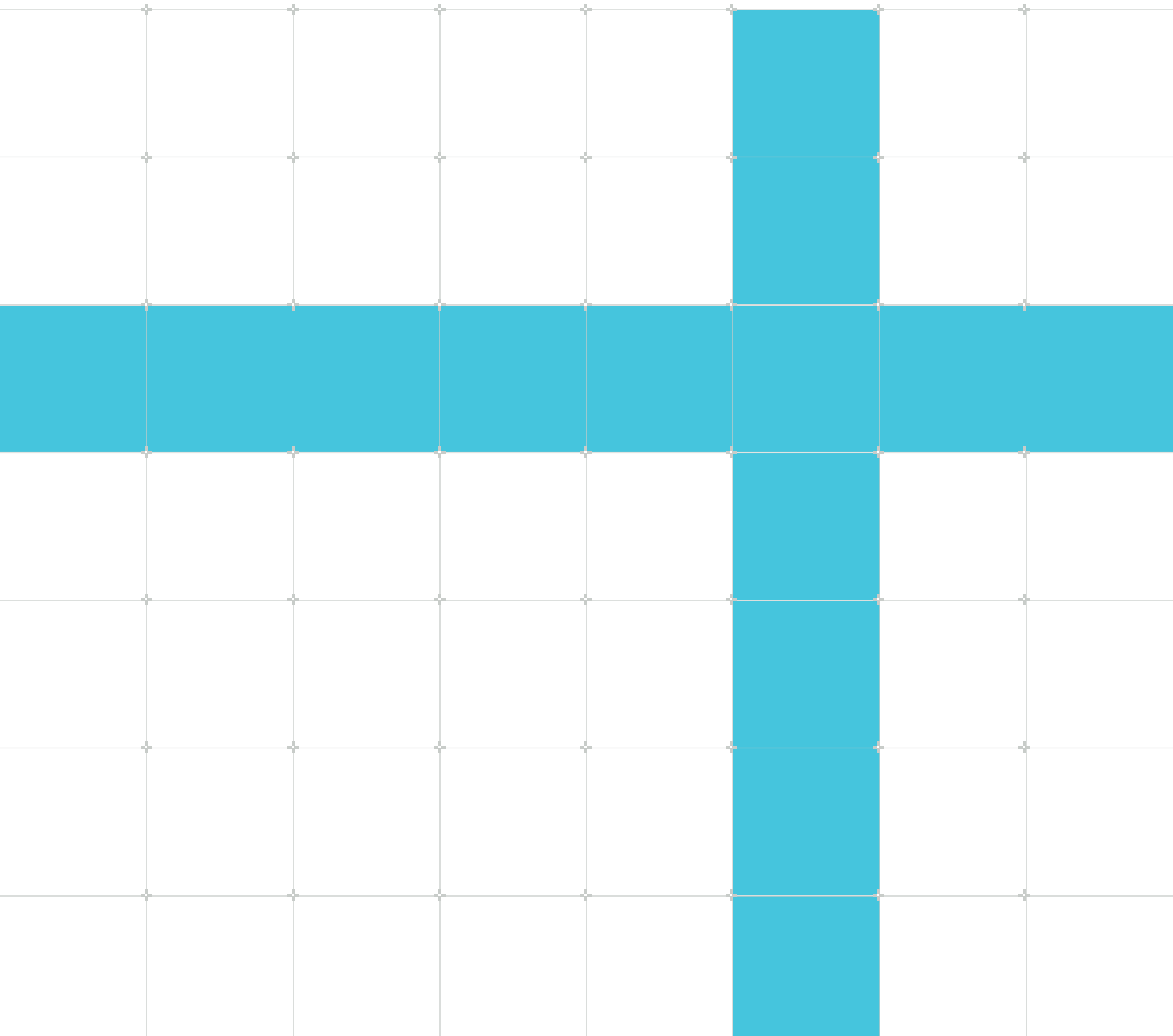

Release Note for Arm Performance Libraries

Release information

Document history

Issue	Date	Confidentiality	Change
2404-01	4 April 2024	Non-Confidential	24.04 release
2310-01	12 October 2023	Non-Confidential	23.10 release
2304-01	19 May 2023	Non-Confidential	23.04.1 release
2210-01	23 September 2022	Non-Confidential	22.1.0 release
2202-01	24 May 2022	Non-Confidential	22.0.2 release
2110-01	24 August 2021	Non-Confidential	21.1.0 release
2100-01	30 March 2021	Non-Confidential	21.0.0 release
2030-01	9 September 2020	Non-Confidential	20.3.0 release
2020-01	7 August 2020	Non-Confidential	20.2 release

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Contents

1. Arm Performance Libraries 24.04 Release Note

Arm Performance Libraries 24.04 covers the following releases:

- Arm Performance Libraries 24.04 - Released 4th April 2024

Arm Performance Libraries 24.04 is is compatible with GCC versions 7 to 13.

1.1 Arm Performance Libraries 24.04 Release Note

Arm conventions and proprietary notices, including confidentiality status, terminology statement, and product release status, can be found at the end of this document.

1.2 Contents

This release note contains the following sections:

1.3 Release overview

Use of the standalone version of Arm Performance Libraries is subject to the terms and conditions of the applicable End User License Agreement (“EULA”). A copy of the EULA can be found in the ‘license_terms’ folder of your product installation.

Product description

The standalone Linux version of Arm Performance Libraries contains optimized math functions, such as linear algebra and Fast Fourier Transforms, for Arm AArch64 implementations, including those with SVE. It is compatible with GCC versions 7 to 13.

Arm Performance Libraries is optimized for a number of microarchitectures. The latest information is available on the Arm Developer website:

https://developer.arm.com/documentation/101004/latest

Release status

This is the 24.04.0 release of Arm Performance Libraries.

These deliverables are being released under the terms of the agreement between Arm and each licensee (the "Agreement"). All planned verification and validation is complete. The release is suitable for volume production under the terms of the Agreement.

1.4 Release contents

The following subsections describe:

- The product parts that are delivered as part of this release.
- Any changes since the previous release.
- Any known issues and limitations that exist at the time of this release.

Deliverables

- Arm Performance Libraries 24.04.0
- Release Notes (this document)
- Documentation

  Product documentation is available on the Arm Developer website:

  https://developer.arm.com/documentation/101004/latest

  Documentation and release notes might change between product releases. For the latest documentation bundle, check the product download page.

  Arm tests PDFs only in Adobe Acrobat and Acrobat Reader. Arm cannot guarantee the quality of its PDFs when used with any other PDF reader. Adobe reader products are available at https://www.adobe.com.

Differences from previous release

The following subsections describe differences from the previous release of Arm Performance Libraries.

Additions and changes:

Describes new features or components added, or any technical changes to features or components, in the 24.04.0 release.

- Arm Performance Libraries 24.04.0 includes the interface to the random number generation part of the VSL library developed by Intel(R) and shipped for x86 processors as part of oneMKL. We are grateful to Intel(R) for having released this interface, along with their documentation, to us under a Creative Commons 4.0 licence, allowing us to develop our own implementation of this functionality for users of Arm-based systems, enabling software portability between architectures.
- We have endeavoured to ensure that the same generators and initializations are used as documented in the oneMKL documentation. This means that functions that return bit sequences are bitwise reproducible between Arm and x86 systems. If an integer or floating point answer is requested answers may differ as the precision of various operations is different between the two libraries.
- Note that in this release not all of the random number functions from VSL have been included. These functions are listed in the documentation as not being currently implemented. We are intending to fill out this coverage in future releases, and we are very keen to hear from users who find missing functionality that they would like us to prioritize.
- Arm PL for Linux now supports performance tunings for an extended list of microarchitectures and SoCs, including:
  - Neoverse V2 (NVIDIA Grace and AWS Graviton4).
  - Neoverse N2 (Alibaba Yitian 710 and Microsoft Cobalt-100).
  - Neoverse V1 (AWS Graviton3).
  - Neoverse N1 (AWS Graviton2 and Ampere Altra/Altra Max).
  - AmpereOne.
  - Fujitsu A64FX.
- Increased performance for:
  - FFT functions, especially Hermitian (c2r/r2c) transforms.
  - Small LAPACK functions when called with many threads.
- When downloading the standalone Linux version of Arm PL there are now just four links to select from:
  - .rpm and .deb based installers for GCC users.
  - .rpm and .deb based installers for NVHPC users.
  - The GCC compatible releases are built with GCC 13 and tested with GCC versions 7 to 13.
  - The NVHPC compatible releases are built and tested with NVHPC 24.1.
    - Note that NVHPC has a different ABI to their previous releases for returning complex types from Fortran functions, and is not backwards compatible.
  - The version of Arm PL released as part of ACfL maintains the same set of installers for supported Linux distributions as in previous releases.
- The Windows version of Arm PL now uses a Windows Installer to guide the user through configuration.
- Performance improvements in libamath for:
  - sinpi, sinpif, cospi, cospif, atanh and atanhf.

- The Windows version of Arm PL now includes libamath for the first time.
  - This includes scalar and Neon math.h functions, with Neon functions using the vector ABI described here:

    https://community.arm.com/arm-community-blogs/b/high-performance-computing-blog/posts/using-vector-math-functions-on-arm

Resolved issues:

There are no resolved issues to report in the 24.04.0 release.

Known limitations

The following subsection describes any issues known at the time of this release.

Open technical issues:

There are no open technical issues in 24.04.0 release.

1.5 Get started

This section describes information to help you get started with accessing, setting up, and using Arm Performance Libraries.

For more information, see the Get Started information on the Arm Developer website:

https://developer.arm.com/documentation/109408/0100/

Licensing information

Use of the standalone version of Arm Performance Libraries is subject to the terms and conditions of the applicable End User License Agreement (“EULA”). A copy of the EULA can be found in the ‘license_terms’ folder of your product installation.

You do not require a license to use this Arm Performance Libraries package.

Prerequisites

If any of the following tools are not already installed by your Linux distribution, you must install them before installing Arm Performance Libraries:

- Python (version 3.6 or later)
- C Libraries:
  - SLES and RHEL: glibc-devel
  - Ubuntu: libc6-dev

Download the product

Arm delivers the files through the Arm Developer website:

https://developer.arm.com/downloads/-/arm-performance-libraries

Unpack the product

The following steps describe how to unpack each constituent part delivered in this bundle:

1. Relocate the bundle file. Move the .tar files to the directory you want to install the product in.
2. Extract the tar file contents using a tar utility:

```
tar -xvf <package_name>.tar
```

Directory structure:

Shows the principal directory structure of this release created after unpacking the bundle:

```
license_terms/
arm-performance-libraries_<version>_*.sh
RELEASE_NOTES.txt
```

Install the product

To install Arm Performance Libraries, navigate into the extracted package directory (`<package_name>`) and run the installation script as a privileged user. Pass any options to configure the installation:

```
cd path/to/<package_name>/
./arm-performance-libraries_<version>_*.sh [option]...
```

Some common installation options are:

- For a headless installation and to automatically accept the EULA, use the `--accept` option.
- To perform a local install, use the `--install-to <dir>` option.

For a full list of supported installation options, see:

https://developer.arm.com/downloads/-/arm-performance-libraries

The installer displays the EULA and prompts you to agree to the terms. Type 'yes' at the prompt to continue.

The packages are unpacked to `<install_location>/arm-performance-libraries_24.04.0_gcc`, and `<install_location>/armpl_24.04.0_gcc`, with environment modulefiles available under `<install_location>/modulefiles`. The default installation location is /opt/arm/. Local installs have the same directory structure starting from your chosen installation root.

RPMs

The installed packages are shipped as RPMs for RPM based Linux distributions. These RPMs are signed by Arm's High Performance Computing (HPC) GPG key. The public key can be downloaded from:

https://developer.arm.com/-/media/files/keys/GPG-PUB-KEY-ARM-HPC-SW-TOOLS.PUB

This key can be imported by running:

```
rpm --import GPG-PUB-KEY-ARM-HPC-SW-TOOLS.PUB
```

More information about Environment Modules can be found at:

http://modules.sourceforge.net

Run the product

1. Load the environment module.

   Ensure you have access to modules, replace `/opt/arm` with `<install_location>` if necessary, and use:

   ```
   module use /opt/arm/modulefiles
   module avail
   module load armpl/24.04.0_gcc
   ```

2. To generate an executable binary with GCC, compile your program with Arm Performance Libraries. Use:

   ```
   gcc -I<install_dir>/include -L<install_dir>/lib <-larmpl> -lm [options] -o <binary>
   <input>
   ```

   or

   ```
   gfortran -I<install_dir>/include -L<install_dir>/lib <-larmpl> -lm [options] -o
   <binary> <input>
   ```

   where:

   - `<-larmpl>` is one of: -larmpl, -larmpl_lp64, -larmpl_ilp64, -larmpl_lp64_mp, or -larmpl_ilp64_mp.
   - `[options]` denotes any other GCC compiler options
   - `<input>` is the source file (or files)
   - `<binary>` is the application executable to build

3. Run the generated binary `<binary>`:

   ```
   ./<binary>
   ```

Examples

Example code can be found at:

```
<install_location>/armpl_24.04.0_gcc/examples*
```

Multiple examples directories are provided in the installation. The suffix of the directory name indicates whether the examples inside link to the 32-bit (`_lp64`) or 64-bit (`_ilp64`) integer variants, and sequential (no suffix indicator) or OpenMP (`_mp`) multi-threaded variants, of Arm Performance Libraries.

The default set of examples in the 'examples' directory link to the sequential, 32-bit integers variant of Arm Performance Libraries.

You need to copy this code to a writeable directory and load Arm Performance Libraries environment module for the examples to build.

For example:

1. Copy the default 'examples' directory somewhere writeable:

   ```
   cp -r <install_location>/armpl_24.04.0_gcc/examples ./
   cd examples
   ```

2. Load the correct environment modules:

   ```
   module load armpl/24.04.0_gcc
   ```

3. Build the examples:

   ```
   make
   ```

For more information about the Arm Performance Libraries examples, see:

https://developer.arm.com/documentation/102620/0100/Compile-and-test-the-examples

Uninstall

For convenience, this package includes an "uninstall.sh" script at:

```
<install_location>/arm-performance-libraries_24.04.0_gcc/uninstall.sh
```

This script attempts to uninstall all the components supplied as part of Arm Performance Libraries. However, if other packages outside of this product depend on the GCC component, GCC will not be uninstalled.

1.6 Support

The documentation that is available for Arm Performance Libraries can be found on the product resources page on the Arm Developer website:

https://developer.arm.com/Tools%20and%20Software/Arm%20Performance%20Libraries#Resources

Reference documentation for the supported routines in Arm Performance Libraries is available at:

https://developer.arm.com/documentation/101004/latest

If you have any issues with the installation, content or use of this release, create a post that describes your issue on the Arm Community HPC forum:

https://community.arm.com/support-forums/f/high-performance-computing-forum

Arm will respond as soon as possible.

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OS

These libraries are supported on the following Linux platforms:

- AArch64 RHEL 7, 8 and 9
- AArch64 SLES 15
- AArch64 Ubuntu 20.04 and 22.04
- AArch64 Amazon Linux 2 and 2023

Full information about the platforms supported by Arm Performance Libraries is available on the Arm Developer website:

https://developer.arm.com/Tools%20and%20Software/Arm%20Compiler%20for%20Linux#Supported-Devices

1.7 Release history

A full release history (with release notes) for Arm Performance Libraries is available on the Arm Developer website:

https://developer.arm.com/downloads/-/arm-performance-libraries/release-history

1.8 Glossary

The Arm Glossary is a list of terms that are used in Arm documentation, together with definitions for those terms. The Arm Glossary does not contain terms that are industry standard unless the Arm meaning differs from the generally accepted meaning.

See the Arm Glossary for more information: https://developer.arm.com/glossary.

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(LES-PRE-20349)

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1.12 Web Address

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