



Arm RAN Acceleration Library

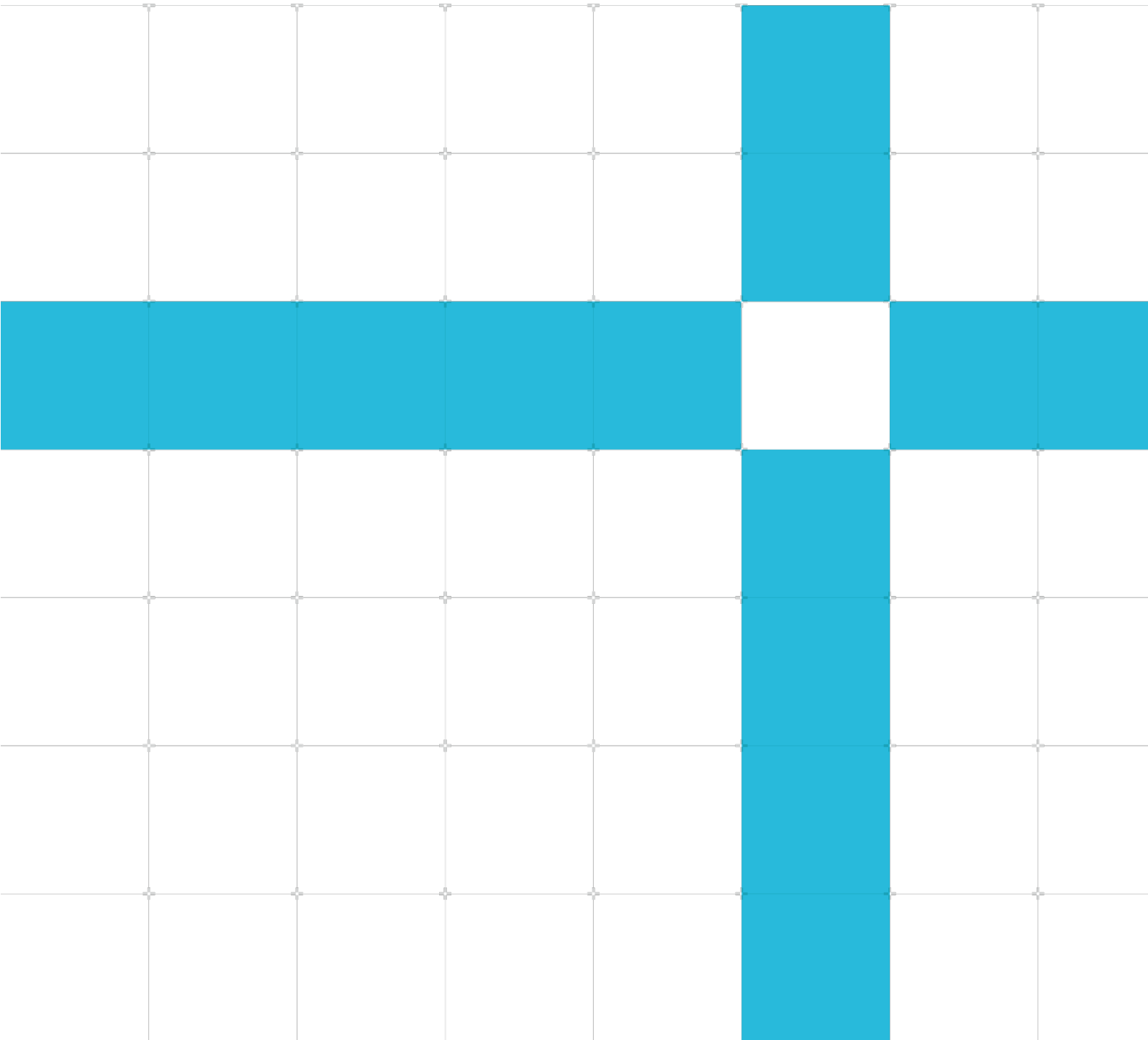
Product revision: 24.01

Release Note

Non-Confidential

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Document ID:
107561



Arm RAN Acceleration Library Release Note

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Product status

The information in this document is Final, that is for a developed product.

Feedback

Arm welcomes feedback on this product and its documentation. To provide feedback on Arm RAN Acceleration Library, create a ticket on <https://support.developer.arm.com>.

To provide feedback on the document, fill the following survey:
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1 Release overview

The following sections describe the product that this release note describes and its quality status at time of release.

Use of Arm RAN Acceleration Library is subject to a BSD-3-Clause license, the text of which can be found in the `license_terms` folder of your product installation. We will receive inbound contributions under the same license.

1.1 Product description

The Arm RAN Acceleration Library (ArmRAL) contains a set of functions for accelerating telecommunications applications such as, but not limited to, 5G Radio Access Networks (RANs).

The Arm RAN Acceleration Library 24.01 package provides a library that is optimized for Arm AArch64-based processors.

Arm RAN Acceleration Library provides:

- Vector functions
- Matrix functions
- Lower PHY support functions
- Upper PHY support functions
- DU-RU Interface support functions

Arm RAN Acceleration Library includes functions that operate on 16-bit signed integers and 32-bit floating-point values.

1.2 Release status

This is the 24.01 release of Arm RAN Acceleration Library.

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.

1.3 Licensing Information

Use of Arm RAN Acceleration Library is subject to a BSD-3-Clause license, the text of which can be found in the `license_terms` folder of your product installation. We will receive inbound contributions under the same license.

If you require a different license than BSD-3-Clause for compatibility with your end product, please get in contact.

2 Release contents

Arm RAN Acceleration Library releases contain documentation and source files.

The following sections describe:

- Downloading and unpacking the product.
- The contents of this release.
- Any changes since the previous release.
- Any known issues and limitations that exist at the time of this release.

2.1 Downloading and unpacking

You can either clone the source as a git repository from Arm's Gitlab, or you can download Arm RAN Acceleration Library as a tarball of source from the Arm Developer website and then unpack the contents.

To clone the Arm RAN Acceleration Library repository via SSH:

```
git clone git@git.gitlab.arm.com:networking/ral.git
```

To clone the Arm RAN Acceleration Library repository via HTTPS:

```
git clone https://git.gitlab.arm.com/networking/ral.git
```

To download the tarball and unpack the contents:

1. Go to <https://developer.arm.com/solutions/infrastructure/developer-resources/5g/ran/download>.
2. Complete the form and click **Submit**. The package downloads.
3. Locate the downloaded .tar.gz file.
4. Copy the .tar.gz file to the directory where these files are to be built.
5. Extract the tar file contents using a tar utility:

```
tar zxvf ral-armral-24.01.tar.gz
```

2.2 Deliverables

The downloaded product includes the deliverables listed in this section.

- Arm RAN Acceleration Library 24.01
- Release Notes (this document)
- Documentation

Product documentation is available on the Arm Developer website at:

<https://developer.arm.com/documentation/102249/2401>



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



Arm tests its PDFs only in Adobe Acrobat and Acrobat Reader. Arm cannot guarantee the quality of this document when used with any other PDF reader. A suitable PDF reader can be downloaded from Adobe at <http://www.adobe.com>.

2.3 Differences from previous release

The following subsections describe differences from the previous release of Arm RAN Acceleration Library.

2.3.1 Additions and functionality changes

Describes new features or any technical changes to features or components in this release.

- Added support for the addition and removal of filler bits in `armral_ldpc_encode_block`, `armral_ldpc_rate_matching` and `armral_ldpc_rate_recovery` when the code block size is not a multiple of lifting set size or when the soft buffer size is less than the full buffer size. This process is described in the 3GPP Technical Specification (TS) 38.212. This work was contributed upstream by 4g5g Consultants.
- Extended `armral_cmplx_pseudo_inverse_direct_f32` and `armral_cmplx_pseudo_inverse_direct_f32_noalloc` to compute the regularized pseudo-inverse of a single complex 32-bit matrix of size $M \times N$ for cases where $M > N$ in addition to the cases where $M \leq N$.

2.3.2 Performance improvements

Describes any features or components whose performance has improved in the current release compared with the previous release.

- Performance improvements for the following routines:
 - `armral_turbo_decode_block` and `armral_turbo_decode_block_noalloc`.
- Performance improvements for SVE2 implementations of the following routines:
 - `armral_seq_generator`, for the cases when `sequence_len` is not a multiple of 64.

2.3.3 Changes to simulation programs

Describes any changes, new features or components added to the channel simulation programs in this release.

- Added support for the addition and removal of filler bits in `ldpc_awgn` when the code block size is not a multiple of lifting set size. This work was contributed upstream by 4g5g Consultants.

2.3.4 Resolved issues

Describes any known issues resolved in the current release.

- LDPC block encoding (`armral_ldpc_encode_block`), rate matching (`armral_ldpc_rate_matching`) and rate recovery (`armral_ldpc_rate_recovery`) now support the insertion and removal of filler bits as described in the 3GPP Technical Specification (TS) 38.212.

2.4 Known limitations

Describes any known limitations of the current release.

- There are no known limitations in this release.

3 Support

If you have any issues with the installation, content or use of this release, create a ticket on <https://support.developer.arm.com>. Arm will respond as soon as possible.



Support for this release of the product is only provided by Arm to partners who have a current support and maintenance contract for the product.

3.1 Tools

The following points list the tools that are required to build or run Arm RAN Acceleration Library:

- A recent version of a C/C++ compiler, such as GCC. Arm RAN Acceleration Library has been tested with GCC 7.5.0, 8.5.0, 9.5.0, 10.5.0, 11.4.0, 12.3.0, and 13.2.0.



If you are cross-compiling, you need a cross-toolchain compiler that targets AArch64. You can download open-source cross-toolchain builds of the GCC compiler on the Arm Developer website:

<https://developer.arm.com/tools-and-software/open-source-software/developer-tools/gnu-toolchain/gnu-a/downloads>

The variant to use for an AArch64 GNU/Linux target is `aarch64-none-linux-gnu`.

- A recent version of CMake (version 3.3.0, or higher).

In addition to the preceding requirements:

- To run the benchmarks, you must have the Linux utility tool `perf` installed and a recent version of Python 3. Arm RAN Acceleration Library has been tested with Python 3.8.5.
- To build a local version of the documentation, you must have Doxygen installed. Arm RAN Acceleration Library has been tested with Doxygen version 1.8.13.
- To generate code coverage HTML pages, you must have `gcovr` installed. The library has been tested with `gcovr` version 4.2.



Arm RAN Acceleration Library runs on AArch64 cores, however to use the convolutional encoder, CRC, and sequence generator functions, you must run on a core that supports the AArch64 PMULL extension. If your machine supports the PMULL extension, `pmull` is listed under the "Features" list given in the `/proc/cpuinfo` file.

4 Release history

A full release history (with release notes) for Arm RAN Acceleration Library is available on the Arm Developer website:

<https://developer.arm.com/downloads/-/arm-ran-acceleration-library/previous-releases-of-the-arm-ran-acceleration-library>

5 Conventions

The following subsections describe conventions used in Arm documents.

5.1 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>.