Release notes for Arm GNU Toolchain for Morello

10.1.Morello-Alp2-2022_11

Non-Confidential

Issue Alp2-2022_11
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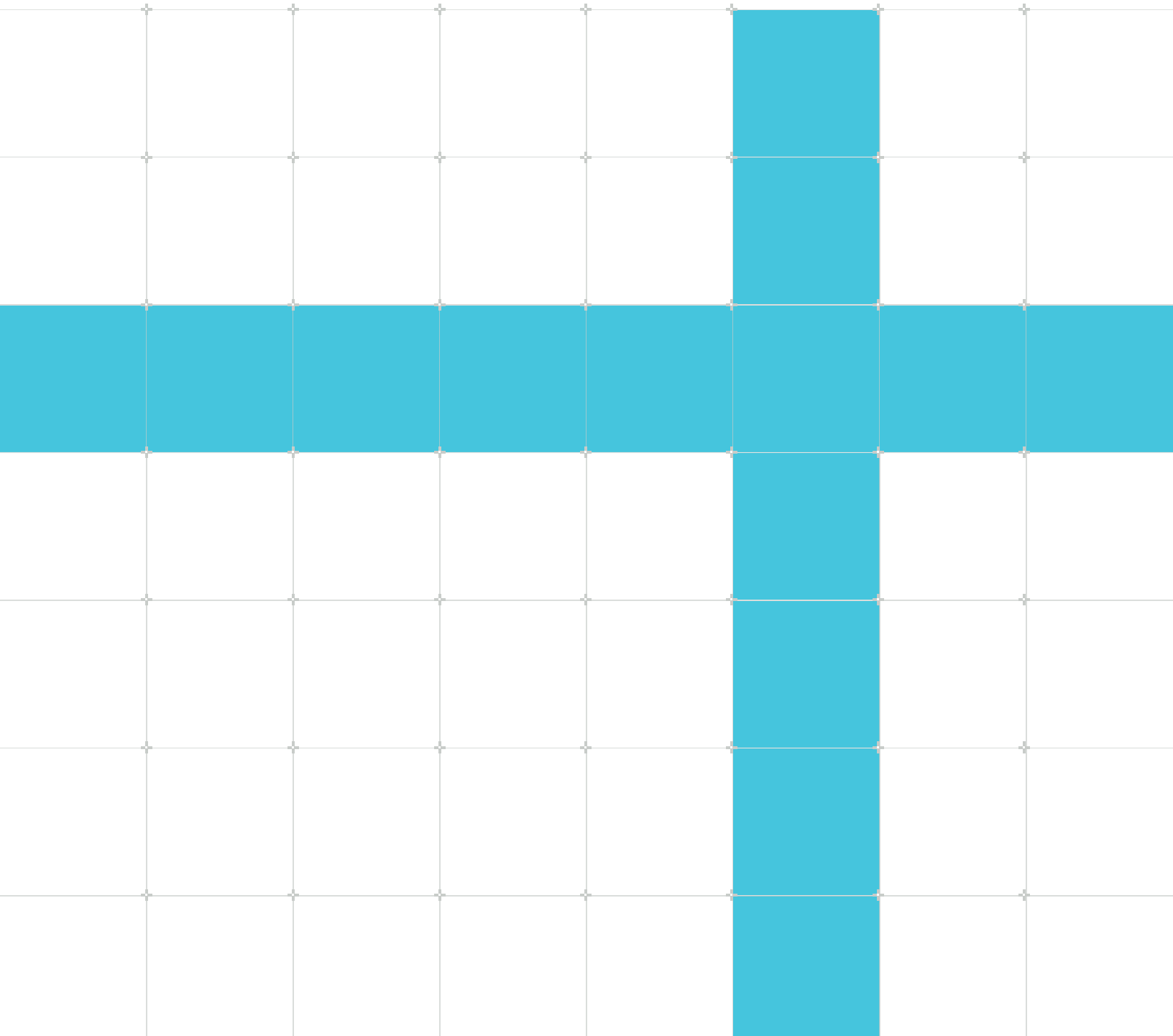

Release notes for Arm GNU Toolchain for Morello

Release information

Document history

Issue	Date	Confidentiality	Change
10.1.Morello-Alp1-2022_06	13 June 2022	Non-Confidential	10.1-Alp1-2022_06 release
10.1.Morello-Alp2-2022_11	30 November 2022	Non-Confidential	10.1-Alp2-2022_11 release

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110 Fulbourn Road, Cambridge, England CB1 9NJ.

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1. Release notes for Arm GNU Toolchain for Morello (2022-11)

Version 10.1.Morello-Alp2. Released 30 November, 2022.

Table of Contents

This release note contains the following:

Introduction

This is release 10.1.Morello-Alp2 of Arm GNU Toolchain for Morello, to enable users to experiment with Morello and provide feedback. This is not a production release of the toolchain. The quality level is Alpha.

For more information on the development status of Morello support, please see the current status of Morello support and Arm Morello Program.

Arm GNU Toolchain releases package pre-built binaries of GNU Toolchain for various Arm targets. These toolchains come with no warranty. For more information, please visit the arm Developer page.

This release includes bare-metal and Linux toolchains for various hosts, as described in the Host Support section.

Changes since Arm GNU Toolchain 10.1.Morello-Alp1

This release contains the following changes since Arm GNU Toolchain 10.1.Morello-Alp1:

- Includes toolchain with aarch64-none-linux-gnu target triplet (includes glibc support).
- Includes support for C++ code.
- Includes support for Morello and CHERI builtins.
- Includes various bounds narrowing improvements.
- Includes various bug fixes.

Known Limitations and Issues

This release includes the following known limitations and issues:

- Sanitizers are disabled for purecap and lp64 multilibs.
- Transactional memory is not supported.
- OpenMP and OpenACC are disabled for purecap.
- __has_feature is not supported. For example: __has_feature(capabilities) is not supported.
- Various performance related issues.
- Hybrid support is enabled for the Linux kernel. However, there is no support for C++, __cheri_fromcap, __cheri_tocap, hybrid “polymorphic &” and “qualified &”.
- Profiling is not supported (flag -p, -pg, gprof, sprof, LD_PROFILE).
- GCC nested functions are not supported.
- C++ stdatomic.h atomic_is_lock_free is not implemented.
- LD_AUDIT has very limited support (no la_symbind, PLT hooks).
- VDSO is not supported (clock_gettime uses a syscall).
- static-pie is not supported.
- POSIX message queue async notify fails (mq_notify with SIGEV_THREAD, pointers passed via an fd).
- Process shared robust mutex does not work (pointers in shared memory).
- Purecap pldd only supports purecap ABI processes (not lp64).
- malloc bounds narrowing has large overhead (locks and hash table lookup).
- malloc bounds narrowing can break code expecting page granularity protection. As a workaround, Use the GLIBC_TUNABLES=glibc.mem.cap_narrowing=0 environment variable.
- String functions are not optimized.
- Executable stack is not supported

Ask Questions

For any questions, and further discussions, you can subscribe to the gnu-morello@op-lists.linaro.org mailing list.

Report Bugs

Please report any bugs via the Linaro Bugzilla under "GNU Binary Toolchain" product.

If you have found a bug in a source project used to build the Arm GNU Toolchain, and the source code is from an Arm specific (vendor) branch, then you must use the respective project in Linaro Bugzilla for reporting the bug:

- Linaro Bugzilla GCC
- Linaro Bugzilla Binutils
- Linaro Bugzilla GDB

Host Support

This release includes the following host support:

Host	Host Identifier (package name)	Toolchain targets
Linux on AArch64 These toolchains are built on, and for, Ubuntu 18.04 on AArch64, and will likely also be useable on OS versions: - later than Ubuntu 18.04 - RHEL8	aarch64	AArch64 Bare-metal AArch64 Linux
Linux on AArch64 These toolchains are built on and for RHEL7 on x86_64, and will likely also be useable on OS versions: - RHEL8 - later than Ubuntu 18.04	x86_64	AArch64 Bare-metal AArch64 Linux

Included Toolchain

The packages of the released GNU toolchain binaries have the following naming convention:

```
arm-gnu-toolchain-<Release Version>-<Host>-<Target Triple>.tar.xz
```

- In the following table , `<Target Triple>` is listed in parentheses in the second column as part of target description.
- The binaries are provided as tarball files.

Toolchain Package Name	Host OS / Target Description
arm-gnu-toolchain-10.1.morello-alp2-x86_64-aarch64-none-elf.tar.xz	Host: x86_64 Linux Target: AArch64 bare-metal(aarch64-none-elf)
arm-gnu-toolchain-10.1.morello-alp2-x86_64-aarch64-none-linux-gnu.tar.xz	Host: x86_64 Linux Target: AArch64 GNU/Linux (aarch64-none-linux-gnu)
arm-gnu-toolchain-10.1.morello-alp2-aarch64-aarch64-none-elf.tar.xz	Host: AArch64 Linux Target: AArch64 bare-metal(aarch64-none-elf)
arm-gnu-toolchain-10.1.morello-alp2-aarch64-aarch64-none-linux-gnu.tar.xz	Host: AArch64 Linux Target: AArch64 GNU/Linux(aarch64-none-linux-gnu)

Released Files

This release contains the following release files:

File Name	Description
arm-gnu-toolchain-*.tar.xz	Toolchain binaries
arm-gnu-toolchain-*src-snapshot*-.tar.xz	Toolchain sources
arm-gnu-toolchain-*-src-manifest.txt	List of remote repositories and the revisions of the source code used for building the toolchain
*.asc	MD5 checksum files for sources and binaries
*.sha256asc	SHA256 checksum files for sources and binaries

Source Code

The sources for this release are provided in the source tar ball, arm-gnu-toolchain-src-snapshot-10.1.morello-alp2.tar.xz. The arm-gnu-toolchain-src-snapshot-10.1.Morello-Alp2-manifest.txt file provides the versions of the source components.

Project	Version	Repository/Branch/Revision
GCC	based on 10.1	git://gcc.gnu.org/git/gcc.git branch: vendors/ARM/heads/morello revision: 87492b28b1c35088d7452c3f6088f5985debd473 For information on vendor branches, see https://gcc.gnu.org/gitwrite.html#vendor
glibc	based on 2.36	git://sourceware.org/git/glibc.git branch: arm/morello/main revision: 187b3dd4263cccc0087df3c4311ded95d866d116
newlib		git://git.morello-project.org/morello/newlib.git branch: morello/master revision: 67fd37136e44556cd0395a3b8ccdad81766e5622
binutils	based on 2.35	git://sourceware.org/git/binutils-gdb.git branch: users/ARM/morello-binutils-gdb-master revision: 7da34f425010957493342b86e97cff4bcba75212
GDB	based on 11	git://sourceware.org/git/binutils-gdb.git branch: users/ARM/morello-binutils-gdb-master revision: 7da34f425010957493342b86e97cff4bcba75212
libexpat	based on 2.2.5	Sources are provided in release source tar ball
Linux Kernel		git://git.morello-project.org/morello/kernel/linux.git branch: morello/master revision: 87d06928f90fe910311210a0149d03f3420f593c
libgmp	based on 6.2	Sources are provided in release source tar ball
libisl	based on 0.18	Sources are provided in release source tar ball
libmpfr	based on 3.1.6	Sources are provided in release source tar ball
libmpc	based on 1.0.3	Sources are provided in release source tar ball

Installation instructions

This release includes the following installation instructions:

Verifying the downloaded packages

You may check using MD5 checksum as follows:

```
$ md5sum --check arm-gnu-toolchain-10.1.morello-alp2-x86_64-aarch64-none-elf.tar.xz.asc
arm-gnu-toolchain-10.1.morello-alp2-x86_64-aarch64-none-elf.tar.xz: OK
```

Similarly for using SHA256 checksum, use the following instructions:

```
$ sha256sum --check arm-gnu-toolchain-10.1.morello-alp2-x86_64-aarch64-none-
elf.tar.xz.sha256asc
arm-gnu-toolchain-10.1.morello-alp2-x86_64-aarch64-none-elf.tar.xz: OKt
```

Installing on Linux

To install a toolchain on Linux, unpack the tarball to the preferred installation directory using the following instruction:

On x86_64:

```
$ tar xJf arm-gnu-toolchain-10.1.morello-alp2-x86_64-<TRIPLE>.tar.xz -C /path/to/
install/dir
```

On aarch64:

```
$ tar xJf arm-gnu-toolchain-10.1.morello-alp2-aarch64-<TRIPLE>.tar.xz -C /path/to/
install/dir
```

Invoking GCC

On Linux, either invoke with the complete path like this:

```
$ <install-dir>/arm-gnu-toolchain-10.1.morello-alp2-<HOST_ARCH>-aarch64-none-elf/
bin/aarch64-none-elf-gcc
```

where, depending on the host, `<HOST_ARCH>` is one of:

```
x86_64
aarch64
```

Or set the path and then invoke the toolchain like this:

```
$ export PATH=$PATH:<install-dir>/arm-gnu-toolchain-10.1.morello-alp2-<HOST_ARCH>-
aarch64-none-elf/bin
$ aarch64-none-elf-gcc --version
```

Architecture Options

This toolchain is built for supporting Arm Morello.

This section describes how to invoke GCC/G++ with the correct command-line options.

For pure capability (purecap) compilation:

```
$ aarch64-none-elf-gcc -march=morello+c64 -mabi=purecap
$ aarch64-none-linux-gnu-gcc -march=morello+c64 -mabi=purecap
```

For hybrid capability compilation:

```
$ aarch64-none-elf-gcc -march=morello
$ aarch64-none-linux-gnu-gcc -march=morello
```

Note:

- Hybrid capability is not supported for linux user space applications.
- The default value for `-mabi` is `lp64`.
- You cannot link `lp64` objects and libraries with `purecap` objects and libraries.

Available multilibs

Arm GNU Toolchain 10.1.morello-alp2 supports a set of multilibs in each toolchain.

To list all multilibs supported by any of the toolchain, use `--print-multi-lib` option. For example:

```
$ aarch64-none-elf-gcc --print-multi-lib
```

To check which multilib is selected by the aarch64-none-elf toolchain based on the `-march` and `-mabi` command line options:

```
$ aarch64-none-elf-gcc -march=<ARCH> -mabi=<ABI> --print-multi-dir
```