



Morello

Software Developer Errata Notice

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Non-Confidential

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This document contains all known errata since the r0p0 release of the product.



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Introduction

Scope

This document describes errata categorized by level of severity. Each description includes:

- The current status of the erratum.
- Where the implementation deviates from the specification and the conditions required for erroneous behavior to occur.
- The implications of the erratum with respect to typical applications.
- The application and limitations of a workaround where possible.

Categorization of errata

Errata are split into three levels of severity and further qualified as common or rare:

Category A	A critical error. No workaround is available or workarounds are impactful. The error is likely to be common for many systems and applications.
Category A (Rare)	A critical error. No workaround is available or workarounds are impactful. The error is likely to be rare for most systems and applications. Rare is determined by analysis, verification and usage.
Category B	A significant error or a critical error with an acceptable workaround. The error is likely to be common for many systems and applications.
Category B (Rare)	A significant error or a critical error with an acceptable workaround. The error is likely to be rare for most systems and applications. Rare is determined by analysis, verification and usage.
Category C	A minor error.

Change Control

Errata are listed in this section if they are new to the document, or marked as "updated" if there has been any change to the erratum text. Fixed errata are not shown as updated unless the erratum text has changed. The [errata summary table](#) identifies errata that have been fixed in each product revision.

01-Mar-2023: Changes in document version v2.0

ID	Status	Area	Category	Summary
2430086	Updated	Programmer	Category B	Client mode tag updates can be lost under certain circumstances

20-Jan-2022: Changes in document version v1.0

ID	Status	Area	Category	Summary
2066137	New	Programmer	Category B	Incorrect target Exception level on LC fault.
2166107	New	Programmer	Category B	AP[2] bit (dirty bit) may be updated even when store fails due to capability bounds fault
2430082	New	Programmer	Category B	Generic Timer - CNTFRQ architecture alignment issue
2430086	New	Programmer	Category B	Client mode tag updates can be lost under certain circumstances
2101099	New	Programmer	Category C	Trapped capability bounds faults not always trapped

Errata summary table

The errata associated with this product affect the product versions described in the following table.

ID	Area	Category	Summary	Found in versions	Fixed in version
2166107	Programmer	Category B	AP[2] bit (dirty bit) may be updated even when store fails due to capability bounds fault	r0p0, r0p1, r0p2	Open
2430082	Programmer	Category B	Generic Timer - CNTFRQ architecture alignment issue	r0p0, r0p1, r0p2	Open
2066137	Programmer	Category B	Incorrect target Exception level on LC fault.	r0p0, r0p1, r0p2	Open
2430086	Programmer	Category B	Client mode tag updates can be lost under certain circumstances	r0p0, r0p1	r0p2
2101099	Programmer	Category C	Trapped capability bounds faults not always trapped	r0p0, r0p1, r0p2	Open

Errata descriptions

Category A

There are no errata in this category.

Category A (rare)

There are no errata in this category.

Category B

2166107

AP[2] bit (dirty bit) may be updated even when store fails due to capability bounds fault

Status

Fault Type: Programmer Category B

Fault Status: Present in r0p0, r0p1, r0p2

Description

When an unaligned store using a non-capability pointer takes a capability bounds fault while the Dirty Bit Modifier (DBM) is enabled, the AP[2] bit may be updated erroneously. The correct behavior is to leave the AP[2] bit unchanged. This erratum causes the AP[2] bit to be updated under the stated conditions.

Configurations affected

All configurations are affected.

Conditions

This erratum occurs when an unaligned store using a non-capability pointer causes a bounds fault while DBM is enabled.

Implications

If the stated conditions are met, then AP[2] is updated rather than being left unmodified.

Note: If there is no bounds fault, it would be correct to update AP[2].

Workaround

Where software cannot handle AP[2] being updated in this case, it should not enable DBM, and manage AP[2] in software.

2430082

System Generic Timer - CNTFRQ register in CNTBaseN and CNTCTLBase views inconsistent

Status

Affects: Morello TAP, Corstone-700

Fault Type: Programmer Cat B

Fault Status: Present in r0p0, r0p1, r0p2

Description

The Generic Timer register CNTFRQ behavior has been updated for Armv8-A.

For the current Armv7-A implementation, the register is visible in two frames CNTBaseN and CNTCTLBase which have been implemented as independent registers.

Software, which expects the Armv8-A behavior, writes the expected value to the CNTFRQ register in the CNTCTLBase frame. This value is then expected to be reflected when read from the CNTFRQ register in the CNTBaseN frame.

However, as these registers are independent the values are not reflected.

Configurations affected

All configurations are affected.

Conditions

Software writes a value to the CNTFRQ register through the CNTCTLBase frame.

Software reads the CNTFRQ register through the CNTBaseN frame.

The value of CNTFRQ read through the CNTBaseN frame does not reflect the value written through the CNTCTLBase frame as these are implemented as independent registers.

Implications

OS software may fail to boot due to inconsistencies in the CNTFRQ views.

Workaround

In the current Armv7-A implementation although the CNTFRQ is 'read-only', for initial configuration it can be written through the CNTBaseN frame.

Software therefore must write the required CNTFRQ value to both the CNTBaseN and CNTCTLBase frames.

This workaround ensures consistency when reading the CNTFRQ value from either CNTBaseN or CNTCTLBase frames.

For example:

```
mmio_write_32(ARM_SYS_TIMCTL_BASE + CNTCTLBASE_CNTFRQ, freq_val);
```

```
mmio_write_32(ARM_SYS_CNT_BASE_NS + CNTBASEN_CNTFRQ, freq_val);
```

2066137

Incorrect target Exception level on LC fault

Status

Fault Type: Programmer Category B
Fault Status: Present in rOp0, rOp1, rOp2

Description

When SCR_EL3.EA = 1 then LC faults behave as if they are synchronous External aborts and are routed to EL3. If SCR_EL3.EA = 0 and HCR_EL2.TEA = 1, they are routed to EL2.

The correct behavior is for LC faults to behave as stage 1/2 Data aborts.

This erratum can cause LC faults to be routed to the wrong Exception level.

Configurations

All configurations.

Conditions

This incorrect fault routing behavior can occur when SCR_EL3.EA is set (or if HCR_EL2.TEA is set).

Implications

The incorrect exception routing for LC faults can cause correctly written software to behave incorrectly.

Workaround

The workaround is to require SCR_EL3.EA = HCR_EL2.TEA = 0. It is worth noting that it would be acceptable to set SCR_EL3.EA while running (only) in EL3.

2430086

Client mode tag updates can be lost under certain conditions

Status

Fault Type: Programmer Category B

Fault Status: Present in r0p0, r0p1. Fixed in r0p2.

Description

In Client mode, the tag bit that indicates a valid capability may not be updated properly under certain circumstances.

Configurations

Configurations which use Client mode are affected.

Conditions

When the system is configured in Client mode, under certain microarchitectural conditions an operation to set or clear a tag in memory may not happen. This results in one or more tags being in a stale (incorrect) state.

Implications

Pointers can have the wrong value of the tag bit. This means that a tag can unexpectedly be 0 when it is supposed to be 1, or 1 when it is supposed to be 0. The first can result in an unexpected exception. The second can result in a violation of the security guarantees of the Morello architecture.

Workaround

Use only Server mode for most testing, particularly when the Morello architecture is being assessed.

Note: It may be possible to use Client mode for certain kinds of testing where the issue described in this erratum is not important. For example, it may be possible to do some performance testing. For this type of use, we recommend that you work closely with Arm.

Category B (rare)

There are no errata in this category.

Category C

2101099

Trapped capability bounds faults not always trapped

Status

Fault Type: Programmer Category C

Fault Status: Present in r0p0, r0p1, r0p2

Description

When access to Morello functionality is trapped to EL3 by CPTR_EL3.EC, or to EL2 by CPTR_EL2.TC, and executing at an Exception level below the target Exception level, an unaligned non-capability store that is split across a page boundary and takes a bounds fault is treated as not trapped by those controls. The correct behavior is to take the exception at the lowest Exception level trapping the access. This erratum can route bounds fault exceptions created under these conditions to the wrong Exception level.

Configurations

All configurations are affected.

Conditions

This incorrect behavior requires:

- Access to capability functionality to be trapped to EL3 by CPTR_EL3.EC or to EL2 by CPTR_EL2.TC
- Execution at an Exception level below the trapping level
- An unaligned store using a non-capability pointer that is split across a page boundary and that takes a bounds fault.

Implications

Incorrect exception routing can occur under the stated conditions. Arm expects that a higher Exception level sets the maximum PCC and DDC for lower Exception levels where access to Morello is disabled and so LC faults will not be generated, so no workaround is necessary.

Workaround

No workaround is necessary.

