TERMA[Ⓣ]

TEMU
Release Info

Version latest, 2024-05-14

Table of Contents

This document contains all TEMU release notes.

Chapter 1. Release Notes

1.1. Version 4

1.1.1. TEMU 4.2.0

TEMU 4.2.0 was released on 2024-05-06.

TEMU 4.2.0 addresses several bugs. It also adds a number of additional features and general enhancements.

Bug Fixes

- GPTIMER chained timer issue, causing unexpected reloads and interrupts under some circumstances.

- GPTIMER event frequency and off by one error.

- GPTIMER could generate negative values under some conditions. in multi-threaded mode.

- GR740 IOMMU configuration file fixes.

- P2020 incorrect RC/EP mode detection for PCIe.

- Memory read traces were not logged under certain cases (mostly impacting PowerPC processors).

- P2020 boot-record handling fixes.

- Fix issue where some TEMU debugging commands would assume there is IR allocated.

- P2020 CCSRBAR write issues.

- Scheduler performance measuring system was incorrectly using the thread clock instead of the monotonic clock.

Enhancement

- Additional statistics collection for `Profiler`.

- Cleanup of some logging.

- P2020 UART trace now contains received characters (if printable).

- Memory dump command now prints out dump in ASCII as well as hex.

- e500 MMU cleanup and logging improvements.

- Binary translation support for floating point instructions (for SPARC processors).

- Outbound window logging improvement for P2020.

- Adding CAN bus implementation example, that can be used as a starting point for mission specific CAN bus models.

Features

- Adding trace command to print out disassembly of all executed instruction (this is currently only for direct CPU execution or the legacy machine model).

- Support code pattern matchers for custom idle mode, code substitution and code skipping.

- Experimental YAML-based components.

1.1.2. TEMU 4.1.0

TEMU 4.1.0 was released on 2023-11-14.

TEMU 4.1.0 addresses several bugs. It also adds a number of useful features for debugging SpaceWire interactions and user applications.

Bug Fixes

- GRETH control register reset bit was not cleared after completing reset. This resulted in Linux GRETH reset polling failing.

- Redundant operations were executed when entering the CPU core, these have been moved to the processor create functions. This reduces the quanta expiration penalty, effecting multi-core processors.

- Memory tracer were not properly handling *large transactions*.

- GPTIMER counter registers were stuck between quantas for the non-primary processor (the model's timesource).

- GR740 was not configured to enable the IRQMAP registers for the GRGPIO devices.

- GRGPIO IRQMAP registers could be written with invalid values, Linux kernel expects that the device only sets valid bits.

- Race condition addressed in code generators.

- Invalid log category name would crash the `log-level` command.

- GRCAN buffer full detection logic was incorrect.

- Memory probing operations used in atomic ASI operations (`casa`, `ldstuba`) on SPARC processors, did not check for MMU privileges.

- Snapshot functions did not return an error code when a file cold not be opened.

Enhancement

- PowerPC processor models are now using the pre-decoded interpretation functionality.

- SPWROUTER model has improved logging that can be enabled using `config` properties. It can now log the packets that are being transmitted, transfer descriptors etc, using *trace* level instead of *debug* level. This makes low level SPWROUTER logging available also in the normal release mode.

- GRCAN transmit logging has been adjusted and is less chatty.

- Exposing `exitReason` as a property on all processor models.

- Performance improvements in several places.

Features

- SPARC processors with MMU now have a `find-page-table-root` command, that lets you search for a page table root matching either a specific VA, or a specific VA-PA translation.
- Added SpaceWire injector models.
- Added SpaceWire PCAP dumping model.
- The old GDB server now lets you set the page table root used for translations on SPARC processors. This enables the debugging of user applications running with the MMU enabled.
- A new GDB server supporting the parallel scheduler has been added.
- Added placeholder models for:
  - `GR740THSENS`
  - `L4STAT`
  - `MEMSCRUB`
  - `MMCTRL`

1.1.3. TEMU 4.0.3

TEMU 4.0.3 was released on 2023-07-26.

Bug Fixes

- A race condition resulting in a deadlock in the parallel scheduler has been fixed. Worker threads not finishing initializing, before the run command was issued by the user could trigger a deadlock on *highly* loaded systems.

1.1.4. TEMU 4.0.2

TEMU 4.0.2 was released on 2023-07-24.

Bug Fixes

- SPWROUTER AMBA port resets not functioning correctly
- GRCAN incorrect memory mapping of sync-registers
- GRIOMMU Register writes should not overwrite read-only bits.

1.1.5. TEMU 4.0.1

TEMU 4.0.1 was released on 2023-07-18.

Bug Fixes

- GDB server not translating addresses using the MMU

- GDB server using deprecated memory interface

- GDB server issuing hwbreak as reasons for a stop, triggering a bug in GDB.

1.1.6. TEMU 4.0.0

TEMU 4.0.0 was released on 2023-06-30.

Features

- Parallelization of TEMU. TEMU has a parallel scheduler, that enables the execution of different simulated processor cores on different host processors. This enables the high speed simulation of multi-core processors. Note that as this effects full determinism, so it is possible to still select the single threaded scheduler.

- User configurable speed factor. The *Cycles per Instruction (CPI)* or *Instructions per Cycle (IPC)* can now be set by the user. This is combined with the elimination of the per instruction timing model. All instructions now execute in one step, the CPI/IPC values are used to convert between steps to / from cycles.

API Changes

Event functions now take a `temu_TimeSource` pointer as argument. The `TimeSource` pointer in `temu_Object` has also been updated to this type. This may lead to failed builds if using C++.

To update the models, make sure you pass a `temu_TimeSource` pointer in place of a `temu_Object` pointer to these functions.

As with the introduction of `temu_Object` pointers in the API of TEMU 3.0.0, to keep compiling without changes, set the pre-processor flag: `TEMU_TYPE_ERASED_POINTERS`.

API Additions

- Scheduler Control

  ◦ `temu_runSecs()`

  ◦ `temu_step()`

  ◦ `temu_stop()`

  ◦ `temu_asyncStop()`

- Time Conversions

  ◦ `temu_cyclesToSteps()`

  ◦ `temu_stepsToCycles()`

  ◦ `temu_cyclesToStepsRoundedUp()`

  ◦ `temu_stepsToCyclesRoundedUp()`

  ◦ `temu_convertToOtherFrequencyTruncated()`

  ◦ `temu_convertToOtherFrequencyRoundedUp()`

Deprecations

- `temu_EventIface` is deprecated.

- The `exchange` function in `temu_MemAccessIface` is deprecated and the function will no longer be called.

- `Machine` class is deprecated. Note that as the new `Scheduler` class is not yet supported by the GDB Server, the Machine will still be around for some time.

Other

- License manager have been reworked a bit. TEMU now requires an explicit installation / configuration step. The steps are detailed in the user's manual.

- Time source system simplified and cleaned up.

- GLIBC version requirement raised to *2.29*.

1.2. Version 3

1.2.1. TEMU 3.0.9

TEMU 3.0.9 was released on 2023-07-24.

Bug Fixes

- SPWROUTER AMBA port resets not functioning correctly

- GRCAN incorrect memory mapping of sync-registers

- GRIOMMU Register writes should not overwrite read-only bits.

1.2.2. TEMU 3.0.8

TEMU 3.0.8 was released on 2023-07-18.

Bug Fixes

- GDB server not translating addresses using the MMU

- GDB server using deprecated memory interface

- GDB server issuing hwbreak as reasons for a stop, triggering a bug in GDB.

1.2.3. TEMU 3.0.7

TEMU 3.0.7 was released on 2023-06-30.

Bug Fixes

- Add missing GRGPIO registers.

1.2.4. TEMU 3.0.6

TEMU 3.0.6 was released on 2023-06-20.

Bug Fixes

- Fix SPWROUTER configuration in GR740 configuration file.

- Fix SPWROUTER not supporting resets via AMBA port RS bit.

- Fix issue with interrupts sometimes being delayed to the next event for SPARC targets.

- Fix issue with IRQAMP model missing some registers on the GR740.

- Fix issue in binary translator resulting in interpreted delay slots being skipped by accidentally chaining the block to the next.

- Improving robustness of some APIs and models with additional null-pointer checks.

1.2.5. TEMU 3.0.5

TEMU 3.0.5 was released on 2023-04-24.

Bug Fixes

- Fix GRCAN IRQ IDs in GR740 configuration file.

- Fix missing GRCAN AMBA P&P updates when configuring IRQ numbers.

- Fix missing GRCAN AMBA P&P updates when mapping devices to memory.

- Fix issue in IRQMP and IRQAMP, with extended main interrupt bits being set incorrectly for extended interrupts.

Features

- Add receive and transmit tracing code to GRCAN model

1.2.6. TEMU 3.0.4

TEMU 3.0.4 was released on 2023-03-22.

Bug Fixes

- Enable GR740 IRQ remapping in config file

- Fix issue where IRQ remapping would be applied to late in the interrupt chain

Features

- Add ABI level stacktrace command to SPARC processor model

1.2.7. TEMU 3.0.3

TEMU 3.0.3 was released on 2023-03-01.

Bug Fixes

- Adding AHB2AHB model for the GR740 (it only provides PNP data)

- Adding two extra AHBCTRL devices in the GR740 (*memory-* and *AHB slave I/O* buses)

- Adding AHB PNP interfaces for GRIOMMU (*master AHB, secondary master AHB* and *slave AHB* interfaces).

- Aligning default capability register values in GRIOMMU with values from GR740 hardware. Documented values were incorrect.

- The `experimental` namespace for the SoC ID and version properties in the `AhbCtrl` added in *TEMU 3.0.2* has been dropped. Properties should now be named without the `experimental` tag.

1.2.8. TEMU 3.0.2

TEMU 3.0.2 was released on 2023-02-07.

Bug Fixes

- Fix sometimes incorrect determination of on/off page jumps in the binary translator.

- Fix invalid jump instructions in binary translated code, that could happen if the offset was more than 2 GiB.

- PikeOS would not boot in TEMU, resolving this by:

  - Fix device version in AMBA PNP data LEON4 processor core

  - Adding `GRGPREG` model. This model is a dummy, but provides the correct PNP info and user configurable registers.

  - Adding `GRGPRBANK` model. This model is a dummy, but provides the correct PNP info and user configurable registers.

  - Adding a workaround in `AhbCtrl` model to expose undocumented SoC ID and version IDs.

Enhancements

- Adding built-in `ExecutionProfiler` model that can monitor performance metrics over time.

- Adding built-in `Sampler` model that can sample arbitrary properties over time.

- Adding built-in `ScriptSequencer` model that can sequence TEMU scripts on specific times.

1.2.9. TEMU 3.0.1

TEMU 3.0.1 was released on 2022-12-19.

Bug Fixes

- Crash in binary translated code due to invalid x86-64 instructions being emitted.

- Move code binary translated code fragment manager from processors to memory system.

Enhancements

- Increase ATC size from 16 to 512 entries on SPARC targets.

1.2.10. TEMU 3.0.0

TEMU 3.0.0 was released on 2022-11-11.

Features

- Several new models (see Section 1.2.10.2).

- New command line interpreter engine. The CLI has been rewritten with a recursive decent parser. The new interpreter adds support for:

  - If-statements

  - Custom commands via `defcmd` construct.

  - C-style single line comments `//`

  - Object commands (e.g. `cpu0.pregs`)

  - Class commands driven by new meta-class concept. A class can customize the new command in the meta-class with additional named parameters.

- Experimental new idle loop pattern detection API.

Models

- Bus Models

  - SPI

  - PCIe

- GRLIB

  - IRQAMP

- PowerPC

  - e500 PowerPC core (including SPE instruction set)

  - P2020 peripherals

    - GPIO

    - eSPI

    - PCIe

    - eTSEC Ethernet MAC

    - DUART

    - PIC

    - DDR controller

    - Coherency module

Enhancements

- Instruction set interpreters have moved to a pre-decoded dispatch mechanism:
  - Much higher performance (50% increase observed).
- Adding a binary translation engine, improving performance a further 100%.

Removals

- The legacy event API has been removed
- External class support has been removed. The replacement of this feature is to write wrapper classes with pseudo properties.

Deprecations

None

1.2.11. TEMU 3.0.0-pre8

TEMU 3.0.0-pre8 was released on 2023-12-11.

Notes

This is a bug fix on the qualified 3.0.0-pre4 release. The release is only intended for users of 3.0.0-pre4.

Note that 3.0.0-pre5, 6 and 7 were internal testing builds and have not been released publicly.

Bug Fixes

- An issue was addressed when running a powered off processor. Processors in power-off state could inadvertently exit idle mode without being powered on first.

1.2.12. TEMU 3.0.0-pre4

TEMU 3.0.0-pre4 was released on 2023-09-04.

Notes

This is a bug fix on the qualified 3.0.0-pre0/pre3 release. The release is only intended for users of 3.0.0-pre0/pre3.

Note that 3.0.0-pre1 and 3.0.0-pre2 were internal testing builds and have not been released publicly.

Bug Fixes

- An issue was addressed when running a powered off processor. Processors in power-off state could inadvertently exit idle mode without being powered on first.

1.2.13. TEMU 3.0.0-pre3

TEMU 3.0.0-pre3 was released on 2023-05-25.

Notes

This is a bug fix on the qualified 3.0.0-pre0 release. The release is only intended for users of 3.0.0-pre0.

Note that 3.0.0-pre1 and 3.0.0-pre2 were internal testing builds and have not been released publicly.

Bug Fixes

- The LEON2 interrupt controller was in the case of, re-raising the same interrupt as the acknowledged one; not immediately triggering the interrupt. Instead it got delayed to the next event. This issue has now been fixed.

1.2.14. TEMU 3.0.0-pre0.6

TEMU 3.0.0-pre0.6 was released on 2023-11-17.

Notes

This is a bug fix on the qualified 3.0.0-pre0 release. The release is only intended for users of 3.0.0-pre0.

Note that 3.0.0-pre0.1, 2, 3, 4, and 5 were internal testing builds and have not been released publicly.

Bug Fixes

- In certain cases, level triggered interrupts would not be cleared after lowering them. Potentially resulting in an extra spurious interrupt being taken.

1.2.15. TEMU 3.0.0-pre0

TEMU 3.0.0-pre0 was released on 2022-04-12.

Features

- New command line interpreter engine. The CLI has been rewritten with a recursive decent parser. The new interpreter adds support for:
  - If-statements
  - Custom commands via `defcmd` construct.
  - C-style single line comments `//`
  - Object commands
  - Class commands driven by new meta-class concept. A class can customize the new command in the meta-class with additional named parameters.
  - In-place snapshot restore without recreating objects

Models

- Data Buses

    - PCIe

    - SPI

- GRLIB

    - GRIOMMU

    - IRQAMP

- PowerPC

    - e500 PowerPC core (including SPE instruction set)

    - P2020 peripherals

        - GPIO

        - eSPI

        - PCIe

        - eTSEC Ethernet MAC

        - DUART

        - PIC

        - DDR controller

        - Coherency module

- Integration Support

    - DeviceIDIntegrator

Enhancements

- Instruction set interpreters have moved to a pre-decoded dispatch mechanism:

    - Much higher performance (50% increase observed).

- Many functions now take and return `temu_Object*` instead of `void*`. This means that some code in C++ may fail building. The old behavior can be enabled conditionally by setting the compiler definition: `TEMU_TYPE_ERASED_OBJECTS=1` when building code using the TEMU API.

Removals

- The legacy event API has been removed

- External class support has been removed. The replacement of this feature is to write wrapper classes with pseudo properties.

Deprecations

None

1.3. Version 2

1.3.1. TEMU 2.3.9

TEMU 2.3.9 was released on 2024-01-23.

Bug Fixes

- CAN_OC incorrectly cleared the Clock Divider Register, when the chip entered reset mode (not to be confused with a device reset).

1.3.2. TEMU 2.3.8

TEMU 2.3.8 was released on 2023-12-21.

Bug Fixes

- CAN_OC reset values not reflecting CAN_OC but SNJ1000

1.3.3. TEMU 2.3.7

TEMU 2.3.7 was released on 2023-11-17.

Bug Fixes

- CAN_OC PeliCAN dual-filter mode was not correctly implemented

1.3.4. TEMU 2.3.6

TEMU 2.3.6 was released on 2023-07-10.

Bug Fixes

- Double transactions issued during byte-read/write decays.
- B1553BRM mode code support added

1.3.5. TEMU 2.3.5

TEMU 2.3.5 was released on 2022-07-26.

Bug Fixes

- #121 LEON2 timer underflow value not as documented in COLE/CREOLE configuration.
- #122 SPARC interrupts could sometimes be delayed due to an incorrect PIL check.

1.3.6. TEMU 2.3.4

TEMU 2.3.4 was released on 2022-06-09.

Bug Fixes

- #114 LEON2 interrupt controller pending / mask not correctly used

1.3.7. TEMU 2.3.3

TEMU 2.3.3 was released on 2022-06-03.

Bug Fixes

- #113 Mode code transfer support for BC mode of B1553BRM model

1.3.8. TEMU 2.3.2

TEMU 2.3.2 was released on 2022-05-20.

Enhancements

- #101 Remote Terminal mode for the B1553BRM device model

1.3.9. TEMU 2.3.1

TEMU 2.3.1 was released on 2022-05-03.

Bug Fixes

- #106 Missing plug-and-play info for B1553BRM device
- #107 Missing examples in GR712RC sysconfig file for instantiating the B1553BRM

1.3.10. TEMU 2.3.0

TEMU 2.3.0 was released on 2022-05-02.

Models

- #86 B1553BRM Bus Controller. Adding model of the B1553B BC used in the GR712RC.

Features

- Support bus inhibit for MILBUS API. It is possible to flag which bus a transaction is not sent to, and to inhibit bus A or bus B in the bus model.

  > API compatibility is provided via the `temu_mil1553Create` family of functions. Manual initialization of 1553 transactions is supported if they are properly zero-initialized (e.g. using `memset` or C-initialization).

1.3.11. TEMU 2.2.17

TEMU 2.2.17 was released on 2022-03-29.

Bug Fixes

- !115 SPARC GPR snapshots. Restoring the GPRs could potentially override adjacent data in virtual CPU.

- #96 Erroneous window count in LEON3 / LEON4 %asr17 register. Adjusting field to reflect reality instead of processor documentation.

1.3.12. TEMU 2.2.16

TEMU 2.2.16 was released on 2021-12-17.

Bug Fixes

- #85 Crash when restoring snapshot containing a `GenericCache` model.

1.3.13. TEMU 2.2.15

TEMU 2.2.15 was released on 2021-11-26.

Bug Fixes

- #82 AHBSTAT failing address register not updated on access to absent memory.

  > In order to enable the support for the FAILAR fixes in your customized processor scripts, connect the memory space `absentHandlers` property to the AbsentMemoryIface interface in AHBSTAT. This can be done by adding a line as follows to the config script: `connect a=mem0.absentHandlers b=ahbstat0:AbsentMemoryIface`.

1.3.14. TEMU 2.2.14

TEMU 2.2.14 was released on 2021-10-14.

Bug Fixes

- #79 CAN_OC self-test mode not supported.

1.3.15. TEMU 2.2.13

TEMU 2.2.13 was released on 2021-09-22.

Bug Fixes

- #76 References to entries in interface arrays cannot be snapshotted/checkpointed.

1.3.16. TEMU 2.2.12

TEMU 2.2.12 was released on 2021-09-14.

Bug Fixes

- #75 LEON2 interrupt controller should support configurable level / edge triggering.

1.3.17. TEMU 2.2.11

TEMU 2.2.11 was released on 2021-07-07.

Bug Fixes

- #66 ApbUart infinite speed mode sets status bits it should not.
- #67 GpTimer warnings over scaler limits generating false positives.
- #70 LEON2 external / GPIO interrupts not correctly modelled.
- #72 ATC not cleared on CPU resets.

1.3.18. TEMU 2.2.10

TEMU 2.2.10 was released on 2021-04-30.

Bug Fixes

- #60 Memory space passes wrong object when decaying block reads to memory transactions.
- #61 IRQMP force interrupts should clear the ext int ack register in certain cases.
- #62 Do-not-exit-at-halt mode does not advance time correctly

1.3.19. TEMU 2.2.9

TEMU 2.2.9 was released on 2021-04-19.

Bug Fixes

- #58: IRQMP extended interrupts not taken if master interrupt masked.

1.3.20. TEMU 2.2.8

TEMU 2.2.8 was released on 2021-04-07.

Bug Fixes

- #56: Address issues with IRQMP extended interrupts.

1.3.21. TEMU 2.2.7

TEMU 2.2.7 was released on 2021-03-18.

Bug Fixes

- #50: Expose GRGPIO pin mask (to adjust the number of GPIO pins) as configuration property.

1.3.22. TEMU 2.2.6

TEMU 2.2.6 was released on 2021-03-15.

Bug Fixes

- #24: Missing CLKDIV register in GRSPW2 model

Enhancements

- #45: Accept TEMU3 licenses in TEMU2

1.3.23. TEMU 2.2.5

TEMU 2.2.5 was released on 2021-01-06.

Bug Fixes

- Regression for #23: Excessive GR1553 logging

1.3.24. TEMU 2.2.4

TEMU 2.2.4 was released on 2020-11-20.

Bug Fixes

- #29: Incorrect null-check in memory space

1.3.25. TEMU 2.2.3

TEMU 2.2.3 was released on 2020-11-09.

Bug Fixes

- #29: Possible crash when fetching instructions from an MMIO device without fetch handlers.

1.3.26. TEMU 2.2.2

TEMU 2.2.2 was released on 2020-10-13.

Bug Fixes

- #26 LEON2 timer problem near overflow
- #27 Expose stickyBits flag in CPU for resume on halt support

1.3.27. TEMU 2.2.1

TEMU 2.2.1 was released on 2020-06-22.

Bug Fixes

- Excessive GR1553 logging (23)

1.3.28. TEMU 2.2.0

TEMU 2.2.0 was released on 2020-06-18.

New Models

- PowerPC architecture support

  ○ Added PPC750 CPU core model

- ARMv7-R architecture support

  ○ ARMv7-R CPU core model.

  ○ Cortex-R4 based memory controller.

  ○ Sysconfig file for TMS570LC43.

  ○ TMS570 VIM, SCI-LIN and RTI device models

- MIL-STD-1553 support is starting to stabilise, it is still however marked as experimental until it has been properly tested by more third parties implementing bus controller and remote terminal models.

- SpaceWire models added (GRSPW, GRSPW2, GRSPWROUTER)

- CAN models added (SimpleCANBus, CAN_OC, GRCAN)

- Ethernet models added (GRETH, GRETH_GBIT)

New Features

- Command API added. In T-EMU 2.1 and earlier, there was no user exposed API for adding custom commands the only way to do this was an internal C++-API which was/is not exposed to the user. We now provide a C and Python API to create user commands.

  ○ Additional functions added to `temu-c/Support/CommandLine.h`

  ○ Added Python API for creating commands using kwarg syntax. the raw API can be accessed with `import temubuiltins` (at the moment).

  ○ ELF Symtab API added. The API supports loading and querying the symbol tables in an ELF file. The symtabs are useful as fallback if DWARF info is not available.

  ○ DWARF support extended and source level debugging commands added.

Changes

- Rebased to LLVM 6.0 (internal change)

- A lot of activity has been on internal cleanup.

- The emulator generator support tool has been rewritten and is a lot simpler now. This paves the way for more advanced interpretation methods and binary translation further on in time. CPUs should otherwise remain identical to their function. This is an internal change and does not

have an impact on the end user.

- GDB C++ API is removed, replaced with plain C-API.

- Python API is reorganised. Please update your Python scripts with the new module paths (temu.c.xxx) insead of temu.xxx.

  ◦ `temu.c.xxx` will keep the raw wrappers over the C-api.

  ◦ `temu.xxx` (not including temu.c) will provide a more native and natural Python API when implemented.

  ◦ Replacing GDB Server C++ API with C99 API, old headers have been deleted.

  ◦ POTENTIALLY BREAKING API CHANGE: Event API is rewritten, the old one is there and is compatible with the new one, except for the event registration function (which should be replaced with `temu_publishOldStyleEvent`) which now takes a source object pointer. The event publication is with the new API mandatory before posting an event (previously, it was technically only needed for checkpointing support). Users should move to the new style events as soon as possible. These events are preallocated when models are allocated and a lot faster than the old style events. The old style event API is marked as deprecated and it will be removed in a later release. Although, while the old style event API is still there, it has been renamed `LegacyEventIface` in the code. Thus, when you rebuild your models you must make a decision on either sticking with the deprecated legacy API or moving to the new API. New API is based on a function interface, and it is no longer needed to handle the writing of a queue property in a special way to register events. To post an event use the `temu_eventPostXXX()` functions (where XXX at present is Cycles, Nanos and Seconds).

Deprecations

- Old / legacy event API is deprecated, will be removed in TEMU 3.0

1.3.29. TEMU 2.1.0

TEMU 2.1.0 was released on 2015-11-12.

New Features

- Command Line Interface Improvements:

  ◦ Variable support, these can be used as parameters to commands. They are set using the var-set command or by assigning them using `VAR=VALUE` syntax.

  ◦ Default variables can now be taken by some commands. Current default variables include DEFAULT_CPU (used by some CPU commands, e.g. register set and inspection commands), DEFAULT_MACHINE (used by some machine commands) and DEFAULT_RUNNABLE (used by the run, step and time commands). System configs have been updated to assign these variables.

- Experimental DWARF support. When loading an ELF file, it is possible to add the parameter dwarf=1, this enables experimental DWARF parsing (and a whole lot of terminal output dumping the DWARF records). Currently, there is support in the disassembler command where

instead of an address, it is possible to specify func=name, where name is the name of the function to disassemble. E.g: "dis cpu=cpu0 func=main" will dissassemble the main function. Note as this feature is experimental, it is likely that there are bugs (e.g. incorrect parsing, memory leaks, etc), and many parsing errors are currently handled with assert().

- Added a non-time-based event API. This is used to issue for example trap taken events that the user can intercept. Currently, the following events are defined 'temu.cpuErrorMode', 'temu.cpuTrapEntry' and temu.cpuTrapExit'. Note that there isn't any standard reporting of these (except the error mode event) and the user should provides his own event handlers in that can report the events.

- Added GUI based console. A problem with the inline serial console was that it was printing too much info in the T-EMU console window when booting systems with lots of output like Linux. There is now a graphical user interface console with rudimentary VT100 support that also supports console input. This keeps your emulator command window clean from serial output. The GUI console does not log traffic at the moment.

- GdbServer now available. The GdbServer is available as firstly a library, secondly through a stand-alone tool (temu-gdbserver) and thirdly as a command in the temu command line interface. Note that it is available as a C library, and C libs in the emulator are not seen as API stable. A stable C library may be made available later if there is need for one.

- Adding Python scripting support to command line interface.

- Adding cache emulation support. Note that unlike hardware, emulating a cache will slow down the emulation. The cache emulation interfaces and a generic cache model are available through libTEMUMemory. The cache APIs exist to allow the user to do detailed performance analysis and estimate the impact from running with and without caches. Note, that for normal usage, it is best to emulate caches by setting the average waitstates on the RAM and / or ROM models.

  ◦ LEON2, 3 and 4 now support caches in the CPU models. Caches are optional and you do not pay for something that is not used.

  ◦ LEON2SoC is now working as a cache controller to keep taps on flushing bits.

Changes

- CPU Changes

  ◦ SPARCv8

    ▪ LEON4

      ▪ Add support for NGMP reset values

- Rebased to LLVM 3.7, giving around 10% performance improvements.

- Added some custom LLVM optimisation passes (2-3 % extra performance).

Deprecations

- Logging function `temu_logCritical()` is deprecated. It is renamed as `temu_logFatal()`` to more clearly illustrate the intent.

- `temu_MemoryKind` is no longer used. The enum will be removed later.

- `temu_MemoryMapIface` is deprecated. The interface is no longer used and the function interface is preferred. At present users should not implement their own memory spaces. This may change in the future, but at the moment, all fields in the interface are deprecated and the interface will be removed in the future.

1.3.30. TEMU 2.0.2

TEMU 2.0.2 was released on 2015-09-03.

Bug Fixes

- License key verification problems.

1.3.31. TEMU 2.0.1

TEMU 2.0.1 was released on 2015-08-28.

Bug Fixes

- Read and write watchpoints were not detected in some cases
- DEB-packages now define architecture.

1.3.32. TEMU 2.0.0

TEMU 2.0.0 was released on 2015-08-21.

Bug Fixes

- Typesafe wrappers for `temu_ifaceArrayDispose` (see temu-c/Support/Objsys.h) were passing the wrong pointer to the dispose function.
- Several other issues discovered in 2.0-pre.

New Features

- Machine class
- `temu_Object` root type added

Changes

- SPARCv8
  - Events are triggered when they expire, even if the CPU is halted
  - Supports machine synchronized events
  - LEON4
    - Adding partial wrpsr instruction support (SPARCv8-E extension)
- Devices

- ◦ All devices inherit from `temu_Object`

- ◦ GpTimer now posts synchronized timer events

- API

- ◦ Adding extra flags argument to event posting function

- ◦ Machine interface is now public

1.3.33. TEMU 2.0-pre

TEMU 2.0-pre was released on 2015-05-27.

New Features

- Processor Models

- ◦ ERC32

- ◦ LEON2

- ◦ LEON3

- ◦ LEON4

- Devices

- ◦ MEC

- ◦ LEON2-on-chip-devices

- ◦ GRLIB AhbCtrl

- ◦ GRLIB ApbCtrl

- ◦ GRLIB ApbUart

- ◦ GRLIB IrqMp

- ◦ GRLIB GpTimer

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The source code of the GCC runtime can be obtained by downloading the *gcc-4.8.4* source code from the GCC website: http://gcc.gnu.org/.

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TEMU 3 introduced the replxx-library in place of libedit.

2.3.1. Common

Date Library

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Our apologies. When the previous paragraph was written, lowercase had not yet been invented (that would involve another several millennia of evolution). We did not mean to shout.

JSON for modern C++

```
  __|  |   __|     |   | |  JSON for Modern C++
  |   |   __|   |  |   | | | |  version 3.5.0
 |_____|_____|_____|_|___|  https://github.com/nlohmann/json
```

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Libcrc

https://github.com/lammertb/libcrc

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wcwidth.cpp

Markus Kuhn — 2007-05-26 (Unicode 5.0)

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2.3.4. TEMU 2

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