Behavior and performance evaluation of Linux Vanilla 2.6.32 on PowerPC

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1 Document Intention

1.1 Purpose and scope

This document presents the quantitative evaluation results of the **Linux Vanilla 2.6.32** operating system on **PowerPC-based platform**.

The layout of this report follows the one depicted in "The OS evaluation template" [Doc. 4]. The test specifications can be found in "The evaluation test report definition" [Doc. 3]. For more detailed references, See section "Related documents" of this document. These documents have to be seen as an integral part of this report!

Due to the tightly coupling between these documents, the framework version of "The evaluation test report definition" has to match the framework version of this evaluation report (which is 2.9). More information about the documents and tests versions together with their corresponding relation between both can be found in "The evaluation framework", see [Doc. 1] in section "Related documents" of this document.

The generic test code used to perform these tests can be downloaded on our website by using the link in the related documents section.

1.2 Test framework used: 2.9

This document shows the test results in the scope of the evaluation framework 2.9. More details about this framework are found in Doc 1 (see section "Related documents").

1.3 Conventions

Throughout this document, we use certain typographical conventions to distinguish technical terms. Our used conventions are the following:

- ***Bold Italic*** for OS Objects
- **Bold** for Libraries, packets, directories, software, OSs...
- `Courier New` for system calls (APIs...)

2 Introduction

This chapter describes the OS that Dedicated Systems tested using their Evaluation Testing Suite, and the hardware on which this OS was running during the testing.

2.1 Evaluated (RTOS) product

The operating system OS that will be evaluated is **Vanilla Linux** 2.6.32.13 with patches from the board vendor (Freescale).

The evaluation of this kernel version (2.6.32.13) was performed using several performance and behavior tests. The testing results are applicable only to this version as other versions may have other significant performance figures and behavior.

The library used between the testing applications and the kernel is the **µClibc** version 0.9.32. This interfacing library is important because user applications (when using POSIX calls) can access the real-time features of the kernel only if this library supports them. Otherwise, direct system calls in user space applications are needed.

Further, the kernel was configured to use a high frequency timer source as clock generation and all power management was disabled. The test application was started from a RAM disk (tmpfs) and the real-time run away protection was disabled by setting `/proc/sys/kernel/sched_rt_runtime_us to -1`.

2.2 Hardware

The hardware that was used for executing our tests is the Freescale QorIQP 1021 Modular Development System (MDS) board from Freescale with the following characteristics:

- Using the P1021 QorIQ™ communication processor.
  - Power Architecture (P1021) dual core e500 processor running at 800 MHz (for the tests in this report, we disable one of the cores). As we use one core only, the results should be the same as on a P1012 board. The only difference between these two processors is the number of cores.
  - L1 Cache: 32KB instruction and 32KB data cache (for each core)
  - L2 Cache: 256KB (shared between cores, but tests run with one core only). Eight-way set-associative cache organization with 32-byte cache lines.
  - 512MB DDR3 RAM (SODIMM) with ECC support running at 800MHz

3 Evaluation results summary

On this PowerPC platform, we were not able to do the interrupt tests because things are a bit different than other platforms. There is the flattened device tree system (dts/dtb files) which passes hardware information to the kernel and which is used to manage resources for drivers.

This should, in theory, simplify how to let your driver be hardware agnostic. However, the special calls that are made to do so deviate a lot from the standard PNP system that normal drivers use.

As a result, we did not achieve to get our interrupt test working on this platform. Also, the platform was not that stable; for example, the kernel could hang while accessing the SD flash device.

As no interrupt tests were done, we can't conclude much about real-time performance. Concerning the other tests, they were pretty stable. Remark that on this platform there are no System Management Interrupts (SMI) like the ones generated by x86 BIOSes. Clock tick duration is quite long and also semaphores can introduce some extra-long latencies.

3.1 Positive points

- No license fees
- Source code available
- Extensible

3.2 Negative points

- The real-time characteristics of the OS are present only when everything is configured and built correctly (and not for all drivers)
- GPL license is not completely free and investment is required to build a marketable system. For instance, though demo systems can be built quickly with Linux, the debugging, tuning and verification required to build a stable system ready for long-term use is much more difficult.
- Setting up a complete embedded target from scratch is a daunting task.

3.3 Ratings

For a description of the ratings, see [Doc. 3].

RTOS Architecture	0	6	10
OS Documentation	0	4	10
OS Configuration	0	6	10
Internet Components	0	10	10
Development Tools	0	6	10
Installation and BSP	0	4	10
Test Results	0	4	10
Support	0	N.A.	10

Although [Doc. 3] gives a description of the ratings, comparison with other reports on other OS should help you understand the scoring.