

RowboPERF User Guide



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RowboPERF User Guide - October 26, 2010

About this manual

This document describes how to install and work with rowboPerf application included in Texas Instruments' Android FroYo DevKit release for OMAP35x, AM37x, AM35x platforms running Android. RowboPERF is the collection of TI's performance and Demo applications for android. The document contains instructions to:

- Install the rowboPerf to android root file system
- Running RowboPERF application

Installation

The RowboPERF application is already integrated to the pre-built file systems provided as part of Android FroYo DevKit. When building from sources, RowboPERF applications need to be integrated to the filesystem before preparing the rootfs tarball.

- Extract the Performance_Apps.tar.gz to some suitable directory

```
#> tar -xvzf ~/Performance_Apps.tar
```

- Assume <rowboat-source>/out/target/product/omap3evm/android_rootfs is the android rootfs directory, Invoke the install_rowboperf.sh script provided inside the RowboPERF package pr android_rootfs directory as arguement.

```
#> cd ~/Performance_Apps
#> ./install_rowboperf.sh
<rowboat-source>/out/target/product/omap3evm/android_rootfs
```

Package Contents

The directory structure of rowboPERF package is listed below

```
Performance_Apps
|-- 0xbench
|   |-- armeabi
|       |-- bench_bind
|       |-- bench_cascade_fcntl
|       |-- bench_cascade_flock
|       |-- bench_cascade_mutex
|       |-- bench_chdir
|       |-- bench_close
|       |-- bench_close_tcp
```

```
| | |-- bench_connection
| | |-- bench_dup
| | |-- bench_exec
| | |-- bench_exit
| | |-- bench_exp
| | |-- bench_fcntl
| | |-- bench_fcntl_ndelay
| | |-- bench_file_lock
| | |-- bench_fork
| | |-- bench_getenv
| | |-- bench_getpeername
| | |-- bench_getpid
| | |-- bench_getrusage
| | |-- bench_getsockname
| | |-- bench_gettimeofday
| | |-- bench_isatty
| | |-- bench_listen
| | |-- bench_localtime_r
| | |-- bench_log
| | |-- bench_longjmp
| | |-- bench_lrand48
| | |-- bench_lseek
| | |-- bench_malloc
| | |-- bench_memcpy
| | |-- bench_memmove
| | |-- bench_memrand
| | |-- bench_memset
| | |-- bench_mktime
| | |-- bench_mmap
| | |-- bench_mprotect
| | |-- bench_msync
| | |-- bench_munmap
| | |-- bench_mutex
| | |-- bench_nop
| | |-- bench_open
| | |-- bench_pipe
| | |-- bench_poll
| | |-- bench_pread
| | |-- bench_pthread_create
| | |-- bench_pwrite
| | |-- bench_read
| | |-- bench_realpath
| | |-- bench_recurse
| | |-- bench_select
| | |-- bench_setsockopt
| | |-- bench_sigaction
| | |-- bench_siglongjmp
```

```
| | |-- bench_signal
| | |-- bench_sigprocmask
| | |-- bench_socket
| | |-- bench_socketpair
| | |-- bench_stat
| | |-- bench_strcasecmp
| | |-- bench_strchr
| | |-- bench_strcmp
| | |-- bench_strcpy
| | |-- bench_strftime
| | |-- bench_strlen
| | |-- bench_strtol
| | |-- bench_system
| | |-- bench_time
| | |-- bench_times
| | |-- bench_ubench_arithoh
| | |-- bench_ubench_context1
| | |-- bench_ubench_dhry2
| | |-- bench_ubench_dhry2reg
| | |-- bench_ubench_double
| | |-- bench_ubench_execl
| | |-- bench_ubench_float
| | |-- bench_ubench_fstime
| | |-- bench_ubench_hanoi
| | |-- bench_ubench_int
| | |-- bench_ubench_long
| | |-- bench_ubench_looper
| | |-- bench_ubench_pipe
| | |-- bench_ubench_register
| | |-- bench_ubench_short
| | |-- bench_ubench_spawn
| | |-- bench_ubench_syscall
| | |-- bench_ubench_whetstone-double
| | |-- bench_write
| | |-- bench_writev
| |-- `-- Benchmark-release.apk
|-- 3D
| |-- libPVRShell_ChameleonMan.so
| |-- libPVRShell_Coverflow.so
| |-- libPVRShell_Shaders.so
| |-- libPVRShell_Vase.so
| |-- OGLLES2ChameleonMan-release.apk
| |-- OGLLES2Coverflow-release.apk
| |-- OGLLES2Shaders-release.apk
| |-- `-- OGLLESVase-release.apk
|-- install_rowboperf.sh
|-- Launcher2
```

```

|   `-- Launcher2.apk
|-- rowboatBench
|   `-- rowboat.benchmark.runner-debug.apk
|-- RowboPERF
|   |-- bin
|   |   |-- armeabi
|   |   |   |-- dhrystone
|   |   |   |-- dhrystonereg
|   |   |   |-- linpack
|   |   |   `-- whetstone
|   |   `-- armeabi-v7a
|   |       |-- dhrystone
|   |       |-- dhrystonereg
|   |       |-- linpack
|   |       `-- whetstone
|   `-- RowboPERF.apk
`-- StorageIO
    `-- StorageIO.apk

```

Detailed descriptions about each component are listed below



Oxbench

Oxbench is a comprehensive benchmark suite by Oxlab and it integrates a series of benchmarks for Android system.

There are currently 16 included benchmarks. Two for arithmetic performance, seven for 2D rendering, four for 3D rendering, one for Dalvik, and two native benchmarks for system performance

Arithmetic

1. Linpack

The Linpack Benchmark make use of a general numerical linear algebra operation to test the device's ability to perform floating point operations (MFLOPS). For detail please refer to Wikipedia, netlib.org, cs.cmu.edu. The original source can be found online here: [Source code](#).

2. Scimark2

The Scimark2 Benchmark Suite includes several scientific calculation (including FFT, MonteCarlo ..etc) for testing the device's ability to perform floating point operations (MFLOPS). For detail please refer to [nist.gov](#).

2D

1. Canvas Redraw

Use random color to redraw canvas repeatedly, and calculate the refresh rate. Note that the refresh rate of this benchmark should (may) be bounded by the device's vertical synchronization (vsync). (60fps for many Android phones, including Nexus One, HTC Hero, HTC Desire)

2. Draw Circle

A simple 2D animation program. Calculate the refresh rate.

3. DrawRect

Repeatedly add random colored, size rectangles on canvas.

4. DrawCircle2

Repeatedly render random colored, size circles on canvas.

5. DrawArc

Simple 2D animation.

6. DrawText

Calculate text rendering speed.

7. DrawImage

Calculate picture rendering speed.

3D

1. GL Cube

A sample program from the Android API Demo that uses OpenGL ES to render a rotating Rubik's Cube.

2. GL Teapot

Use OpenGL ES to render a rotating Utah Teapot (Wikipedia). Adapted from android-utah-teapot project (which uses source code from Android SDK sample programs and iPhone SDK sample programs).

3. NeHe Lesson08

A rotating 3D cube with textured applied and alpha blending enabled. For detail please refer to [nehe.gamedev.net\(blending\)](http://nehe.gamedev.net/blending). For source code and explanation please refer to NeHe lesson08.

4. NeHe Lesson16

A rotating 3D cube with textured applied and GLFog enabled. For detail please refer to [nehe.gamedev.net\(Cool look fog\)](http://nehe.gamedev.net(Cool look fog)). For source code and explanation please refer to NeHe lesson16.

Dalvik

1. Garbage Collection

Test the performance of the garbage collection mechanism on the Dalvik VM. For detail please refer to hpl.hp.com. The original source can be found online here: [GCBench.java](#)

Native

1. LibMicro

A portable set of microbenchmarks that executes abundant system calls to measure the performance of different system and library calls (bionic). Since calling system functions directly is required, this benchmark depends on a set of executable files that needs to be deployed in advance. (Which requires root permission of your device) More information on LibMicro can be found here: [Project LibMicro, OpenSolaris](#)

2. BYTE UnixBench

A set of benchmark cases originally started development in 1983 updated by many over the years. Byte UnixBench is intended to provide indication on the performance of unix-like system. More information on Byte UnixBench can be found on [Google Code](#).

ARM Benchmarks

Three important benchmark applications Dhrystone, Whetstone and Linpack are included to test CPU performance

Dhrystone

The Dhrystone benchmark was designed to test performance factors important in non numeric systems programming (operating systems, compilers, wordprocessors, etc.). Some Important fetures of Dhrystone are,

- it contains no floating point operations;
- a considerable percentage of time is spent in string functions making the test very dependent upon the way such operations are performed (e.g. by in-line code, routines written in assembly language, etc.) making it susceptible to manufacturers 'tweaking' of critical routines;
- it contains hardly any tight loops so in the case of very small caches the majority of instruction accesses are will be misses; however, the situation changes radically as soon as the cache reaches a critical size and can hold the main measurement loop;
- only a small amount of global data is manipulated (as opposed to Whetstone).

Whetstone

The Whetstone benchmark was the first intentionally written to measure computer performance and was designed to simulate floating point numerical applications:

- it contains a large percentage of floating point data and instructions;
- a high percentage of execution time (approximately 50%) is spent in mathematical library functions;
- the majority of its variables are global and the test will not show up the advantages of architectures such as RISC where the large number of processor registers enhance the handling of local variables;
- Whetstone contains a number of very tight loops and the use of even fairly small instruction caches will enhance performance considerably;

Linpack

The Linpack benchmark was derived from a real application which originated as a collection of linear algebra subroutines in Fortran. As one would expect it tests floating point performance and results are presented in Mflops (millions of floating point instructions per second):

- it has a large percentage of floating point operations (note that division is not used);
 - it uses no mathematical functions (in contrast to Whetstone);
 - there are no global variables; operations being carried out on local variables or an array passed to subroutines as a parameter;
 - it operates on a two-dimensional array and when comparing results care must be taken to ensure that the same array size was used;
 - results are for single or double precision operations (which should be specified);
 - a large percentage (over 70%) of the execution time is spent within a single function where even a small instruction cache can alter results considerably;
-

rowboatBench

rowboatBench is another set of performance test applications for the Android Platform. It is developed by mentor graphics and it contains the following tests

* 2D graphics:

1. Archs
2. Fill Rate
3. Circles
4. Rectangles
5. Bitmap Animation
6. Text

* 3D graphics:

1. Colored Cube
2. Lighting
3. Textures
4. AlphaBlending
5. glFog
6. Reflection effect
7. Multitexturing
8. Utah teapot
9. GlxGears
10. Stars
11. Sphere mapping
12. Bezier surface

* CPU:

1. Dhrystone
2. Whitestone
3. Himeno
4. Spectral normalization

3D Demos

Four 3D demos from Imagination Tec are included to show the 3D performance of Android system.



Chameleon Man

The Chameleon Man demo shows a matrix skinned character in combination with DOT3 per pixel lighting. Matrix skinning is the act of animating a vertex over time given a set (palette) of matrices and a known set of blend weights assigned to those matrices. The Chameleon Man model has 19 bones and an animation cycle of 16 frames.



Shader Library Browser

Demo illustrating a collection of Shader Effects including procedural texturing effects, environment based effects and complex lighting applied to a collection of procedurally generated geometry objects.

Cover Flow

In this demo, the highly popular Cover Flow-style concept of browsing through a music collection is implemented at 60+ FPS rates with minimal power consumption and maximal eye-candy. This demo shows the typical mirror effects and a per-pixel specular highlight together with a variety of transition effects including a high-performance blur effect.



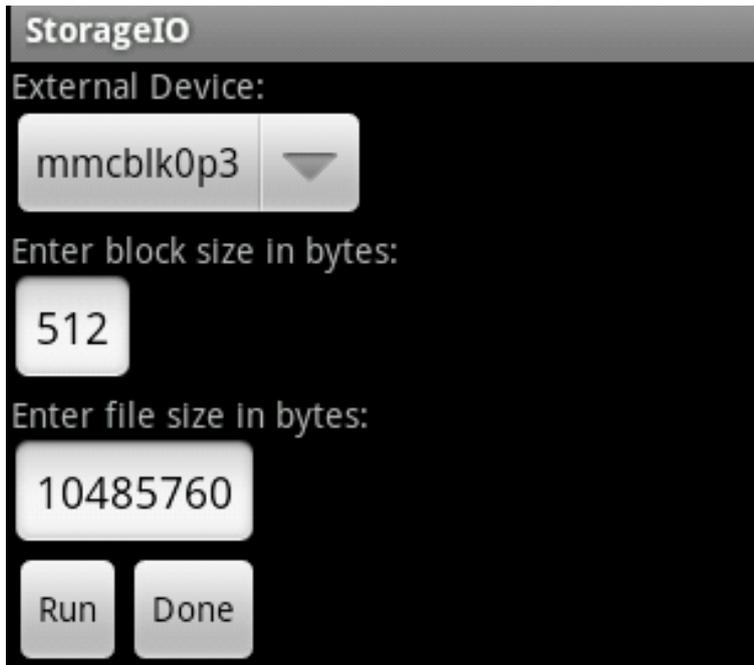
Vase

This demo shows a transparent vase with dynamic reflections on its metallic sections.

Storage IO

This Application measures the read and write speed of the selected mounted device.

The SD card partition which is used as the EXTERNAL STORAGE is already mounted on the File System. So for measuring the SD card speed, select the device node corresponding the SD card partition from the list and run the test. Other external storage devices need to be mounted via adb shell or console before executing this test.

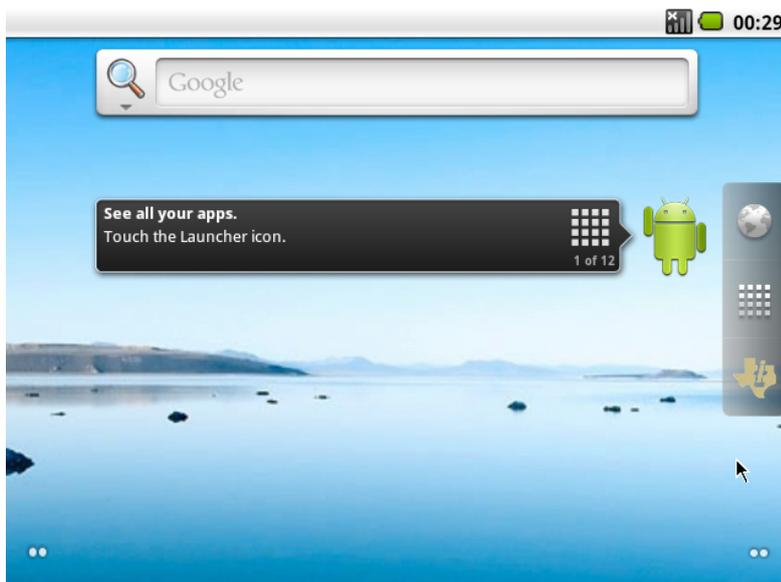


Limitations:

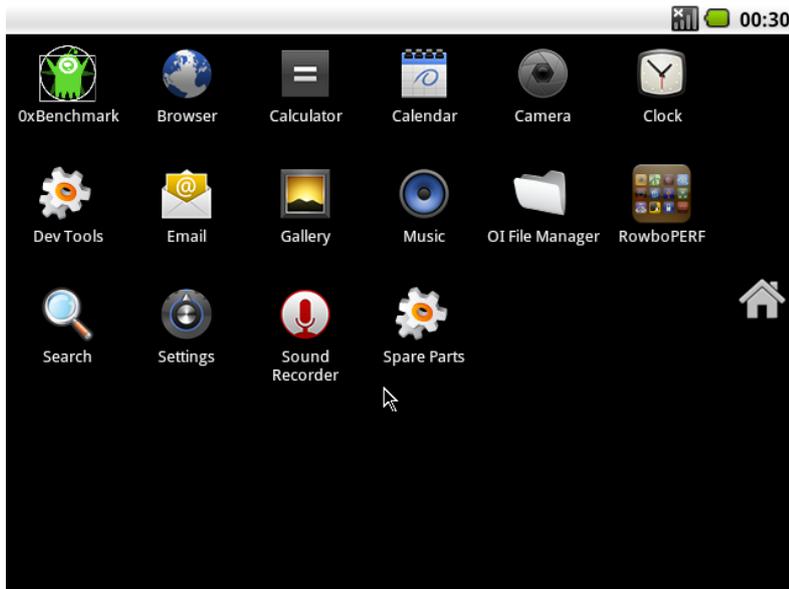
1. If not already mounted, you have to manually mount the node you want to test (via adb) because mount operations are not allowed within the app environment.
2. You have to manually mount the node, even if it is already mounted by vold. This is because when vold automounts a node the node lists as `/dev/block/vold/<partition>`, and the app is not able to figure out how to map this device information to the block device associated with it so it is not able to determine the mount point.

Running RowboPERF

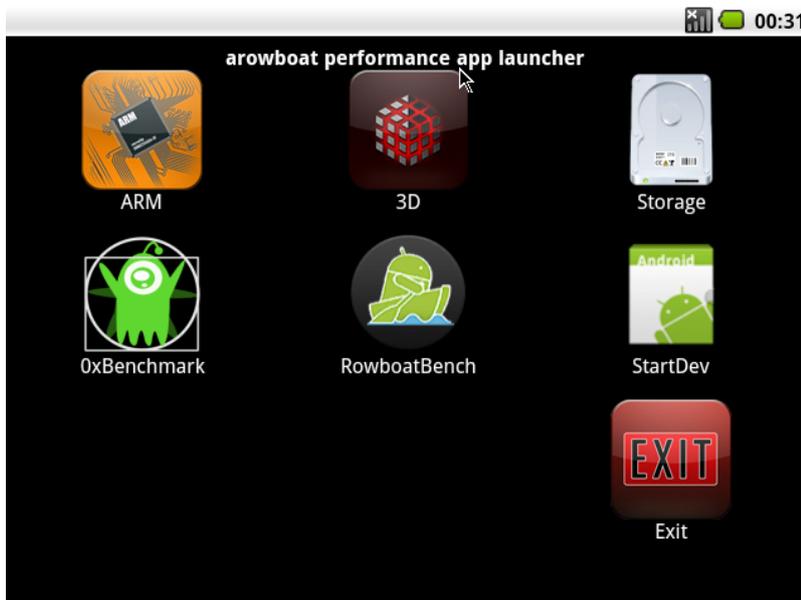
After booting up Android, you can find the RowboPERF launcher on the home screen, left to the launcher button.



Else you can find the RowboPERF icon on the Launcher Screen



After you launch RowboPERF the resulting window looks like below



From this menu you can navigate all the RowboPERF packages described in the previous section.

Versioning

This is Version 1.0

Technical Support and Product Updates

For further information or to report any problems, contact <http://e2e.ti.com> "Android" or <http://support.ti.com>.

For community support join <http://groups.google.com/group/rowboat>

For IRC #rowboat on irc.freenode.net

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