

oERV 专项测试拾遗：次世代 LTP 执行器 Kirk

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内容概述

- openEuler 专项测试介绍
- LTP & Kirk 介绍
- 为什么需要新的测试执行器
- 如何使用 Kirk
- 一些已知问题

openEuler 专项测试

必要性?

- 面向数字基础设施的开源操作系统
- 有大量下游商业发行版
- 有严格的质量保障体系
 - 功能/性能/安全/虚拟化/内核/长稳/兼容性/etc
- SIG-QA 测试工具
 - RadiaTest, Compass CI, mugen, etc
- RISC-V 合入主线支持

LTP

全称 Linux Test Project, 是由 SGI 发起, 和 OSDL 和 Bull 等联合开发的项目, 并由 IBM, Cisco, Fujitsu, SUSE, Red Hat, Oracle 等维护, 其目的是向开源社区提供用于验证 Linux 可靠性、健壮性和稳定性的测试套件。自 2001 年四月初次发布至今, 项目本身已有二十余年历史。

截止 20230929 版本, LTP 已经有:

- 33 个测试套
- 2411 个测试用例
- 约两万个测试点 (计入结果统计的功能、标志、返回值等测试)

Homepage: <https://linux-test-project.github.io/>

GitHub: [linux-test-project/ltptest](https://github.com/linux-test-project/ltptest)

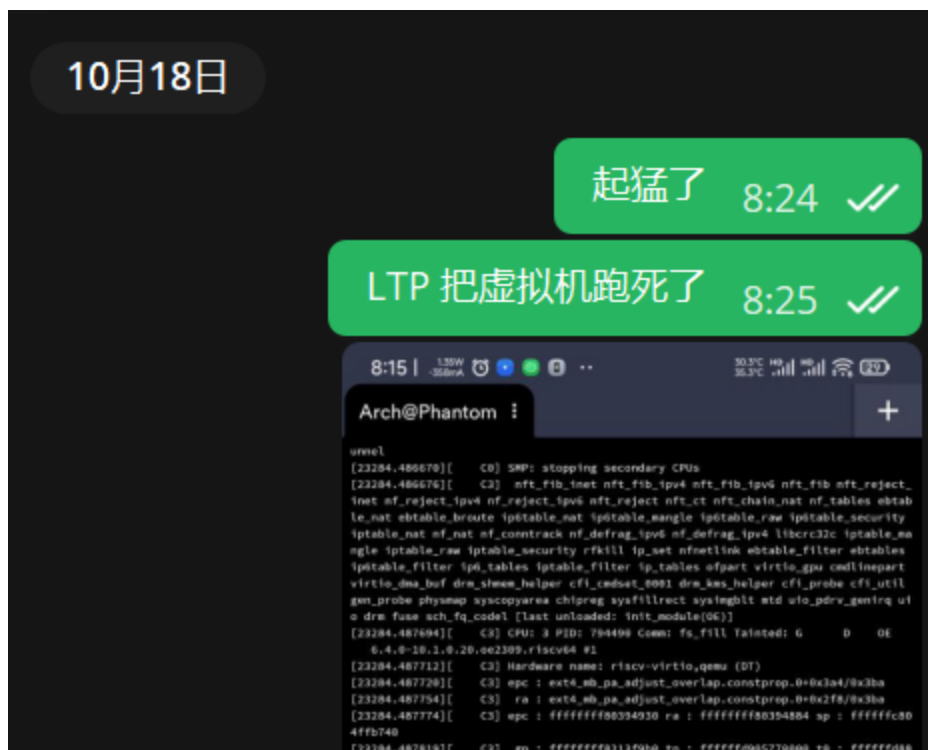
laokz - OERV LTP 测试简介 | [av824186799](#)

目前的 oERV LTP 测试方式 (23.03 ~ 23.09)



为什么需要新的测试执行器

缘起·「发生甚么事了」



runltp 本身存在的问题

Andrea Cervesato at SUSE Labs Conference 2022:

- 仅能在受测机上运行，无法处理 kernel panic/oops
- 代码混乱，难以阅读，甚至难以调试 (bash + C)
- 生成的报告难以解析 (logs + HTML)
- 部分选项和功能使用率很低

2014 年 LTP 引入了一套新的 API，总计约 5700 个 commit，其中与 runltp 相关的仅仅 31 个。

Kirk

Kirk 是 [runltp-ng](#) 的一个分支，目标是将多个 Linux 测试框架整合进一个工具中，提供 QEMU, SSH, LTX 远程测试能力，同时也允许并发执行测试用例。

Kirk 于 LTP 20230929 版本正式取代 runltp-ng，随 LTP 一起发布。

GitHub: [linux-test-project/kirk](https://github.com/linux-test-project/kirk)

Kirk - All-in-one Linux Testing Framework

options:

- h, --help show this help message and exit
- version, -V Print current version
- verbose, -v Verbose mode
- no-colors, -n If defined, no colors are shown
- tmp-dir TMP_DIR, -d TMP_DIR
Temporary directory
- restore RESTORE, -R RESTORE
Restore a specific session
- env ENV, -e ENV List of key=value environment values separated by ':'
- skip-tests SKIP_TESTS, -i SKIP_TESTS
Skip specific tests
- skip-file SKIP_FILE, -I SKIP_FILE
Skip specific tests using a skip file (newline separated item)
- suite-timeout SUITE_TIMEOUT, -T SUITE_TIMEOUT
Timeout before stopping the suite
- exec-timeout EXEC_TIMEOUT, -t EXEC_TIMEOUT
Timeout before stopping a single execution
- run-suite [RUN_SUITE ...], -r [RUN_SUITE ...]
List of suites to run
- run-command RUN_COMMAND, -c RUN_COMMAND
Command to run
- workers WORKERS, -w WORKERS
Number of workers to execute tests in parallel
- force-parallel, -p Force parallelization execution of all tests
- sut SUT, -s SUT System Under Test parameters. For help please use '-s help'
- framework FRAMEWORK, -f FRAMEWORK
Framework parameters. For help please use '-f help'
- json-report JSON_REPORT, -j JSON_REPORT
JSON output report

简单小热身

在本机环境上运行 `math` 测试套：

```
[openeuler@openeuler ltp]$ ./kirk -r math  
Host information
```

```
System: Linux  
Node: openeuler  
Kernel Release: 6.4.0-10.1.0.20.oe2309.riscv64  
Kernel Version: #1 SMP Sat Oct 7 06:19:28 UTC 2023  
Machine Architecture: riscv64  
Processor: riscv64
```

```
Temporary directory: /tmp/kirk.openeuler/tmpggkjfvry
```

```
Connecting to SUT: host  
Starting suite: math  
abs01: pass (0.209s)  
atof01: pass (0.148s)  
float_bessel: pass (15.960s)  
float_exp_log: pass (10.219s)  
float_iperb: pass (4.228s)  
float_power: pass (8.152s)  
float_trigo: pass (10.339s)  
fptest01: pass (0.081s)  
fptest02: pass (0.085s)  
nextafter01: pass (0.068s)
```

```
Execution time: 55.786s
```

```
Suite Name: math
Total Run: 10
Total Runtime: 49.490s
Passed Tests: 22
Failed Tests: 0
Skipped Tests: 0
Broken Tests: 0
Warnings: 0
Kernel Version: Linux 6.4.0-10.1.0.20.oe2309.riscv64 #1 SMP Sat Oct 7 06:19:28 UTC 2023
CPU: riscv64
Machine Architecture: riscv64
RAM: 8120392 kB
Swap memory: 0 kB
Distro: openEuler
Distro Version: 23.09

Disconnecting from SUT: host
[openeuler@openeuler ltp]$
```

想看详细输出？ 没问题！

```
[openeuler@openeuler ltp]$ ./kirk -r math -v  
Host information
```

```
System: Linux  
Node: openeuler  
Kernel Release: 6.4.0-10.1.0.20.oe2309.riscv64  
Kernel Version: #1 SMP Sat Oct 7 06:19:28 UTC 2023  
Machine Architecture: riscv64  
Processor: riscv64
```

```
Temporary directory: /tmp/kirk.openeuler/tmpntdda51f
```

```
Connecting to SUT: host  
Starting suite: math
```

```
===== abs01 =====
```

```
command: abs01
```

```
abs01      1  TPASS   : Test passed  
abs01      2  TPASS   : Test passed  
abs01      3  TPASS   : Test passed
```

```
Summary:
```

```
passed     3  
failed     0  
broken     0  
skipped    0  
warnings   0
```

```
Duration: 0.052s
```

输出 json 文件

```
$ ./kirk -r math -v -j ~/report.json
```

```
{
  "test_fqn": "nextafter01",
  "status": "fail",
  "test": {
    "command": "nextafter01",
    "arguments": [],
    "log": "nextafter01    1  TPASS  : Test passed\nnextafter01    2  TPASS  : Test passed\nnextafter01    3  TPASS  : Test passed\n",
    "retval": [
      "0"
    ],
    "duration": 0.05034971237182617,
    "failed": 0,
    "passed": 3,
    "broken": 0,
    "skipped": 0,
    "warnings": 0,
    "result": "fail"
  },
  "stats": {
    "runtime": 48.59621572494507,
    "passed": 22,
    "failed": 0,
    "broken": 0,
    "skipped": 0,
    "warnings": 0
  },
  "environment": {
    "distribution": "openEuler",
    "distribution_version": "23.09",
    "kernel": "Linux 6.4.0-10.1.0.20.oe2309.riscv64 #1 SMP Sat Oct  7 06:19:28 UTC 2023",
    "arch": "riscv64",
    "cpu": "riscv64",
    "swap": "0 kB",
    "RAM": "8120392 kB"
  }
}
```

从中断处恢复执行

```
[openeuler@openeuler ltp]$ ls -alh /tmp/kirk.openeuler/  
total 0  
drwxr-xr-x  7 openeuler openeuler 160 Dec 14 02:01 .  
drwxrwxrwt 11 root      root      220 Dec 14 01:56 ..  
lrwxrwxrwx  1 openeuler openeuler  31 Dec 14 02:01 latest -> /tmp/kirk.openeuler/tmpzob_dpo  
[openeuler@openeuler ltp]$ cat /tmp/kirk.openeuler/latest/executed  
math::abs01  
math::atof01
```

```
$ ./kirk -r math -R /tmp/kirk.openeuler/latest/
```

利用 Kirk 提供的 SUTs (System Under Tests) 进行测试

```
./kirk -s help
--sut option supports the following syntax:

    <name>:<param1>=<value1>:<param2>=<value2>:...

Supported plugins: | host | ltx | qemu | ssh |

host has not configuration

ltx configuration:
  stdin: transport stdin file
  stdout: transport stdout file

qemu configuration:
  image: qemu image location
  kernel: kernel image location
  initrd: initrd image location
  user: user name (default: '')
  password: user password (default: '')
  prompt: prompt string (default: '#')
  system: system architecture (default: x86_64)
  ram: RAM of the VM (default: 2G)
  smp: number of CPUs (default: 2)
  serial: type of serial protocol. isa|virtio (default: isa)
  virtfs: directory to mount inside VM
  options: user defined options

ssh configuration:
  host: IP address of the SUT (default: localhost)
  port: TCP port of the service (default: 22)
  user: name of the user (default: root)
  password: root password
  timeout: connection timeout in seconds (default: 10)
  key_file: private key location
  reset_command: command to reset the remote SUT
  sudo: use sudo to access to root shell (default: 0)
```

直接使用 Kirk 调用 QEMU

需要先对虚拟机镜像进行处理，添加串口配置：

- 编辑 `/etc/default/grub`，向 `GRUB_CMDLINE_LINUX` 中添加
 - `console=$tty_name, console=tty0`
- 重新生成 GRUB 配置
 - `grub-mkconfig -o /boot/grub/grub.cfg`

使用 Kirk 启动虚拟机执行测试：

```
$ kirk -r $testsuite -s qemu:image=image.qcow2
```

* QEMU SUT 目前在 oERV 不可用。

使用 SSH 连接至远端机器进行测试

```
$ kirk -r $testsuite -s ssh:host=$host:port=$port:user=$user:password=$password:key_file=~/.ssh/id_rsa:reset_command=reboot
```

前置条件

- 手动安装 `asyncssh` 包: `pip install asyncssh` (推荐在 `venv` 中进行)
- SSH 通过公私钥鉴权, 需要在受测机上先行配置主控机公钥
(`~/.ssh/authorized_keys`)
- 需要先行在主控机上连接一次受测机/添加至 `known_hosts`
- 需要受测机已安装有 LTP 且安装路径为默认的 `/opt/ltp`
 - 是的, Kirk 现在还不能直接通过 SSH 把测试用例传输到受测机直接执行
 - 如果有这个需求, 需要使用 QEMU SUT 并通过 `virtfs` 选项直接将 LTP 目录挂载进虚拟机内

已知问题

- 使用 Kirk 代替 runltp 直接在本机运行时，由于部分测试用例会触发 OOM，可能会把 Kirk 进程杀死导致测试中断

```
[ 2502.666057][T20104] [ 20077] 0 20077 13305 12873 135168 0 0 memcg_process_s
[ 2502.666281][T20104] [ 20080] 0 20080 13305 12851 135168 0 0 memcg_process_s
[ 2502.666526][T20104] [ 20083] 0 20083 13305 12883 135168 0 0 memcg_process_s
[ 2502.666808][T20104] [ 20086] 0 20086 13305 12896 135168 0 0 memcg_process_s
[ 2502.667052][T20104] [ 20089] 0 20089 13305 12876 139264 0 0 memcg_process_s
[ 2502.667293][T20104] [ 20092] 0 20092 13305 12878 139264 0 0 memcg_process_s
[ 2502.667575][T20104] [ 20095] 0 20095 13305 12882 139264 0 0 memcg_process_s
[ 2502.667940][T20104] [ 20098] 0 20098 13305 12881 135168 0 0 memcg_process_s
[ 2502.668208][T20104] [ 20101] 0 20101 13305 12840 135168 0 0 memcg_process_s
[ 2502.668432][T20104] [ 20104] 0 20104 13305 12378 131072 0 0 memcg_process_s
[ 2502.668745][T20104] [ 20107] 0 20107 13305 9152 102400 0 0 memcg_process_s
[ 2502.668986][T20104] [ 20110] 0 20110 13305 12890 135168 0 0 memcg_process_s
[ 2502.669262][T20104] [ 20113] 0 20113 13305 12907 135168 0 0 memcg_process_s
[ 2502.669523][T20104] [ 20116] 0 20116 13305 12840 135168 0 0 memcg_process_s
[ 2502.669782][T20104] [ 20119] 0 20119 13305 12896 135168 0 0 memcg_process_s
[ 2502.670044][T20104] [ 20122] 0 20122 13305 12862 135168 0 0 memcg_process_s
[ 2502.670322][T20104] [ 20125] 0 20125 13305 12908 135168 0 0 memcg_process_s
[ 2502.670586][T20104] [ 20128] 0 20128 13305 12876 135168 0 0 memcg_process_s
[ 2502.670866][T20104] [ 20131] 0 20131 13305 12894 135168 0 0 memcg_process_s
[ 2502.671132][T20104] [ 20134] 0 20134 13305 12855 135168 0 0 memcg_process_s
[ 2502.671419][T20104] [ 20137] 0 20137 13305 12887 135168 0 0 memcg_process_s
[ 2502.671649][T20104] [ 20140] 0 20140 13305 12866 135168 0 0 memcg_process_s
[ 2502.672037][T20104] [ 20143] 0 20143 13305 12885 135168 0 0 memcg_process_s
[ 2502.672268][T20104] [ 20145] 0 20145 631 288 36864 0 0 sleep
[ 2502.672536][T20104] oom-kill:constraint=CONSTRAINT_NONE,nodemask=(null),cpuset=/,mems_allowed=0,global_oom,task_memcg=/system.slice/sshd.service,task=python3,pid=974,uid=0
[ 2502.673178][T20104] Out of memory: Killed process 974 (python3) total-vm:313480kB, anon-rss:134556kB, file-rss:9216kB, shmem-rss:0kB, UID:0 pgtables:344kB oom_score_adj:0

[root@openeuler ~]#
```

已知问题

- QEMU SUT 目前暂时无法启动 openEuler RISC-V 虚拟机
- SSH SUT 仍需要受测机已安装 LTP
- 在同一台机器上并行运行测试用例可能会导致软死锁或内核崩溃（不推荐此用法）

谢谢大家！