

高级操作系统 实验报告

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一、 实验内容

HyperKernel

Commuter

二、 HyperKernel

1. 实验环境

Ubuntu 17.10 虚拟机

GCC : 7.2

2. 运行测试

安装 QEMU, Binutil

make && make qemu

```
ns: dhcp initializing
ns: inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.2
init: starting httpd
init: starting vncd
init: starting sh
httpd: waiting for http connections...
vncd: 1322 8x16 glyphs
vncd: waiting for vnc connections...
$ ls
.          1 1 4096
..         1 1 4096
bench     2 2 16552
bounce    2 3 12144
cat        2 4 12760
cpio       2 5 14488
daytime    2 6 13416
echo       2 7 12112
dmesg      2 8 12272
fault      2 9 12808
freelist   2 10 13696
```

3. 验证

安装 LLVM

Sudo apt-get install llvm-5.0 llvm-5.0-dev

安装 Clang

Sudo apt-get install clang-5.0 clang-5.0-dev

安装 Z3

需要注意的是，需要配置安装的位置，从而指定 Z3 包的位置，否则出现找不到 z3 的情况。

```
python scripts/mk_make.py --  
prefix=/home/zhenyanjie/gaowei_zhenbao/os/z3install2 -  
-python --  
pypkgdir=/home/zhenyanjie/gaowei_zhenbao/os/z3install2  
/lib/python-2.7/site-packages
```

运行测试

```
cg@ubuntu:~/workspace/os/test/hv6$ make hv6-verify  
CC_IR      o.x86_64/hv6/device.ll  
CC_IR      o.x86_64/hv6/fd.ll  
CC_IR      o.x86_64/hv6/invariants.ll  
CC_IR      o.x86_64/hv6/ioport.ll  
CC_IR      o.x86_64/hv6/ipc.ll  
CC_IR      o.x86_64/hv6/mmap.ll  
CC_IR      o.x86_64/hv6/proc.ll  
CC_IR      o.x86_64/hv6/syscall.ll  
CC_IR      o.x86_64/hv6/sysctl.ll  
CC_IR      o.x86_64/hv6/vm.ll  
GEN        o.x86_64/hv6/hv6.ll  
C++        o.x86_64/irpy/compiler/PyEmitter.o  
C++        o.x86_64/irpy/compiler/Emitter.o  
C++        o.x86_64/irpy/compiler/PyLLVMEmitter.o  
C++        o.x86_64/irpy/compiler/irpy.o  
C++        irpy/compiler/irpy  
IRPY       o.x86_64/hv6/hv6.py  
Parsing took 30.444 ms.  
Emitting took 12471.6 ms.  
PY2        hv6-verify  
Using z3 v4.8.0.0  
.....
```

由于时间较长，于是单独测试了样例。

```
cg@ubuntu:~/workspace/os/test/hv6$ make hv6-verify -- -v --failfast HV6.test_sys_dup  
PY2        hv6-verify  
Using z3 v4.8.0.0  
test_sys_dup (__main__.HV6) ... ok  
-----  
Ran 1 test in 21.152s  
OK
```

```

cgn@ubuntu:~/workspace/os/test/hv6$ make hv6-verify -- -v --failfast HV6.test_sys_alloc_frame
PY2      hv6-verify
Using z3 v4.8.0.0
test_sys_alloc_frame (__main__.HV6) ... ok

-----
Ran 1 test in 31.555s

OK
cgn@ubuntu:~/workspace/os/test/hv6$ make hv6-verify -- -v --failfast HV6.test_sys_free_frame
PY2      hv6-verify
Using z3 v4.8.0.0
test_sys_free_frame (__main__.HV6) ... ok

-----
Ran 1 test in 14.744s

OK

```

```

cgn@ubuntu:~/workspace/os/test/hv6$ make hv6-verify -- -v --failfast HV6.test_sys_set_runnable
PY2      hv6-verify
Using z3 v4.8.0.0
test_sys_set_runnable (__main__.HV6) ... ok

-----
Ran 1 test in 4.728s

I
OK
cgn@ubuntu:~/workspace/os/test/hv6$ make hv6-verify -- -v --failfast HV6.test_sys_map_pml4
PY2      hv6-verify
Using z3 v4.8.0.0
test_sys_map_pml4 (__main__.HV6) ... ok

-----
Ran 1 test in 15.009s

OK

```

三、Commuter

Commuter 安装过程繁杂困难，重点介绍下 BUG

1. 系统

一开始采用 17.10，但是最后发现编译 linux-mtrace 的时候，总是报
pic 错误，调试不过，就换成了 16.04

2. Z3

直接使用 setup 安装，发现 Z3 编译不通过，通过添加—z3-commit

add8d26，即最新的版本通过

3. 安装 mtrace

由于系统没有安装 pkg-config，一直报 libelf 错，以为是 libelfin 安装错误，卡了很久，最后发现是 pkg-config 没装。

4. 安装 linux-mtrace

开始在 17.10 安装一直报错，最后在 16.04 下使用 gcc 5.4 安装成功。

5. Sv6

SV6 下载之后，需要修改几个地方，参考谭院士的修改

[修改了 timeconst.pl373 行@val](#) 和添加了

compiler-gcc5.h。

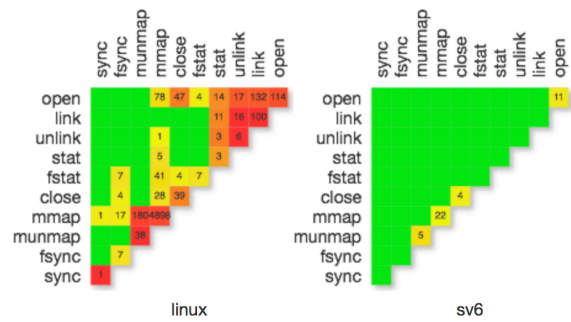
关闭 Werror，-std=c++11，以及修改 thread_local，和 pagefault 问题。

6. 测试运行

产生大量的数据

```
debug.py model.out.034 model.out.073 model.out.112 model.out.151 model.out.190 model.out.229 testgen.c.013 testgen.c.052 testgen.c.091 testgen.c.130 testgen.c.169 testgen.c.208
ext model.out.035 model.out.074 model.out.113 model.out.152 model.out.191 model.out.230 testgen.c.014 testgen.c.053 testgen.c.092 testgen.c.131 testgen.c.170 testgen.c.209
graph.py model.out.036 model.out.075 model.out.114 model.out.153 model.out.192 model.py testgen.c.015 testgen.c.054 testgen.c.093 testgen.c.132 testgen.c.171 testgen.c.210
graph.pyc model.out.037 model.out.076 model.out.115 model.out.154 model.out.193 model.pyc testgen.c.016 testgen.c.055 testgen.c.094 testgen.c.133 testgen.c.172 testgen.c.211
model.out model.out.038 model.out.077 model.out.116 model.out.155 model.out.194 models testgen.c.017 testgen.c.056 testgen.c.095 testgen.c.134 testgen.c.173 testgen.c.212
model.out.000 model.out.039 model.out.078 model.out.117 model.out.156 model.out.195 NOTES testgen.c.018 testgen.c.057 testgen.c.096 testgen.c.135 testgen.c.174 testgen.c.213
model.out.001 model.out.040 model.out.079 model.out.118 model.out.157 model.out.196 par-mem.py testgen.c.019 testgen.c.058 testgen.c.097 testgen.c.136 testgen.c.175 testgen.c.214
model.out.002 model.out.041 model.out.080 model.out.119 model.out.158 model.out.197 par-mtrace.py testgen.c.020 testgen.c.059 testgen.c.098 testgen.c.137 testgen.c.176 testgen.c.215
model.out.003 model.out.042 model.out.081 model.out.120 model.out.159 model.out.198 par-spec.py testgen.c.021 testgen.c.060 testgen.c.099 testgen.c.138 testgen.c.177 testgen.c.216
model.out.004 model.out.043 model.out.082 model.out.121 model.out.160 model.out.199 progress.py testgen.c.022 testgen.c.061 testgen.c.100 testgen.c.139 testgen.c.178 testgen.c.217
model.out.005 model.out.044 model.out.083 model.out.122 model.out.161 model.out.200 progress.pyc testgen.c.023 testgen.c.062 testgen.c.101 testgen.c.140 testgen.c.179 testgen.c.218
model.out.006 model.out.045 model.out.084 model.out.123 model.out.162 model.out.201 README.md testgen.c.024 testgen.c.063 testgen.c.102 testgen.c.141 testgen.c.180 testgen.c.219
model.out.007 model.out.046 model.out.085 model.out.124 model.out.163 model.out.202 setup testgen.c.025 testgen.c.064 testgen.c.103 testgen.c.142 testgen.c.181 testgen.c.220
model.out.008 model.out.047 model.out.086 model.out.125 model.out.164 model.out.203 setup.py testgen.c.026 testgen.c.065 testgen.c.104 testgen.c.143 testgen.c.182 testgen.c.221
model.out.009 model.out.048 model.out.087 model.out.126 model.out.165 model.out.204 sinsym.py testgen.c.027 testgen.c.066 testgen.c.105 testgen.c.144 testgen.c.183 testgen.c.222
model.out.010 model.out.049 model.out.088 model.out.127 model.out.166 model.out.205 sinsym.pyc testgen.c.028 testgen.c.067 testgen.c.106 testgen.c.145 testgen.c.184 testgen.c.223
model.out.011 model.out.050 model.out.089 model.out.128 model.out.167 model.out.206 sintest.py testgen.c.029 testgen.c.068 testgen.c.107 testgen.c.146 testgen.c.185 testgen.c.224
model.out.012 model.out.051 model.out.090 model.out.129 model.out.168 model.out.207 sintest.pyc testgen.c.030 testgen.c.069 testgen.c.108 testgen.c.147 testgen.c.186 testgen.c.225
model.out.013 model.out.052 model.out.091 model.out.130 model.out.169 model.out.208 spec.py testgen.c.031 testgen.c.070 testgen.c.109 testgen.c.148 testgen.c.187 testgen.c.226
model.out.014 model.out.053 model.out.092 model.out.131 model.out.170 model.out.209 spec.pyc testgen.c.032 testgen.c.071 testgen.c.110 testgen.c.149 testgen.c.188 testgen.c.227
model.out.015 model.out.054 model.out.093 model.out.132 model.out.171 model.out.210 split-testgen.py testgen.c.033 testgen.c.072 testgen.c.111 testgen.c.150 testgen.c.189 testgen.c.228
model.out.016 model.out.055 model.out.094 model.out.133 model.out.172 model.out.211 syntest.py testgen.c.034 testgen.c.073 testgen.c.112 testgen.c.151 testgen.c.190 testgen.c.229
model.out.017 model.out.056 model.out.095 model.out.134 model.out.173 model.out.212 syntypes.py testgen.c.035 testgen.c.074 testgen.c.113 testgen.c.152 testgen.c.191 testgen.c.230
model.out.018 model.out.057 model.out.096 model.out.135 model.out.174 model.out.213 syntypes.pyc testgen.c.036 testgen.c.075 testgen.c.114 testgen.c.153 testgen.c.192 testgen.py
model.out.019 model.out.058 model.out.097 model.out.136 model.out.175 model.out.214 TASKS testgen.c.037 testgen.c.076 testgen.c.115 testgen.c.154 testgen.c.193 testgen.pyc
model.out.020 model.out.059 model.out.098 model.out.137 model.out.176 model.out.215 testgen.c testgen.c.038 testgen.c.077 testgen.c.116 testgen.c.155 testgen.c.194 tools
model.out.021 model.out.060 model.out.099 model.out.138 model.out.177 model.out.216 testgen.c.000 testgen.c.039 testgen.c.078 testgen.c.117 testgen.c.156 testgen.c.195 viewer
model.out.022 model.out.061 model.out.100 model.out.139 model.out.178 model.out.217 testgen.c.001 testgen.c.040 testgen.c.079 testgen.c.118 testgen.c.157 testgen.c.196 web
model.out.023 model.out.062 model.out.101 model.out.140 model.out.179 model.out.218 testgen.c.002 testgen.c.041 testgen.c.080 testgen.c.119 testgen.c.158 testgen.c.197 z3util.py
model.out.024 model.out.063 model.out.102 model.out.141 model.out.180 model.out.219 testgen.c.003 testgen.c.042 testgen.c.081 testgen.c.120 testgen.c.159 testgen.c.198 z3util.pyc
model.out.025 model.out.064 model.out.103 model.out.142 model.out.181 model.out.220 testgen.c.004 testgen.c.043 testgen.c.082 testgen.c.121 testgen.c.160 testgen.c.199
model.out.026 model.out.065 model.out.104 model.out.143 model.out.182 model.out.221 testgen.c.005 testgen.c.044 testgen.c.083 testgen.c.122 testgen.c.161 testgen.c.200
model.out.027 model.out.066 model.out.105 model.out.144 model.out.183 model.out.222 testgen.c.006 testgen.c.045 testgen.c.084 testgen.c.123 testgen.c.162 testgen.c.201
model.out.028 model.out.067 model.out.106 model.out.145 model.out.184 model.out.223 testgen.c.007 testgen.c.046 testgen.c.085 testgen.c.124 testgen.c.163 testgen.c.202
model.out.029 model.out.068 model.out.107 model.out.146 model.out.185 model.out.224 testgen.c.008 testgen.c.047 testgen.c.086 testgen.c.125 testgen.c.164 testgen.c.203
model.out.030 model.out.069 model.out.108 model.out.147 model.out.186 model.out.225 testgen.c.009 testgen.c.048 testgen.c.087 testgen.c.126 testgen.c.165 testgen.c.204
model.out.031 model.out.070 model.out.109 model.out.148 model.out.187 model.out.226 testgen.c.010 testgen.c.049 testgen.c.088 testgen.c.127 testgen.c.166 testgen.c.205
model.out.032 model.out.071 model.out.110 model.out.149 model.out.188 model.out.227 testgen.c.011 testgen.c.050 testgen.c.089 testgen.c.128 testgen.c.167 testgen.c.206
model.out.033 model.out.072 model.out.111 model.out.150 model.out.189 model.out.228 testgen.c.012 testgen.c.051 testgen.c.090 testgen.c.129 testgen.c.168 testgen.c.207
```

运行比较慢，选择了其中 6 个系统调用进行测试



12373 conflict-free **68%** 32% 5865 conflicted
18238 total

calls	path	test	id	shared
open_open	...p0	...0	...linux	11 addrs
			...sv6	0 addrs
		...1	...linux	13 addrs
			...sv6	0 addrs
	...p12	...0	...linux	0 addrs
			...sv6	0 addrs
	...p16	...0	...linux	6 addrs
			...sv6	0 addrs
	...p1a	...0	...linux	0 addrs
			...sv6	0 addrs
18228 more...				