KLEE Tutorial

Wednesday, April 03, 2019 2:33 PM

Install docker. See https://docs.docker.com/docker-for-windows/.
Visit http://klee.github.io/docker/ for installing Klee on docker.

```
$ docker pull klee/klee:2.0
$ docker run --rm -ti --ulimit='stack=-1:-1' klee/klee:2.0
```

Tutorial: http://klee.github.io/tutorials/testing-function/

The Program:

```
int get_sign(int x) {
  if (x == 0)
    return 0;

  if (x < 0)
    return -1;
  else
    return 1;
}
```

To perform symbolic execution, make the input symbolic.

```
int main() {
  int a;
  klee_make_symbolic(&a, sizeof(a), "a");
  return get_sign(a);
}
```

```
$ cd klee_src/examples/get_sign

$ clang -I ../../include -emit-llvm -c -g -O0 -Xclang -disable-O0-optnone get_sign.c

$ klee get_sign.bc
```

Note that bc refers to LLVM bitcode format.

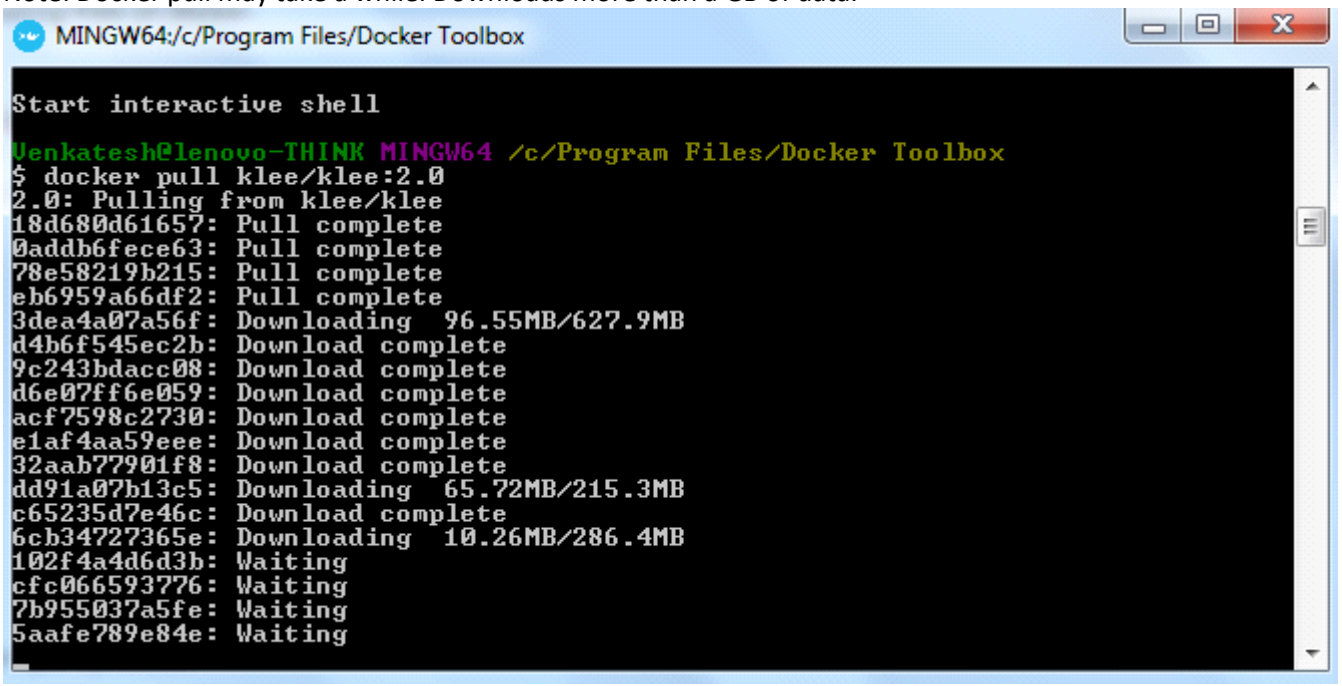
```
KLEE: output directory = "klee-out-0"

KLEE: done: total instructions = 33
KLEE: done: completed paths = 3
KLEE: done: generated tests = 3

$ ls klee-last/
assembly.ll     run.istats      test000002.ktest
info            run.stats       test000003.ktest
messages.txt    test000001.ktest warnings.txt

$ ktest-tool klee-last/test000001.ktest
ktest file : 'klee-last/test000001.ktest'
args       : ['get_sign.bc']
```

num objects: 1
object 0: name: 'a'
object 0: size: 4
object 0: data: b'\x00\x00\x00\x00'
object 0: hex : 0x00000000
object 0: int : 0
object 0: uint: 0
object 0: text: ....

$ ktest-tool klee-last/test000002.ktest
ktest file : 'klee-last/test000002.ktest'
args : ['get_sign.bc']
num objects: 1
object 0: name: 'a'
object 0: size: 4
object 0: data: b'\x01\x01\x01\x01'
object 0: hex : 0x01010101
object 0: int : 16843009
object 0: uint: 16843009
object 0: text: ....

$ ktest-tool klee-last/test000003.ktest
ktest file : 'klee-last/test000003.ktest'
args : ['get_sign.bc']
num objects: 1
object 0: name: 'a'
object 0: size: 4
object 0: data: b'\x00\x00\x00\x80'
object 0: hex : 0x00000080
object 0: int : -2147483648
object 0: uint: 2147483648
object 0: text: ....

Note: Docker pull may take a while. Downloads more than a GB of data.



Docker is ready. Let us run the get_sign example.

```
klee@b7b2ea2c43ff:~/klee_src/examples/get_sign$ klee get_sign.bc
KLEE: output directory is "/home/klee/klee_src/examples/get_sign/klee-out-1"
KLEE: Using STP solver backend

KLEE: done: total instructions = 33
KLEE: done: completed paths = 3
KLEE: done: generated tests = 3
klee@b7b2ea2c43ff:~/klee_src/examples/get_sign$
```

Klee identified three paths and generated three corresponding tests. Here is one of them.