Know your QEMU and KVM test frameworks

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Introduction

- The KVM / QEMU virtualization stack is rather huge and complex

- There are many different test frameworks which might be good to know:
  - KVM selftests
  - kvm-unit-tests
  - QEMU test suites
  - Avocado-based tests
  - ...

KVM selftests

KVM selftests

- C framework for testing the KVM ioctl API

- Resides in the Linux kernel git tree
  (see tools/testing/selftests/kvm/ folder)

- Library functions for creating VMs & vCPUs

- No QEMU involved

- ELF loader for using the same program in the guest

```
static void guest_code(void)
{
    uint64_t cr4 = get_cr4();
    cr4 |= X86_CR4_OSXSAVE; set_cr4(cr4);
    GUEST_ASSERT(cr4_cpuid_is_sync());
    GUEST_SYNC(0);
    GUEST_D
}


int main(i
{   ...
    /* Create VM */
    vm = vm_create_default(VCPU_ID, 0, guest_code);
    run = vcpu_state(vm, VCPU_ID);

    while (1) {
        rc = _vcpu_run(vm, VCPU_ID);
        ...
    }
    kvm_vm_free(vm);
}
```

KVM selftests demo

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kvm-unit-tests

kvm-unit-tests

- A test framework almost as old as KVM

- Low-level CPU & device tests using QEMU

- Guest code is compiled as standalone binary and run via the "-kernel" option

- Has a simple libc and other libs for the guest

- Website:
https://gitlab.com/kvm-unit-tests/kvm-unit-tests
http://www.linux-kvm.org/page/KVM-unit-tests

Using the kvm-unit-tests

- git clone
  https://gitlab.com/kvm-unit-tests/kvm-unit-tests.git

- Run the "configure" script and "make"
  (Use "--arch=..." for different targets)

- run_tests.sh script runs all tests as defined in
  the .../unittests.cfg file

- qemu-system-x86_64 -serial stdio \
  -accel kvm -kernel x86/sieve.flat \
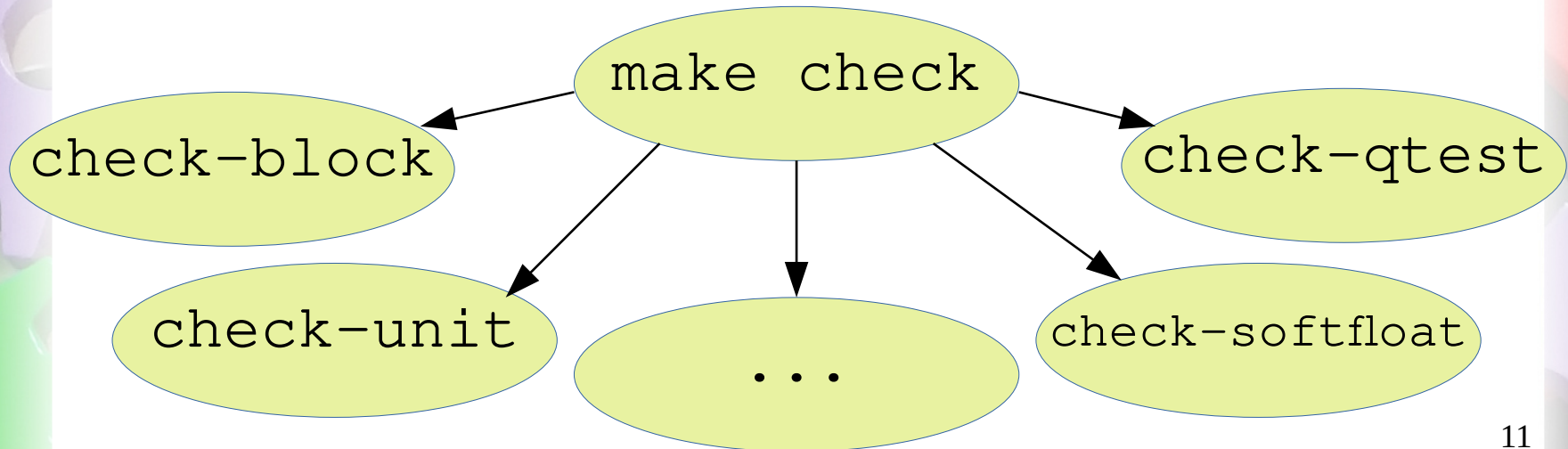 -device isa-debug-exit,iobase=0xf4,iosize=0x4

kvm-unit-tests demo

QEMU tests

- Multiple test suites in the QEMU repo
- Get some help with: `make check-help`
- Run most in one go with: `make check`

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QEMU unit tests

- See `tests/unit/` folder

- Language: C

- "Classical" unit tests, link test code with code from the QEMU binaries

- Mainly used to test the functions from the `util/` folder (but also some others)

- Compile & run with:
`make check-unit`

QEMU unit tests demo

QEMU iotests

- See `tests/qemu-iotests/` folder

- Languages: bash and Python

- A big mixed bag with various scripts that test the block layer of QEMU

- Run subset with:
  ```
  make check-block
  ```
  or more tests with:
  ```
  cd tests/qemu-iotests/
  ./check -qcow2 ...
  ```
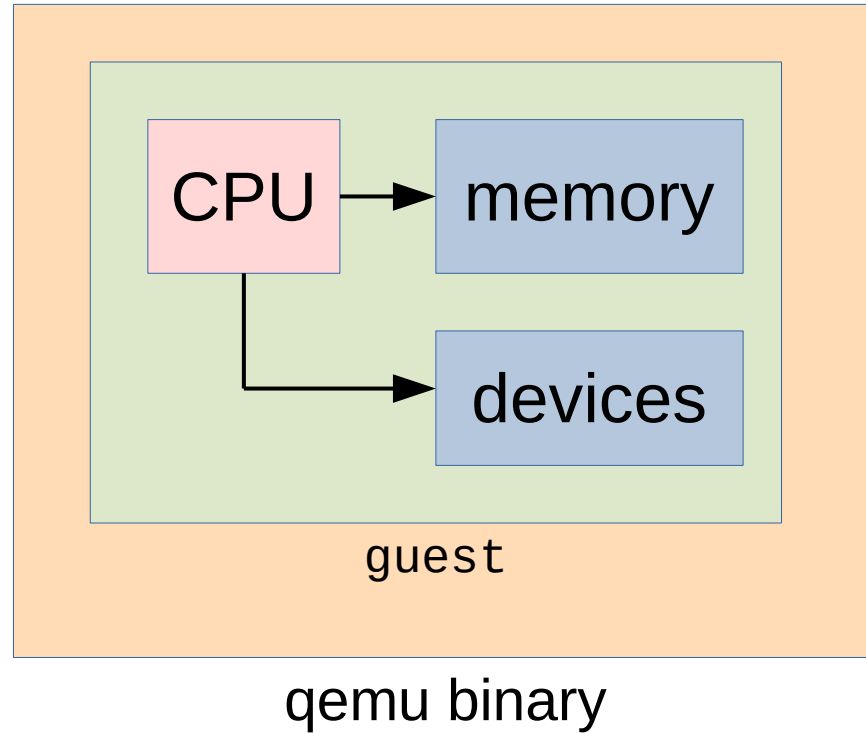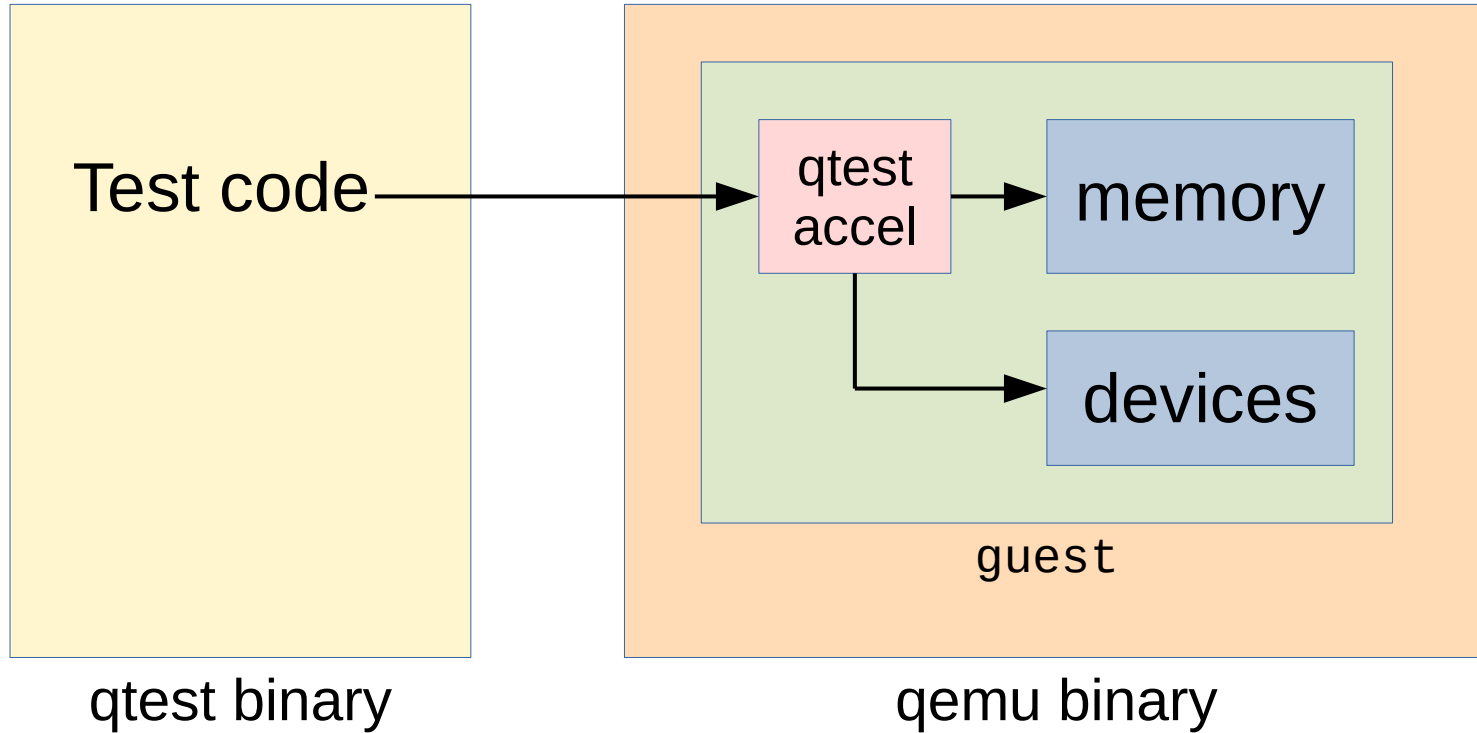
QEMU iotests demo

QEMU qtests

- See `tests/qtest/` in the QEMU repo

- Language: C

- Framework to exercise devices in QEMU

- Runs QEMU with the CPU replaced by the "qtest accelerator"

- Tests can read/write guest memory, trigger IRQs, step the clock, etc.

QEMU normal run

guest

qemu binary

QEMU qtest run

QEMU qtest demo

QEMU avocado tests

- See `tests/acceptance/` folder

- Language: Python

- Download Linux and other test kernel blobs from the internet

- Check that the kernels are behaving right when running in QEMU

- Run with: `make check-acceptance` (not part of "make check")

QEMU avocado tests demo

Other QEMU tests

- More test suites in the QEMU repository:
  - Benchmark / performance tests
  - QAPI schema tests
  - FPU softloat tests
  - TCG (guest CPU instruction) tests
  - Decodetree tests
- More external test suites like avocado-vt
- No time for these today (sorry!)

Thanks for your attention!