QEMU M680x0 support

November 2020, Laurent Vivier

Who am I?

- Laurent Vivier,

  QEMU maintainer for M68K CPU emulation, Quadra 800 emulation, linux-user mode, ...

- Author of EMILE, the Macintosh Linux bootloader

  (Allow to create bootable CDROM for Mac)

- I work at Red Hat since 2015 in the Virtualization Team

Agenda

- M68K System QEMU and user-mode QEMU
- Introducing a pure M68K Virtual Machine
- Demo
- Q/A

M68K System QEMU and user-mode QEMU

QEMU and M68K

- Motorola Coldfire support since 2006 (Paul Brook)
- Motorola 680x0 since 2015
- NeXT cube, incomplete support since 2018 (GSoC 2011)
- Macintosh Quadra 800 since 2019

Why a Quadra 800?

- Easier to emulate than an Amiga or an Atari
- Built with standard component (SCSI, Serial, …) but
  - Endianness updates,
  - Pseudo DMA mode for SCSI
- Can re-use emulation parts from PowerMac emulation
- I already know how to by-pass the ROM to load the kernel
- I own a Quadra 800 so I can check with the reality

Why is Quadra 800 not enough?

- Quadra 800 emulation is limited by the real machine:
  - Limited to 1 GB (kernel, but specs say 136 MiB)
  - No PCI or other modern buses or interfaces
  - To emulate real device is CPU time consuming
  - No DMA

Why is QEMU user-mode emulation not enough?

- qemu-m68k is faster and allows to use all the CPU cores and memory of the host but:
  - All the data structures must be translated between the user side and the kernel side
  - Some syscalls cannot be emulated correctly
  - Need to be constantly updated to be in sync with the kernel
  - Apps detect the kernel configuration of the host arch.

Why a pure virtual machine is better?

- To overcome real hardware limitations (Memory, devices)
- To leverage all industry QEMU/KVM investments:
  - Virtio interfaces
  - Migration
  - To have access to more QEMU backends (encryption, RNG, vhost, GPU, …)
  - Run a m68k kernel

A pure M68K Virtual Machine

What is QEMU virt m68k machine?

- It’s a pure virtual machine with no real hardware emulation
  - A M680x0 processor (only 68040 for now)
  - 4 GiB available memory
  - 128 Virtio buses
  - Google Android Goldfish virtual devices for the basic functions (serial port, RTC, timer, PIC)
  - No Firmware

Virtio devices

- Ethernet device (virtio-net)
- Block device (virtio-blk and virtio-scsi)
- Serial port (virtio-serial and virtconsole)
- Graphic and input devices (virtio-gpu, virtio-mouse, virtio-tablet, virtio-keyboard)
- Crypto and entropy devices (virtio-crypto and virtio-rng)
- Host file system mapping (virtio-9p)

```
qemu-system-m68k -device help
```

Command line example (simple)

```
qemu-system-m68k \
   -M virt \
   -m 1G \
   -nographic \
   -serial mon:stdio \
   -device virtio-blk-device,drive=disk0 \
   -drive \
    file=system.qcow2,format=qcow2,if=none,id=disk0 \
   -kernel vmlinux \
   -append "console=ttyGF root=/dev/vda2 rw"
```

Command line example (More 1/3)

- Entropy device (for sshd):

```
-device virtio-rng-device
```

- Serial port:

```
-device virtio-serial-device \
-device virtconsole,chardev=char0
```

- Graphic display with inputs:

```
-device virtio-keyboard-device \
-device virtio-tablet-device \
-device virtio-gpu-device
```

Command line example (More 2/3)

- Shared filesystem:

```
-fsdev local,id=home0,path=/home,
                          security_model=passthrough \
-device virtio-9p-device,fsdev=home0,
                            mount_tag=home0
```

- Mount command:

```
mount -t 9p home0 /home \
      -o version=9p2000.L,
         posixacl,msize=104857600,cache=loose
```

Command line example (More 3/3)

- CDROM:

```
-device virtio-scsi-device \
-drive file=cdrom.iso,format=raw,if=none,id=cdrom0 \
-device scsi-cd,drive=cdrom0
```

- Networking:

```
-device virtio-net-device,netdev=hostnet0
```

- Networking backend:

```
-netdev user,id=hostnet0
```

or

```
-netdev bridge,id=hostnet0,br=virbr0,
        helper=/usr/libexec/qemu-bridge-helper
```

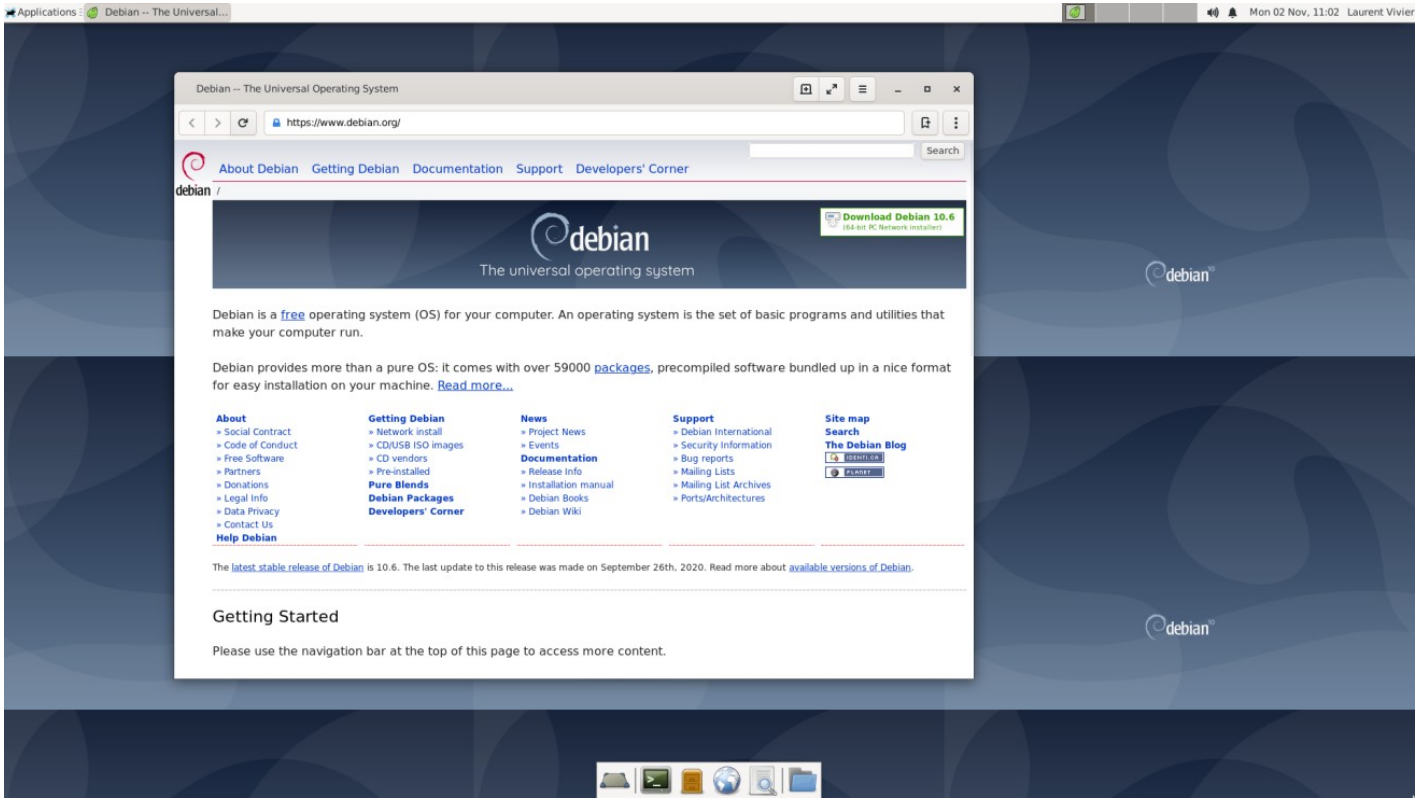
Sources (QEMU)

- QEMU:
  - `git clone git://github.com/vivier/qemu-m68k.git`
  - `git checkout m68k-virt`
  - `./configure -target-list=m68k-softmmu`
  - `make`

Sources (Linux)

- Linux:
  - `git clone git@github.com:vivier/linux.git`
  - `git checkout m68k-virt`
  - `export ARCH=m68k`
  - `export CROSS_COMPILE=m68k-linux-gnu-`
  - `make virt_defconfig`
  - `make vmlinux`

Demo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Backup

MacOS Boot