Getting to Work with OpenPiton

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http://openpiton.org
Operating System and System Software
Open source system stack

- Applications run on Linux
- Linux manages virtualised HW, calls to HV
- OpenBoot handles OS boot from SD
- Hypervisor manages HW resources
- Open source hardware

- You can read, modify and recompile all of them!
Boot Process

1. Interrupt
   – Core woken from outside
2. Reset Code
   – Clears registers and on-chip memories
3. Hypervisor
   – Sets up trap table, copies self to memory
4. OpenBoot
   – Initial bootloader, reads SILO ELF from SD
   – Drop to OpenBoot shell using Stop-A/Break
5. SILO
   – Loads Linux kernel from SD card
6. Linux
Anatomy of a disk image

- Bottom 1MB:
  - Reset code, HV, OpenBoot
- At next 16MB alignment:
  - Sun disk image
- First sector contains SILO first.b
- Disk image is formatted as ext3
- Debian is vanilla from debootstrap
Mounting a disk image

- `objcopy -I binary -O binary --reverse-bytes=8 mydisk.img mydisk-rev.img`

- `sudo mount -o loop,offset=16M mydisk-rev.img mntdir/`

- `cd mntdir/`

- Navigate, copy files, etc
Installing applications

- Works natively, should work modified on Debian x86_64
- Setup chroot:
  - mkdir mntdir
  - sudo mount -o loop,offset=16M mydisk-rev.img mntdir/
  - Be very careful running these!
  - sudo mount -o bind /proc mntdir/proc
  - sudo mount -o bind /dev mntdir/dev
  - sudo mount -o bind /sys mntdir/sys
  - sudo cp /etc/resolv.conf mntdir/etc/
  - cd mntdir/
  - sudo chroot .
Installing applications

• Install apps:
  • sudo apt-get install <package>

• Then when you are done (Be very careful running these!):
  • exit
  • sudo umount mntdir/proc
  • sudo umount mntdir/dev
  • sudo umount mntdir/sys
  • sudo umount mntdir/

• objcopy -I binary -O binary --reverse-bytes=8 mydisk-rev.img mydisk.img
Building the Linux kernel

• Clone our git repository from https://github.com/PrincetonUniversity/piton-linux
• Build native or set up a cross-compiler for sparc64
• Set $ARCH to sparc, change config to cross-compile
• Navigate to the root directory and compile
  – make oldconfig && make -j32
• Copy files to disk image
  – vmlinux, zImage, System.map, .config
Copying kernel to disk image

- `sudo mount -o loop,offset=16M mydisk-rev.img mntdir/`

- `sudo cp piton-linux/vmlinux mntdir/boot/vmlinux`

- `sudo cp piton-linux/System.map mntdir/boot/System.map-4.1-piton`

- `sudo cp piton-linux/arch/sparc/boot/zImage mntdir/boot/vmlinuz-4.1-piton`

- `sudo cp piton-linux/.config mntdir/boot/config-4.1-piton`
Building the Hypervisor and OpenBoot

- Lightly modified from T1, tested on Solaris 9
- Clone our git repository from https://github.com/PrincetonUniversity/piton-sw
- Set up Sun development tools
  - `source subos/OpenSPARCT2_SAM.bash`
  - `cd t1_fpga/subos/t1_fpga/src/`
  - `make`
- Copy `xilinx/prom/1c1t_obp_prom.bin` to remote machine
  - `dd if=1c1t_obp_prom.bin mydisk-rev.img conv=notrunc`