# Getting to Work with OpenPiton

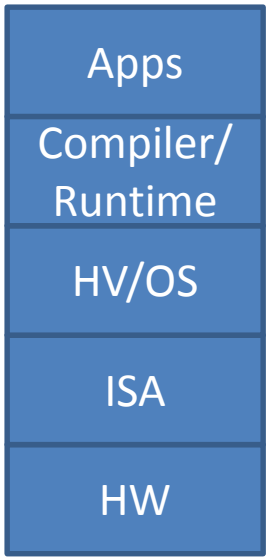
Princeton University

http://openpiton.org


# Operating System and System Software

# Open source system stack

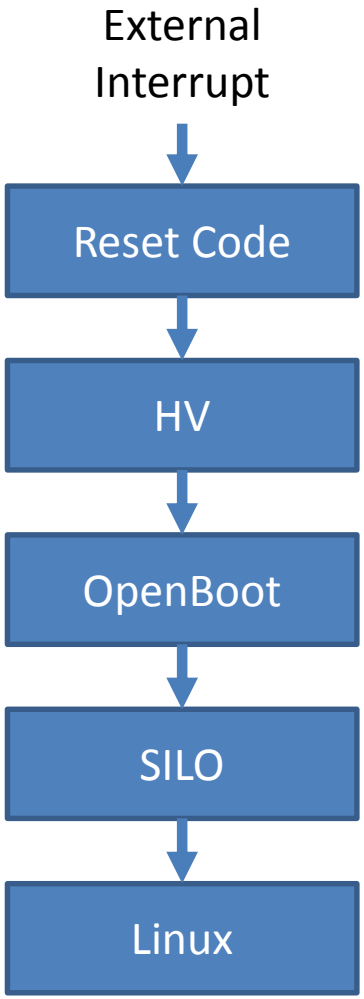
- Applications run on Linux
- Linux manages virtualised HW, calls to HV
- OpenBoot handles OS boot from SD
- Hypervisor manages HW resources
- Open source hardware




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

# Boot Process

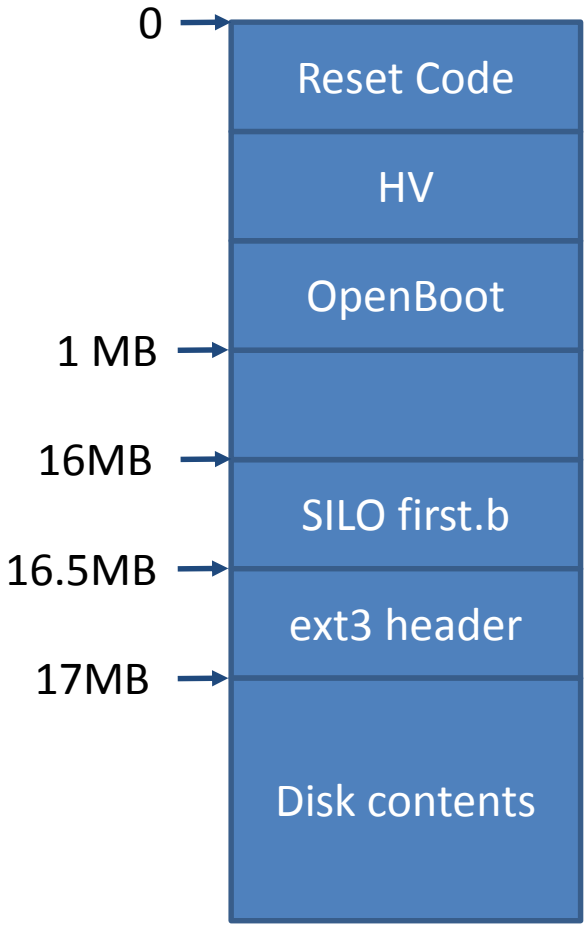
1. Interrupt
   - Core woken from outside
2. Reset Code
   - Clears registers and on-chip memories
3. Hypervisor
   - Sets up trap table, copies self to memory
4. OpenBoot
   - Initial bootloader, reads SILO ELF from SD
   - Drop to OpenBoot shell using Stop-A/Break
5. SILO
   - Loads Linux kernel from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

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

- `cd mntdir/`
- Navigate, copy files, etc

# Installing applications

- Works natively, should work with qemu/multiarch 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`
- `cd ..`
- `sudo umount mntdir/proc`
- `sudo umount mntdir/dev`
- `sudo umount mntdir/sys`
- `sudo umount mntdir/`

# 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`

*Our released cross-compiler is currently untested for linux kernel compilation

# 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-4.7-piton`
- `sudo cp piton-linux/arch/sparc/boot/zImage mntdir/boot/vmlinuz-4.7-piton`
- `sudo cp piton-linux/.config mntdir/boot/config-4.7-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`
  - `conv=notrunc` is vital - don't accidentally delete your image