FreeBSD on PowerNV
POWER8 and POWER9

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In collaboration with QCM Technologies, IBM, and Semihalf

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What is OpenPOWER?

- Commercial RISC arch launched ~1990
  - AIM, POWER, FreeScale, etc
- Speeds and Feeds
  - Short pipeline, high clock, high core, SMT
  - P9 mem BW: 120GB/s (SO) 230GB/s (SU)
- I/O
  - PCIe 4.0, OpenCAPI, NVLink
- 1.5yr tick/tock
- Anchored by HPC
  - Summit and Sierra supercomputers
  - https://www.nextplatform.com/2017/09/19/power9-rollout-begins-summit-sierra/
- Open ISA, platform
  - ALL firmware on GitHub
  - https://github.com/open-power

Cast of Characters

- Semihalf
  - Development leader
- QCM Technologies
  - QCM Technologies is based in Scottsdale AZ, and has been an IBM Premier Business Partner since 2001
  - Core competencies include IBM Power Systems and Storage with key relationships in POWER development
- IBM
  - Arch and reference material, relicensing
- LLNW
  - CDN benchmark target, sales lead
- Special thanks to nwhitehorn@ and jhibbits@
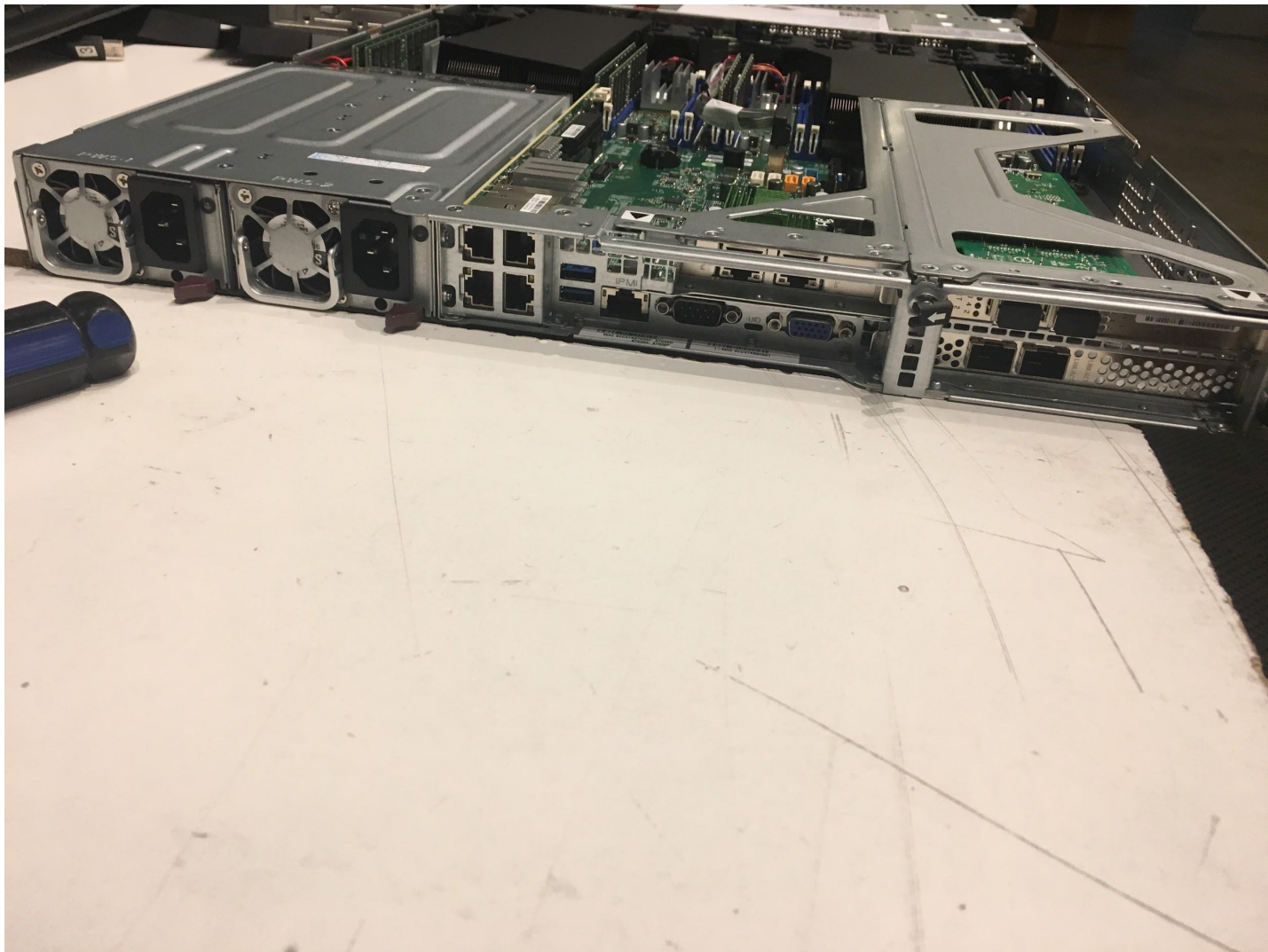
OpenPOWER S821LC

Initial porting target

Port Status

- Basic architecture support
  - Memory Management Unit
  - Interrupts
  - System timers
  - OPAL console
  - PCIe initial support
- RAM root filesystem embedded into the kernel

Booting up

- Store kernel and kexec files in Petitboot accessible location (TFTP server in this example)
- Enter Petitboot shell
- Copy the modified kexec binary into Petitboot Linux
  - tftp -g -r <tftp_directory>/kexec <server_ip>
- Copy the FreeBSD kernel into Petitboot Linux
  - tftp -g -r <tftp_directory>/kernel <server_ip>
- Run the FreeBSD
  - chmod +x kexec
  - ./kexec -l kernel
  - ./kexec -e -f

Elided dmesg

```
FreeBSD 12.0-CURRENT #308 b50f6f60c1d(tst)-dirty: Mon Sep
25 14:18:07 CEST 2017
wma@ppc64-prime:/home/wma/ppc64-freebsd/obj/powerpc.powerp
c64/home/wma/ppc64-freebsd/sys/GENERIC64 powerpc
...

FreeBSD/SMP: Multiprocessor System Detected: 128 CPUs
...
cpu0: IBM POWER8 revision 2.0, 2328.00 MHz
cpu0: Features
dc005180<PPC32,PPC64,ALTIVEC,FPU,MMU,SMT,ARCH205,ARCH206,V
SX>
cpu0: Features2 c2000000<ARCH207,HTM,VCRYPTO>
...
```

Current Blockers

- SMP boot does not work on boot reliably
- AHCI does not work due to bugs in hardware and lack of quirks in FreeBSD
- Intel IGB e1000 driver stalls under a heavy traffic
- Console drops some output if big chunks of text are displayed

Long term risks/needs

- Toolchain
  - Want external GCC and clang, LLD
- Big Endian vs Little Endian
  - Linux ppc switching to ppc64le
- Port drift..
  - Drivers, atomics, pmap, etc
- Architectural features
  - High core/thread count
  - Dynamic SMT
  - Crypto
  - HTM
- bhyve

Following along & getting involved

- Meet with QCM and IBM to gauge interest today
  - Sam, Michael, Dan
- freebsd-ppc@ mailing list
- Ongoing reviews in phabricator, pettiboot

If you want more info or to make introductions:
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