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OpenBMC:
Open Source System Management Firmware Stack

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Agenda

• BMC Overview
• OpenBMC Community Project
• Q&A
BMC Overview
System Management @scale

- Remote Data Centers
- 24x7 Uptime
- Fault Tolerant
- 1 Service Tech. per 1000’s of systems
Inventory Info

- Manufacturer ID
- Manufacture Date
- Product ID
- Serial Number
- Asset Tag
- (optional) Configuration Info
Power Management

• Power Control
  – On, Off, Cycle
• Power Monitoring
  – Consumption
• Power Capping
  – Range: 20W to 100W+
  – P-State control
System Monitoring

• Sensors
  – Voltage, Temperature, Tach, GPIOs
  – Fan Speed Control

• Event Logs
  – Track Login
  – Power on/off
  – System Health events
Remote Debug

• Typical Debug
  − Remote Login
  − OS/Application Logs
  − CPU/Memory State Info
• Abnormal Cases
  − CPU Core dump
  − Remote Console (and history)
Firmware Update

- CPLD
- VR
- BIOS/UEFI
- NIC
- BMC
BMC Overview

- Baseboard Management Controller
- Provide System Management
- Autonomous System
  - CPU, Memory, Storage
- Stand-By Power
- Overhead?
  - Low Cost
  - Low Power

* Image Courtesy of Aspeed
Multi Host System - Yosemite

OCP V2 Mezz Card
50G or 100G Multi-Host

1S Server

Slot 1
Slot 2
Slot 3
Slot 4

BMC

HSC

12V STBY
12V RACK
BMC SoC Details (AST2500*)

- CPU: ARM11@800MHz
- RAM: Up to 1G Byte, ECC, DDR4@1600Mbps
- Flash: SPI Flash
- LAN: Dual 10/100/1000Mbps MAC
- USB: USB2.0, USB1.1 HID
- VGA: PCIe VGA 2D controller (1920x1200)
- iKVM

* Courtesy of Aspeed
BMC SoC Details (Pilot4*)

- CPU: Dual ARM Cortex A9 500MHz
- RAM: DDR4@1600Mbps
- LAN: Dual 10/100/1000Mbps MAC
- Graphics Controller and Remote Keyboard
- SuperI0
- ClearKVM for remote KVM
- eSPI

* Courtesy of Aspeed
BMC SoC Details (NPCM705G*)

- CPU: Dual Core ARM Cortex A9 800MHz
- Co-Processor: 200MHz 32-bit RISC
- RAM: DDR4
- Network: Dual: RGMII, RMII/NC-SI
- Virtual Media and Keyboard, Video and Mouse Redirection (KVMR)
- Super I/O
- PCIe Gen-2 Root-Complex(RC)
- MCTP over PCIe
- eSPI

*Courtesy of Nuvoton
OCP* LCD Debug Card

- **LCD**
  - System Information
  - POST Code
  - GPIO Status
  - SEL
  - Critical Sensors
- **Control**
  - Power
  - Reset
  - Console Selection
  - Hot Service
- **Spec**
  - https://www.opencompute.org/wiki/Server/SpecsAndDesigns

*Open Compute Project @ https://www.opencompute.org/*
Host System->Debug Card Interface
Example Debug Pictures #1

POST Code Status

GPIO Status
Example Debug Pictures#2

Critical Sensor Info

System Information
At-Scale Debug

*Image courtesy of ASSET InterTech*
OCP NIC Card

https://www.opencompute.org/wiki/Server/Mezz
OCP Multi-Host Yosemite system

https://www.opencompute.org/wiki/Server/SpecsAndDesigns-old
Multi-Host Yosemite topology

OCP V2 Multi-Host NIC Mezz
50G

1S Server

BMC

Slot 1
Slot 2
Slot 3
Slot 4
OCP NIC evolution

• **OCP Spec v0.5 (2012)**
  - 10G
  - X8 PCIe Gen3
  - I2C Sideband
  - 2x SFP

• **OCP Spec v2.0 (2015)**
  - 10G/25G/40G/50G/100G
  - X16 PCIe Gen3
  - I2C and RMII sideband
  - Upto 4x SFP28, 2xQSFP28, 4x RJ45

• **OCP Spec v3.0 (2018)**

• **Industry Adoption (public)**
  - Broadcom Limited
  - Chelsio
  - Intel
  - Mellanox Technologies
  - Qlogic
  - Quanta
  - Silicom
  - WiWynn
  - Zaius (Rackspace/Google)
NIC management use cases

- Pass-through Management traffic control
- Inventory of NIC capabilities and parameters
- Port link status reporting and NIC Statistics
- Notifications: driver presence state changes, link status change, soft reset, etc.
- Inventory of provisioned BMC MAC addresses
- Temperature reading
- Inventory and configuration of host PCIe functions
- Firmware inventory (versions of images, firmware package string) and update
PMCI* components used by OCP NIC

*Platform Management Components Intercommunications (PMCI) WG of the DMTF defines MCTP, NC-SI, and PLDM Standards
A Brief History of OpenBMC Project

Two independent implementations

Facebook

IBM

Linux Foundation Project
(IBM, Google, Intel, Microsoft, Facebook)
OpenBMC Overview

- Open Source System Management embedded Linux distribution
- Linux Foundation Community Project
- Software/Tooling use unified firmware interface
- Heterogenous architectures in DC can be managed seamlessly

* Courtesy of Aspeed
Community Calls

• Weekly Community Telecon – Mondays 10am CT (1500 UTC)
• Redfish – Mondays 4pm CT (2100 UTC)
• Security – Wednesdays 12pm CT (1700 UTC)
• Test – Thursdays 10:30am CT (1530 UTC)

• See https://github.com/openbmc/openbmc/wiki

* Courtesy of Aspeed
OpenBMC Development Model

Traditional

- 3rd Party BMC FW Vendor (Aspeed/Nuvoton)
- BMC FW Source Code
- 3rd Party BMC FW Vendor

OpenBMC

- 3rd Party BMC HW Vendor (AIC/PS/NVMe)
- OpenBMC Project
- 3rd Party BMC HW Vendor (Aspeed/Nuvoton)
- BMC FW Source Code
- ODM Server Vendor
OpenBMC Architecture
OpenBMC Build

OpenBMC build machine
# git clone github.com/openbmc
# ...set target machine...
# bitbake obmc-phosphor-image

Linux kernel v4.18.5

Yocto & OpenEmbedded

OpenBMC repos in github.com/openbmc

Machine and BMC support
Common machine elements
Various OpenBMC elements

Machine hardware

BMC firmware image

BMC Firmware

BMC Hardware
Getting Started

• Build Setup
  • Ubuntu/Fedora Pkgs
  • Download github:openbmc
  • Target hardware
  • Build

• Validation and Testing
  • Jenkins
  • QEMU
  • CI tests
  • Robot Framework

• Contribution
  • Submit Code/Design
  • Gerrit Reviews
  • Bug Reports
  • Github
Release Priority Features

- User Management
- KVM over IP
- Remote Media
- Signed Firmware Update
- LDAP
- IPMI 2.0
- IPMB Support
- Redfish
- IPv6 support
- Secure Boot
- SSH based Serial Over Lan

- KCS Host Interface
- BT Host Interface
- PECI
- Dynamic Sensor Configuration & Scanning
- Fan Speed Control / Thermal Mgmt
- Remote Host JTAG Debug
- SSL Certificate Generate/Upload
- LED Management
- Event Logging
- Yocto refresh (Thud 2.6)
- Automated Testing
Feature Backlog

- SNMP Traps
- GUI Enhancements
- PMBus
- MCTP (SMBus & PCIe)
- SSIF
- HBA Management Library
- PCIe Switch Management
- NVMe Management
- GPU Management
- OOB Firmware Update

- File System Hardening
- Component Recovery
- Restricted Shell
- Power Capping
- Host Console Redirection
- Controllers Console Redirection
- Out of Band Host State Dump
- OCP LCD Debug Card Support
- POWER On Chip Controller (OCC) Support
Release Milestone Planning

First Release Target Date is February 4 – 7, 2019
OpenBMC Hackathon Fall Event

Date: October 9th - 11th, 2018

Location: Intel Corporation
Jones Farm Campus -- Building 5 (JF5)
2111 NE 25th Ave.
Hillsboro, Oregon 97124

See the OpenBMC mailing list for registration instructions
Seating is limited due to space constraints.
OpenBMC Hackathon Topics

On Boarding/Training
Writing and Debugging Code
User Management
Linux Drivers
Redfish
IPMI
Validation
WebUI Design
Demonstrations

Hardware Requirements
Bootloader
Secure Boot
Security
BMC Device Enablement
Logging and Debug mechanisms
Telemetry Data
Event Alerting
Development and Release Planning
Additional Resources

• Source Code:
  • https://github.com/openbmc

• Continuous Integration Testing
  • https://openpower.xyz

• Code Reviews
  • http://gerrit.openbmc-project.xyz

• Contact
  • Mail: openbmc@lists.ozlabs.org
  • IRC: #openbmc on freenode.net
  • Riot: #openbmc:matrix.org

• Web Page:
  • www.openbmc.org
OpenBMC for OCP Ecosystem

OCP Design Collateral

- Presentations
- Specifications
- Schematics
- Data Sheets
- Design Packages
- 3D/CAD Files
- Firmware (Build Meta Data)

Binary Blobs

Product/Company Specific Source Repo

OCP Specific Source Repo (e.g. LED Config, Redfish Profiles)

Open Source Community Repo (e.g. OpenBMC, LinuxBoot, Coreboot)
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