Enable RISC-V In Cloud Computing

Zhipeng Huang, Huawei
Bio

- Open Source Manager and Principal Engineer from Huawei
- Involved in
  - CNCF Security SIG, Kubernetes Policy WG, OpenStack Cyborg Project, OpenStack Public Cloud WG, OpenSDS, Open Service Broker API, Akraiino, LF Edge, ONNX, MLSpec
- Heavy metal fan and proud father of two daughters!

Zhipeng Huang
@nopainkiller
Venture Technologist, Open Source Infra for Cloud, AI, Blockchain, and Beyond
- 33.642931,-117.84131
- hannibalhuang.github.io
- Joined May 2009
Background
New Era of Domain Specific Architecture

NPU
Neural network processors for machine learning

GPU
GPUs for graphics, virtual reality, ML

SmartNIC/FPGA
Programmable network switches and hardware
Cloud Computing Beyond Hype
Open Source In Prime Time
However The Problem Few Talks About

What is the software ecosystem you need?

What is the hardware ecosystem you need?

What is the main problem you have?

Device SDKs !!

It’s not already there ??

Applications presume they can just run, and loads of SDKs we don’t have a clue how to connect them to cloud

Accelerator Dev

Application Dev

Cloud Infra Dev
Example

GPU talks: 3, FPGA talks: 0, Acceleration in general: 0, out of nearly Four hundreds of accepted talks
RISC-V and Accelerators
FireSIM as Accelerator

• Any accelerator can be integrated (if it fits inside FPGA)
• Develop and test software for your accelerator in Linux environment before having the chip in hand
• Get fast and accurate performance results
Open Celerity Accelerator Centric SoC
Support RISC-V Accelerators in Open Source Cloud Computing
Open Source Cloud Infrastructure With Acc Support

Legend
- Pike Finished
- Queens Finished
- Rocky Planned
- Out-of-scope

Pythonclient-cyborg -> cyborg-api -> cyborg-conductor -> cyborg-agent

Quota

Cyborg-db (resource provider)

SPDK driver -> NVMe SSD
Intel FPGA driver -> Intel FPGA
NVIDIA GPU driver -> NVIDIA GPU
Xilinx FPGA driver -> Xilinx FPGA
Open Source Cloud Infrastructure With Acc Support

- kube-acc-service
  - kube-acc-controller
    - Life Cycle Management
    - Resource Modeling
    - Policy Enforcement
  - IaaS Acc Controllers (Optional)
  - New Kube-acc plugin
  - Existing Acc Drivers

- Kubernetes
  - API Server
  - Controller
  - Node
  - DPI Plugin

- kube-batch

Topology-aware scheduling

Kube-acc CRD Ops
Metadata - The Thing Needed The Most For Cloud

| Device - FPGA |

device_uuid / \ device_uuid

| Deployable | | Deployable |

root_id / \ parent_id

| Deployable | num_accelerators=2 | | | Deployable |

/ \ deployable_id / ^ ^

/deployable_id

| Attach Handle A | | | | Attach Handle B | | | Attribute B |

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<th>nullable</th>
<th>description</th>
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<td>name of the bitstream (not unique)</td>
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<td>The uuid generated during synthesis</td>
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<td>Xilinx</td>
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<td>Vendor of the card</td>
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<td>board</td>
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</table>
Build Open Source Cloud Ecosystem For RISC-V

Cloud Management
(OpenStack, Kubernetes, etc...)

RISC-V Core Capabilities (topology, socket closeness, affinity, power, ...)

RISC-V Core Based Accelerator
General Rule For Acc support in Cloud

You want to expose as little as possible to the application, but as much as possible to the cloud management/orchestration platform.
New Open Source Accelerator Ecosystem Initiative
Open Heterogeneous Computing Framework

Developer driven full stack open source reference framework built with Formula and Tournaments

(https://github.com/open-heterogeneous-computing-framework)
Proposed Governance

Open Heterogeneous Computing Framework

- Linux Foundation
- OpenStack
- OPEN Compute Project
- RISC-V
- OpenCAPI
Proposed Governance

- Lightweight organized developer centric technical community
- Foundation structure focus on marketing operation
Example Workflow

- Kubernetes
- LinuxBoot/core boot/oreboot
- OCP OAI
- CORE-V
- RISC-V

Edge Computing
Upcoming OHCF related events

Santis Systems Summit 19
Friday, June 14, 2019 08:00 AM - Friday, June 14, 2019 10:00 PM

Monday, June 24 • 09:00 - 16:00

Open Heterogeneous Computing Framework Introduction hosted by Huawei (Additional Registration Required)

Registration Fees: Complimentary
Presentation will be in: English

In this event we will introduce the new open source initiative Open Heterogeneous Computing Framework, efforts from related communities and planning for 2019 and 2020. In this event we will introduce the new open source initiative Open Heterogeneous Computing Framework, efforts from related communities and planning for 2019 and 2020. In this event we will introduce the new open source initiative Open Heterogeneous Computing Framework, efforts from related communities and planning for 2019 and 2020.

How to Register: Pre-registration is required. To register for Open Heterogeneous Computing Framework Introduction, add it on during your KubeCon + CloudNativeCon + Open Source Summit registration.

For questions regarding this event, please reach out to zhipengh512@gmail.com
Github-Issue based CFP process

- Open Source: Accelerating Innovation in the AI Market
  #6 opened 20 days ago by ibrahimhaddad

- A Lightweight Accelerator Management Framework in Edge
  #5 opened 26 days ago by wangzh1993

- A AI accelerator HDDL in Edge Computing
  #4 opened 26 days ago by lvmxh

- TLS offloading solution using heterogeneous HW management
  #3 opened 26 days ago by xxinran

- A heterogeneous hardware management solution for 5G Ultra Reliable & Low Latency Network
  #2 opened 27 days ago by YumengBao

- Proposed Topic: An accelerated AI platform for heart disease diagnosis
  #1 opened 27 days ago by gao/jinhua
Thank you!

Q & A

Feel free to contact me

- Via email: zhipengh512@gmail.com
- Via twitter: @nopainkiller
- Via slack: ohcf.slack.com