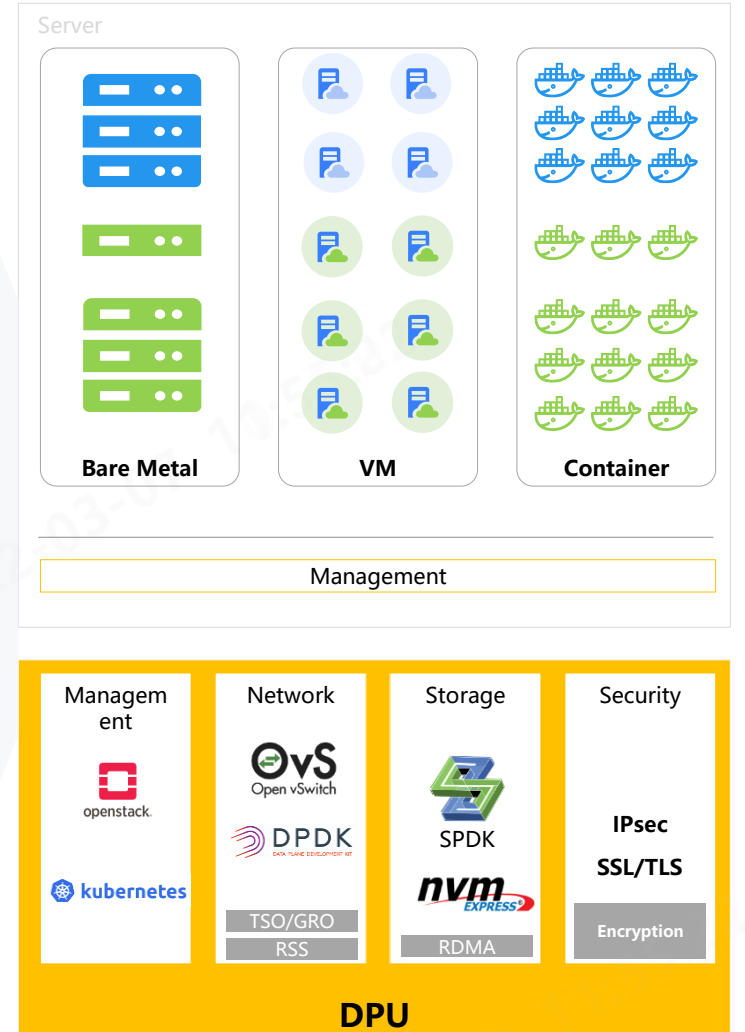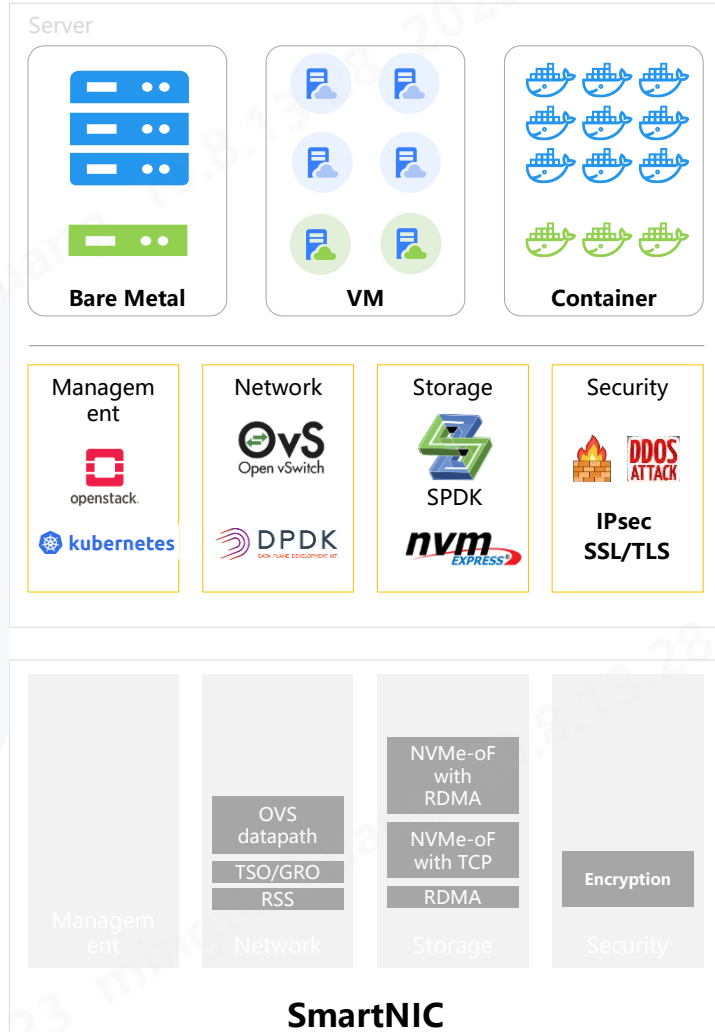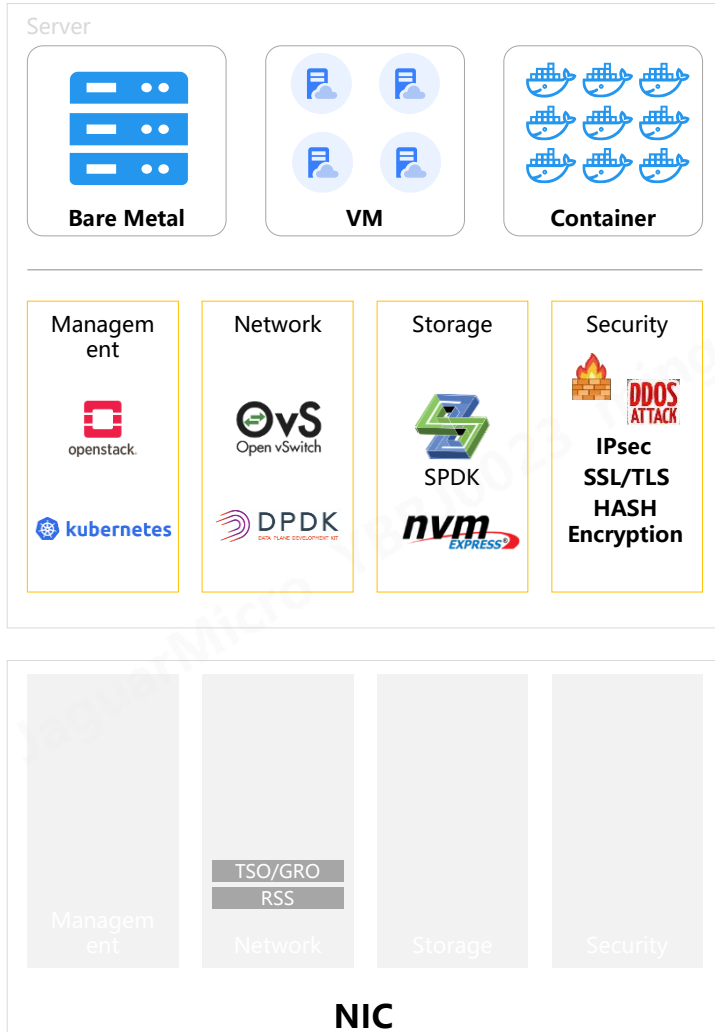# Improving Data Center Infrastructure by JaguarMicro DPU

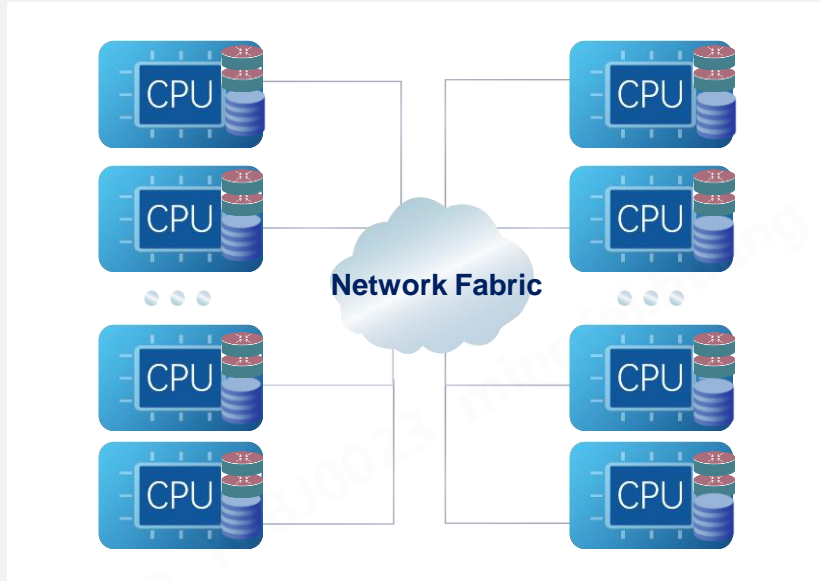Mingfei Huang

Mar 8， 2022

Why DPU

Data Center – shifting from CPU-centric to DPU-centric architecture

CPU-centric Data Center → **DPU-centric Data Center**
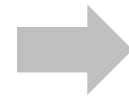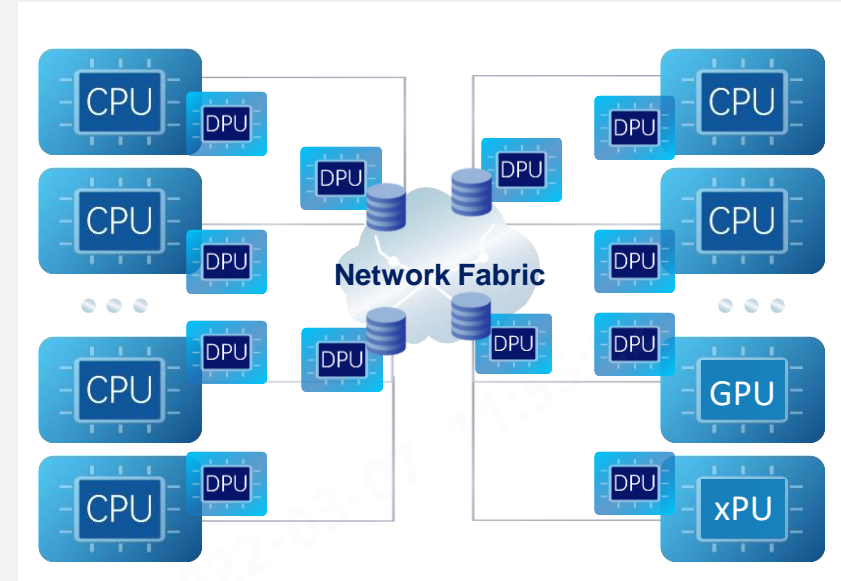
- As demand for big data and network bandwidth explodes, data center can't rely only on CPU to handle all workloads.
- All future data center infrastructure workloads (network, storage, virtualization, management) will be handled by data processing units (DPUs).

DPU becoming the "controller" of next-gen data center

Jaguar Microsystems

China's leader in Data Processing Unit (DPU) and Solutions

A leading technology company developing a new generation of DPUs and advanced silicon solutions for modern data centers. Founded by Dr. Sunny Siu and a core team each with over 20 years of experience in the semiconductor industry, the company has gathered a world-class silicon and software team formerly from Broadcom, Intel, Arm, HiSilicon (Huawei), and Alibaba.

Major investors

Tencent 腾讯 | SEQUOIA CAPITAL 红杉资本 | CHINA | NIO Capital | 中芯聚源 China Fortune-Tech Capital | 五源资本 | SCGC 深创投 | 弘卓资本 HUNDREDS CAPITAL | 耀途资本 Glory Ventures | ZWC 众为资本 | 正心谷资本 Loyal Valley Capital

Challenges in Data Center

1	**Unified Management**	How to unify the management of VM, Container and Bare Metal services
2	**Hot Migration**	Offloading Network, Storage, Management workload from Host CPU to DPU makes VM Migration more complex
3	**Elastic Cluster**	How to support elastic cluster resource management for VM, Container and Bare Metal services
4	**Flexibility**	How to achieve programmability with performance acceleration
5	**Compatibility**	How to ensure minimal disruption to existing systems

Jaguarmicro DPU combines 3 chips 'functionalities into an SoC

CPU + FPGA + NIC

CPU

+

FPGA

+

NIC

Current solution

3 chips in 1

Jaguarmicro DPU SoC

JaguarMicro DPU solution

Host interfaces   DDR interfaces

PCIe	Arm Cores	Memory
Virtio	NVMe	

Coherent Mesh Network

| Ethernet ports | Fully Programmable DPU Engines | Autonomous Acceleration Engines |

Network interfaces
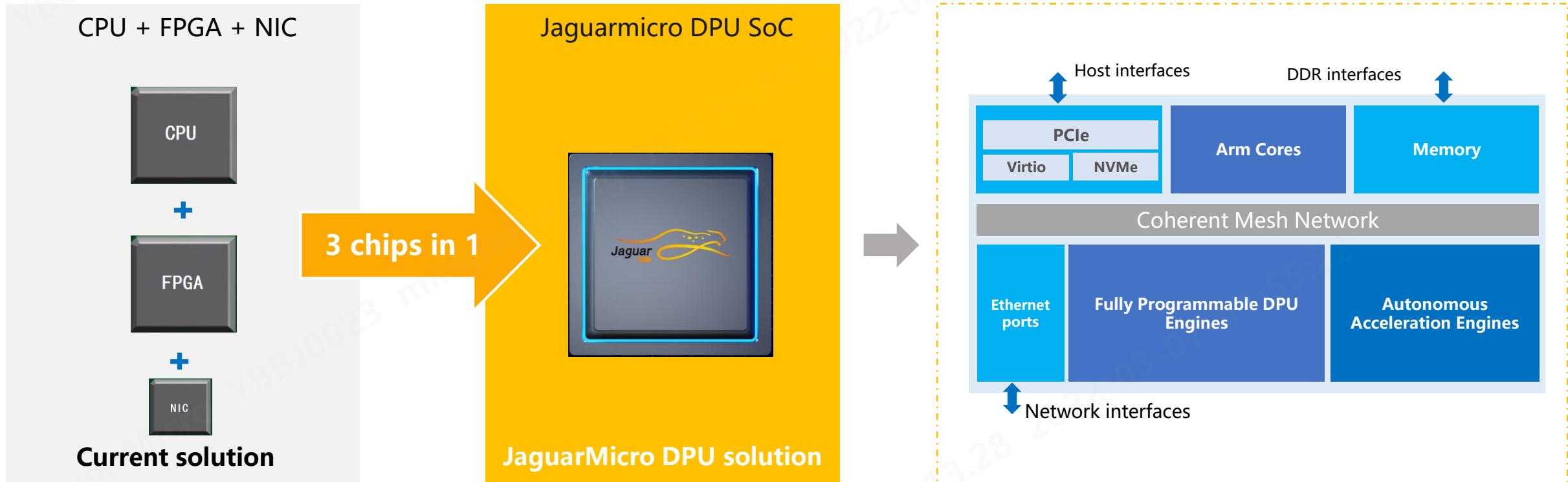
- 3 chips solution, very expensive
- Power exceeding 150W
- Cannot reach 2*100Gbps+.

- Single chip solution reducing cost & power each by over 50%
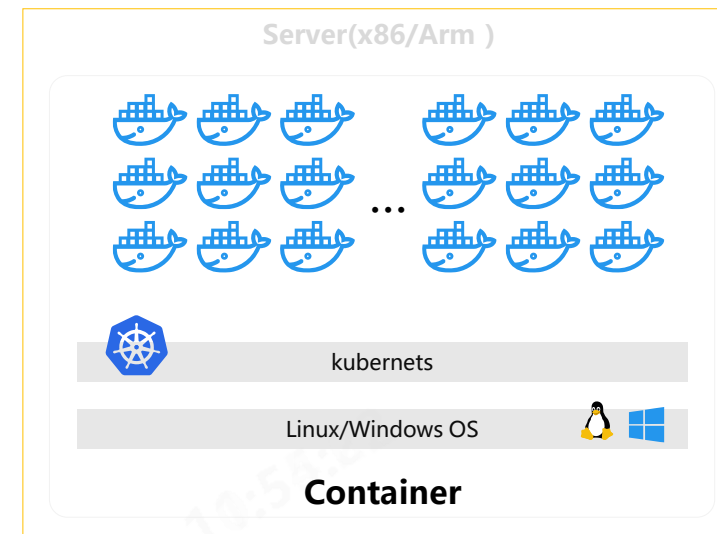- Multi-fold increase in performance.

Features

- ✓ Unified support of Bare-metal, VMs and Containers services

- ✓ 2x25G network support and high-performance storage

- ✓ Enable elastic and on-demand virtual network and storage interfaces

- ✓ Support hot migration, hot upgrade, and hot pluggable

- ✓ Allow smooth migration from standard NIC card to FPGA-based DPU

Bare-metal, VM & Container service support

Unified Management and Single Pool for BM, VM and Container

Kebernetes Solution

Kubernetes Solution

K8S master node

- Virt-controller
- Virt-api

- API Server
- Controller manager
- Scheduler
- etcd

BMS(BareMetal Service)

SDN Controller Kube-OVN

- kube-ovn-controller
- OVN管控
  - ovn-nb
  - northd
  - ovn-sb

APP
- VM
- VM

APP
- VM
- VM
- Container
- Container

APP
- Container
- Container

APP
- Baremetal
- Baremetal

node
- Virt-launcher
- Virt-handler
- kubelet
- CNI/CSI

Virtio-net   Virtio-blk

node
- kubelet
- CNI/CSI

Virtio-net   Virtio-blk

Bare Metal Node

Virtio-net   Virtio-blk

JM DPU
- Virtio backend
- agent
- libvirt
- OVS-DPDK
- SPDK
- ovn-controller

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Bare Metal

- Kube-apiserver add and configure virtio-net and virtio-blk devices to bare-metal host.

Container

- Kube-apiserver create | delete | manage pods through kubelet on work node.
- Kubelet talks with DPU through CNI/CSI plugin to add and configure virtio-net and virtio-blk devices.

Virtual Machine

- Kube-apiserver create | delete | manage VMs through kubelet & Virt-handler & Virt-lancher on work node.
- Kubelet talks with DPU through CNI/CSI plugin to add and configure virtio-net and virtio-blk devices.

Openstack Solution
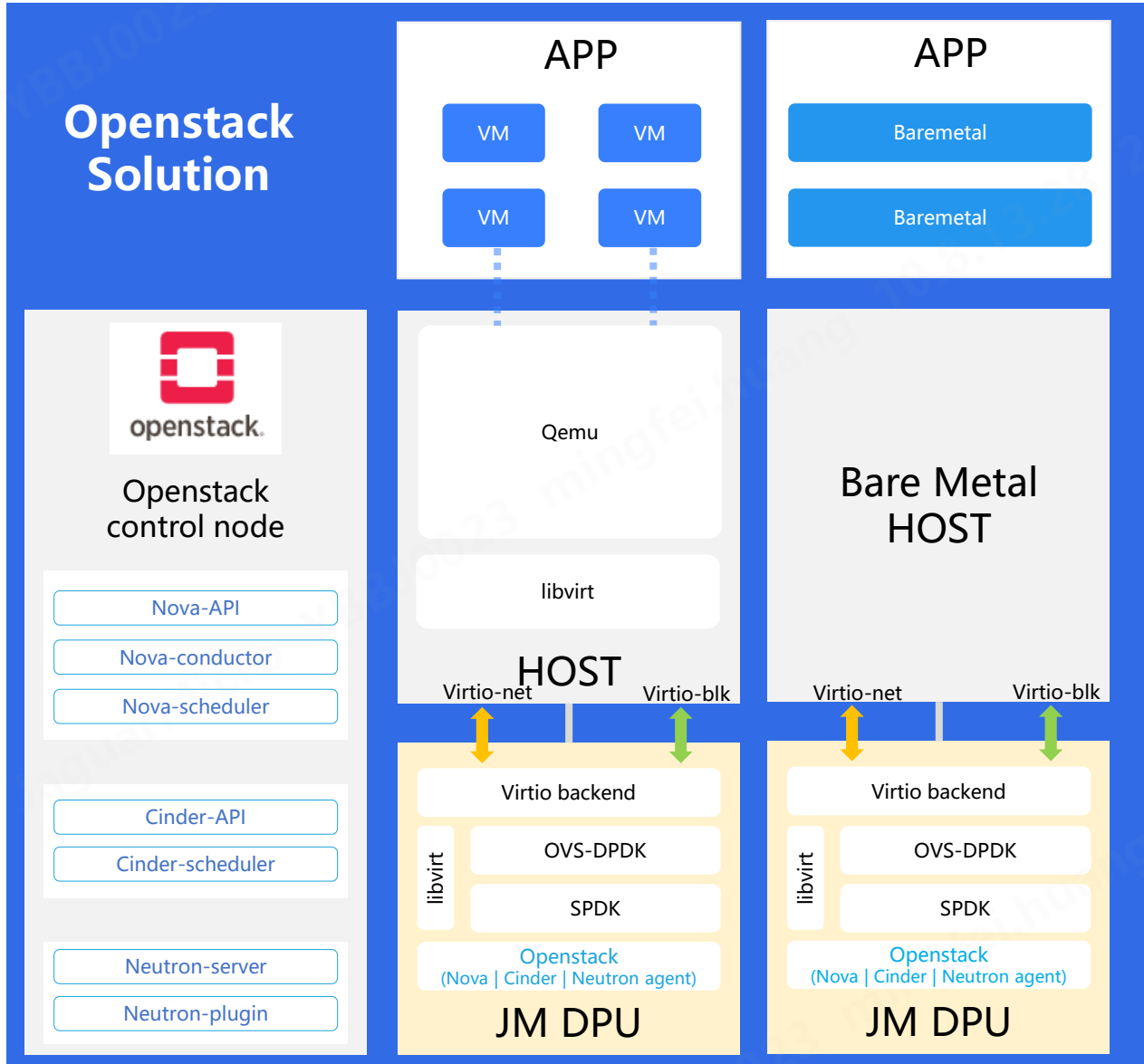
Bare Metal

- By libvirt on DPU, Nova, Cinder and Neutron agents add or configure virtio-net or virtio-blk devices.

VM

- By libvirt on DPU, Nova, Cinder and Neutron agents add or configure virtio-net or virtio-blk devices.

Software Architecture

Applications

AI	Big Data	Database	NFV

Infrastructure Management | Software-defined Networking | Software-defined Storage | Software-defined Security

IaaS (Baremetal | Virtualization | Container)

JaguarMicro Cloud-native DPU SDK

Cloud Management

- Kubernetes
- Openstack
- Libvirt
- Live Migration
- Hot Plug
- Hot Upgrade

Networking
P4 | OVN | OVS-DPDK | Virtio-net

Storage
SPDK | Virtio-blk | NVMe | RoCE | iWarp

AI
DataDirectPath RMDA | Storage

Security
Inline-Crypto | Virtio-Crypto

Hypervisor
Hyper-Commander

Telemetry
IFA2.0

Resources Abstract Layer (RAL)

Virtio-net device	Virtio-crypto device	RDMA device	Arm	x86 CPU Cores
Virtio-blk device	NVMe device	C Programmable DPE Engine	

DPU Hardware Platform

FPGA | SoC

JaguarMicro DataDirectPath Storage

AI Unit(like DTU)/GPU access storage without DDPS

System Memory

CPU

PCIe Switch

DTU   NIC ⟷ Remote NVMe

AI Unit(like DTU)/GPU access storage with DDPS@DPU

System Memory

CPU

PCIe Switch

DTU   DPU ⟷ Remote NVMe
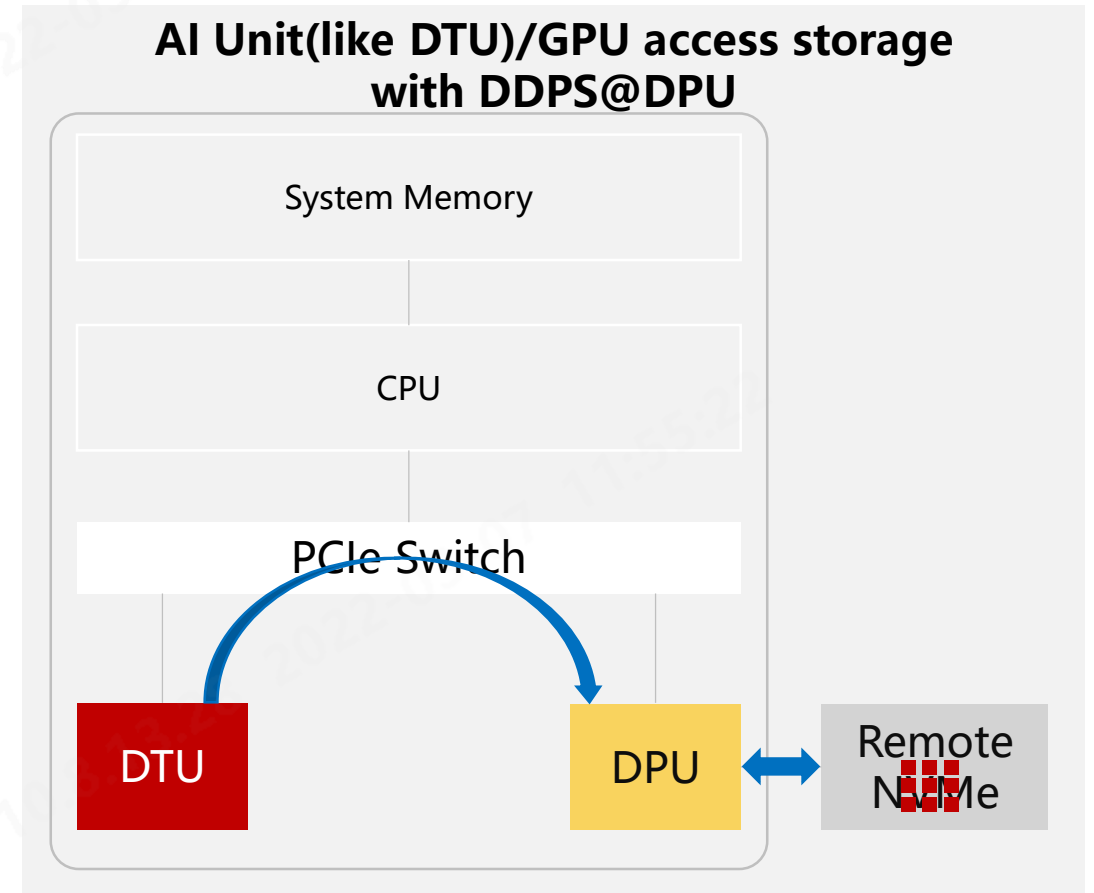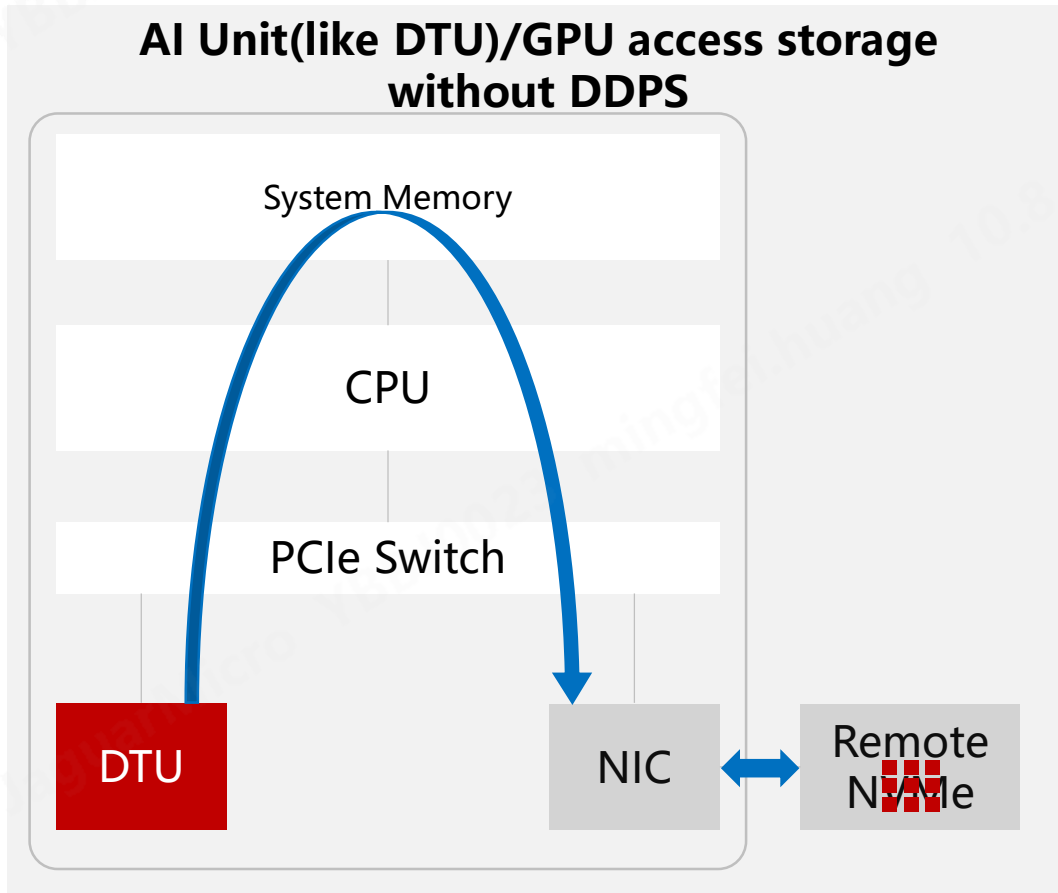
On DPU with DDPS enabled, AI Unit (like DTU) or GPU can access remote storage bypass Host, getting lower latency and higher performance.

Highlights

Network
- Hardware Accelerator
- Compatibility
- C programming

Storage
- Hardware offload
- Compatibility
- DataDirectPath Storage|RDMA

Security
- Zero Trust
- Hardware Accelerator

Management
- Unified Infrastructure Mgmt
- VM Migration
- Hot Upgrade
- Diskless Boot
- Hot Plugging

云豹智能
Micro

Roadmap

DPU Chip

Sicily DPU
- 2th JaguarMicro DPU
- Up to 2*400GE
- Arm CPU & Programable DPU
- PCIe Gen6/CXL2.0

Corsica DPU
- Virtio-net/blk
- Up to 2*200GE
- Arm CPU & Programable DPU

DPU Card

Rocky
- Sicily DPU-based
- 2x400GE

Himalayan
- Corsica DPU-based
- 2x200GE

ALPS v2.0
- FPGA-based
- 2x100GE
- Inline Cypto

ALPS(云豹云霄) v1.0
- FPGA-based
- Virtio-net/blk
- 2x25GE
- Hot Migration/Upgrade/Plug

2021   **2022**   **2023**   **2024**

Addressable Markets

Offloading infrastructure workloads from server CPUs

Private cloud and Enterprise applications (edge computing, control plane etc)

VM Cloud

Bare-metal Cloud

Telecom & 5G

Enterprise

Support and unify management of Bare-metal cloud service

Support NFV for telecom and 5G operators
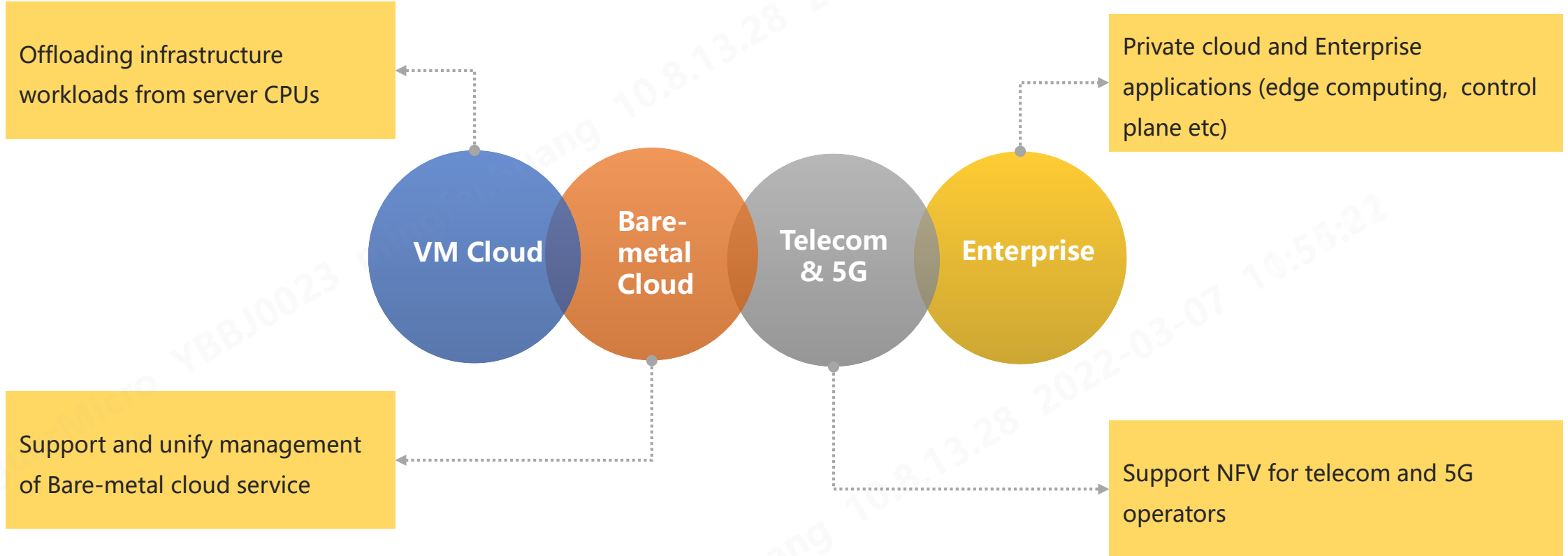
THANKS!

Contact us: info@jaguarmicro.com

AKRAINO