R4 Architecture Document of IEC Type 5: SmartNIC for Integrated Edge Cloud (IEC) Blueprint Family

Blueprint overview/Introduction

Integrated Edge Cloud(IEC) is an Akraino approved blueprint family and part of Akraino Edge Stack, which intends to develop a fully integrated edge infrastructure solution, and the project is completely focused on Edge Computing. This open-source software stack provides critical infrastructure to enable high performance, reduce latency, improve availability, lower operational overhead, provide scalability, address security needs, and improve fault management. The IEC project will address multiple edge use cases and industry, not just the Telco Industry. IEC intends to develop solution and support of carrier, provider, and the IoT networks.

IEC Type 5 is focused on SmartNIC, which could accelerate network performance and provide more management convenience.

In general, the architecture consists of two layers: IaaS (IEC), SmartNIC layer. But in R4, we have two simple layers: Host Layer, SmartNIC Layer.

Use Case

1. OVS-DPDK offload into SmartNIC to accelerate the network performance and save computing resources which is important in the edge cloud environment and CT(connection-tracking) is supported and also offloaded into Smart NIC to provide security needs.
2. part of the UPF functions like load balance, forwarding, dpi, etc offloaded into SmartNIC to enhance the performance of UPF who will be deployed in carrier's edge cloud datacenters

Where on the Edge

Business Drivers: SmartNIC is located in edge cloud servers, which belongs to the EC infrastructure and VPC, 5G UPF can use SmartNIC to accelerate the performance.
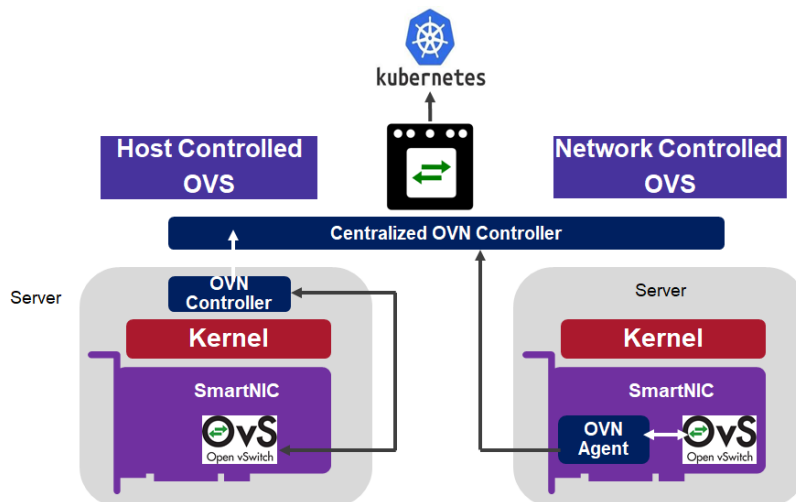
Overall Architecture

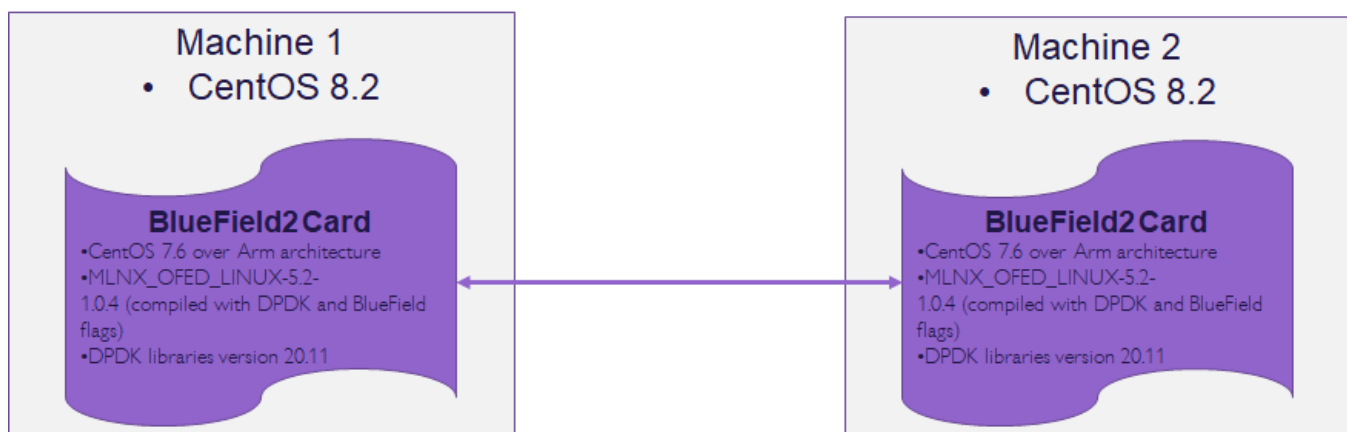SmartNIC Datacenter Services across all Clouds as the diagram shown below:
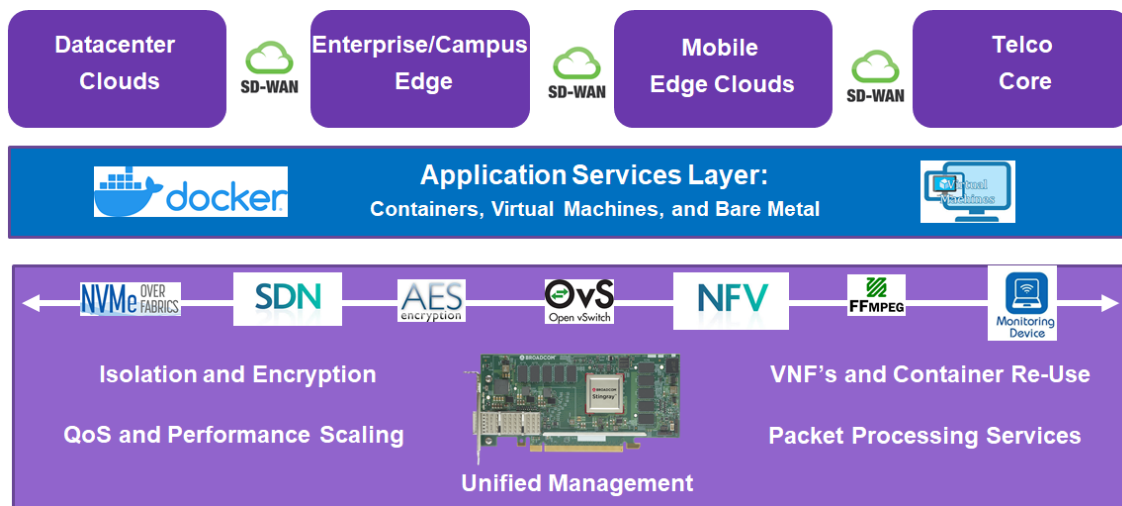
Platform Architecture

- OVS-DPDK offload into SmartNic (when it applied on the computing cluster)

For R4 Release, we haven't used the Kubernetes component.

For the hardware components information:

Qty.	Item	Comments
2	x86 servers running CentOS 8.2	Intel(R) Xeon(R) Gold 6248 CPU @ 2.50GHz/ 40 cores / 2 numa / 320G memory
1	ConnectX-6 Dx NIC (FW: 22.29.1016)	-
1	BlueField2 25GbE SmartNIC with Arm processor (FW: 24.29.1016)	ARM A72 8 cores / single numa / 16G memory/ 25G bandwidth
1	25GB/s SFP28 networking cable	-
1	QSA28 Adapter Module	-
1	UART-to-USB cable	For SmartNIC USB console access
1	Mini USB Type B cable	For SmartNIC USB Console access
1	bfb image to be loaded on the BlueField SmartNIC Arm.	Image contains: • CentOS 7.6 over Arm architecture • MLNX_OFED_LINUX-5.2-1.0.4 (compiled with DPDK and BlueField flags) • DPDK libraries version 20.11 • Pre-configured network settings for easy SmartNIC management

Software Platform Architecture

	System	Software	DPDK
Machine 1	Centos 8.2	OVS-DPDK 2.14	version 20.11
Machine 2	Centos 8.2	OVS-DPDK 2.14	version 20.11

APIs

Not Applicable

Hardware and Software Management

The detailed hardware is itemized below

	Bare Metal Machine(Host Layer)	SmartNic Layer	System	Software
Machine 1	Intel(R) Xeon(R) Gold 6248 CPU @ 2.50GHz/ 40 cores / 2 numa / 320G memory	ARM A72 8 cores / single numa / 16G memory/ 25G bandwidth	Centos 8.2	OVS-DPDK 2.14
Machine 2	Intel(R) Xeon(R) Gold 6248 CPU @ 2.50GHz/ 40 cores / 2 numa / 320G memory	ConnectX-6 Dx NIC (FW: 22.29.1016)	Centos 8.2	OVS-DPDK 2.14

Licensing

• GNU/common license