QNAP

QuCPE-7012

Network Virtualization Premise Equipment

Supports hardware acceleration SR-IOV technology

intel. XEON D | SR-IOV | DPDK | QAT

CONSOLE

QNAP

QuCPE

QuCPE-7012
1.0.0.001

1-MGMT   2   3   4   5   6   7   8   9   10   11   12   USB   RST

	QuCPE-7012-D2166NT-64GB	QuCPE-7012-D2146NT-32GB	QuCPE-7012-D2123IT-8GB	QuCPE-3034-C3758R-16G	QuCPE-3032-C3558R-8G
CPU	Intel Xeon D-2166NT 12 cores, 24 treads 2.0GHz (Max 3.0GHz)	Intel Xeon D-2146NT 8 cores, 16 treads 2.3GHz (Max 3.0GHz)	Intel Xeon D-2123IT 4 cores, 8 treads 2.2GHz (Max 3.0GHz)	Intel Atom C3758R 8 cores, 8 treads 2.4GHz	Intel Atom C3558R 4 cores, 4 treads 2.4GHz
Memory	64GB DDR4 ECC (4x16GB)	32GB DDR4 ECC (2x16GB)	8GB DDR4 ECC (2x4GB)	16GB DDR4 (2x8GB)	8GB DDR4 (2x4GB)
Port	10GbE SFP+ x4 2.5GbE RJ45 x8	10GbE SFP+ x4 2.5GbE RJ45 x8	10GbE SFP+ x4 2.5GbE RJ45 x8	10GbE SFP+ x4 2.5GbE RJ45 x8	10GbE SFP+ x2 2.5GbE RJ45 x8
Network Module	1	1	1	-	-
PCIe Slot	1x PCIe Gen3 x8	1x PCIe Gen3 x8	1x PCIe Gen3 x8	-	-
HDD Slot	2x 2.5" SATA slots	2x 2.5" SATA slots	2x 2.5" SATA slots	-	-
M.2 SSD Slot	-	-	-	2x 2280 M.2 MVMe	2x 2280 M.2 MVMe
SR-IOV support	V	V	V	V	V

Inside the QuCPE

Intel® Xeon® D

Xeon D-2123IT
Xeon D-2146NT
Xeon D-2166NT

1 x PCIE Gen3 x 8 FH/HL
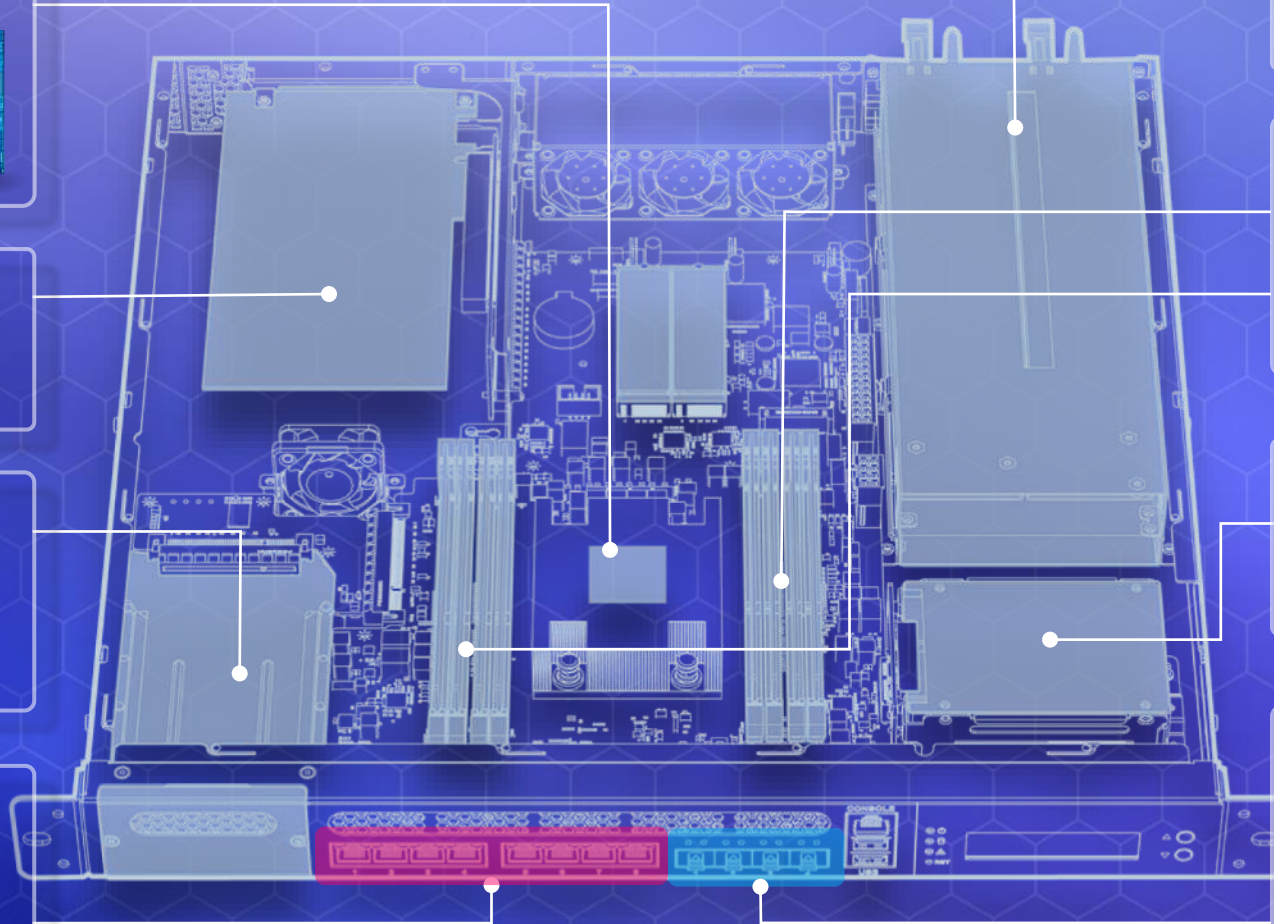
1 x Network module Expansion for 10GbE / 25GbE

8 x 2.5GbE RJ45 ports

Dual 300W Power (Main/Backup)

8 x DDR4 Slots, up to 128GB (U-DIMM) & 256GB (R-DIMM)

2 x 2.5" slots Support SATA 6Gbps

4 x 10GbE SFP+ Fiber (SR-IOV supported)

High speed expansion with Network module

|	PulM-10G4SF-XL710	PulM-10G4SF-MLX	PulM-25G2SF-MLX
Speed	10 GbE	10 GbE	25 GbE
Ports	4	4	2
Interface	SFP+	SFP+	SFP28
Processor	Intel XL710	Nvidia Mellanox ConnectX-4	Nvidia Mellanox ConnectX-4
Bus	PCIe 3.0 x8	PCIe 3.0 x8	PCIe 3.0 x8

What is SR-IOV?

With a smart NIC support SR-IOV. It allow the network adapter can be shared and direct attached to virtual environment. With PF (Physical function) and VF (Virtual function) supported. It give the possibility to VNF (virtual network function) to access the physical interface directly without non-essential packet process on host OS.

The result comes after is to increase the packets forwarding capability and reduce the CPU utilization on the host system.
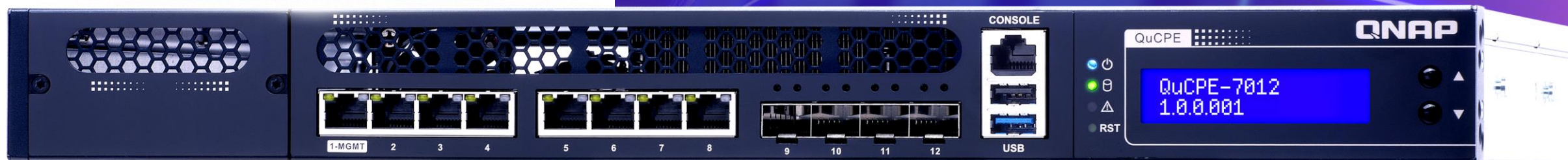
SR-IOV test Topology
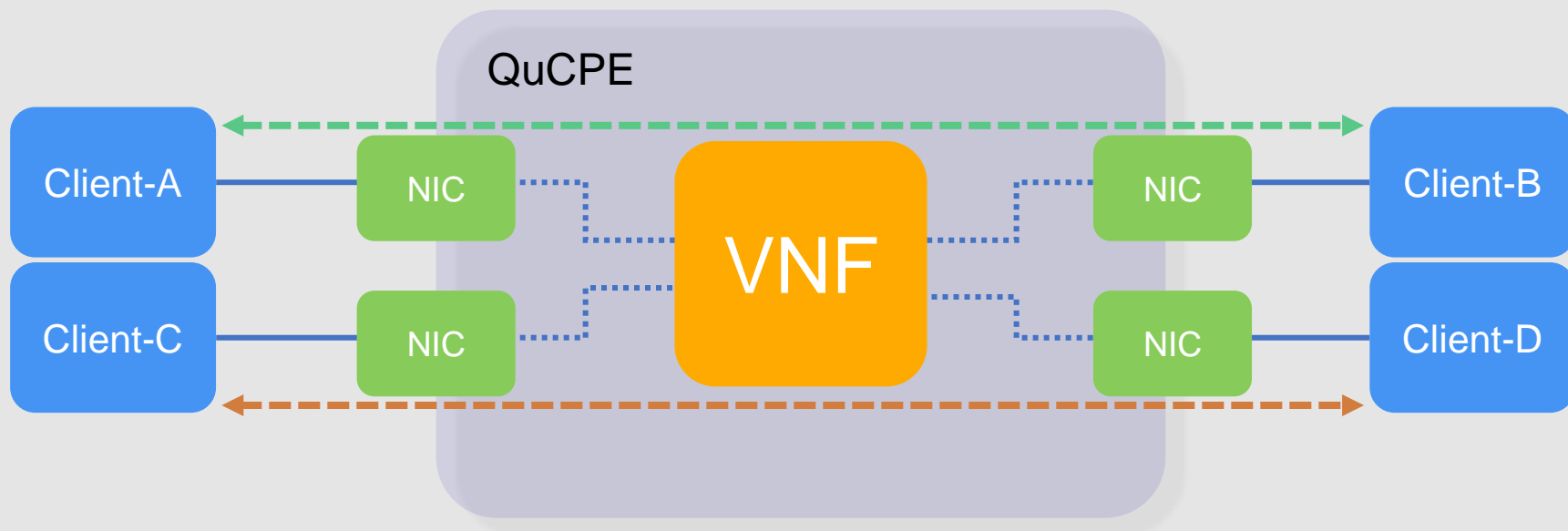
Packet Forwarding Flow

PF/VF

PF (Physical Function)

With SR-IOV supported smart network adapter. A single PF (physical function) mapping to a single Ethernet port. Take an example on QuCPE 7012, build in 4 ports 10GbE SFP+ powered by Intel X722 Ethernet controller support 4 PF (physical function) by default. Can be expand up to 4 10GbE SFP+ and 4 PF (physical function) by additional expansion card.
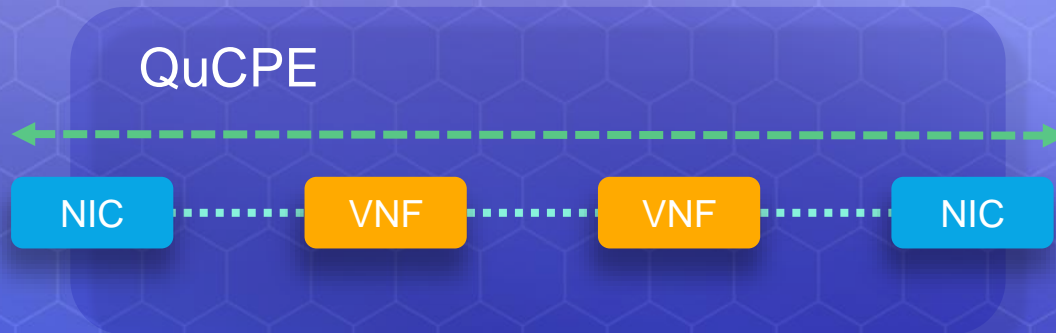
VF (Virtual Function)

VF (virtual function) functioning as a virtual NIC on virtual machine which allow virtual machine access to PF (physical function) directly through SR-IOV technology. A single PF (physical function) can map to multiple VF (virtual function) depending on Ethernet controller. Take an example on QuCPE 7012, with Intel X722 Ethernet controller. One single PF (physical function) can map to 32 VF (virtual function). But the total bandwidth still limited by physical link speed which is up to 10GbE (single direction) maximum for one single PF (physical function)
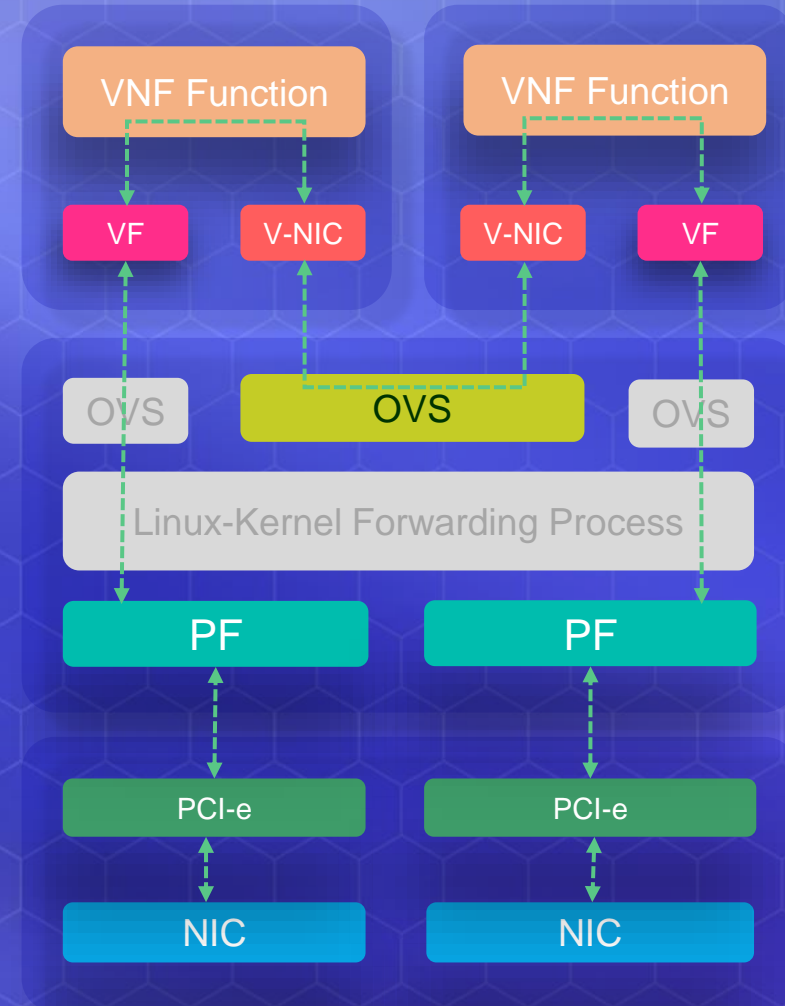
VNF Function	VNF Function
VF VF	VF VF

User Space

Linux-Kernel Space

PF

PCI-e

NIC
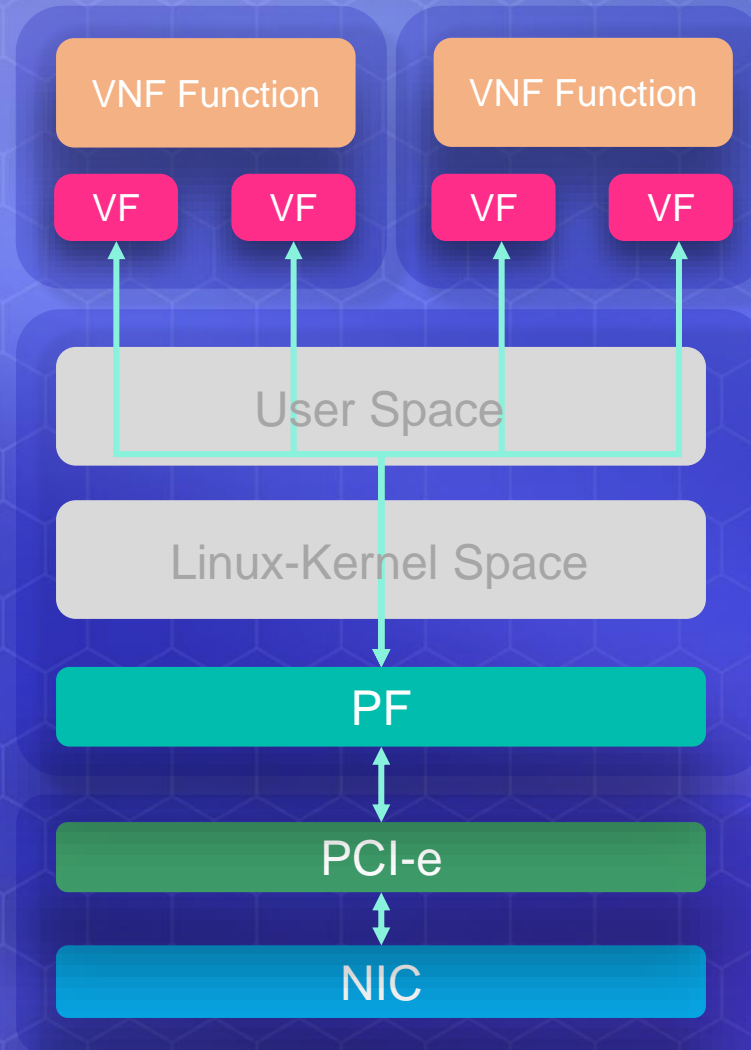
Application Notes

QuCPE

NIC .... VNF .... VNF .... NIC

Each of VF need to mapping to a PF. Which that means the SR-IOV cannot enable on the links between VNFs/VMs when a single chain topology are required as the diagram above. But the VF and virtual NIC can be enable on the same gust OS at the same time. The packets will be process as the diagram shown on the right in this case.
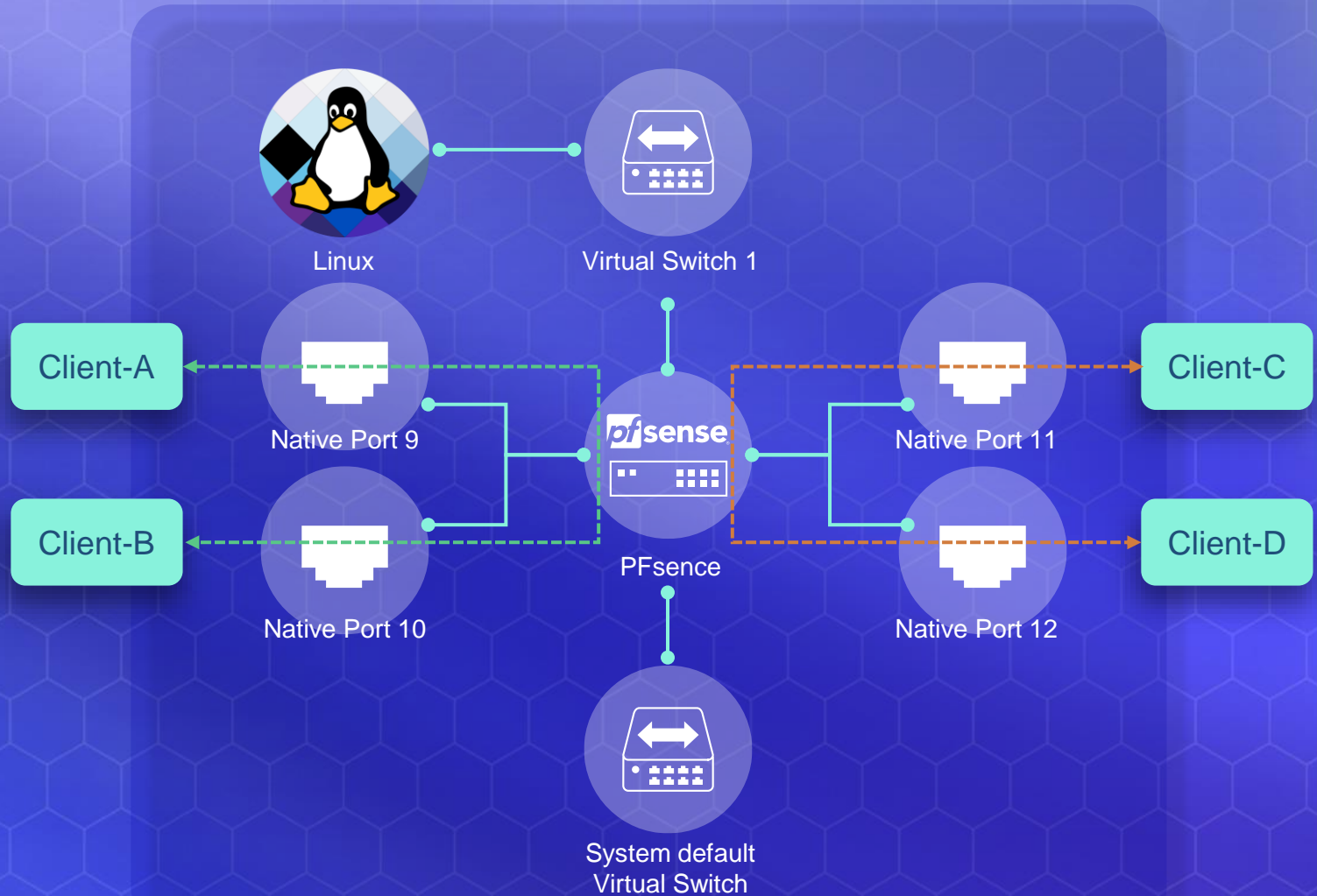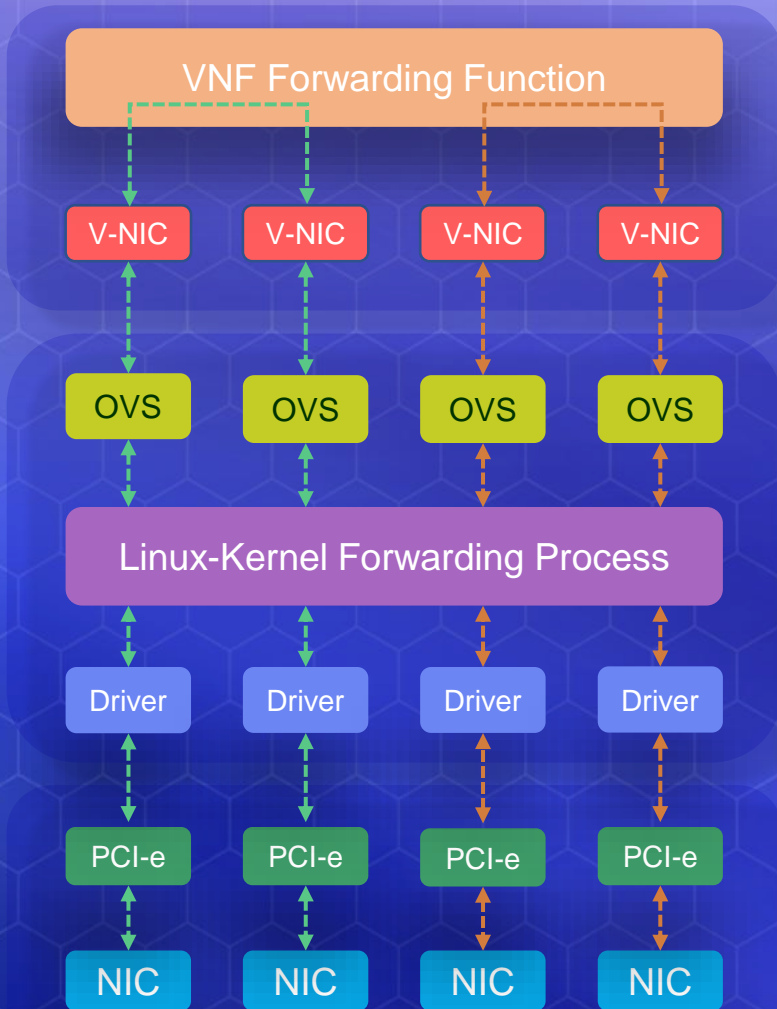
VNF Function

VNF Function

VF   V-NIC

V-NIC   VF

OVS   OVS   OVS

Linux-Kernel Forwarding Process

PF   PF

PCI-e   PCI-e

NIC   NIC

Test Setup – without SR-IOV
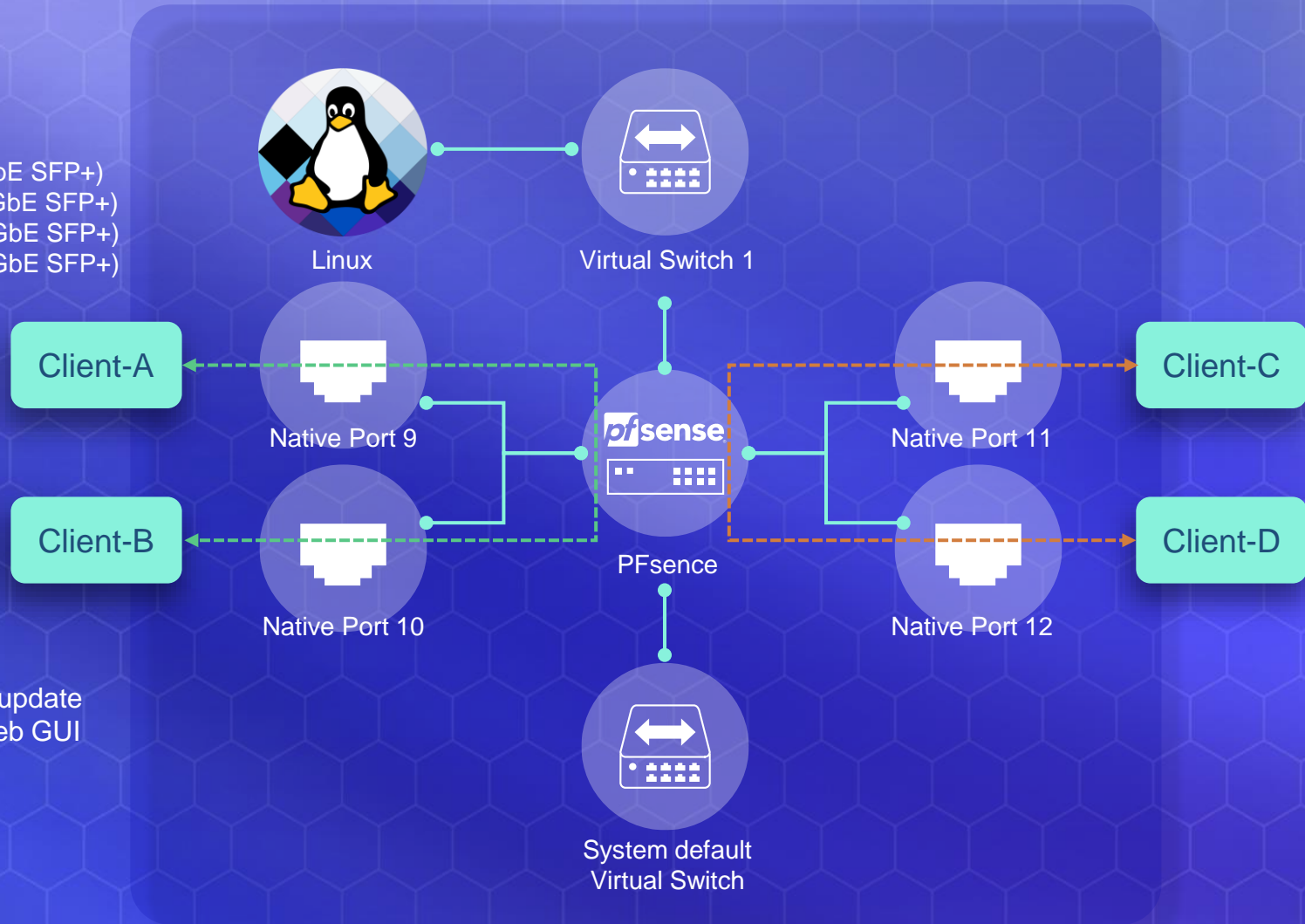
Test Setup – without SR-IOV

QuCPE

Client

- OS: QNE 1.0.3.q573
- Tool: Iperf 3.1.3
- Client-A: 192.168.61.1/24, connect to QuCPE 7012 port 9 (10GbE SFP+)
- Client-B: 192.168.62.1/24, connect to QuCPE 7012 port 10 (10GbE SFP+)
- Client-C: 192.168.63.1/24, connect to QuCPE 7012 port 11 (10GbE SFP+)
- Client-D: 192.168.64.1/24, connect to QuCPE 7012 port 12 (10GbE SFP+)
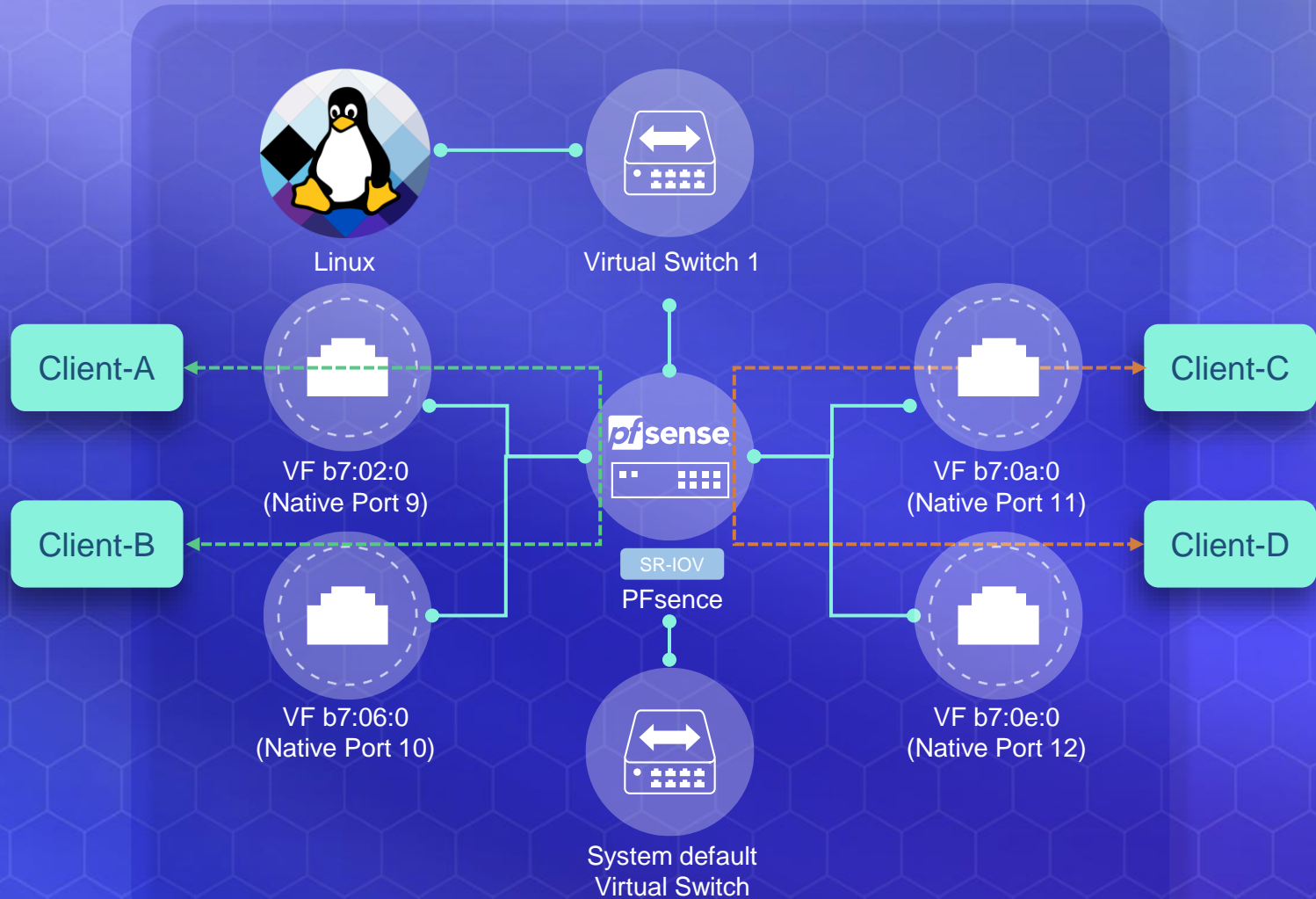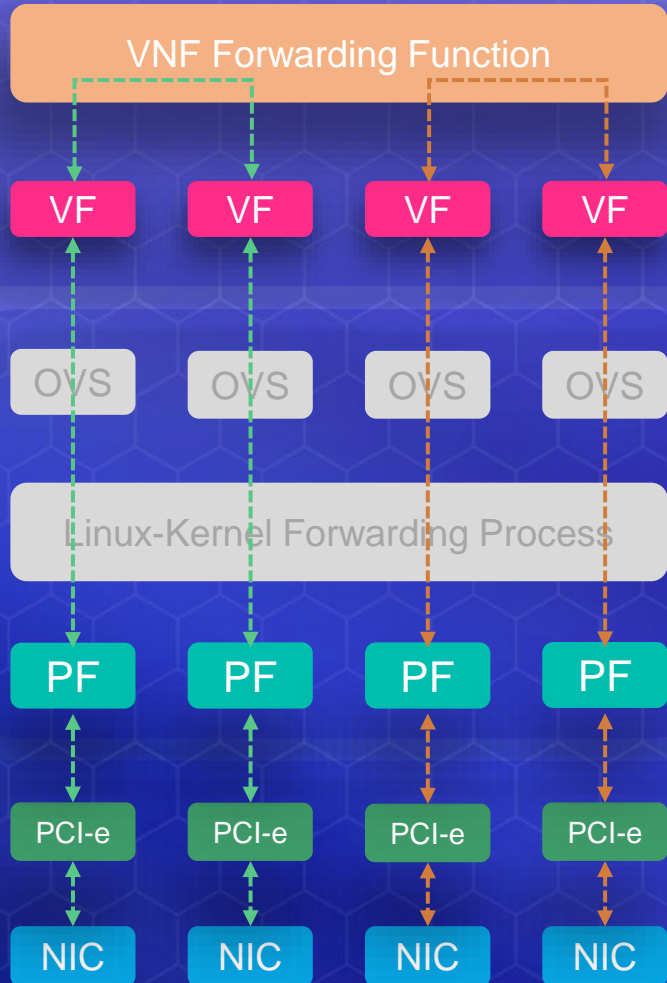
QuCPE-7012

- CPU: Intel Xeon-D 2146NT
- RAM: 32GB
- OS: QNE 1.0.3.573

Pfsense:

- CPU assign: Core 3-8 (Total 12 threads)
- RAM: 1G
- HDD: 100G
- Version: 2.6.0 Release
- WAN: DHCP from system default virtual switch for system update
- LAN: 192.168.60.254/24 to Virtual switch 1 (for pfsense Web GUI access)
- OPT1: 192.168.61.254/24, VirtIO to Native Port 9
- OPT2: 192.168.62.254/24, VirtIO to Native port 10
- OPT3: 192.168.63.254/24, VirtIO to Native port 11
- OPT4: 192.168.64.254/24, VirtIO to Native port 12

Linux

Virtual Switch 1

Client-A

Native Port 9

Client-B

Native Port 10

pfsense

PFsence

Client-C

Native Port 11

Client-D

Native Port 12

System default
Virtual Switch

Test Setup – With SR-IOV
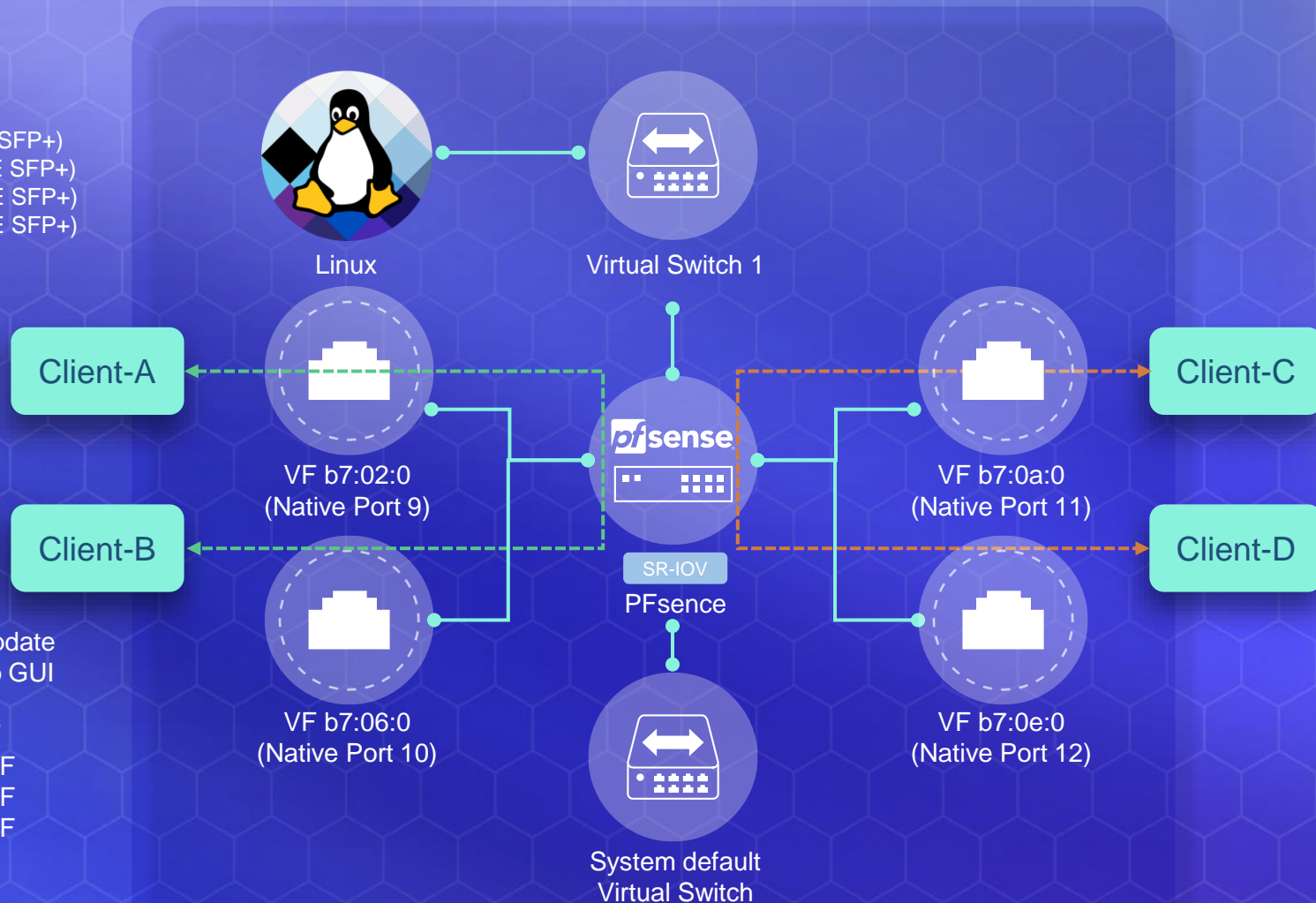
Test Setup – With SR-IOV

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- Client-C: 192.168.63.1/24, connect to QuCPE 7012 port 11 (10GbE SFP+)
- Client-D: 192.168.64.1/24, connect to QuCPE 7012 port 12 (10GbE SFP+)

QuCPE-7012

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- RAM: 32GB
- OS: QNE 1.0.3.573

Pfsense

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- RAM: 1G
- HDD: 100G
- Version: 2.6.0 Release
- WAN: DHCP from system default virtual switch for system update
- LAN: 192.168.60.254/24 to Virtual switch 1 (for pfsense Web GUI access)
- OPT1: 192.168.61.254/24, connect to port 9 with SR-IOV VF
- OPT2: 192.168.62.254/24, connect to port 10 with SR-IOV VF
- OPT3: 192.168.63.254/24, connect to port 11 with SR-IOV VF
- OPT4: 192.168.64.254/24, connect to port 12 with SR-IOV VF

Linux

Virtual Switch 1

Client-A

VF b7:02:0
(Native Port 9)

Client-B

VF b7:06:0
(Native Port 10)

pfsense

SR-IOV

PFsence

System default
Virtual Switch

Client-C

VF b7:0a:0
(Native Port 11)

Client-D

VF b7:0e:0
(Native Port 12)

QuCPE-7012

is your best choice