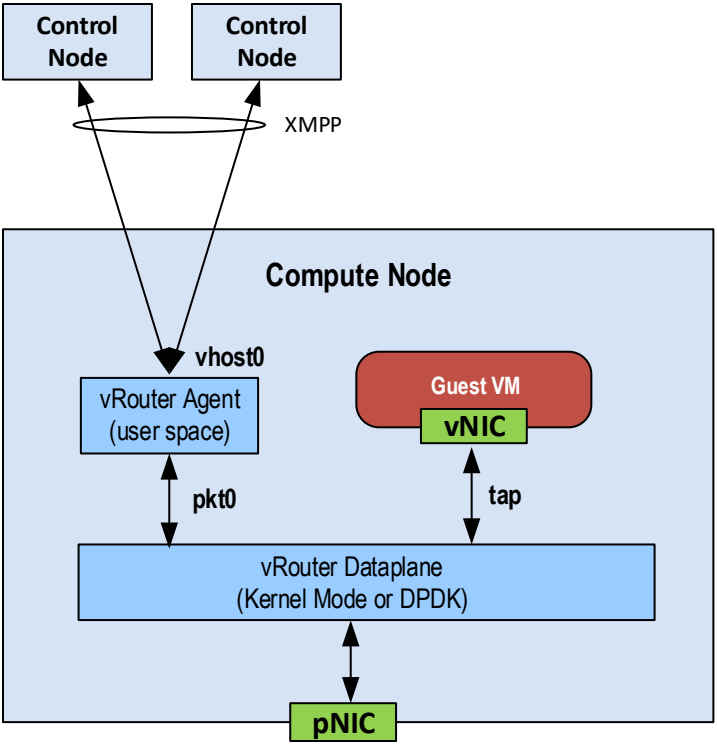
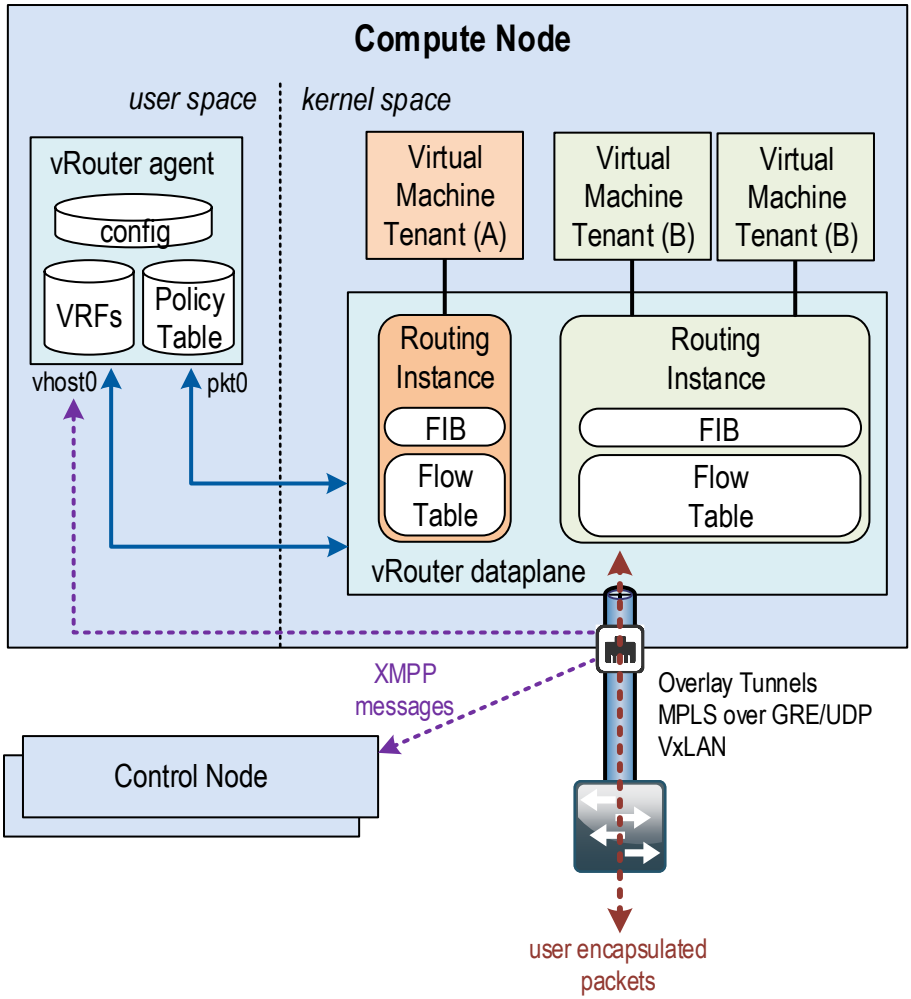
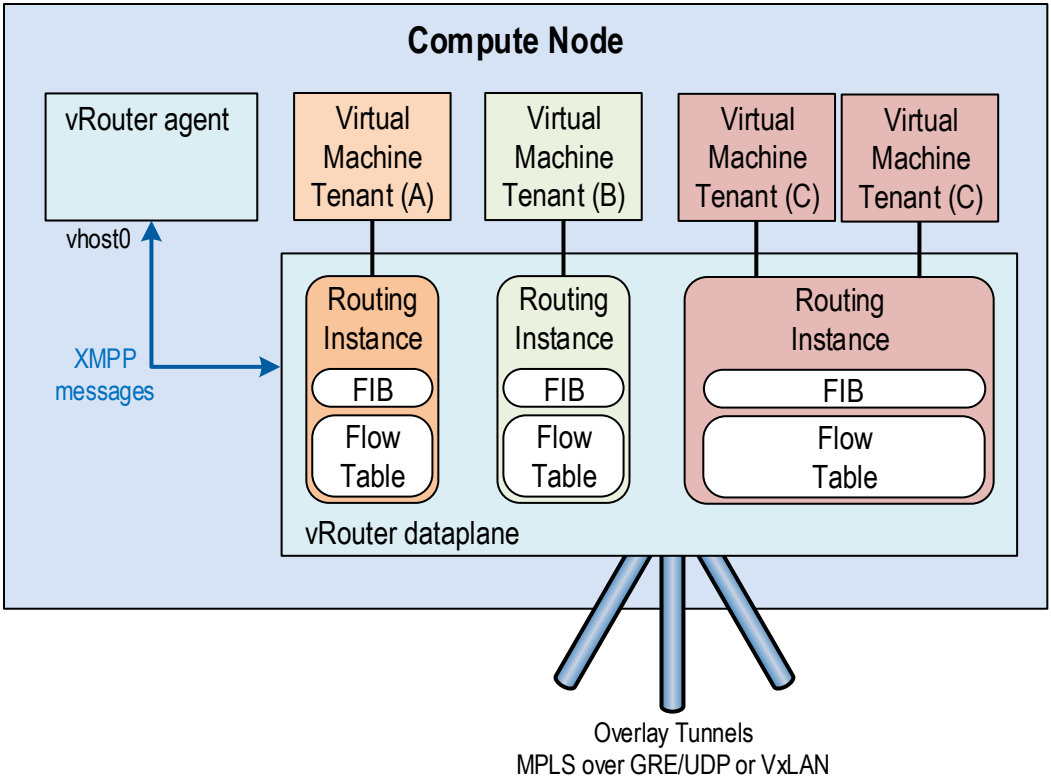


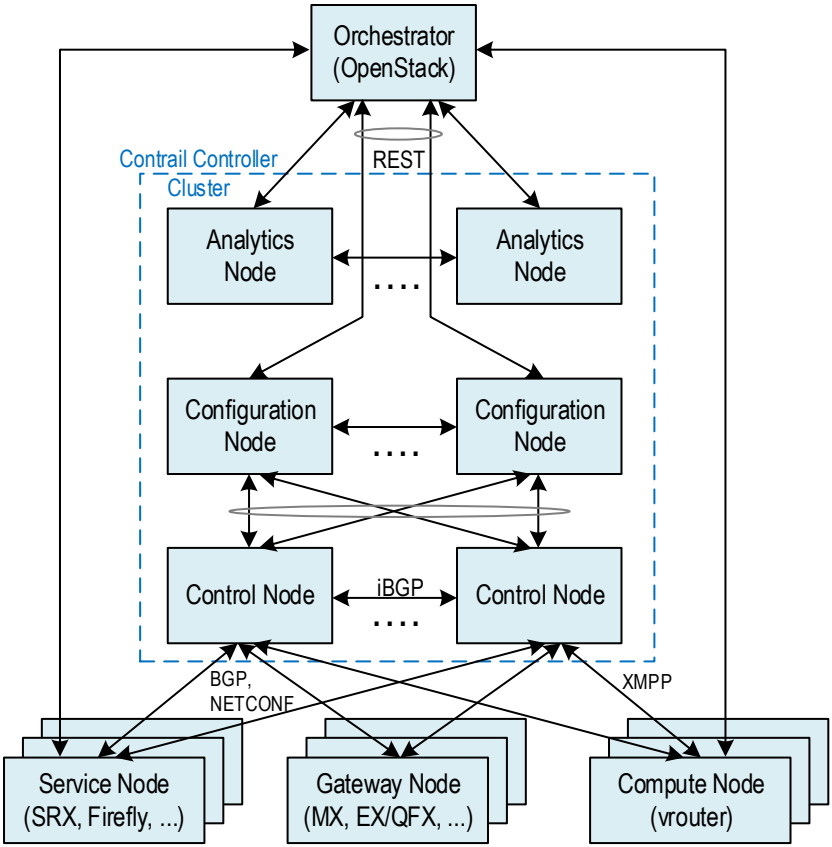
Title: vrouter overview	
version: 1.0	date: 25/03/2020



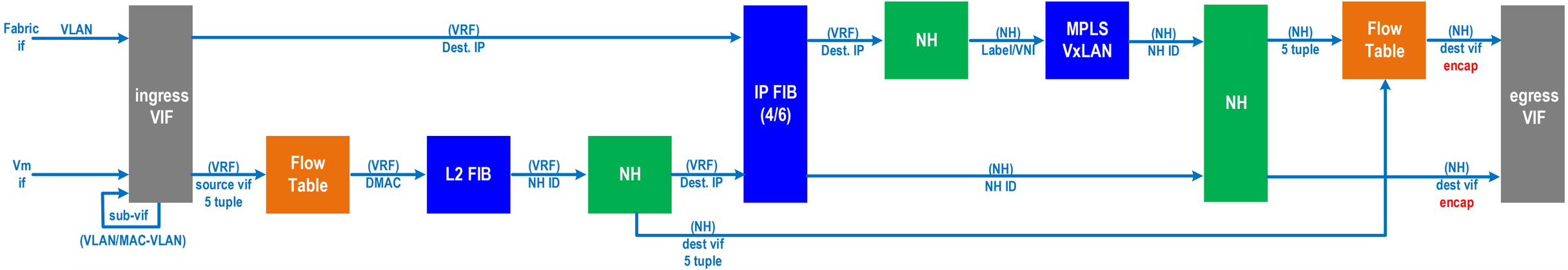
Title: vRouter XMPP path	
version: 1.0	date: 01/10/2020



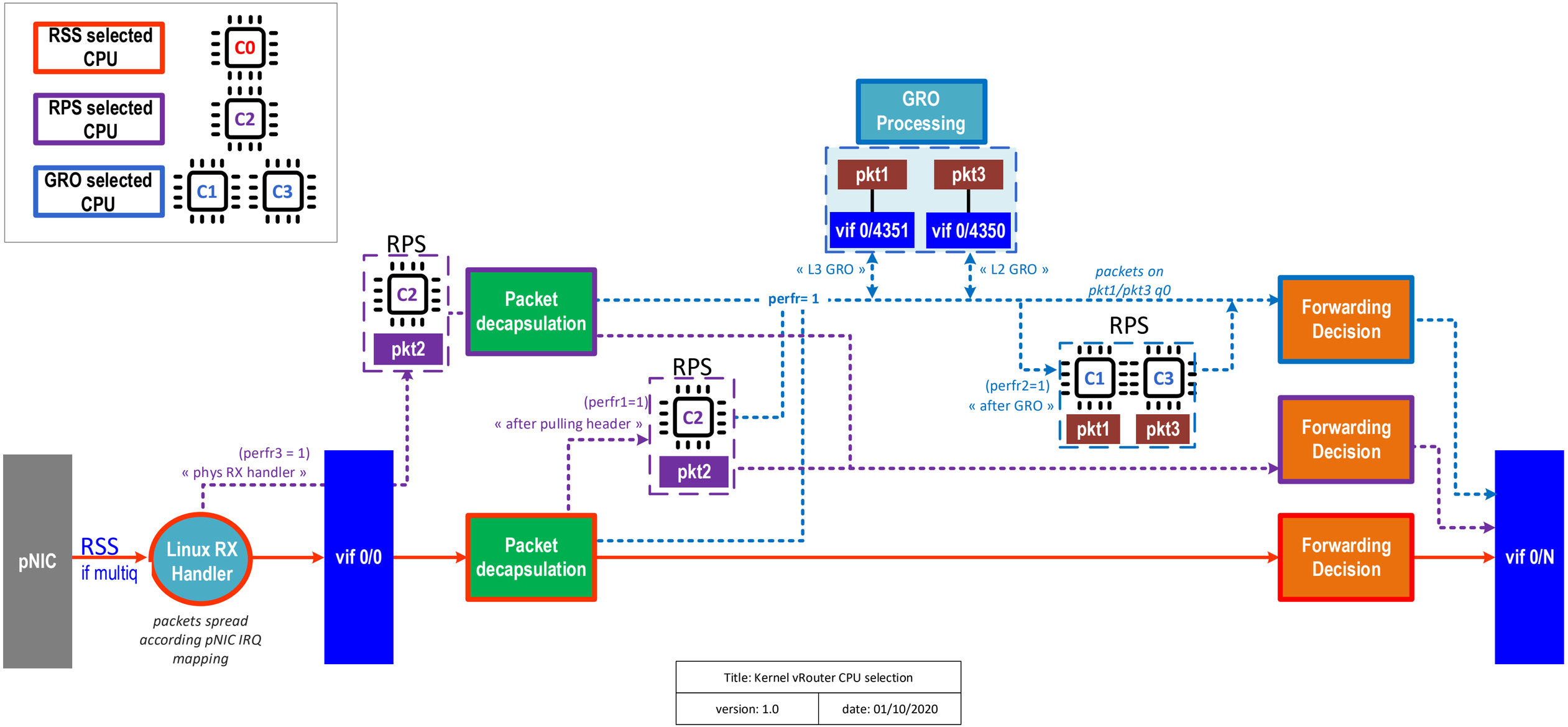
Title: vRouter internal paths	
version: 1.0	date: 01/10/2020

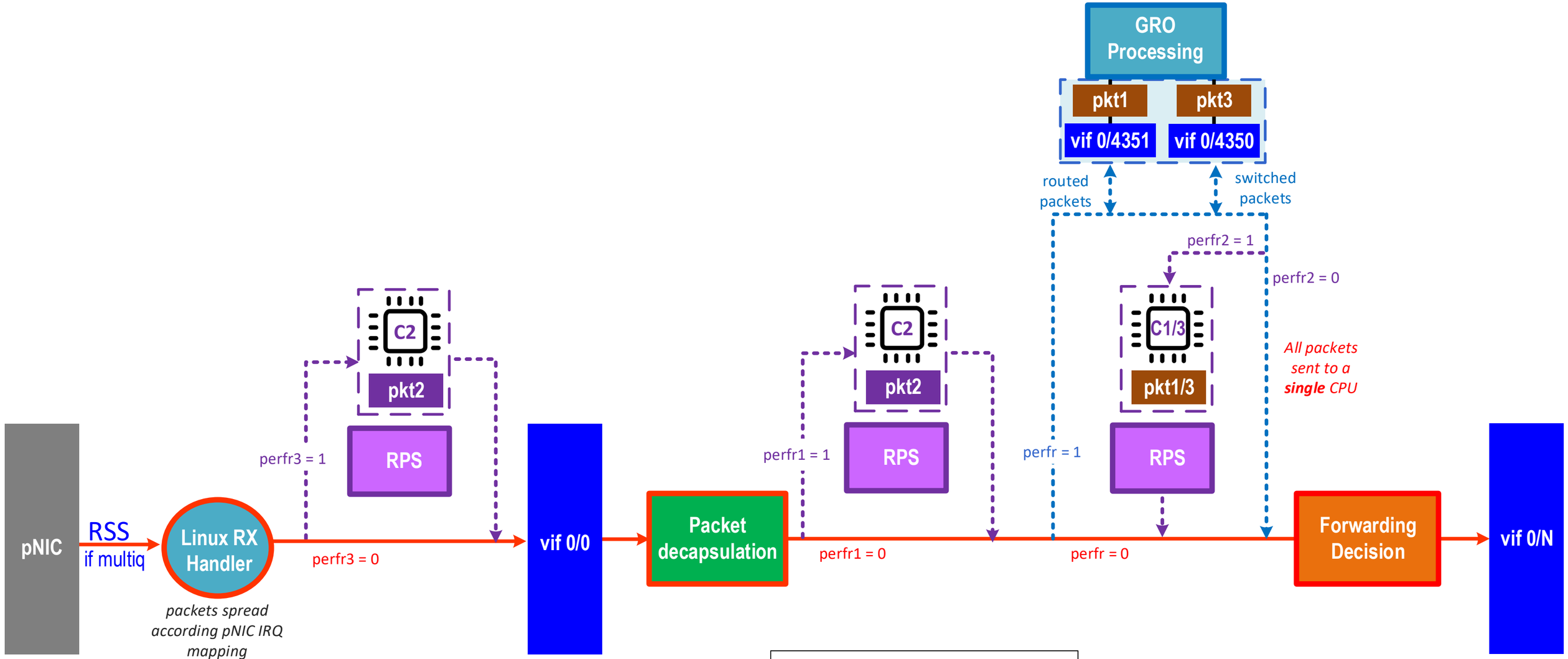


Title: Contrail Architecture	
version: 1.0	date: 01/10/2020

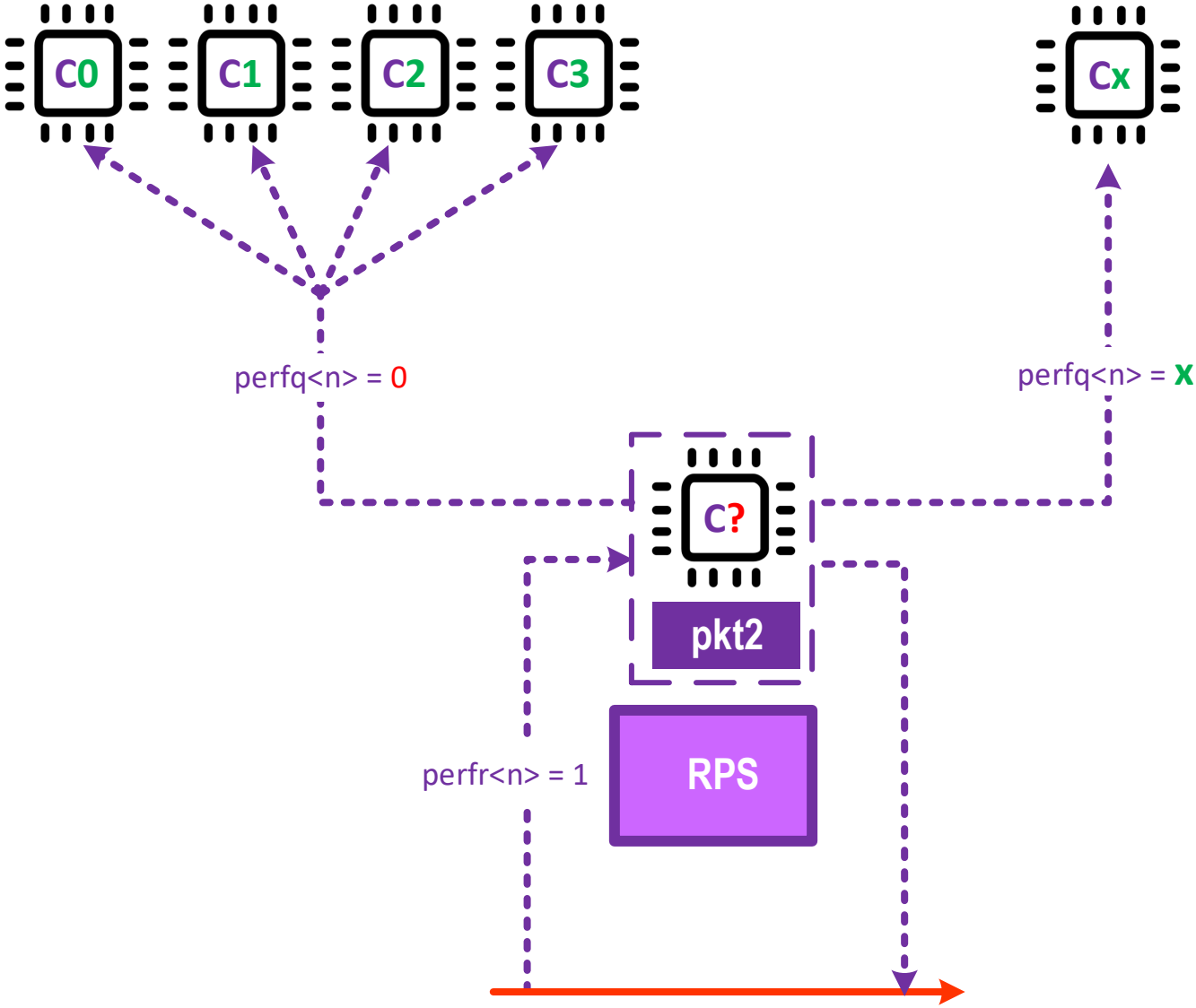


Title: vRouter Packet processing	
version: 1.0	date: 01/10/2020

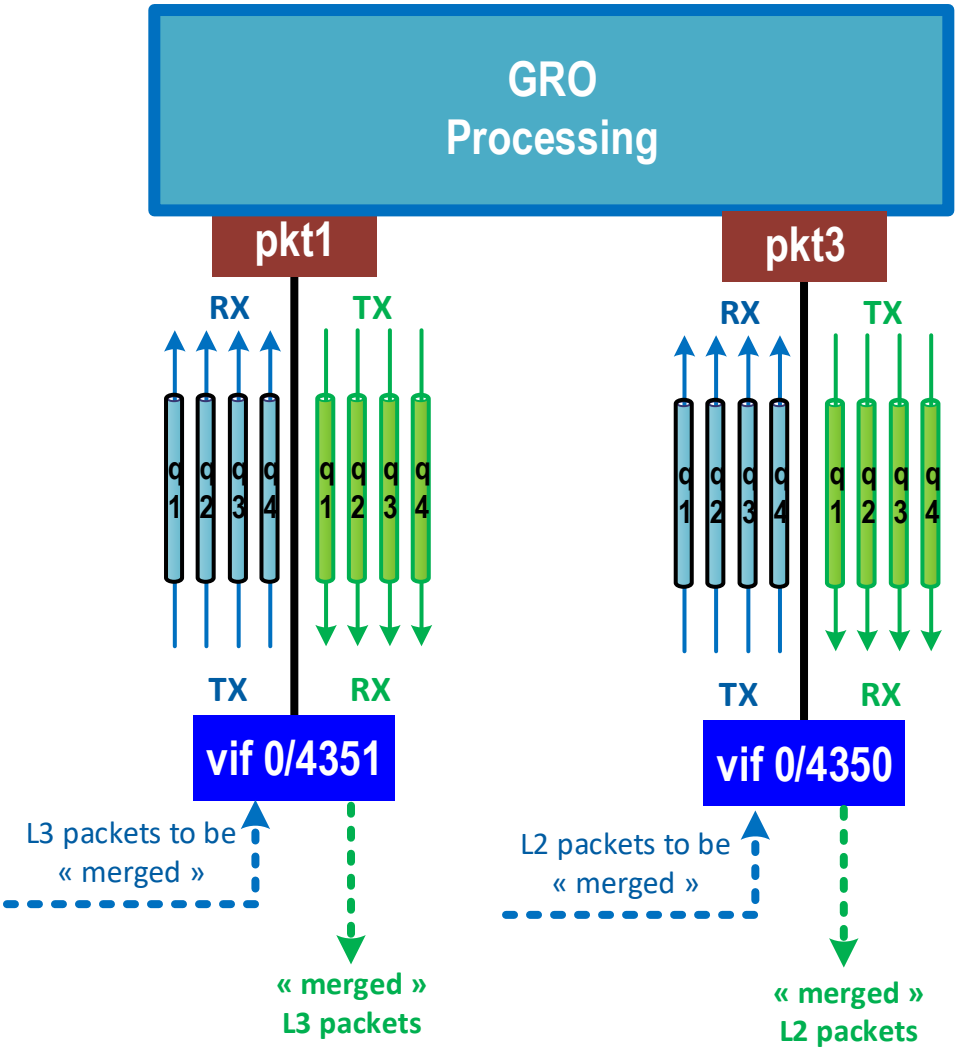

RSS selected CPU
RPS selected CPU
GRO selected CPU
C0
C2
C1
C3
GRO Processing
pkt1
pkt3
vif 0/4351
vif 0/4350
« L3 GRO »
« L2 GRO »
packets on pkt1/pkt3 q0
RPS
C2
pkt2
Packet decapsulation
perfr= 1
RPS
(perfr1=1)
« after pulling header »
C2
pkt2
RPS
(perfr2=1)
« after GRO »
C1
C3
pkt1
pkt3
Forwarding Decision
Forwarding Decision
Forwarding Decision
(perfr3 = 1)
« phys RX handler »
pNIC
RSS
if multiq
Linux RX Handler
packets spread according pNIC IRQ mapping
vif 0/0
Packet decapsulation
vif 0/N
Title: Kernel vRouter CPU selection
version: 1.0
date: 01/10/2020



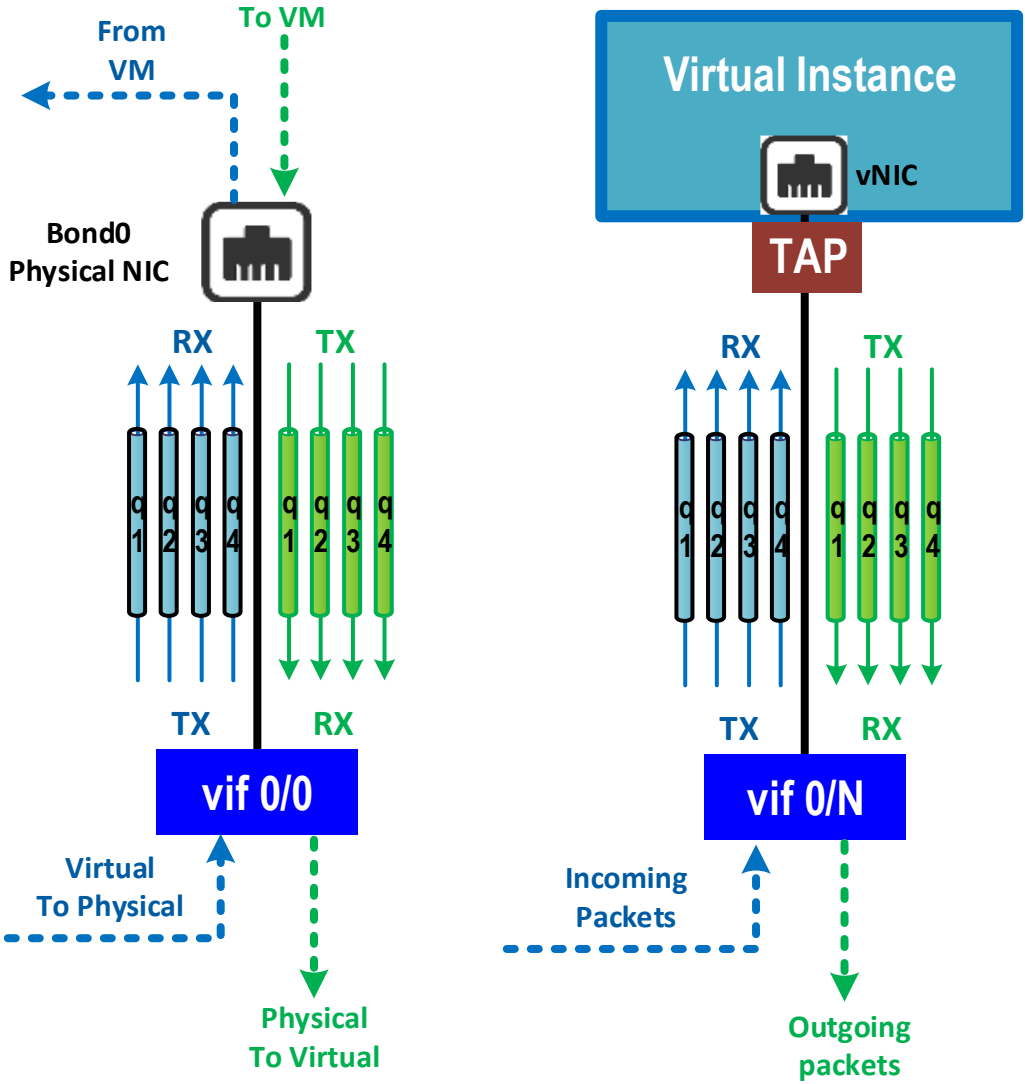
Title: Kernel vRouter CPU selection v2	
version: 1.0	date: 01/10/2020



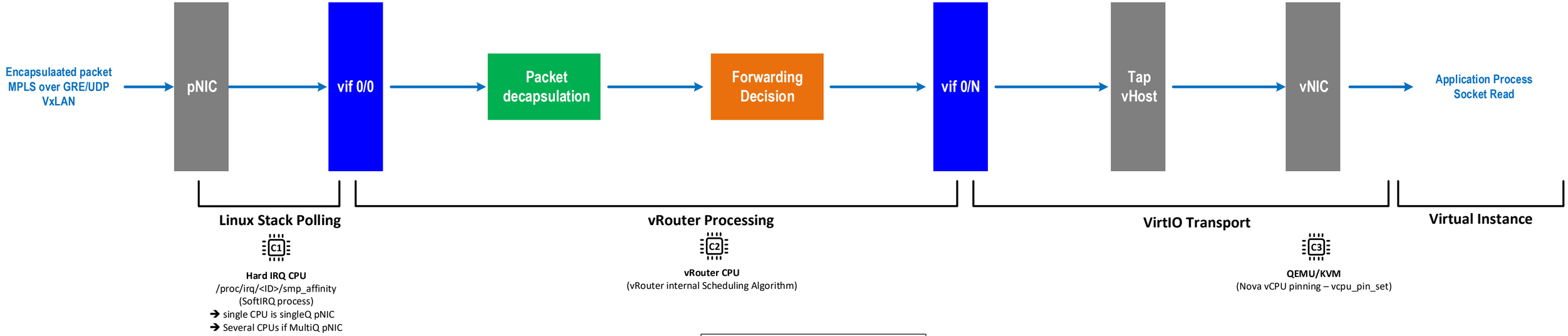
Title: Kernel vRouter RPS CPU selection	
version: 1.0	date: 01/10/2020



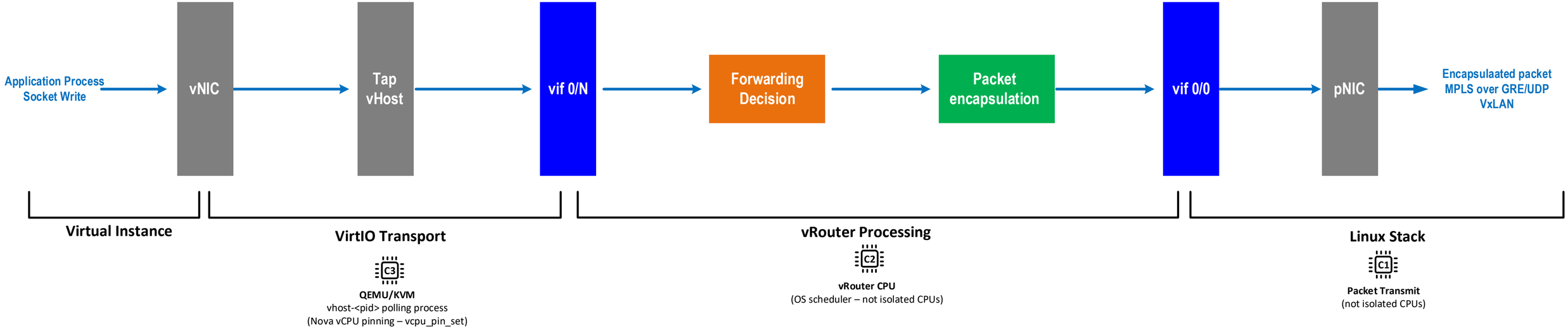
Title: Kernel vRouter GRO CPU selection	
version: 1.0	date: 01/10/2020



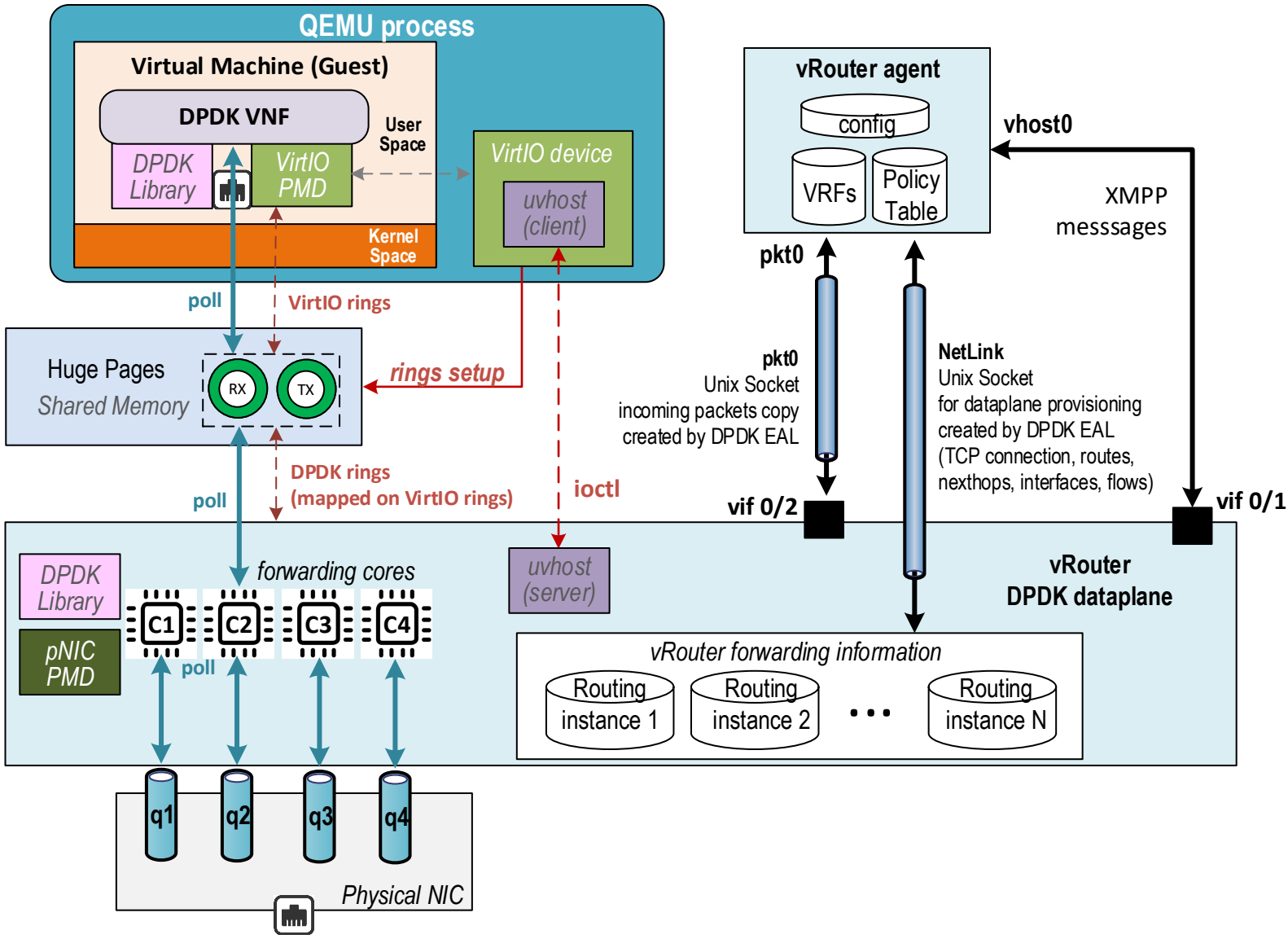
Title: Kernel vRouter vif TX/RX	
version: 1.0	date: 01/10/2020



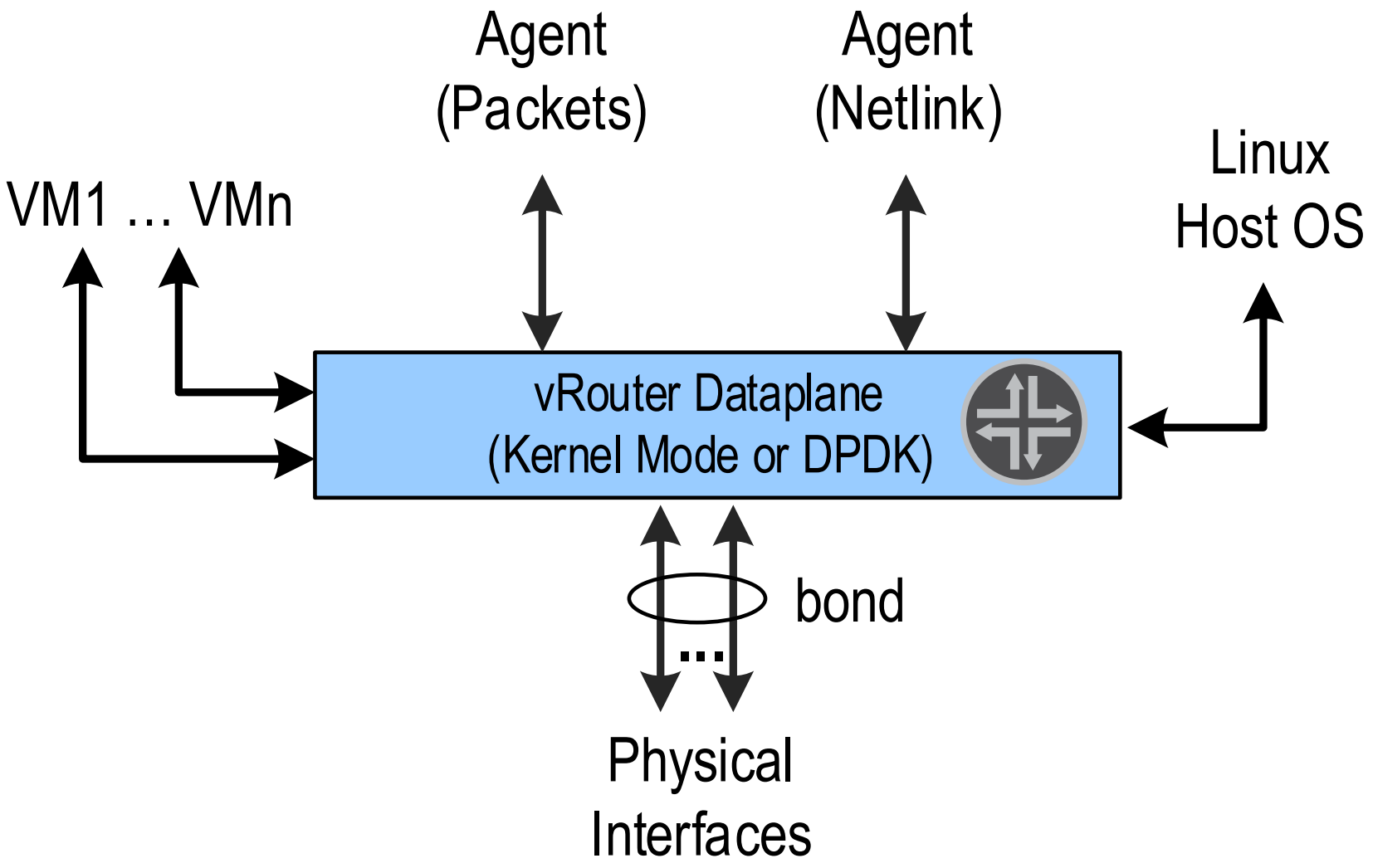
Title: Kernel vRouter Physical to Virtual	
version: 1.0	date: 01/10/2020



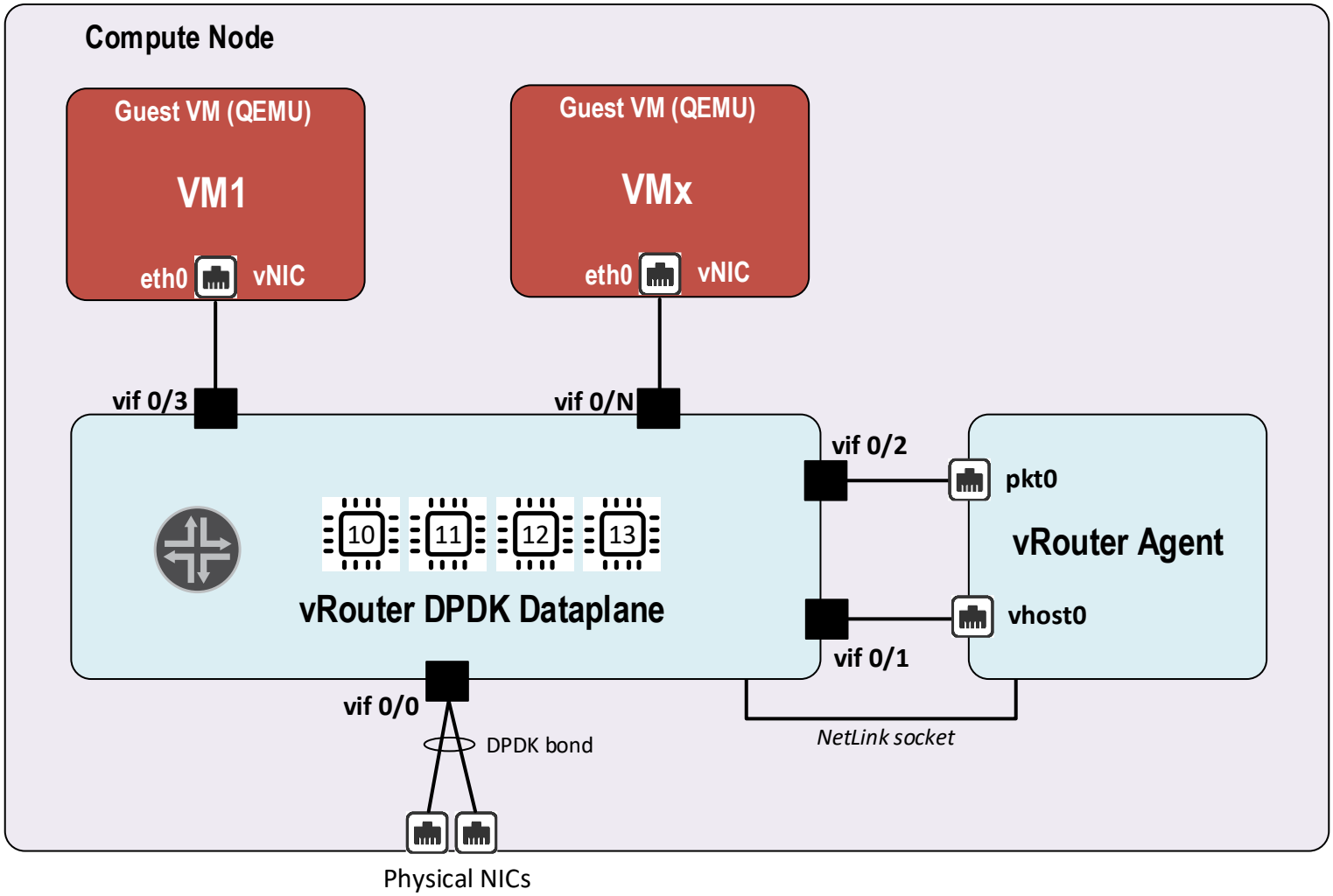
Title: Kernel vRouter Virtual to Physical	
version: 1.0	date: 01/10/2020



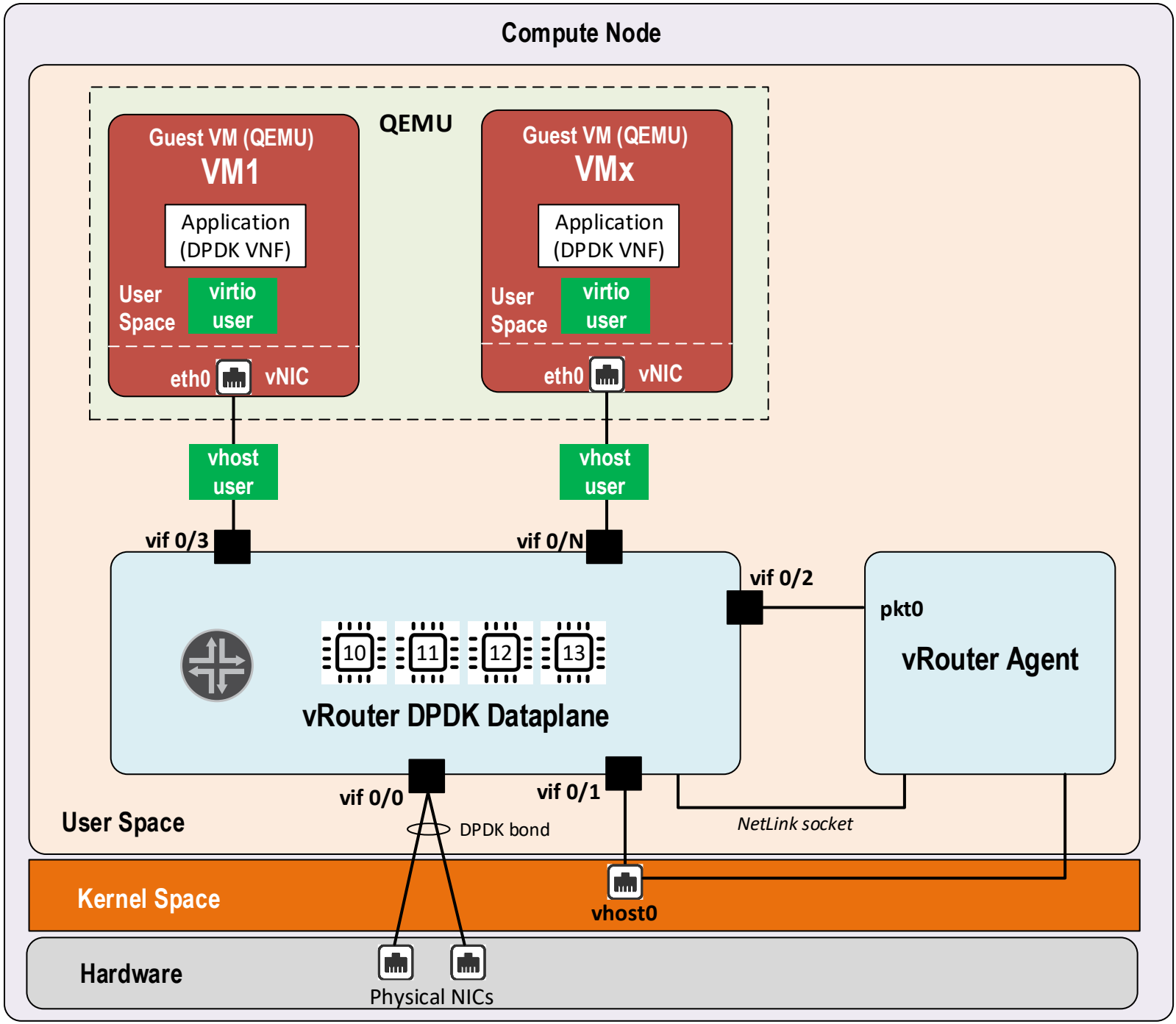
Title: DPDK vRouter internal logic	
version: 1.0	date: 01/10/2020



Title: vRouter interfaces	
version: 1.0	date: 01/10/2020



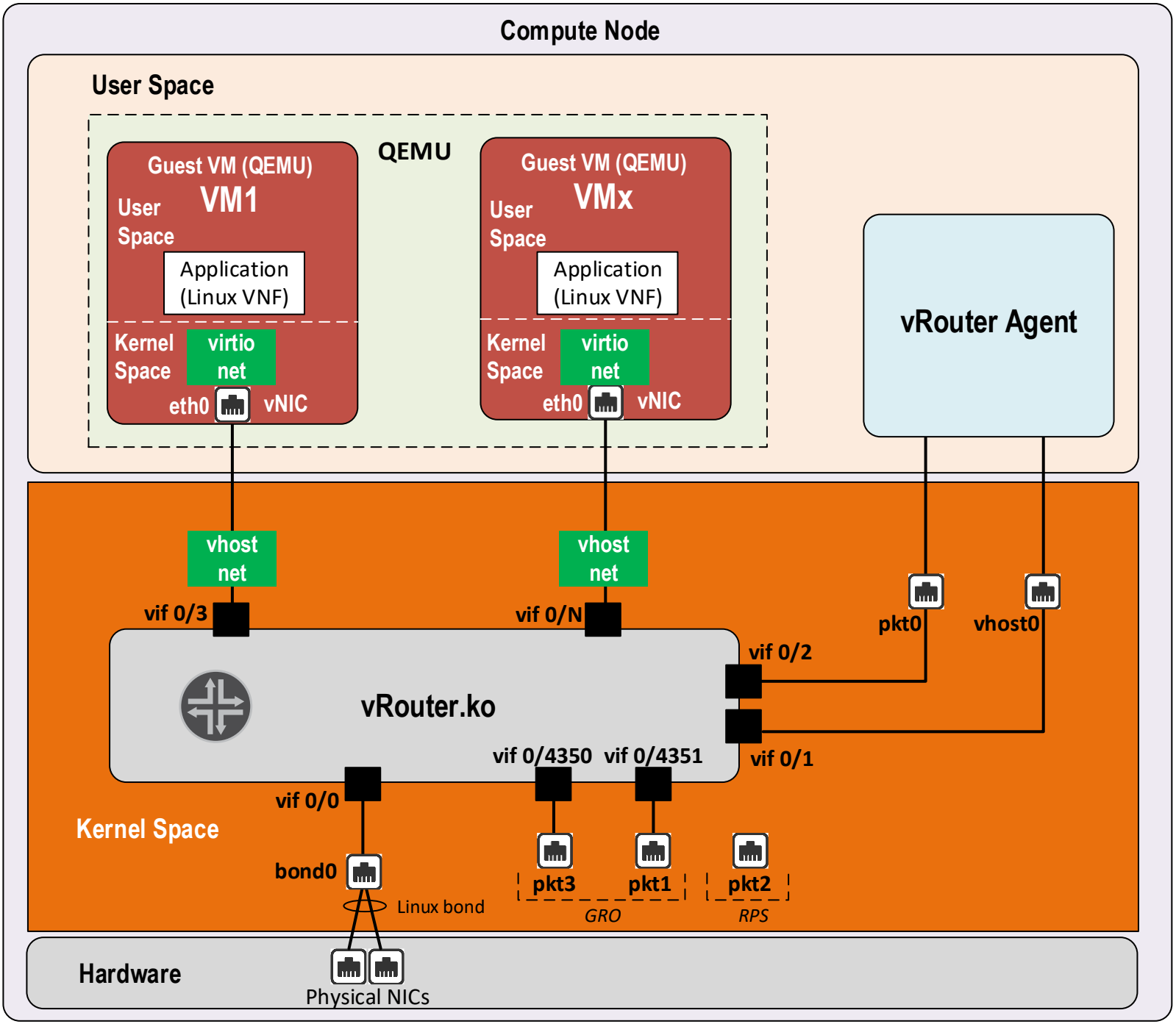
Title: DPDK vRouter interfaces overview	
version: 1.0	date: 27/03/2020



Title: DPDK vRouter interfaces overview v2	
version: 1.0	date: 27/09/2020

DPDK model fast:

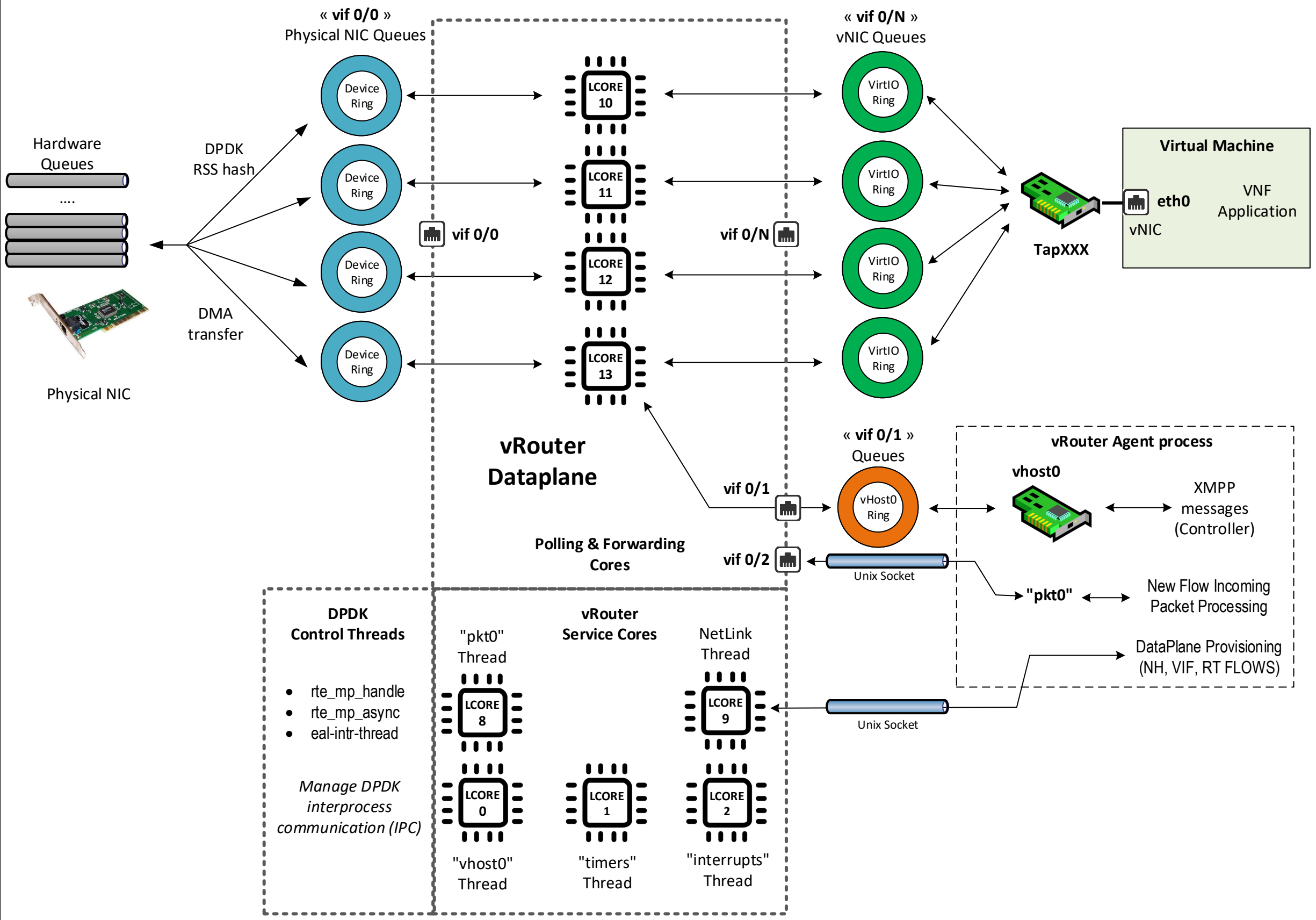
- NIC DMA directly into user-space.
- DPDK memory allocation with hugepages reduces TLB misses.
- DPDK in host & guest copies directly from host user-spac



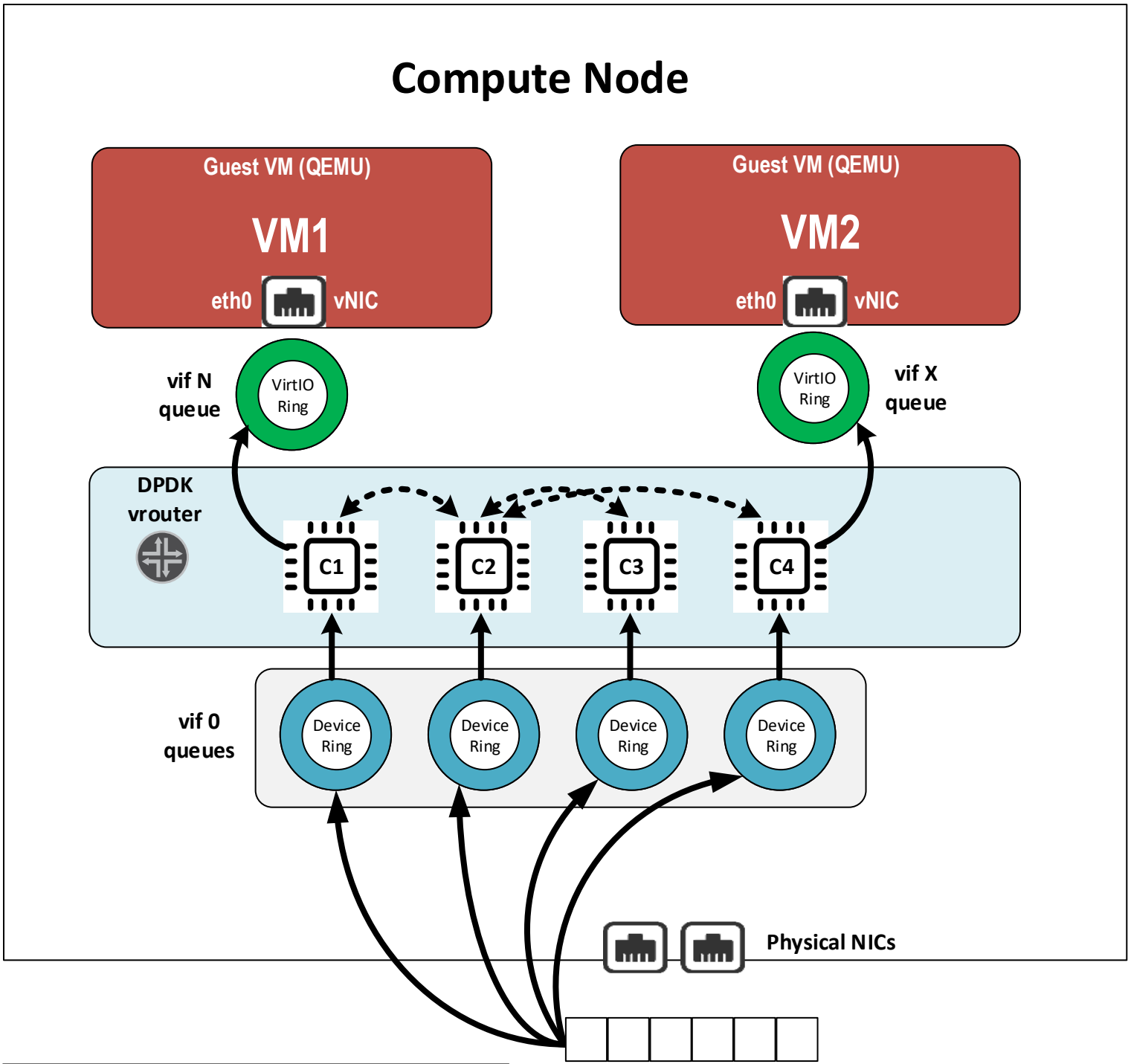
Title: Kernel Mode vRouter interfaces overview	
version: 1.0	date: 27/09/2020

Kernel model slow:

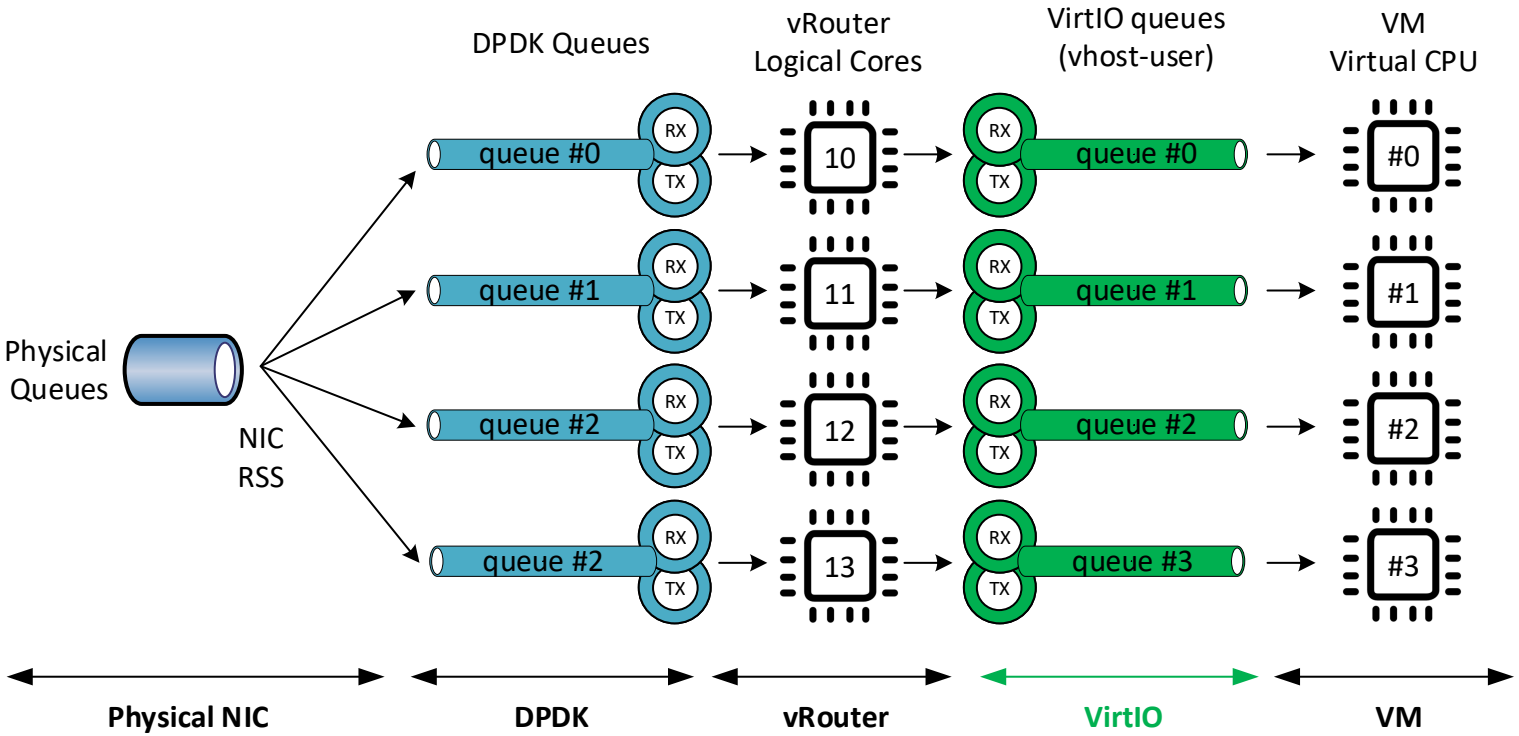
- Packet needs to be copied across kernel/user-space boundary in both host and guest
- Kernel code responsible for packet I/O, tunneling, etc.



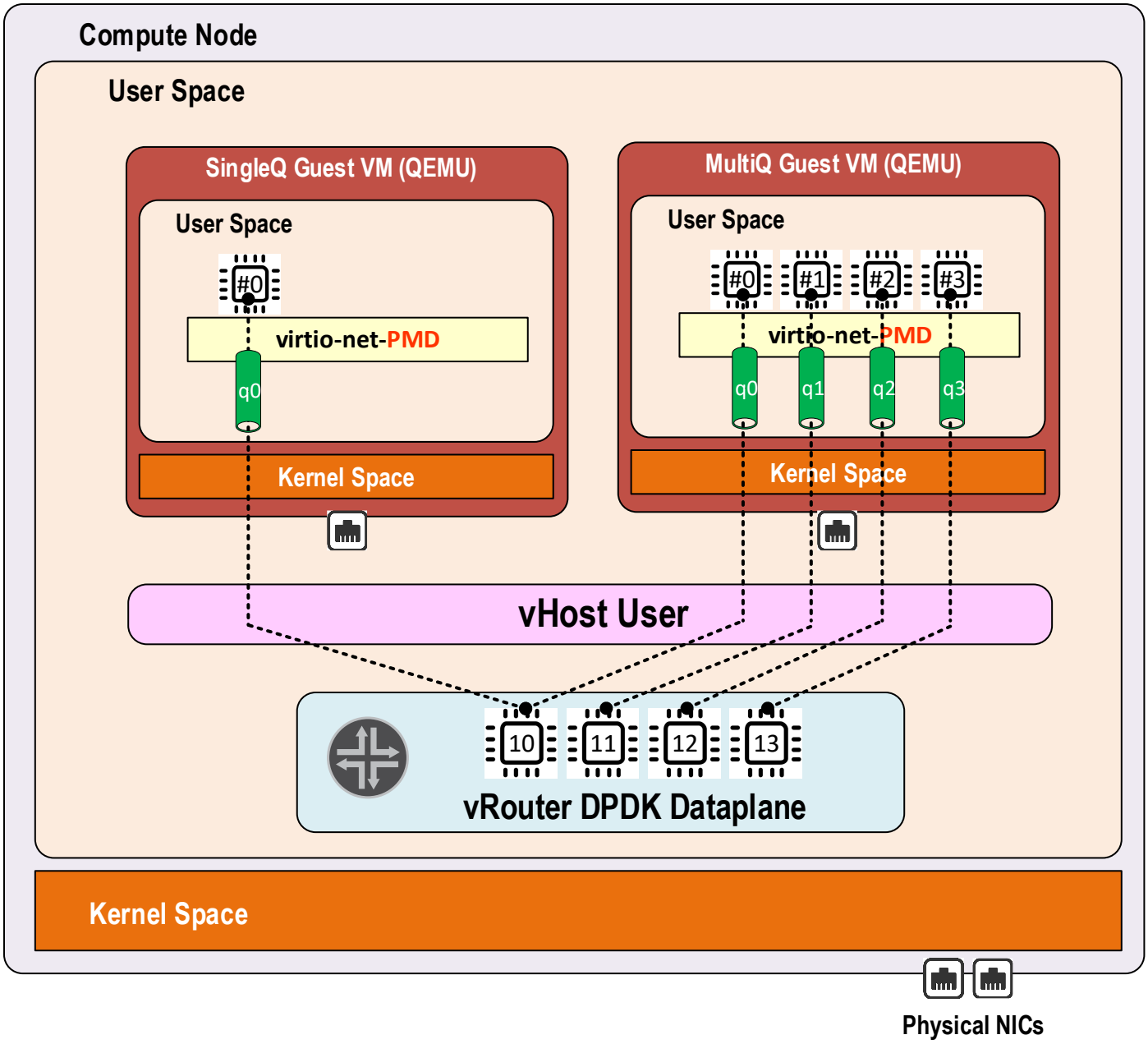
Title: vRouter Internal Architecture	
version: 1.1	date: 22/05/2020



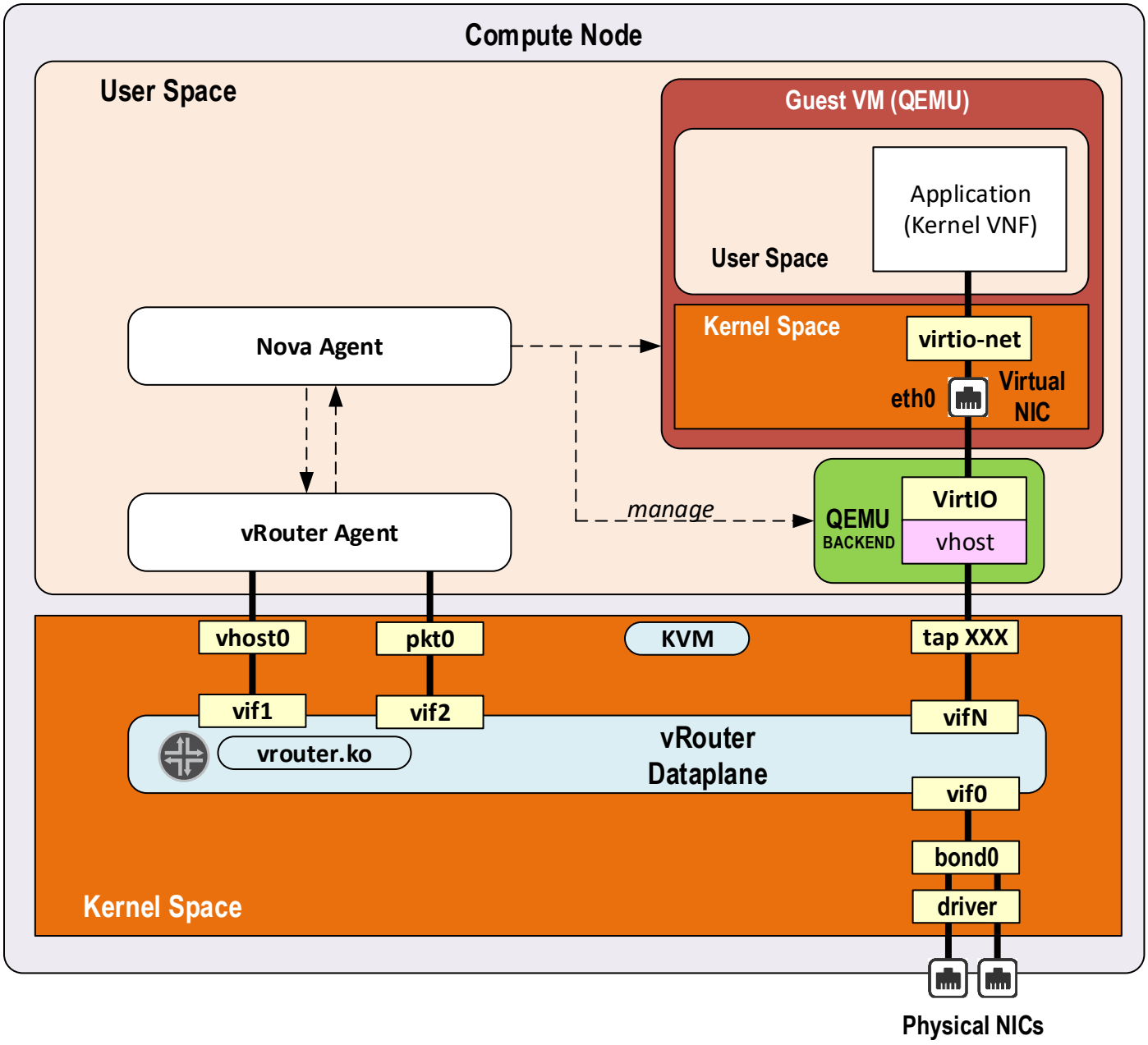
Title: DPDK Packet Processing Overview	
version: 1.0	date: 25/03/2020



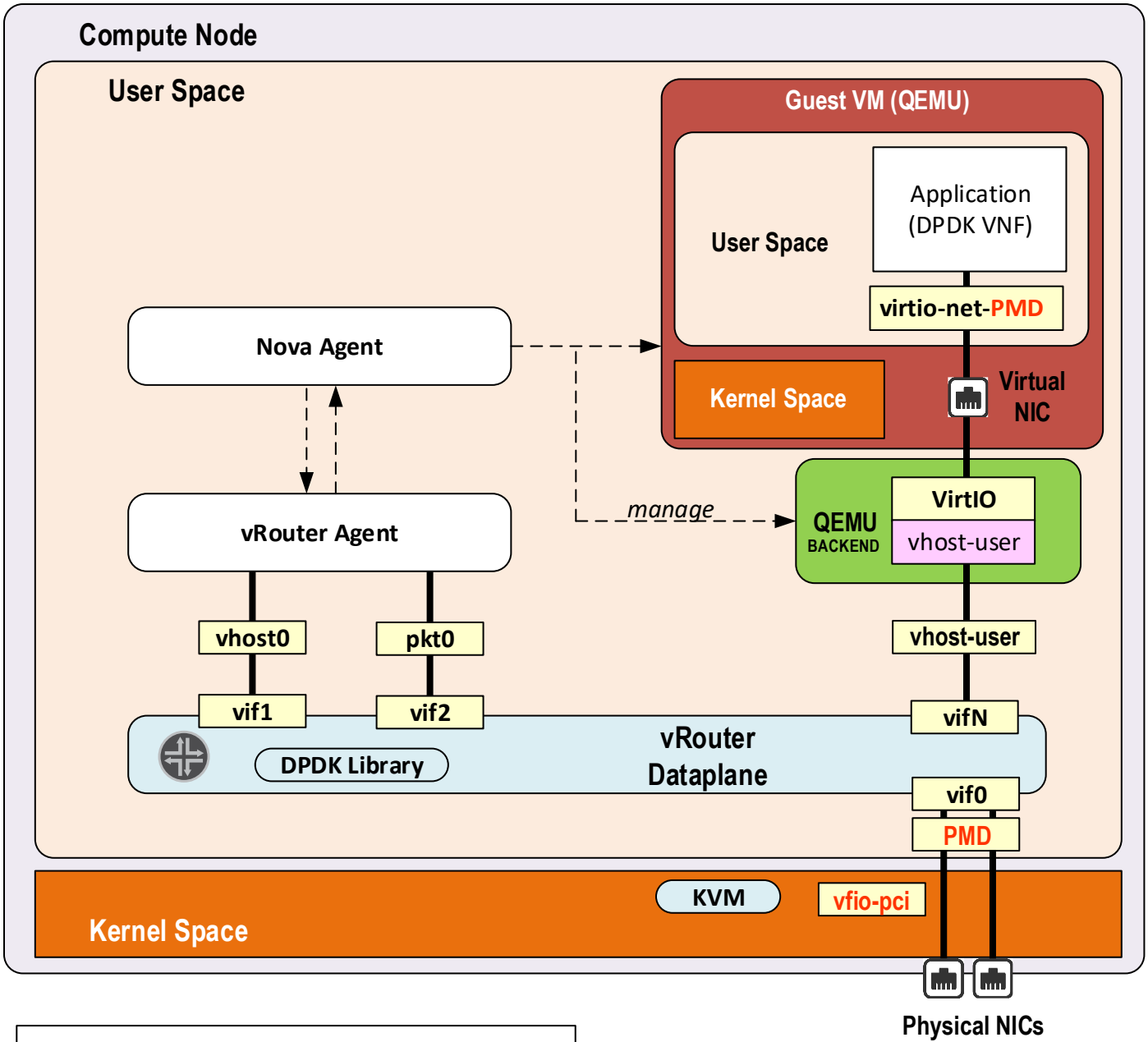
Title: DPDK End to End Packet Processing	
version: 1.0	date: 27/03/2020



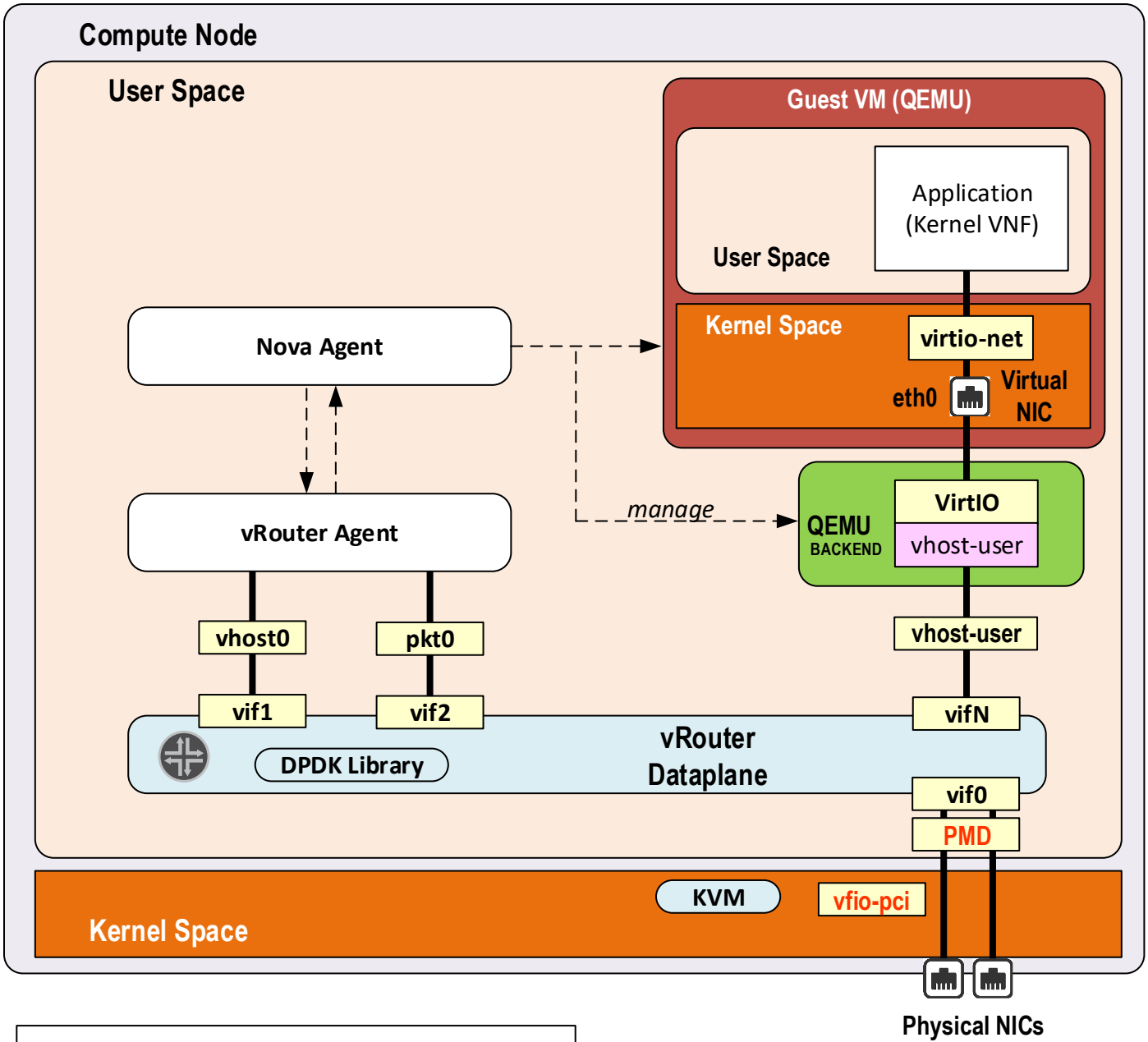
Title: SingleQ versus MultiQ VNF	
version: 1.0	date: 27/03/2020



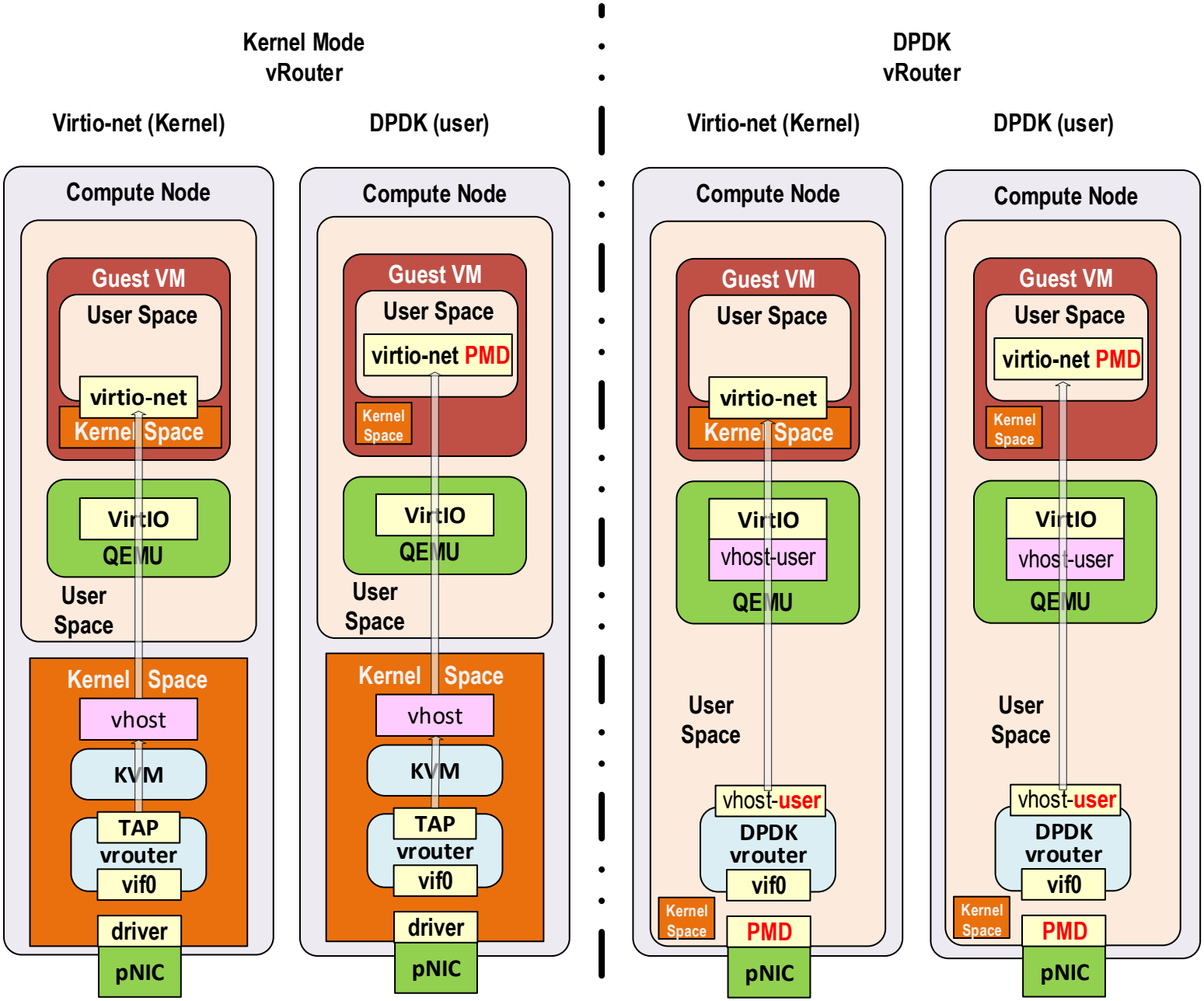
Title: Kernel vRouter details	
version: 1.0	date: 25/03/2020



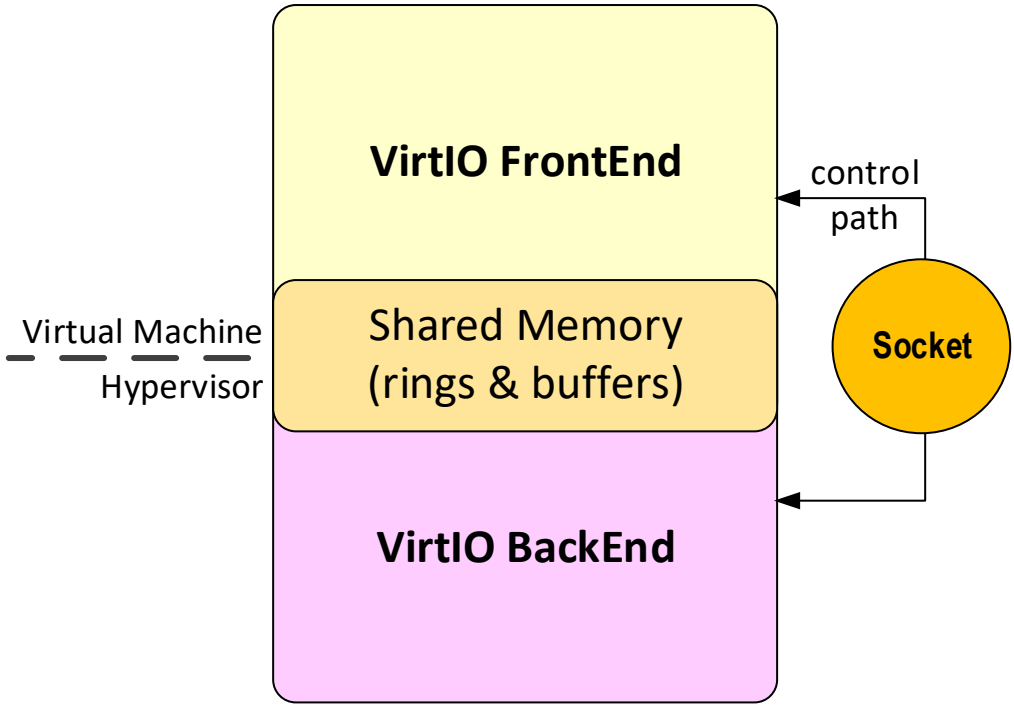
Title: DPDK vRouter details (DPDK App)	
version: 1.0	date: 25/03/2020



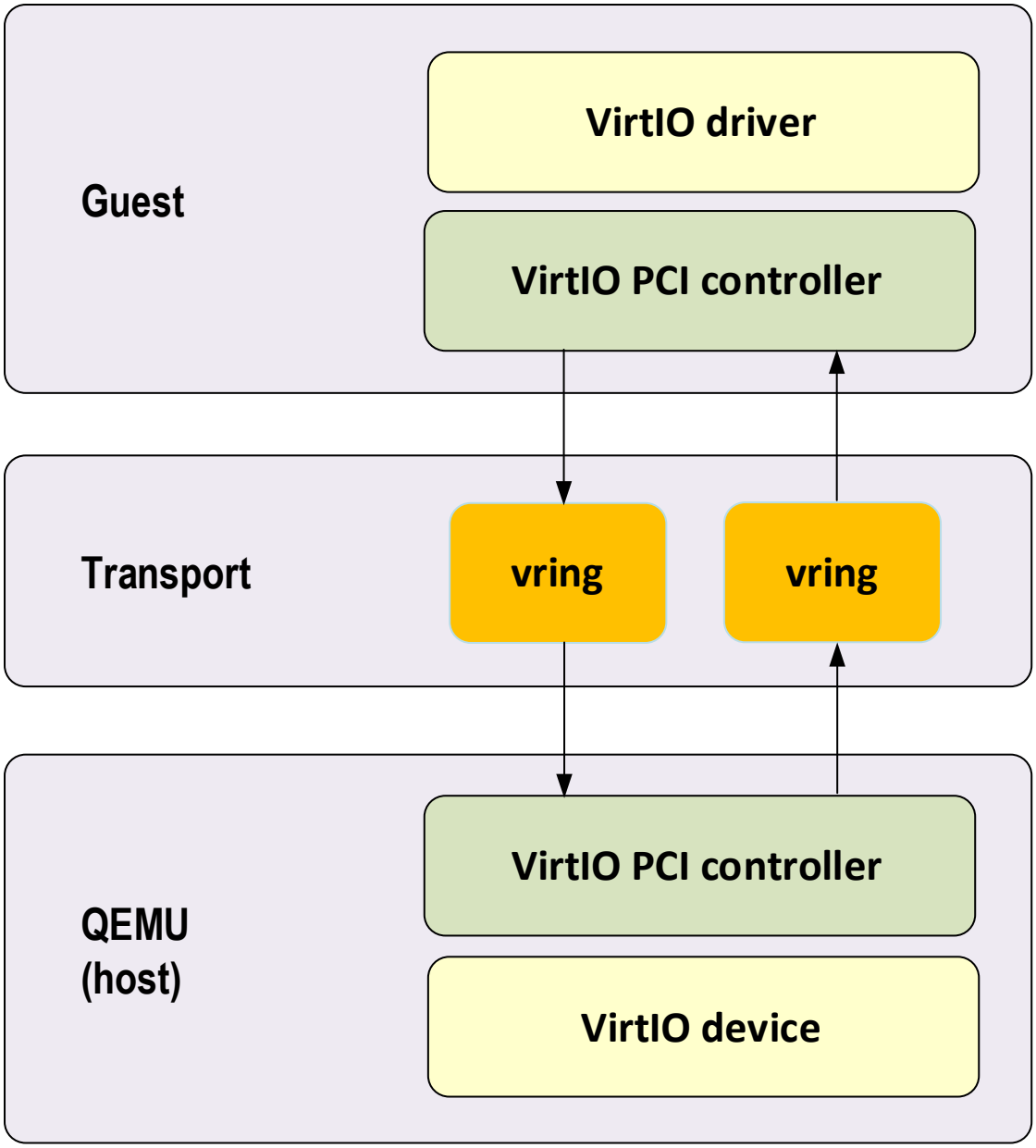
Title: DPDK vRouter details (Kernel App)	
version: 1.0	date: 25/03/2020



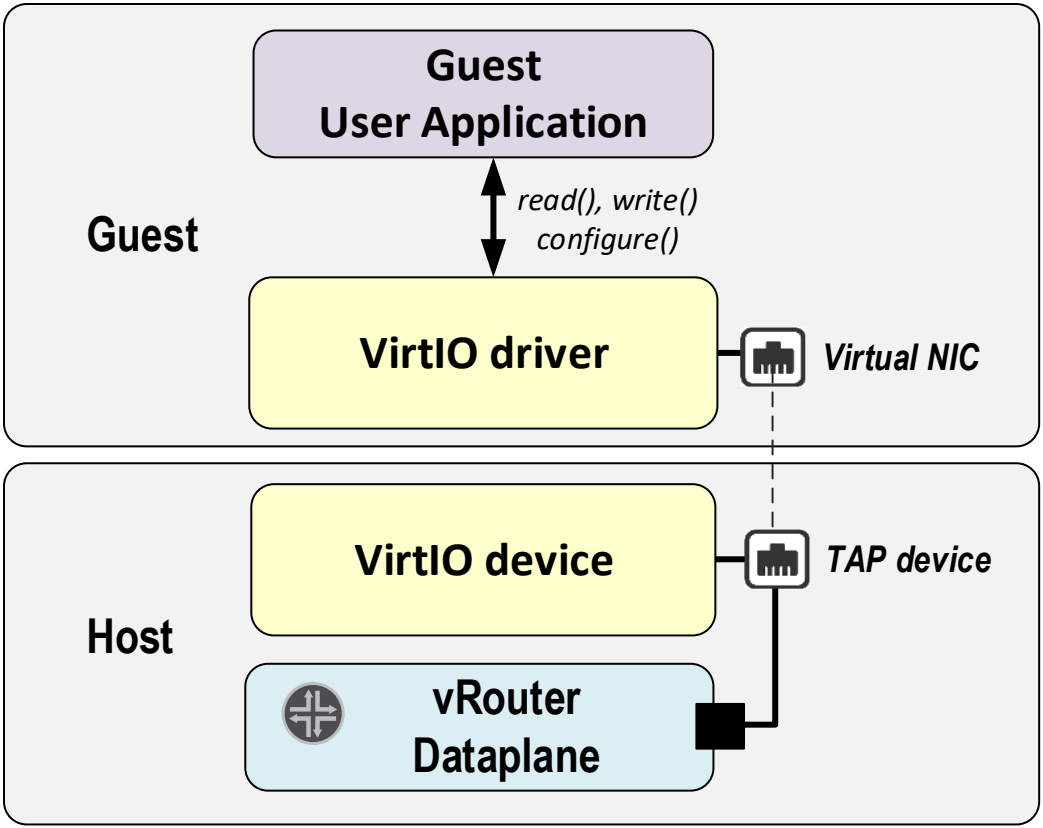
Title: Kernel vRouter All Cases	
version: 1.1	date: 22/05/2020



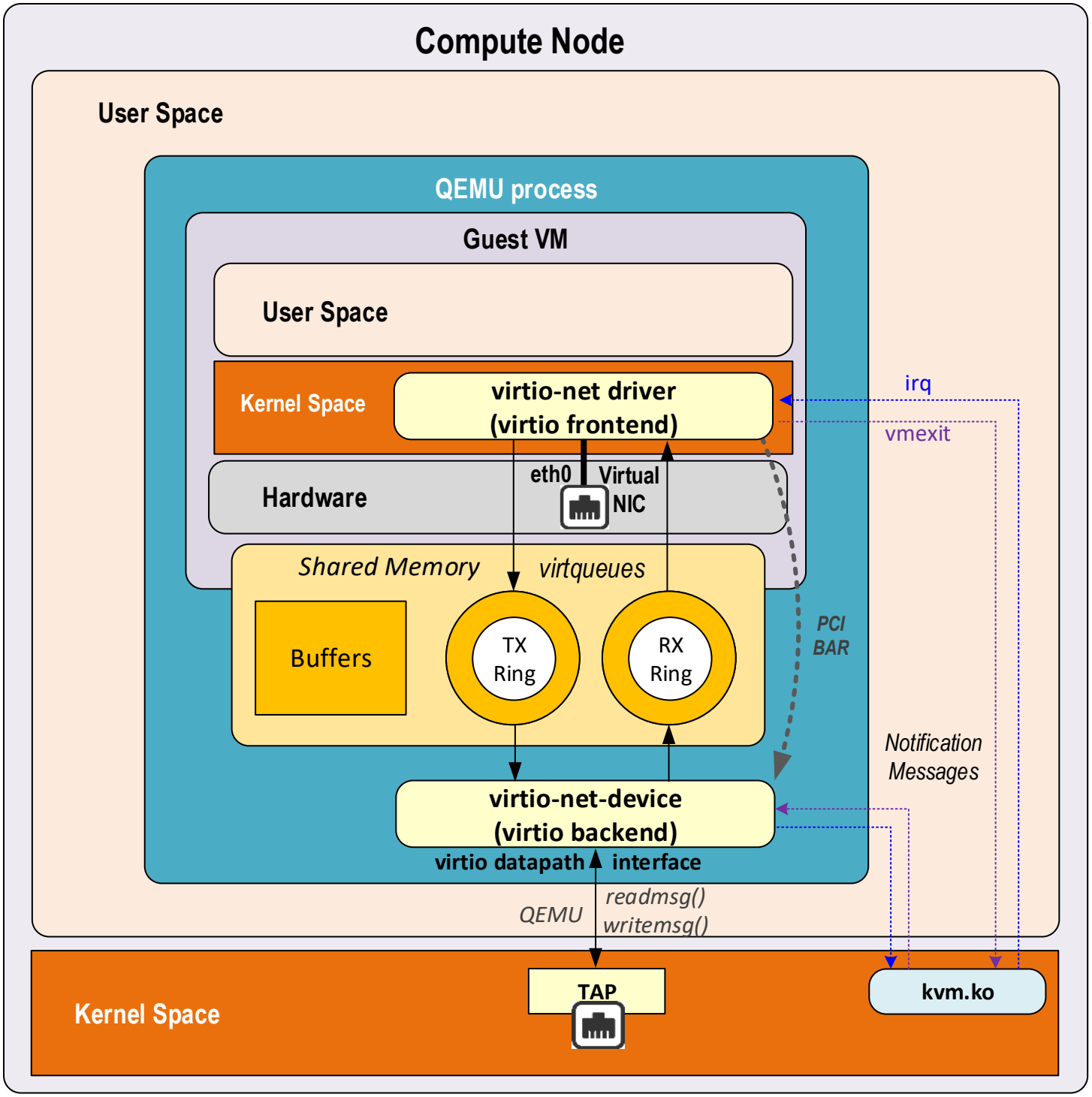
Title: VirtIO overview	
version: 1.0	date: 25/03/2020



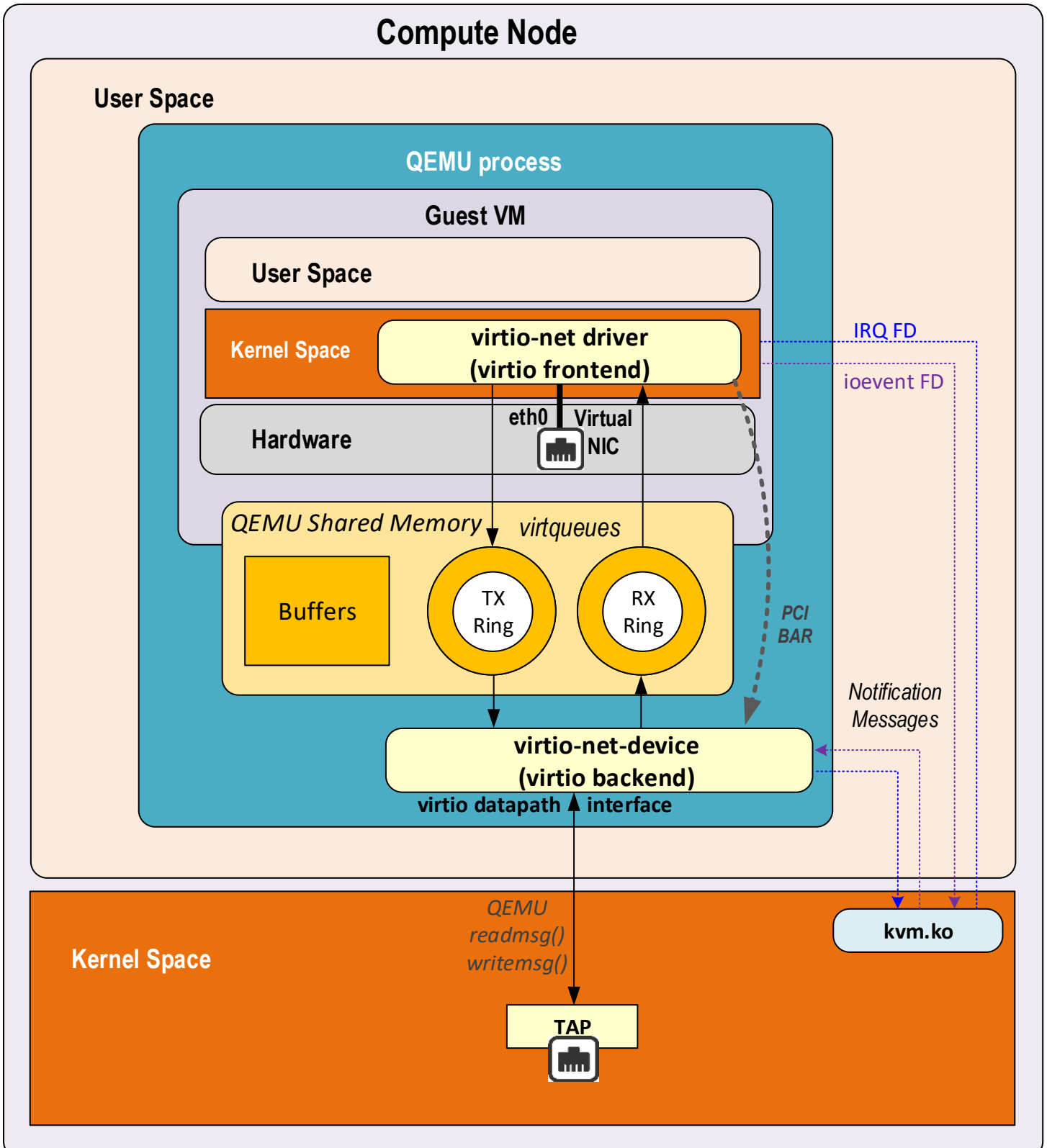
Title: VirtIO driver and device	
version: 1.0	date: 02/06/2020



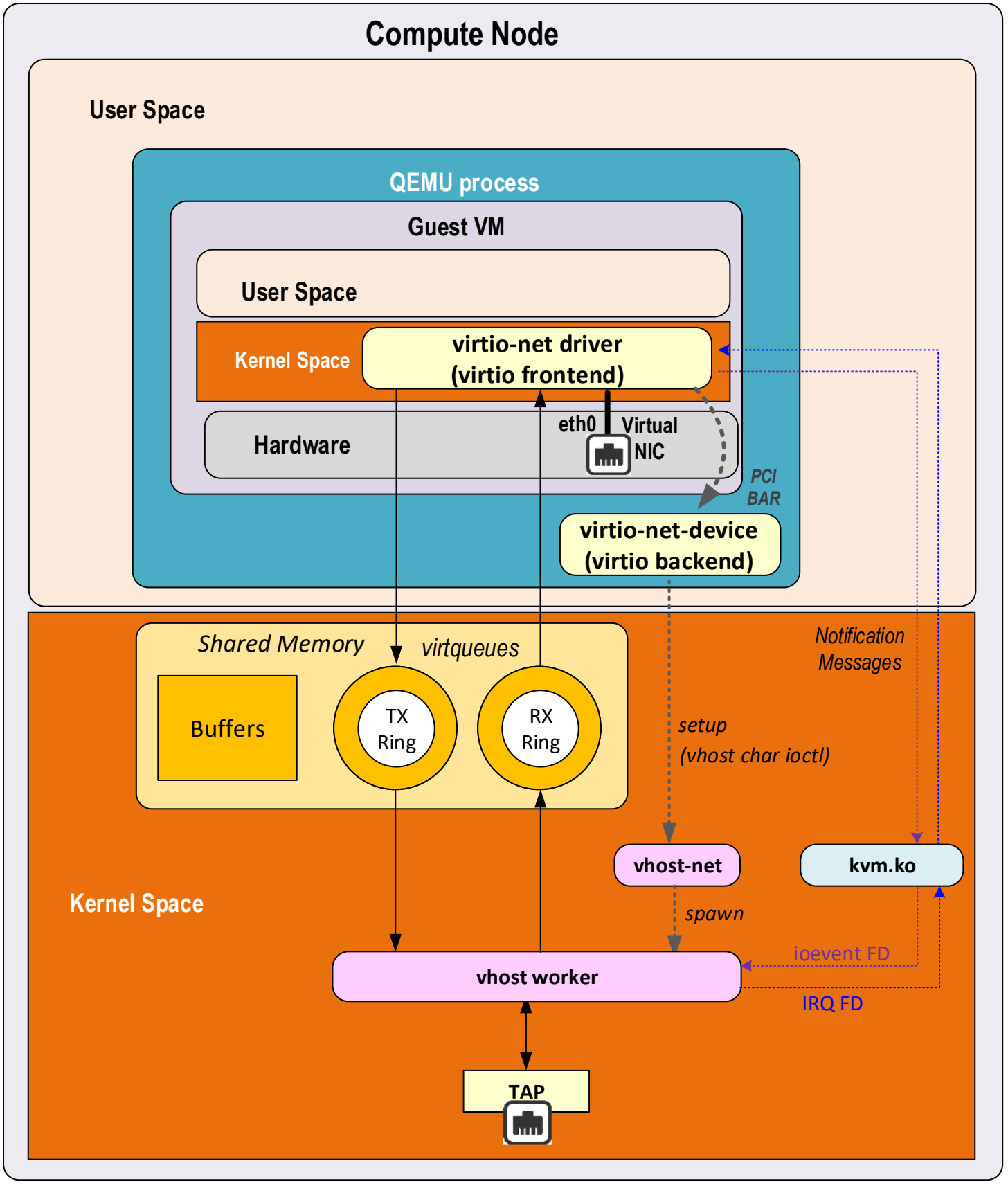
Title: Virtio & virtual infrastructure	
version: 1.0	date: 02/06/2020



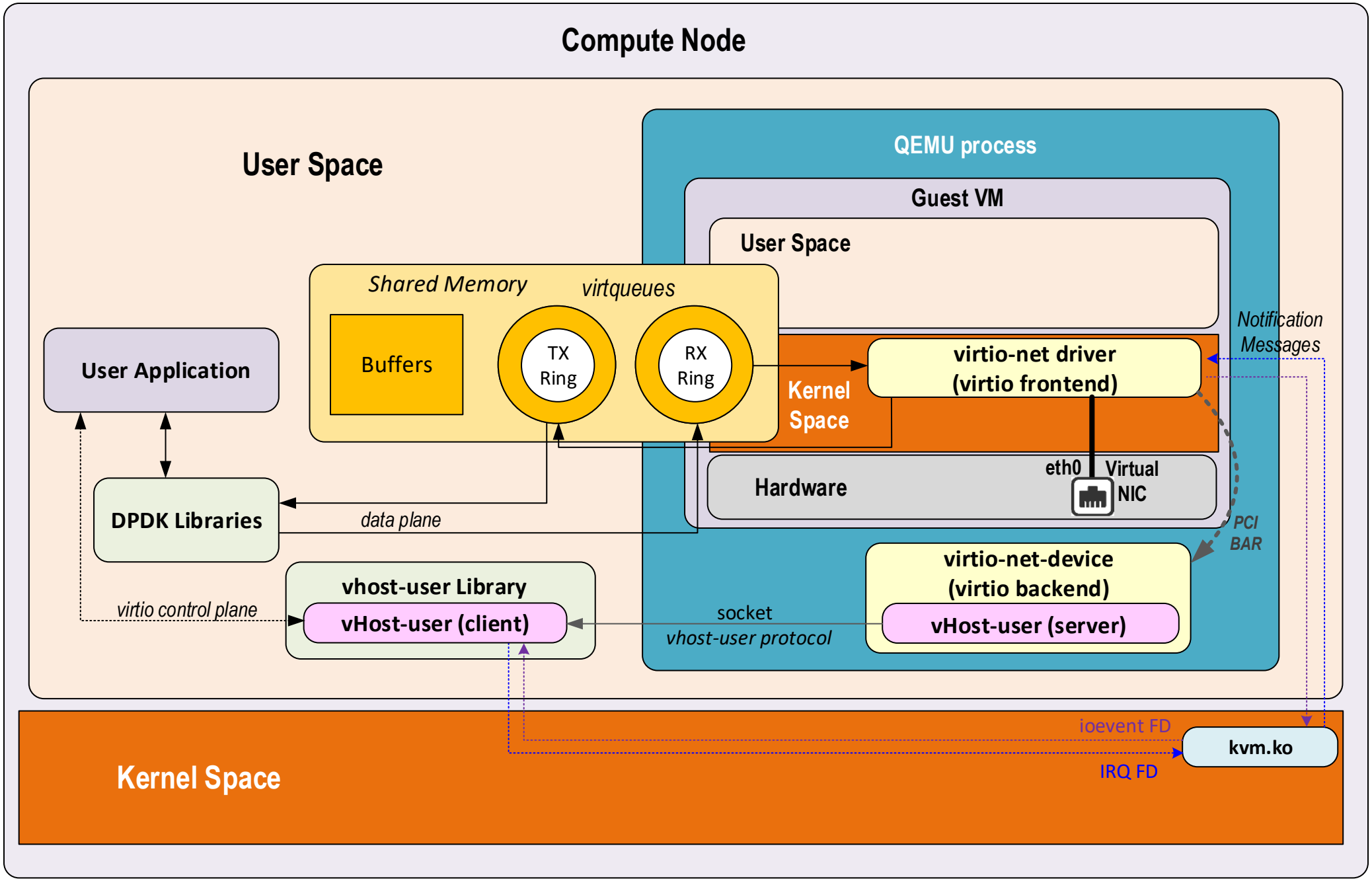
Title: VirtIO Net	
version: 1.0	date: 04/06/2020



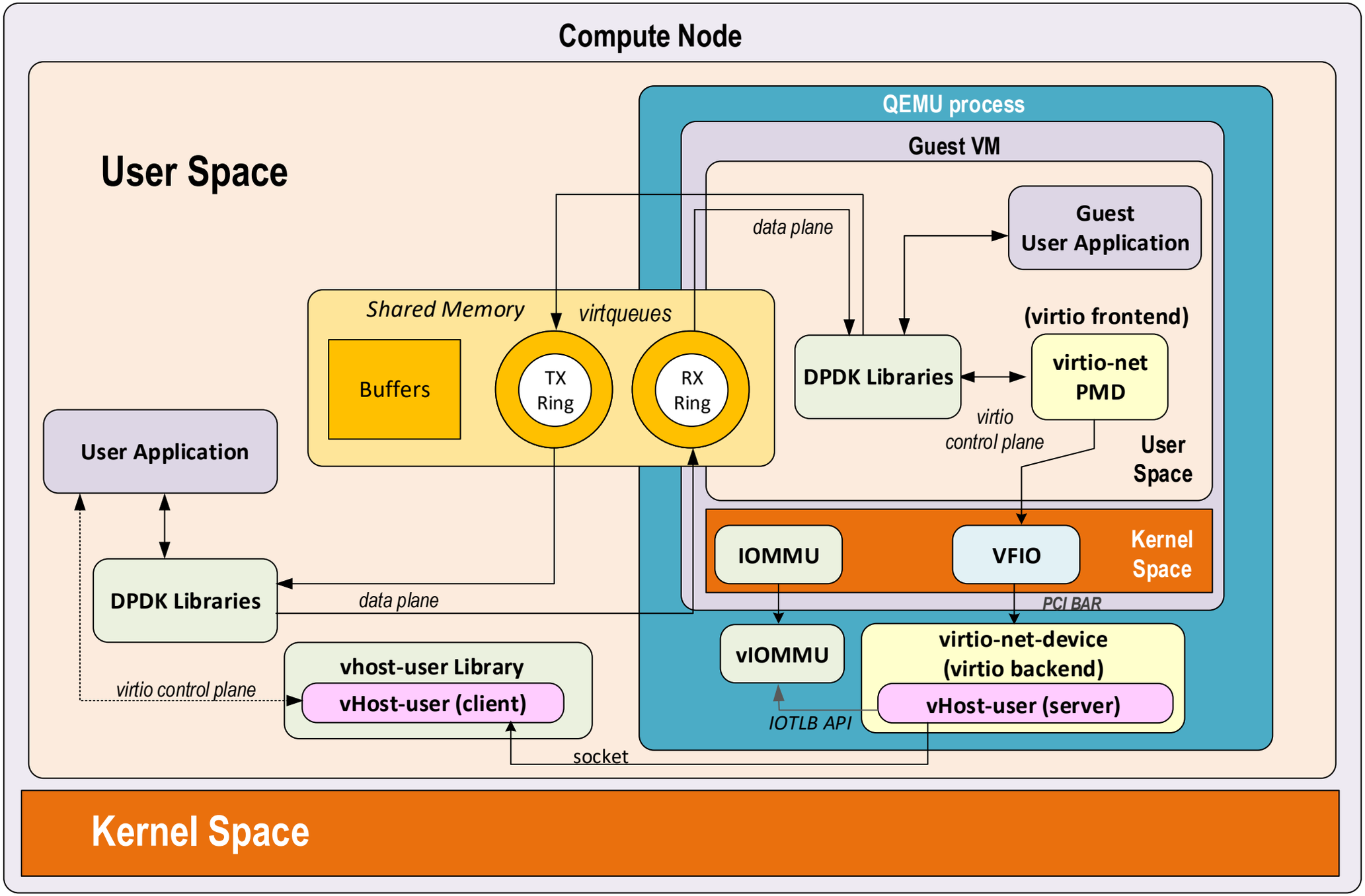
Title: Virtio-Net	
version: 1.0	date: 27/09/2020



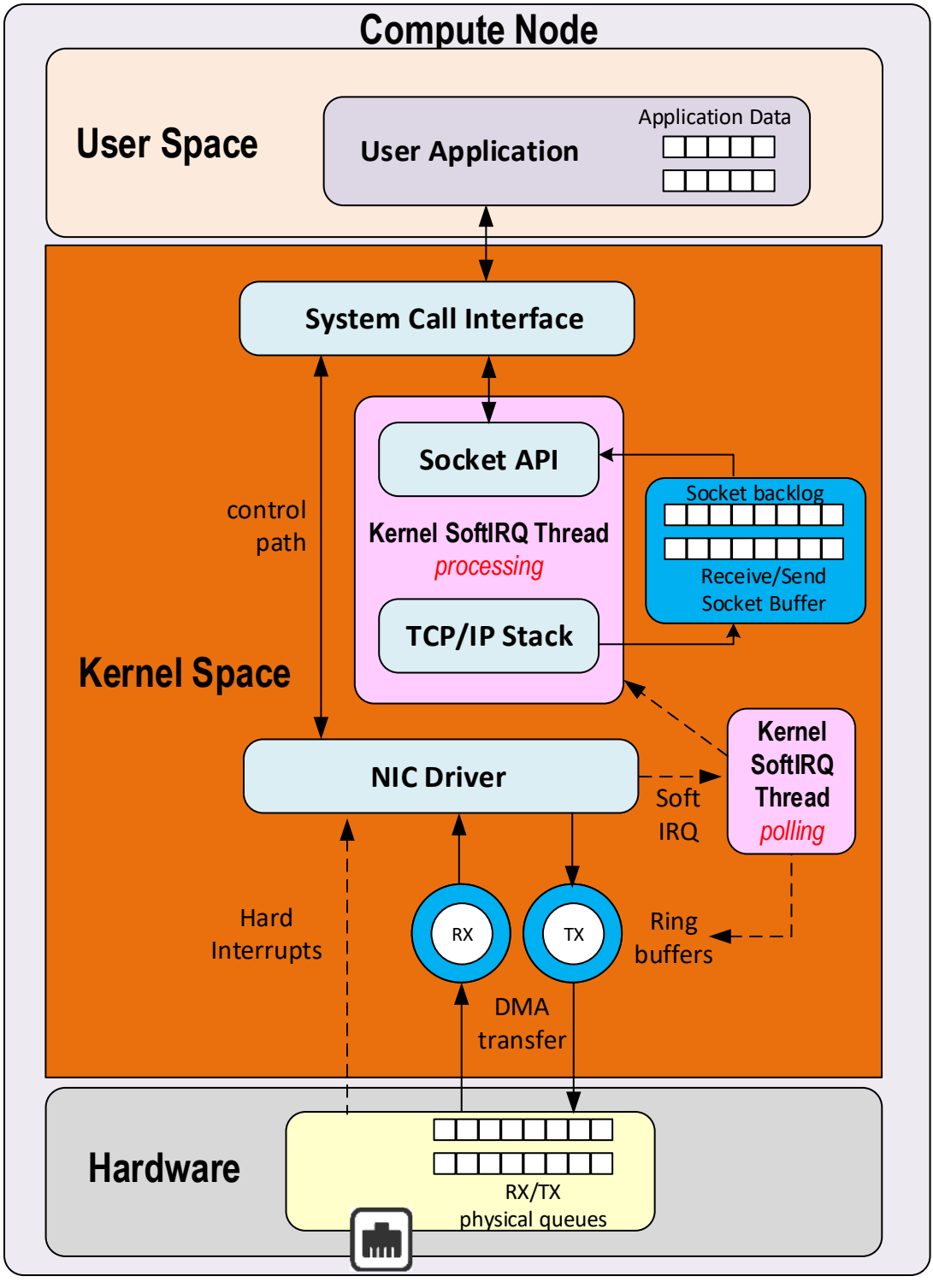
Title: vHost Net	
version: 1.0	date: 04/06/2020



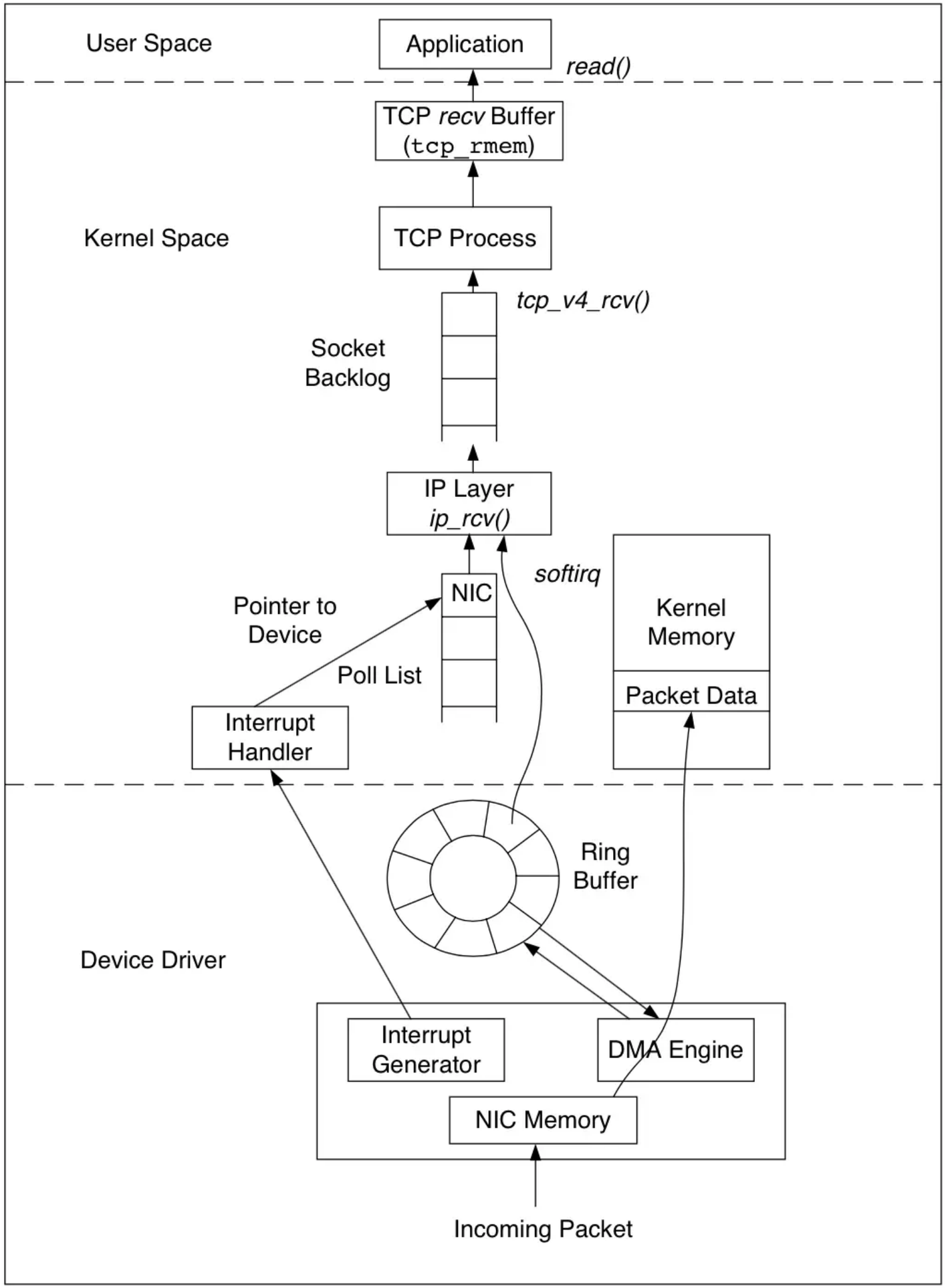
Title: vHost User	
version: 1.0	date: 04/06/2020

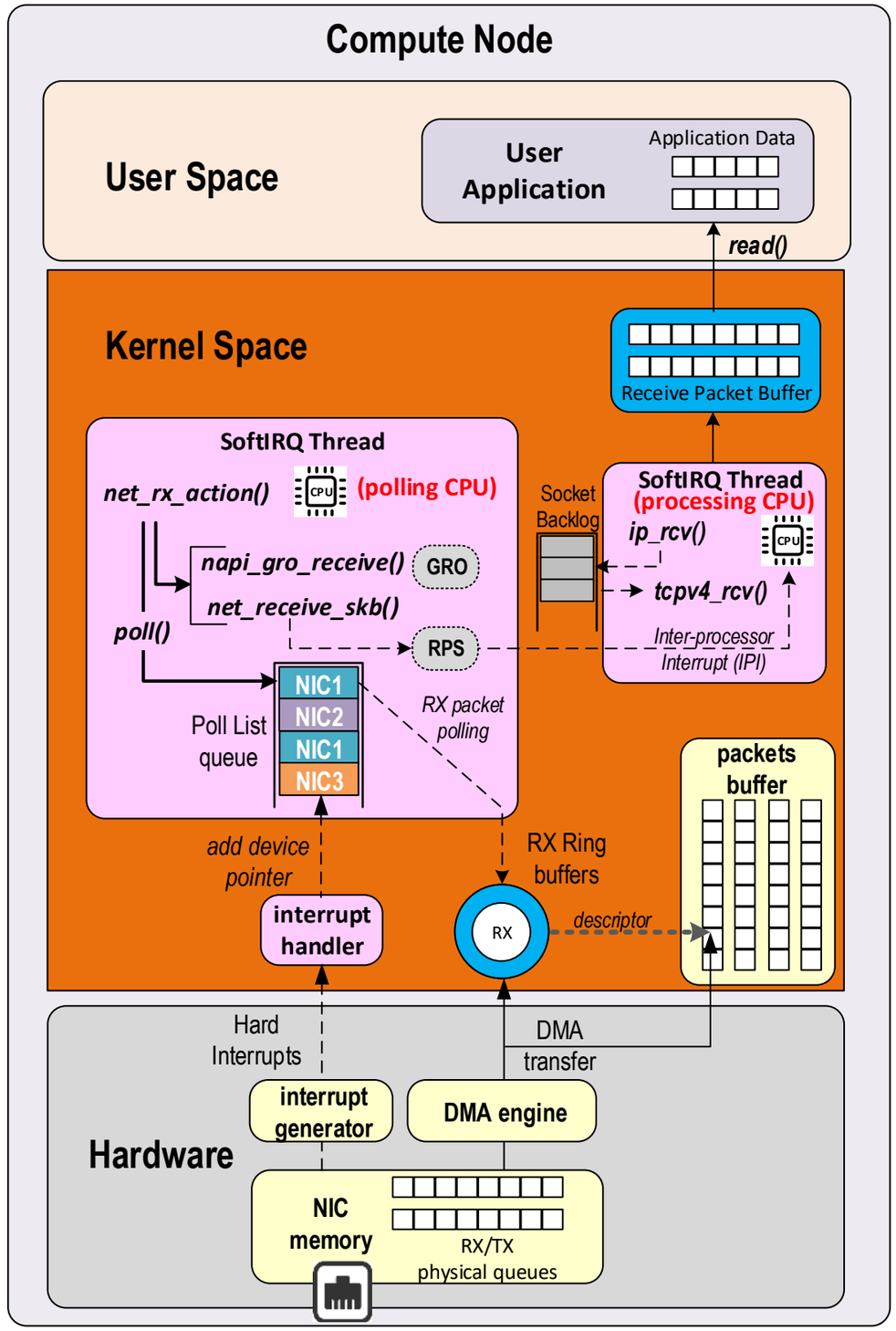


Title: VirtIO PMD (full DPDK)	
version: 1.0	date: 04/06/2020



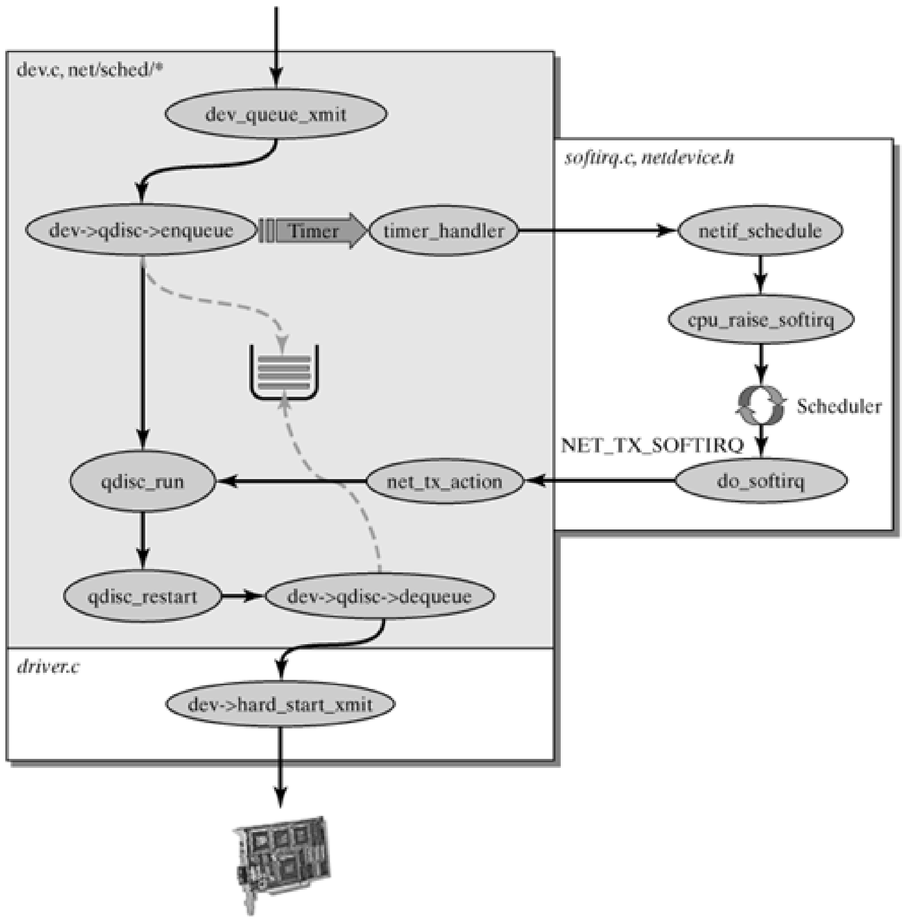
Title: Linux TCP/IP Stack	
version: 1.0	date: 23/09/2020

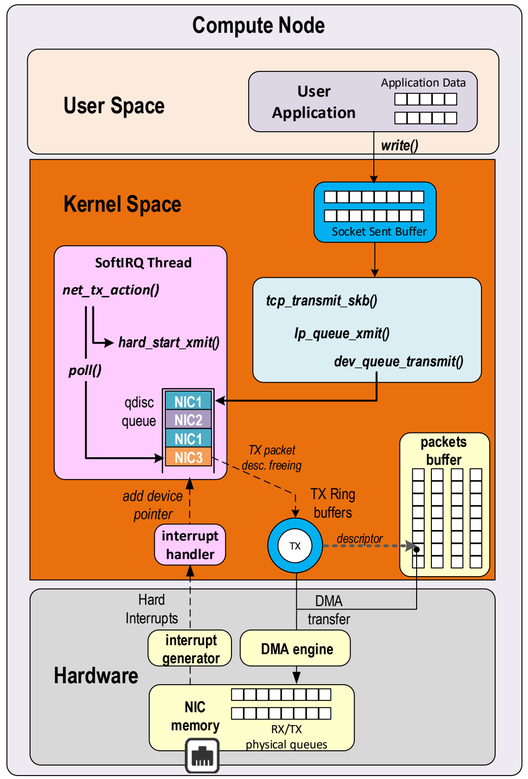




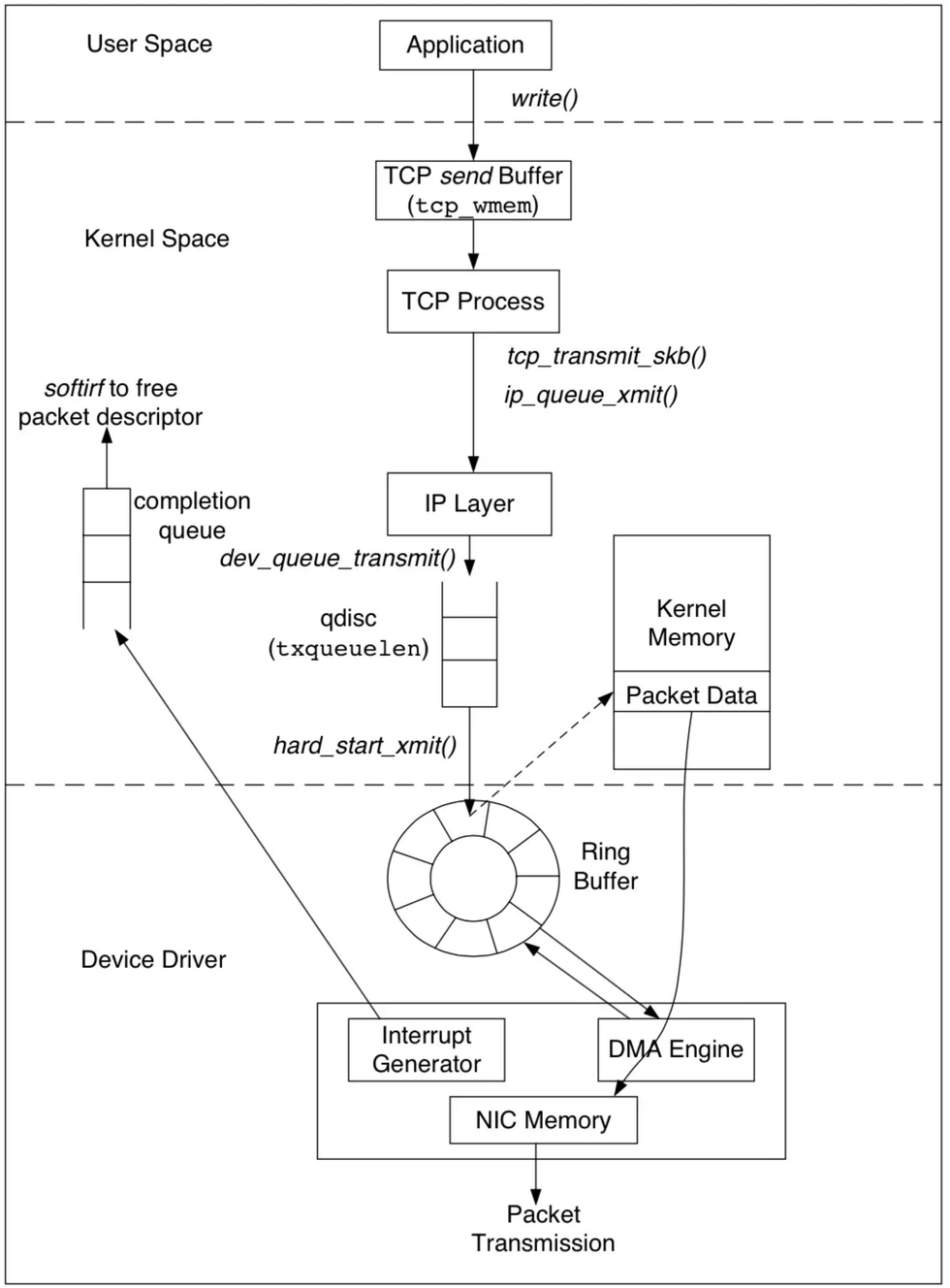
Title: Linux TCP/IP Stack (RX - NAPI)	
version: 1.0	date: 23/09/2020

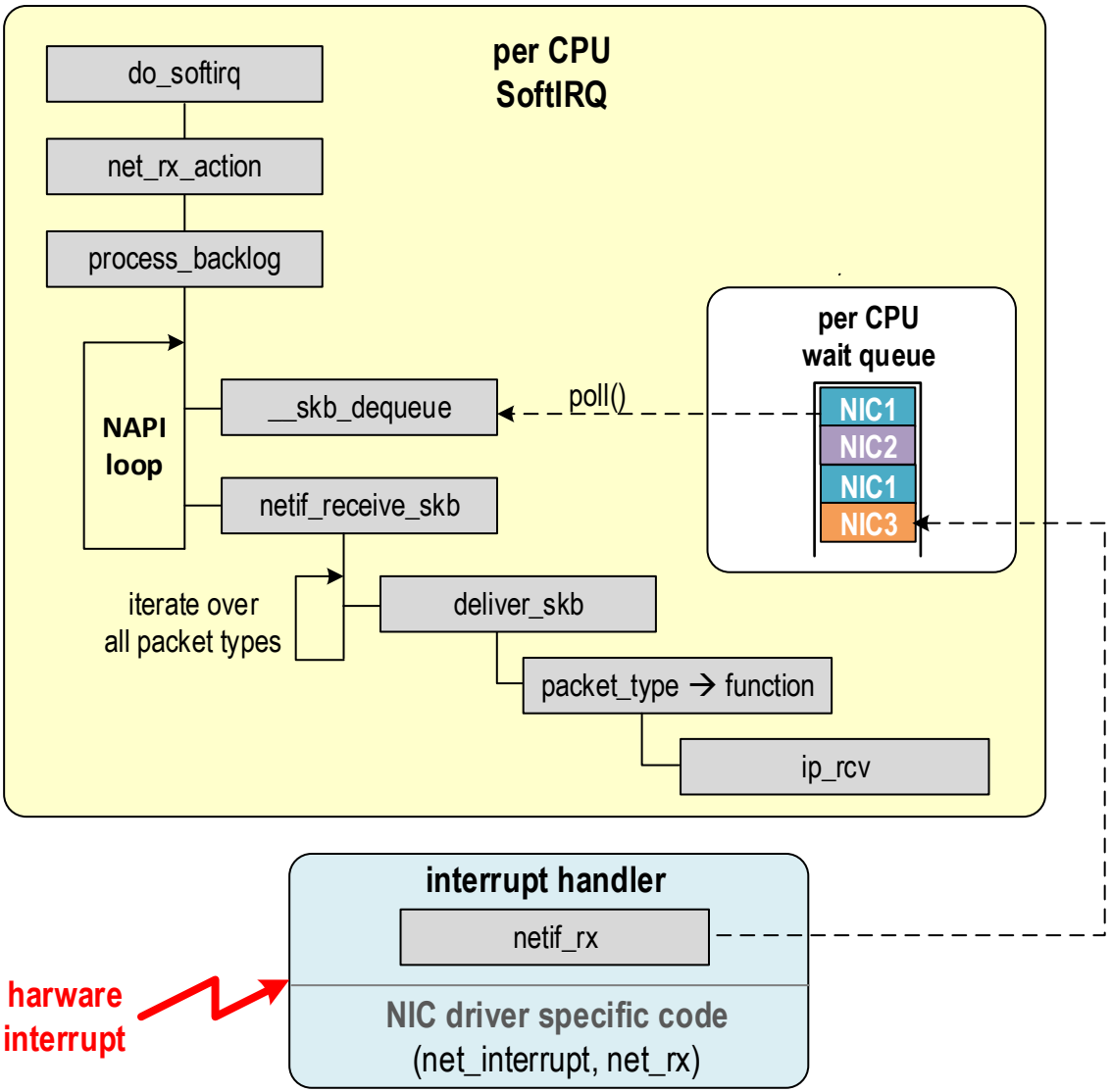
napi_gro_receive()



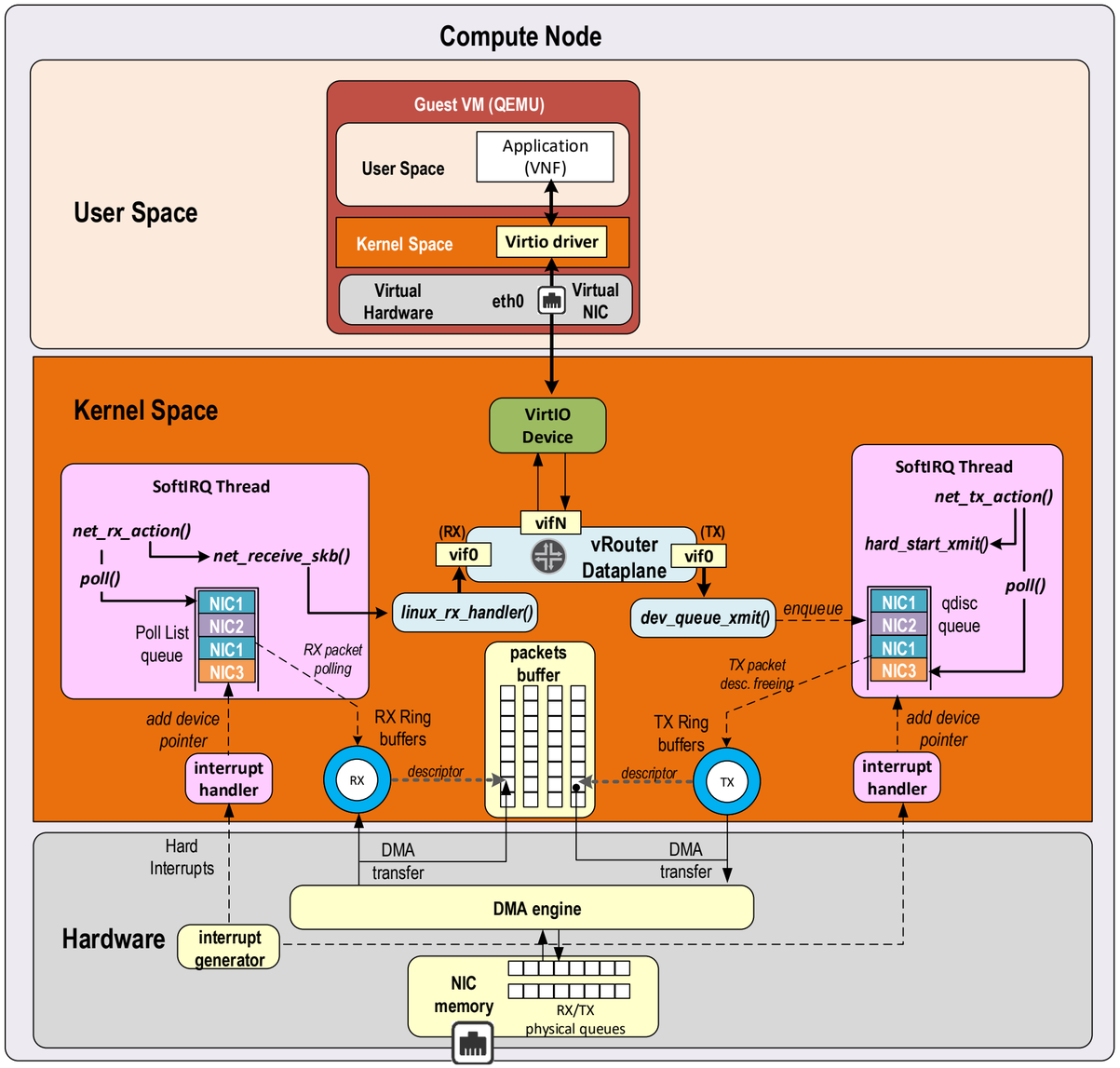


Title: Linux TCP/IP Stack (TX - API)	
version: 1.0	date: 23/09/2020

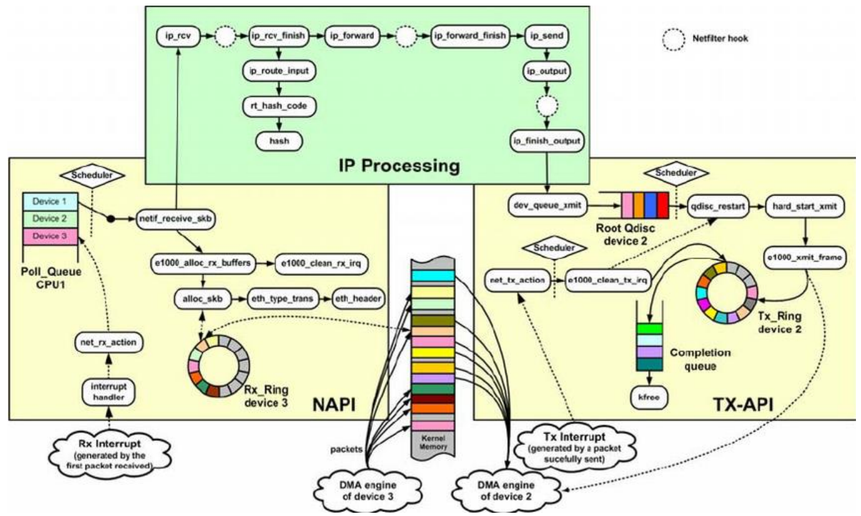


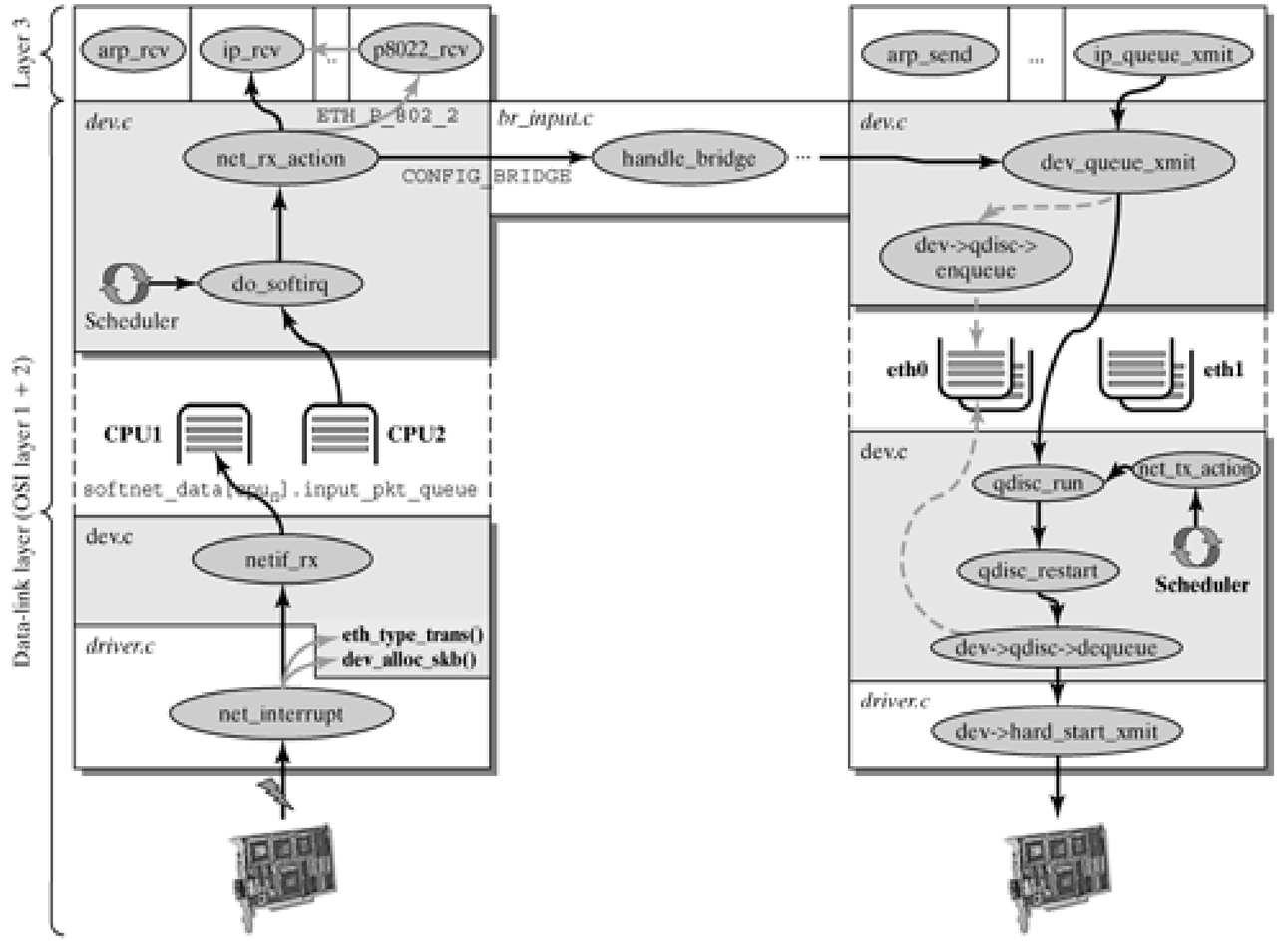


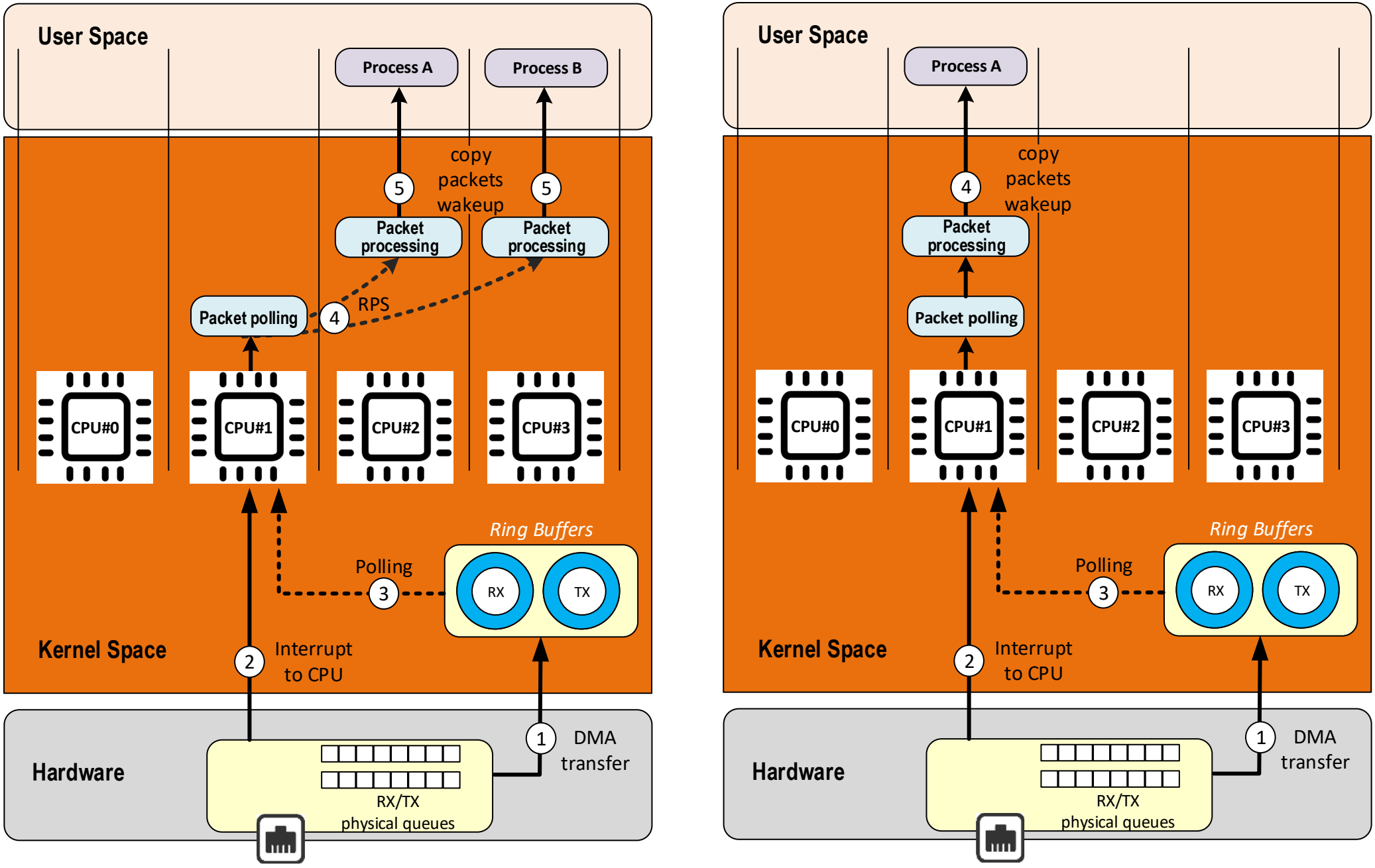
Title: Linux Receive IP packet algorithm	
version: 1.0	date: 23/09/2020



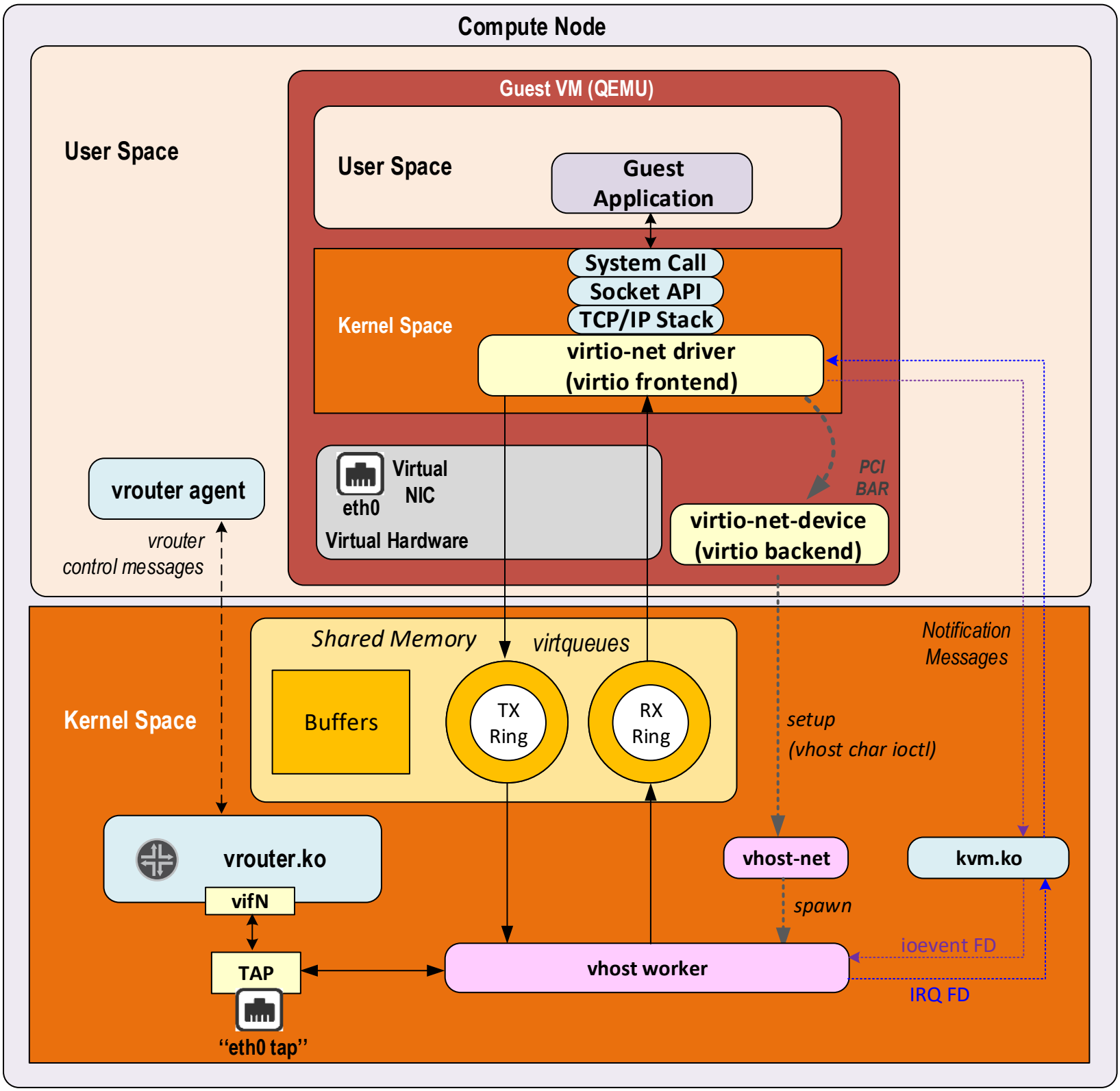
Title: Linux TCP/IP Stack (vRouter insertion)	
version: 1.0	date: 23/09/2020



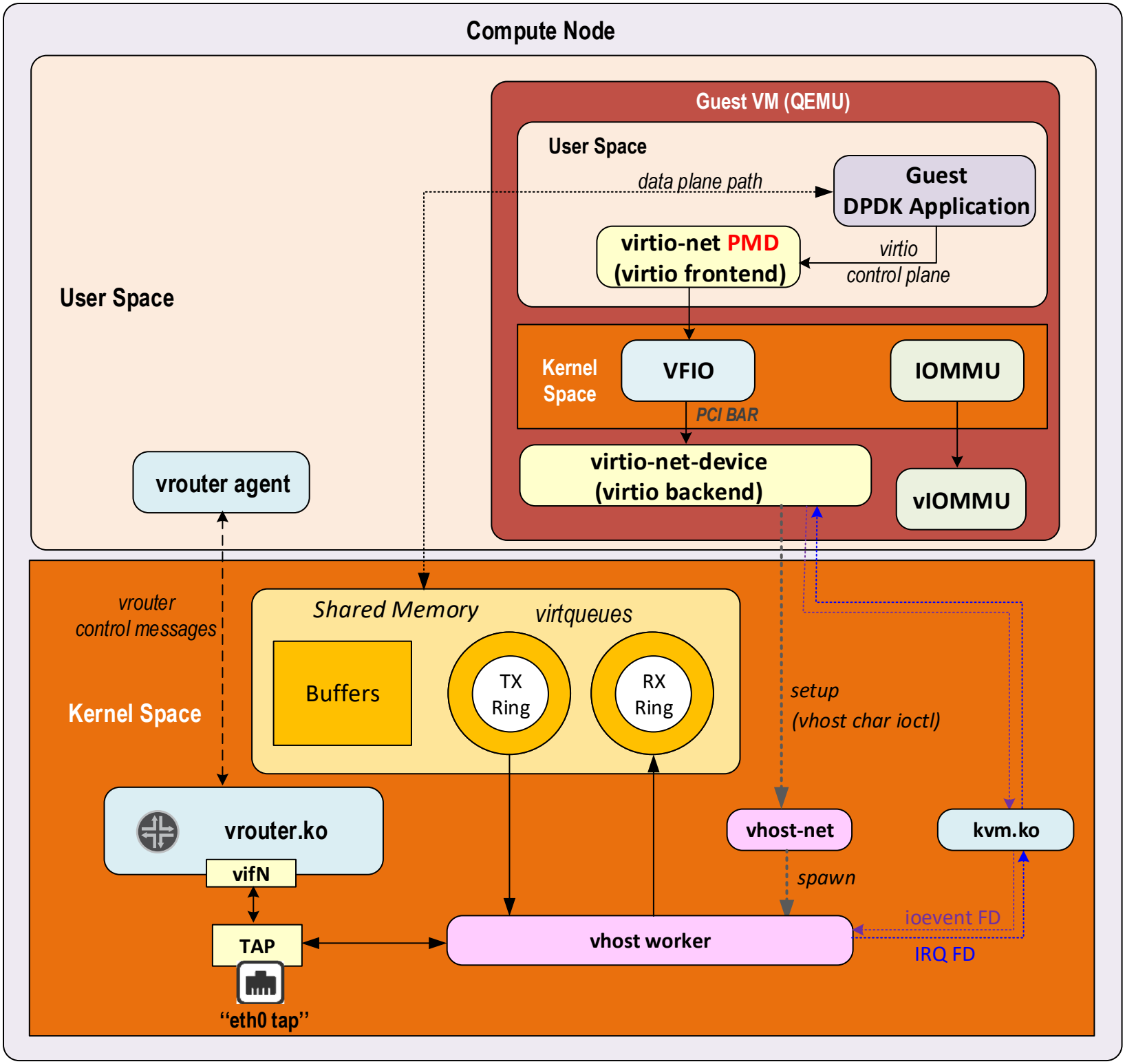




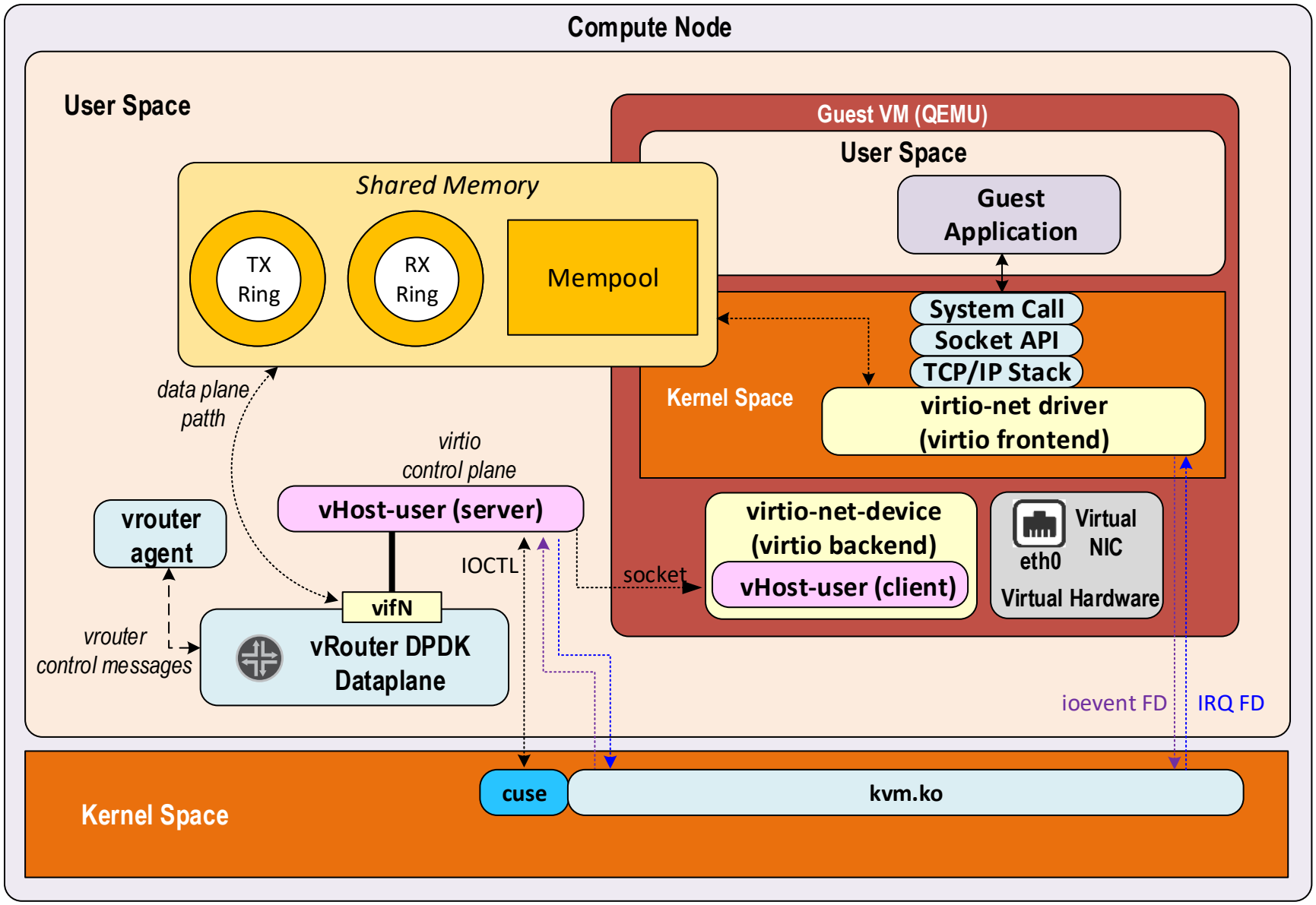
Title: Linux Packets Processing	
version: 1.0	date: 23/09/2020



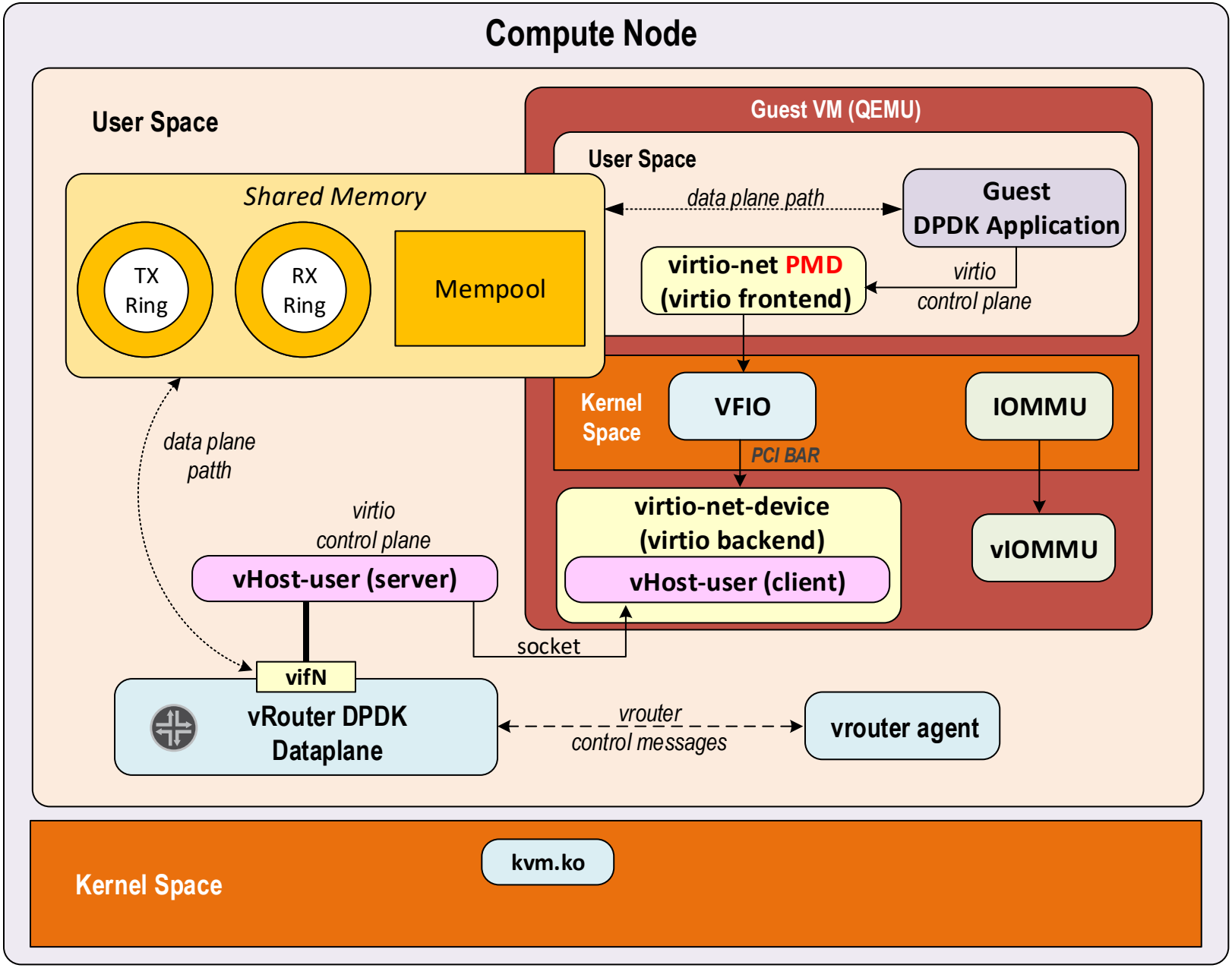
DPDK vrouter (Kernel mode App)	
version: 1.0	date: 27/09/2020



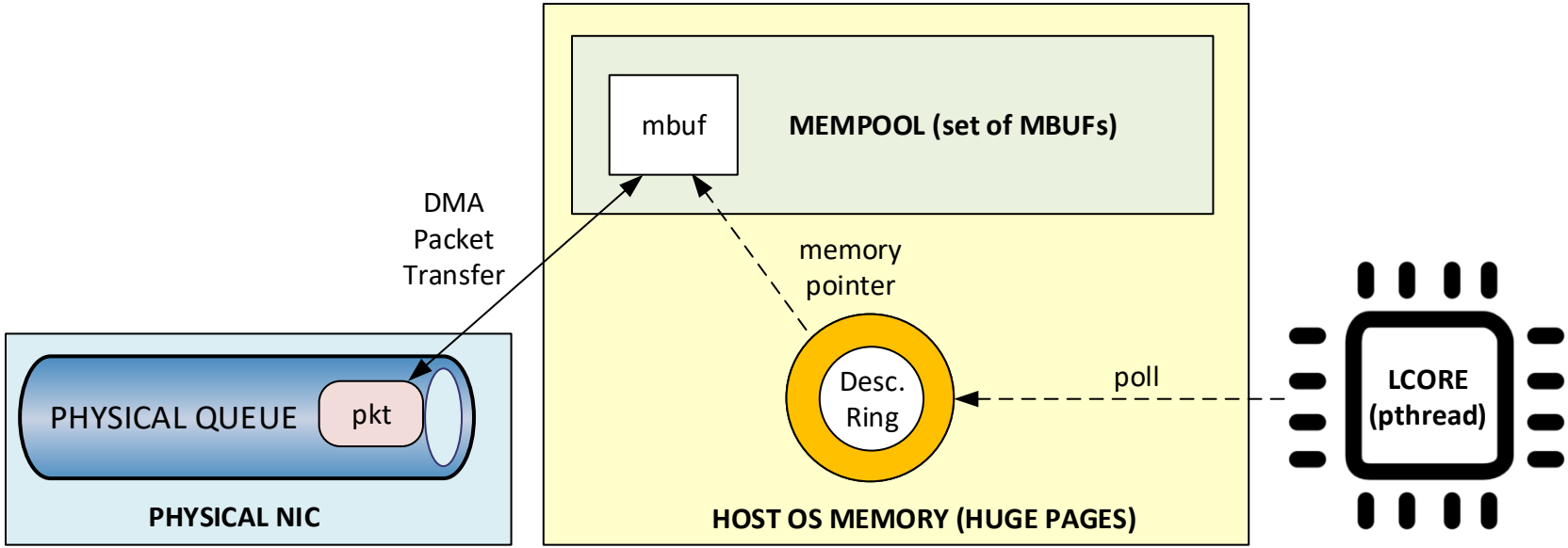
DPDK vrouter (Kernel mode App)	
version: 1.0	date: 27/09/2020



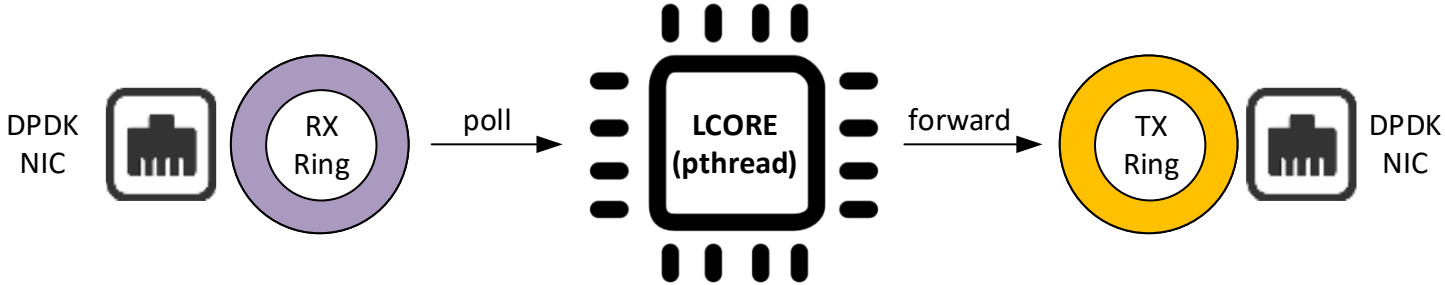
DPDK vrouter (Kernel mode App)	
version: 1.0	date: 04/06/2020

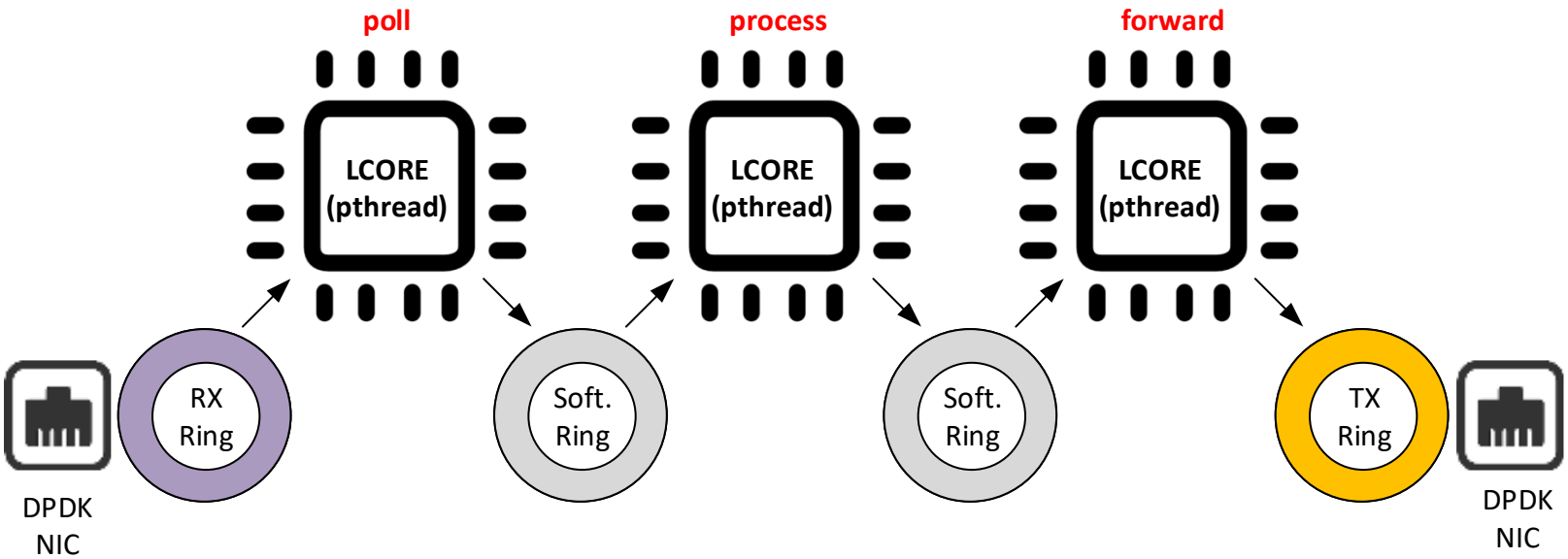


Title: DPDK vrouter (DPDK mode App)	
version: 1.0	date: 04/06/2020

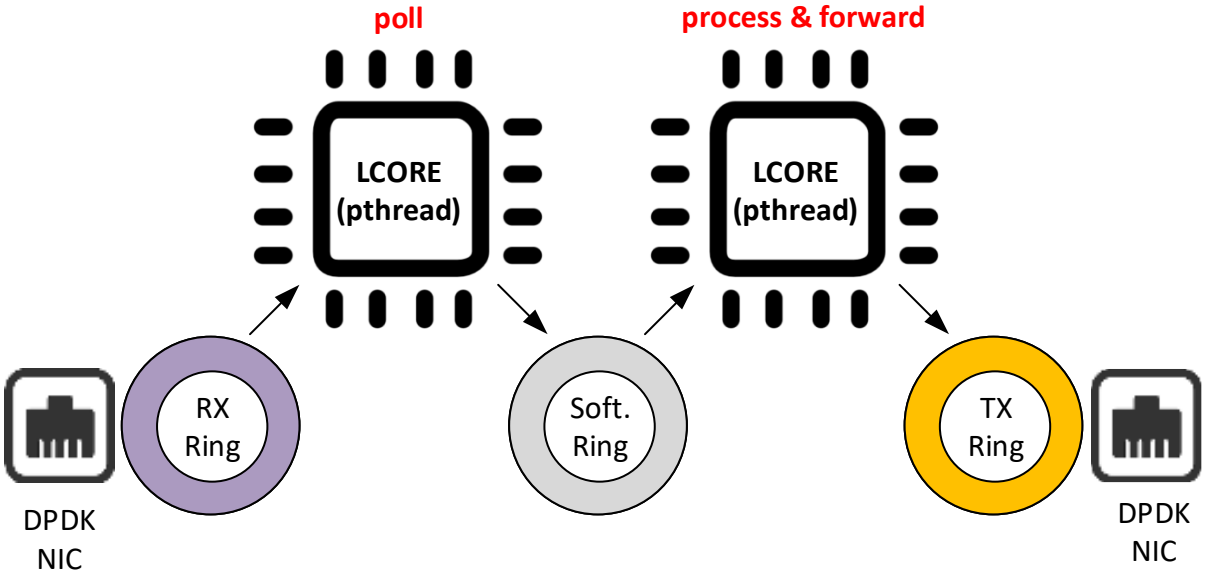


Title: DPDK High Level Components	
version: 1.0	date: 02/06/2020

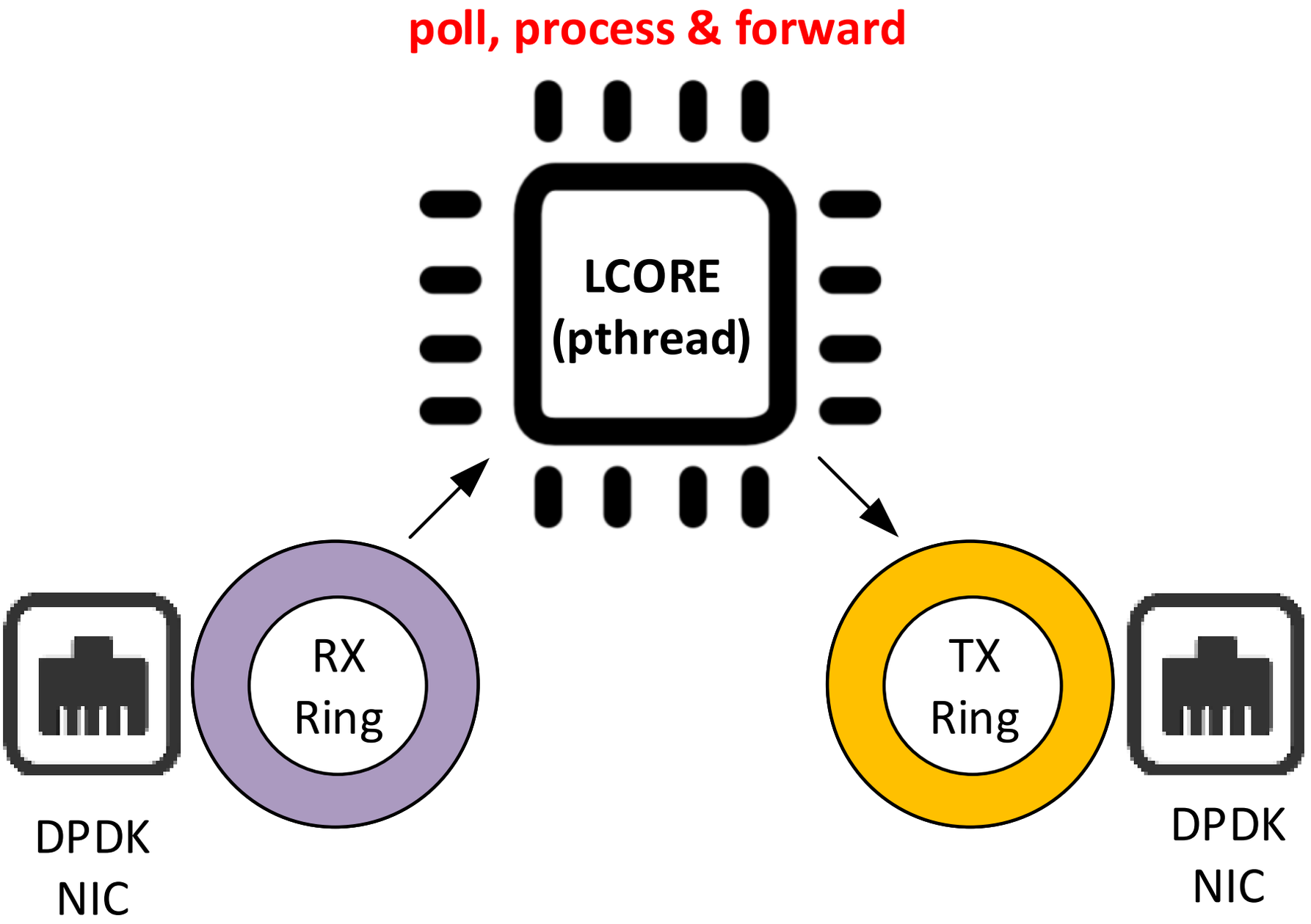




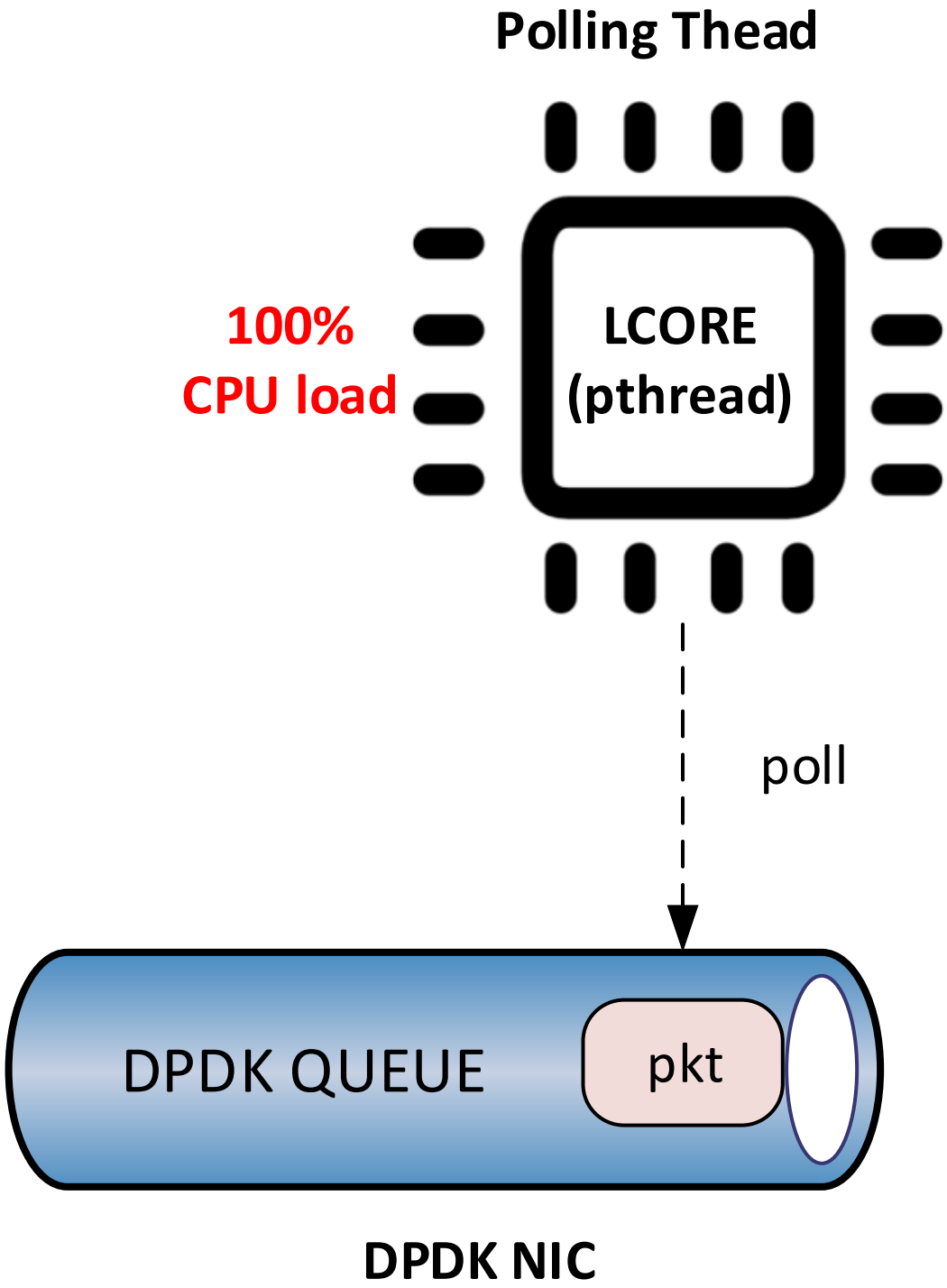
Title: DPDK Packets processing models	
version: 1.0	date: 02/06/2020



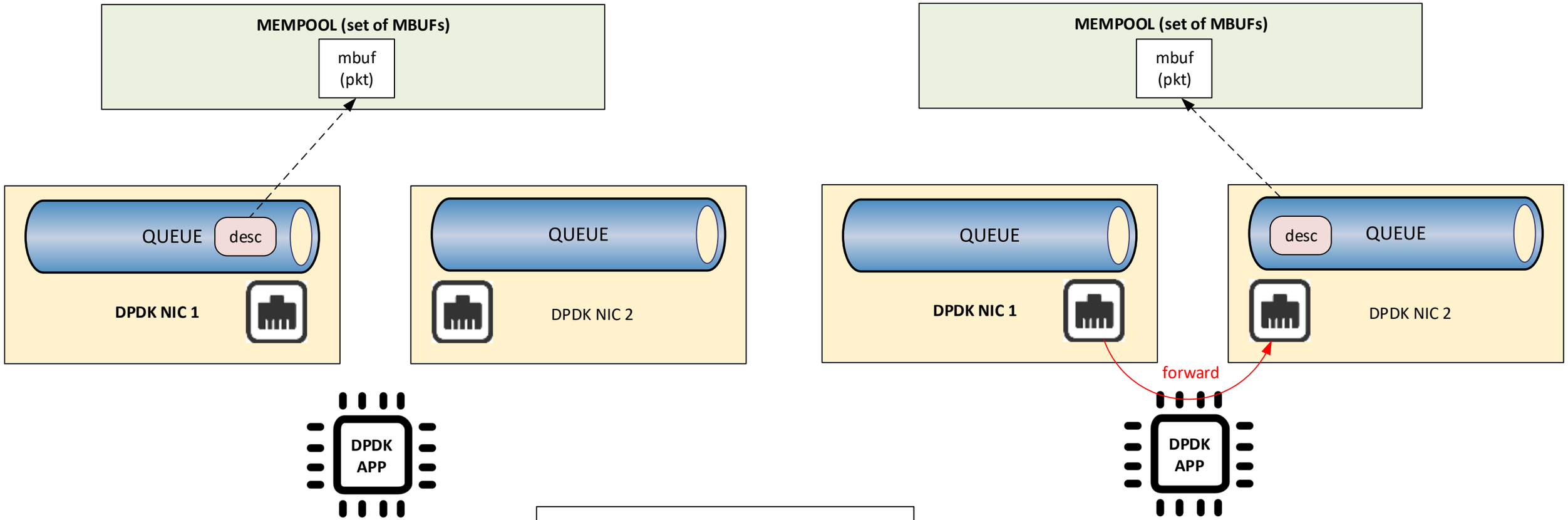
Title: Contrail vrouter DPDK processing model	
version: 1.0	date: 15/06/2020



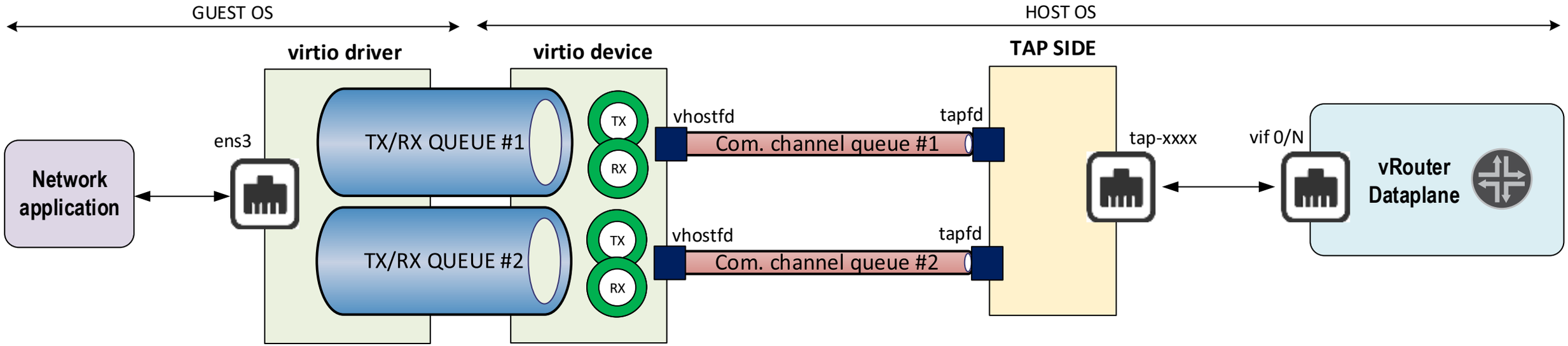
Title: Contrail vrouter DPDK new processing model	
version: 1.0	date: 15/06/2020



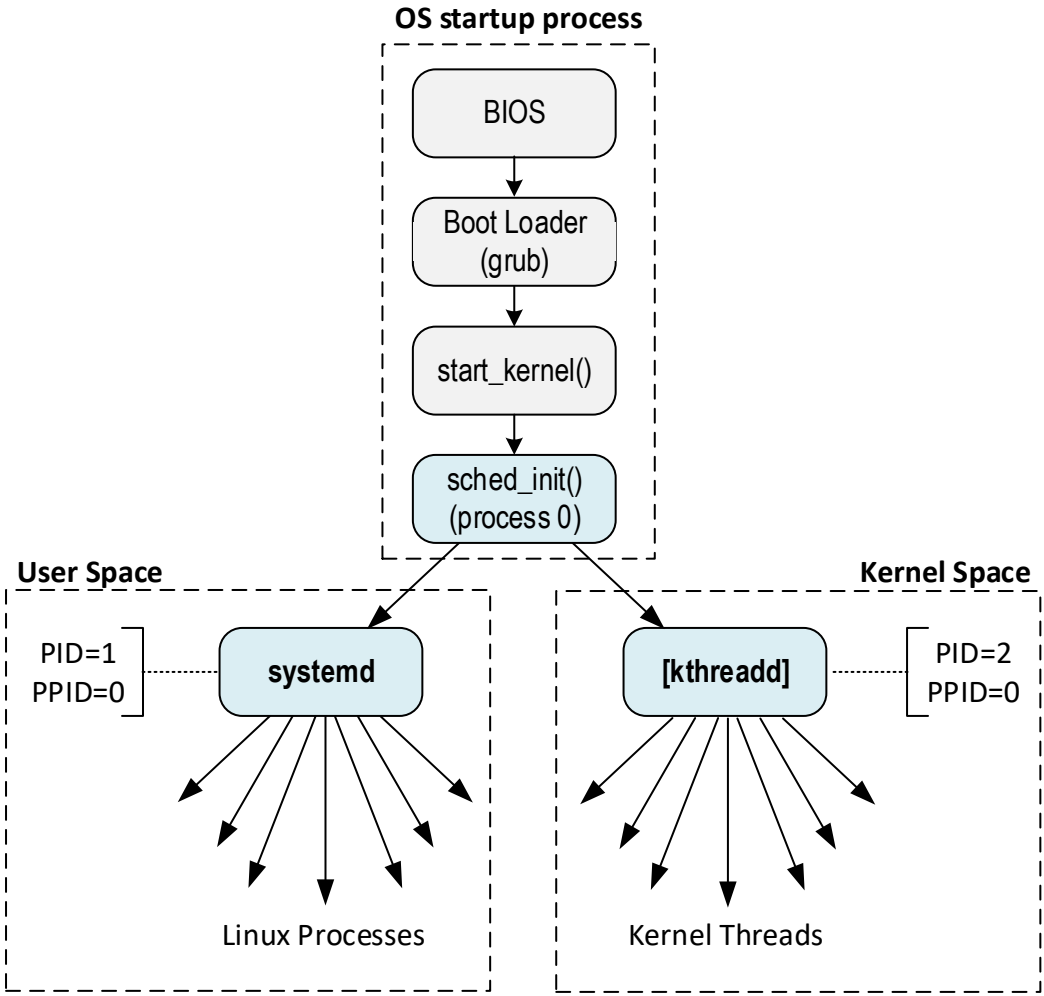
Title: DPDK polling	
version: 1.0	date: 02/06/2020



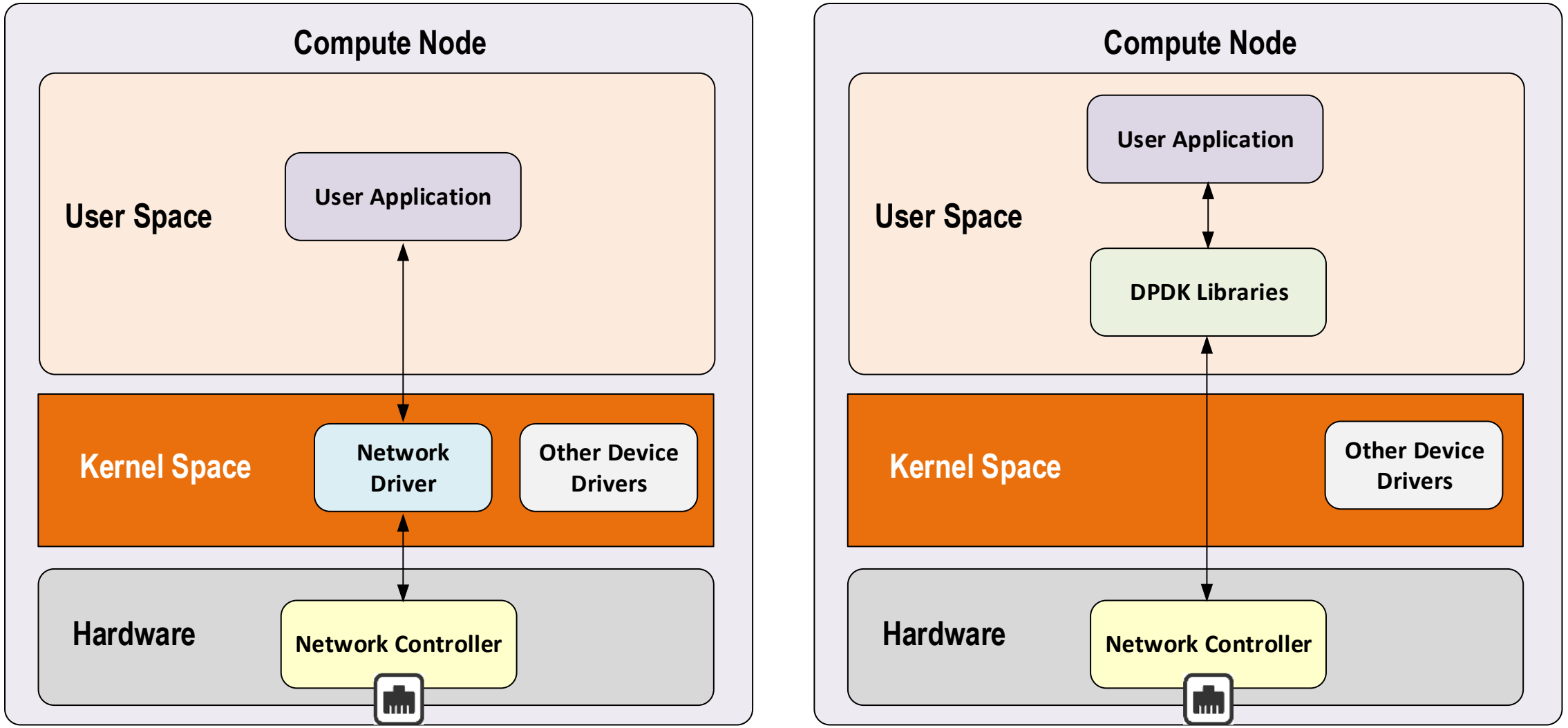
Title: DPDK Packet Forwarding	
version: 1.0	date: 03/06/2020



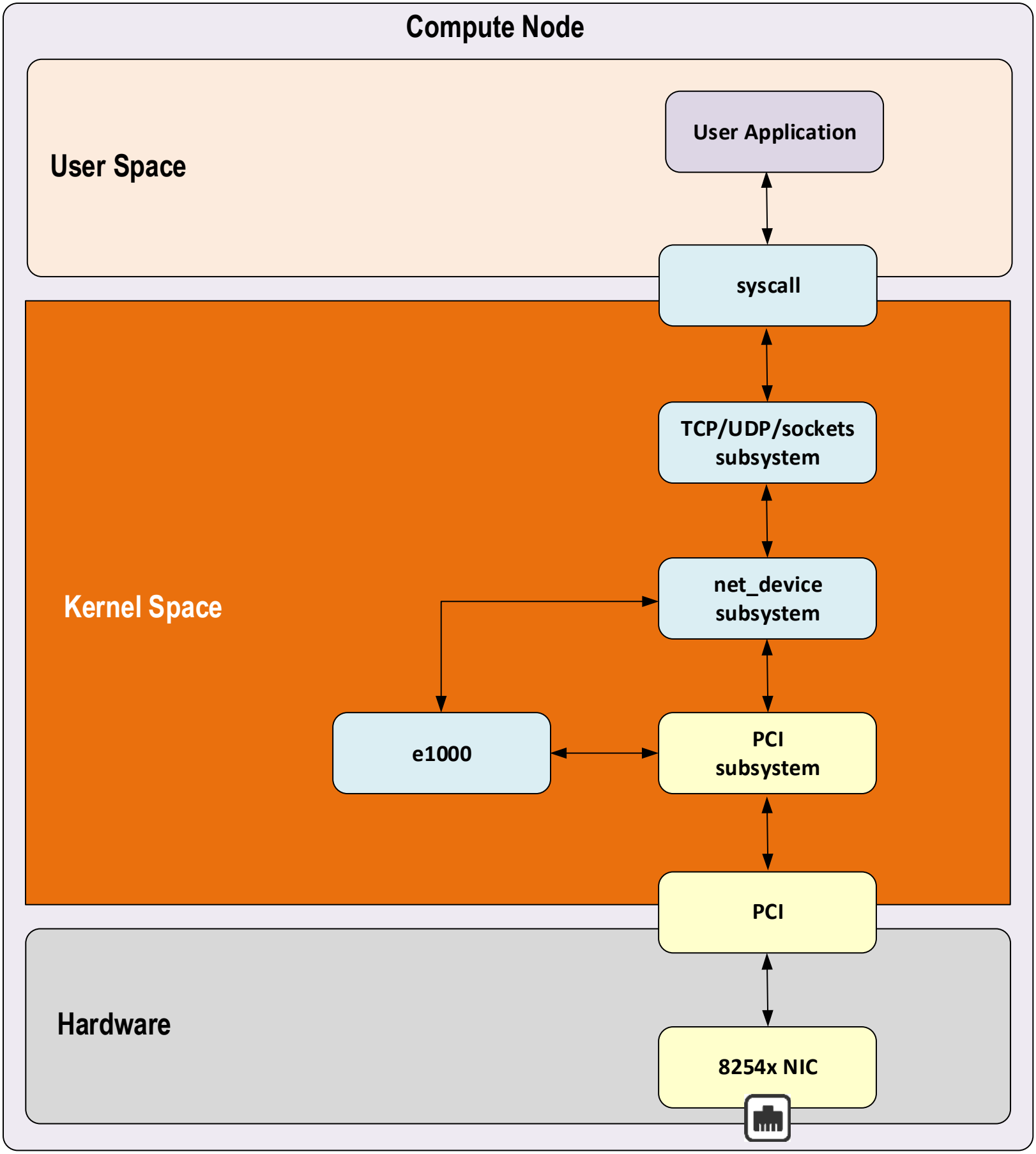
Title: vHost FDs	
version: 1.0	date: 30/09/2020



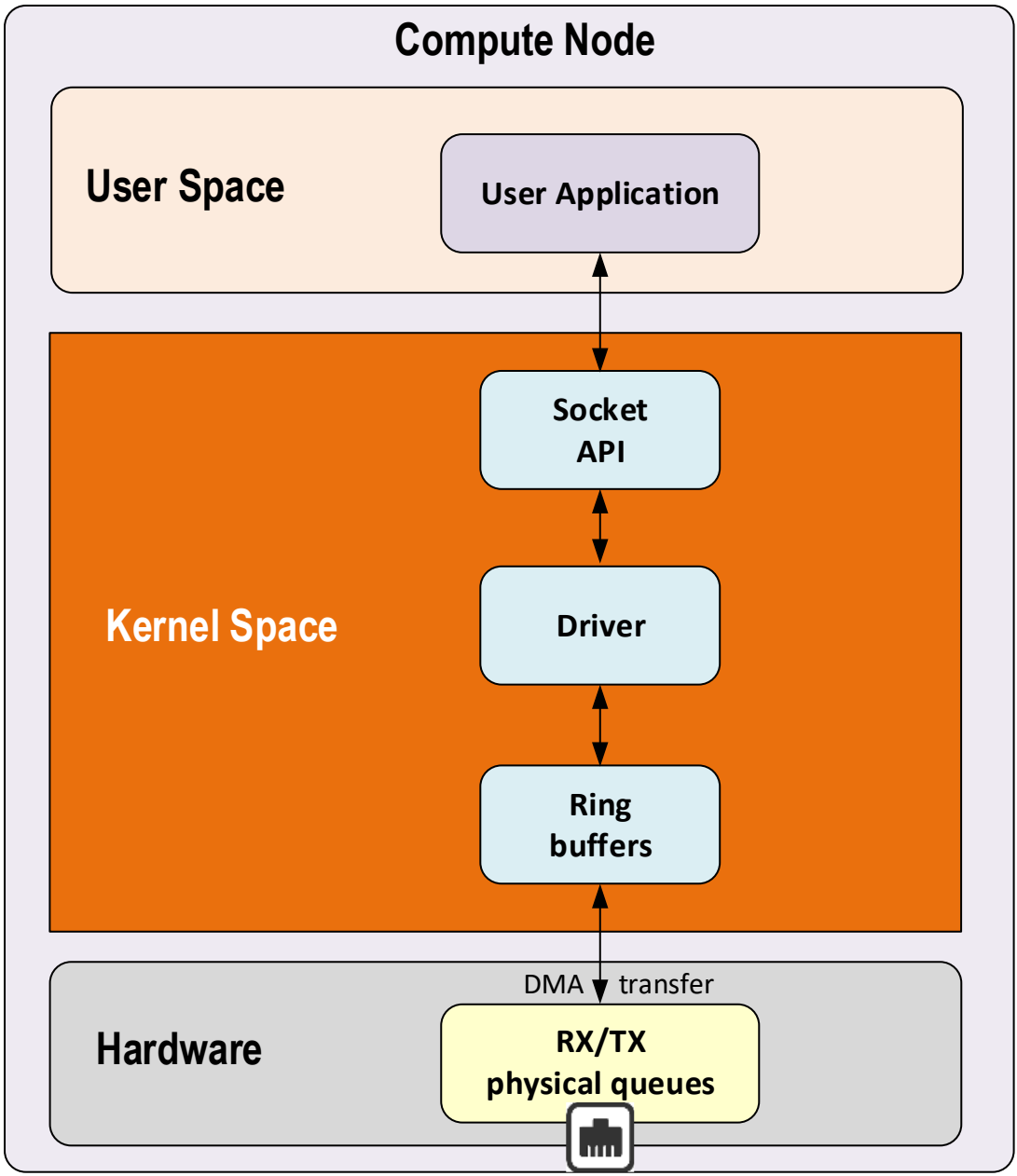
Title: Linux Startup	
version: 1.0	date: 30/09/2020



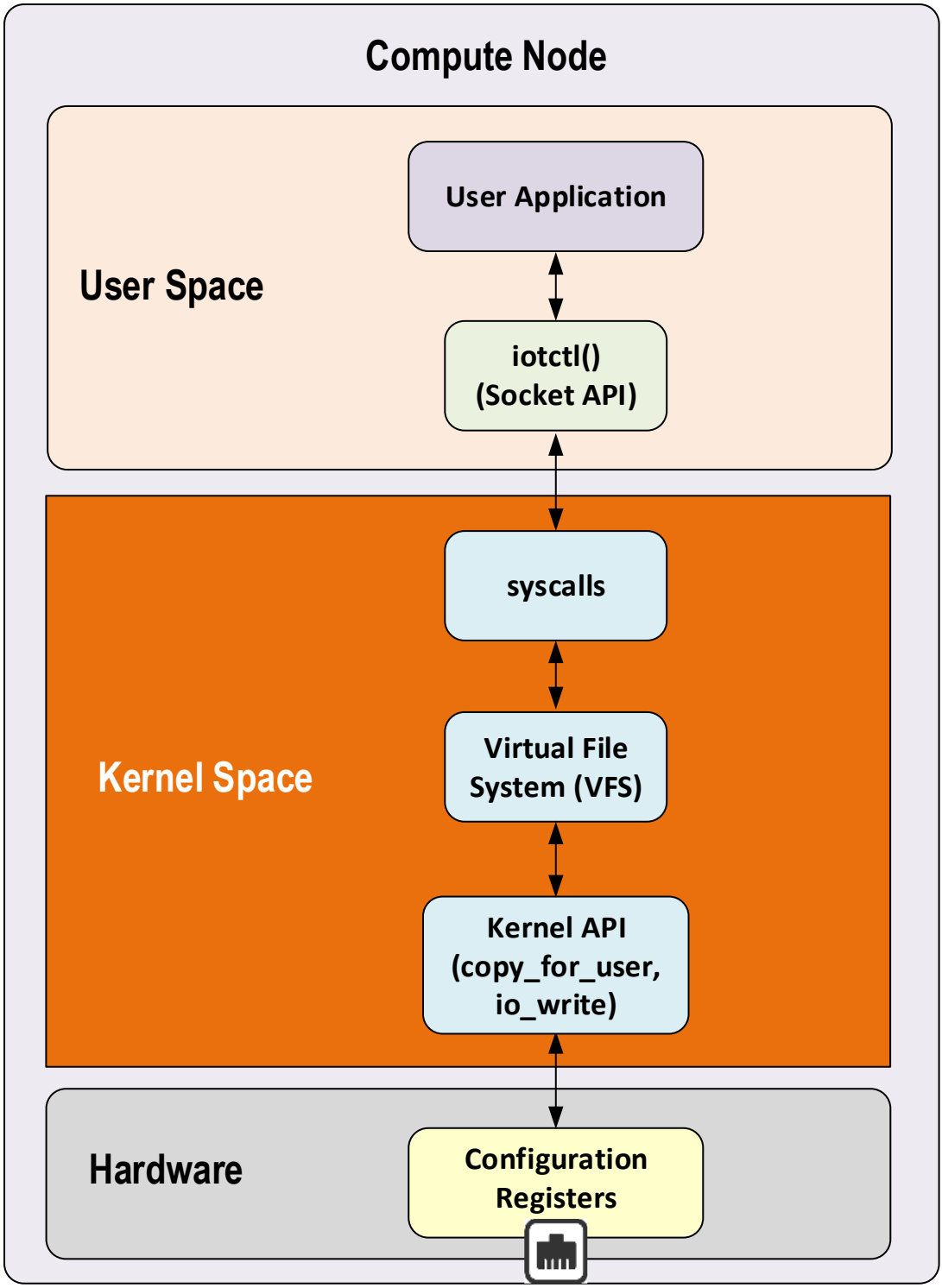
Title: DPDK versus NIC Kernel Overview	
version: 1.0	date: 30/05/2020



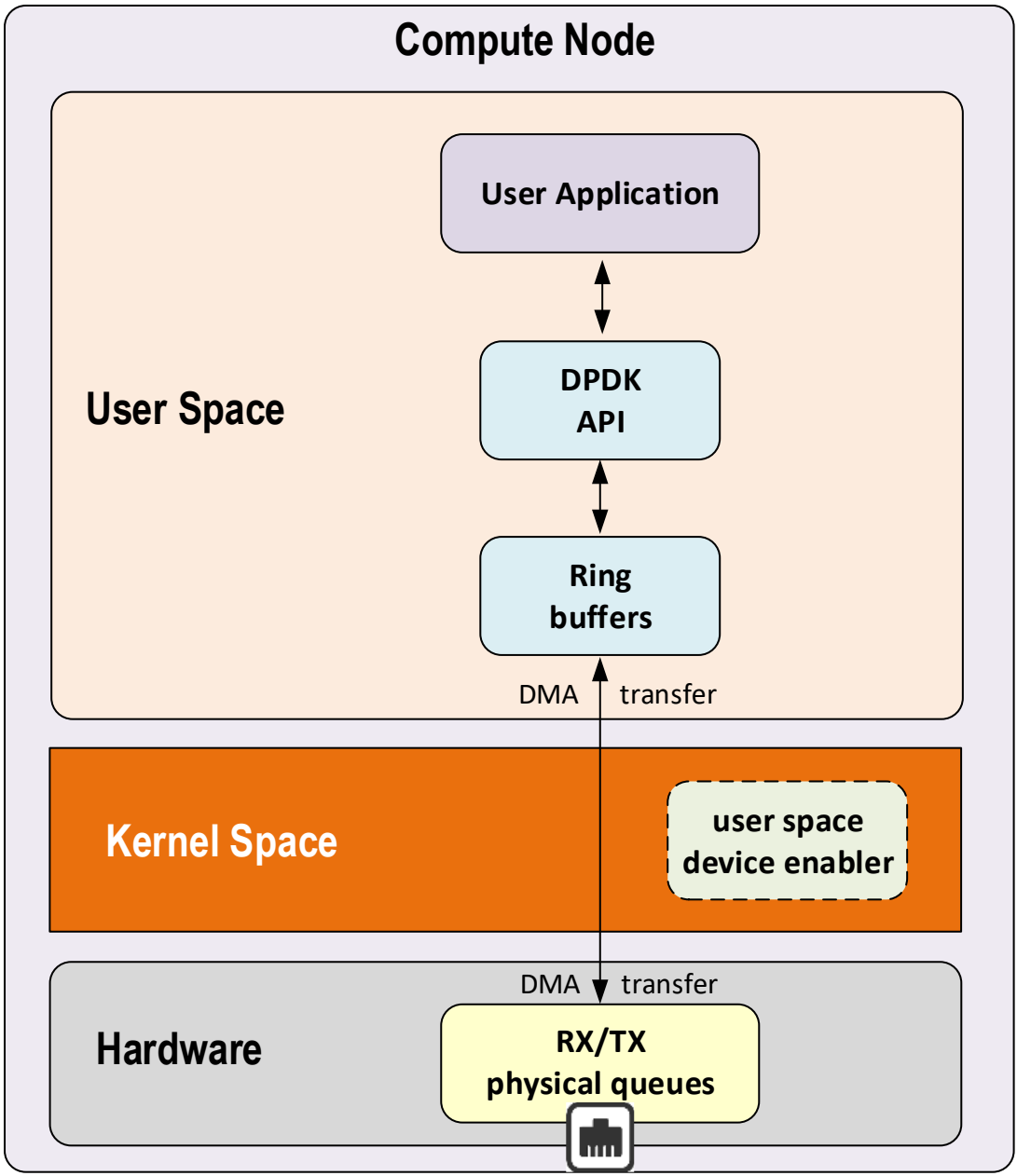
Title: NIC Kernel Driver	
version: 1.0	date: 30/05/2020



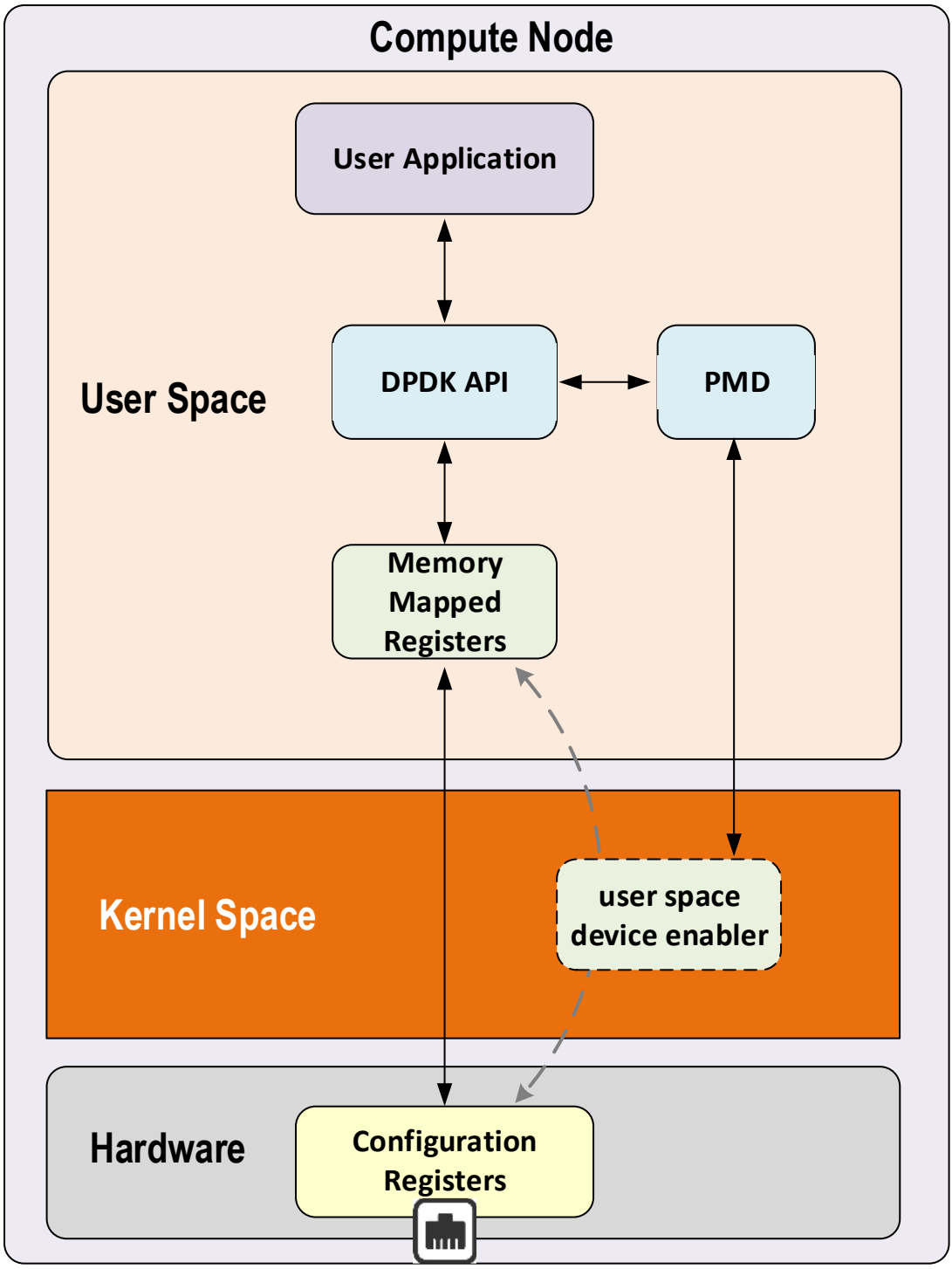
Title: NIC Kernel Driver – Packet Processing	
version: 1.0	date: 30/05/2020



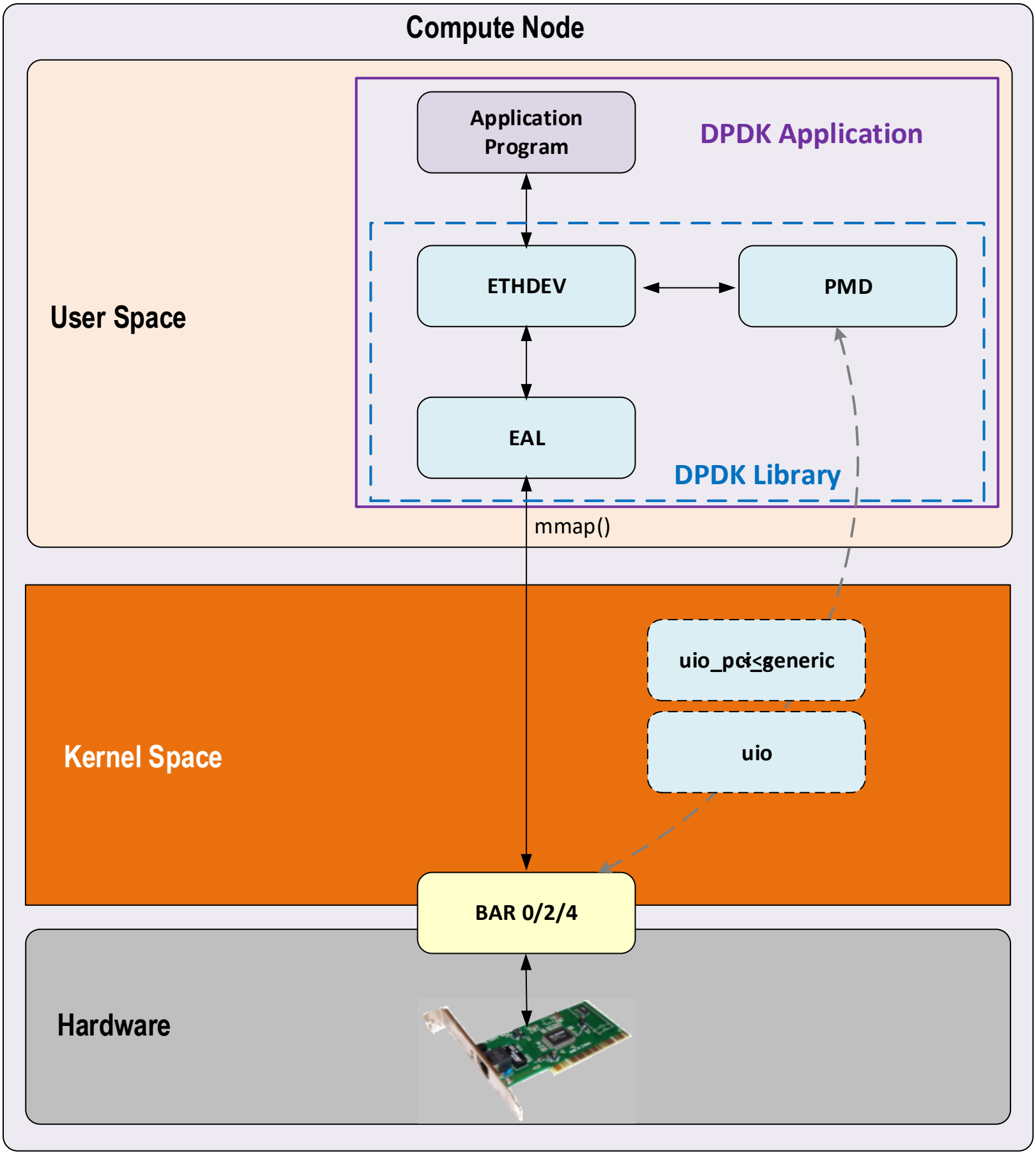
Title: NIC Kernel Driver – Configuration	
version: 1.0	date: 30/05/2020



Title: NIC PMD Driver – Packet Processing	
version: 1.0	date: 02/06/2020



Title: NIC PMD Driver – Configuration	
version: 1.0	date: 02/06/2020



Title: DPDK NIC Configuration	
version: 1.0	date: 02/06/2020

Compute Node

User Space

Guest VM

User Space

User Application

DPDK
Vendor specific PMD

Read/Write

Assign

Kernel Space

VFIO

vIOMMU

Virtual
PCI NIC

Emulated
Hardware

Huge Pages Memory

Guest
huge pages

map

NIC
registers and queues

Assign

Kernel Space

VFIO

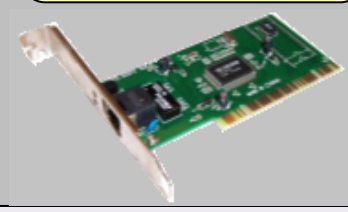
IOMMU

map

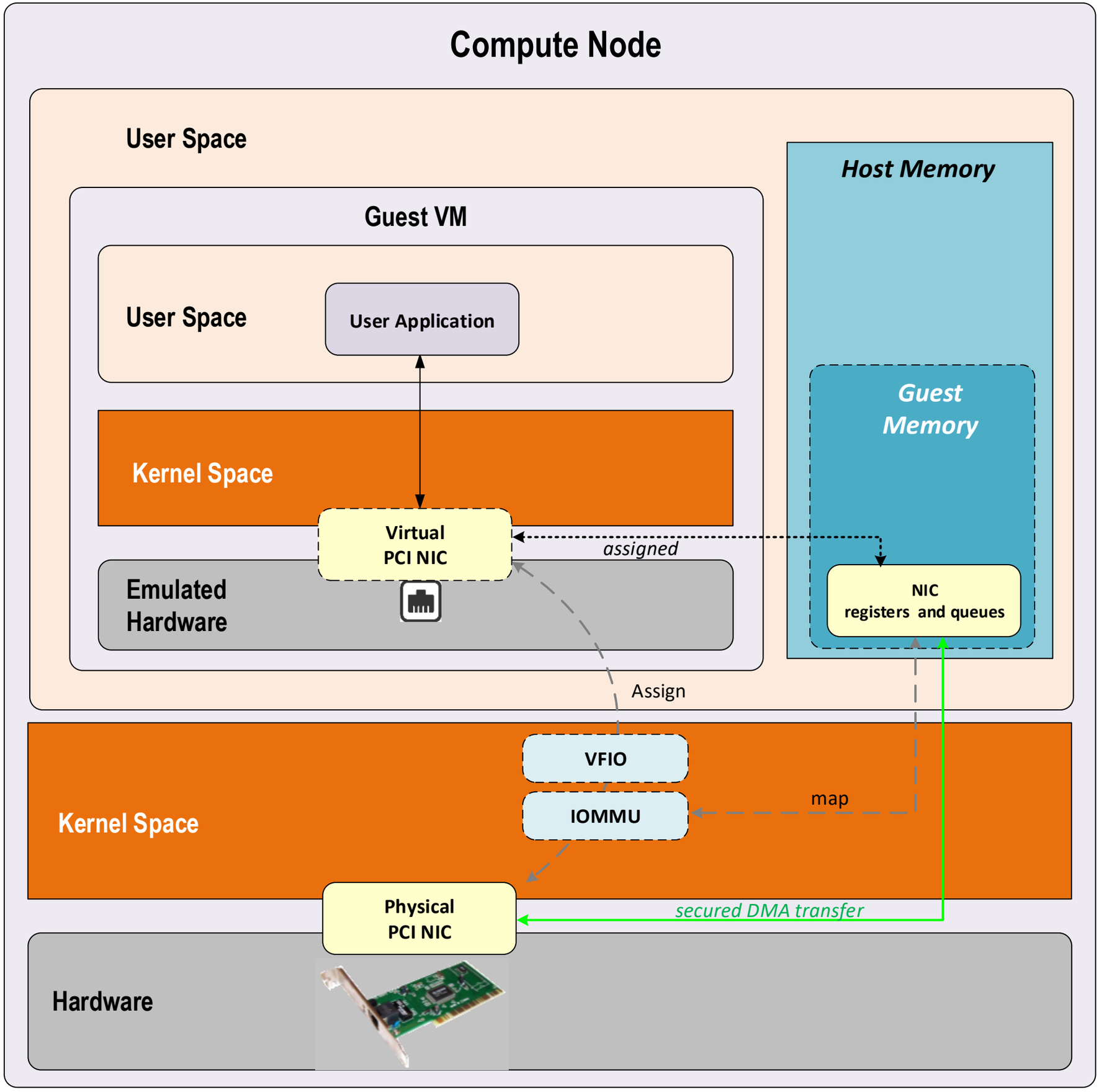
Physical
PCI NIC

secured DMA transfer

Hardware



Title: DPDK VFIO and IOMMU (PCI passthrough)	
version: 1.0	date: 02/06/2020



Title: VFIO device assignment	
version: 1.0	date: 02/06/2020

Compute Node

User Space

Guest VM

User Space

User Application

Kernel Space

Virtual
PCI NIC

Emulated
Hardware

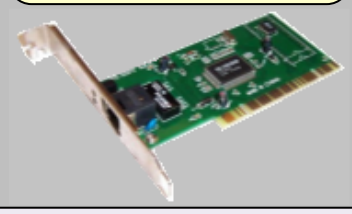
QEMU process

LibVirt

Kernel Space

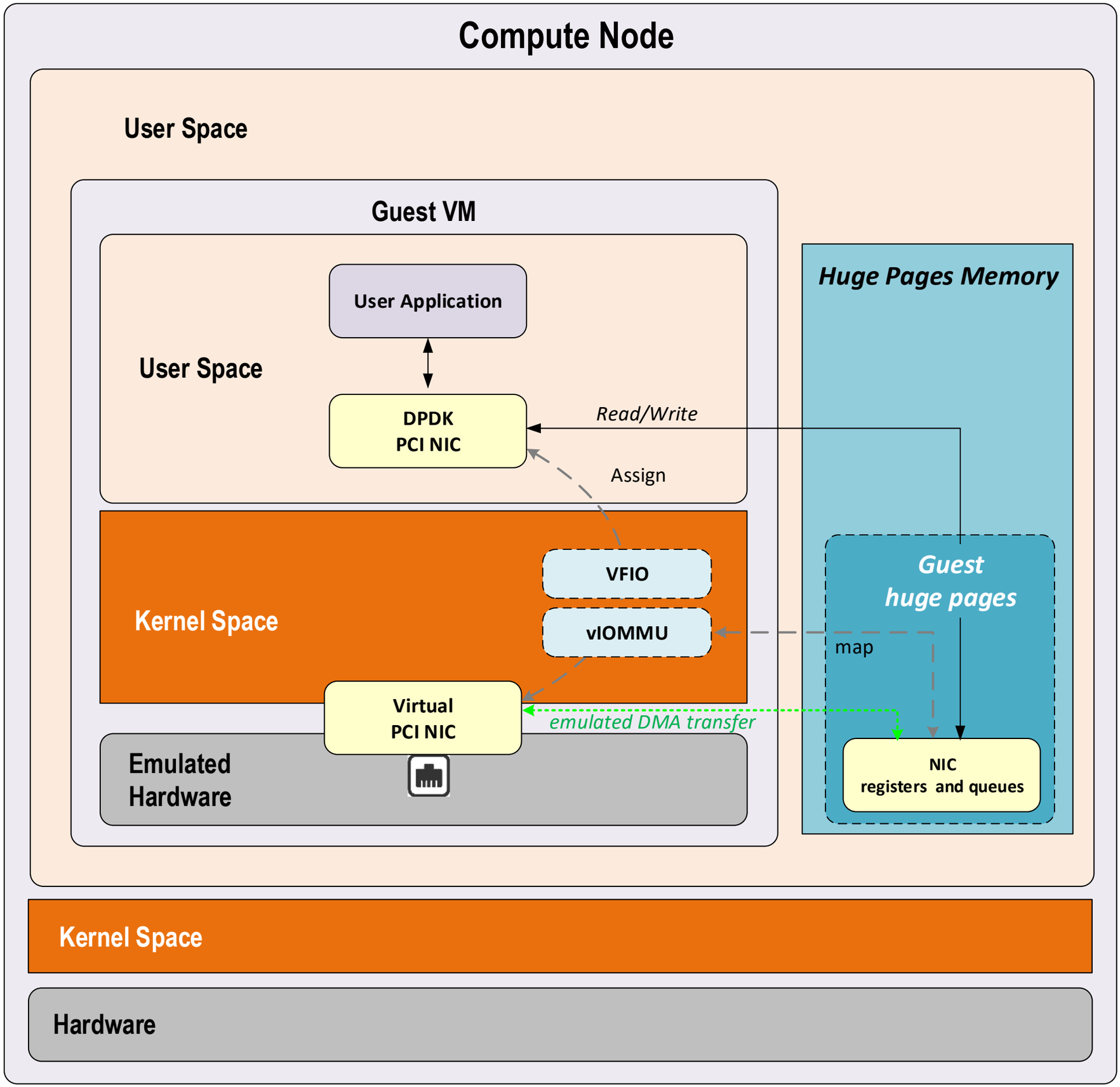
KVM

Physical
PCI NIC

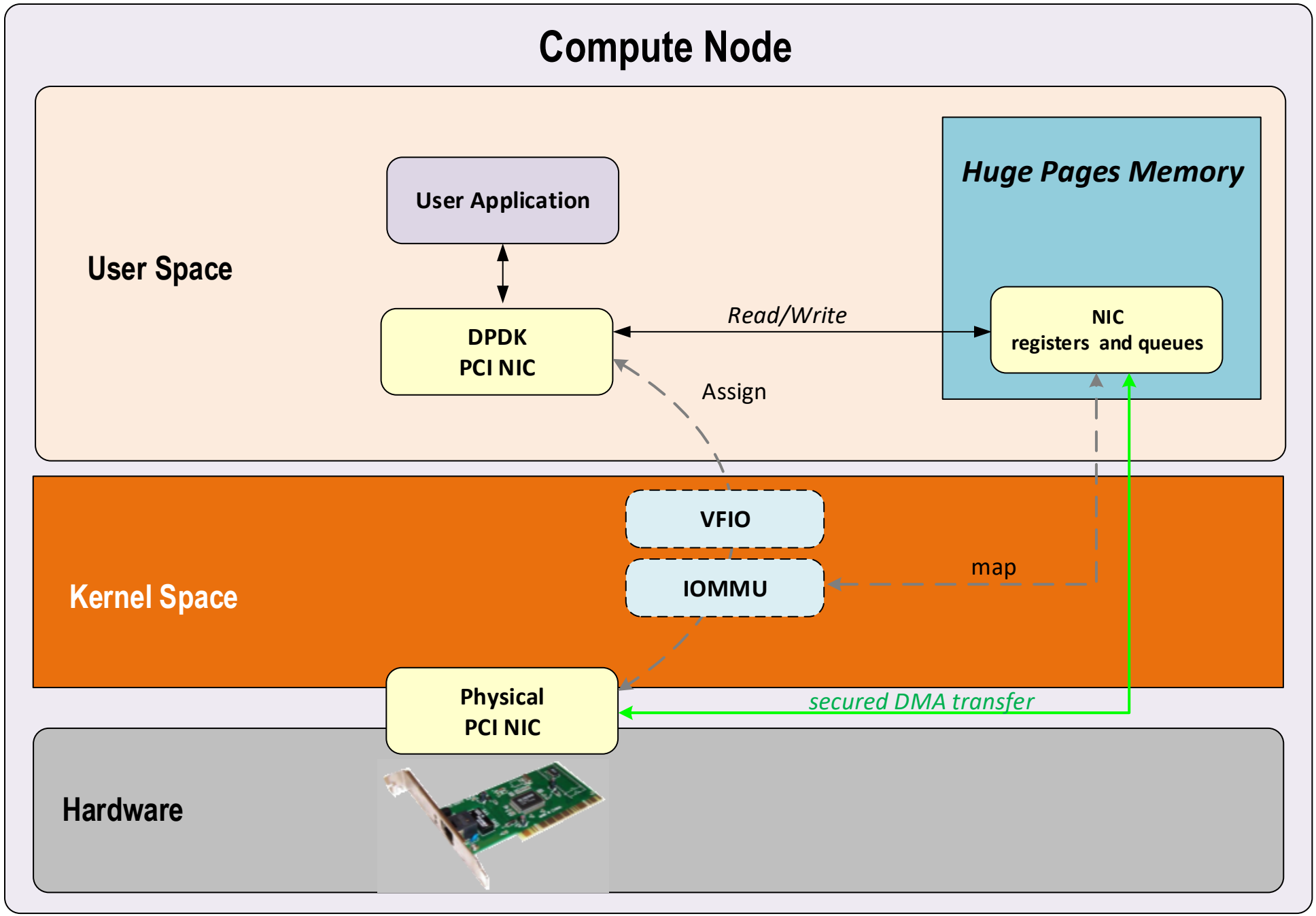


Hardware

Title: QEMU-KVM-LibVirt	
version: 1.0	date: 02/06/2020



Title: DPDK VFIO and emulated NIC	
version: 1.0	date: 02/06/2020



Title: DPDK VFIO and physical NIC	
version: 1.0	date: 02/06/2020

Compute Node

DPDK Application

DPDK Library Framework

QOS
- METER
- SCHED

Classify
- ACL
- LPM
- TABLE
- EXACT MATCH

PLATFORM
- POWER
- KNI
- IVSHMEM

Accelerators
- CRYPTO
- ...

Extentions
- VHOST
- ...

Core Libraries
- EAL
- MALLOC
- MBUF
- MEMPOOL
- RING
- TIMER

Poll Mode Drive (Physical and Virtuals)
- ETHDEV
- IGB
- VMXNET3
- BONDING
- IXGBE
- VIRTIO
- PCAP
- E1000
- RING
- I40E
- AF_PKT
- NULL

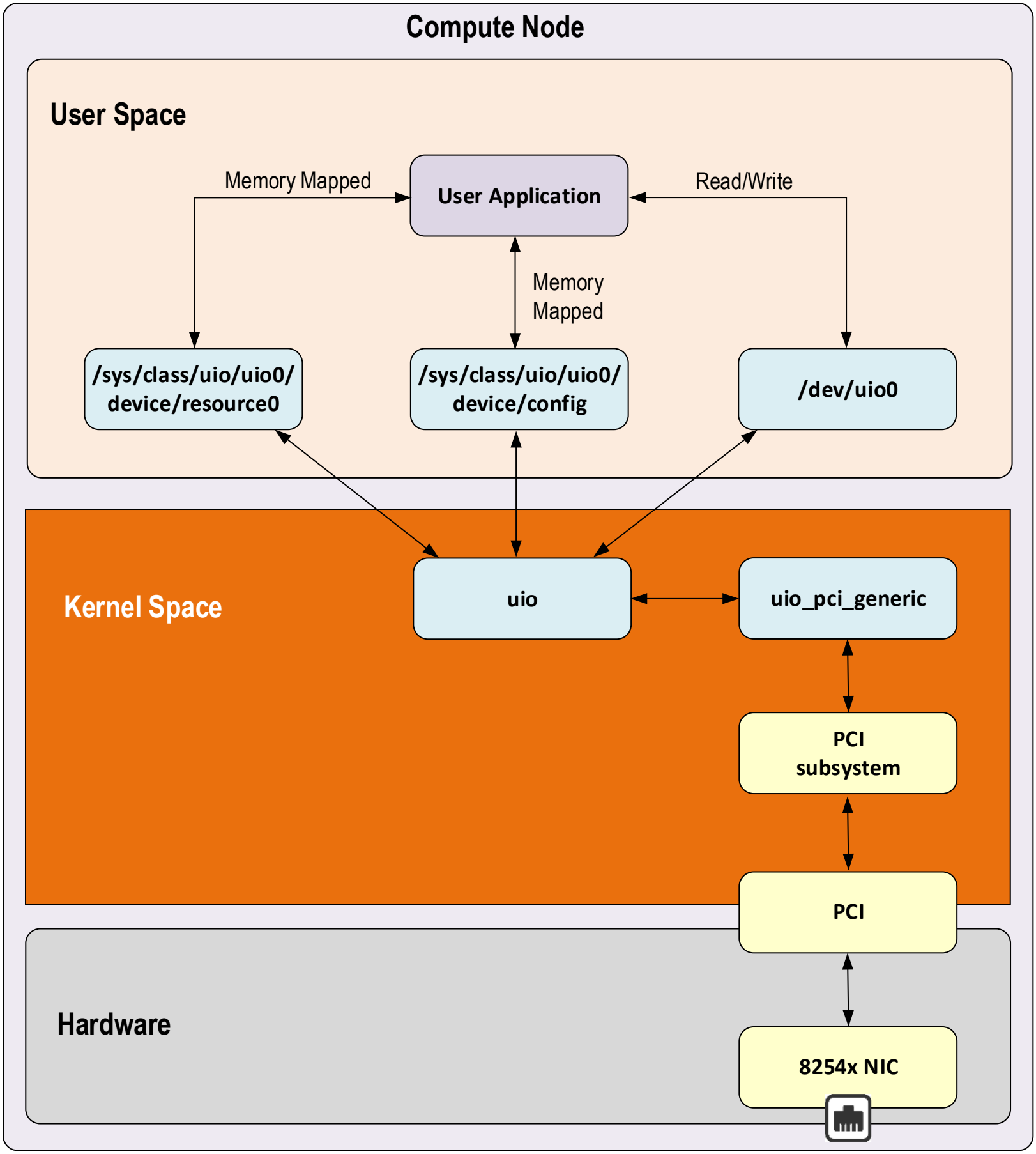
Packet Framework
- PORT
- PIPELINE
- HASH
- IP FRAG
- REORDER

User Space

Kernel Space
- KNI
- IGB_UIO
- UIO_PCI_GENERIC
- UIO
- VFIO

Hardware
- Network Controller

Title: DPDK Library Framework	
version: 1.0	date: 02/06/2020



Title: NIC PMD Driver	
version: 1.0	date: 30/05/2020

vrouter Queues size:
--vr_dpdk_tx_ring_sz (1024)
--vr_dpdk_rx_ring_sz (1024)

Allow or not core re-balancing (enable or not internal hasing):
--vr_no_load_balance

Allow or not forwarding cores to be released:
--yield_option (1)

Physical NIC Queues size:
--dpdk_txd_sz (128)
--dpdk_rxd_sz (128)

vRouter

Polling Cores

vrouter hash

Processing Cores

VM DPDK Application

RSS hash

Virtual NIC

VirtIO Ring

LCORE pthread

Intern. Q

Device Ring

« vif 0/N » vNIC Queues

« vif 0/0 » Physical NIC DPDK Queues

Service & Control Cores

Hardware Queues

....

DMA transfer

Physical NIC

Service and Control cores pinning:
--service_core_mask
--dpdk_ctrl_thread_mask

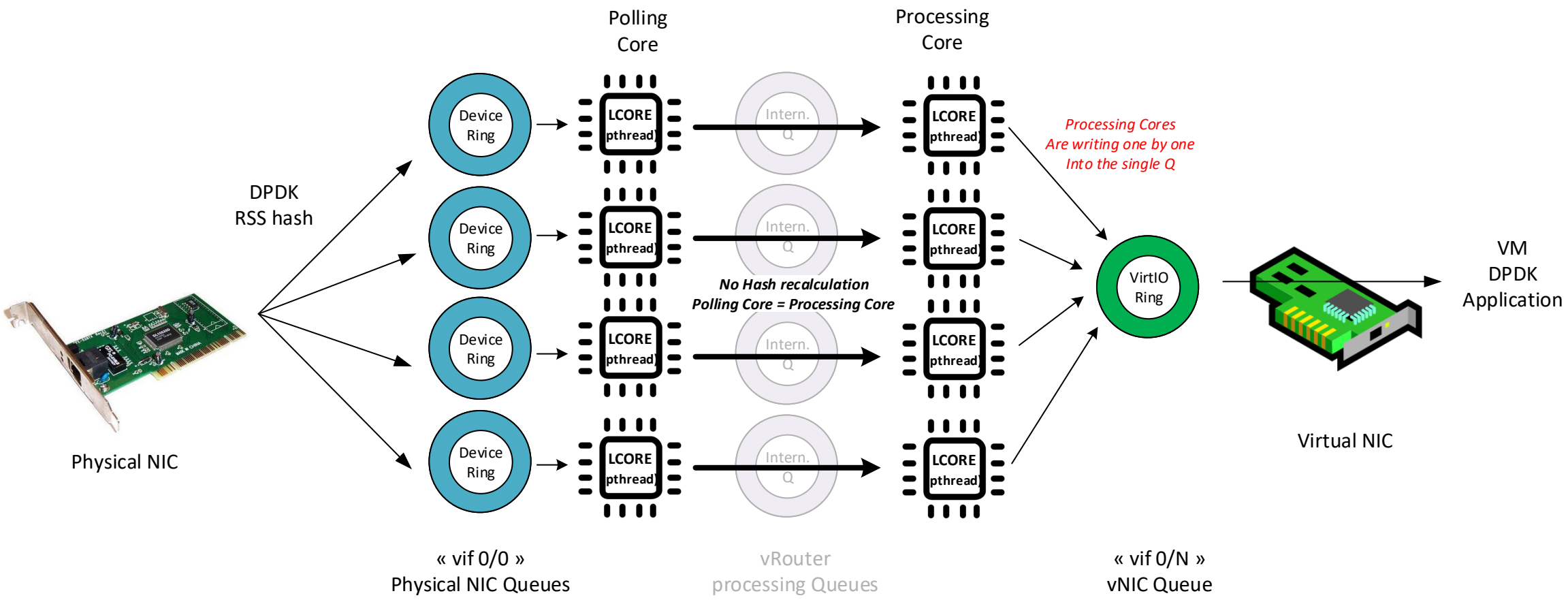
Mempool size:
--vr_mempool_sz (16384)

MEMPOOL (DPDK rings memory)

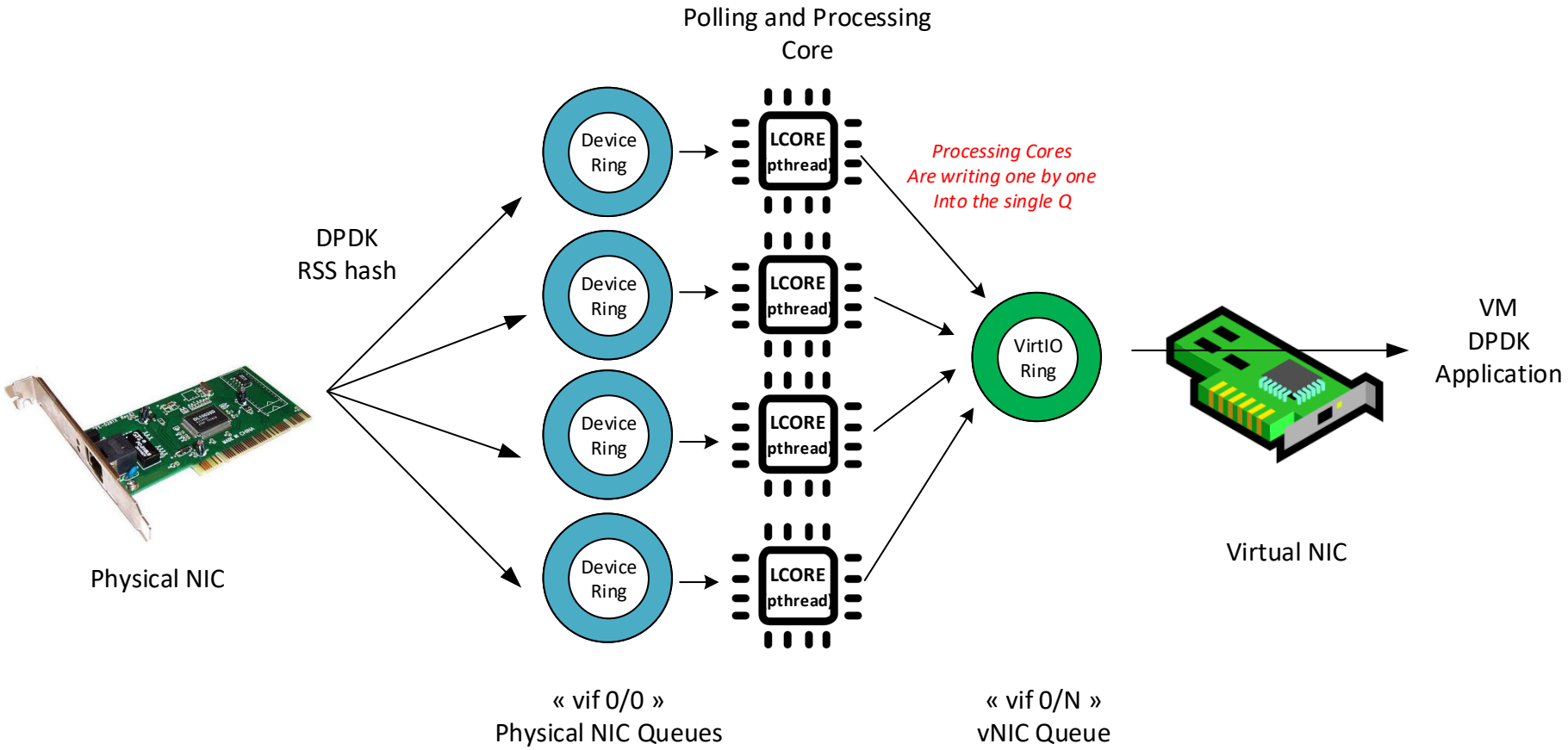
Hugepages Memory

Socket Memory (hugepages) booked at startup:
--socket-mem (1024,1024)

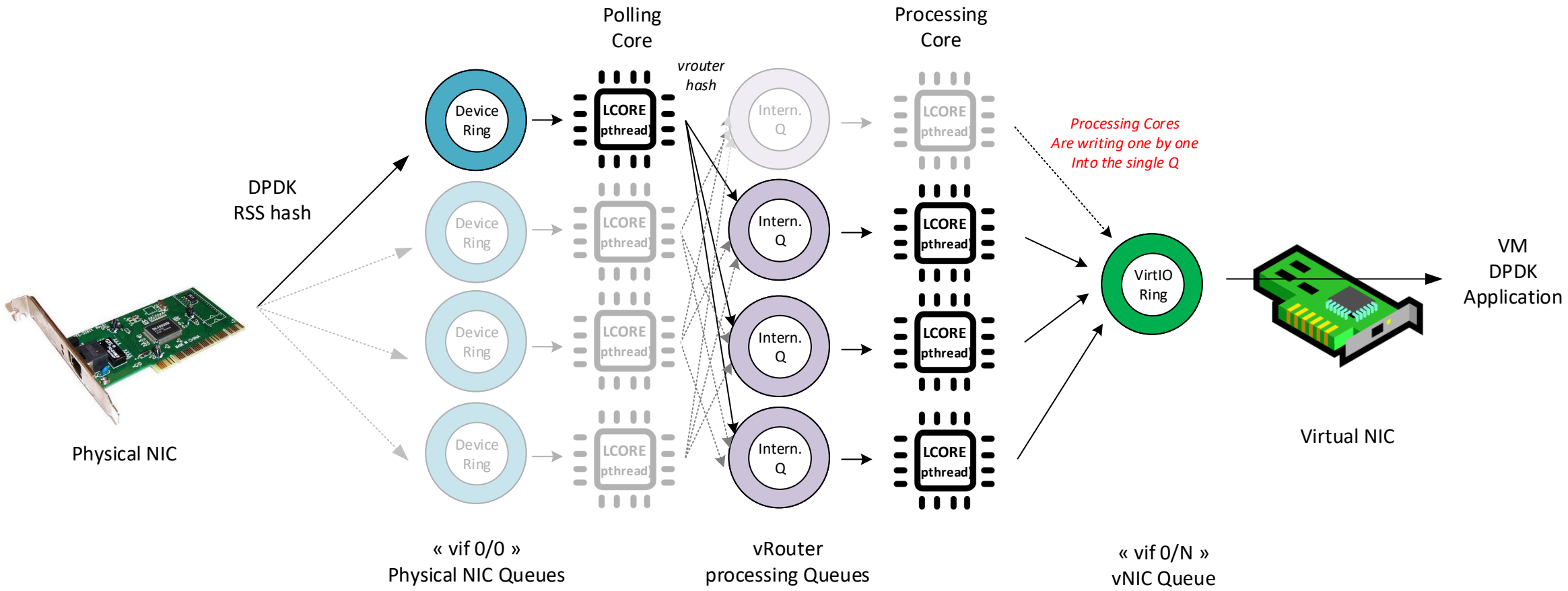
Title: vRouter Architecture	
version: 1.1	date: 22/05/2020



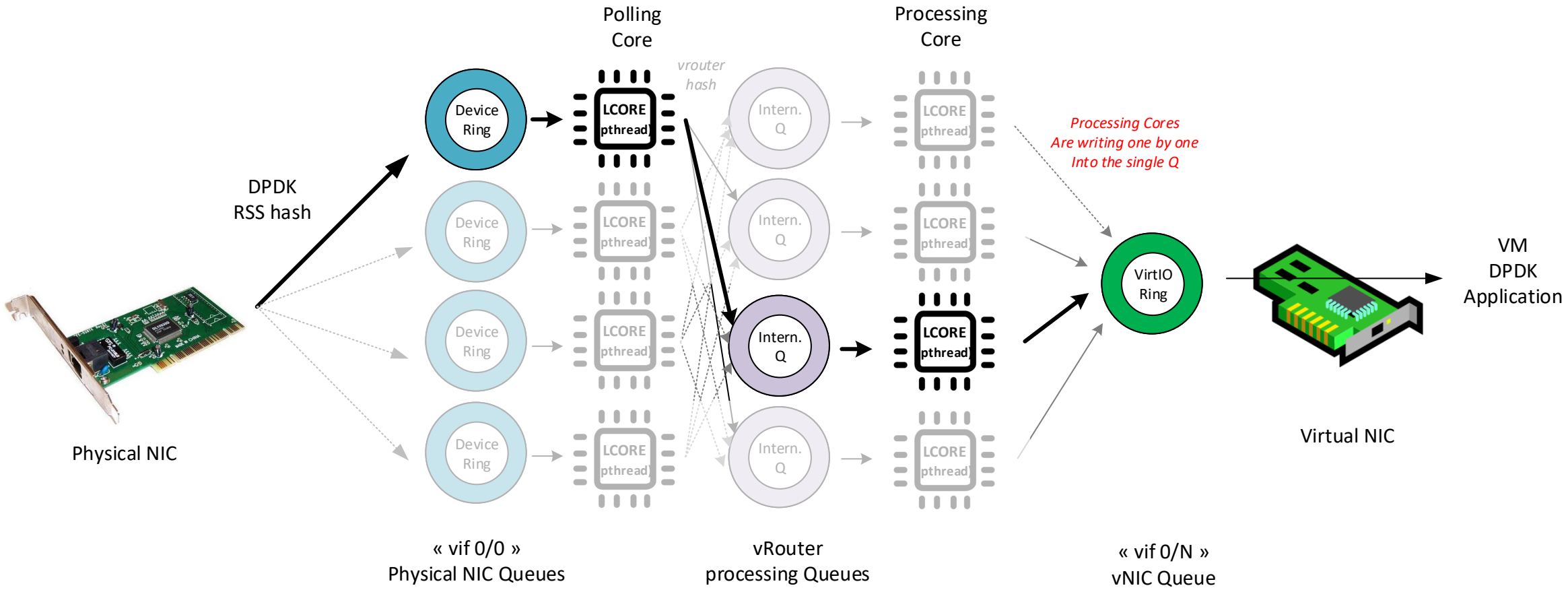
Title: UDP to SingleQ	
version: 1.0	date: 25/03/2020



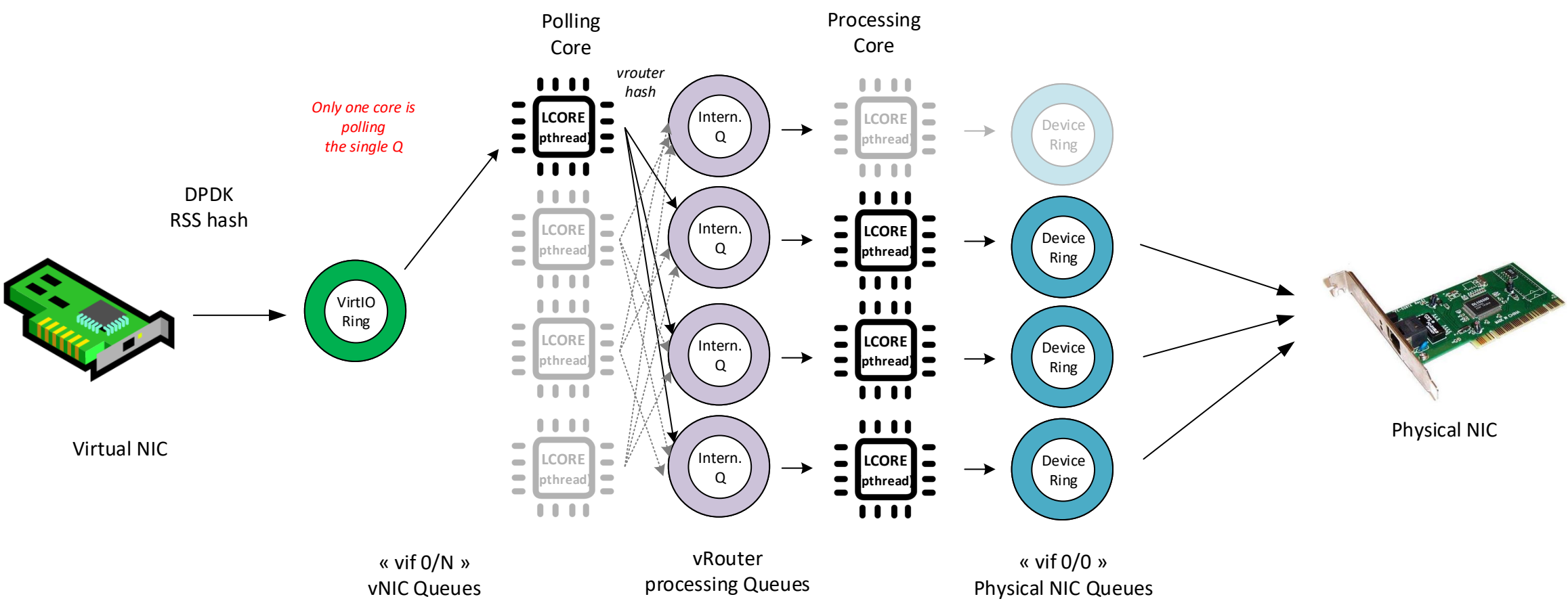
Title: UDP to SingleQ v2	
version: 1.0	date: 13/10/2020



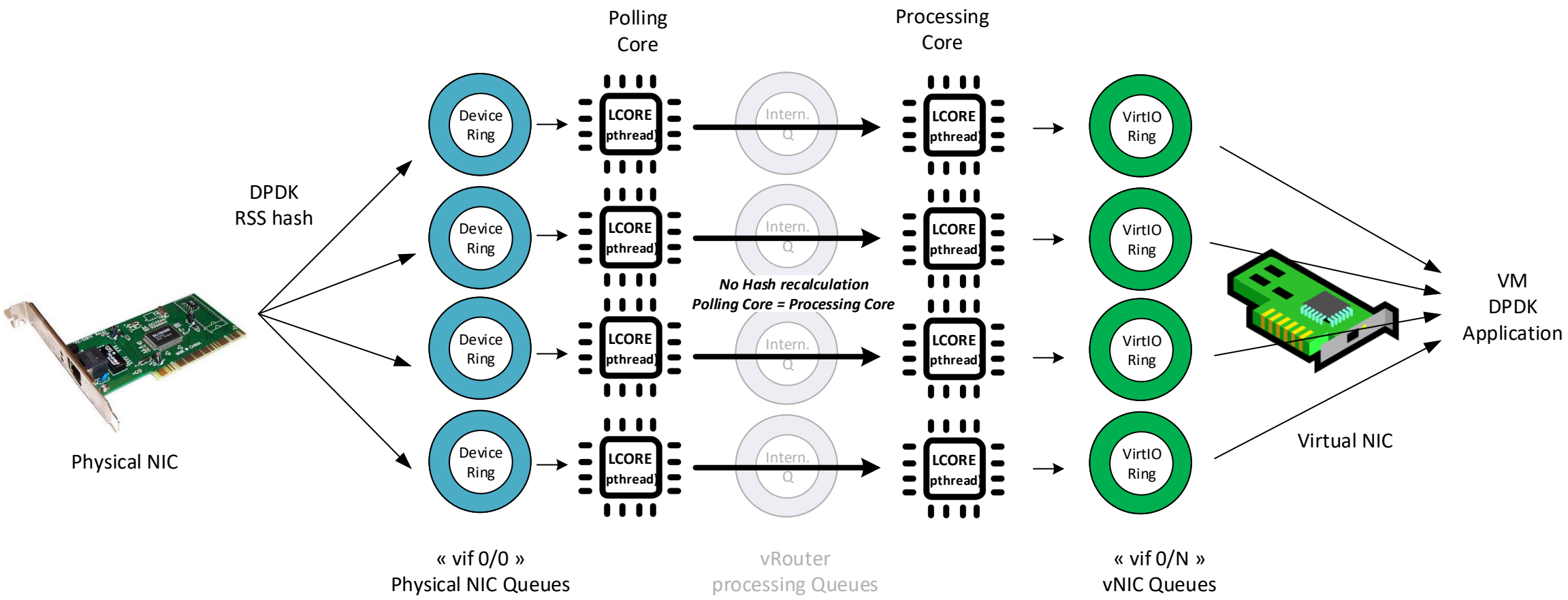
Title: GRE to SingleQ	
version: 1.0	date: 25/03/2020



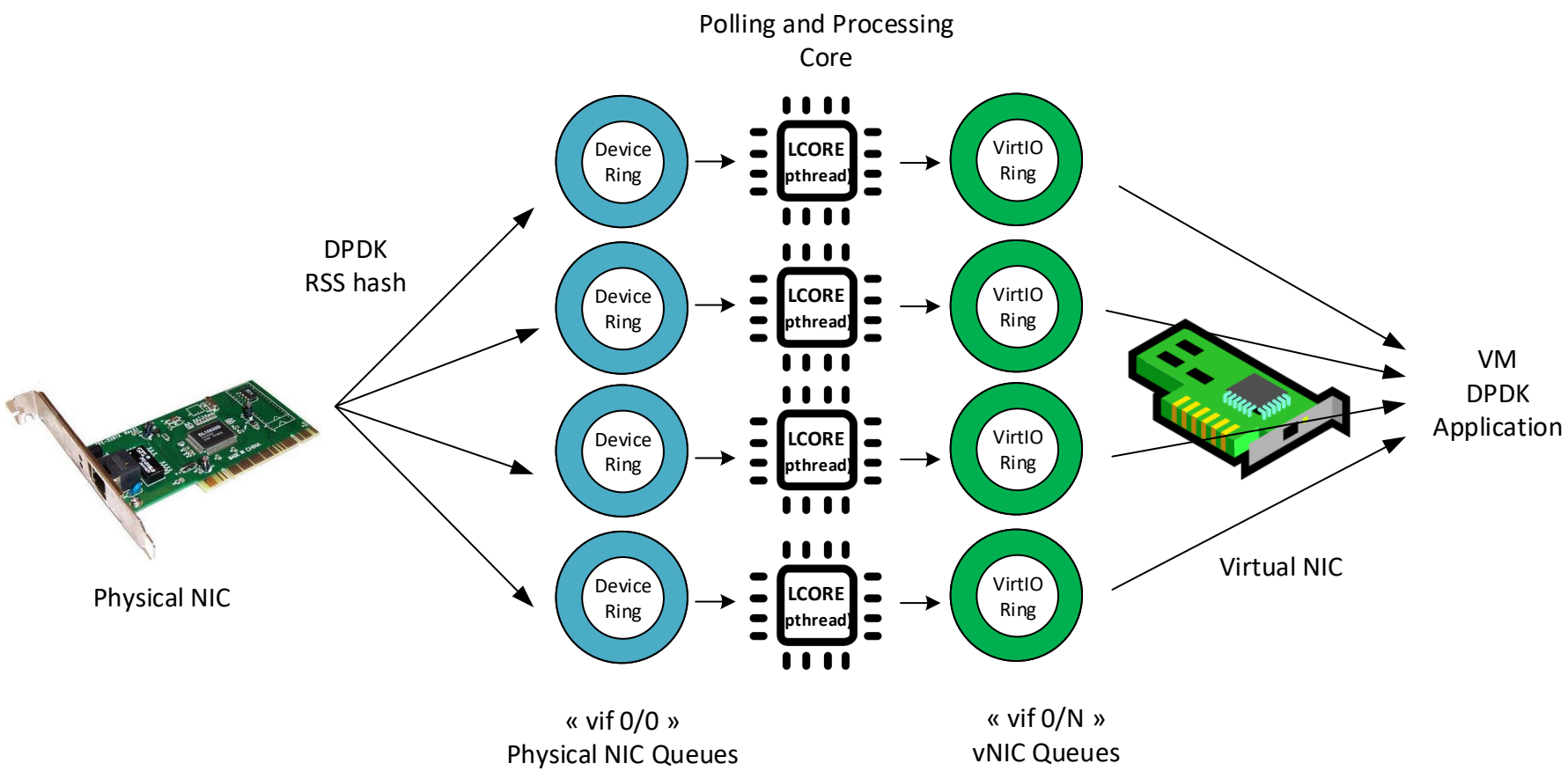
Title: GRE to SingleQ v2	
version: 1.0	date: 25/03/2020



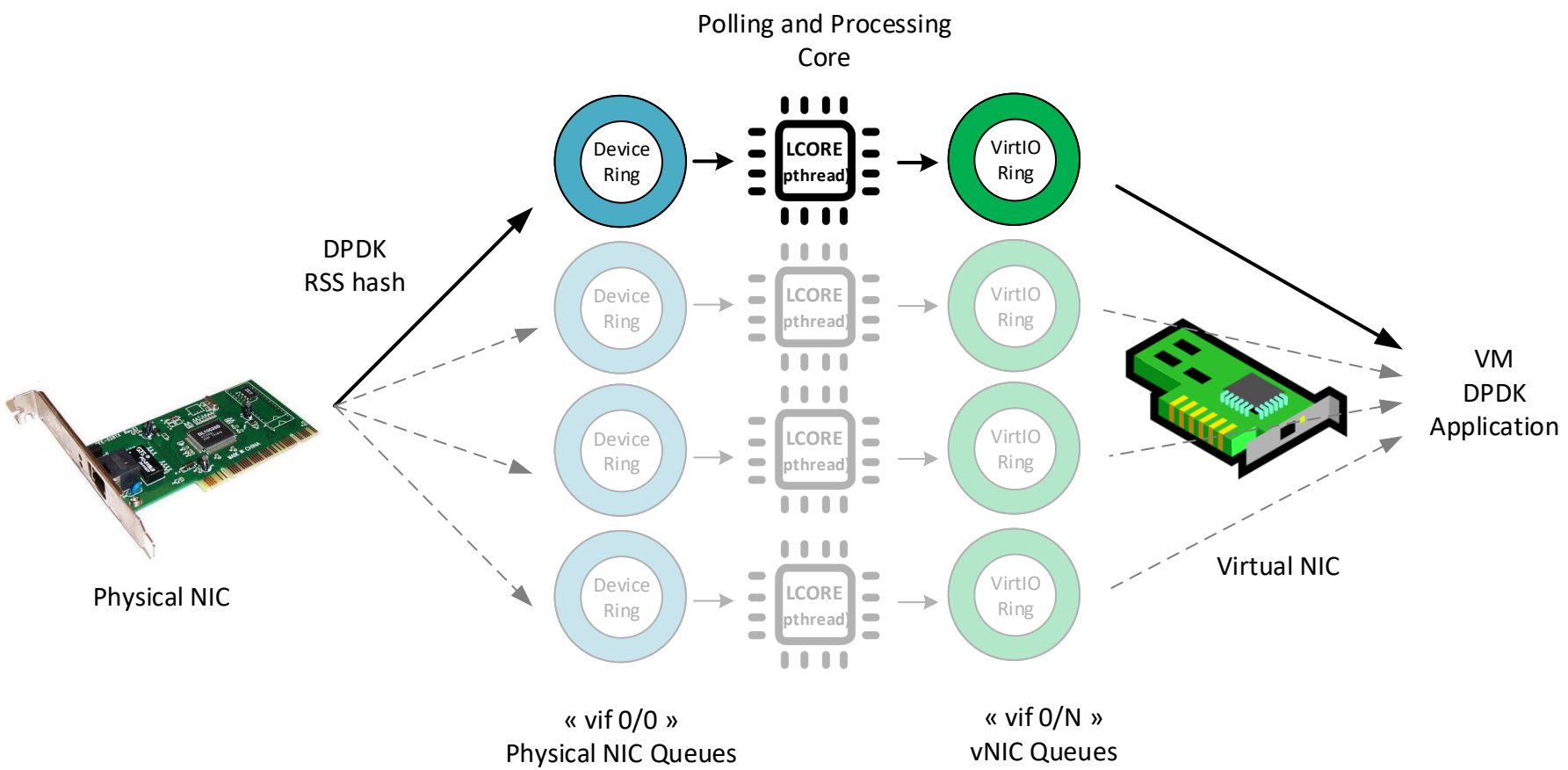
Title: SingleQ to Underlay	
version: 1.0	date: 25/03/2020



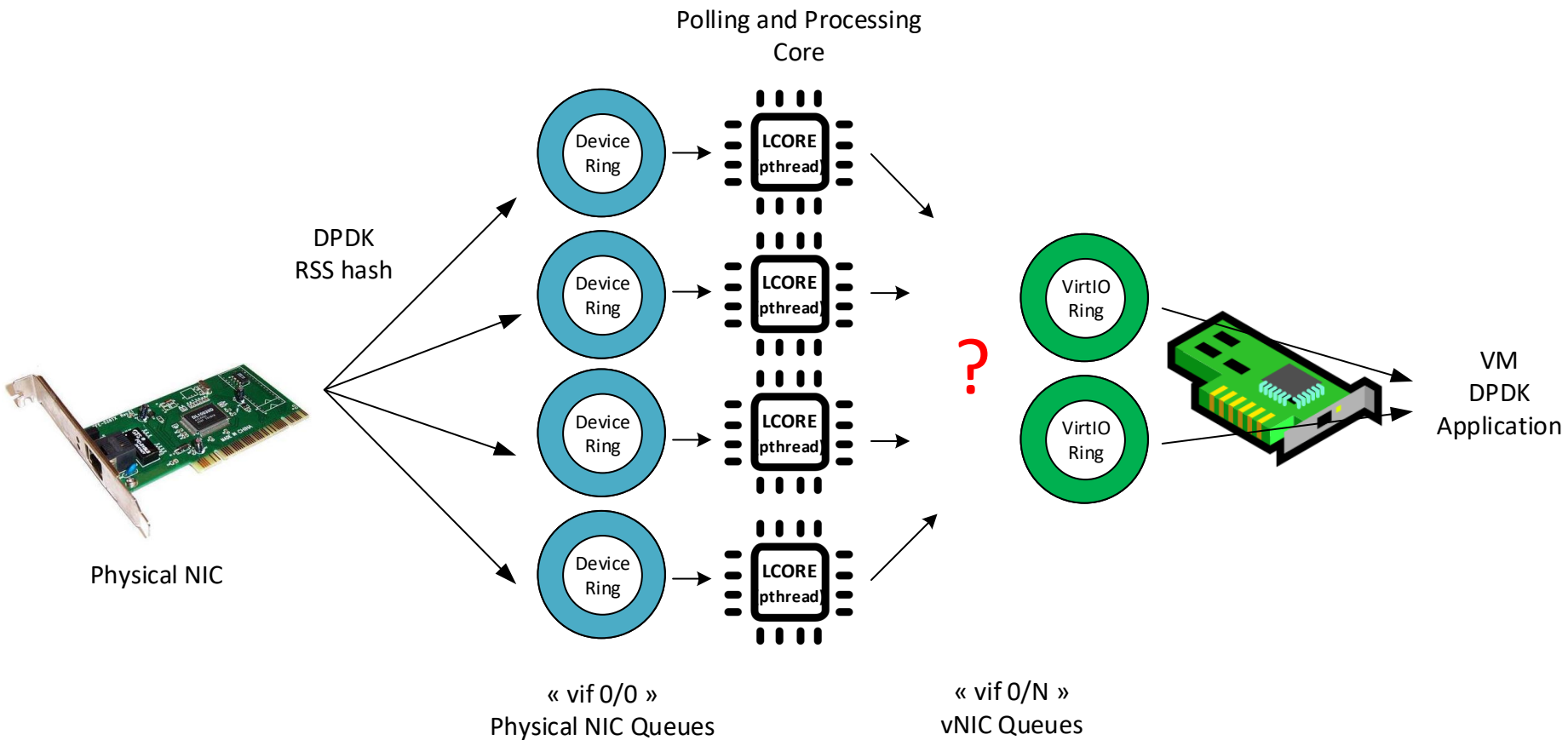
Title: UDP to MultiQ	
version: 1.0	date: 25/03/2020



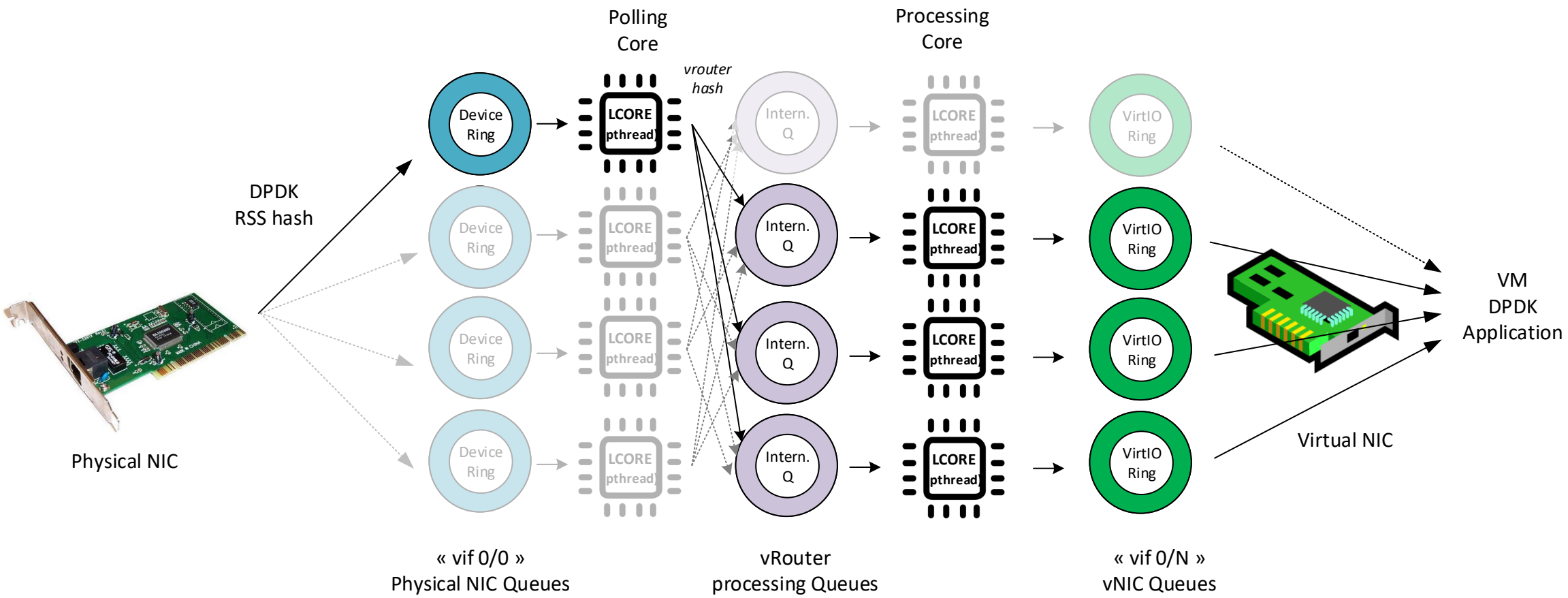
Title: UDP to MultiQ v2	
version: 1.0	date: 13/10/2020



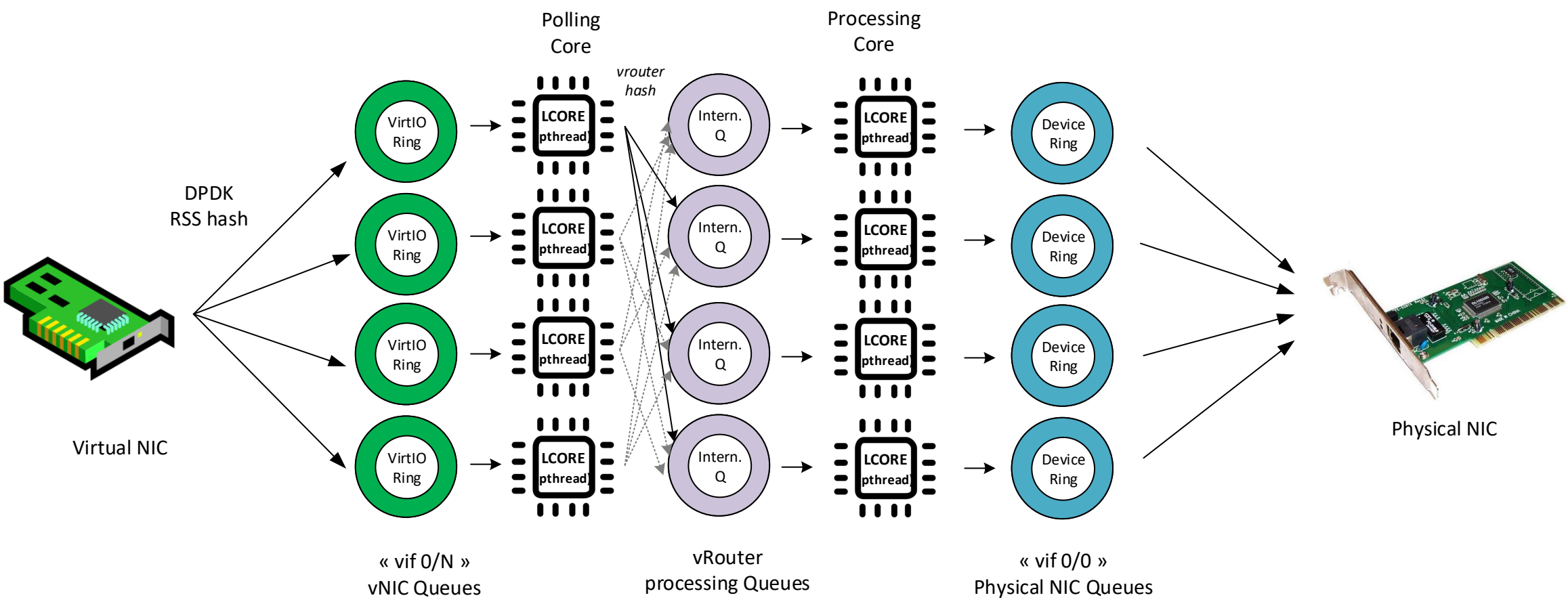
Title: UDP to MultiQ v3	
version: 1.0	date: 13/10/2020



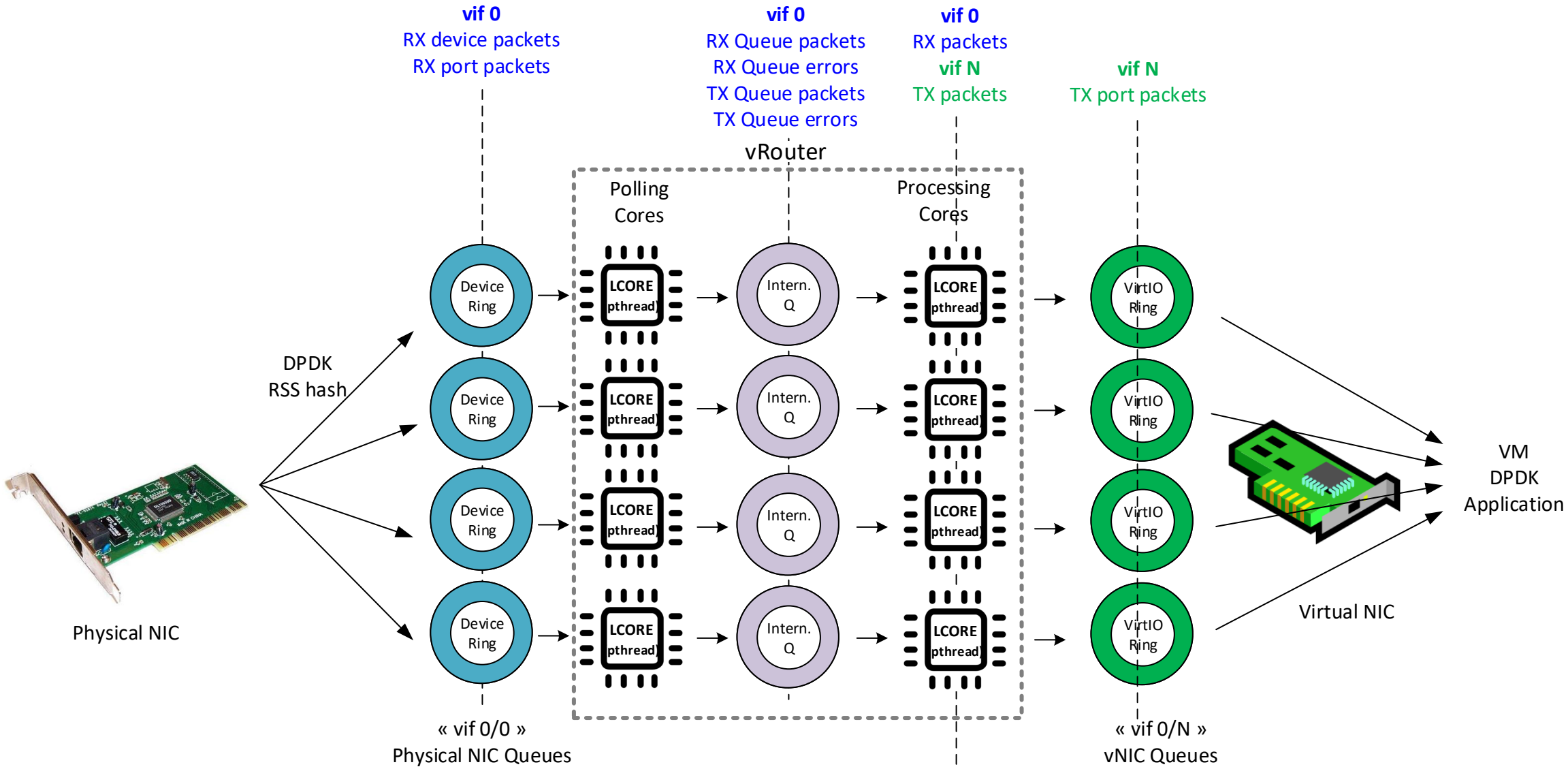
Title: TX on multiQ	
version: 1.0	date: 13/10/2020



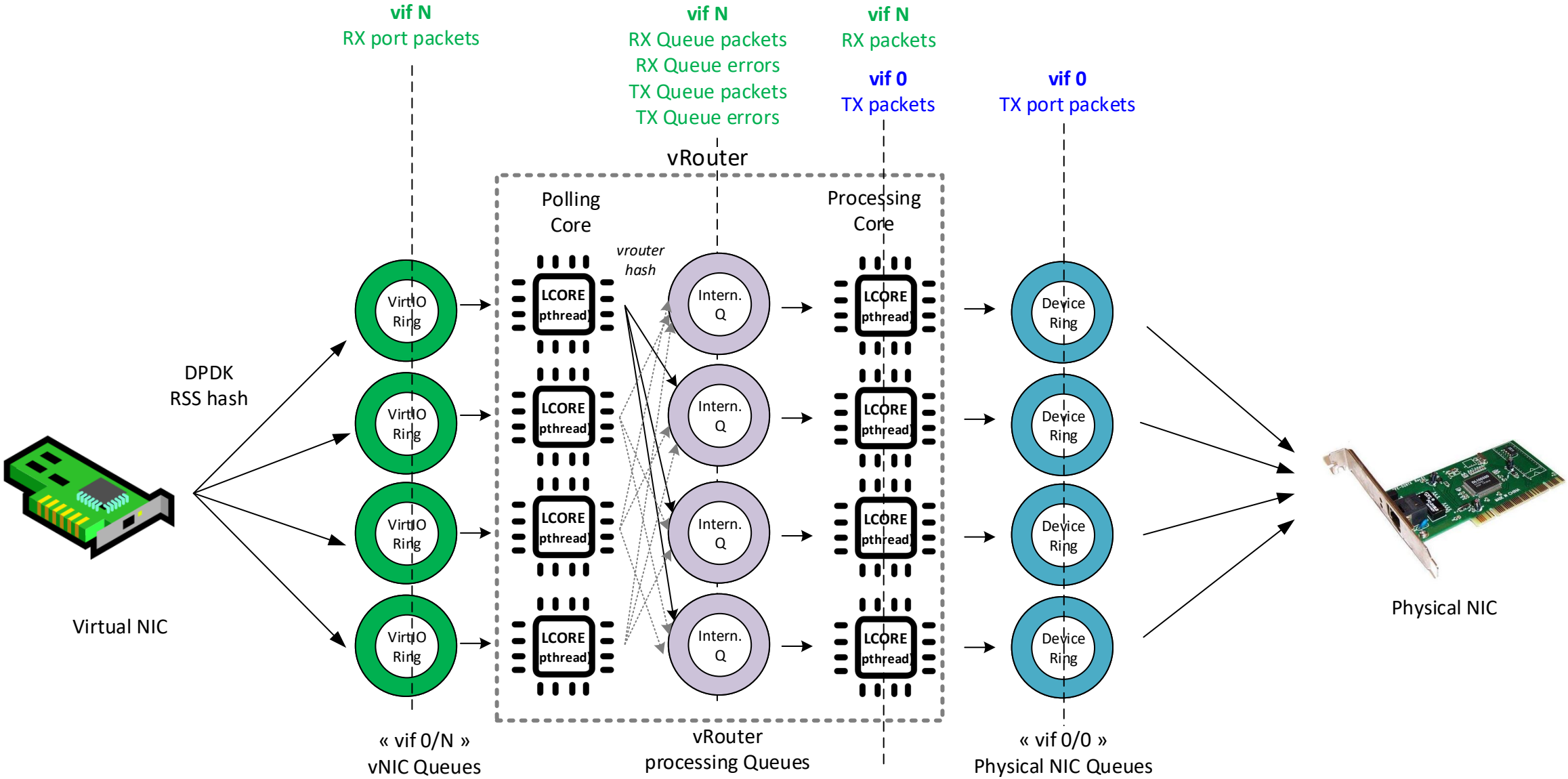
Title: GRE to MultiQ	
version: 1.0	date: 25/03/2020



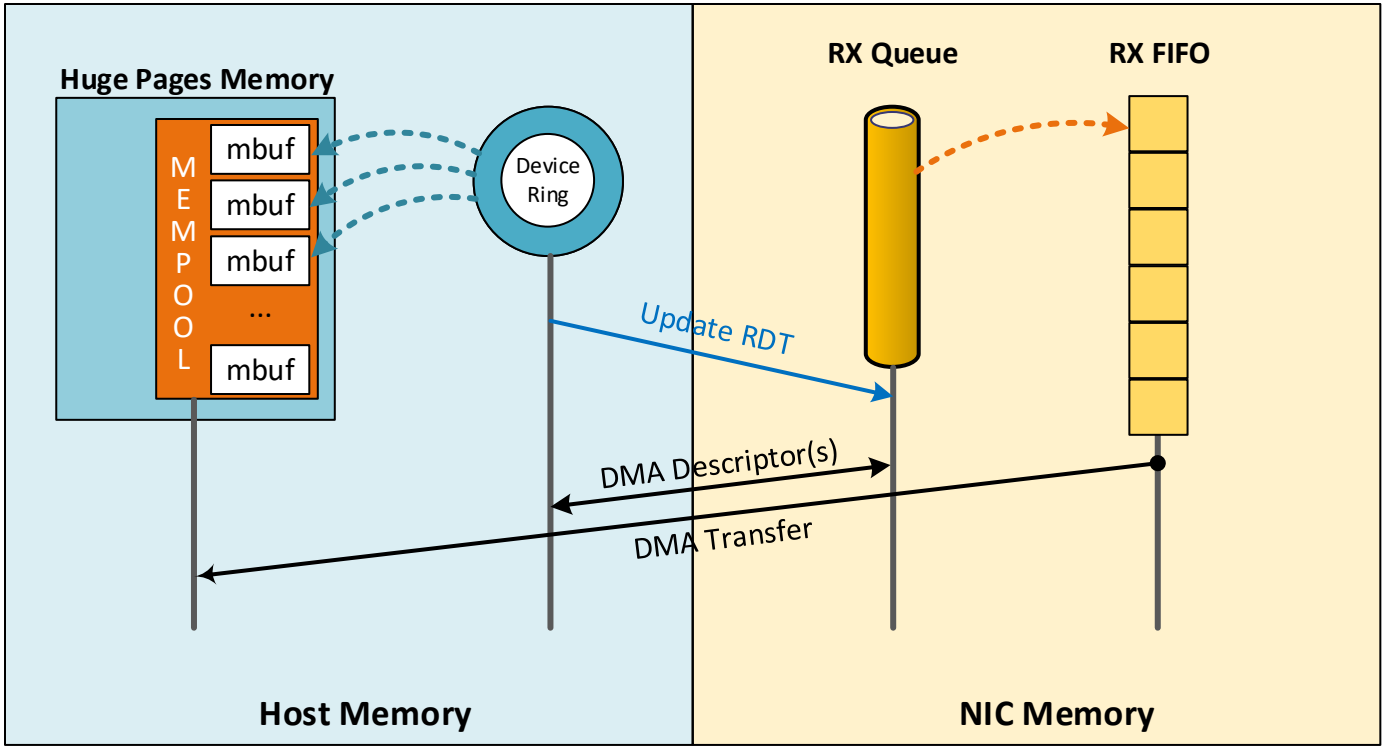
Title: MultiQ to Underlay	
version: 1.0	date: 25/03/2020



Title: vif counters (phys to virt)	
version: 1.0	date: 25/03/2020

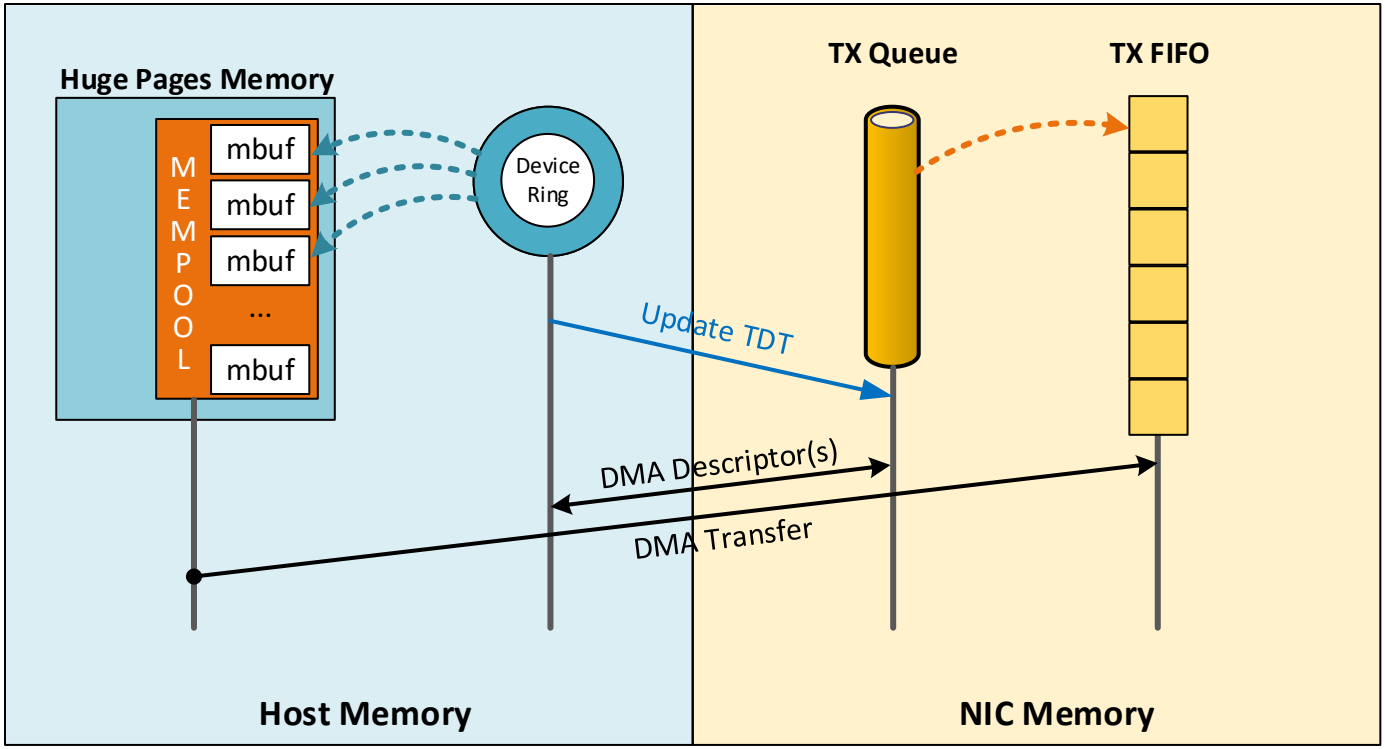


Title: vif counters (virt to phys)	
version: 1.0	date: 25/03/2020



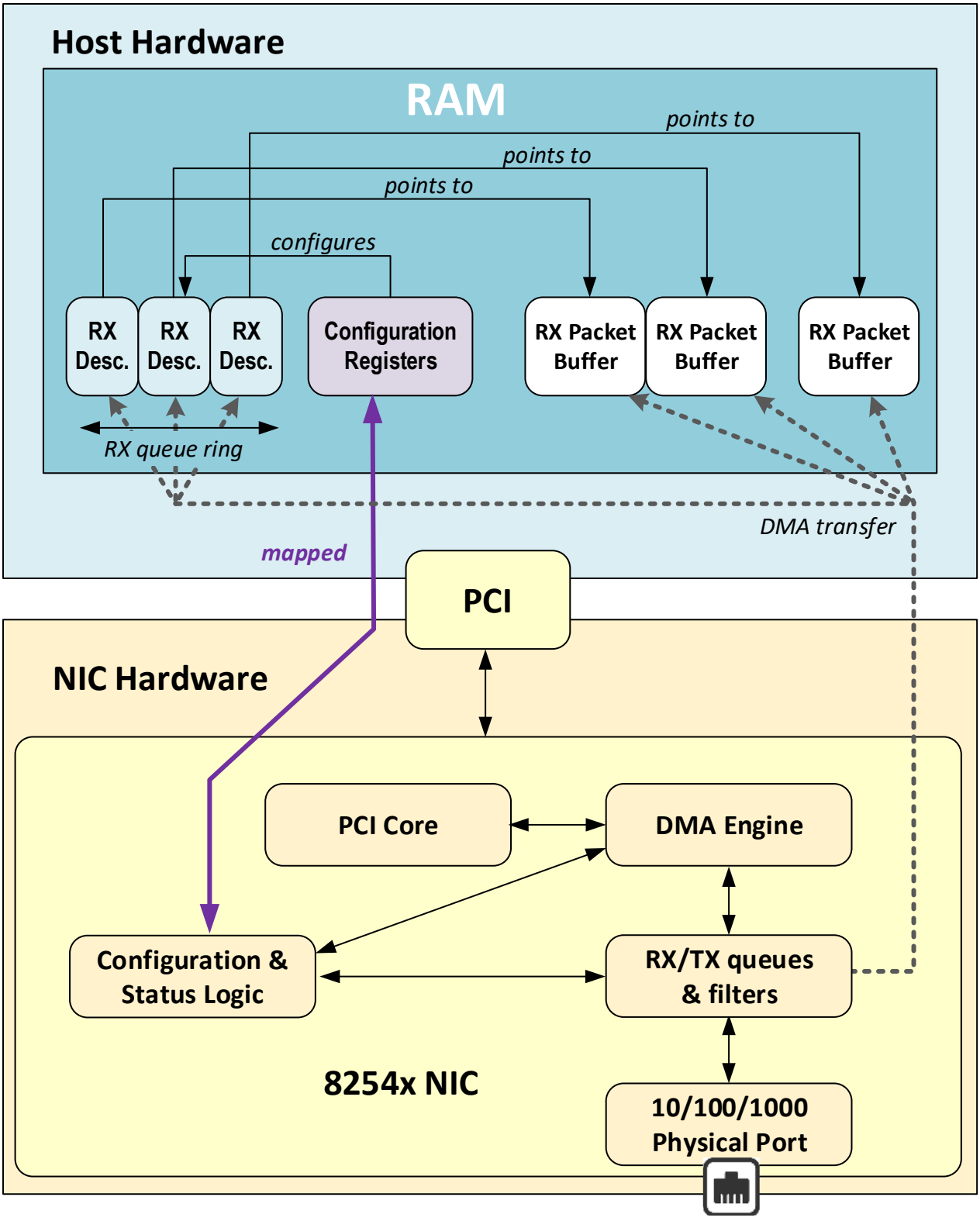
RDT: Receive Descriptor Tail

Title: pNIC incoming packet	
version: 1.0	date: 25/03/2020

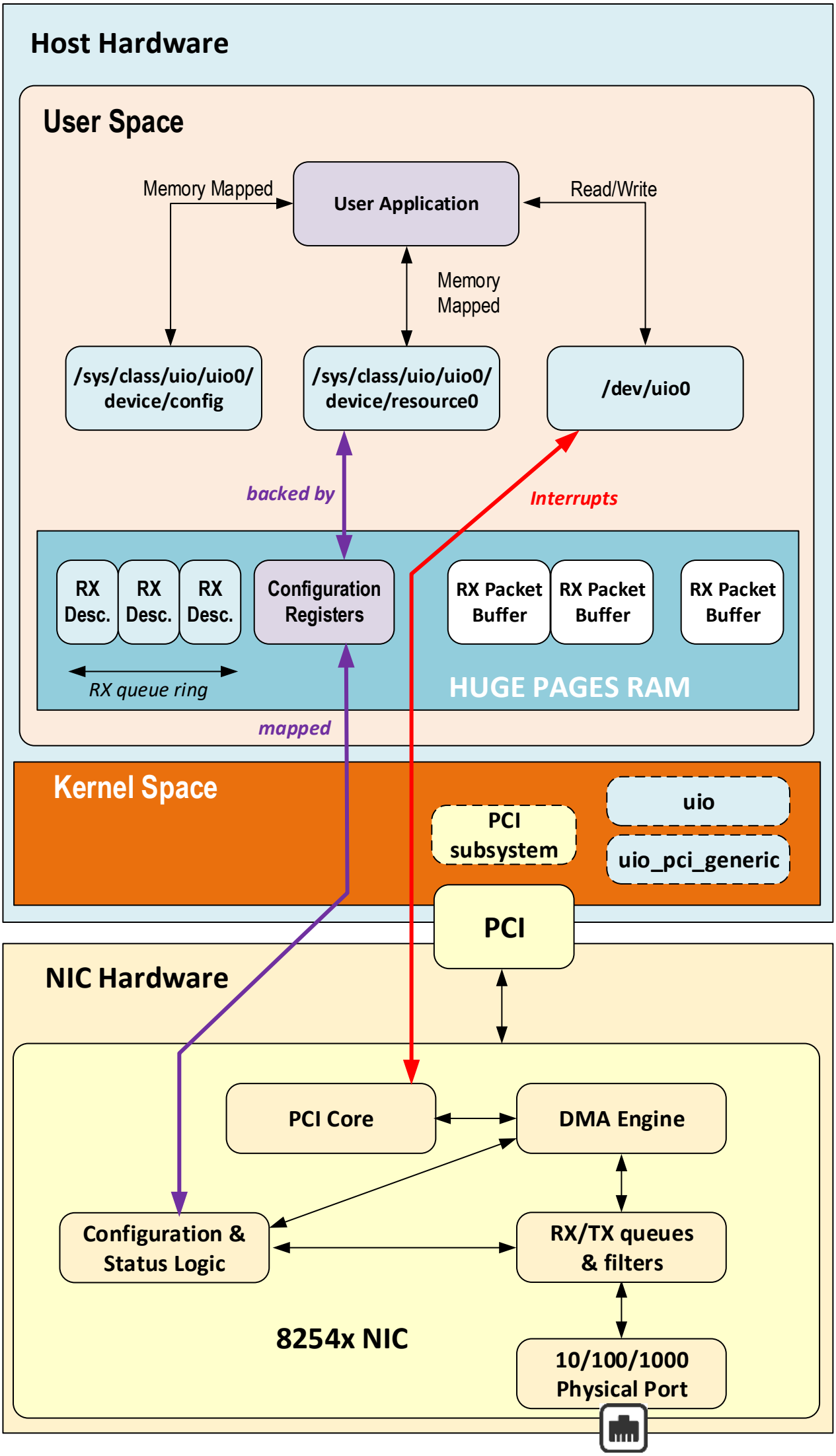


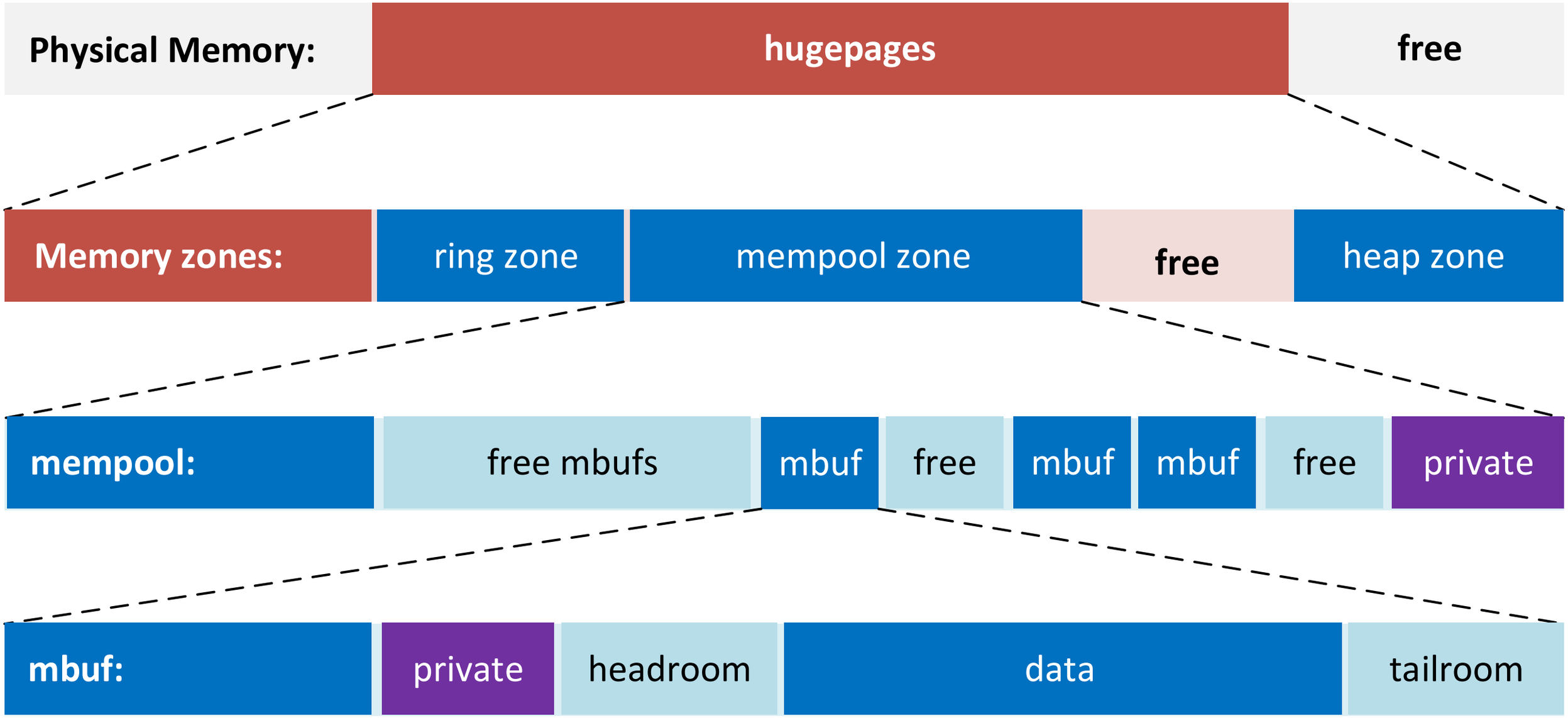
TDT: Transmit Descriptor Tail

Title: pNIC outgoing packet	
version: 1.0	date: 25/03/2020

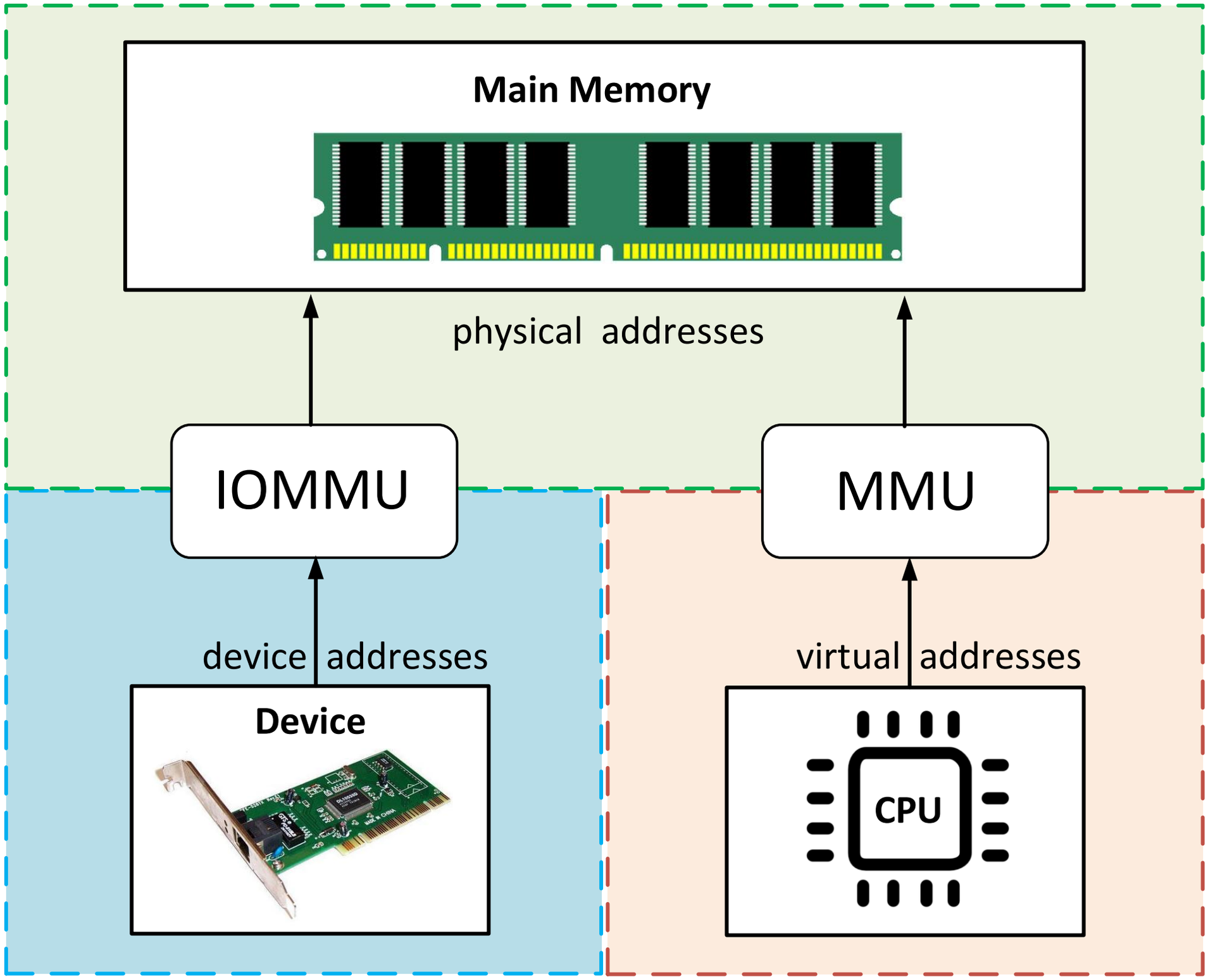


Title: pNIC - Host Memory Mapping	
version: 1.0	date: 30/05/2020

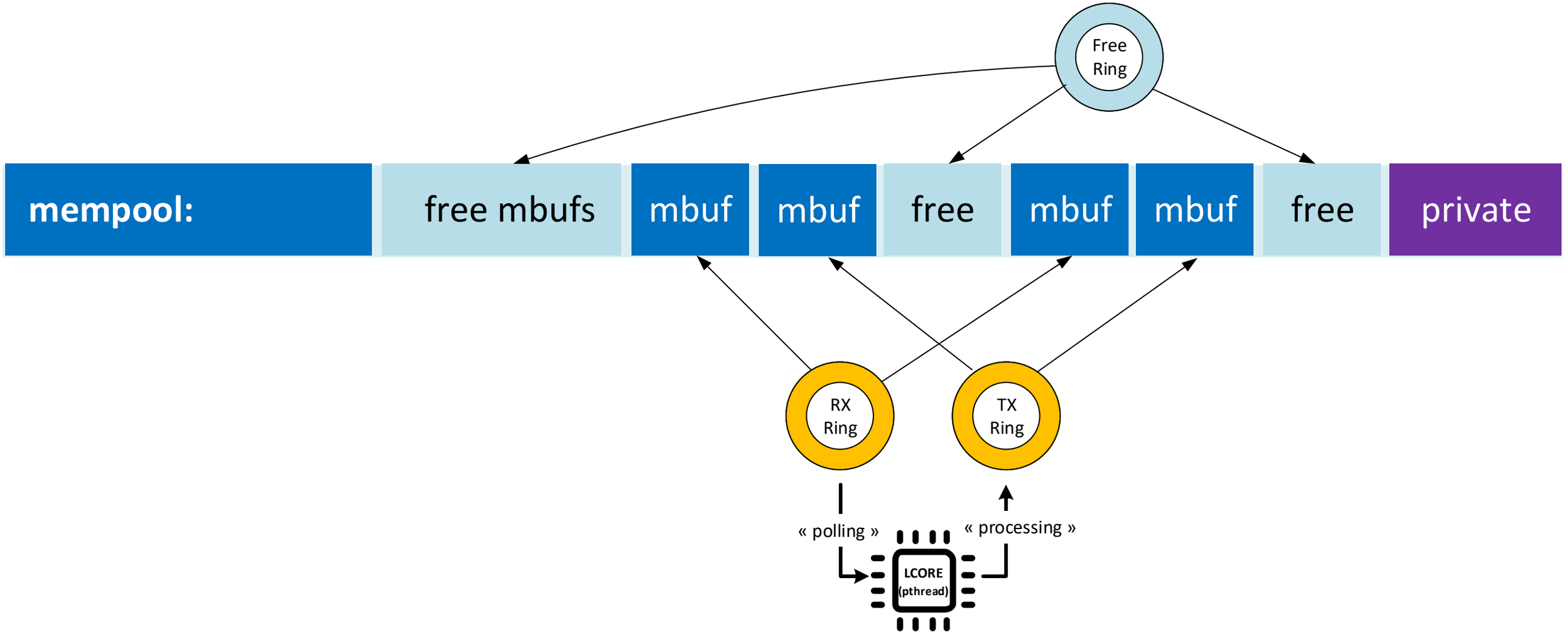

Host Hardware
User Space
Memory Mapped
User Application
Read/Write
Memory Mapped
/sys/class/uio/uio0/ device/config
/sys/class/uio/uio0/ device/resource0
/dev/uio0
backed by
Interrupts
RX Desc.
RX Desc.
RX Desc.
Configuration Registers
RX Packet Buffer
RX Packet Buffer
RX Packet Buffer
RX queue ring
HUGE PAGES RAM
mapped
Kernel Space
PCI subsystem
uio
uio_pci_generic
PCI
NIC Hardware
PCI Core
DMA Engine
Configuration & Status Logic
RX/TX queues & filters
8254x NIC
10/100/1000 Physical Port



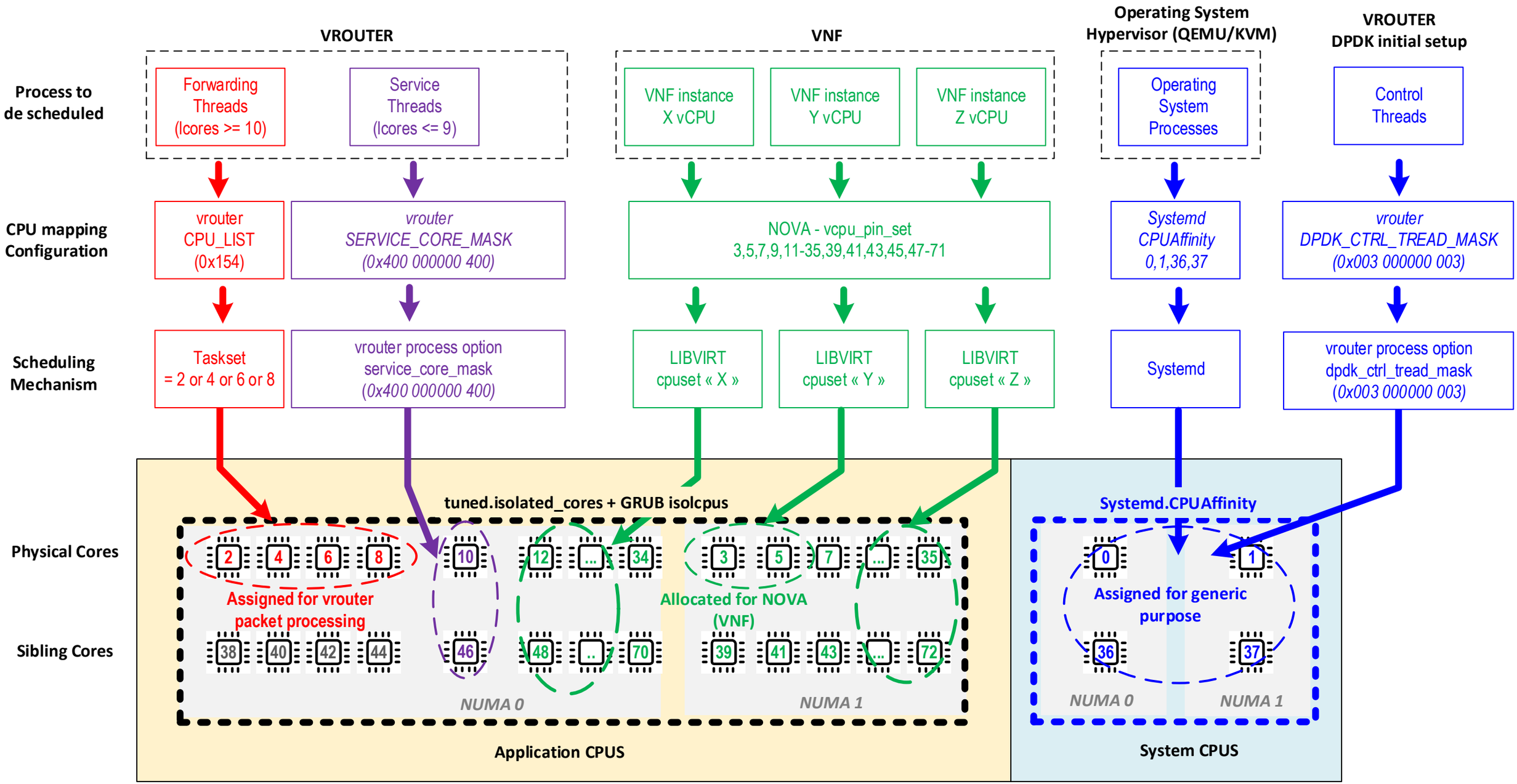
DPDK and Memory	
version: 1.0	date: 25/03/2020



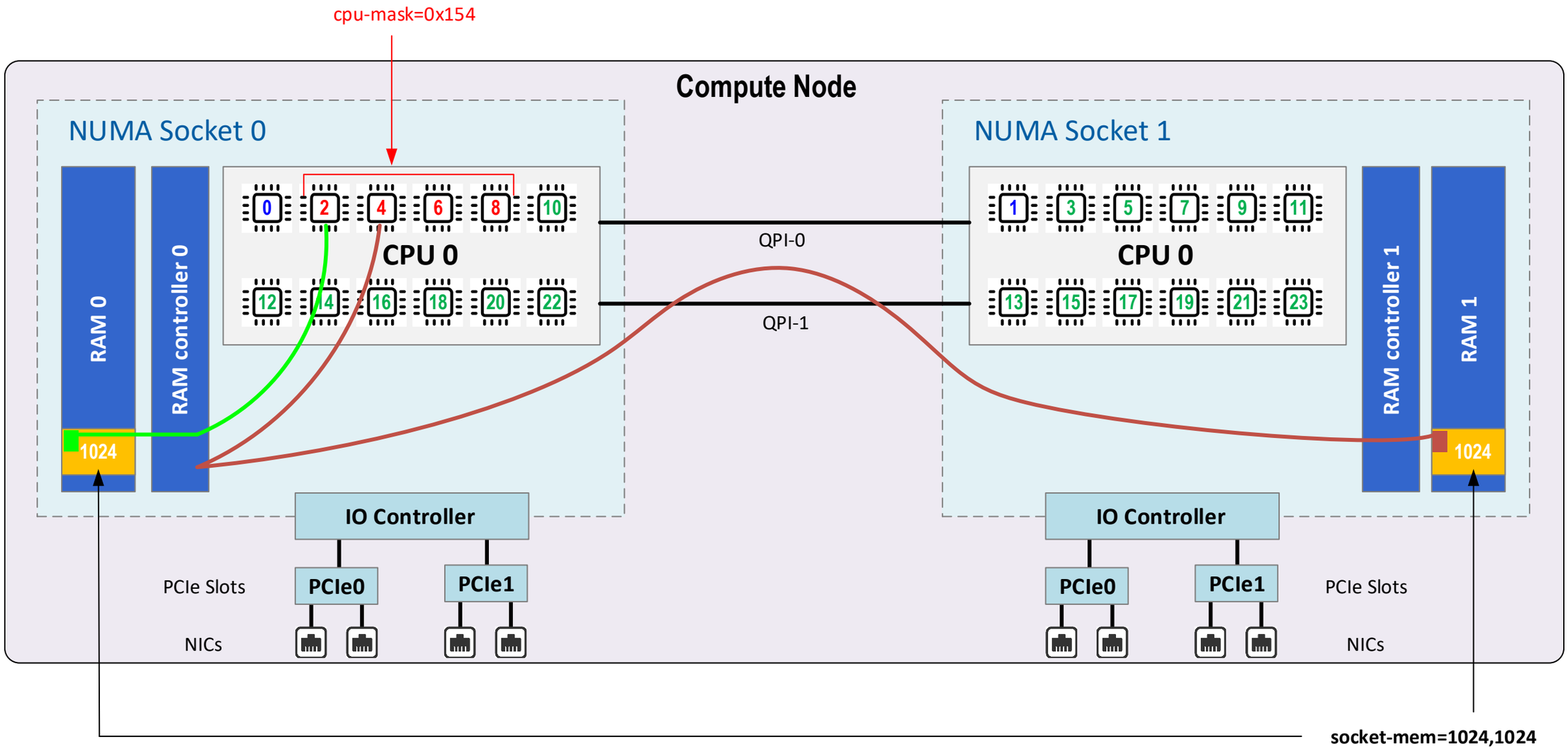
Memory Addressing	
version: 1.0	date: 27/03/2020



Packets Processing and Memory	
version: 1.0	date: 25/03/2020



Title: CPU Pinning	
version: 1.0	date: 25/03/2020



X vRouter DPDK PMD allocated CPUs

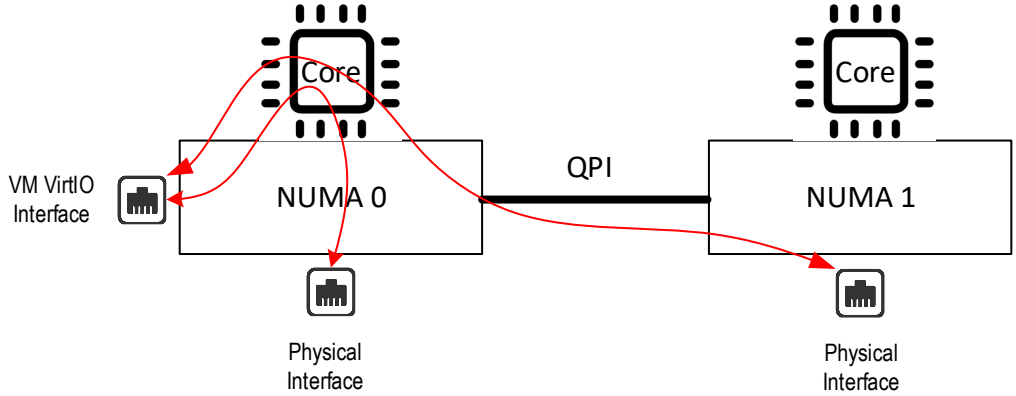
X VM allocated CPUs

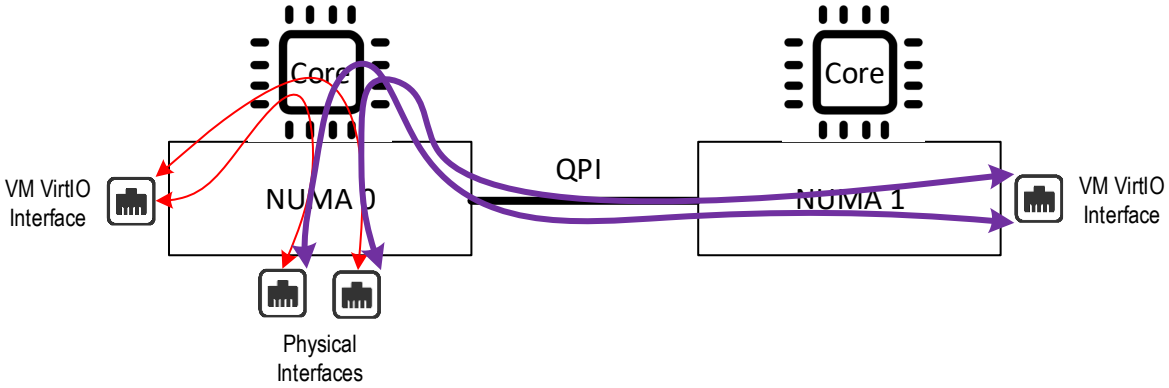
X Host OS allocated CPUs

vRouter memory access shortest path

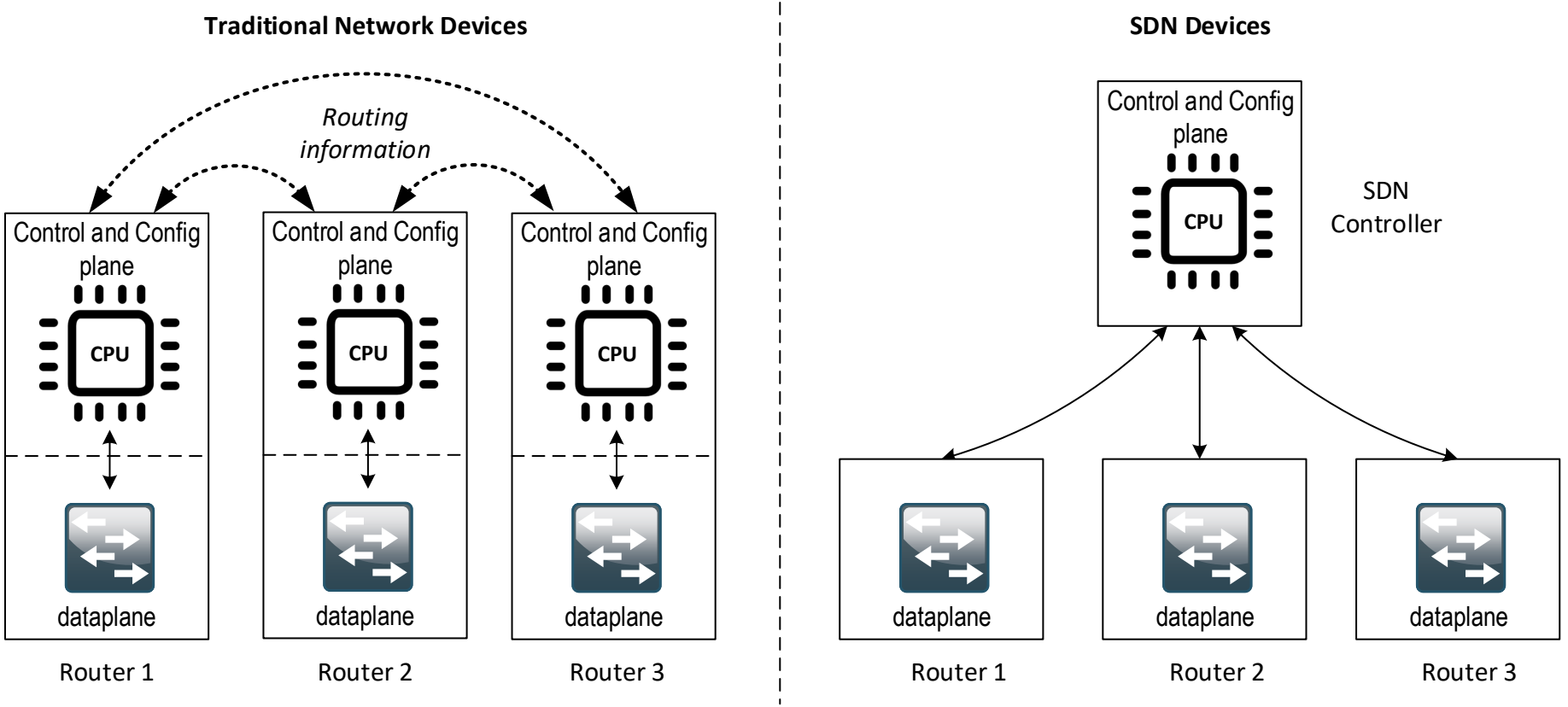
vRouter memory access longer path

Title: vRouter Memory Access and NUMA	
version: 1.0	date: 27/03/2020

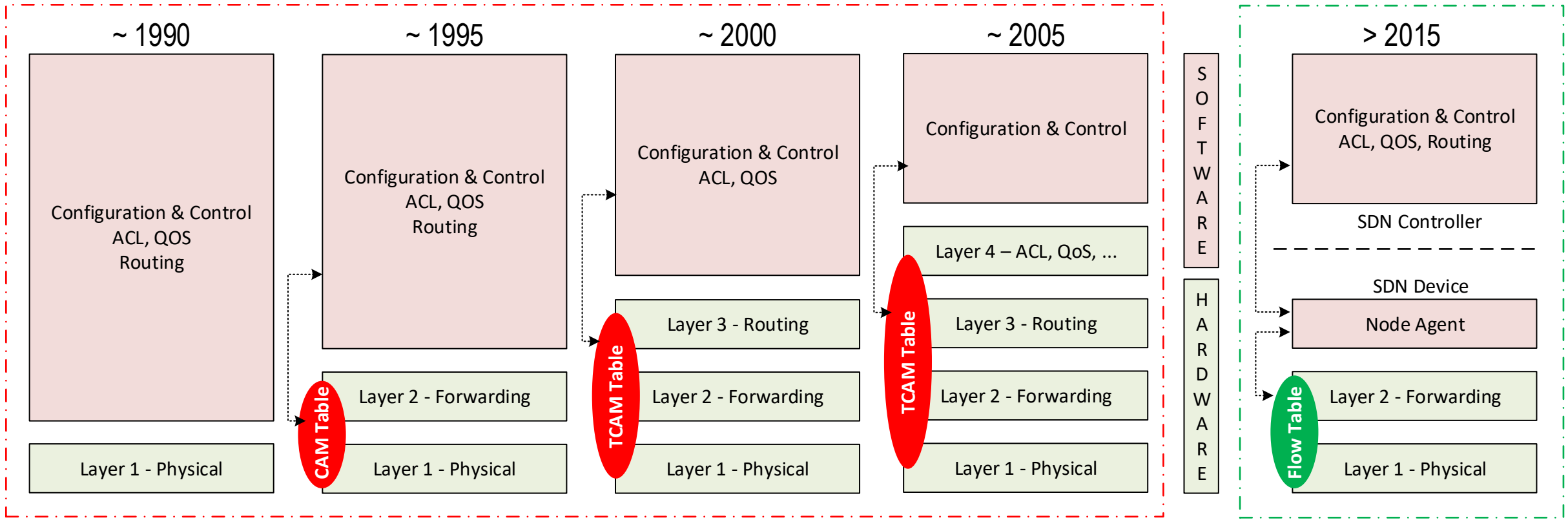




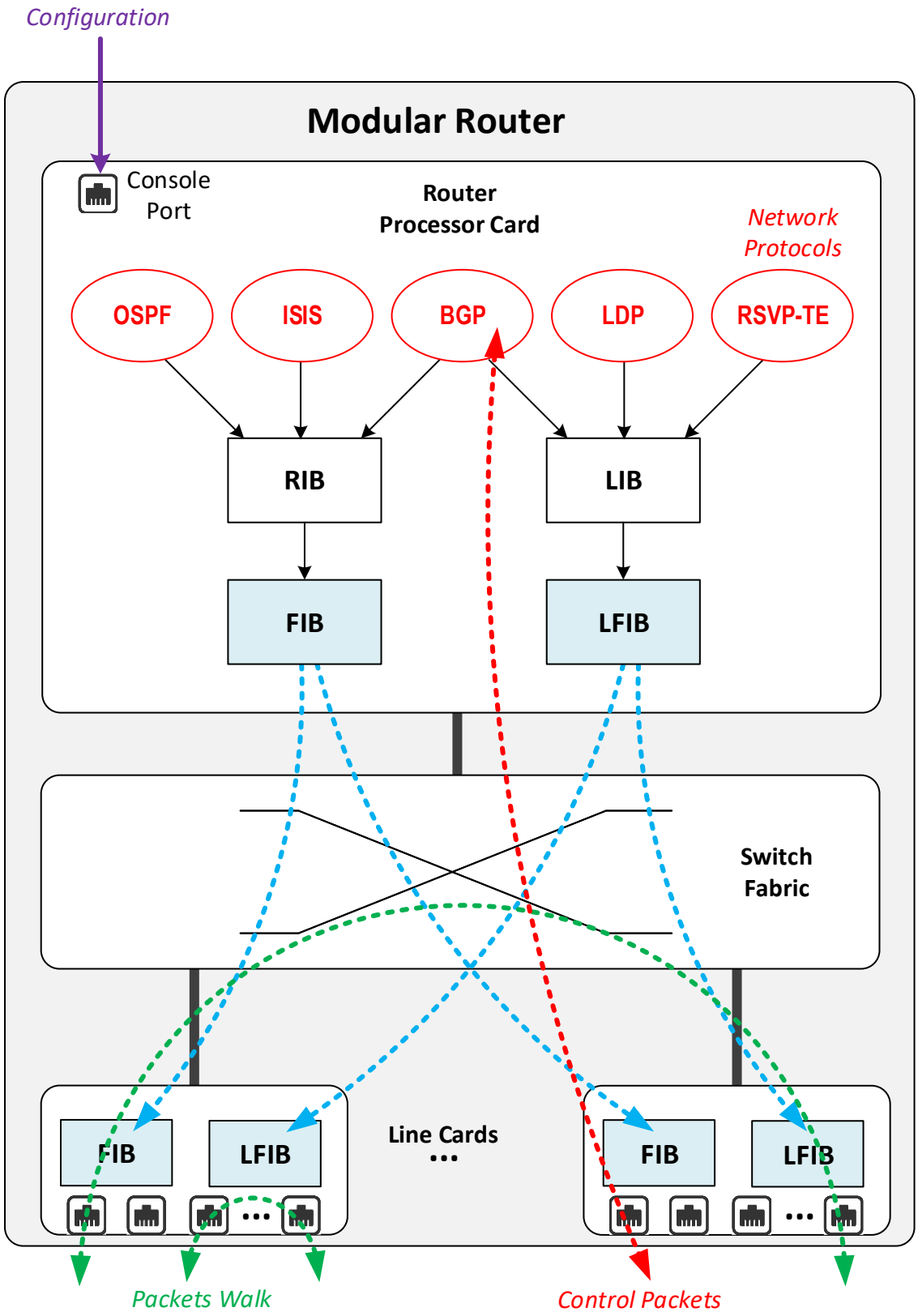
Title: NUMA concern	
version: 1.0	date: 25/03/2020



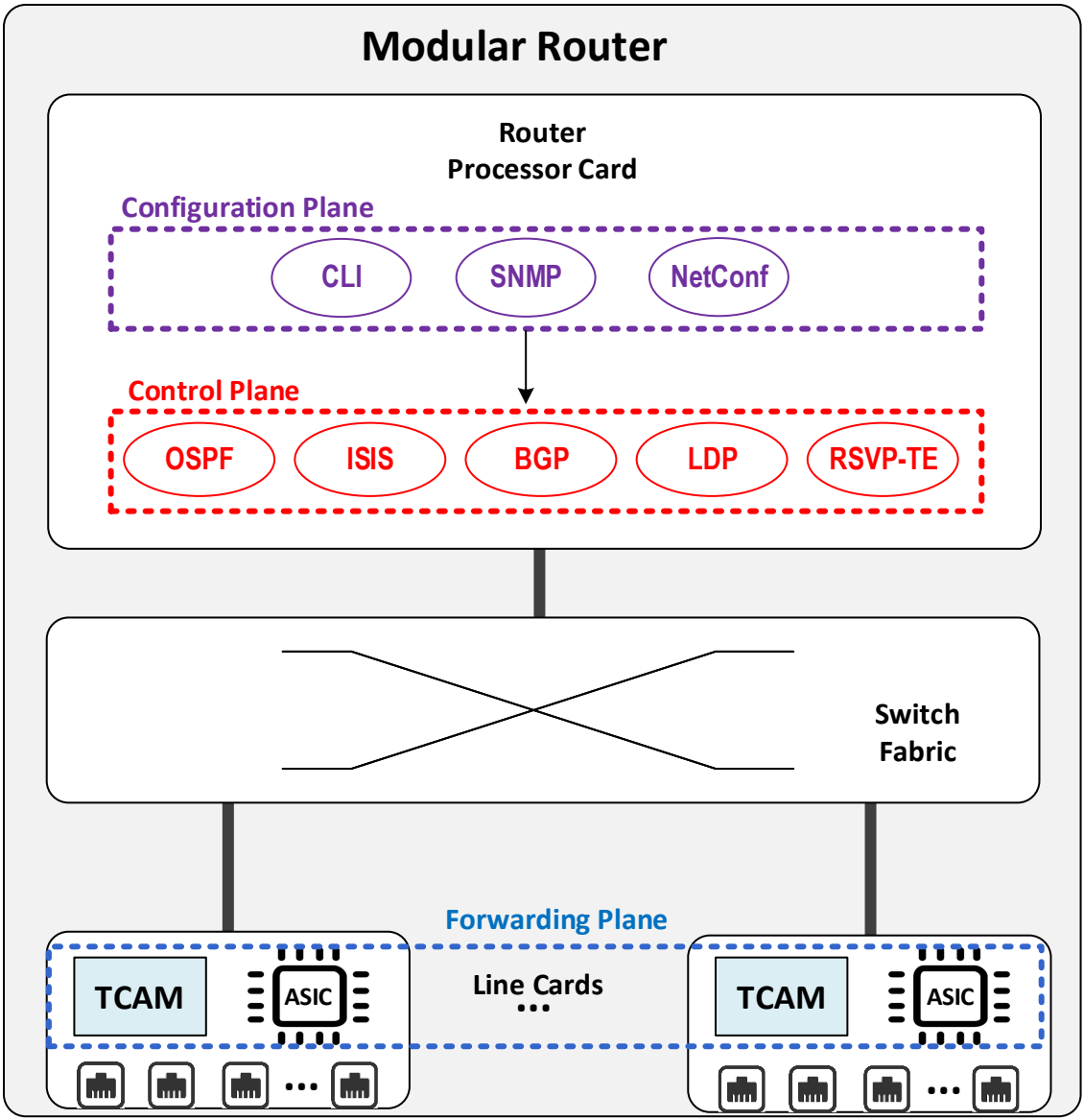
Title: SDN Overview	
version: 1.0	date: 13/04/2020



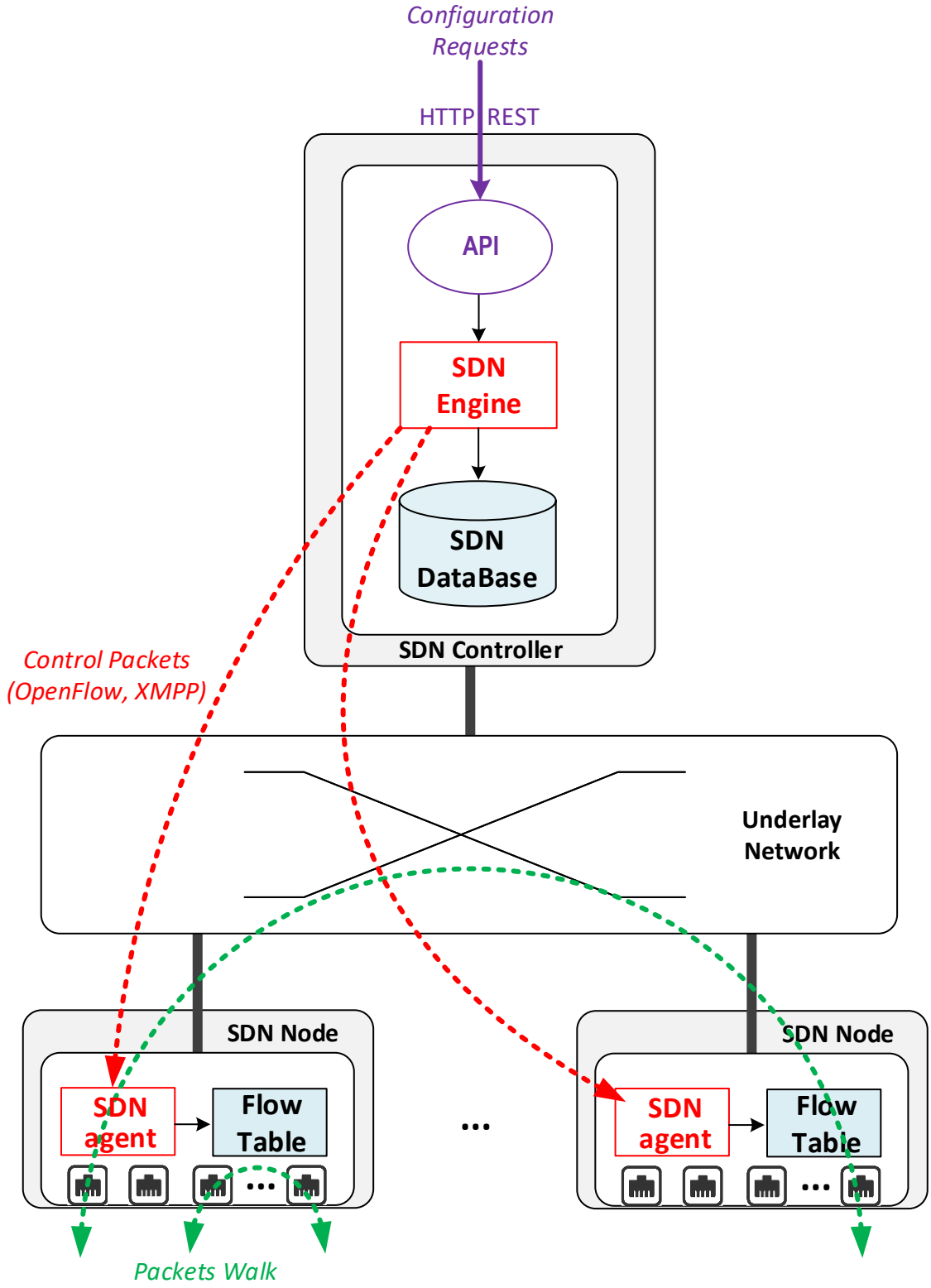
Title: SDN History	
version: 1.0	date: 13/04/2020



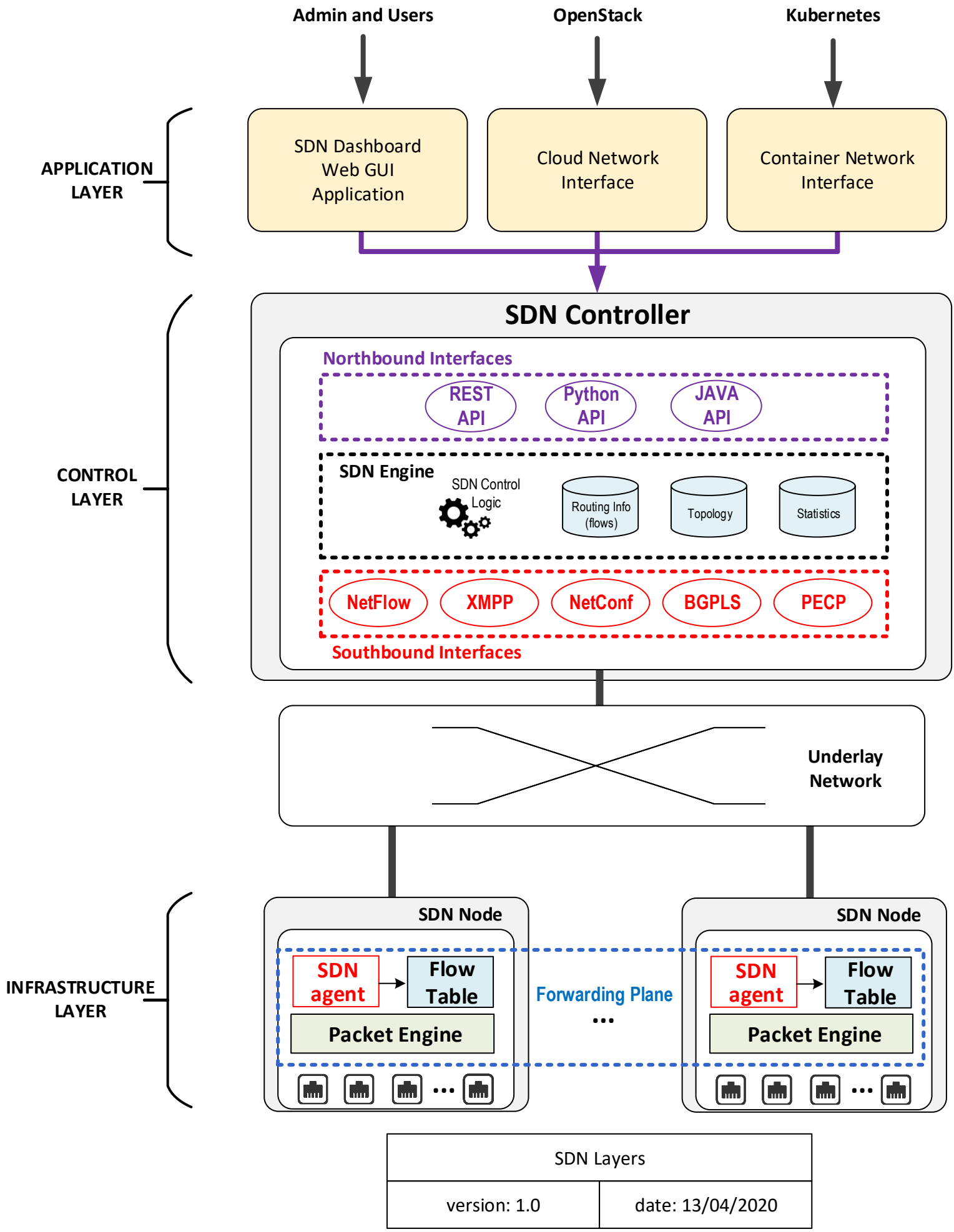
Traditional Network Node	
version: 1.0	date: 13/04/2020



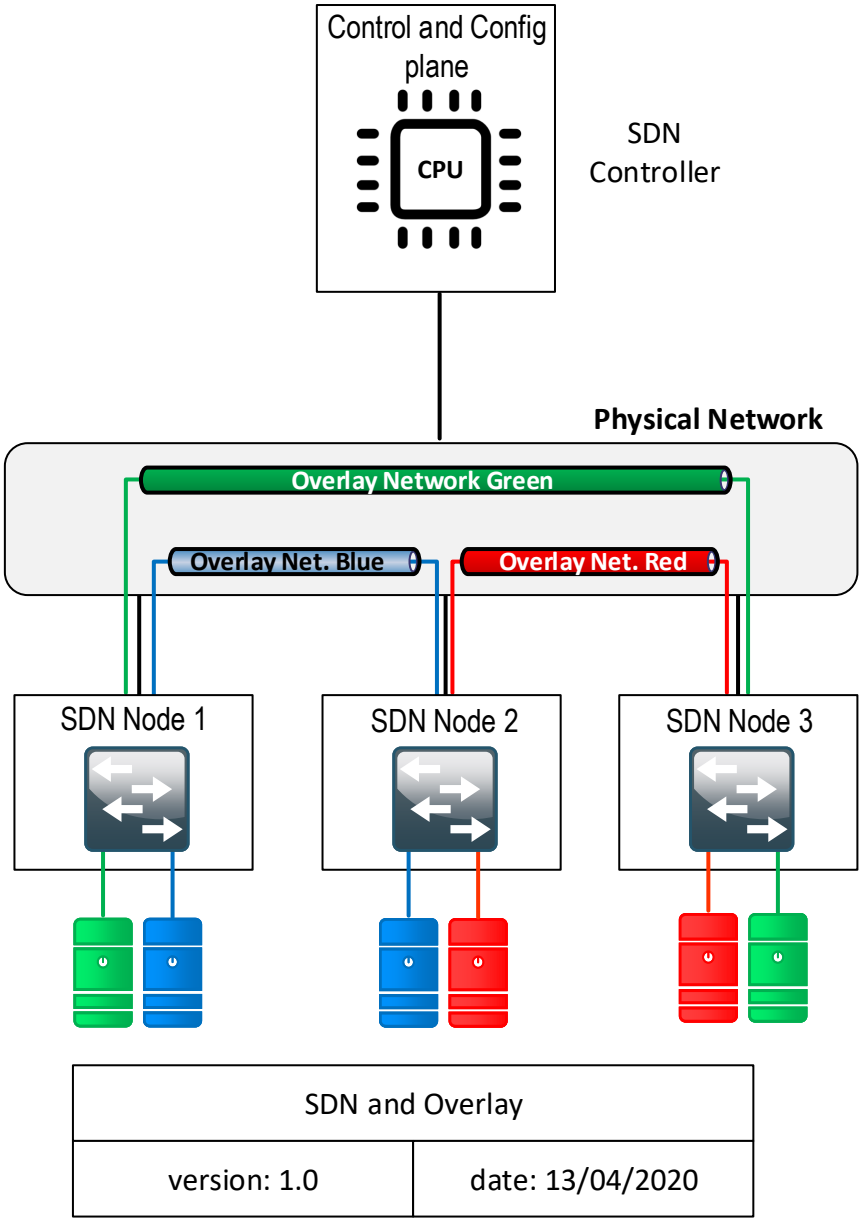
Traditional Network Planes	
version: 1.0	date: 13/04/2020



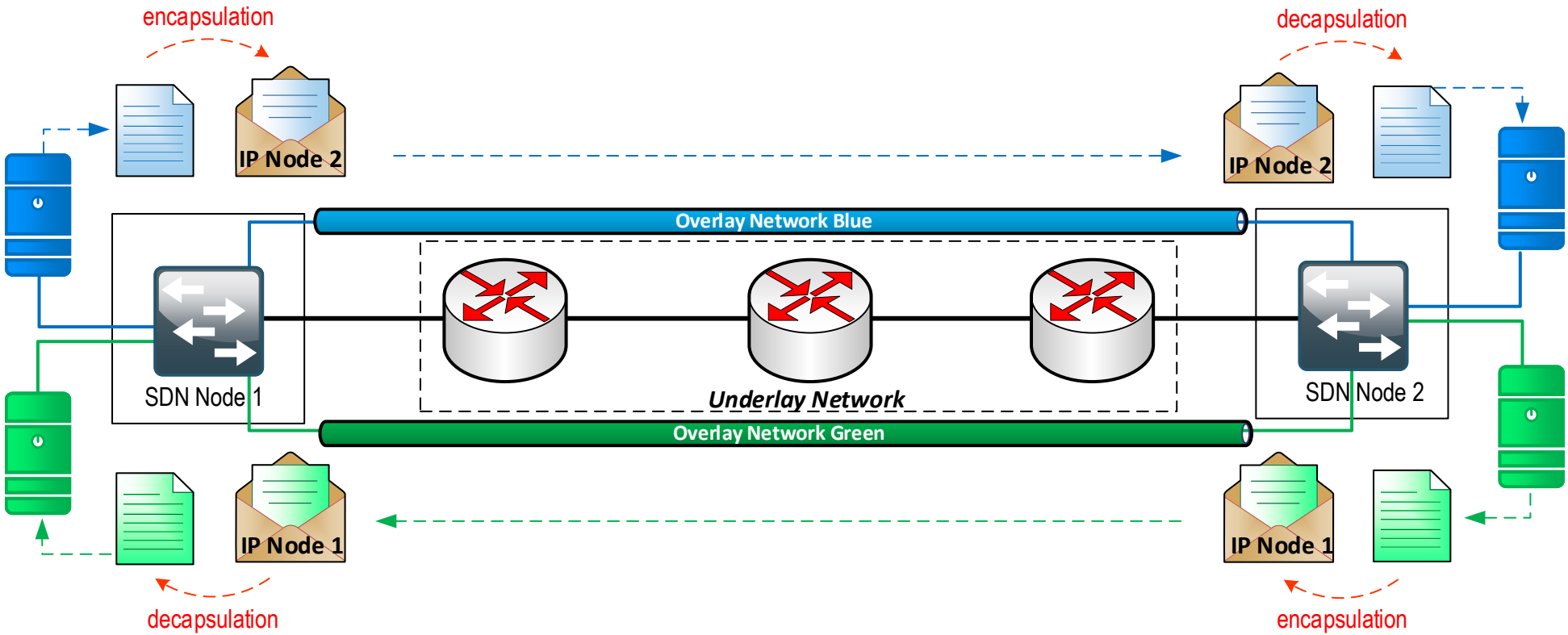
SDN Detailled Architecture	
version: 1.0	date: 13/04/2020



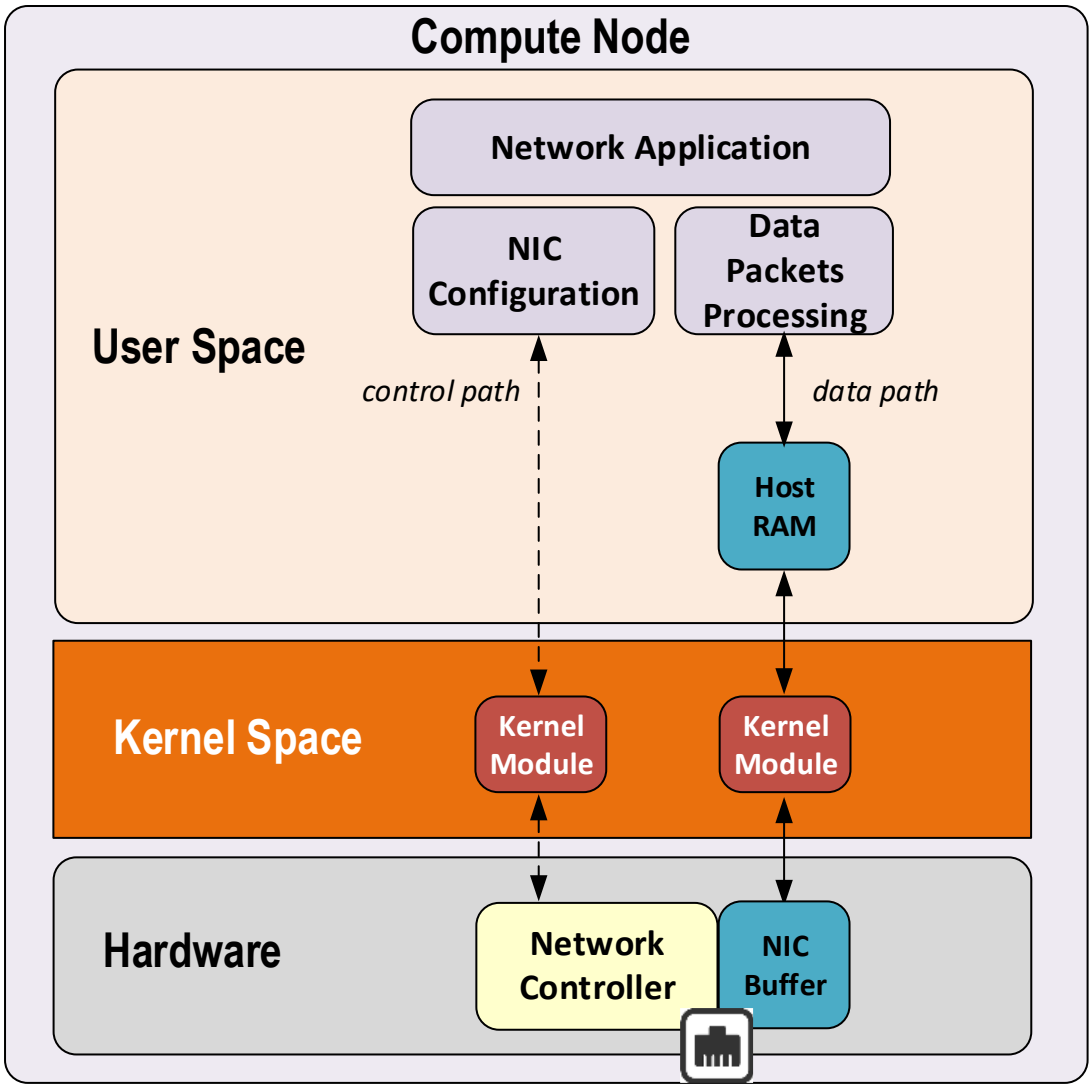
SDN Layers	
version: 1.0	date: 13/04/2020



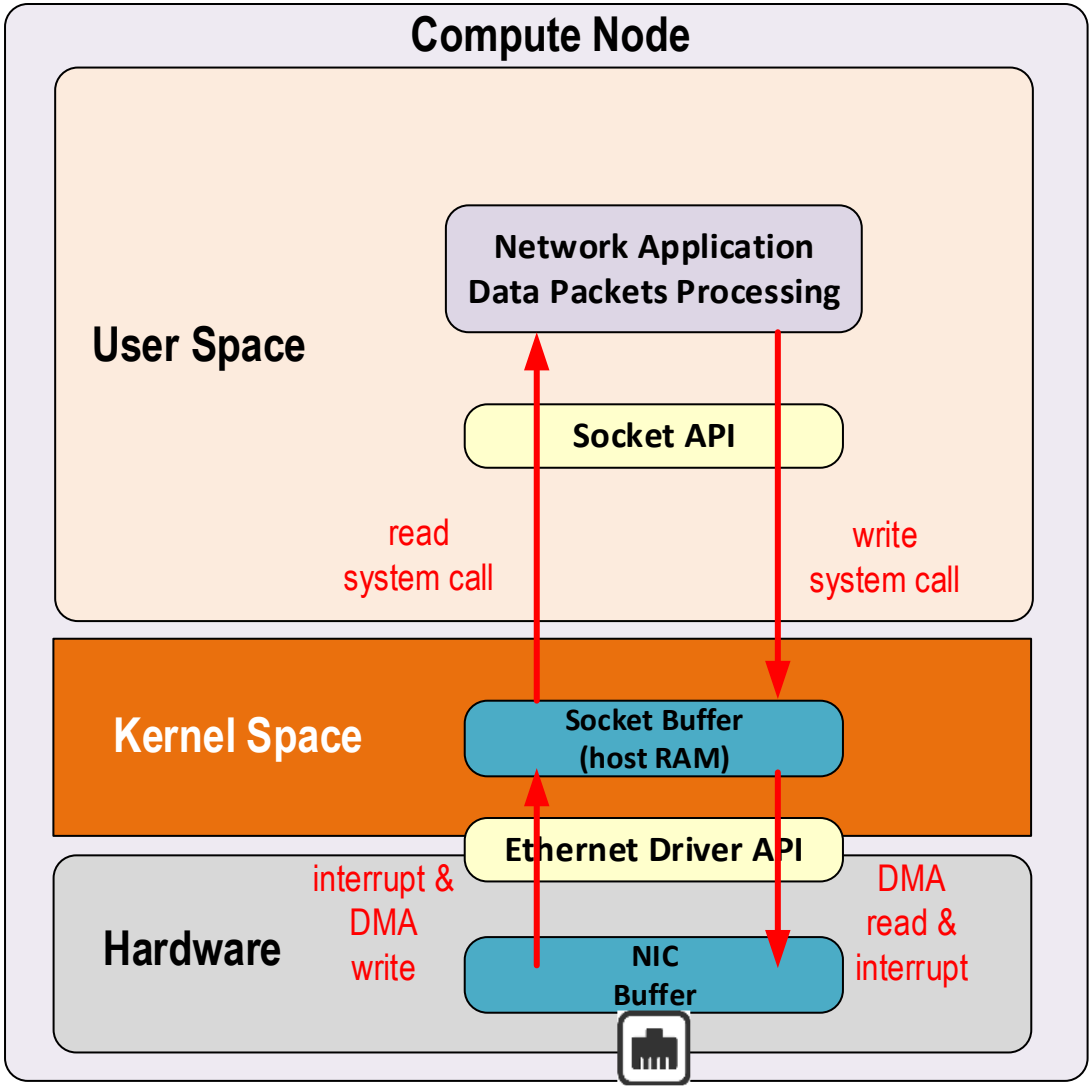
SDN and Overlay	
version: 1.0	date: 13/04/2020



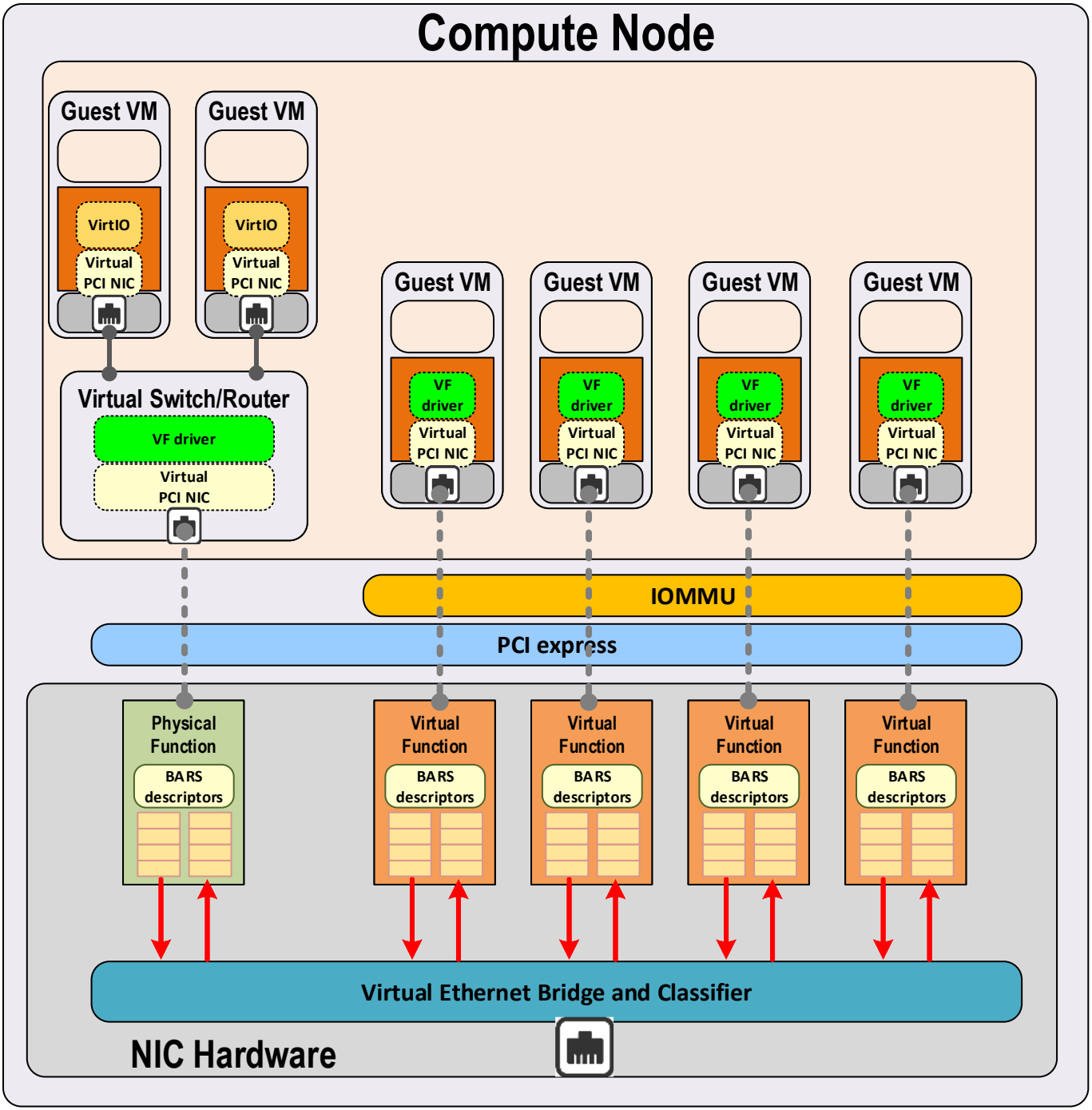
SDN and Encapsulation Principle	
version: 1.0	date: 13/04/2020



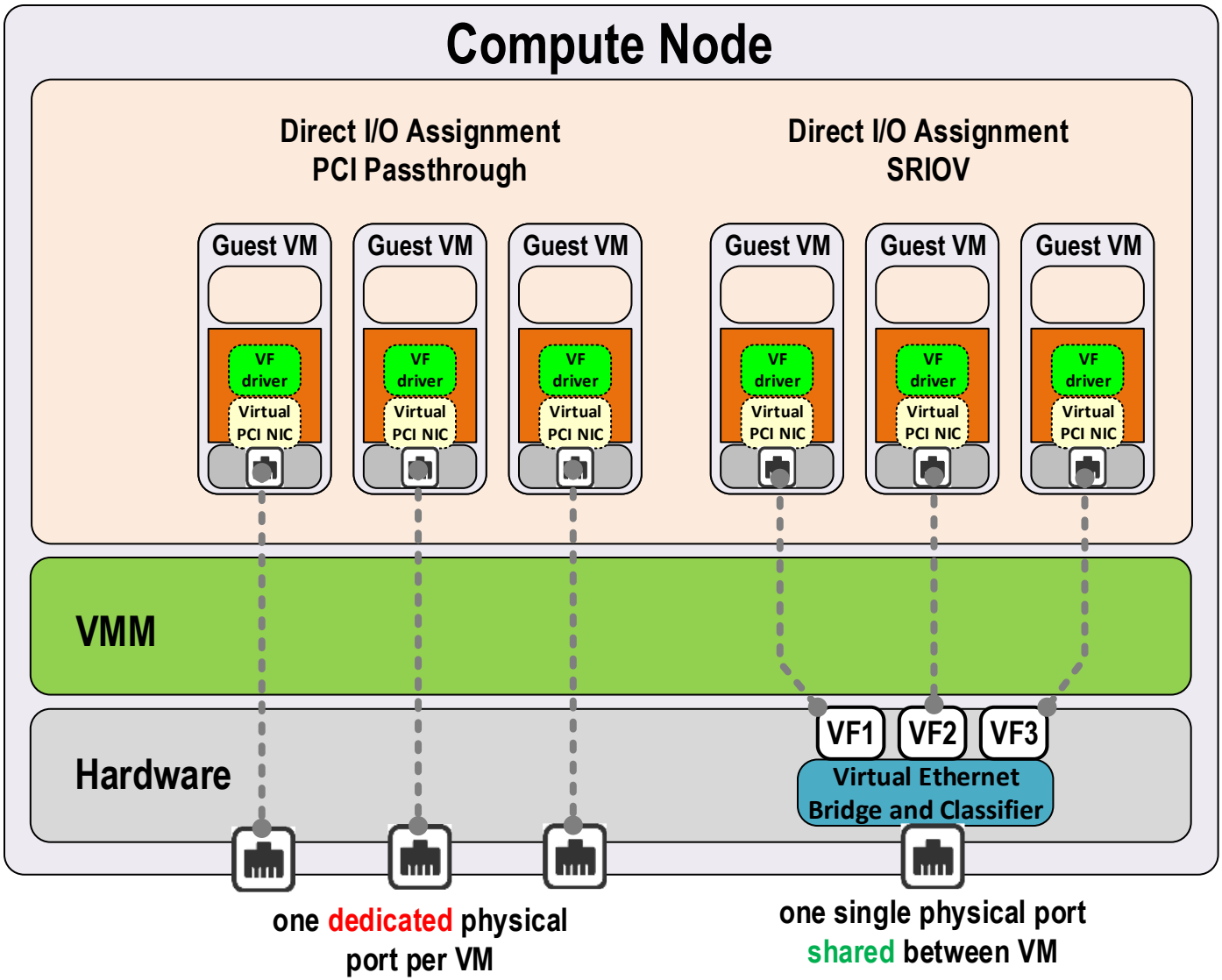
Title: Control and Data paths	
version: 1.0	date: 08/06/2020



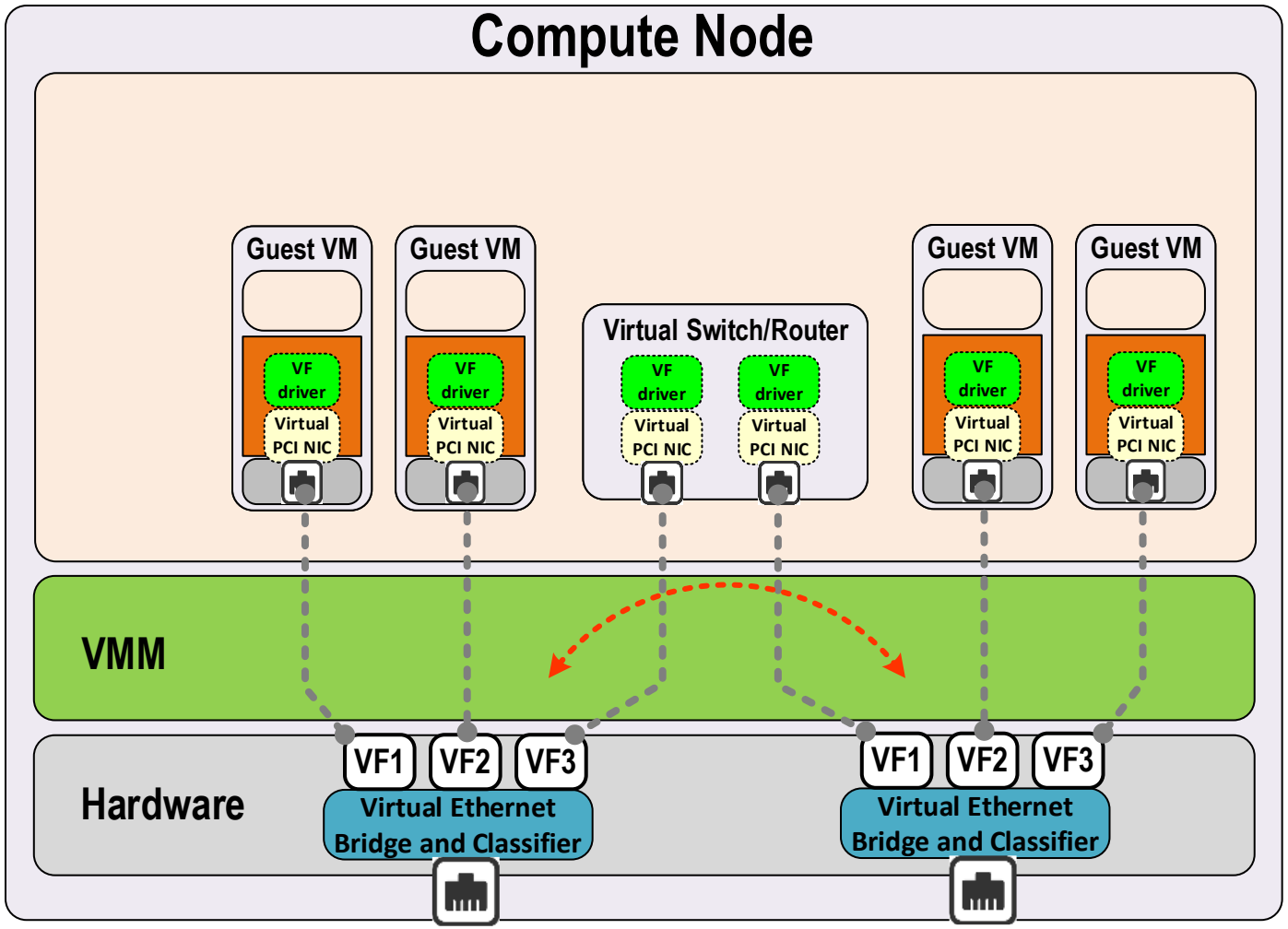
Title: Event Base Packet processing	
version: 1.0	date: 08/06/2020

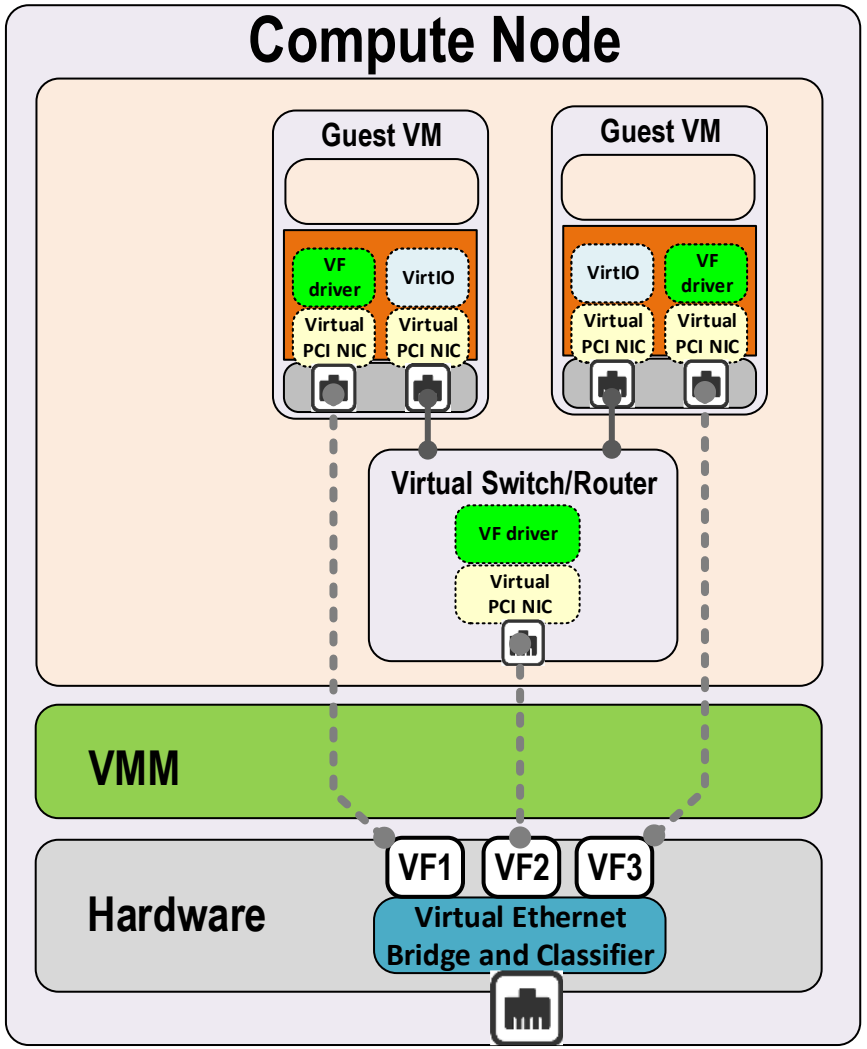


Title: SRIOV - Overview	
version: 1.0	date: 08/06/2020

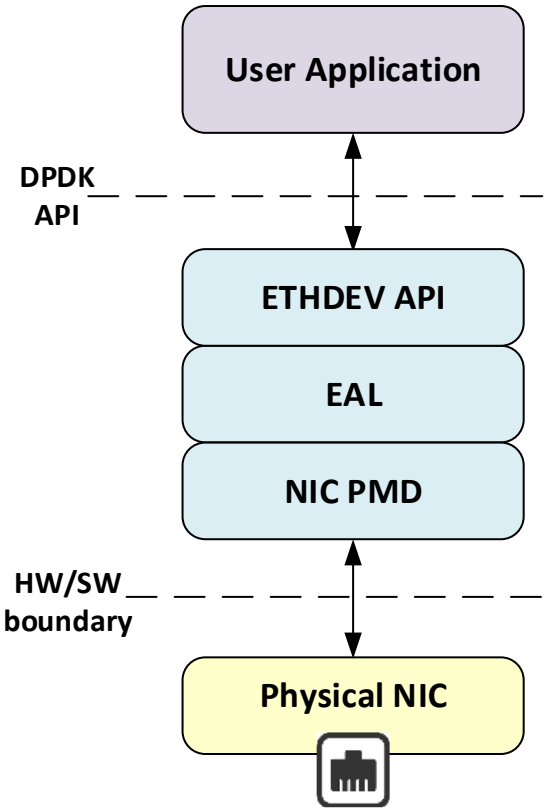


Title: SRIOV versus PCI Passthrough	
version: 1.0	date: 08/06/2020

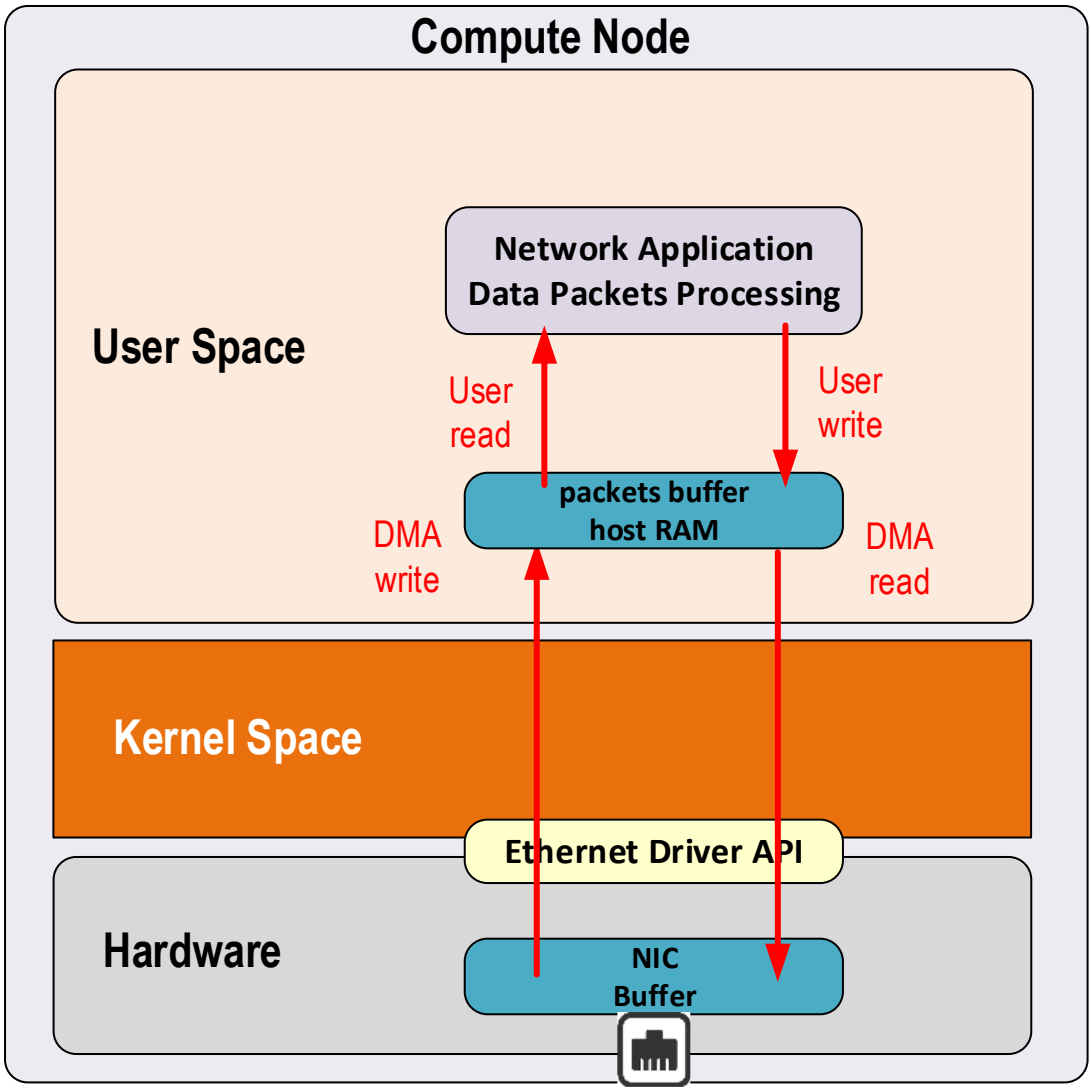




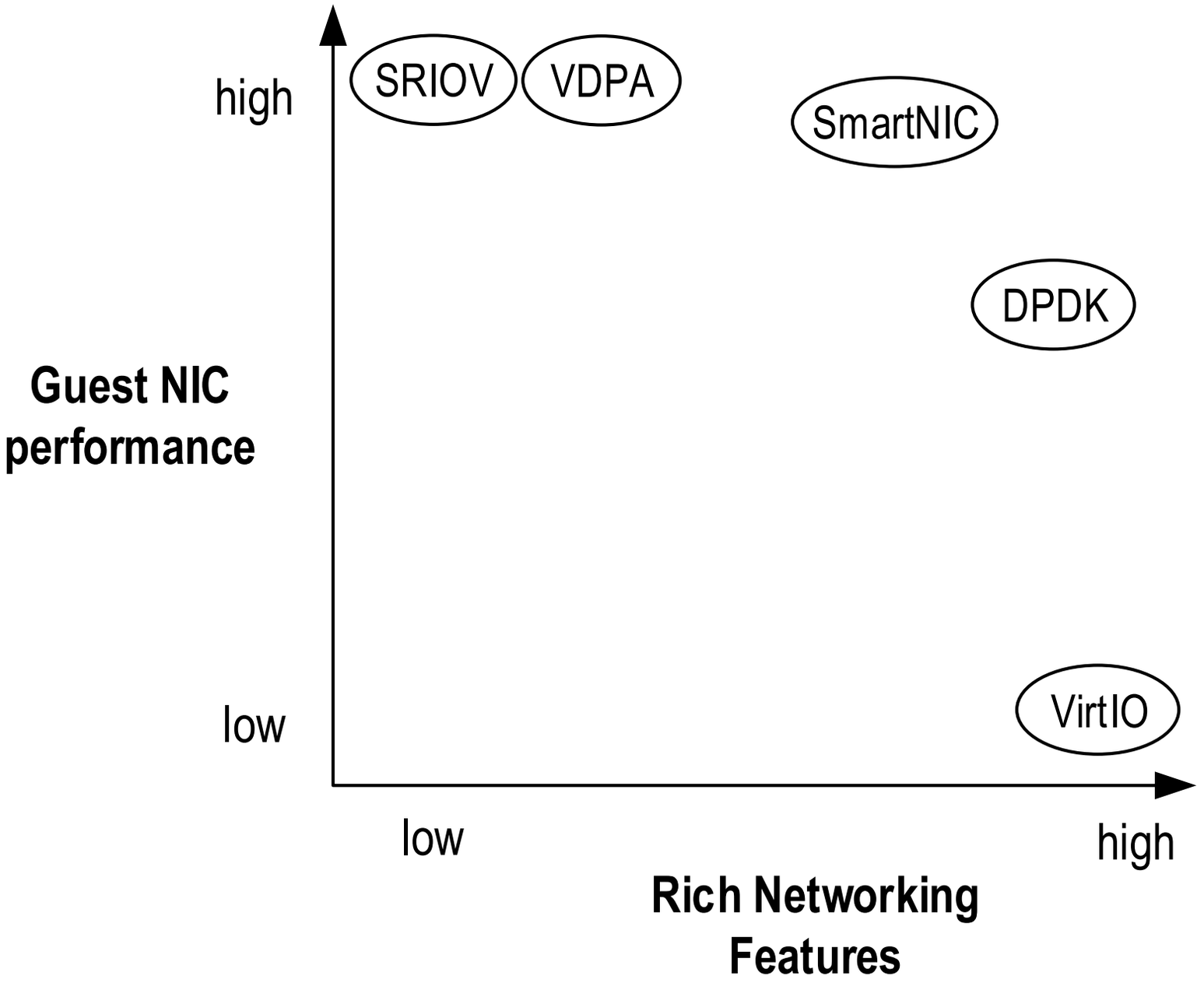
Title: SRIOV and SDN	
version: 1.0	date: 08/06/2020



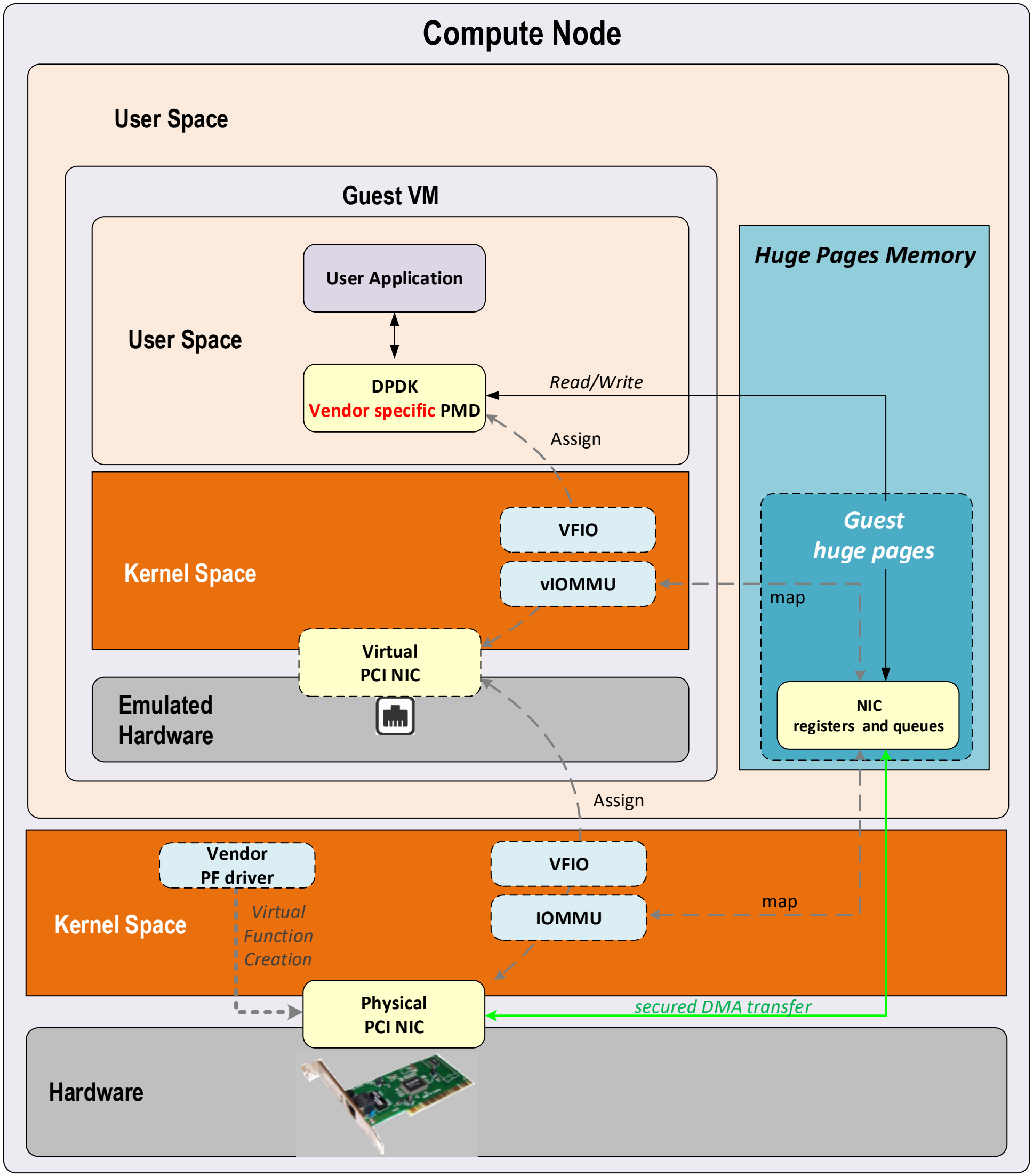
Title: DPDK model	
version: 1.0	date: 08/06/2020



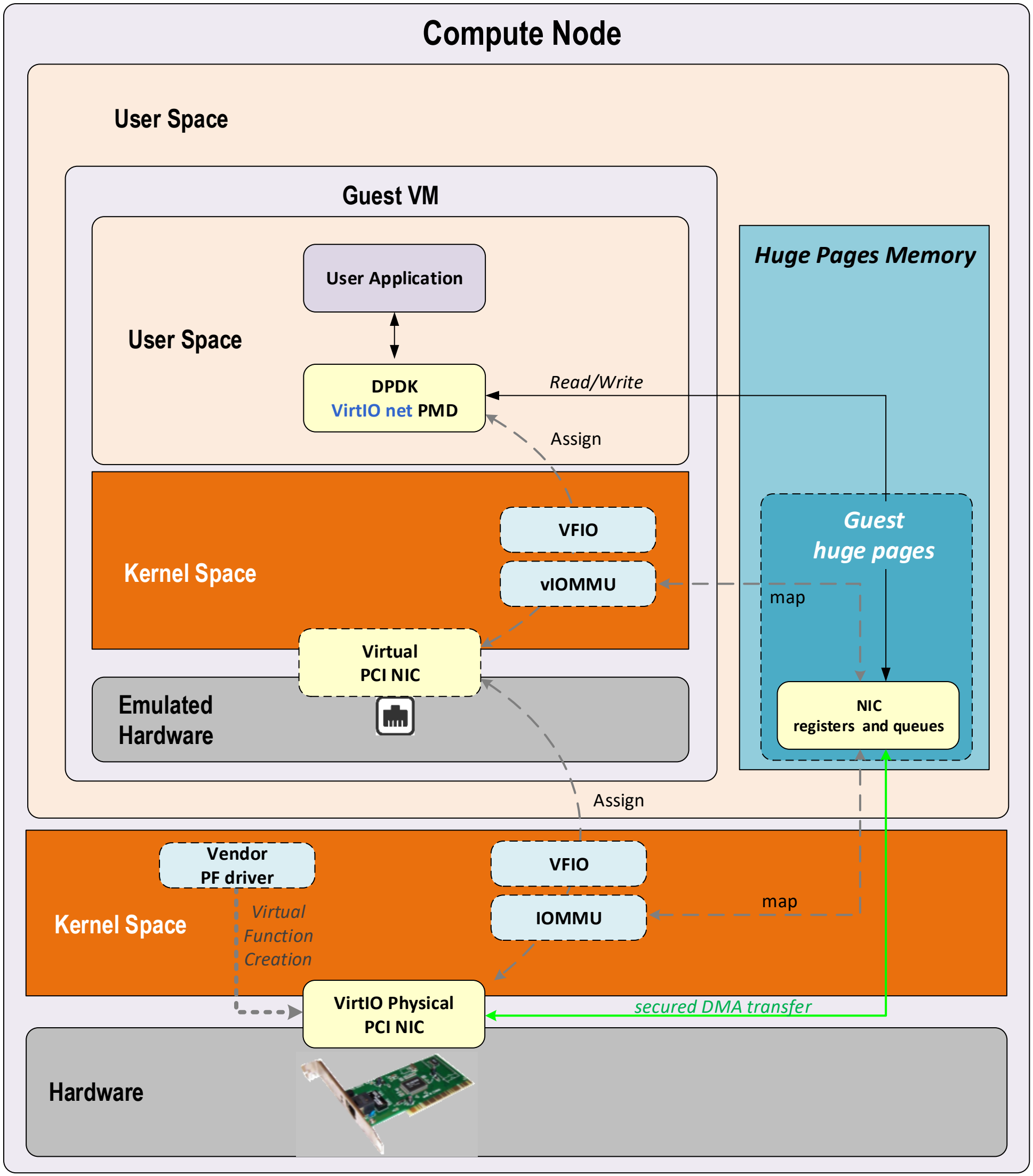
Title: Polling Based Packet processing	
version: 1.0	date: 08/06/2020



Title: Comparison Diagram	
version: 1.0	date: 08/06/2020



Title: Guest VM DPDK and SRIOV	
version: 1.0	date: 13/06/2020



Title: Guest VM DPDK and VirtIO passthrough	
version: 1.0	date: 13/06/2020

Compute Node

User Space

Guest VM

User Space

User Application

DPDK
VirtIO net PMD

Read/Write

Assign

Kernel Space

VFIO

vIOMMU

Virtual
PCI NIC

Emulated
Hardware

Huge Pages Memory

Guest
huge pages

map

NIC
registers and queues

Assign

Kernel Space

Vendor
PF driver

Virtual
Function
Creation

VFIO

VFIO-MDEV

IOMMU

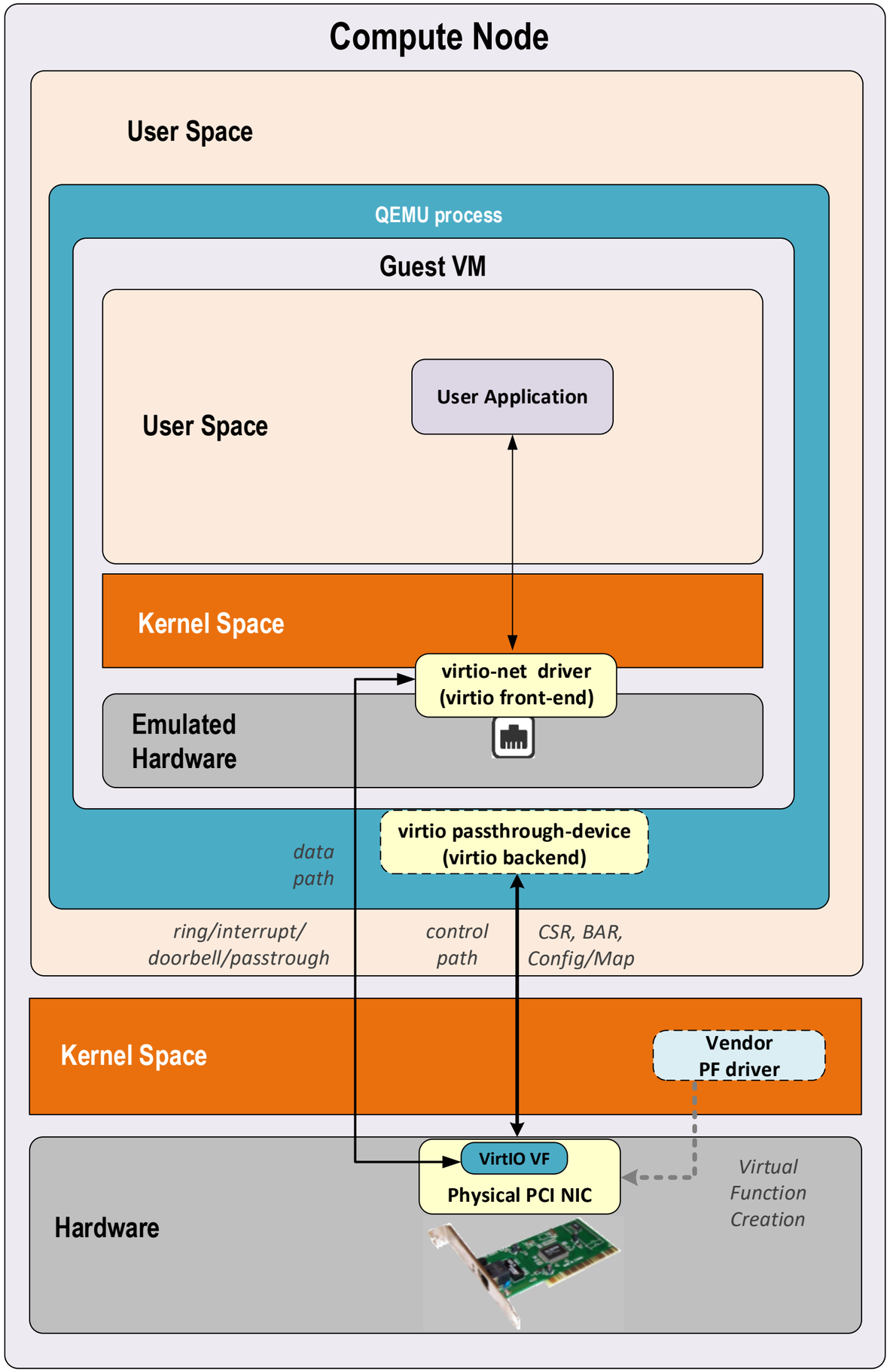
map

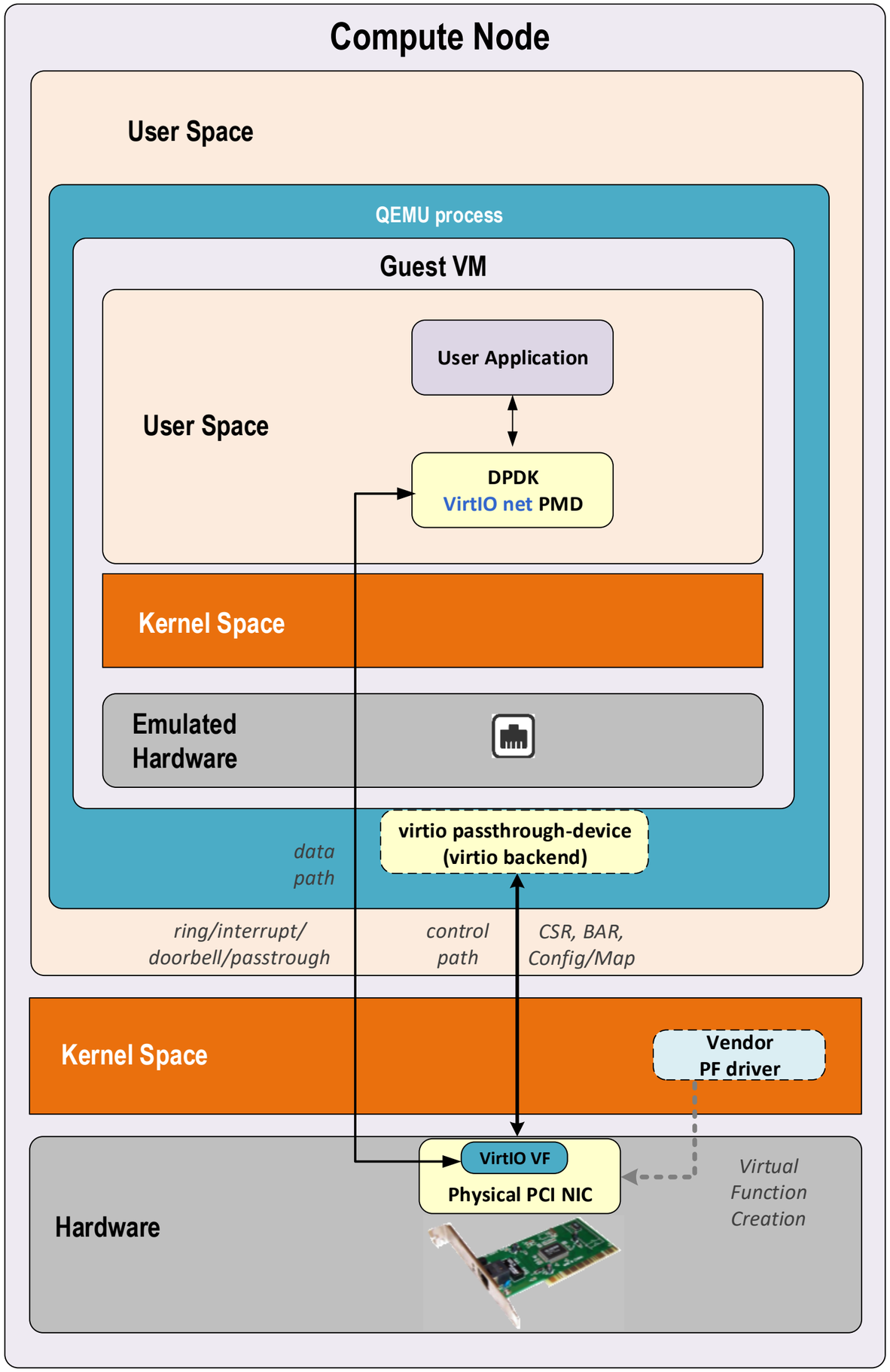
vDPA Physical
PCI NIC

secured DMA transfer

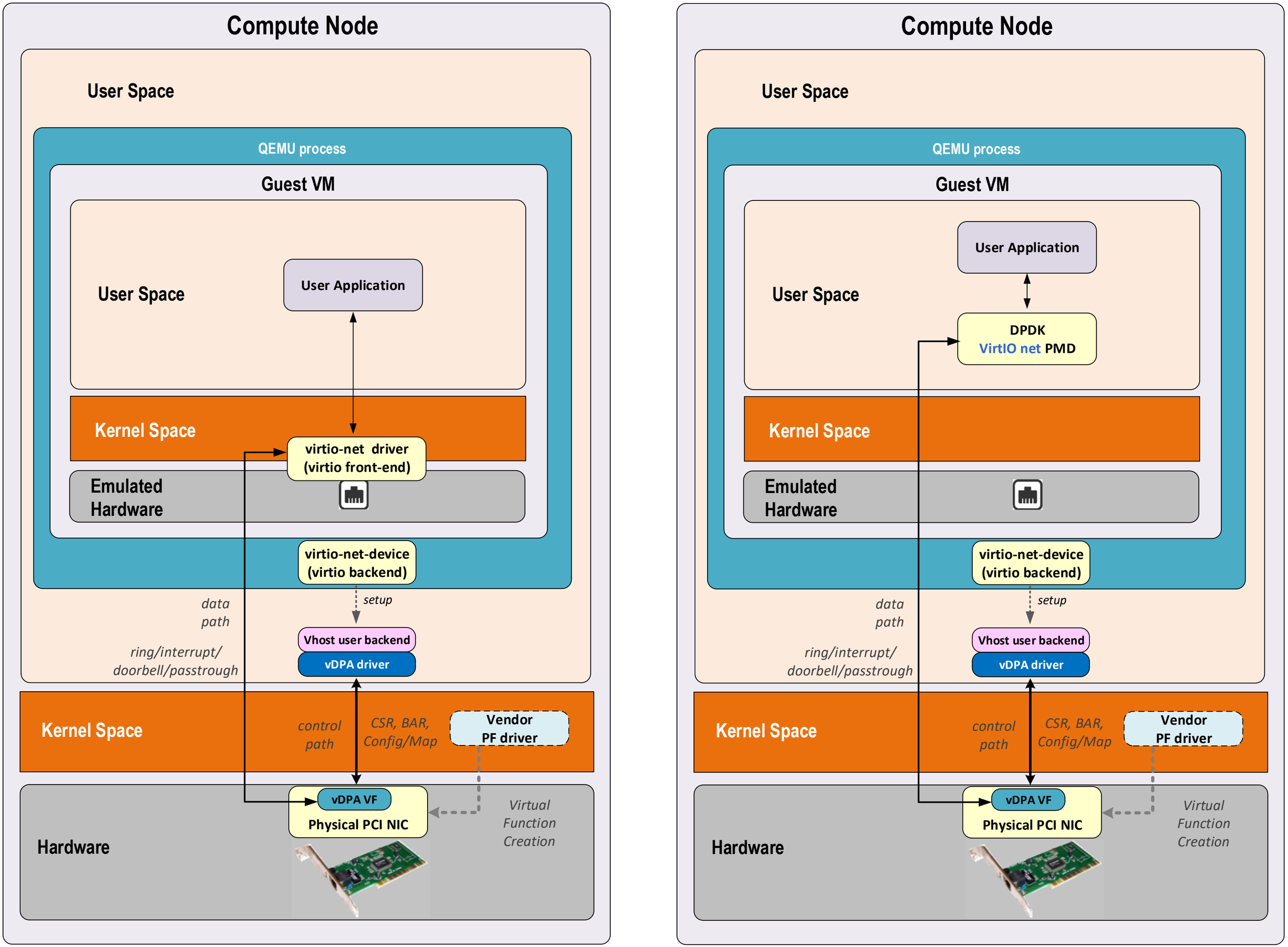
Hardware

Title: Guest VM DPDK and vDPA	
version: 1.0	date: 13/06/2020

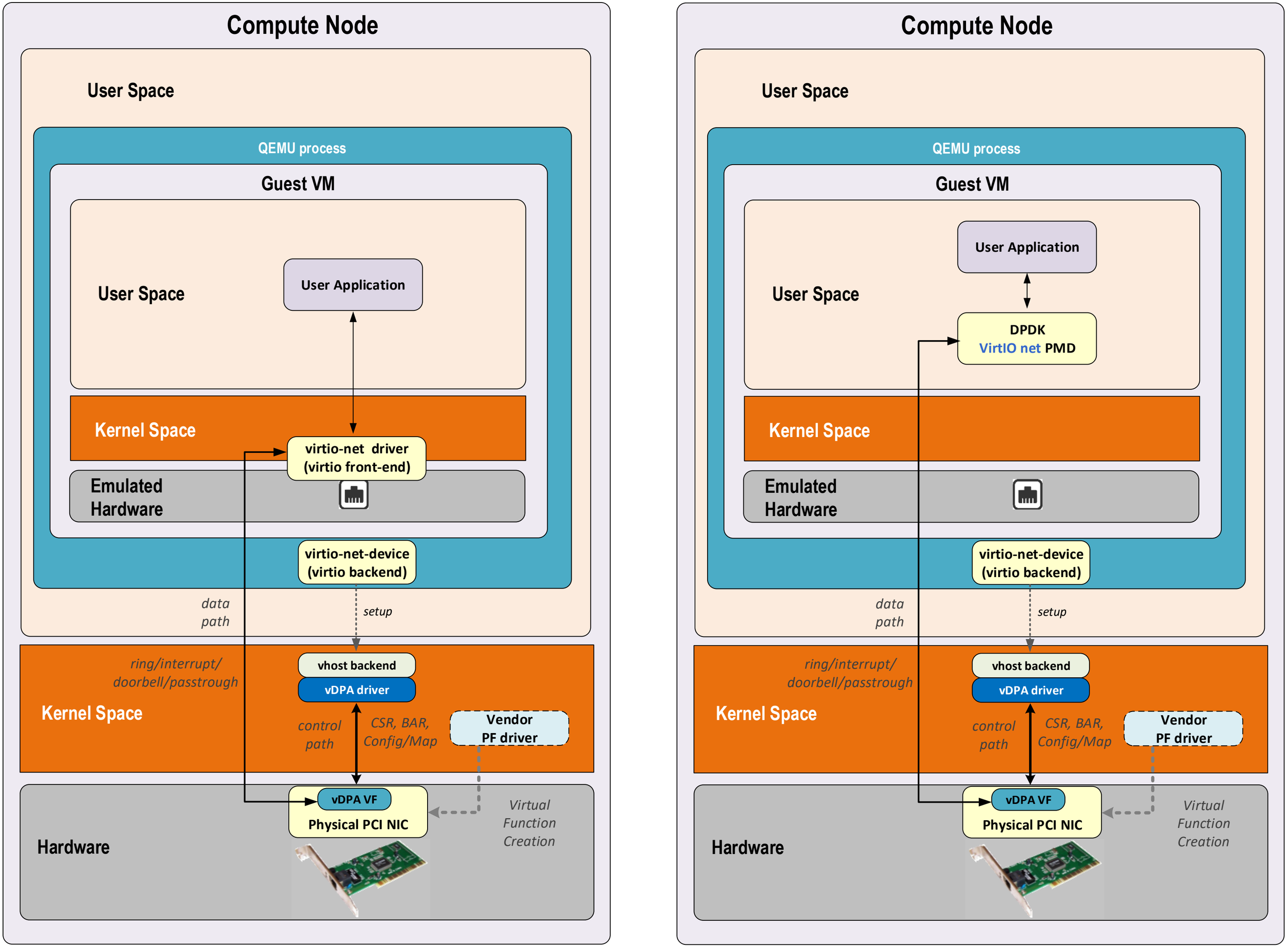




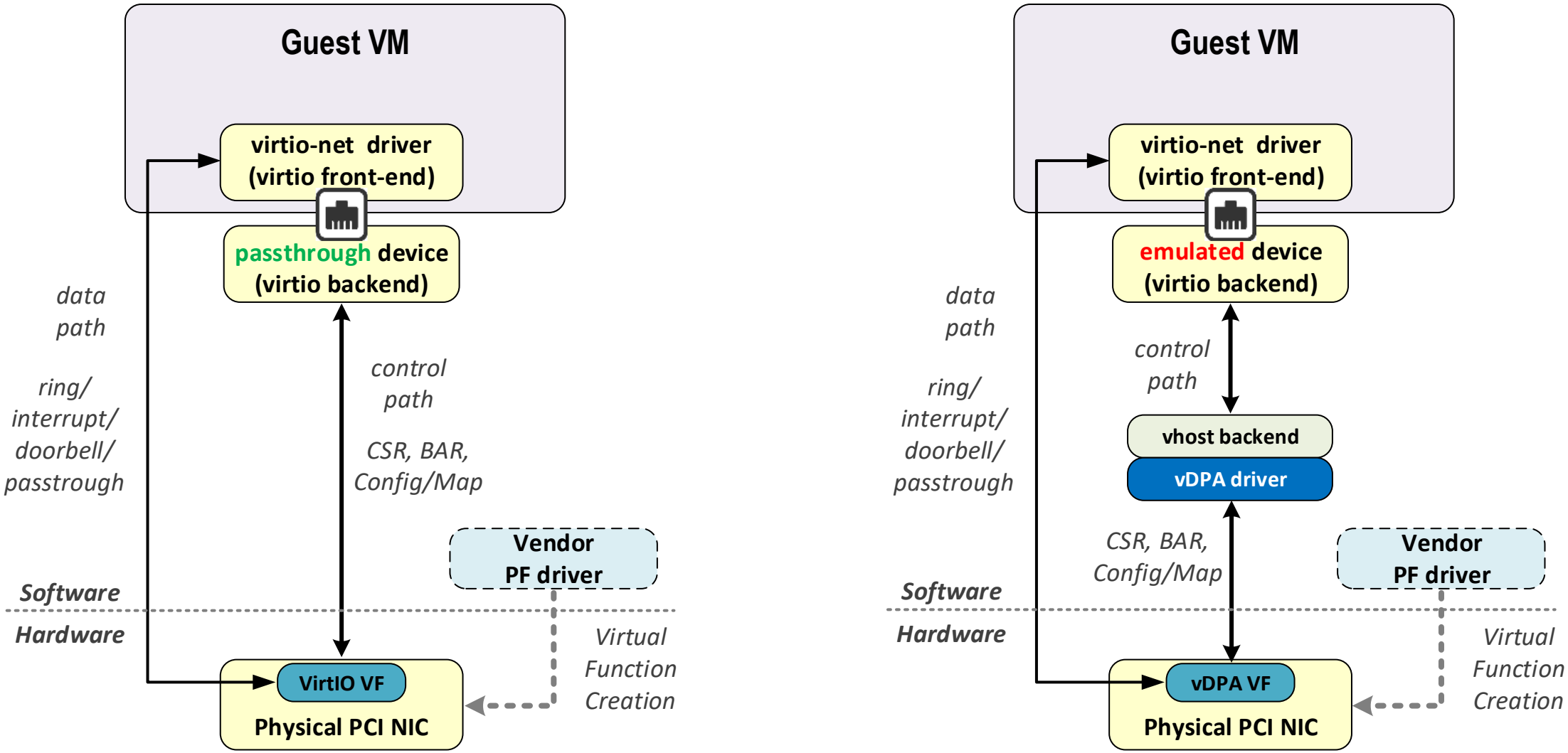
Title: VirtIO full offloading	
version: 1.0	date: 13/06/2020



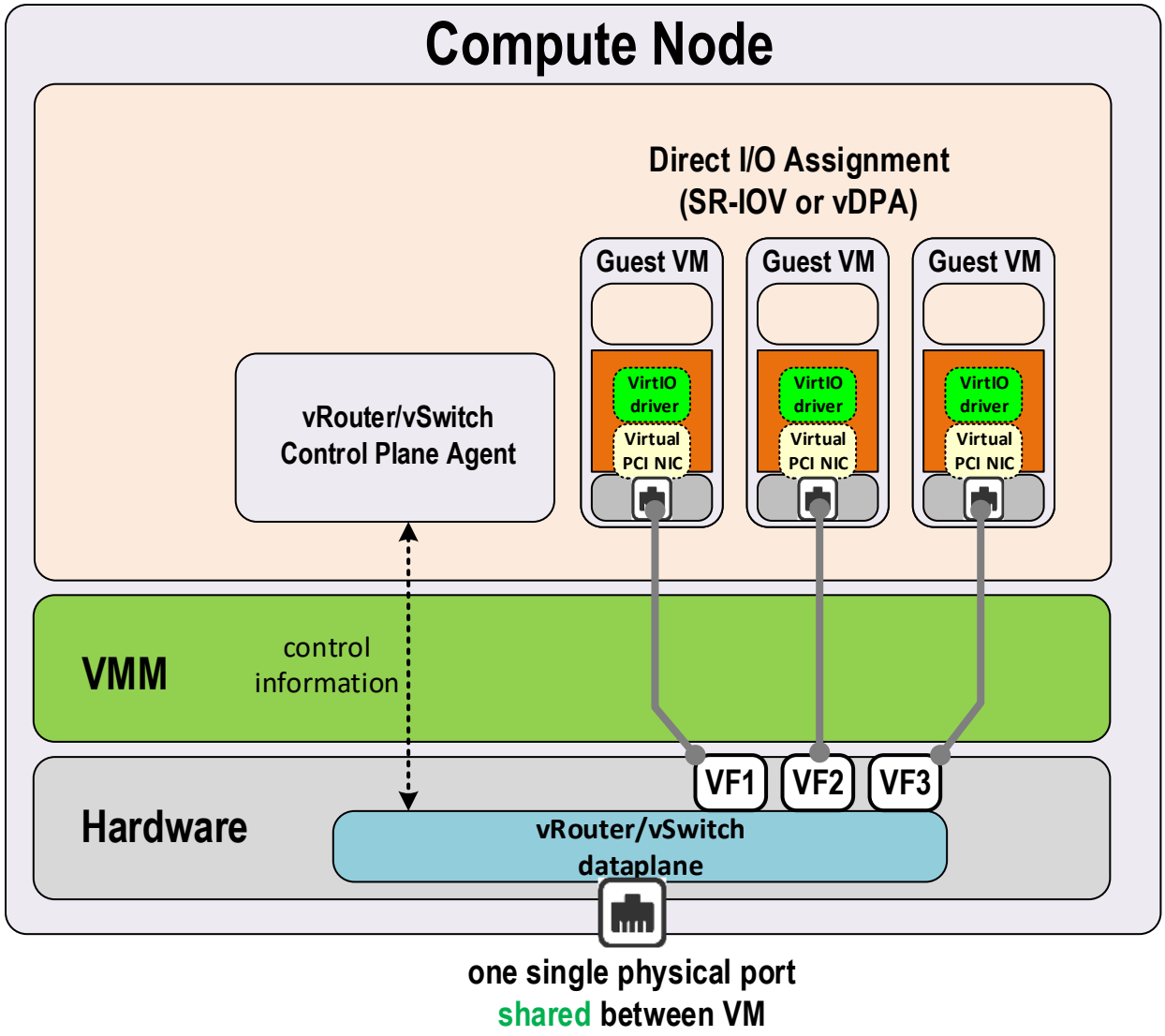
Title: VirtIO vDPA (user)	
version: 1.0	date: 13/06/2020



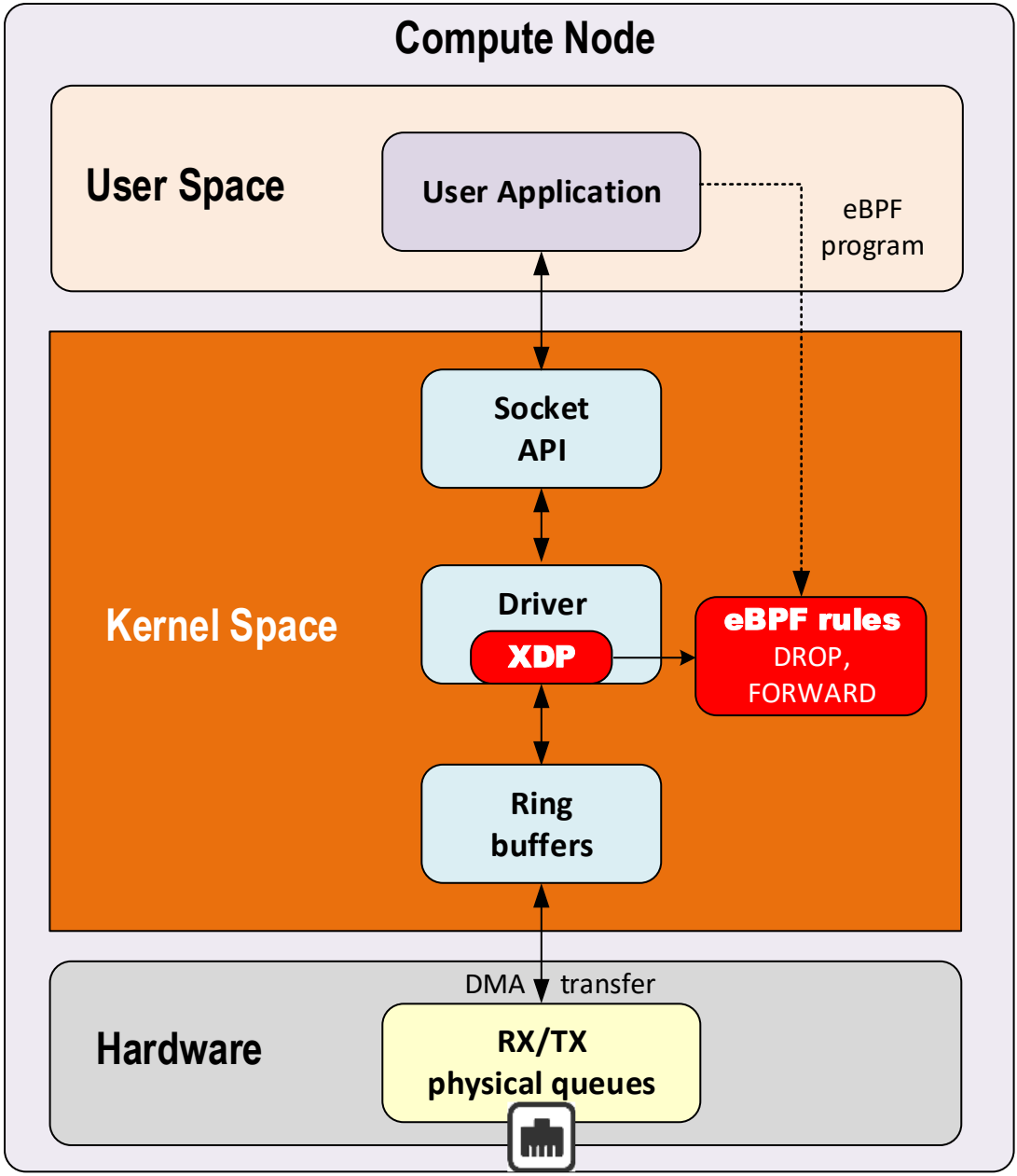
Title: VirtIO vDPA (kernel)	
version: 1.0	date: 13/06/2020



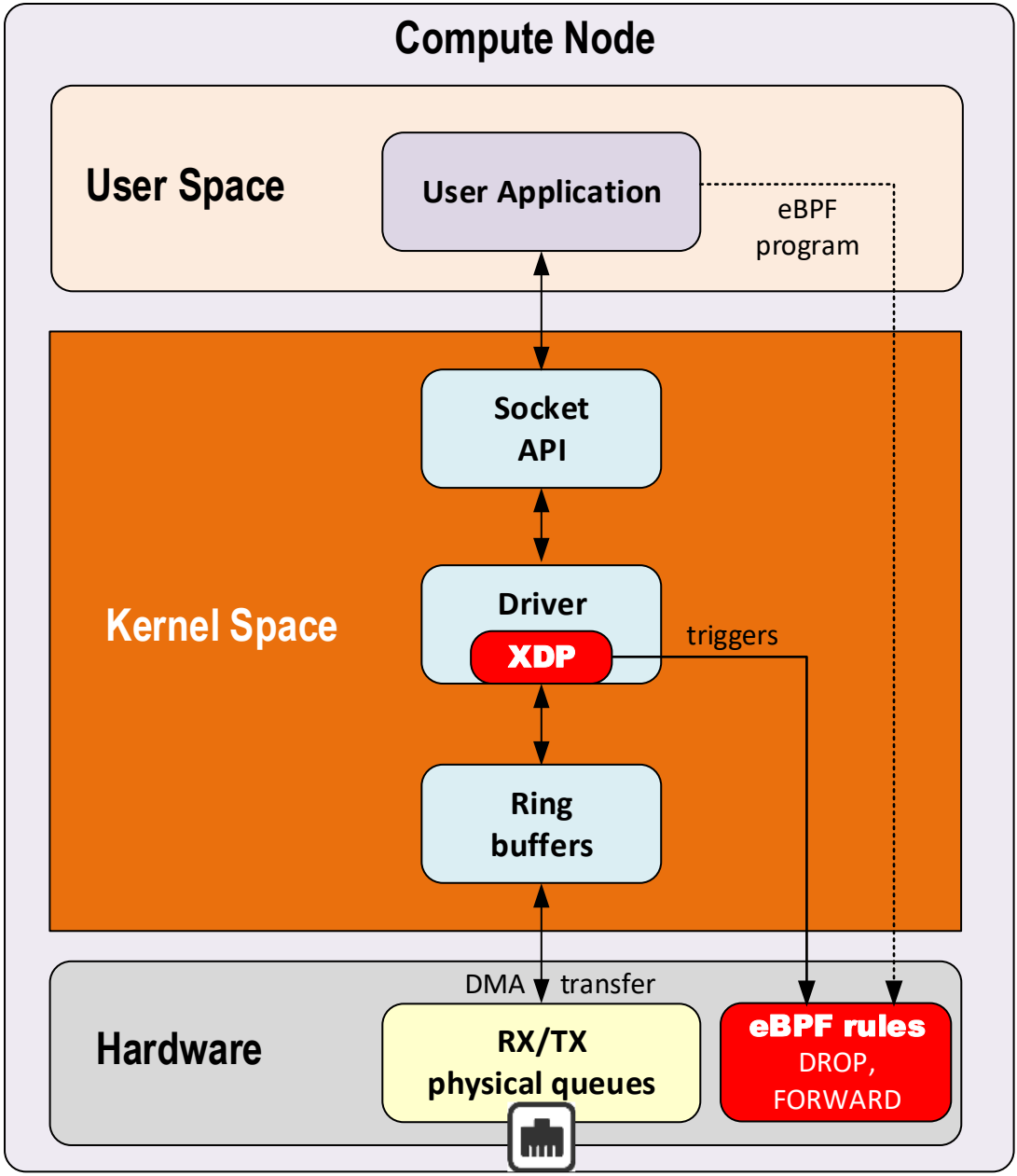
Title: VirtiO Hardware Accelleration	
version: 1.0	date: 13/06/2020



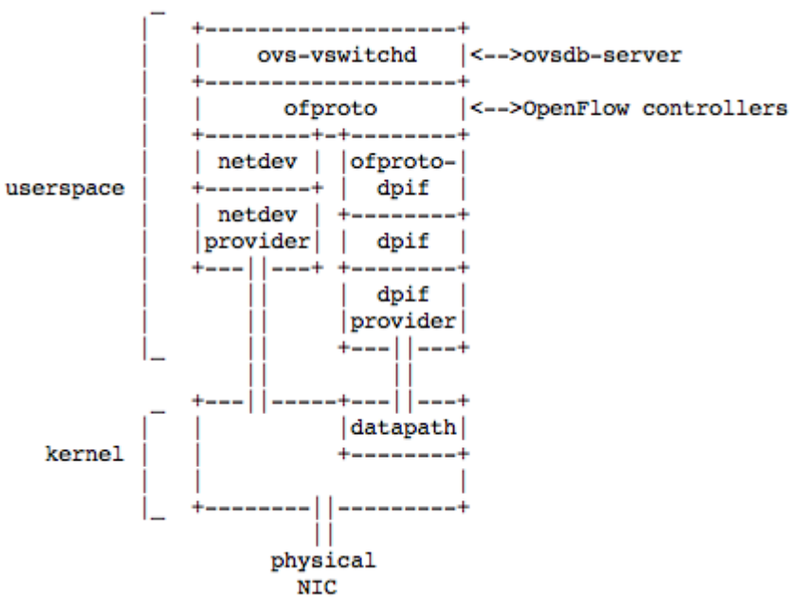
Title: Smart NIC	
version: 1.0	date: 13/06/2020

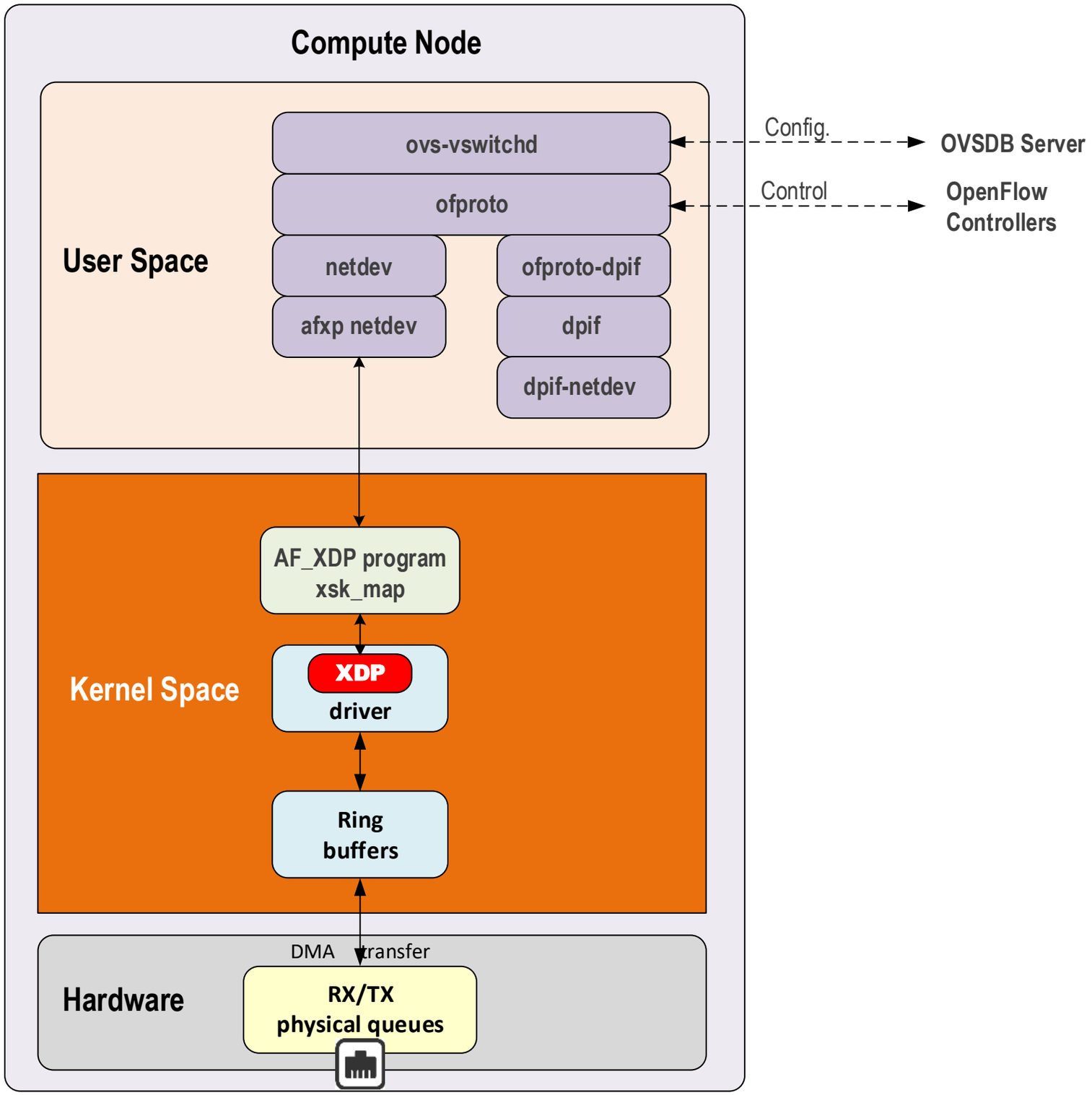


Title: XDP and eBPF	
version: 1.0	date: 13/06/2020



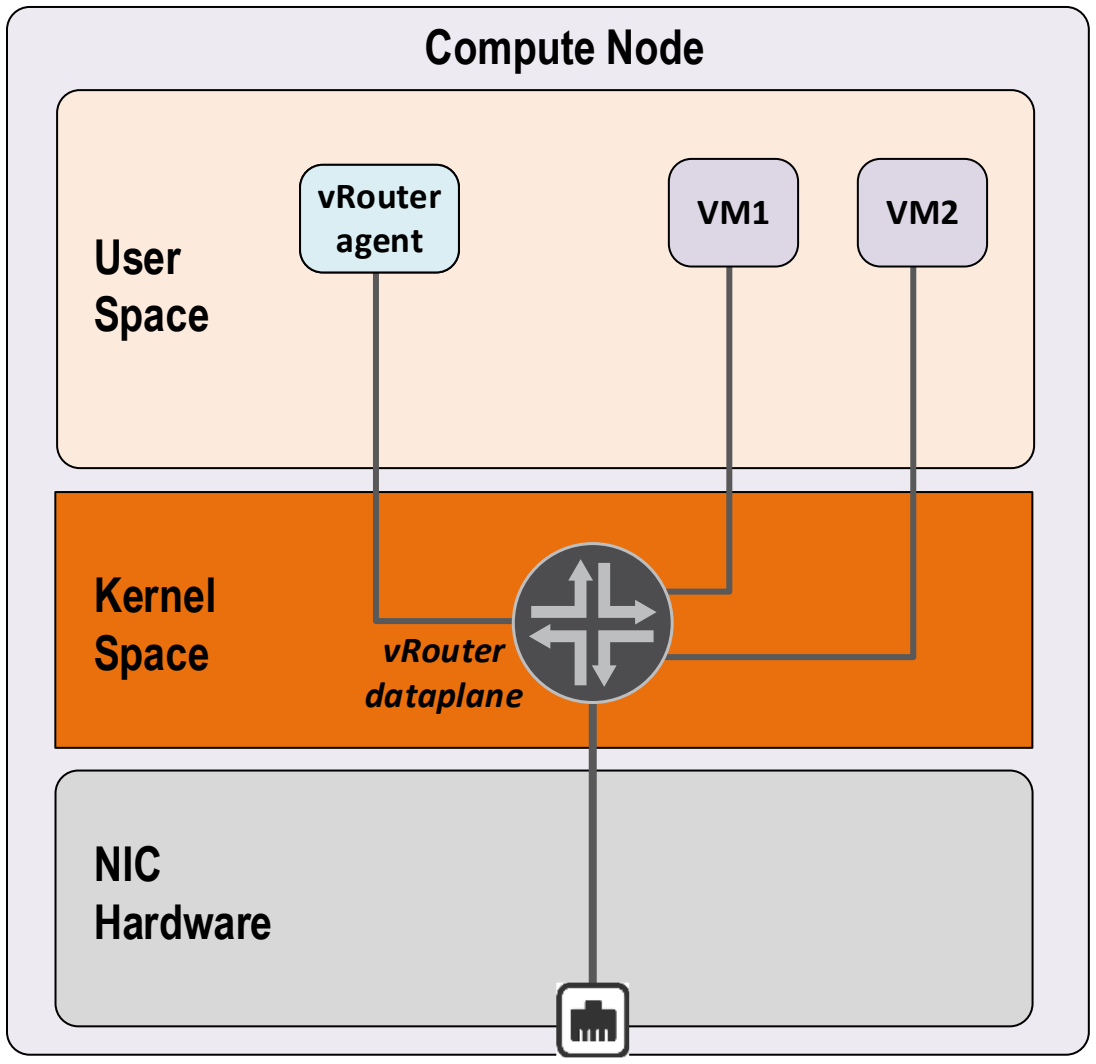
Title: XDP and eBPF offload	
version: 1.0	date: 13/06/2020



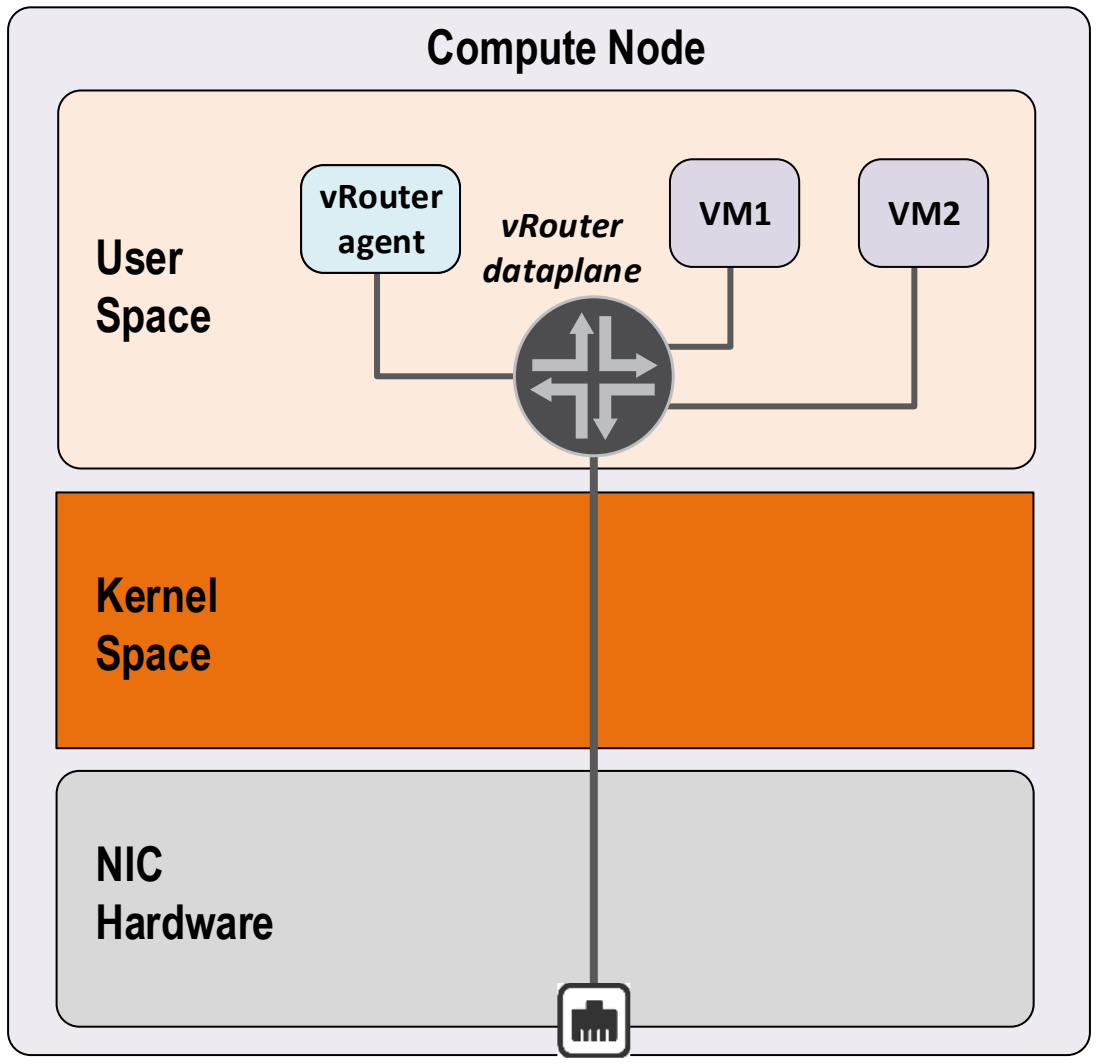


Title: XDP and OVS	
version: 1.0	date: 13/06/2020

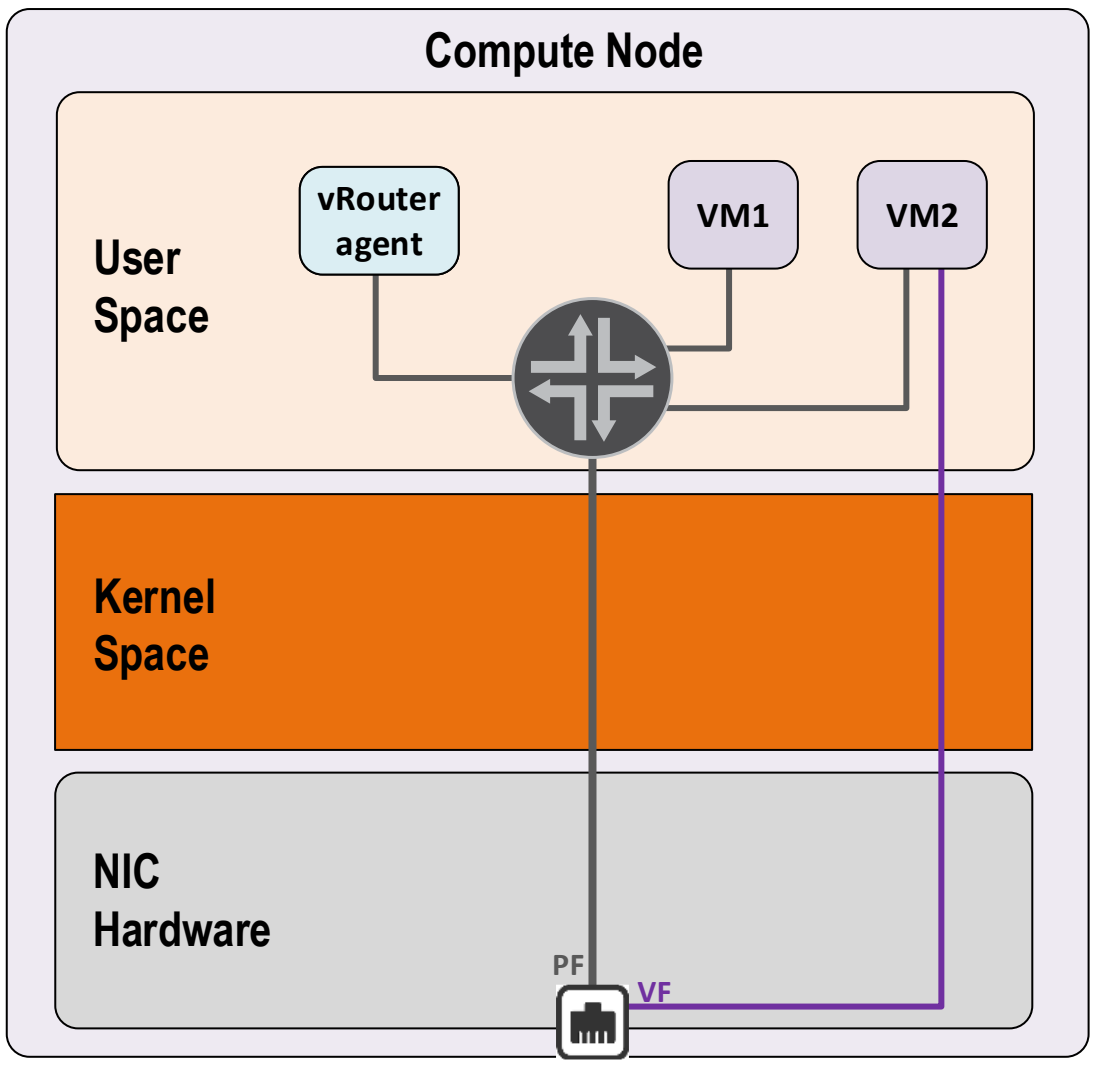
Kernel mode



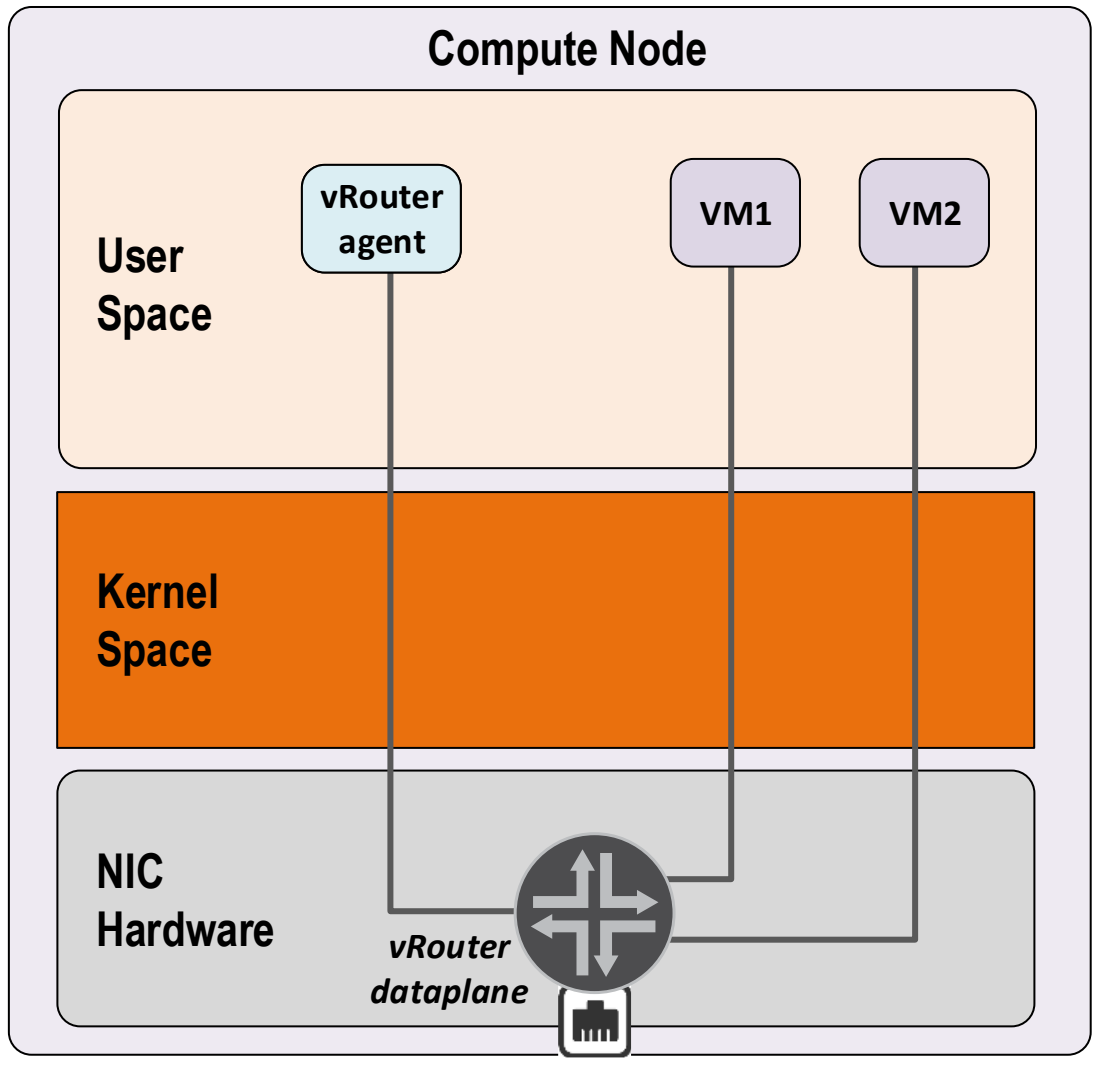
DPDK mode



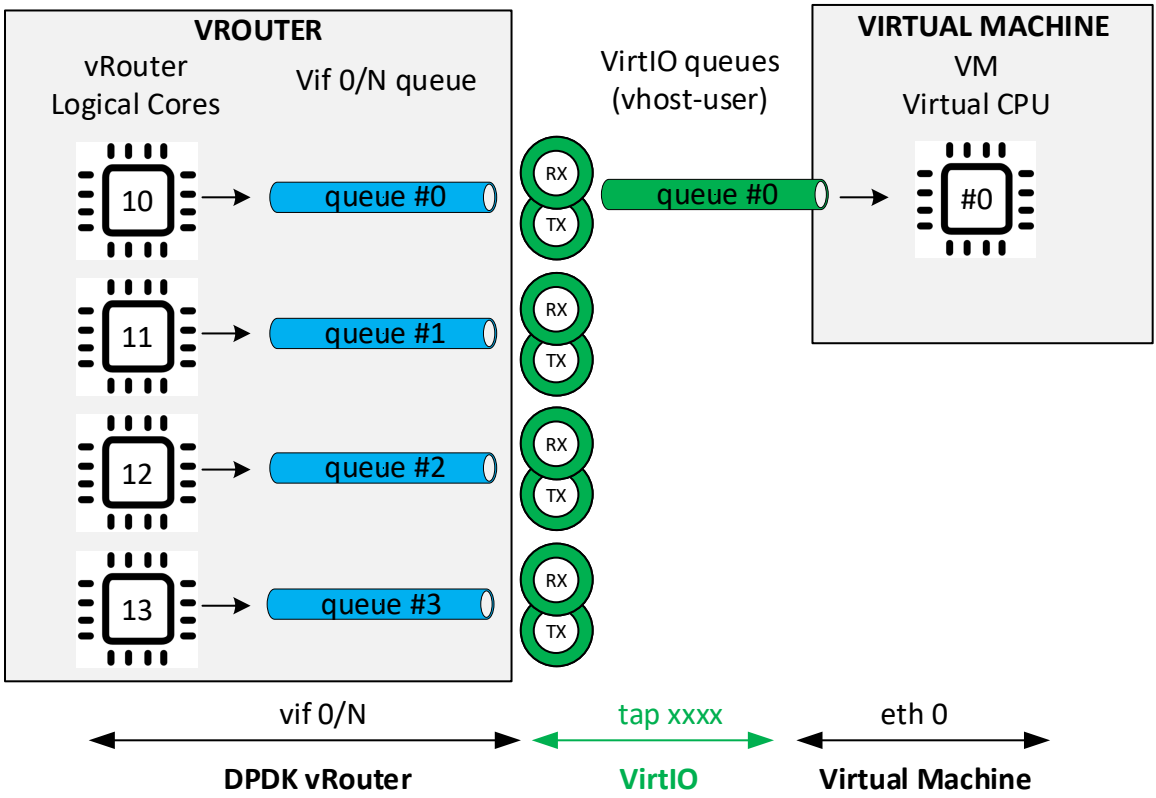
Hybrid SRIOV-DPDK



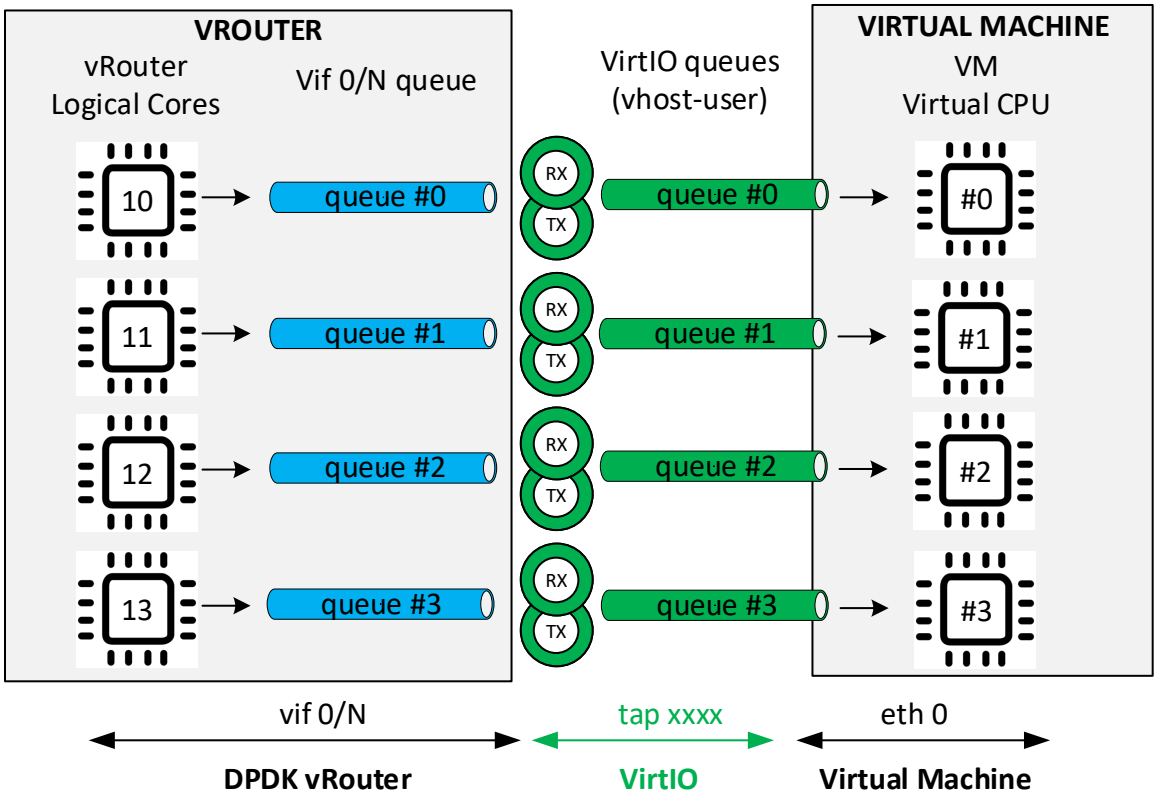
Smartnic



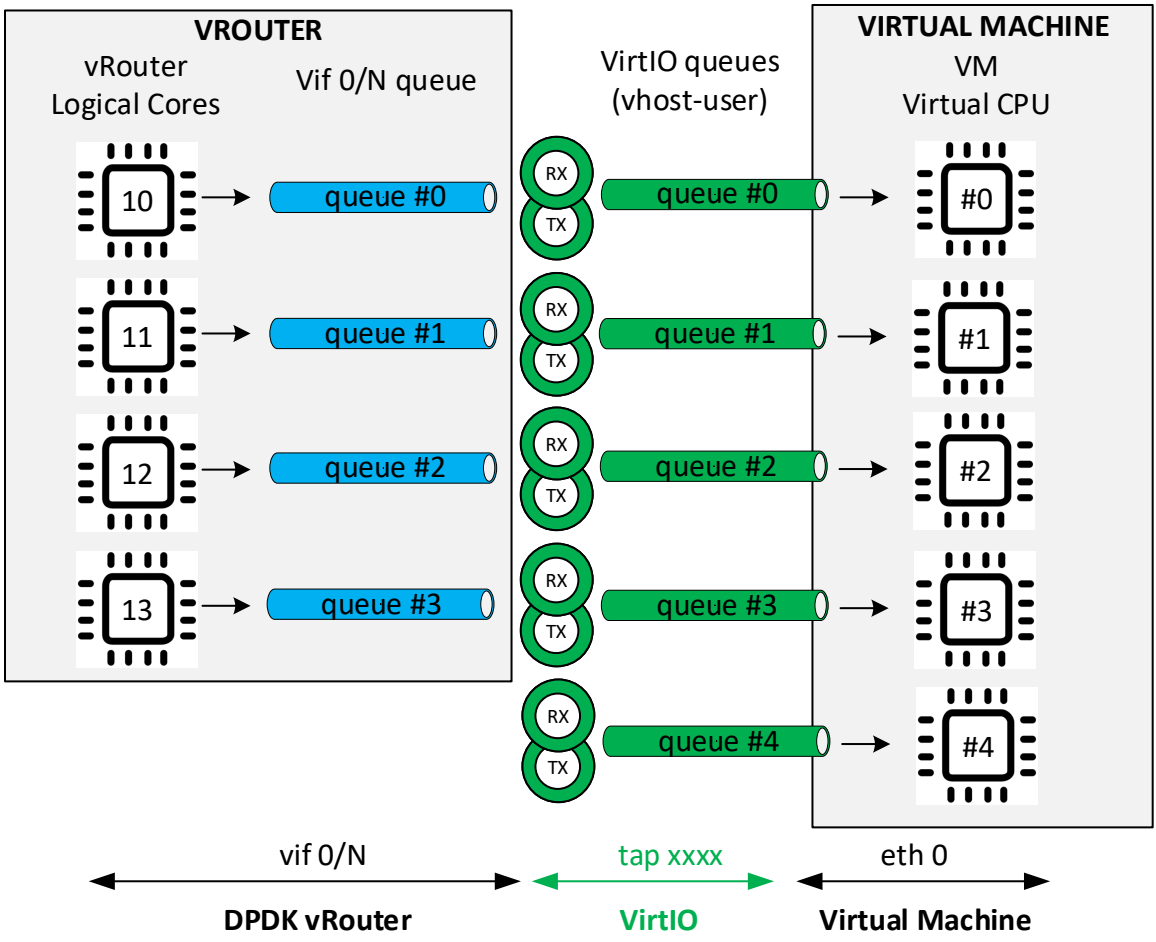
Title: vRouter Dataplane scenarios	
version: 1.0	date: 16/06/2020



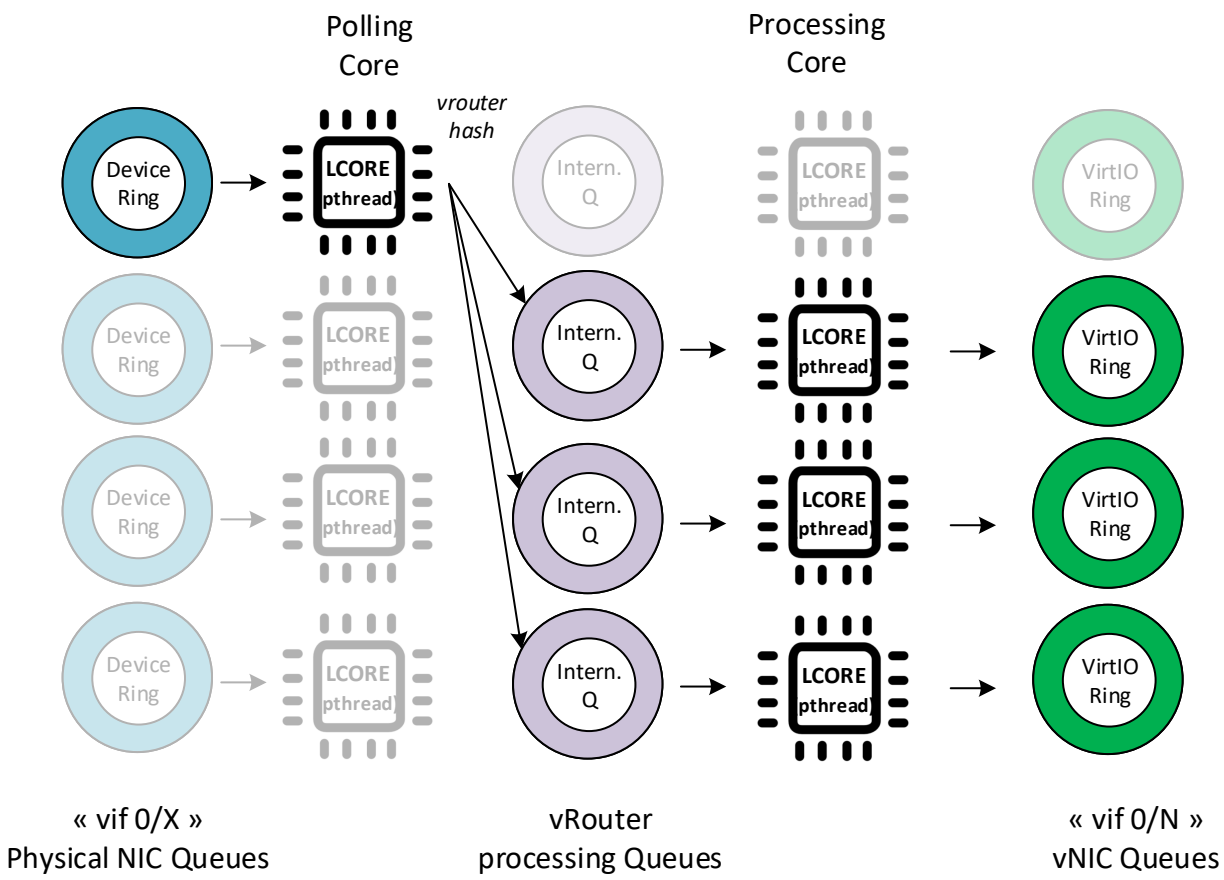
Title: DPDK Single Queue mapping	
version: 1.0	date: 16/09/2020



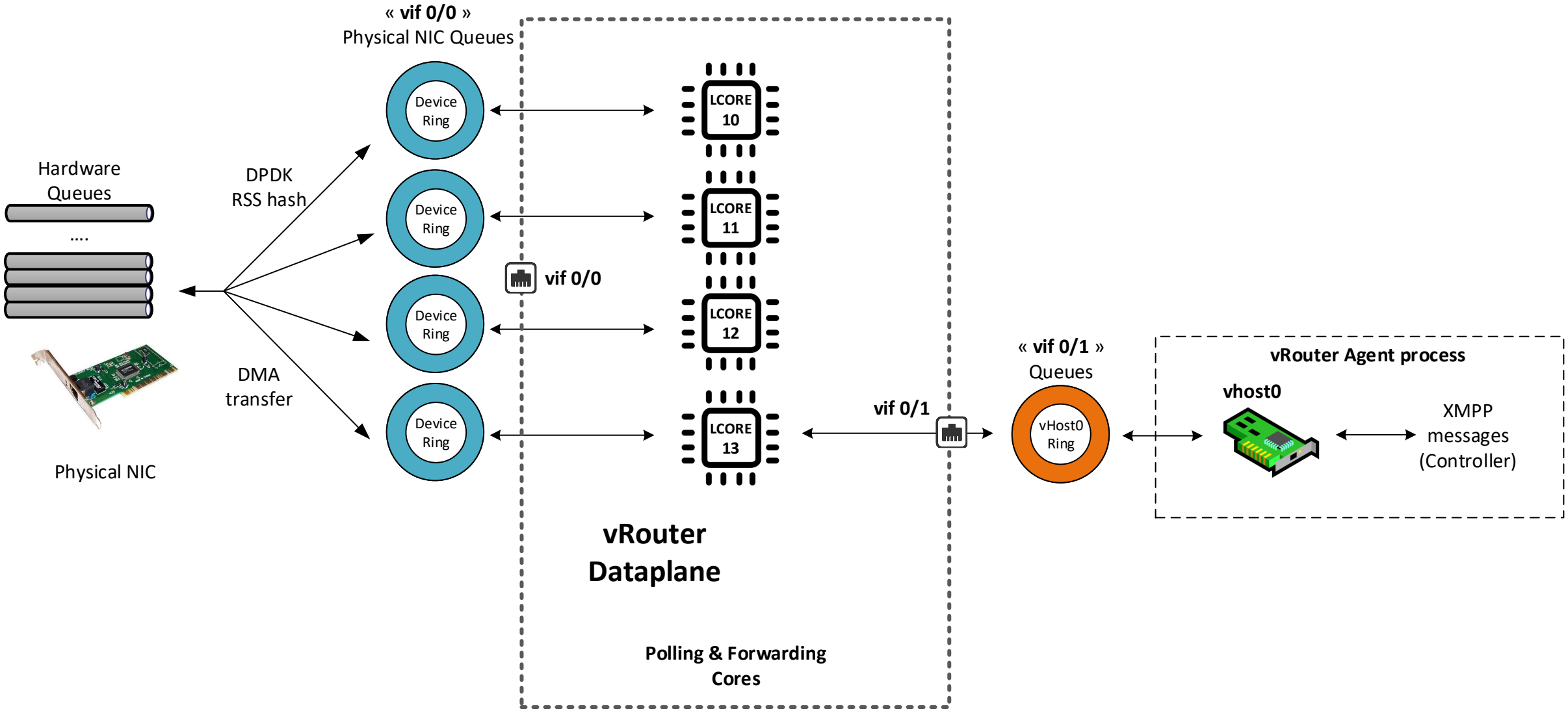
Title: DPDK MultiQueue mapping	
version: 1.0	date: 16/09/2020



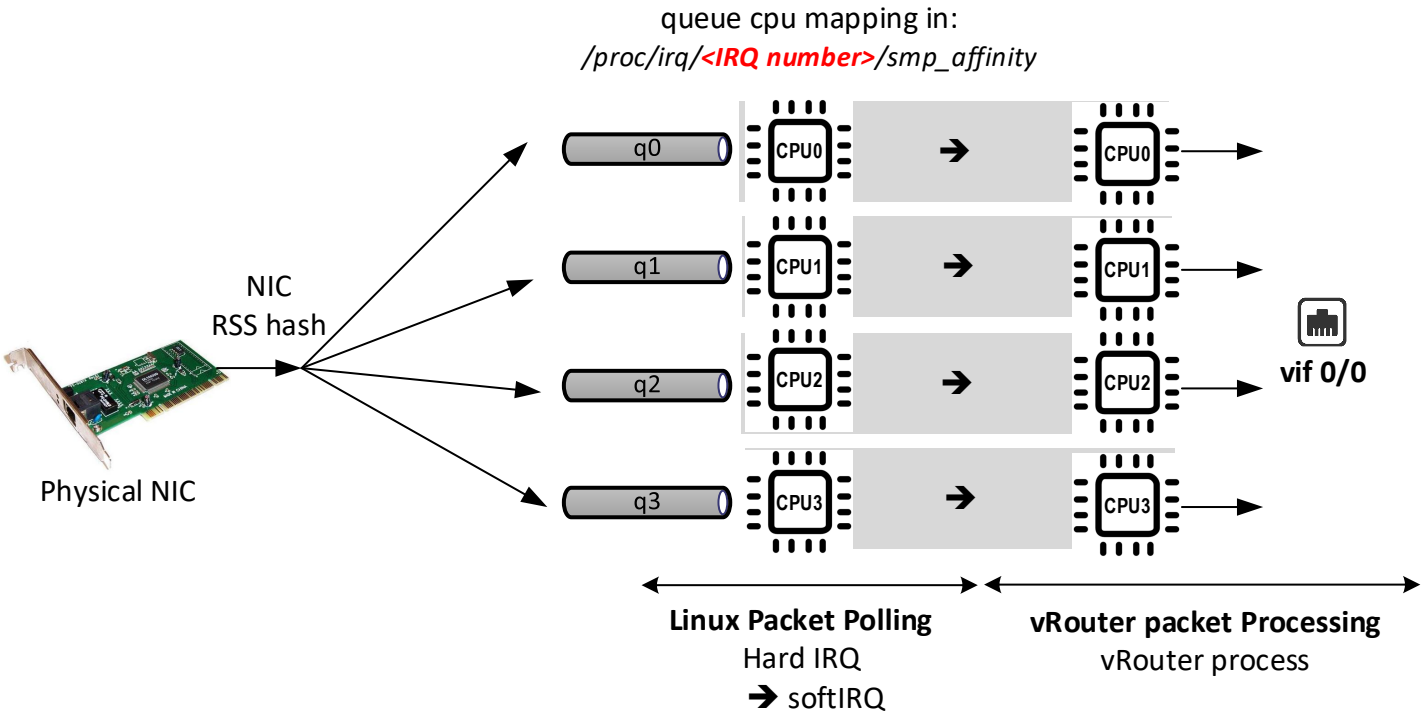
Title: DPDK Faulty MultiQueue mapping	
version: 1.0	date: 16/09/2020



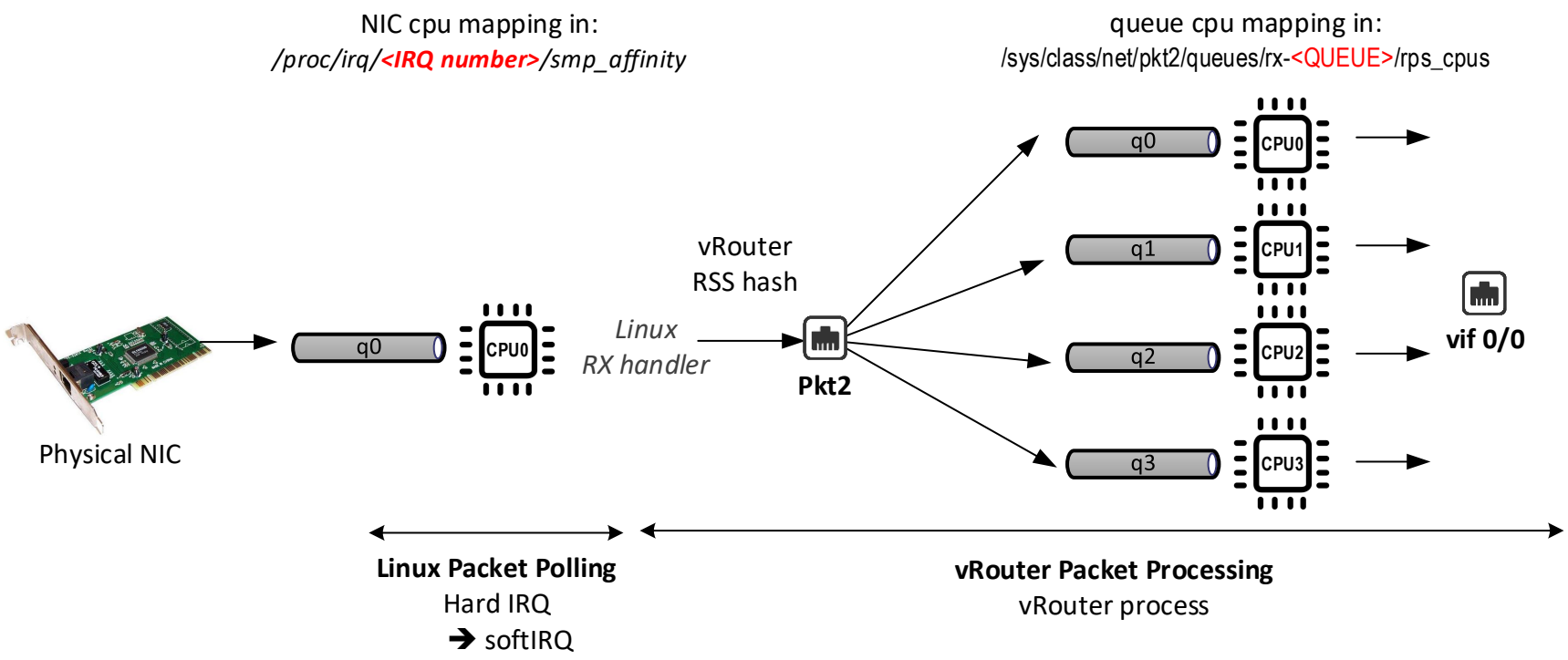
Title: vRouter internal loadbalancing	
version: 1.0	date: 16/09/2020



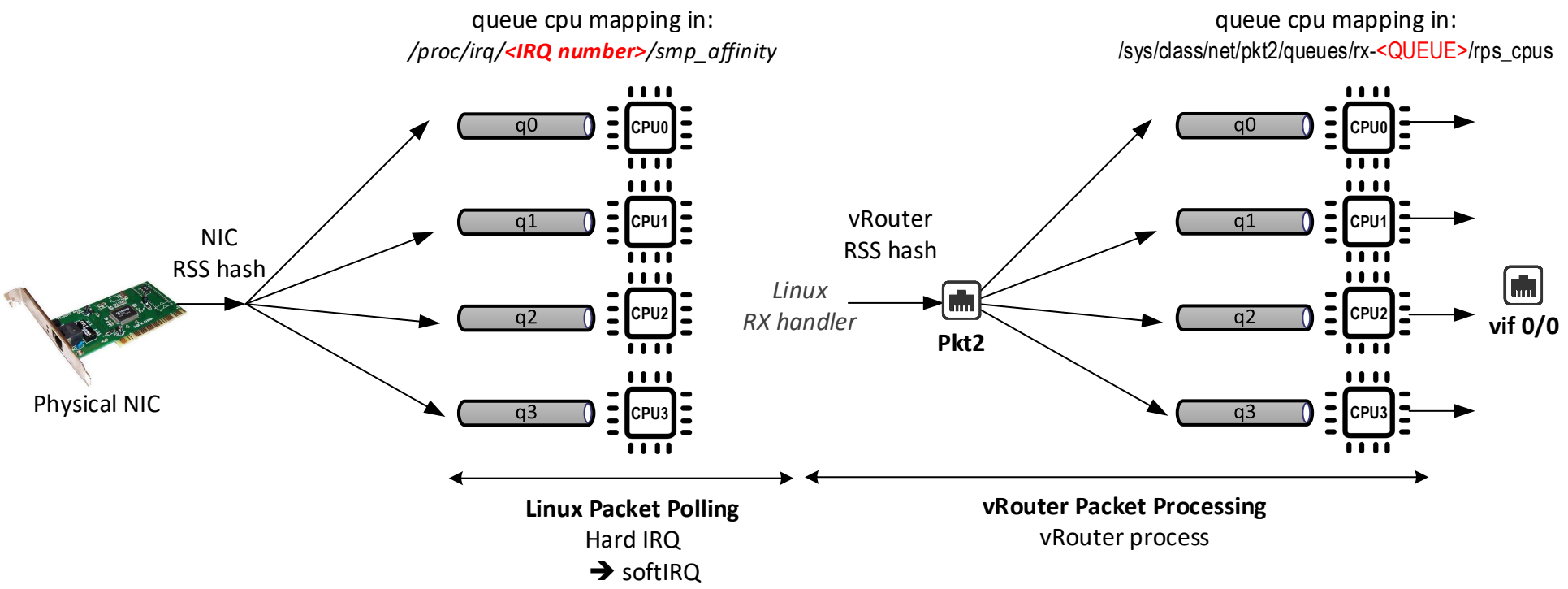
Title: vRouter Agent XMPP Messages Path	
version: 1.0	date: 16/09/2020



Title: Kernel vRouter MultiQ NIC without RPS	
version: 1.0	date: 16/09/2020



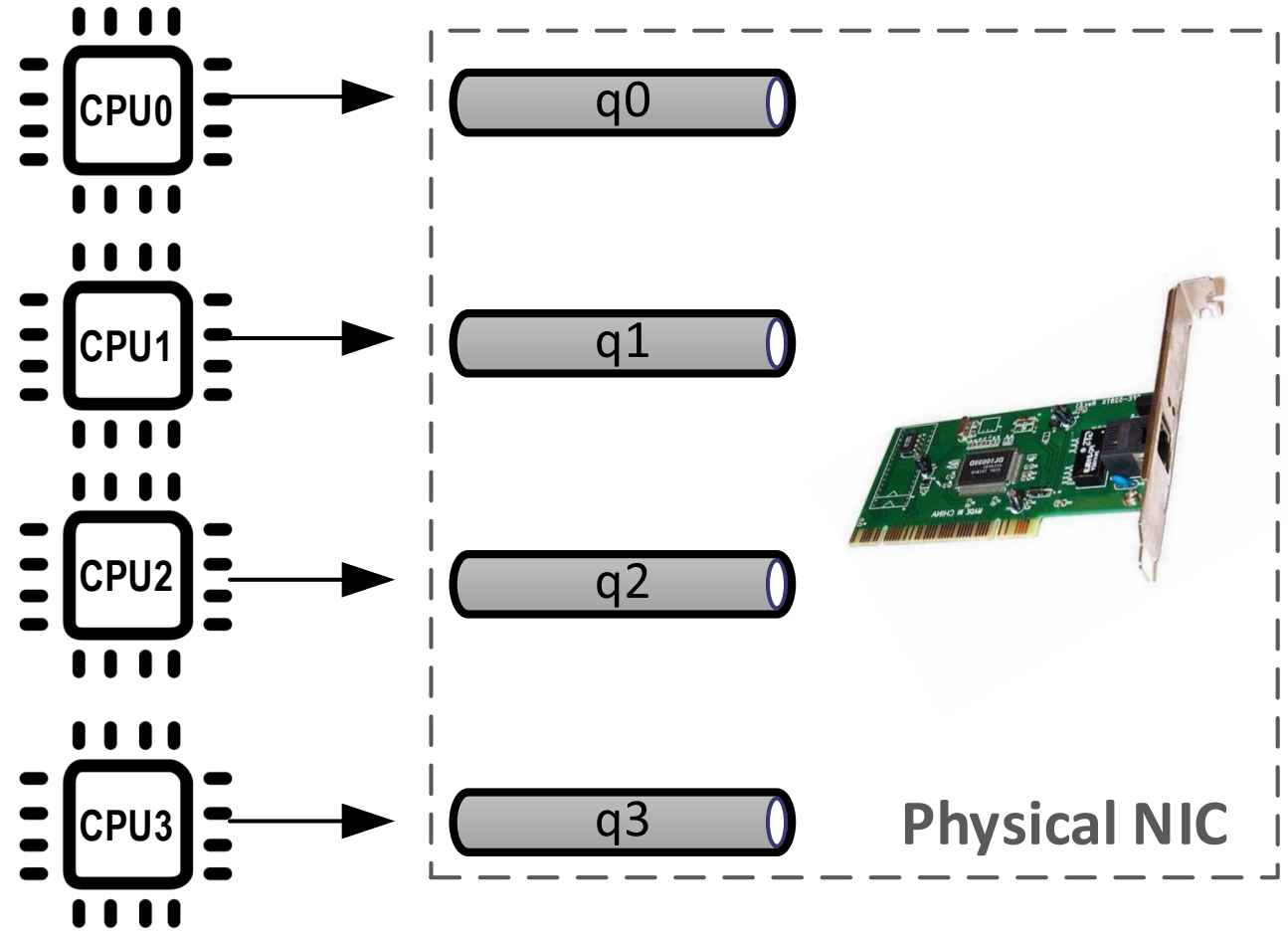
Title: Kernel vRouter RPS – SingleQ NIC	
version: 1.0	date: 16/09/2020



Title: Kernel vRouter RPS – MultiQ NIC	
version: 1.0	date: 16/09/2020

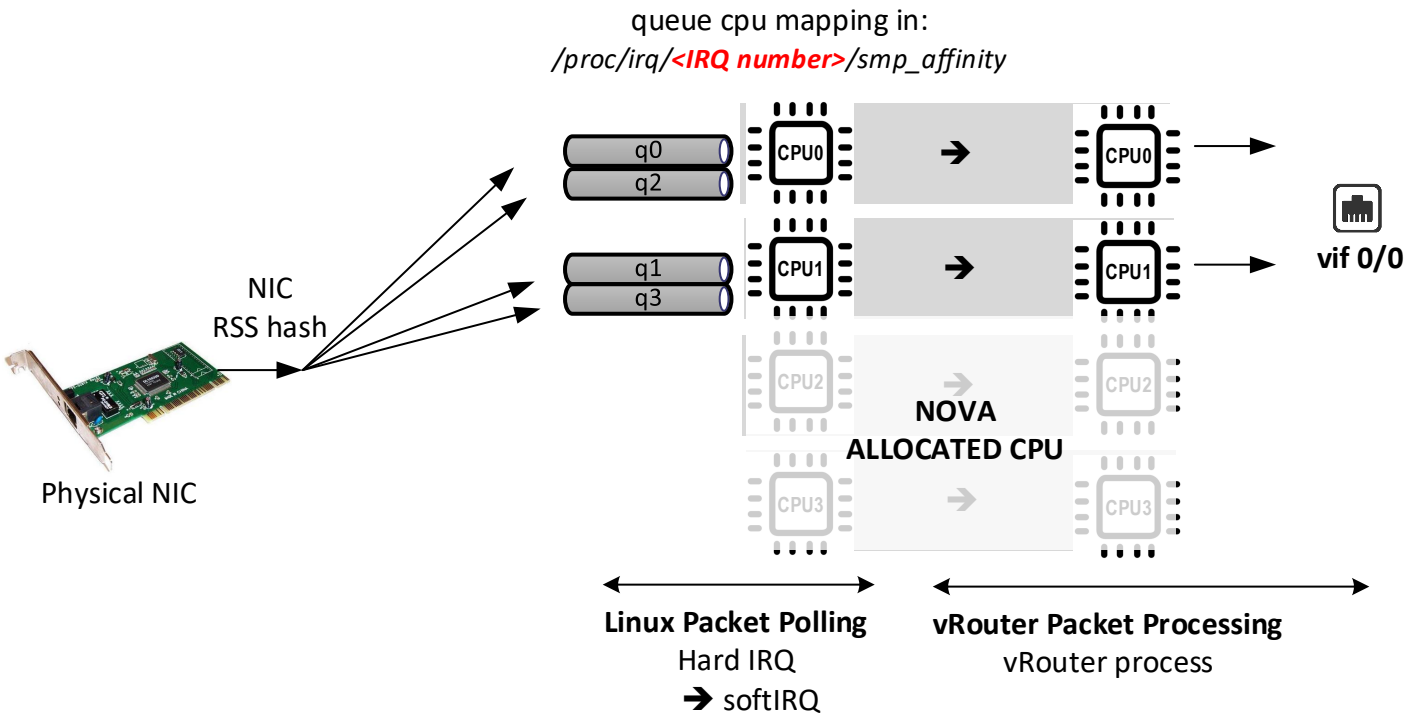
queue cpu mapping in:

/sys/class/net/<NIC>/queues/tx-<QUEUE>/xps_cpus

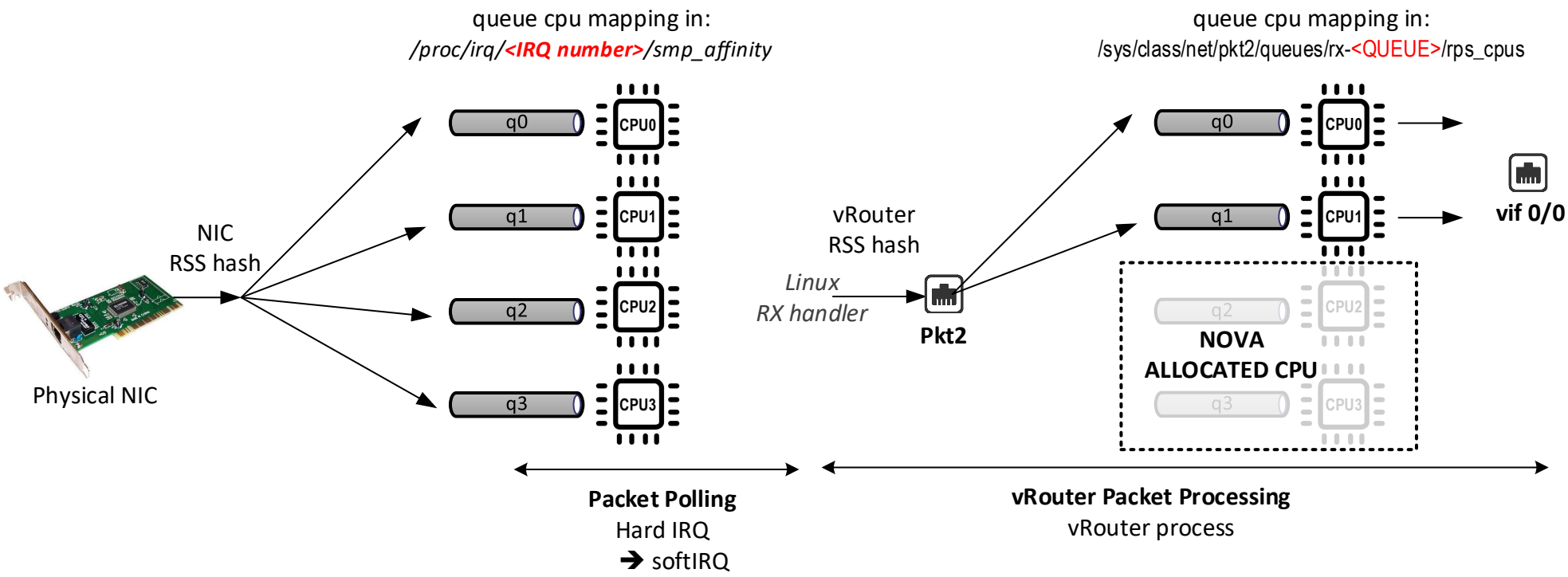


Transmit Packets Processing

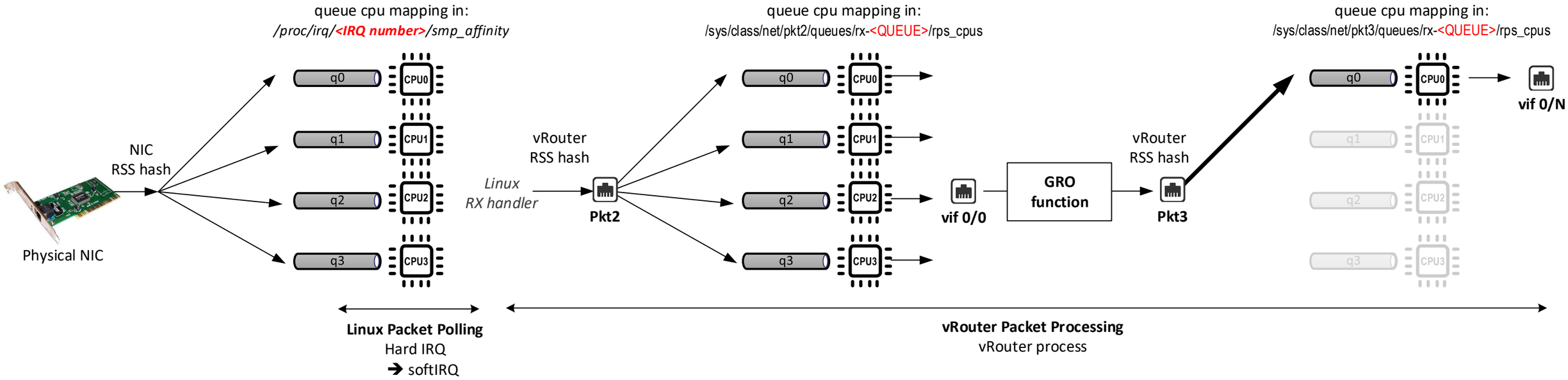
Title: Linux XPS – MultiQ NIC	
version: 1.0	date: 16/09/2020



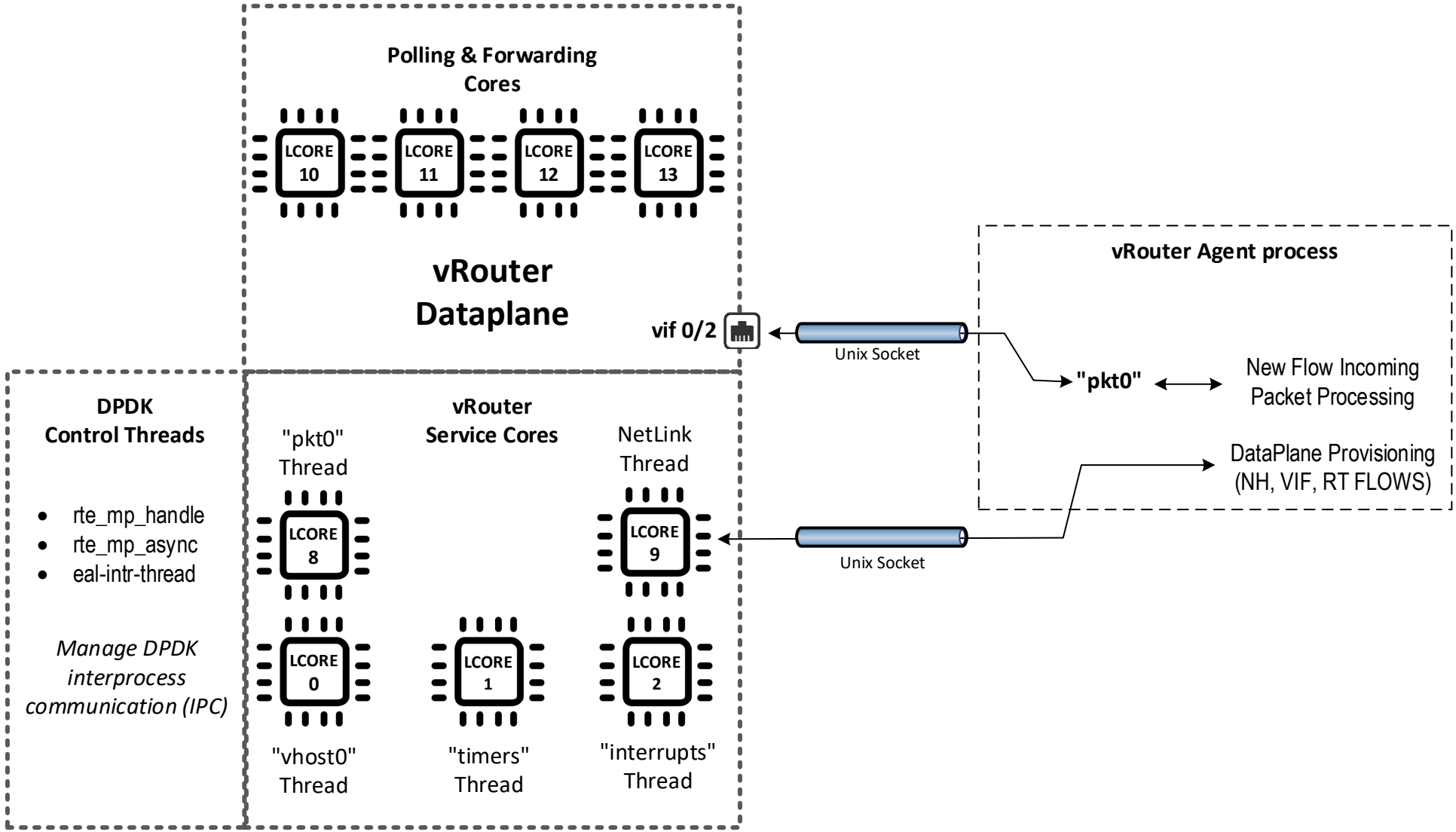
Title: Kernel vRouter MultiQ NIC without RPS tuned	
version: 1.0	date: 16/09/2020



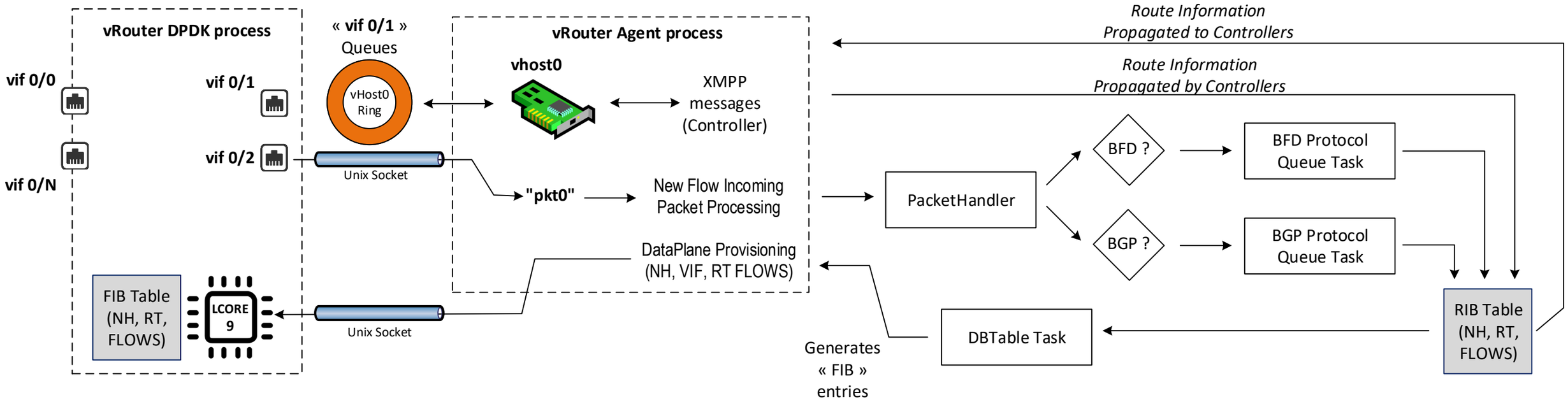
Title: Kernel vRouter RPS expected	
version: 1.0	date: 16/09/2020



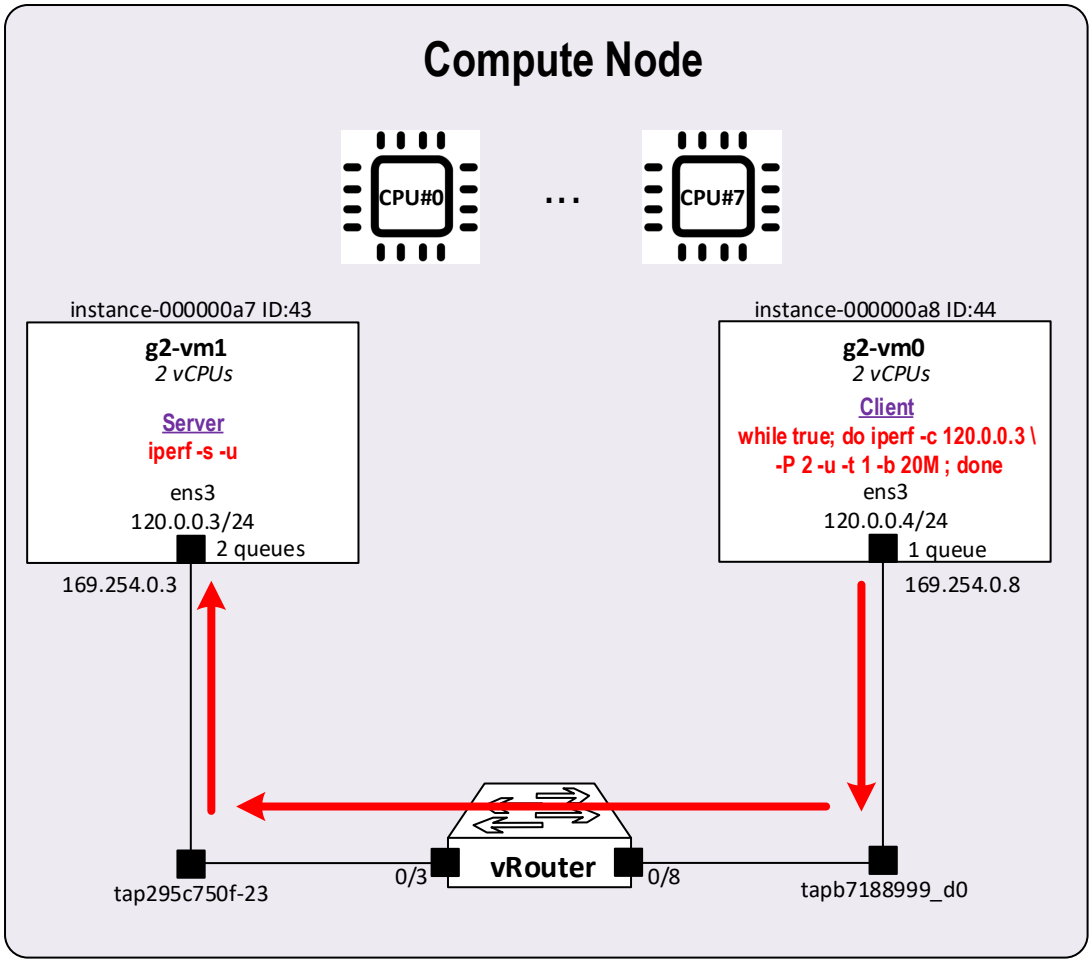
Title: Kernel vRouter RPS issue	
version: 1.0	date: 16/09/2020



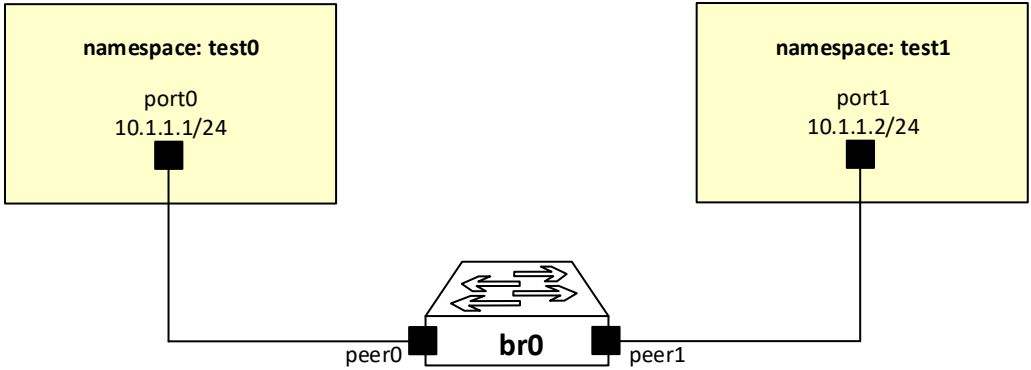
Title: vRouter Agent New Flow Processing Path	
version: 1.0	date: 16/09/2020



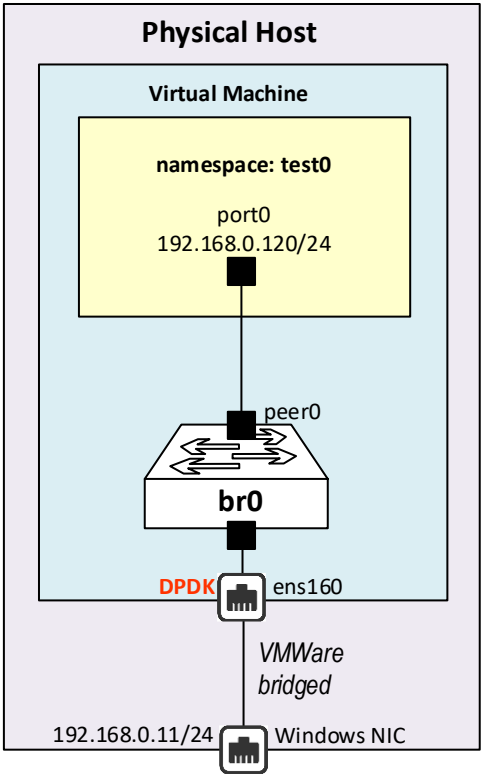
Title: vRouter Agent Protocol Processing	
version: 1.0	date: 16/09/2020



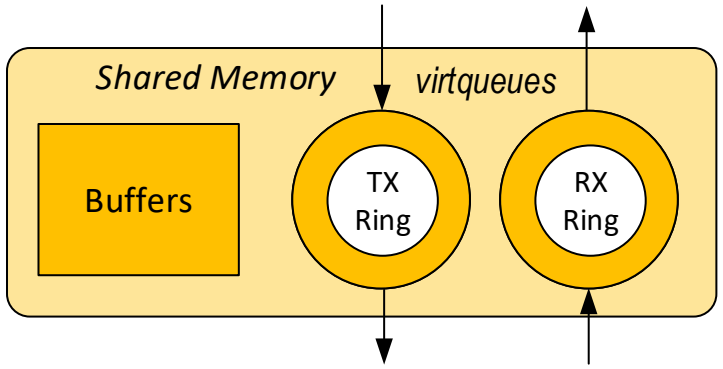
Title: Test Lab	
version: 1.0	date: 23/09/2020



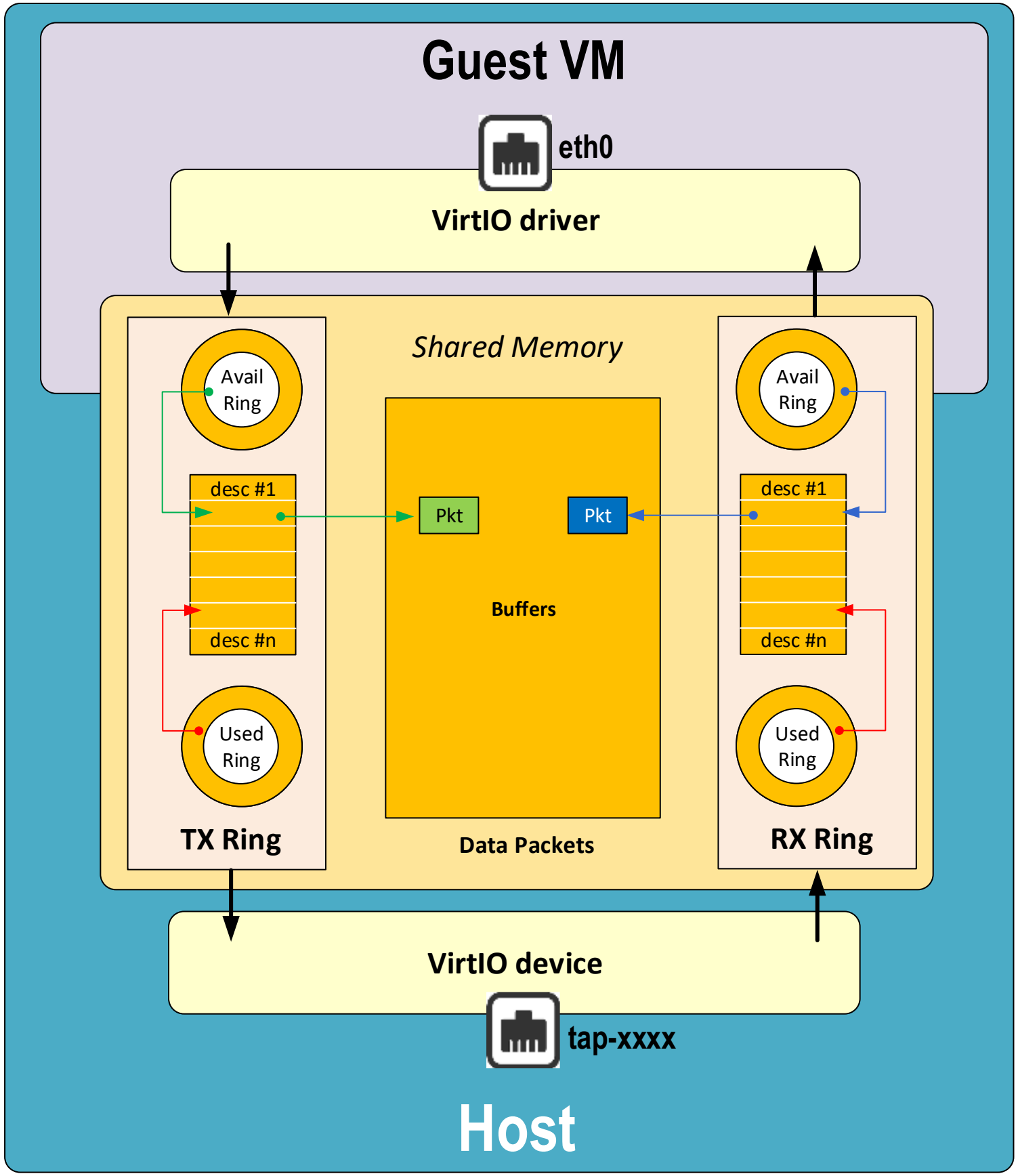
Title: Lab OVS-XDP	
version: 1.0	date: 12/10/2020

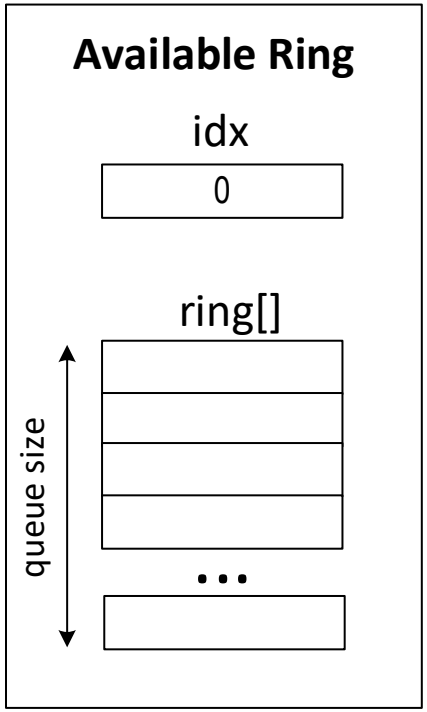


Title: Lab OVS-DPDK	
version: 1.0	date: 12/10/2020

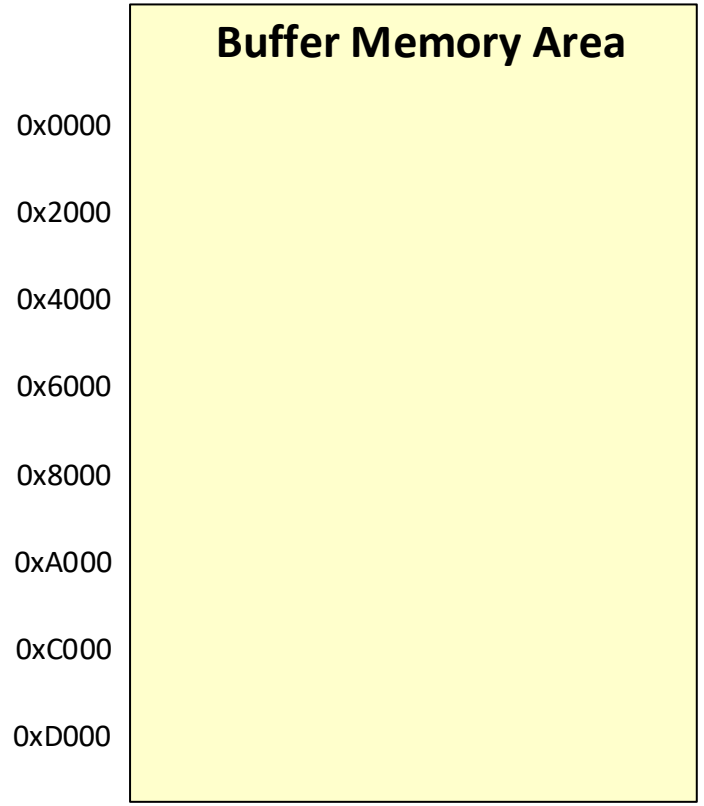


Title: VirtIO rings	
version: 1.0	date: 16/09/2020

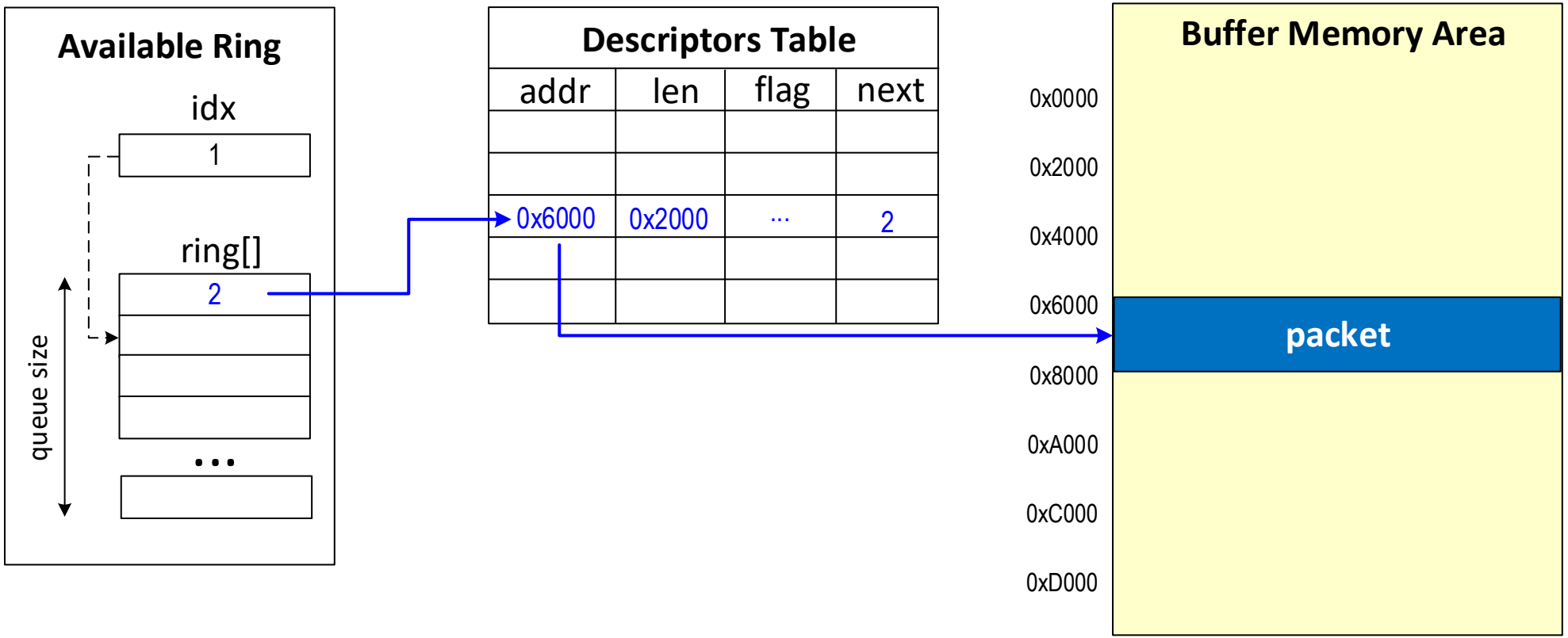




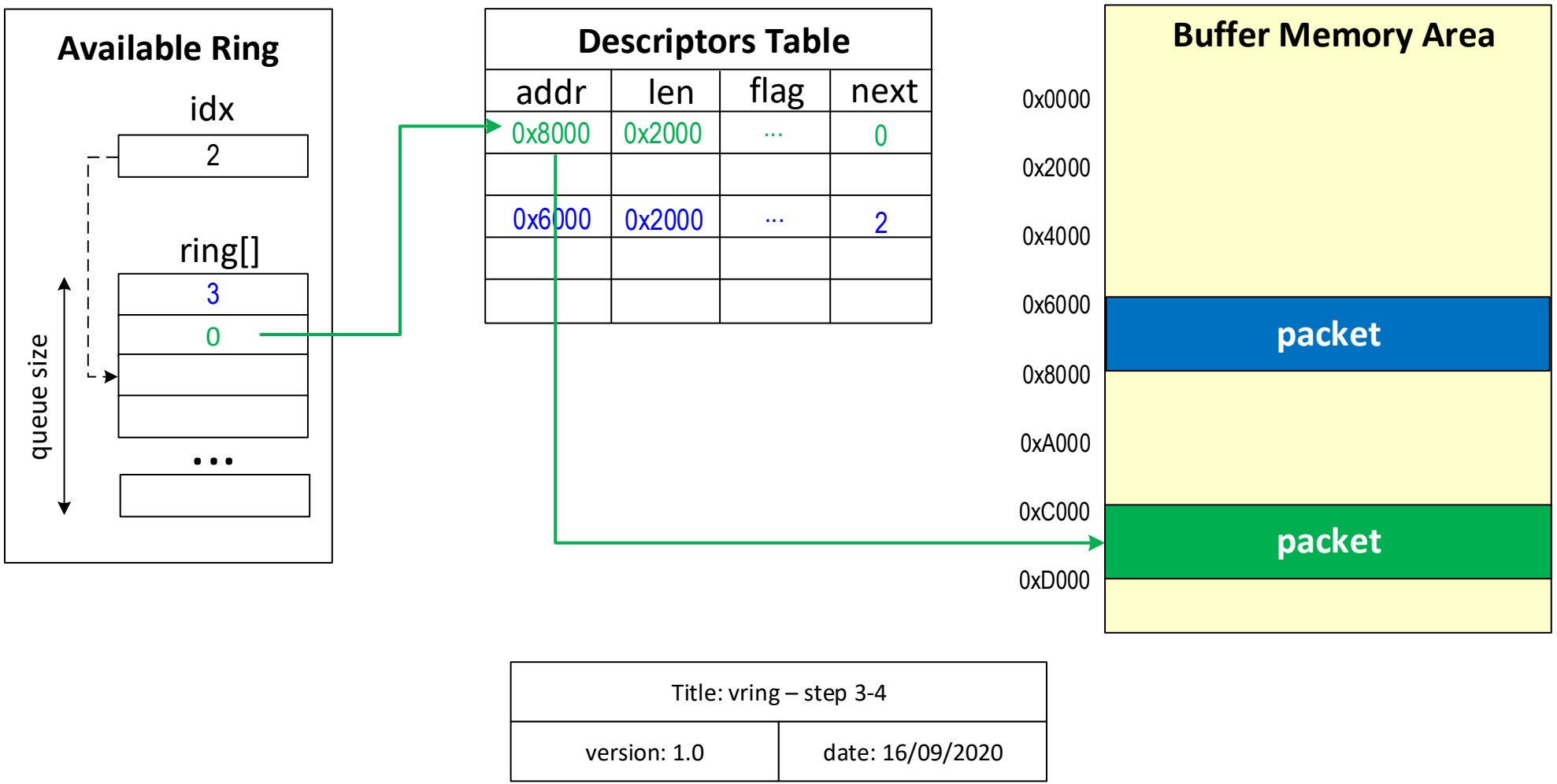
Descriptors Table			
addr	len	flag	next



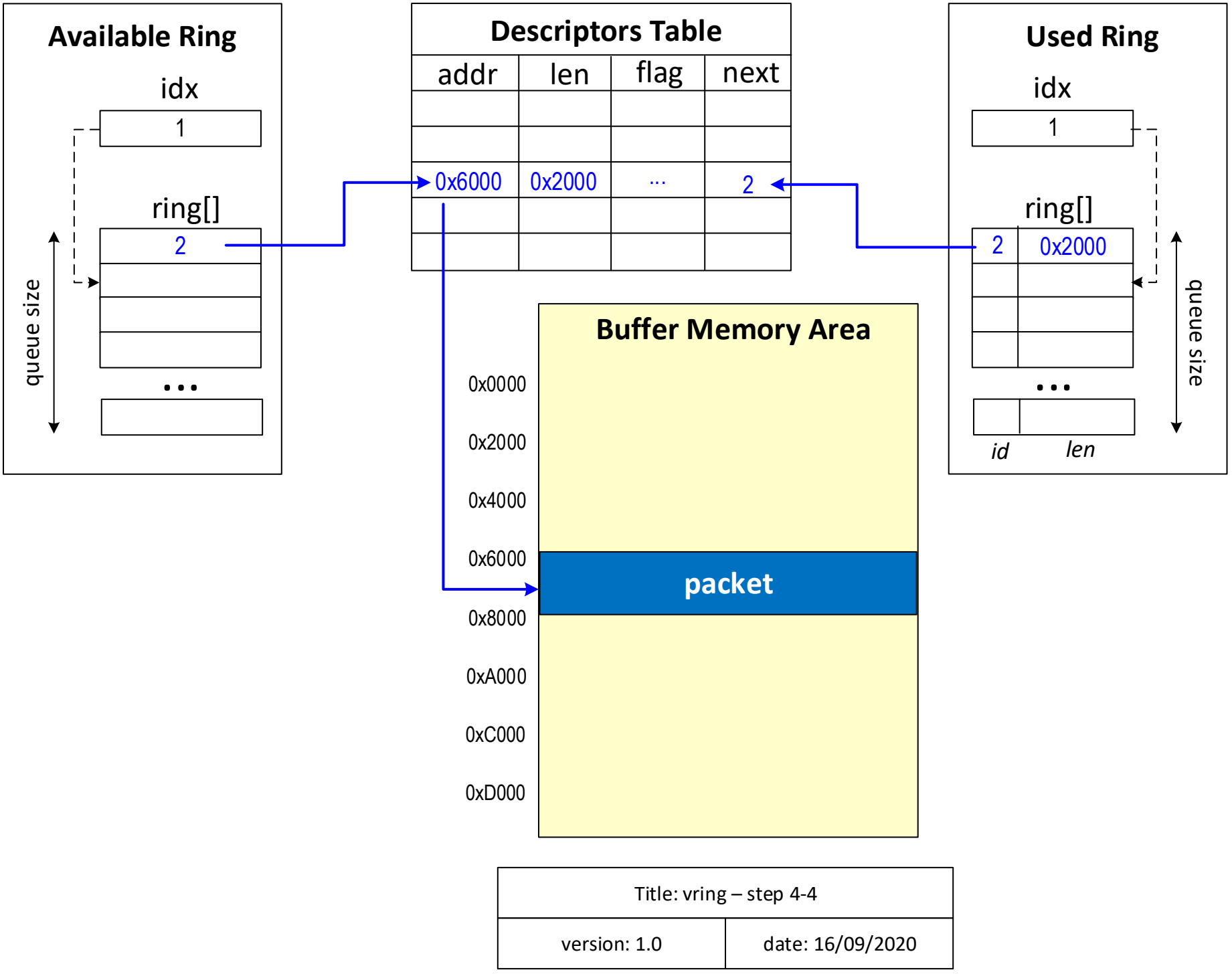
Title: vring – step 1-4	
version: 1.0	date: 16/09/2020



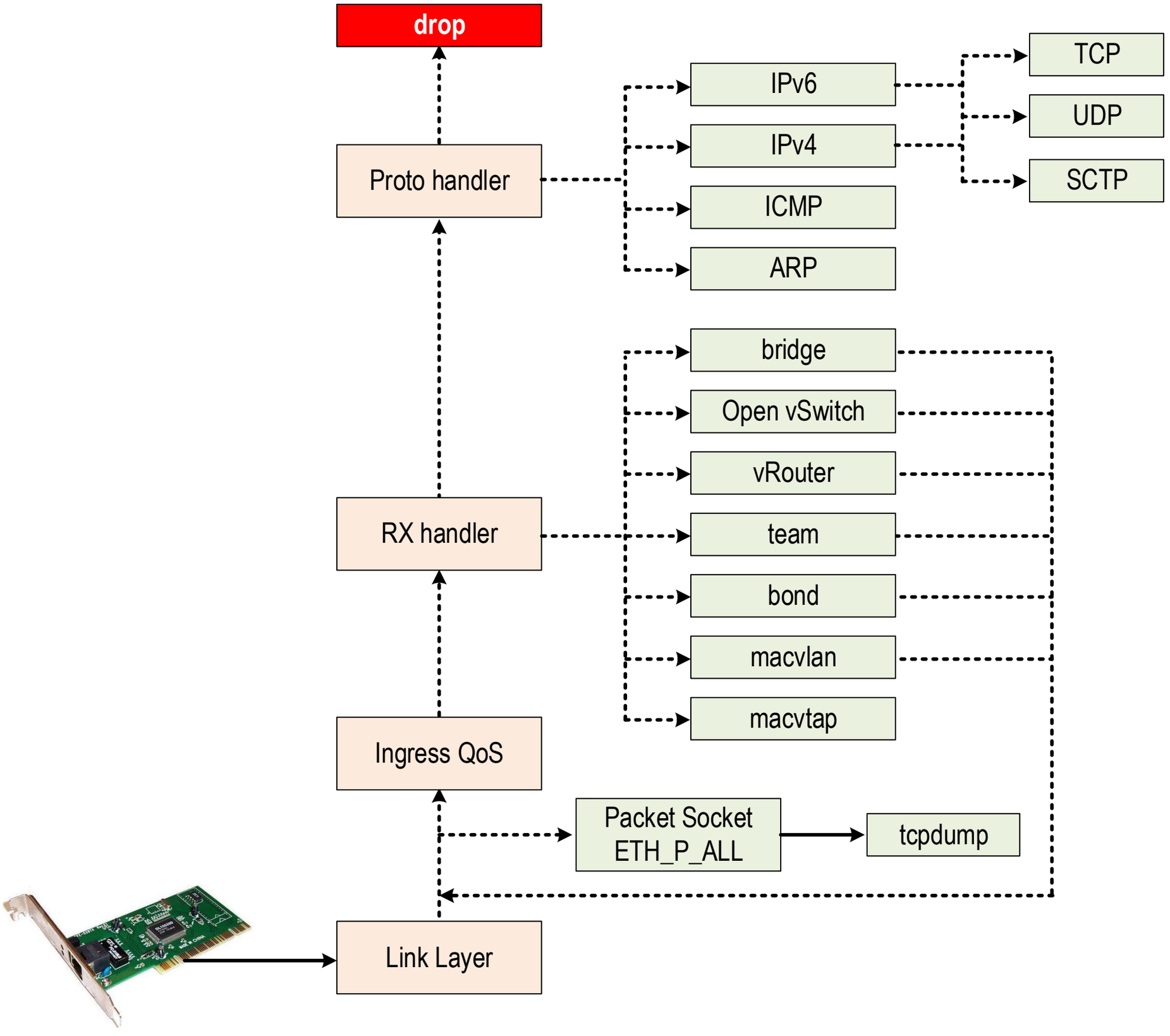
Title: vring – step 2-4	
version: 1.0	date: 16/09/2020



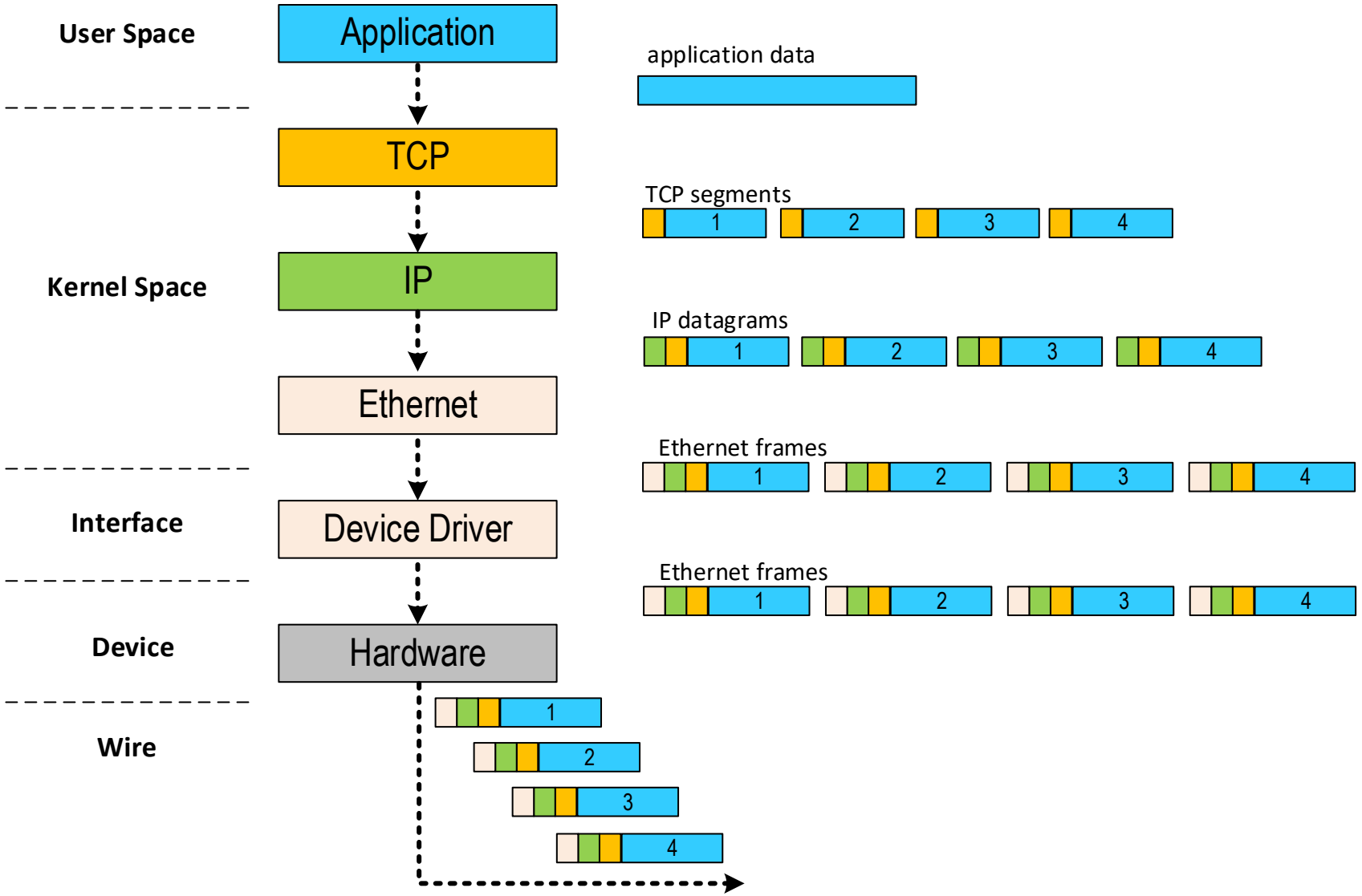
Title: vring – step 3-4	
version: 1.0	date: 16/09/2020



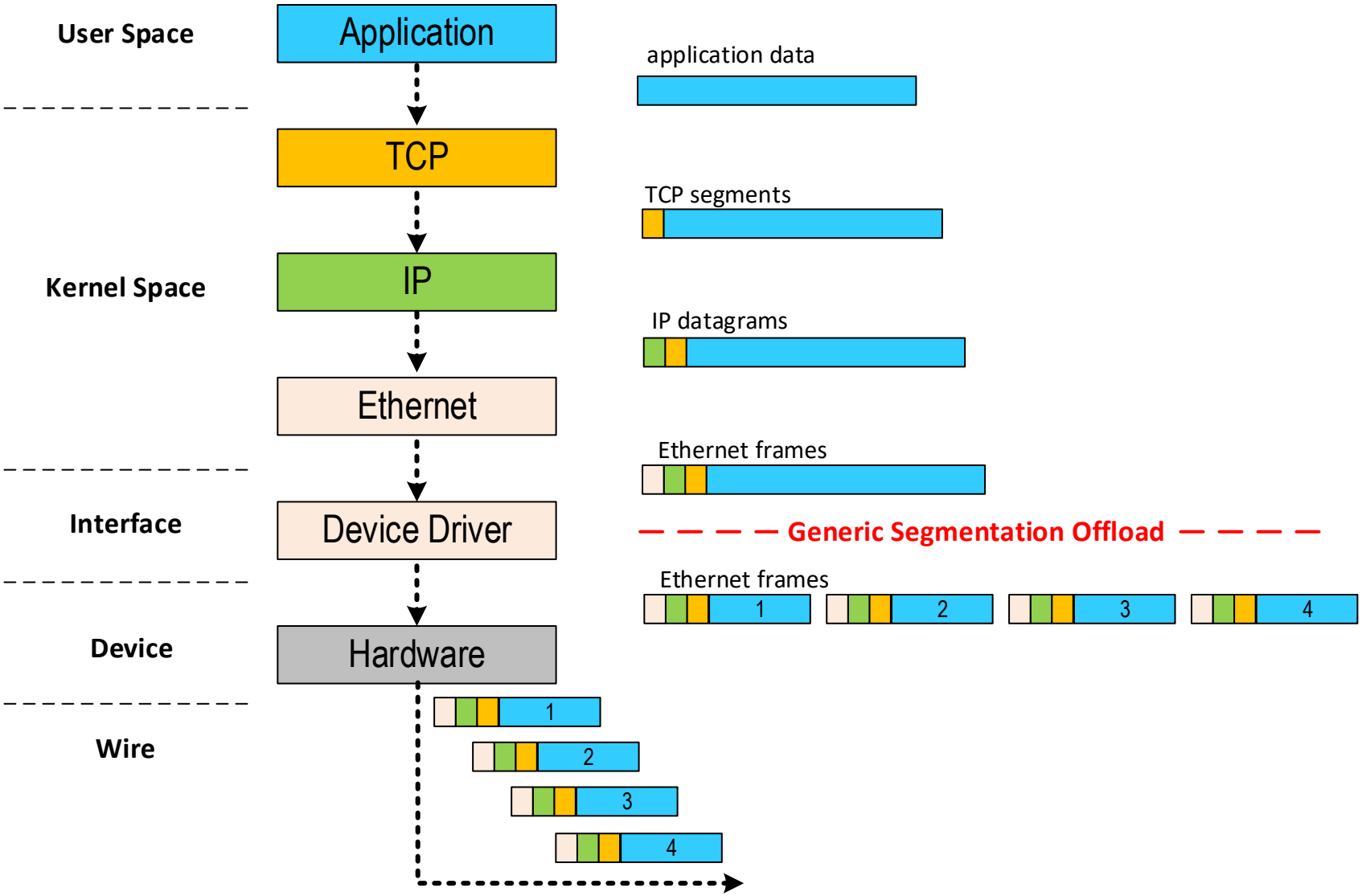
Title: vring – step 4-4	
version: 1.0	date: 16/09/2020



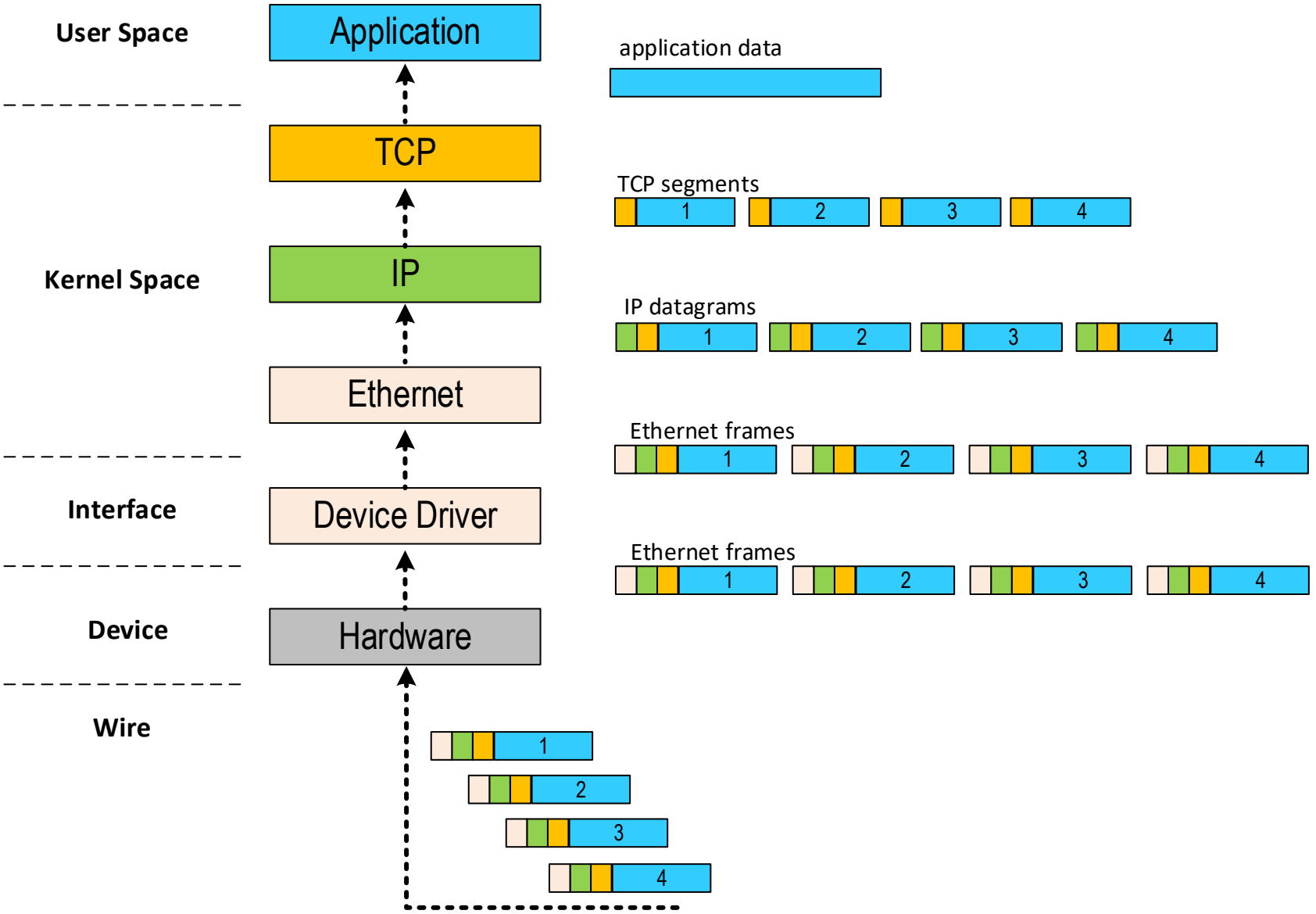
Title: TCP/IP Stack and RX Handler	
version: 1.0	date: 09/10/2020



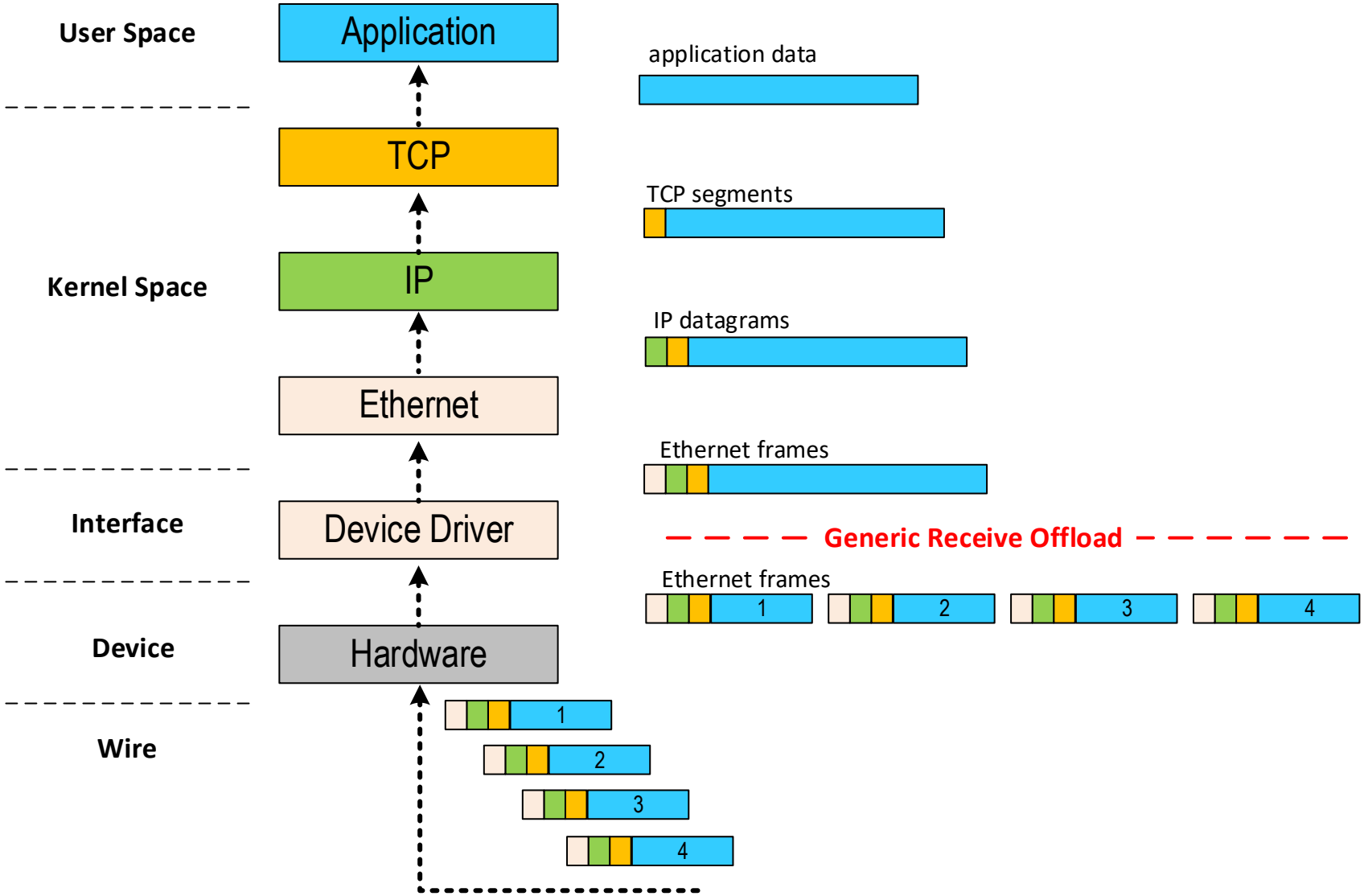
Title: Data segmentation	
version: 1.0	date: 09/10/2020



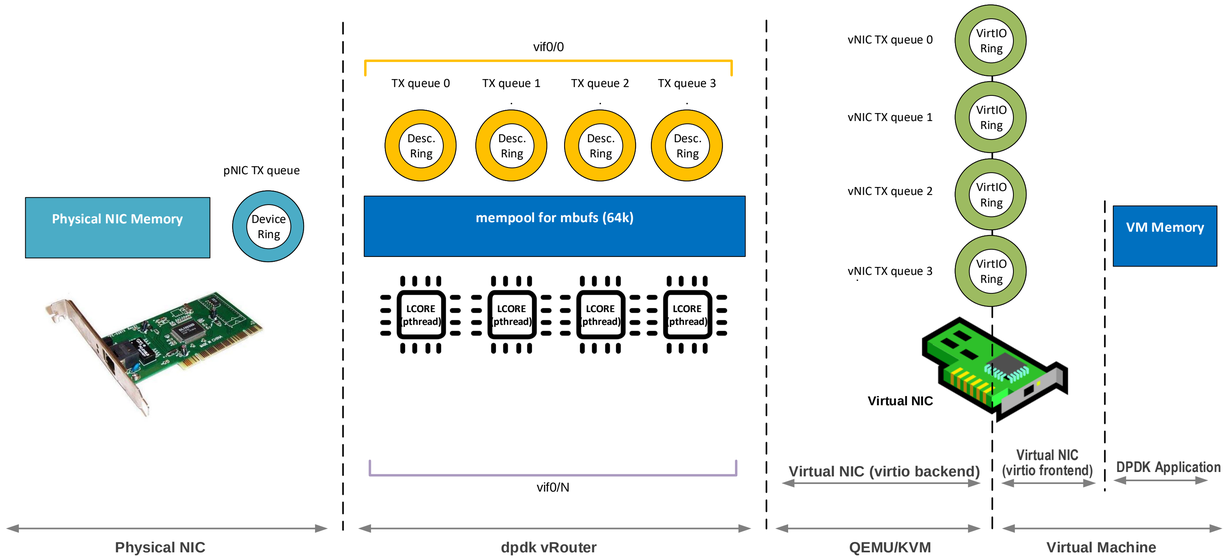
Title: Generic Segmentation Offload	
version: 1.0	date: 09/10/2020

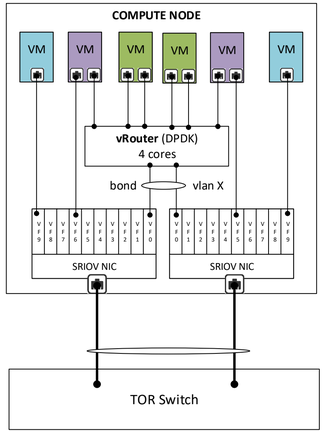


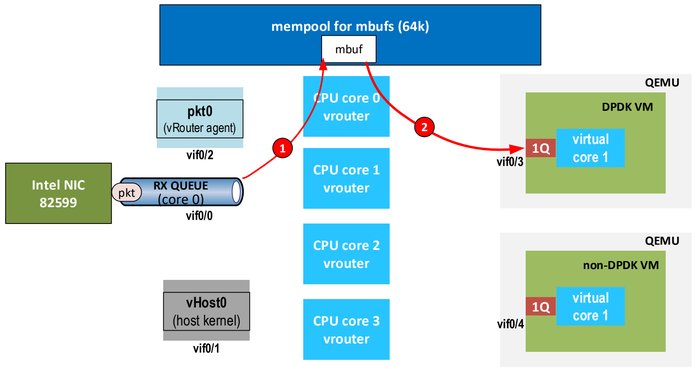
Title: Segments Reassembly	
version: 1.0	date: 09/10/2020

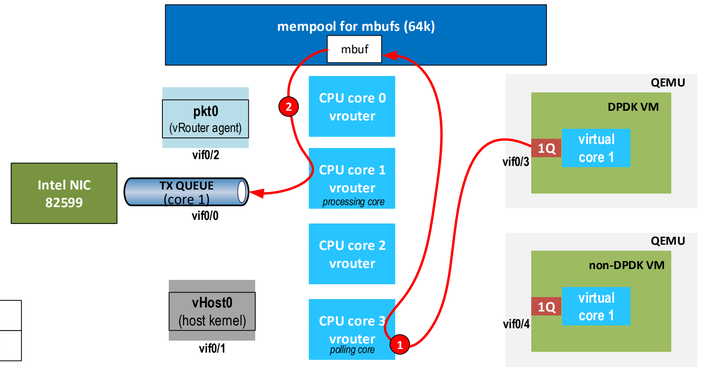


Title: Generic Receive Offload	
version: 1.0	date: 09/10/2020

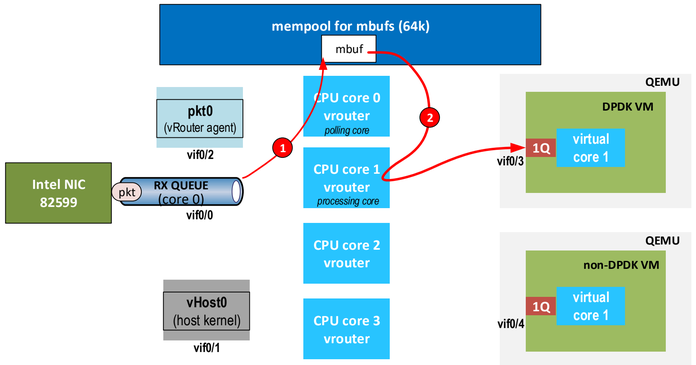


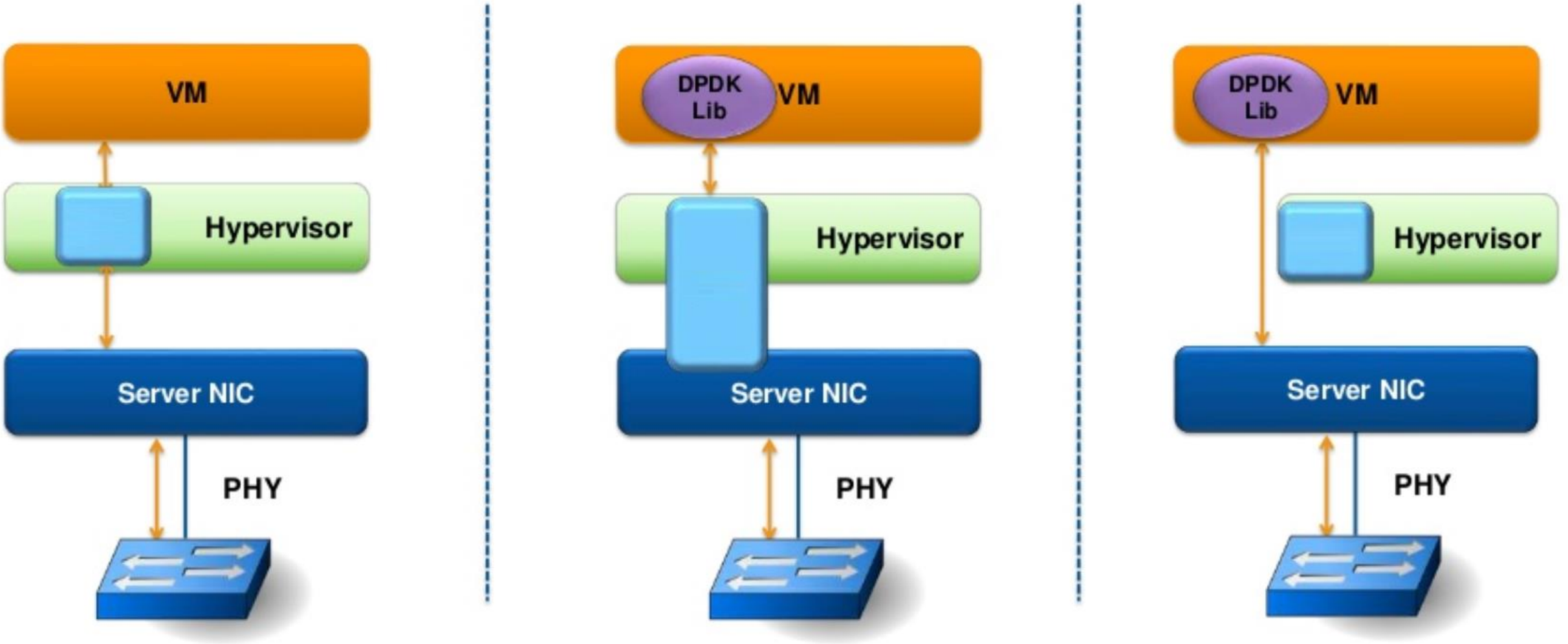


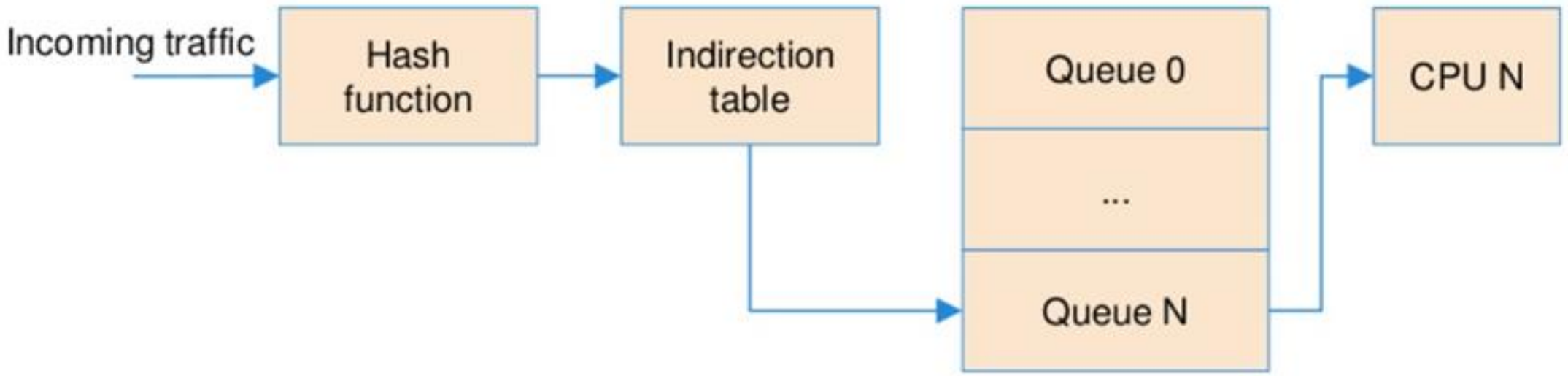




Title: Personal Stuff	
version: 1.0	date: 25/03/2020







Title: Stuff (no source)	
version: 1.0	date: 25/03/2020