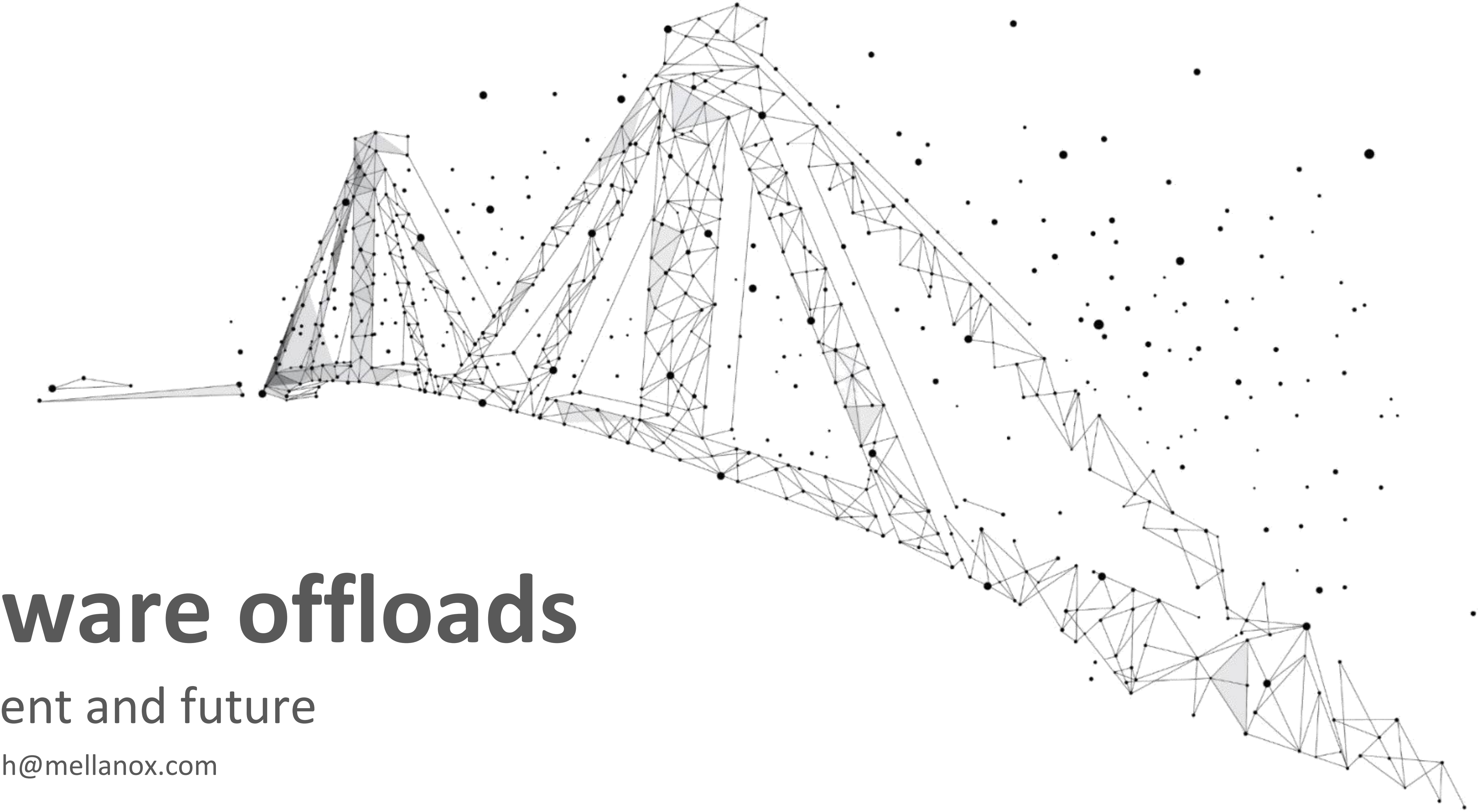
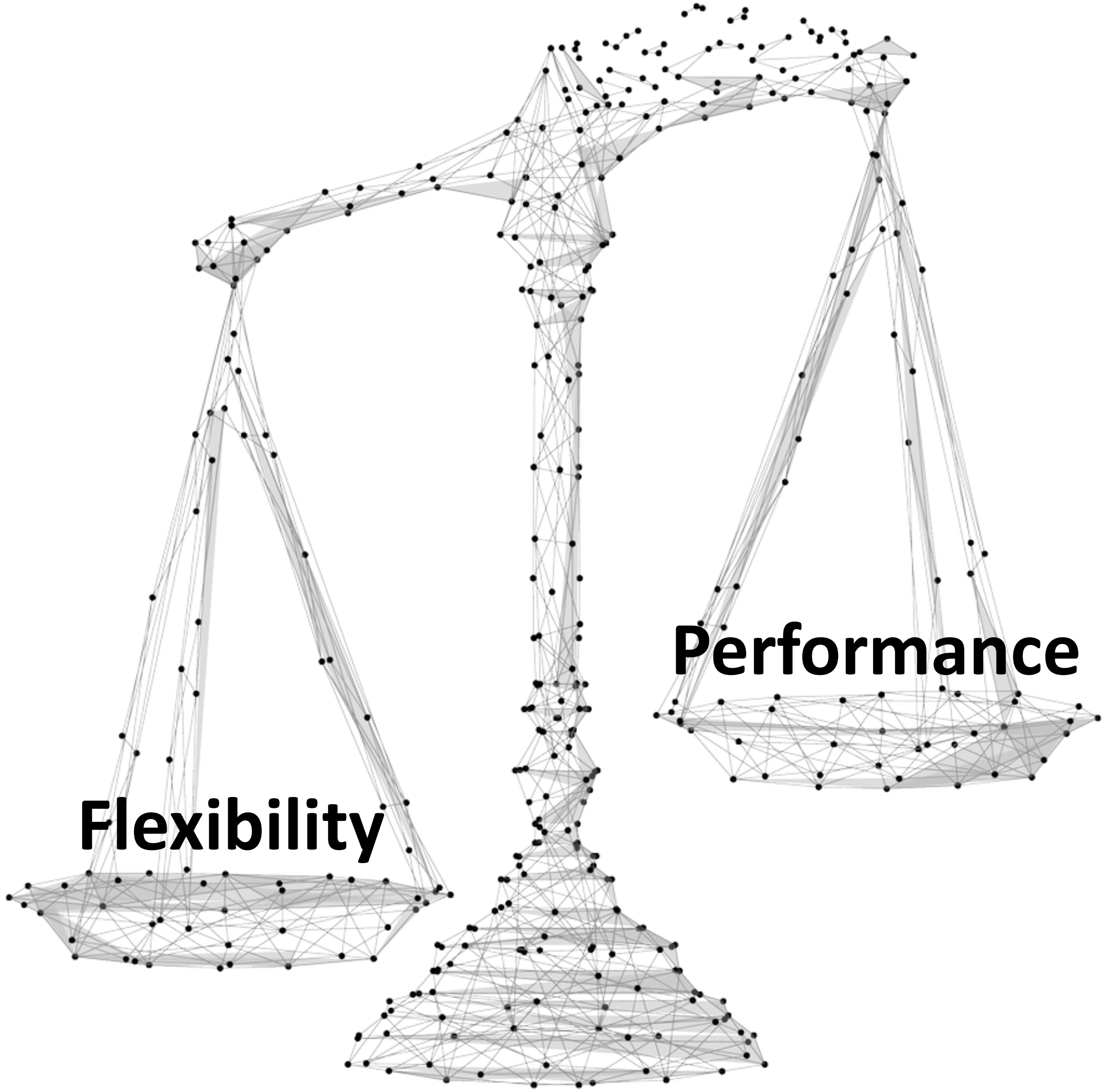


Hardware offloads

Past present and future

Oz Shlomo – ozsh@mellanox.com

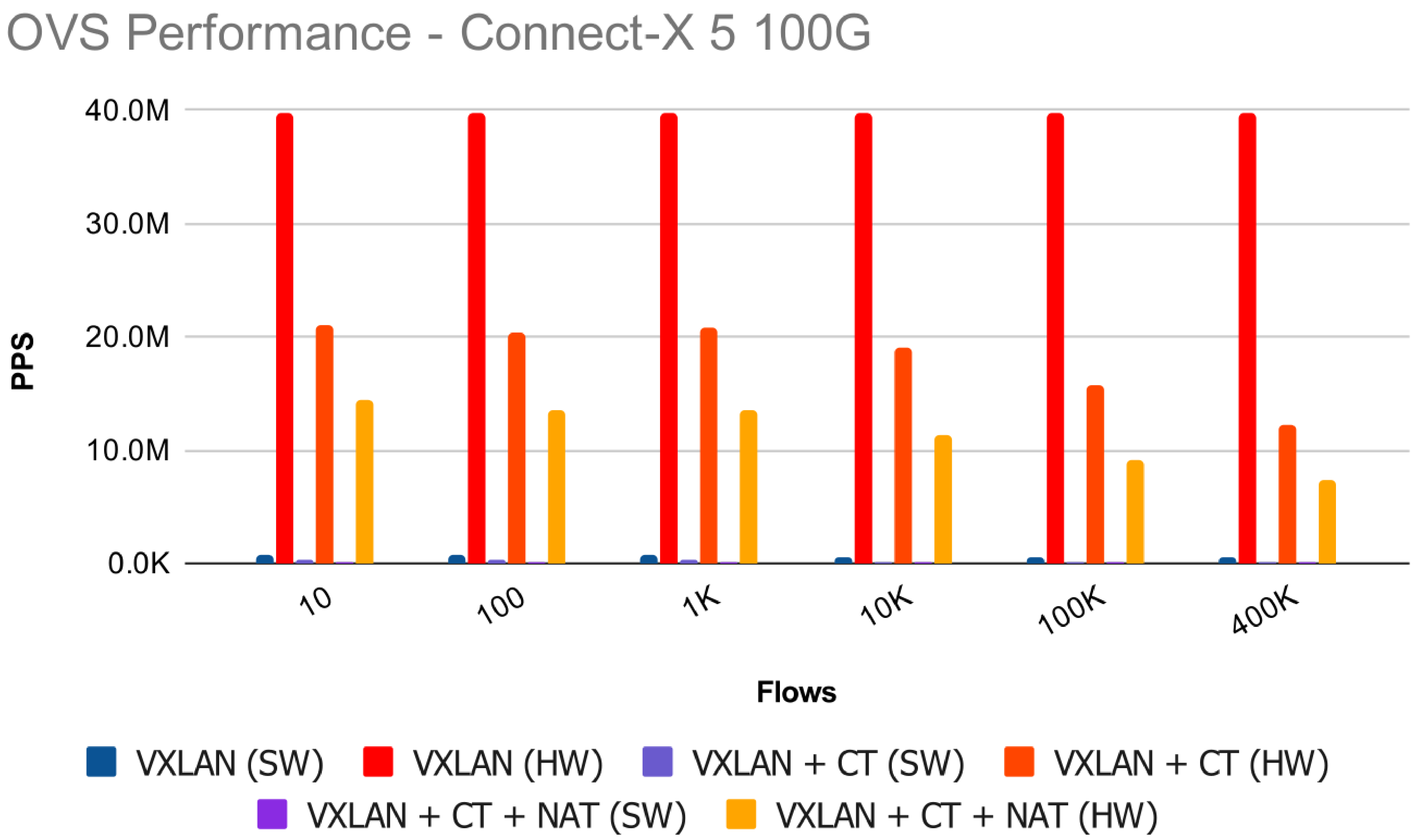
The challenge of data plane platforms



Performance

Flexibility

Hardware offload performance



HW offloads system integration

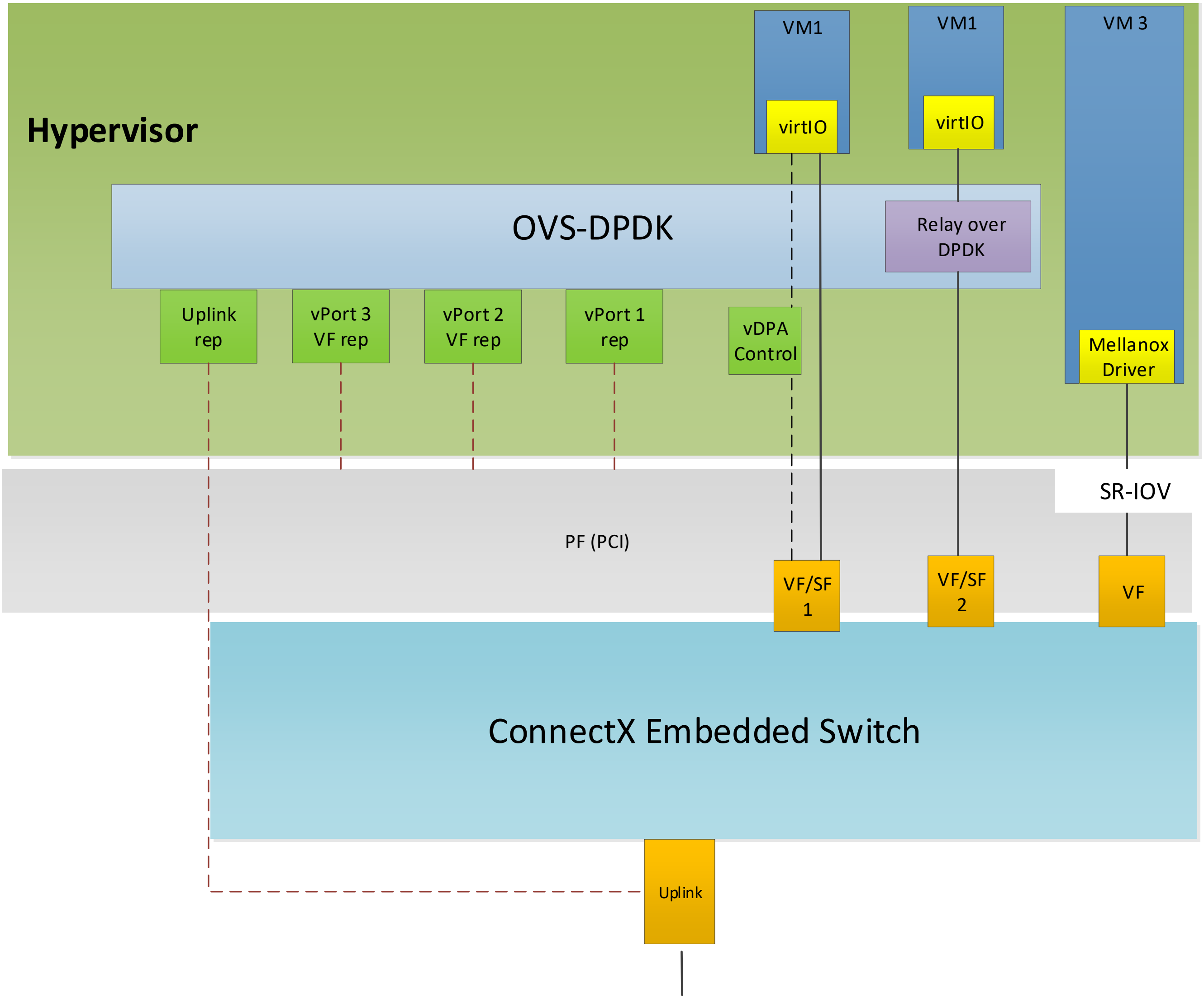
- SR-IOV
  - Bare metal performance

- vDPA SW mode - VirtIO SW acceleration
  - No vendor driver on the Guest OS
  - Native live migration support
  - High scale

new

- vDPA HW mode - VirtIO offload
  - ConnectX 6DX, Bluefield , Bluefield 2

new



HW offload in OVS

```
ovs-vsctl set Open_vSwitch . other_config:hw-offload=true
```

- Flow add/delete/stats events are forwarded to HW offload thread
  - Kernel offload using TC
  - DPDK offload using rte_flow

HW offload control plane

```
recirc_id(0),in_port(3),eth(src=24:8a:07:a5:28:02,dst=24:8a:07:a5:28:01),eth_type(0x0800) actions:2
```

```
tc filter add dev ens1f0_1 ingress protocol ip chain 0 prio 3
flower dst_mac 24:8a:07:a5:28:01 src_mac
24:8a:07:a5:28:02 action mirred egress redirect dev
ens1f0_0
```

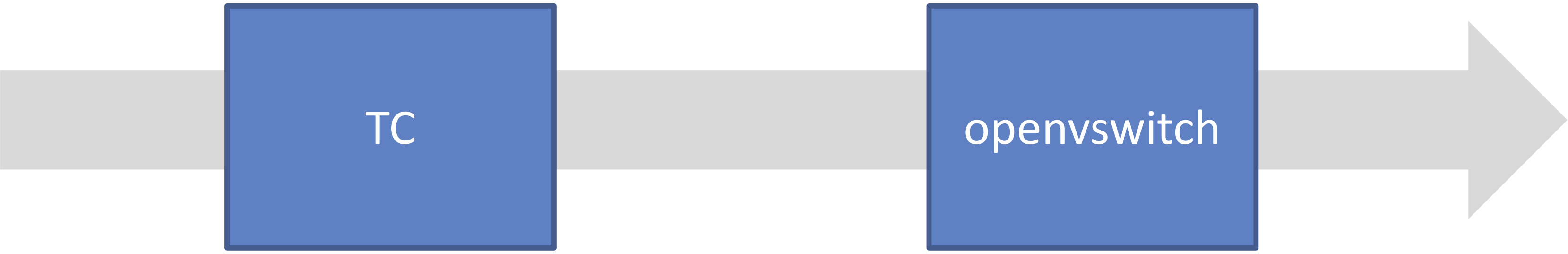
- OVS data plane rules are converted to TC filters
  - TC is used to configure *Traffic Control* in the Linux kernel
  - One component is a packet classifier
  - The flower classifier is a flow based filter

```
flow create 1 ingress transfer pattern eth src is
24:8a:07:a5:28:02 dst 24:8a:07:a5:28:01 type is 0x0800 /
/ end actions port_id id 0 / end
```

- OVS data plane rules are downloaded to the NIC via rte_flow API

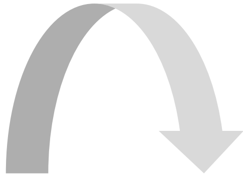
Netlink netdev – data plane

- TC filters are processed ***before*** openvswitch
  - The openvswitch kernel driver hooks to the rx_handler



```
tc filter add dev ens1f0_1 ingress protocol ip chain 0
prio 3 flower
        dst_mac 24:8a:07:a5:28:01
        src_mac 24:8a:07:a5:28:02
        ip_flags nofrag
        action mirred egress redirect dev ens1f0_0
```

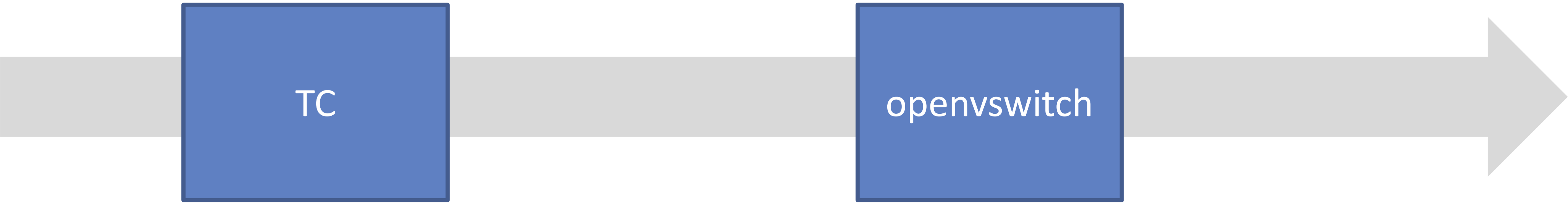
```
recirc_id(0),in_port(3),eth(src=
24:8a:07:a5:28:02,dst=24:8a:0
7:a5:28:01),eth_type(0x0800),i
pv4(frag=no) actions:2
```



Netlink netdev – data plane

With recirculations (e.g. CT)

- TC filters are processed ***before*** openvswitch
  - The openvswitch kernel driver hooks to the rx_handler



recirc_id(0), in_port(4),ct_state(-trk),eth(),eth_type(0x0800),ipv4(proto=6,frag=no), actions:ct(zone=1),recirc(0x9)

tc filter add dev ens1f0_0 ingress prio 1 chain 0 proto ip flower src_mac 24:8a:07:a5:28:01 ip_flags nofrag ct_state -trk action ct zone 1 pipe action **goto chain 9**

TC_SKB_EXT
new

Recirc_id = 9

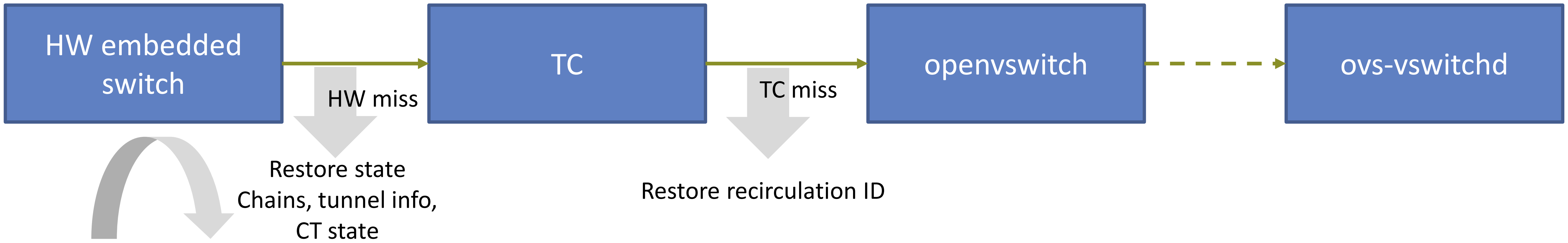
recirc_id(9),in_port(4),ct_state(+trk+new), eth(),eth_type(0x0800),ipv4(proto=6,frag=no), actions:ct(zone=1,commit), 2

Netlink netdev data plane processing pipeline

- Packet is processed by openvswitch
  - HW offload is disabled
  - OVS/TC limitation

- Packet is processed by TC
  - NIC vendor limitation

- Packet is partially processed by TC
  - Recirculation was partially offloaded



DPDK netdev offload

- Currently only partial offload is supported
  - Rules matches are marked in HW
  - HW marks are associated with netdev filters

- Add full offload support
  - Matches and actions are performed in HW

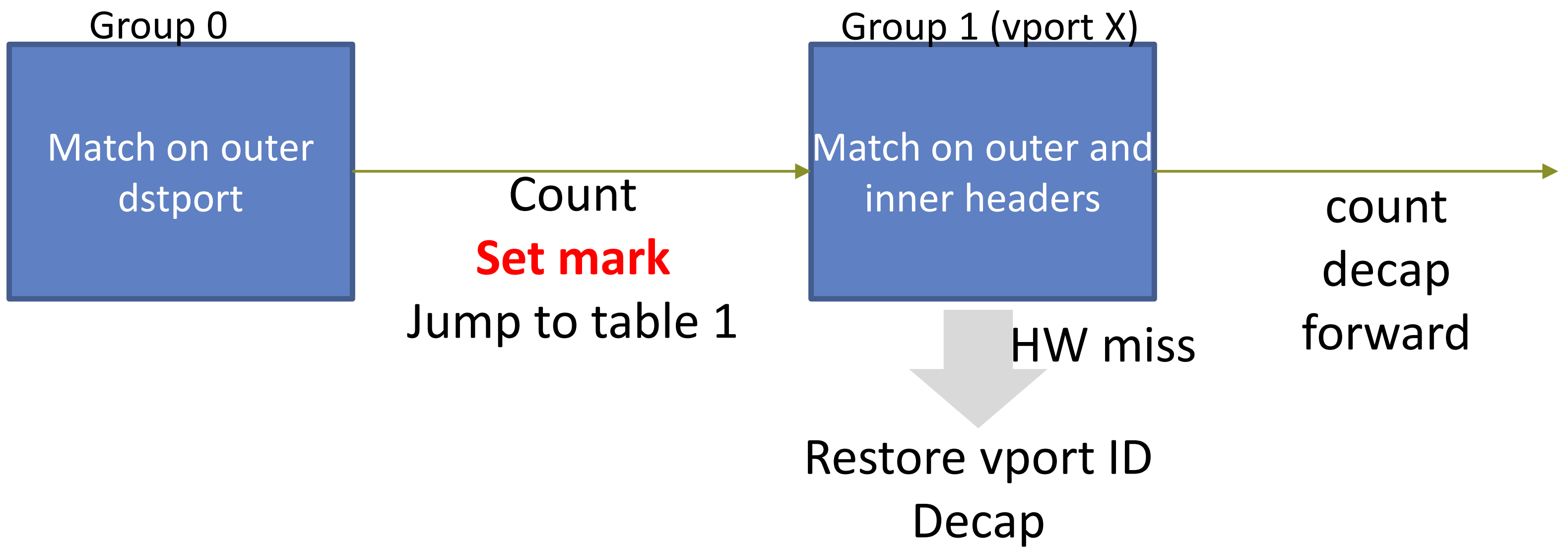
DPDK

DATA PLANE DEVELOPMENT KIT

DPDK Netdev - tunnels offload

- Tunnel encapsulation translates to a single raw_encap action
- Tunnel decapsulation is composed of 2 flows
  - br_phy flow – Classify tunnel (e.g. UDP port match), decap and (implicit) recirc
  - br_int flow – The application flow

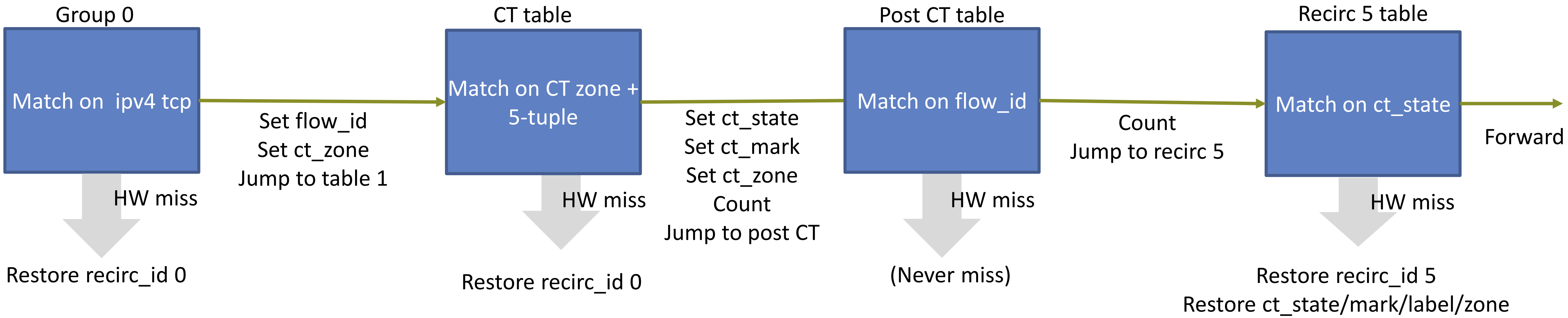
- Realize the HW model when offloading tnl_pop action
  - Map tunnel vport to a HW group
  - HW registers (DPDK mark, meta, tags) are required for multi-table state



DPDK netdev connection tracking offload

- Multi table architecture
- Query and restore flow state information using mark, meta and tags

```
recirc_id(0),in_port(2),ct_state(-trk),eth_type(0x0800),ipv4(proto=6,frag=no), actions:ct(zone=1),recirc(0x5)
recirc_id(0x5),in_port(2),ct_state(+new+trk),eth_type(0x0800),ipv4(proto=6,frag=no), actions:ct(commit,zone=1),3
recirc_id(0x5),in_port(2),ct_state(+est+trk),eth_type(0x0800),ipv4(proto=6,frag=no), actions:3
```



Takeaways

- HW offload is the way to get high performance in OVS
- HW offload supports sriov and virtio
- HW offload will not break system logic - Misses on HW will be handled by software
- HW offload is added incrementally based on SW platform and NIC vendor support
- Kernel datapath HW offload integration uses TC
  - HW model is implemented in the vendor driver
- DPDK datapath HW offload integration uses rte_flow
  - HW model is implemented in OVS

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Thank You