

High Performance NFV Infrastructure (NFVI): DPDK Host Applications with Neutron/OpenStack and VNF Acceleration

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SPEED MATTERS

Telecom - The technology behind



Telecom - The technology behind



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Proprietary hardware

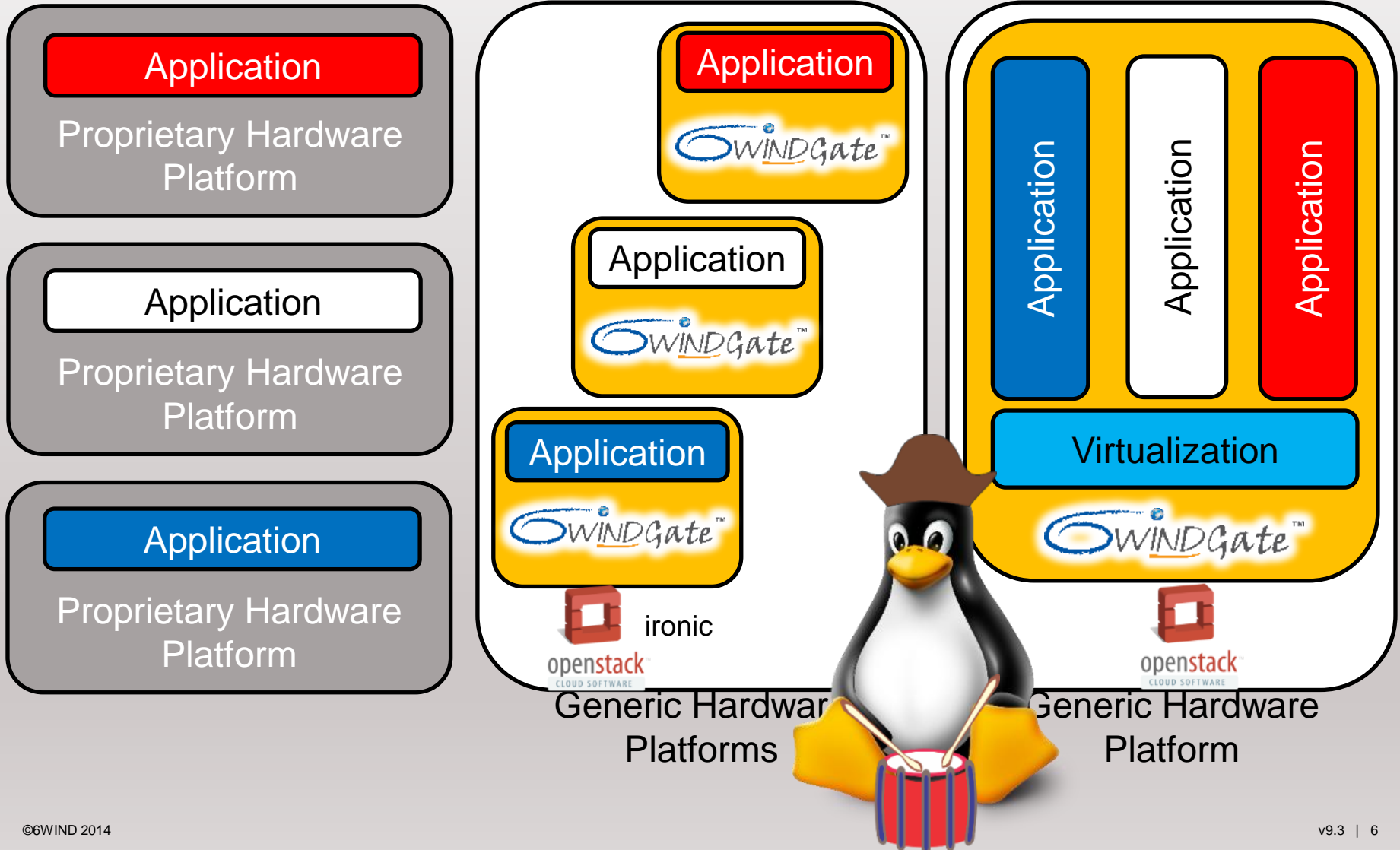


Telecom - The technology behind

Full re-deployment for each new generation.



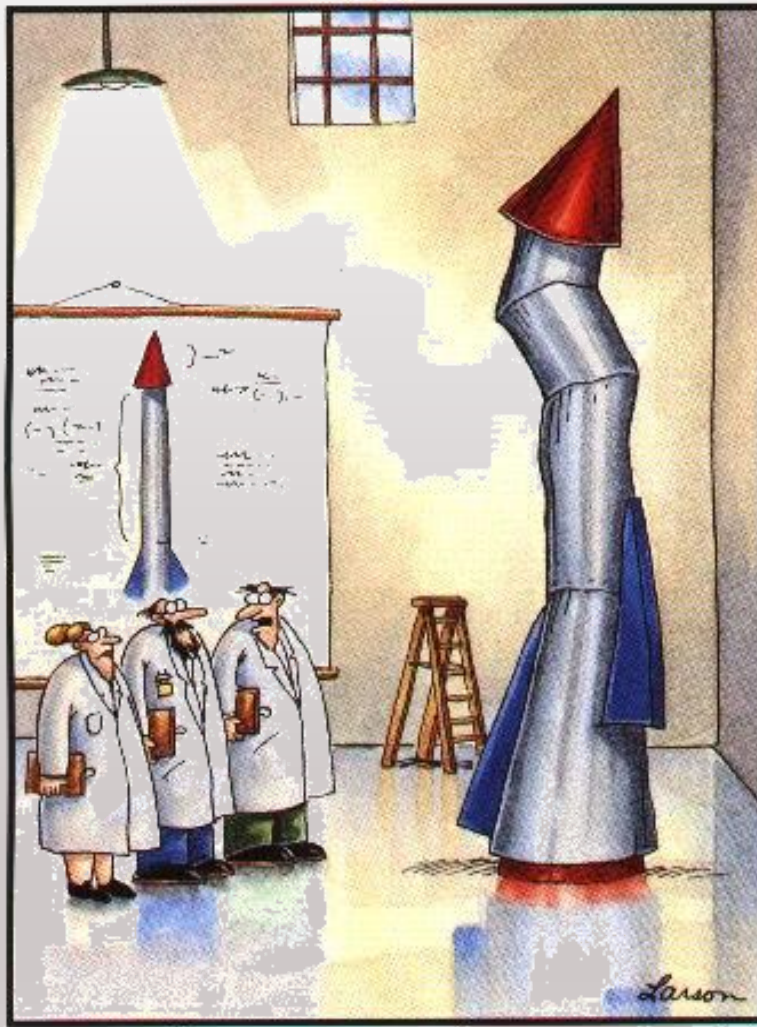
Network Architecture Transformation Towards NFV



SDN – 2 lines

1. **SDN : freedom of ability to create any networks and their overlays**
 2. **Troll: is an Openflow HW/ASIC switch a SDN equipment?**
 - How to support any new “what if”? => wait and buy a new switch
-
- **SDN != NFV , but SDN can be made of VNF & NFVI**

... but SysOps/DevOps virtualizing their networks...



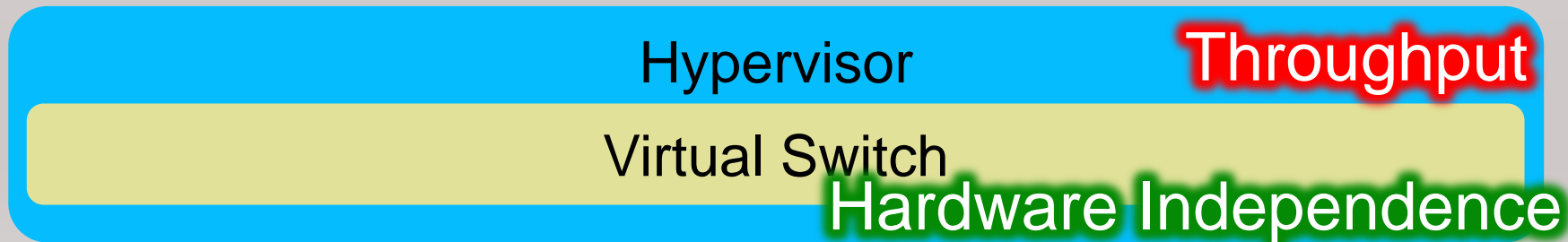
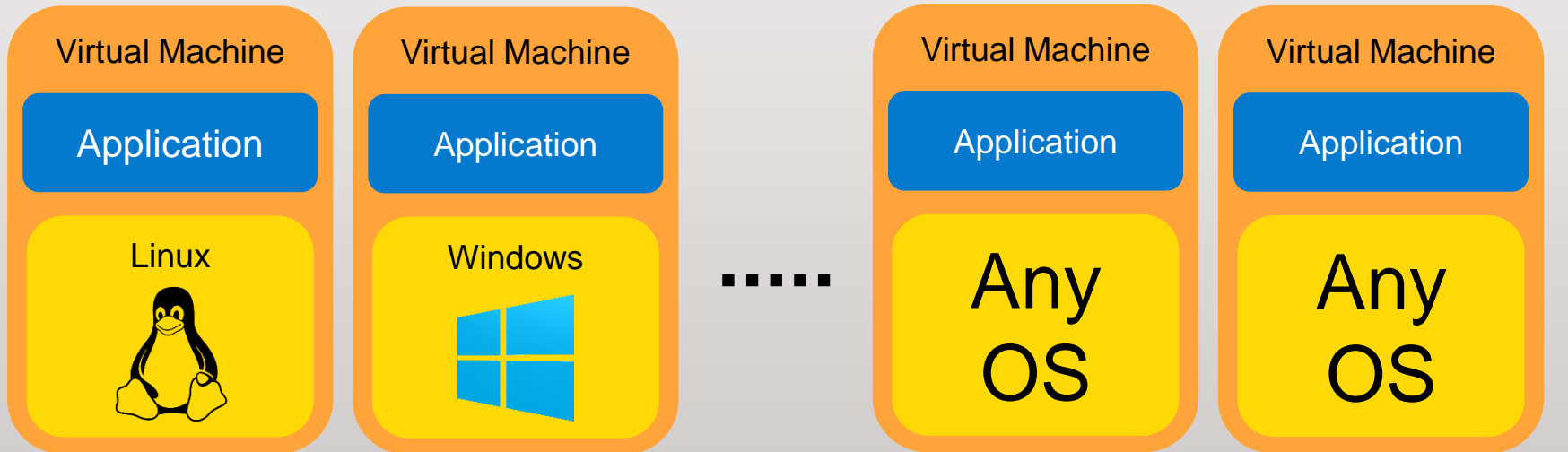
Where is my network performance?

"It's time we face reality, my friends. ...
We're not exactly rocket scientists."

Performance first



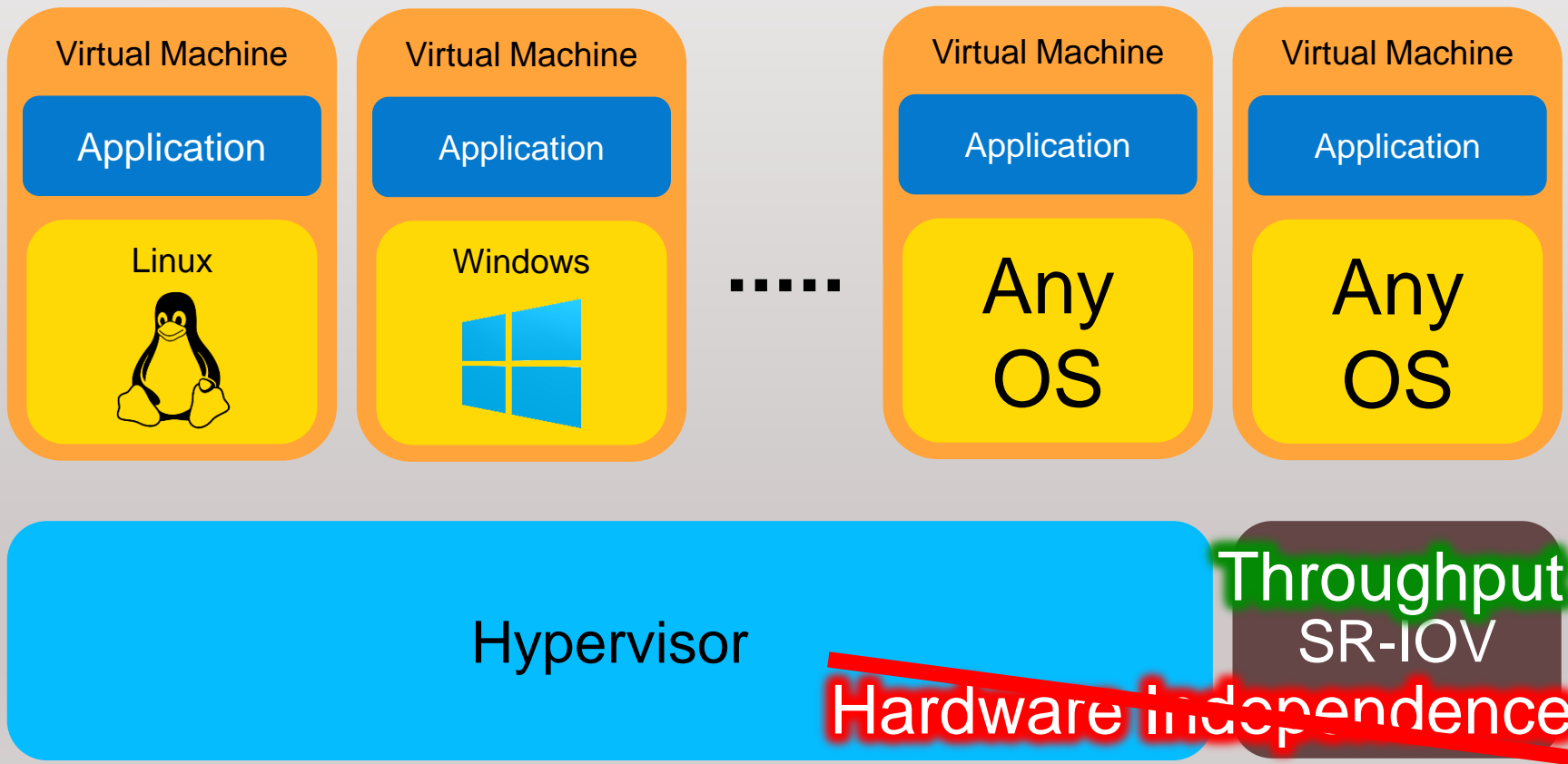
High Performance East-West Communications



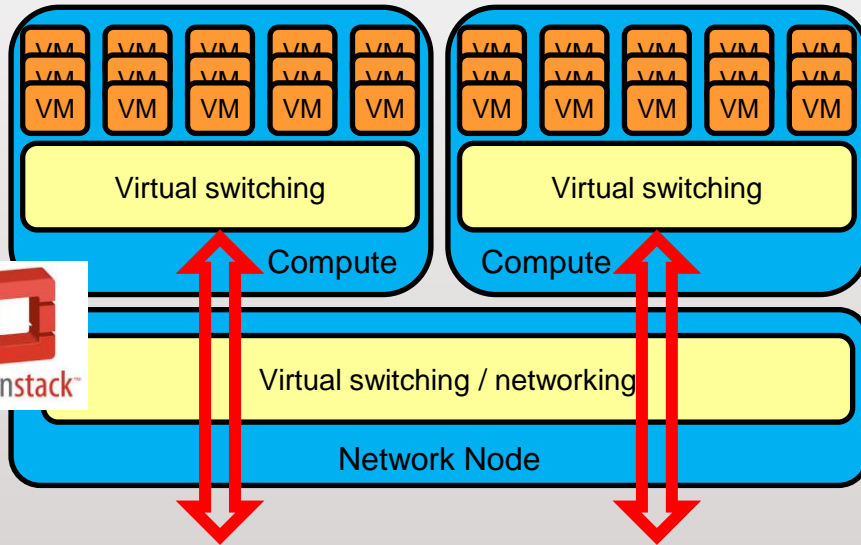
What if SRIOV?

or what if XYZ PCI passthru technologies?

High Performance East-West Communications



Data Center Virtualization Use Case



- **Number of VMs is limited by virtual switching / networking capacity in both compute and network nodes**

NFV / ETSI Simplified Architecture

Virtual Network Functions (VNFs)

VNF

VNF

VNF

VNF

VNF

Network Functions Virtualization Infrastructure (NFVi)

Virtual
Compute

Virtual
Storage

Virtual
Network

Virtualization Layer

Compute

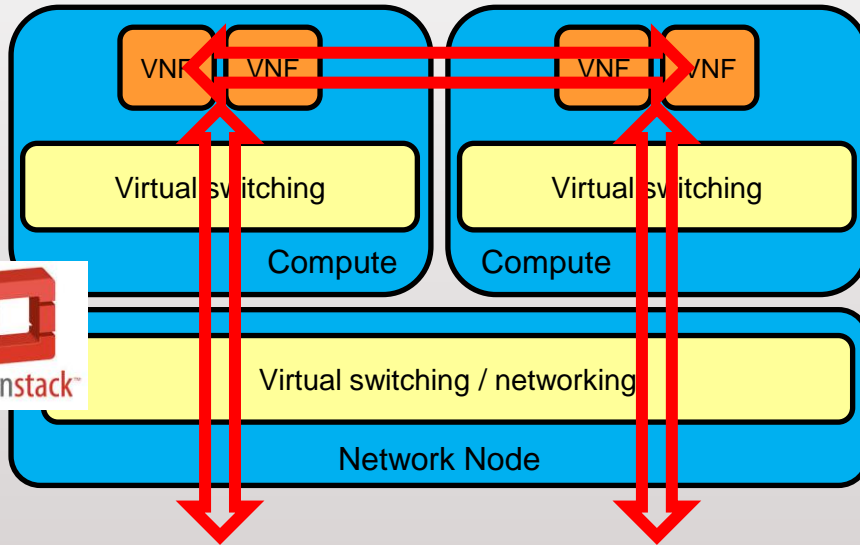
Storage

Network

Hardware resources

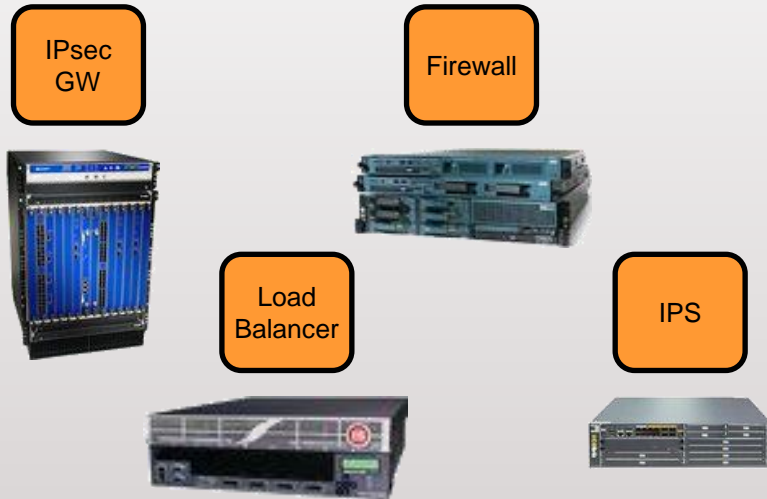
NFV Management
and Orchestration

Network Function Virtualization Use Case



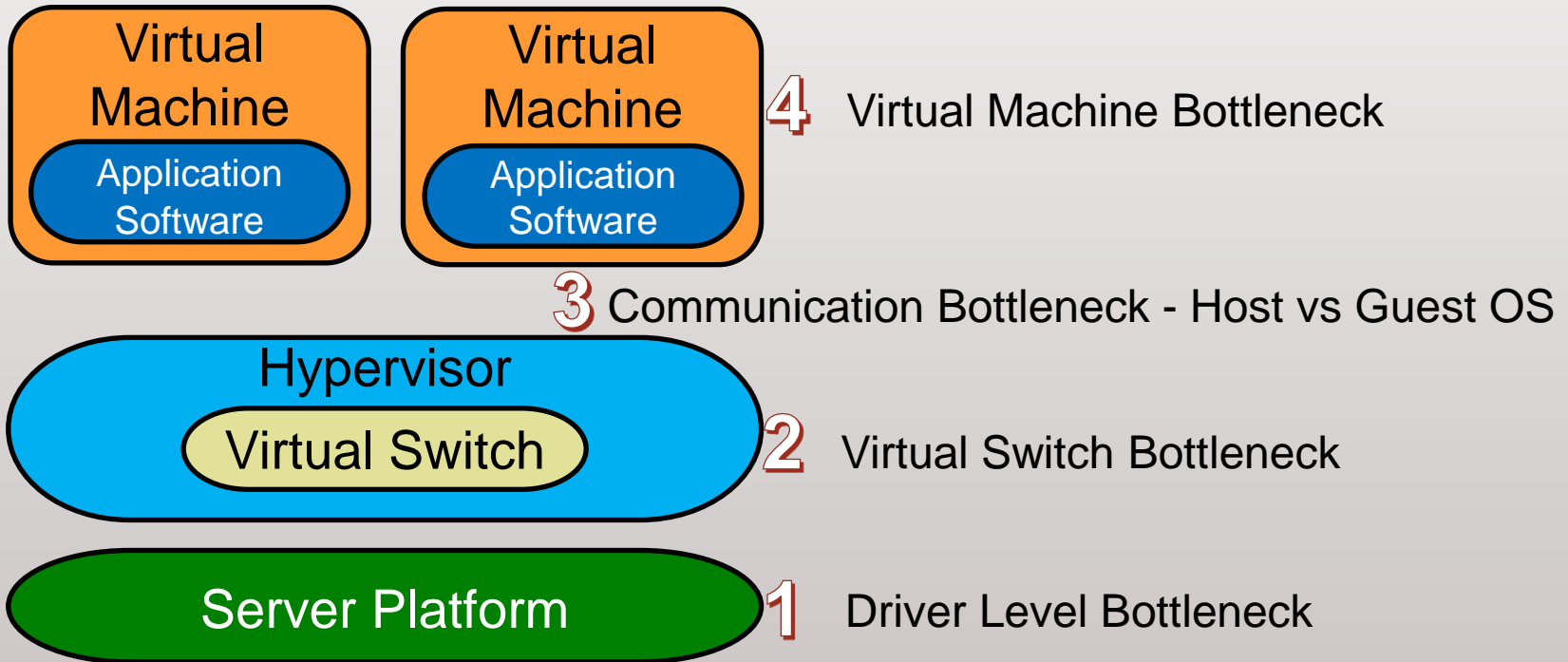
- VNF (North-South) and service chain (East-West) throughput is limited by Linux virtual switching / networking capacity

Appliance Virtualization Use Case



- **Appliance is based on specialized architectures**
 - Rigid
 - High development costs
 - Long TTM

Typical NFV Performance Bottlenecks



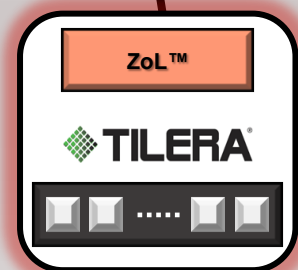
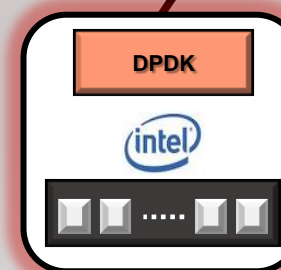
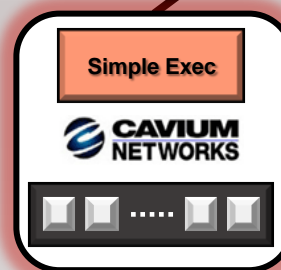
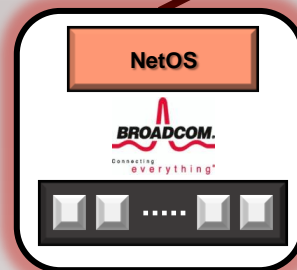
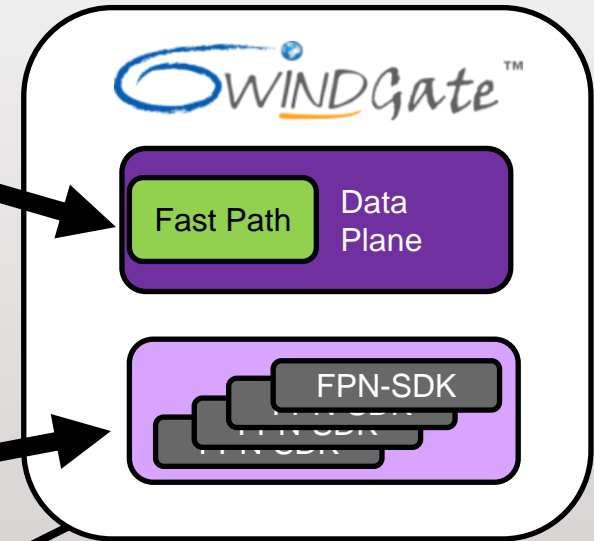
6WINDGate for Industry-Leading Processor Platforms

Architecture-independent "Fast Path Modules"

- Generic, processor-independent source code
- Cycle-level and pipeline-level optimizations

Architecture-specific "Fast Path Networking SDK"

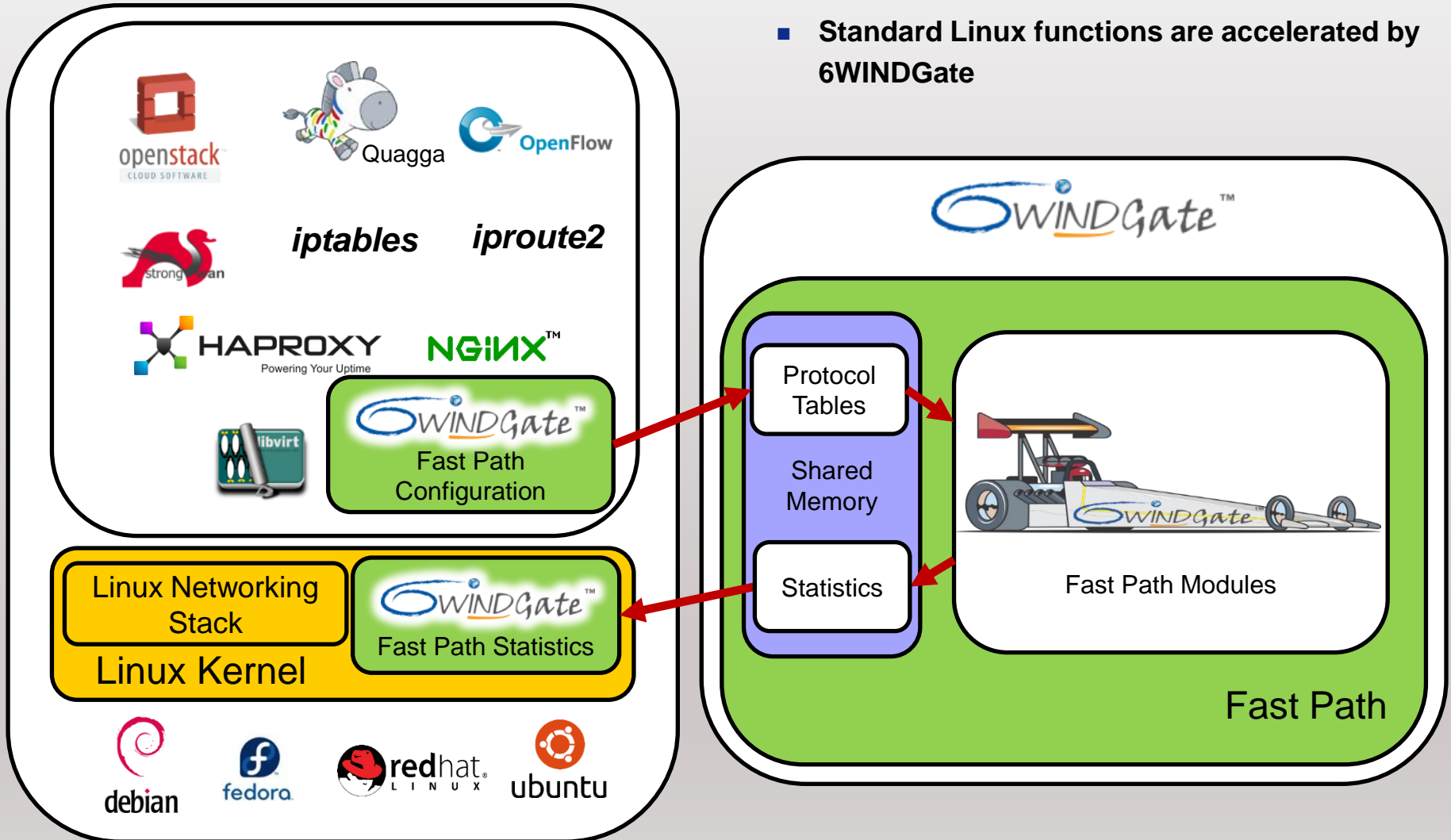
- Zero-overhead API for fast path modules
- Support for processor-specific features and resources
- Leverages processor suppliers' SDKs



Linux Compatibility is Critical

Linux Acceleration via 6WINDGate

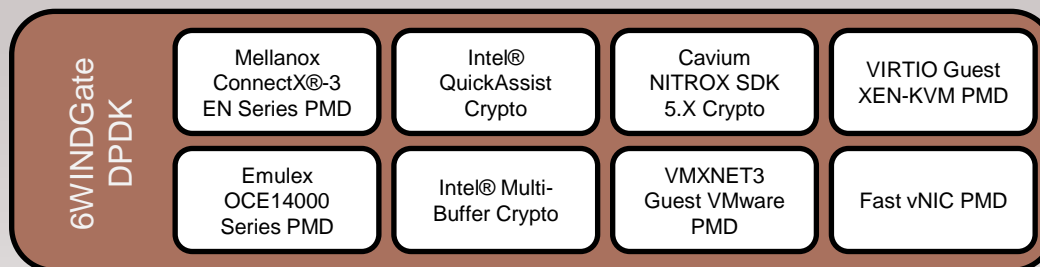
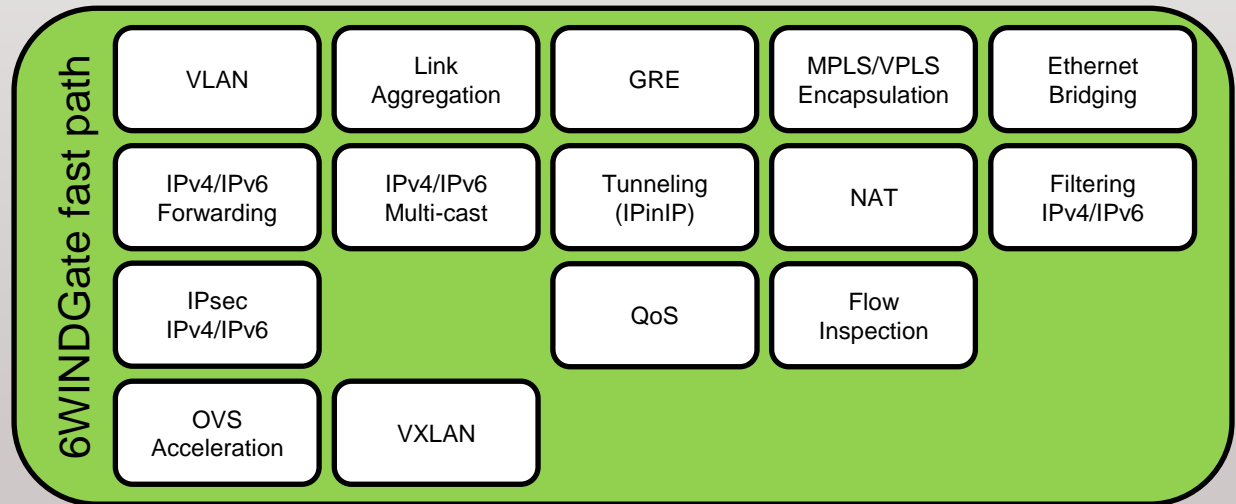
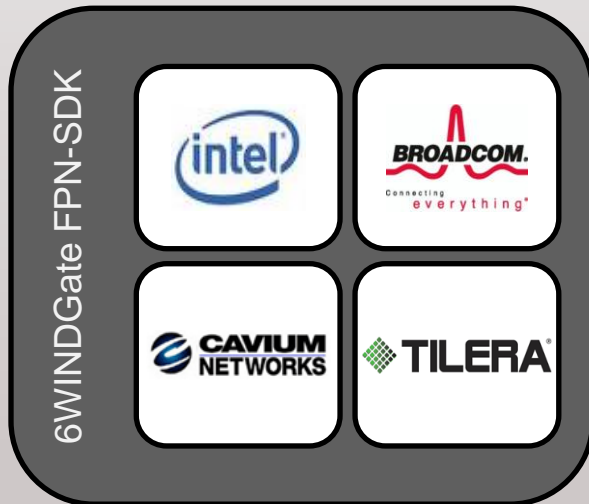
- Standard Linux functions are accelerated by 6WINDGate



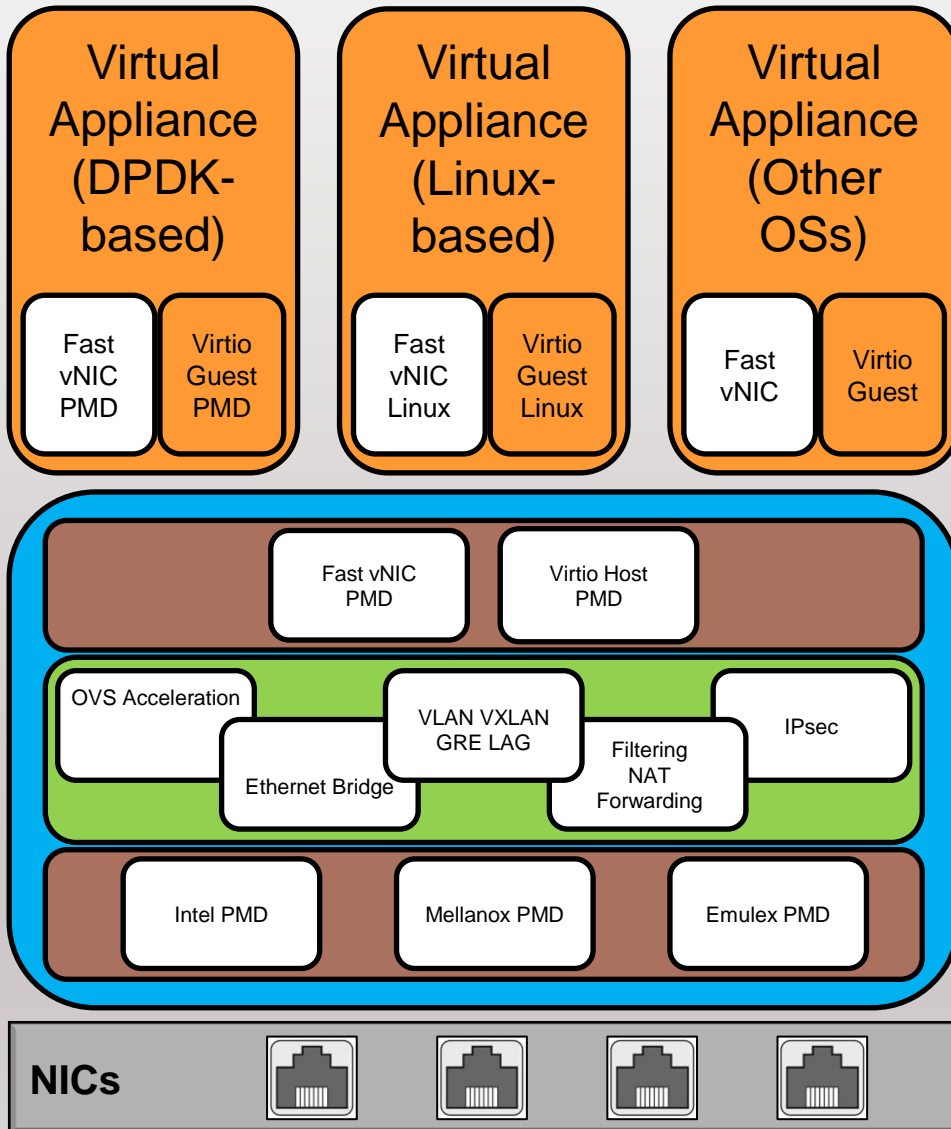
Neutron's protocols – strong needs for a fast path



Say no to proprietary plugins
Say no to SRIOV to be SDN ready.
Accelerate Neutron



6WINDGate Extensions to Virtualization



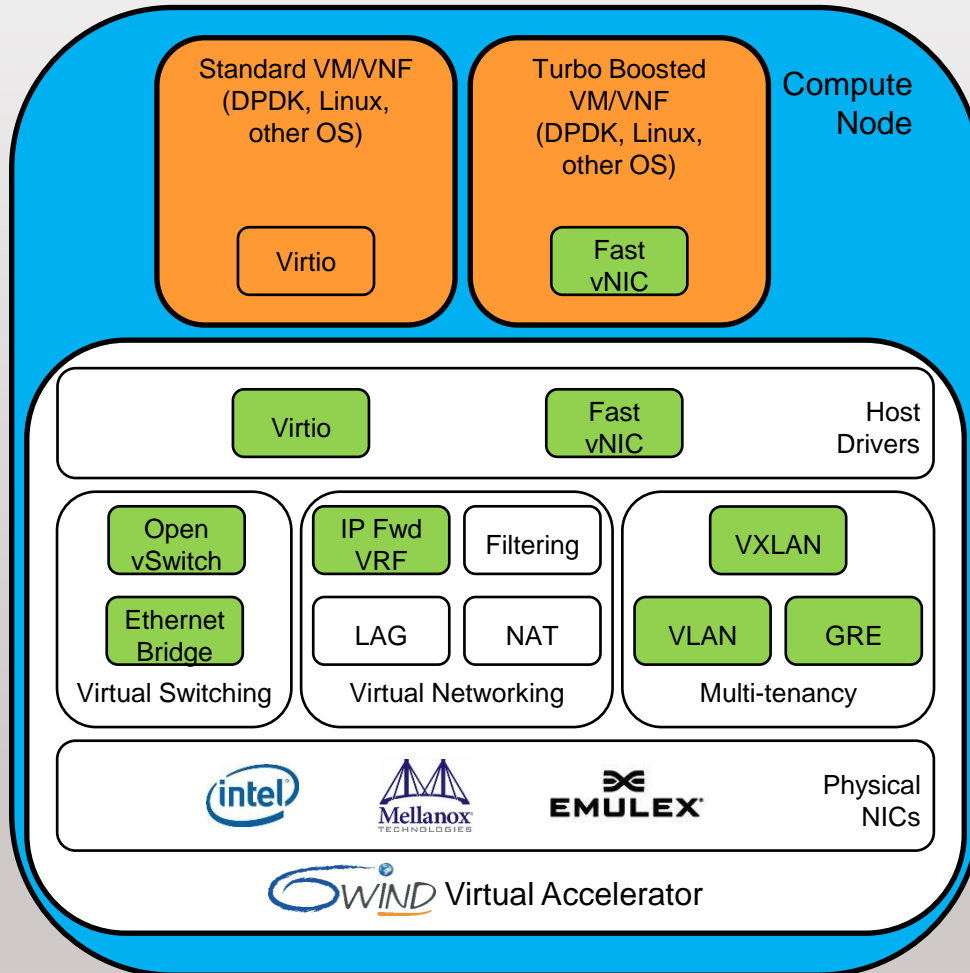
Drivers for Virtual Appliance

- 6WIND drivers for high performance communications
- Standard drivers for existing Virtual Appliances
- Extensible for all OSs

Virtual Acceleration

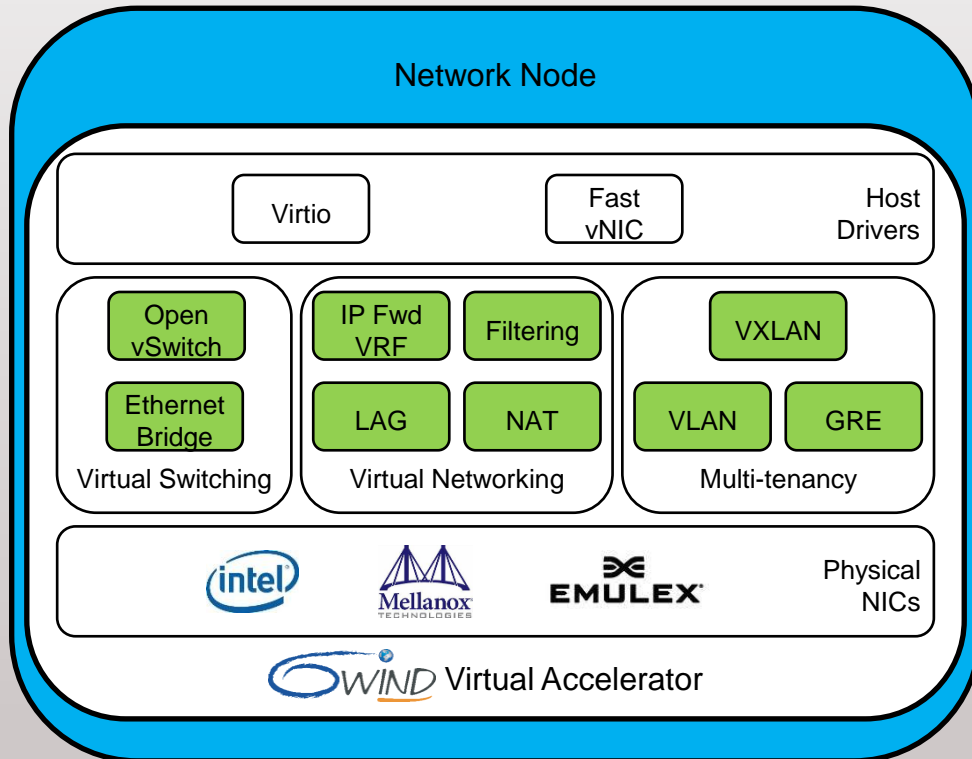
- 6WIND drivers for high performance communications
- Accelerated virtual switch and bridging
- Extended network services
- Dpdk.org with multi-vendor NIC support

6WIND Virtual Accelerator in OpenStack Compute Node



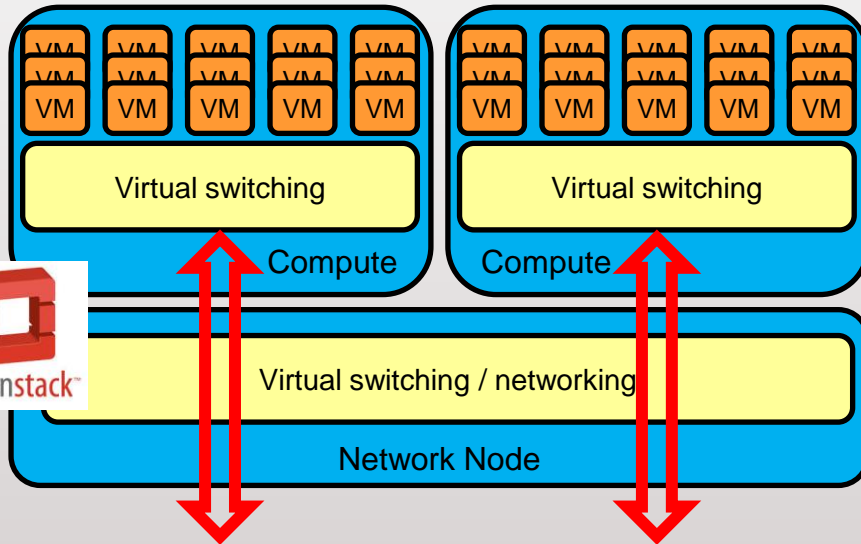
- **240Gbps 6WIND Virtual Accelerator throughput on 12 cores of Xeon E5-2697 v2 @ 2.70GHz**
- **1 core provides a 20Gbps Virtual Accelerator bandwidth**
- **Examples on a dual socket / 24 cores server**
 - 120Gbps North-South traffic delivered to standard VMs or VNFs with 12 cores remaining for VMs
 - 40Gbps North-South traffic with 20 cores remaining for VMs
 - 40Gbps North-South traffic and 160 Gbps East-West traffic for service chaining with 3 Turbo Boosted VNFs

6WIND Virtual Accelerator in OpenStack Network Node



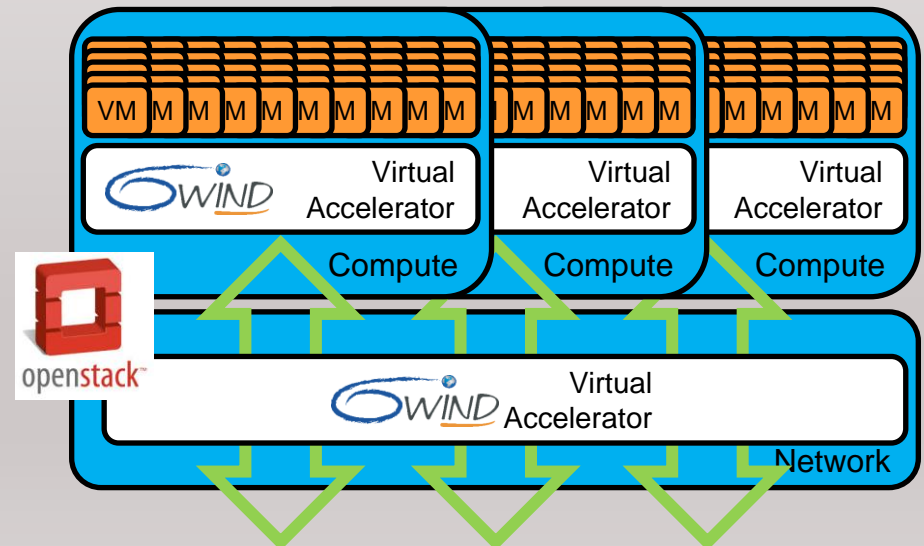
- **255Gbps 6WIND Virtual Accelerator throughput on 8 cores of Xeon E5-2697 v2 @ 2.70GHz**
- **1 core provides a 30 Gbps Virtual Accelerator bandwidth**
- **Examples**
 - 40Gbps North-South traffic on a dual socket / 24 cores server hosting both Network and Compute Node on 6 cores, with 18 cores remaining for VMs
 - 240Gbps North-South traffic on a single socket / 8 cores server feeding six 40Gbps Compute Nodes, each hosting a 3 Turbo Boosted VNFs service chain

Data Center Virtualization Use Case

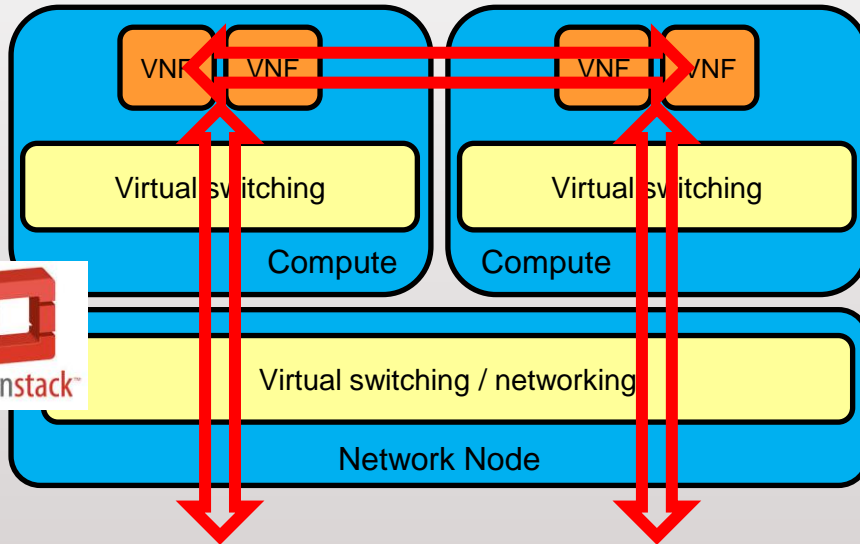


- Number of VMs is limited by virtual switching / networking capacity in both compute and network nodes

- 6WIND Virtual Accelerator removes Linux performance bottlenecks and enables high VM density without any change to the environment

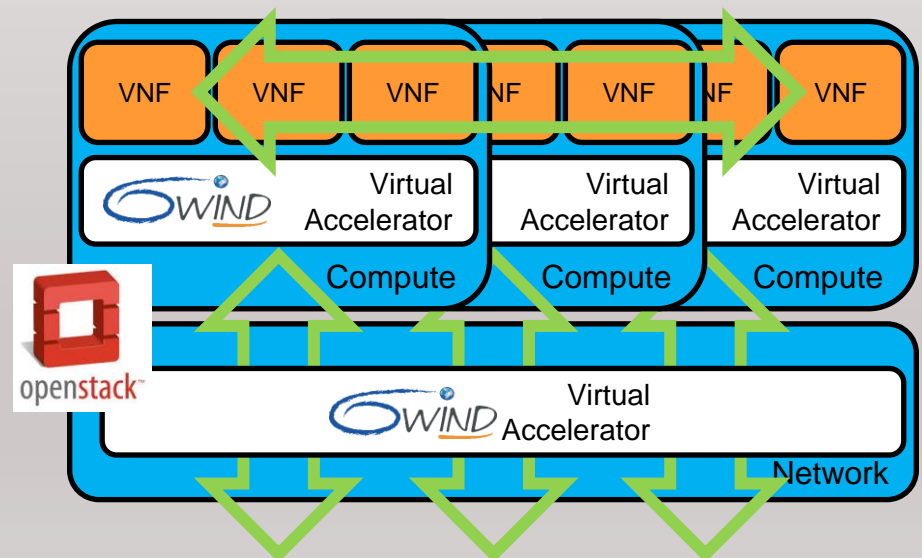


Network Function Virtualization Use Case



- **6WIND Virtual Accelerator removes Linux performance bottlenecks and maximizes North-South and East-West throughput with higher VNF density without any change to the environment**

- **VNF (North-South) and service chain (East-West) throughput is limited by Linux virtual switching / networking capacity**



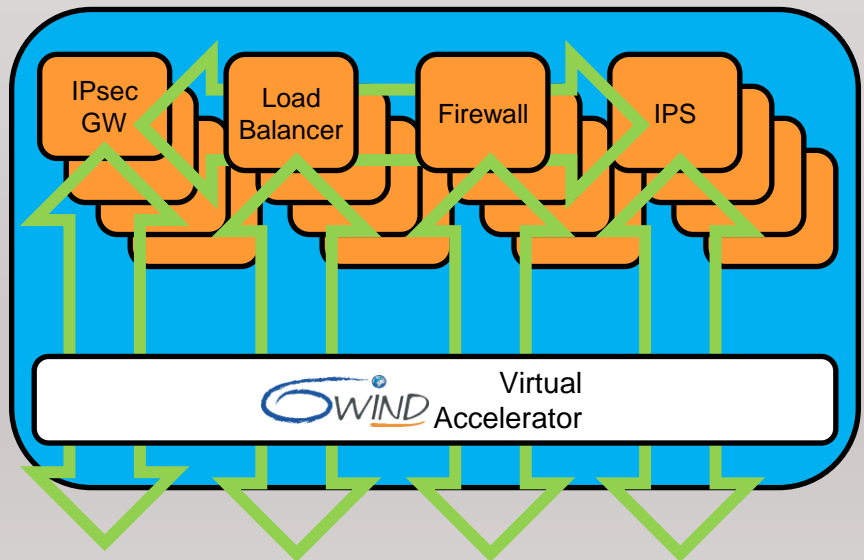
Appliance Virtualization Use Case



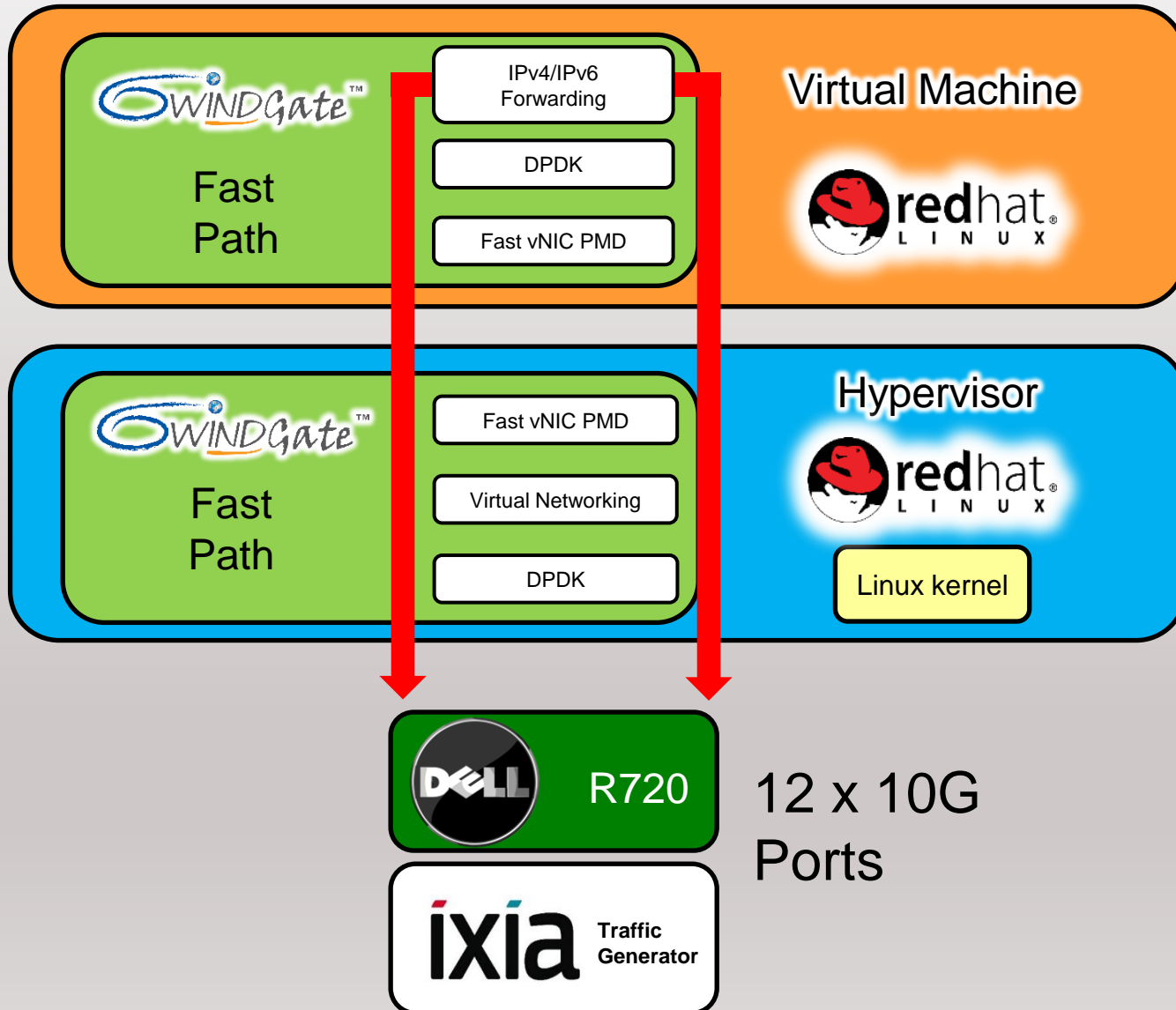
- **Appliance is based on specialized architectures**

- Rigid
- High development costs
- Long TTM

- **6WIND Virtual Accelerator removes Linux networking performance bottlenecks on standard servers and enables flexibility brought by virtualization**



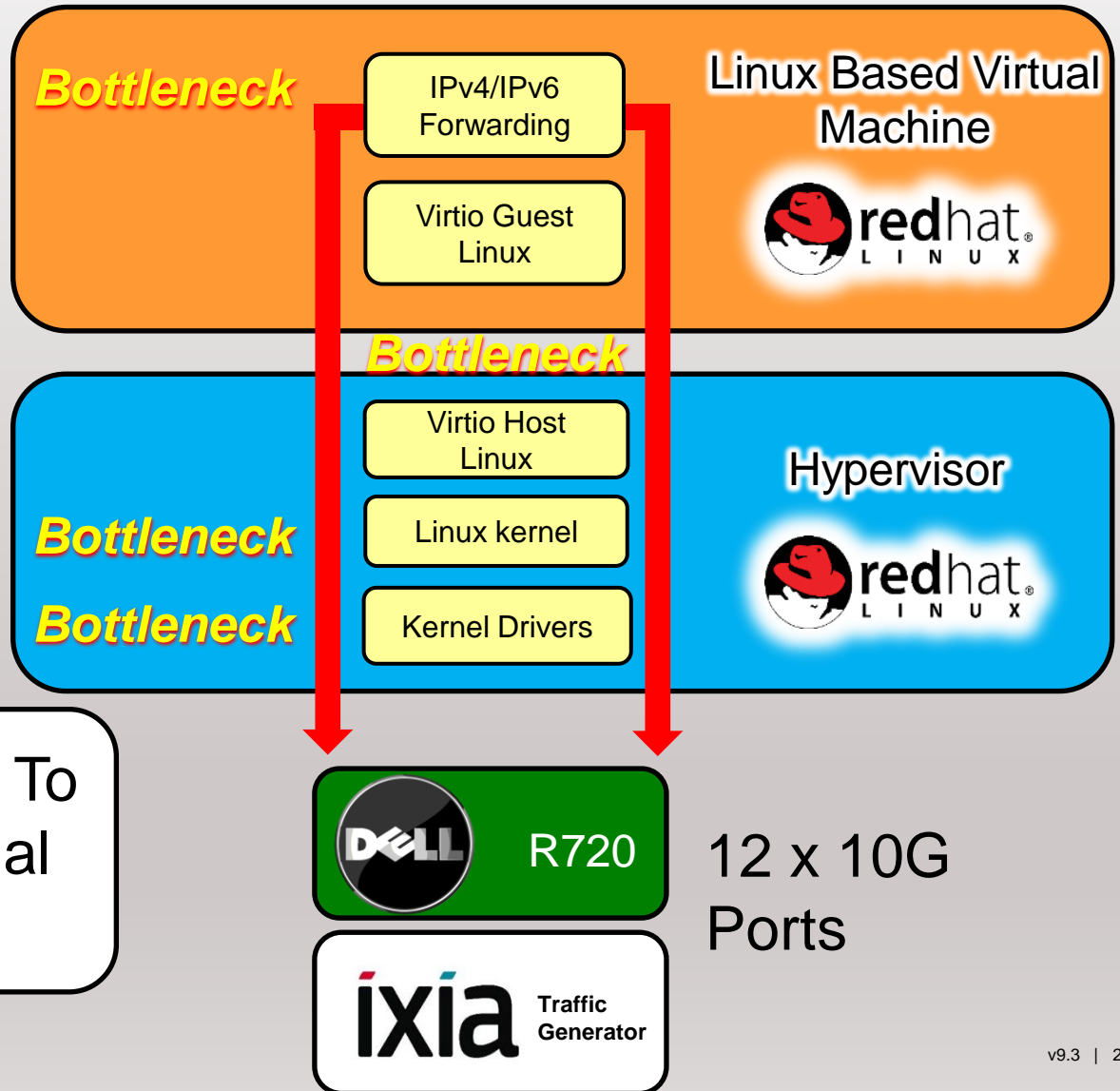
6WINDGate NFVI + VM Performance Comparison



Test 1: Standard Open vSwitch + Virtio

L2 Throughput

7.2 Gbps



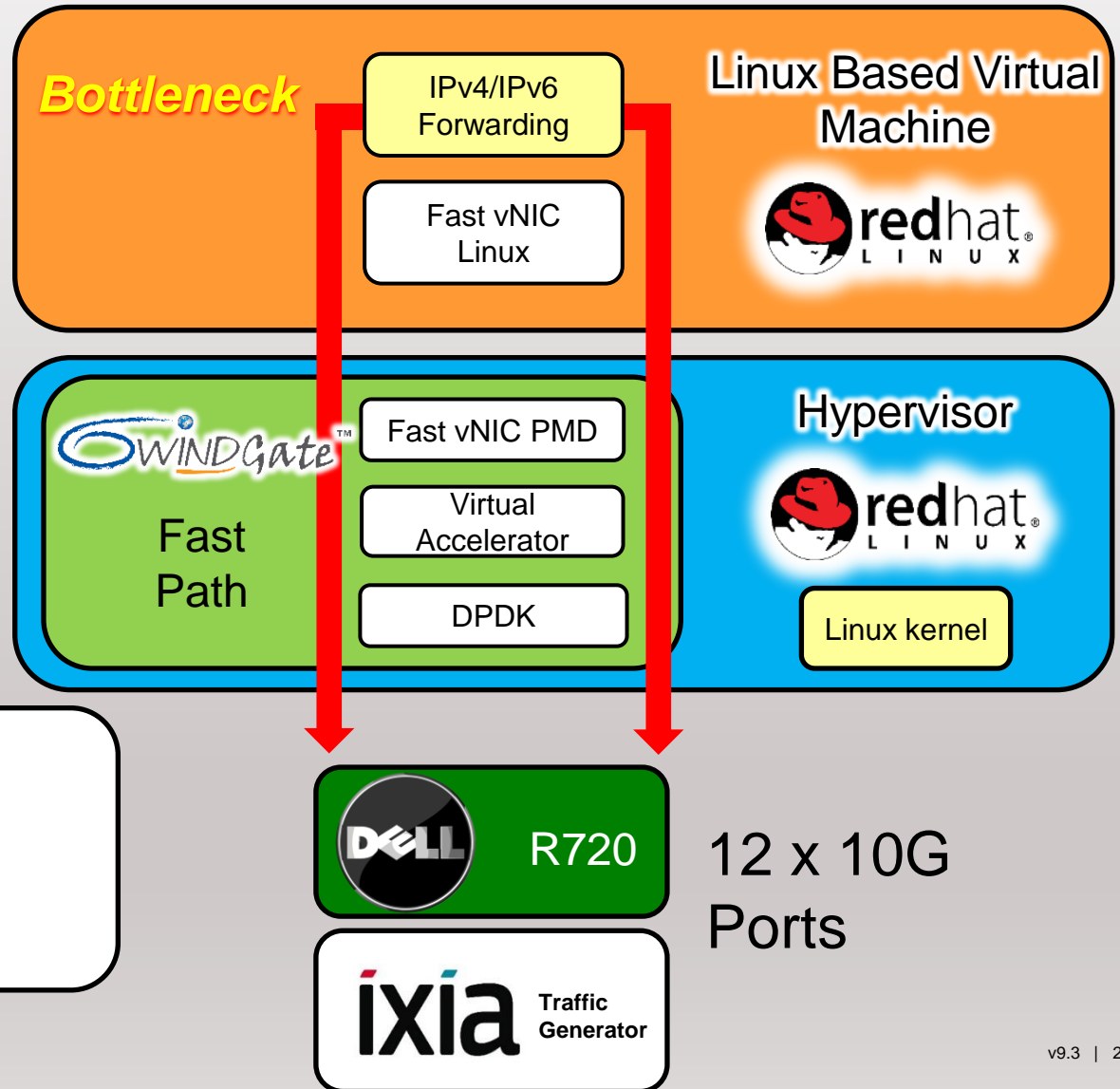
Limited Bandwidth To
Linux Based Virtual
Machines

Test 2:

6WINDGate OVS Acceleration + Fast vNIC Linux

L2 Throughput

7.2 Gbps
59.2 Gbps



9X Throughput
Performance
Increase

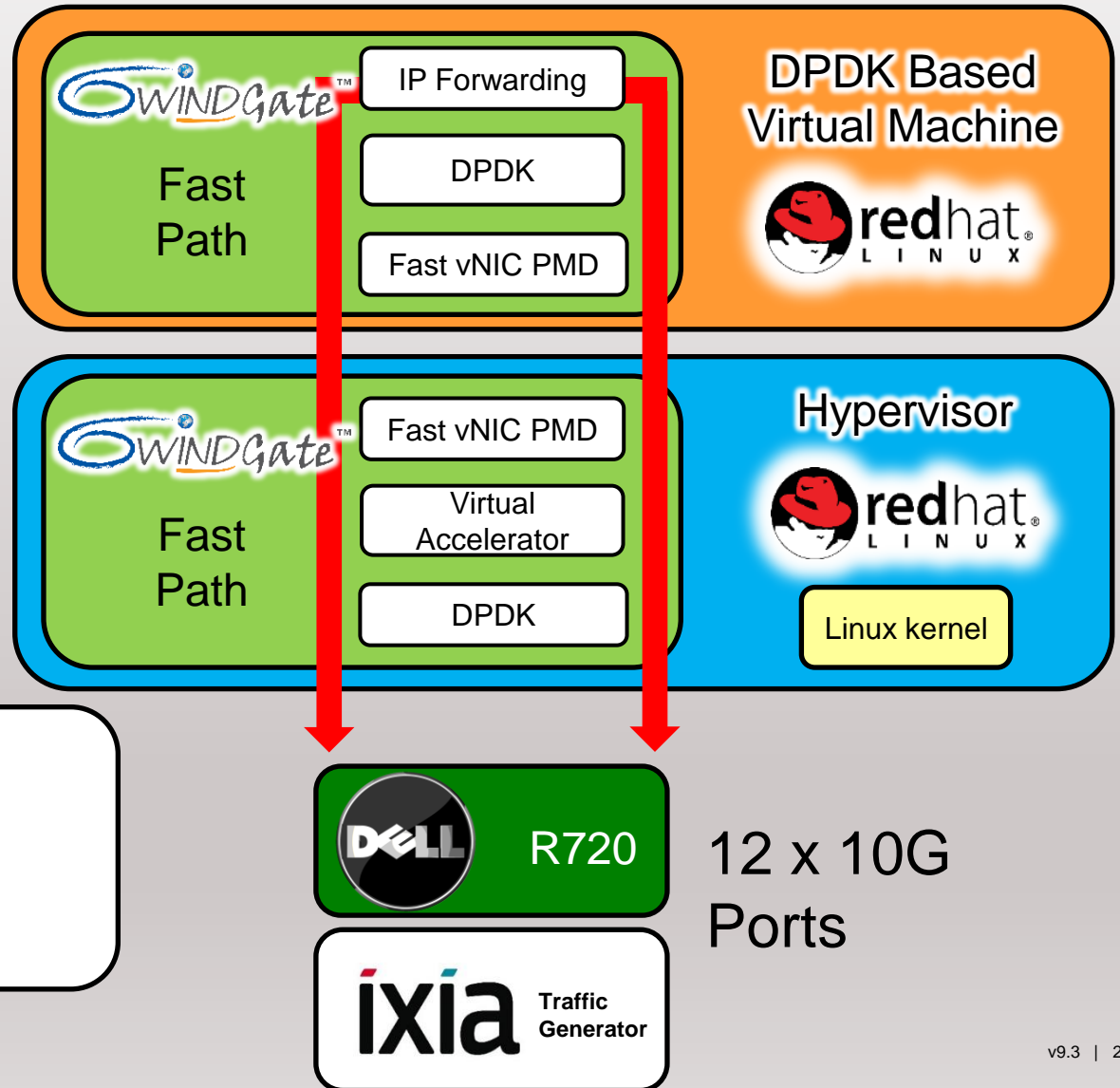
12 x 10G
Ports

Test 3:

6WINDGate OVS Acceleration + Fast vNIC PMD

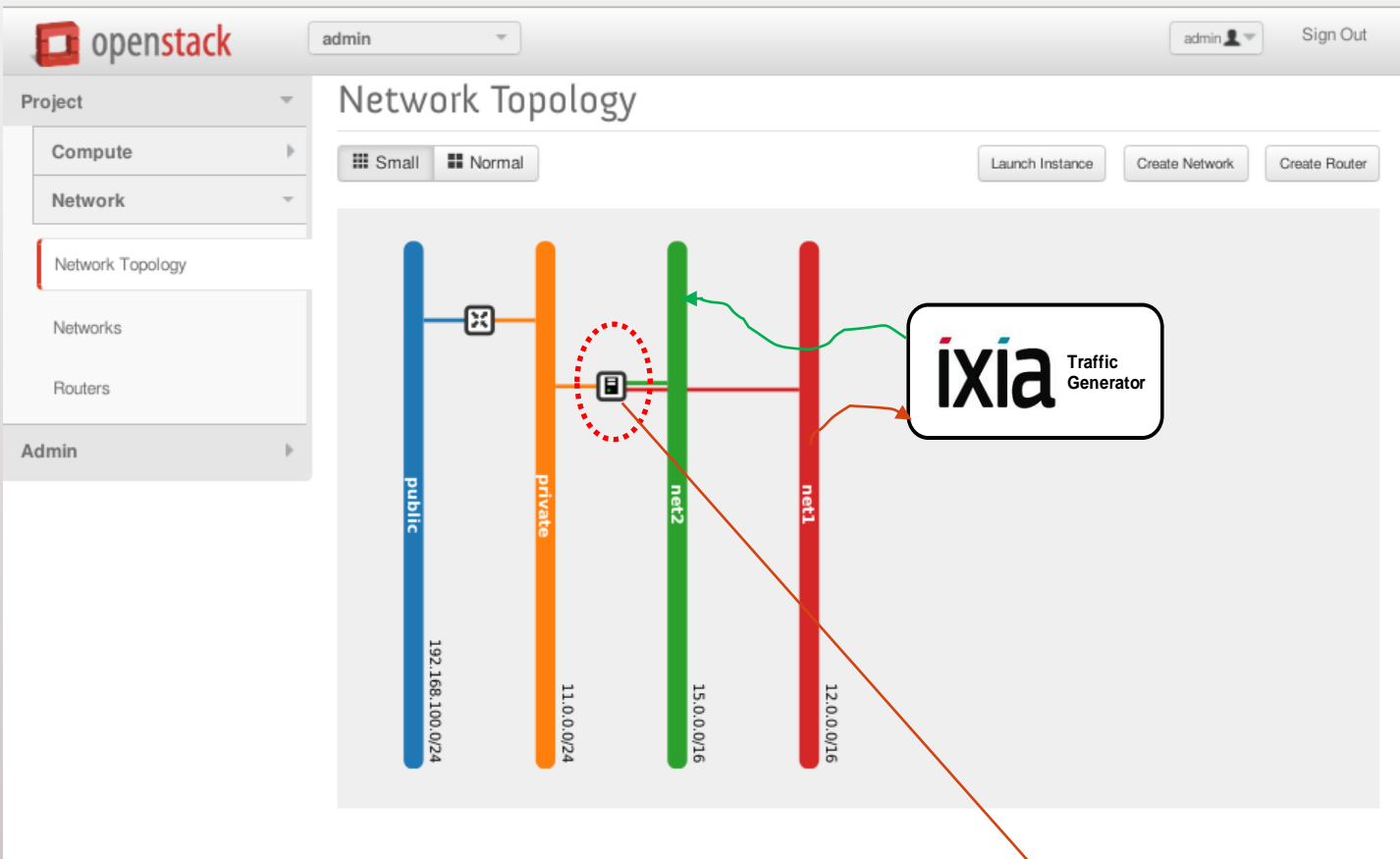
L2 Throughput

7.2 Gbps
59.2 Gbps
118.4 Gbps



Wire Speed Performance

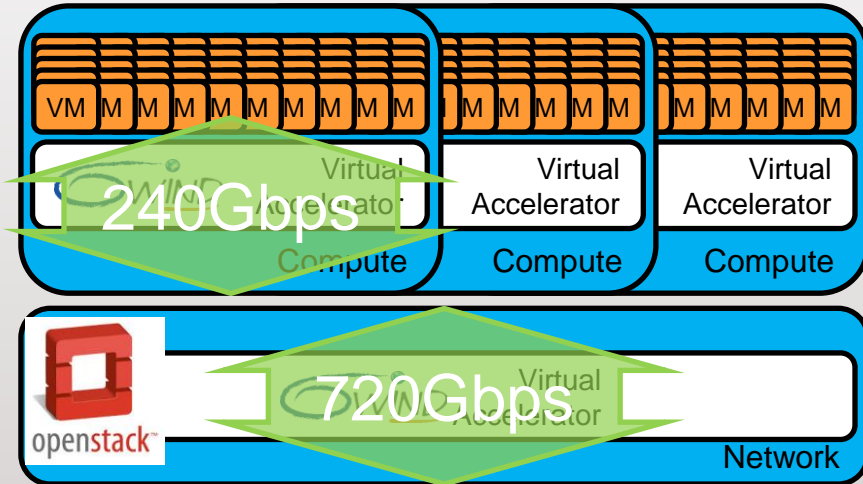
Compute nodes with 6WINDGate, Openstack-horizon



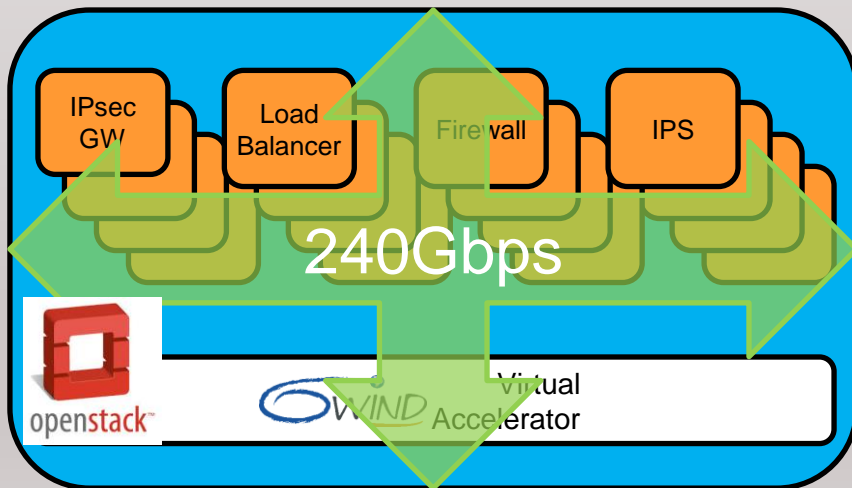
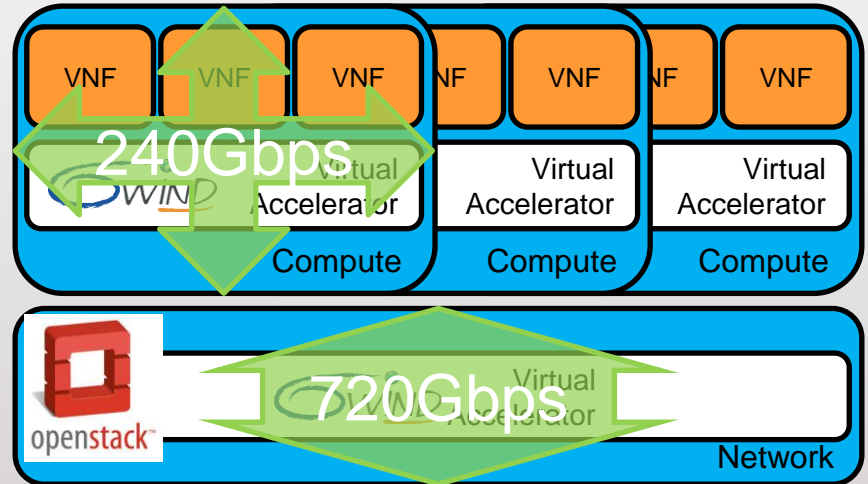
Compute node/host:
yum install 6windgate*.rpm
systemctl enable 6windgate.service

6WIND Virtual Accelerator Performance Summary

For Data Center Virtualization



For Network Function Virtualization



For Appliance Virtualization

- Servers are dual socket Xeon E5-2697 v2 @ 2.70GHz (12 cores per socket)
- Independently of HW constraints (number of ports per socket for example)

SPEED MATTERS

Turbo Boost Linux

The OEM Advantage



Unlock Hidden Performance
Reduce Time-To-Market
Enable Transition To SDN / NFV

L2-L4 Acceleration
IPsec VPN Gateways
TCP / UDP Termination
Virtual Switching
DPDK
And More...

 **WINDGate™**

Packet Processing Software
Up To 10X Network Performance

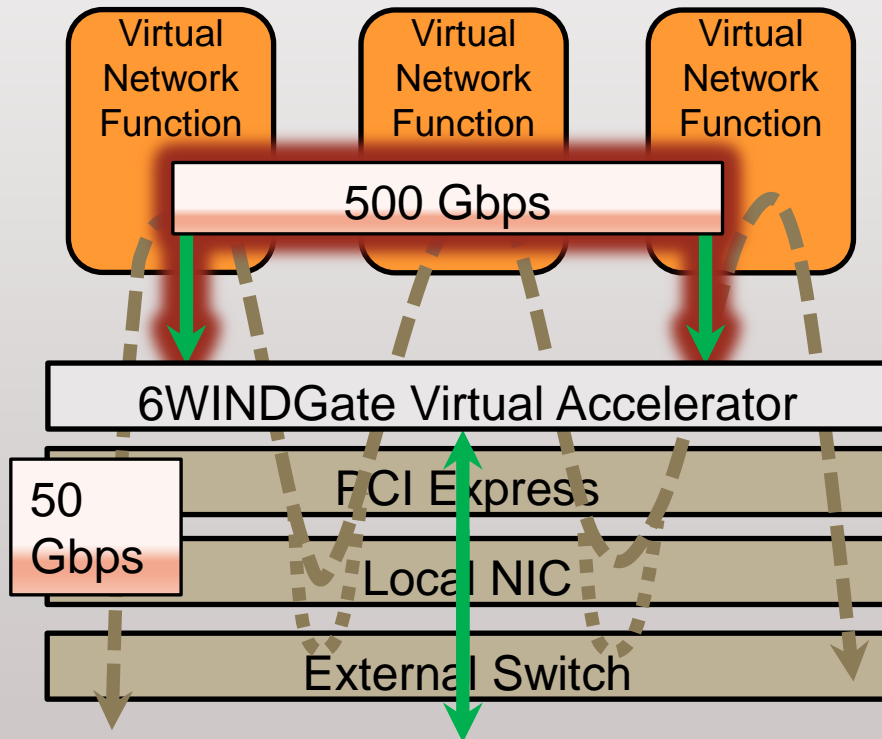
Increase Data Plane Performance
No Change To Linux Environments
Portable Across All Major Platforms
Support Extensive Set Of Protocols



backup

Virtual Accelerator

Lowest Latency and Flexible Chaining



6WINDGate Virtual Accelerator

- Hardware independent virtual switching (NIC driver)
- Aggregate 500 Gbps bandwidth with low latency
- No external limit to number of chained VNFs
- DPDK ready

Physical Switching Limitations

- Hardware dependent switching (SR-IOV, RDMA, NIC embedded switching)
- Throughput is limited by PCI Express (50 Gbps) and faces PCI Express and DMA additional latencies
- Available PCI slots limit the number of chained VNFs
- At 30 Gbps a **single** VNF is supported per node!

Introduction to NFV & and why Openstack – 1 slide

■ **NFV = Network Function Virtualization**

- How do I spawn a VM that is an IPsec router, that is a L2TP/DSL (LNS) server, that is a firewall, etc...? Instead of using a physical HW?

■ **You need network cables ...**

- Network cables => **NFVI** – Network Function Virtualization Infrastructure
 - It provides interconnect between the physical cables and the virtual network equipments that are spawned
 - L2 switch, L3 switch, ACL/Switch

■ **... and network equipments**

- Network Function (equipments) => Virtualized => **VNF** – Virtual Network Function (vNF)
 - vIPsec, vBRAS, vRouter, vFirewall, vXXX

■ **Openstack provides the framework to spawn Virtual Machines**

■ **Virtual Machines can have multiple virtual network interfaces (vmxnet3, virtio) per VM**

- `vm1# ip link show | grep virtio | wc -l`

■ **Any VMs with mutiple network interfaces can be any network nodes**

- IPsec, Firewall, Proxy

■ **To some extends, the VMs are the containers of the VNF**

- run vIPsec, vFirewall, vProxy

■ **Openstack/Neutron and Openstack/Nova VIF drivers provides the automations of the provisioning for interconnecting the VMs**

- vhost/tuntap, brctl, OVS, L3/routes

■ **To some extends, this software interconnect of VMs is the NFVI**