

eBPF based Cloud Native Load Balancer for Next Generation Workloads : LoxiLB

SEOKHWAN KONG

CONTENTS



02

**NetLOX
Introduction**

**LoxiLB Project
Introduction**



NetLOX

INTRODUCTION

New Era Service Trends

Metaverse

Self Driving

High Throughput

Low Latency

5G & CLOUD

Banking

Autonomous Robot

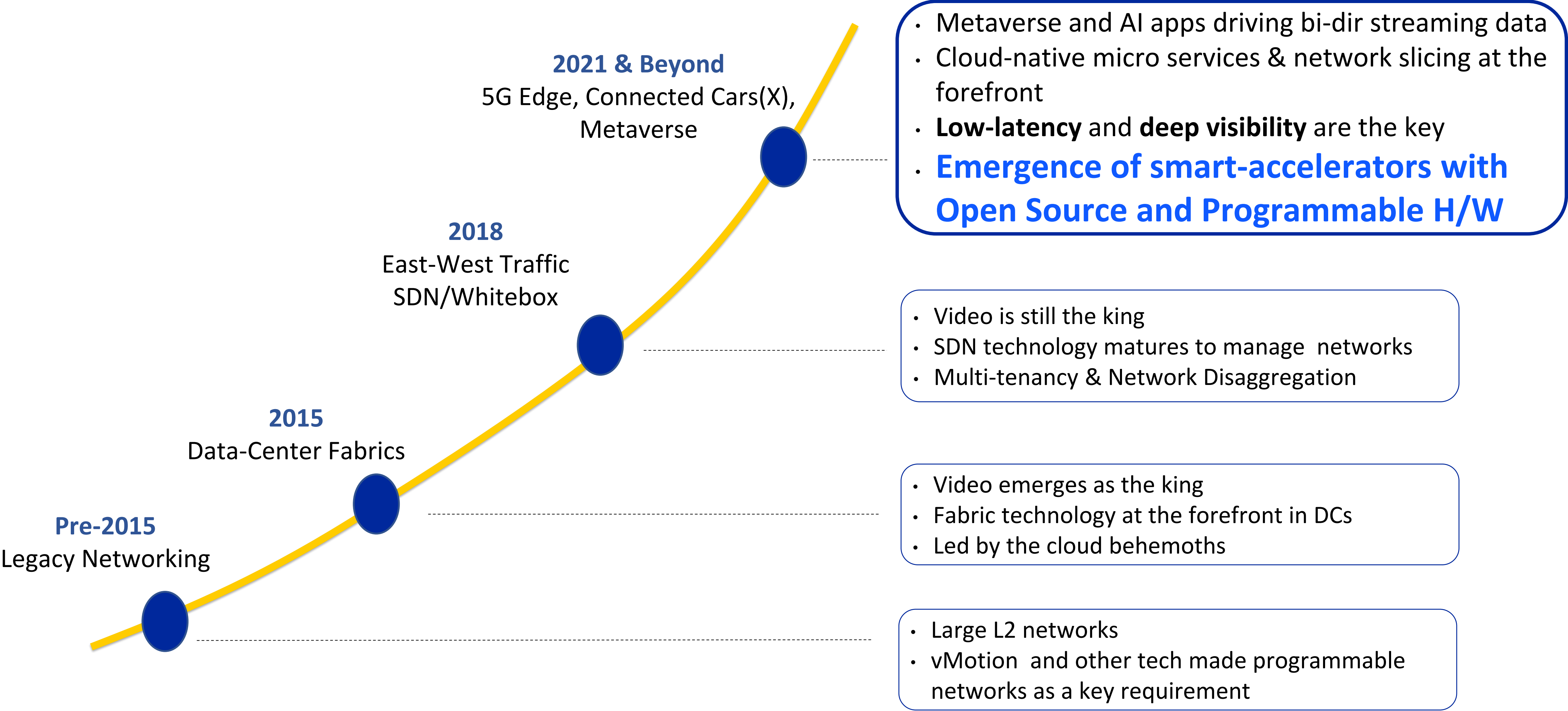


Dr. Milan Nedeljkovic
Member of the Board of Management BMW AG Production

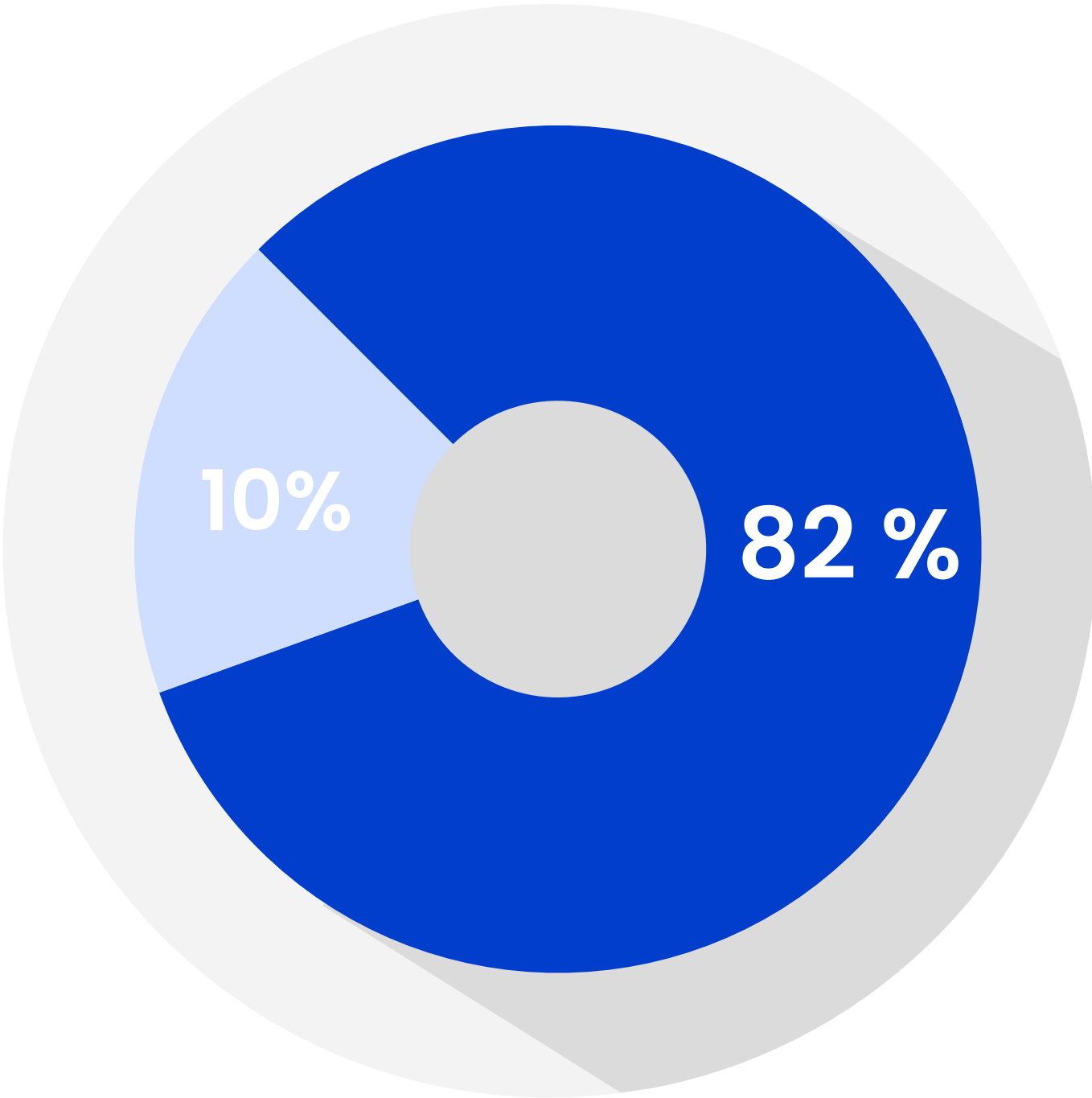


Jensen Huang
Founder & CEO NVIDIA

Technical Problem Challenging in the New Era Service Adoption



Paradigm Shift To Open Source

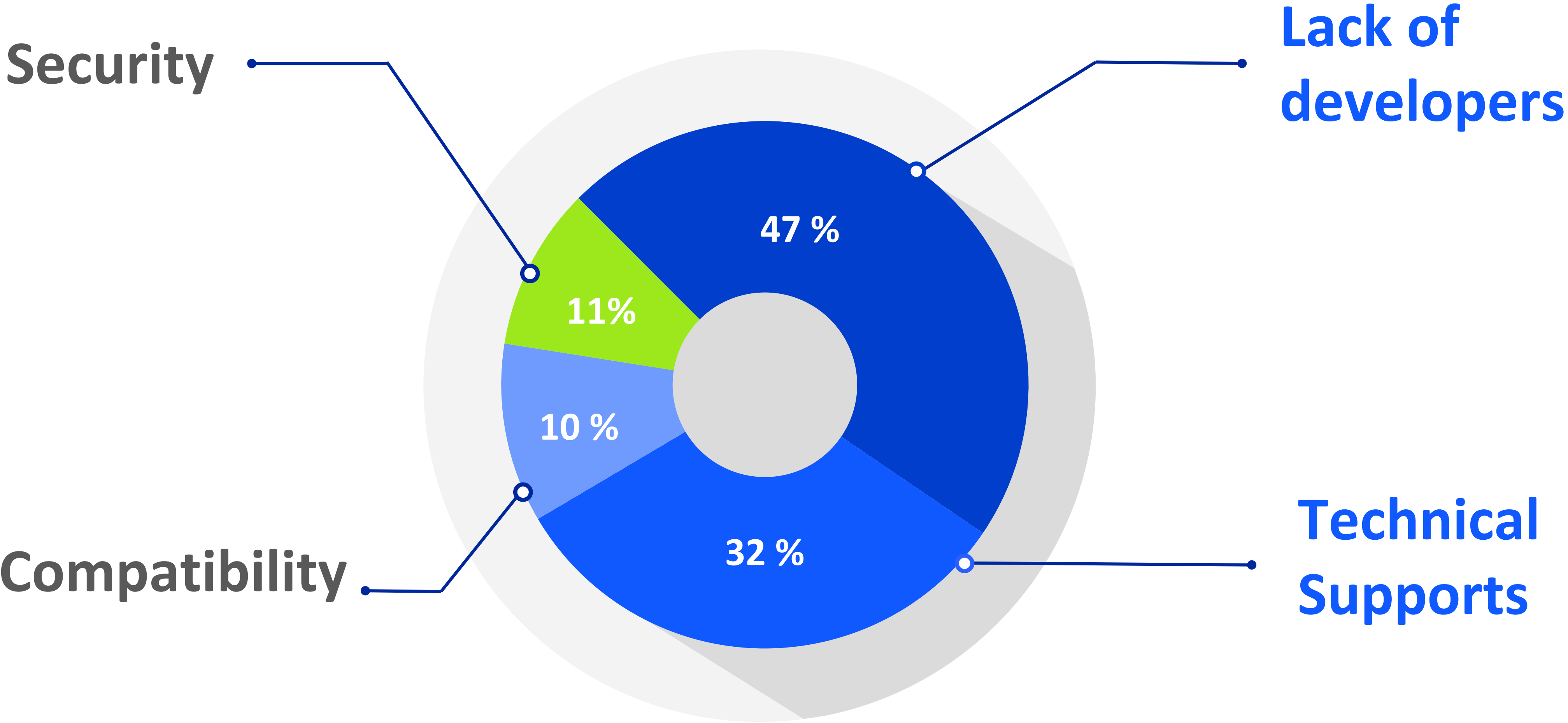


of IT leaders are more likely to select a vendor who contributes to the **open source** community.

(APAC = 77%, EMEA = 82%, LATAM = 83%, U.S. = 82%)

Ref: “The State of Enterprise Open Source”, A Red Hat Report. 2022. 02

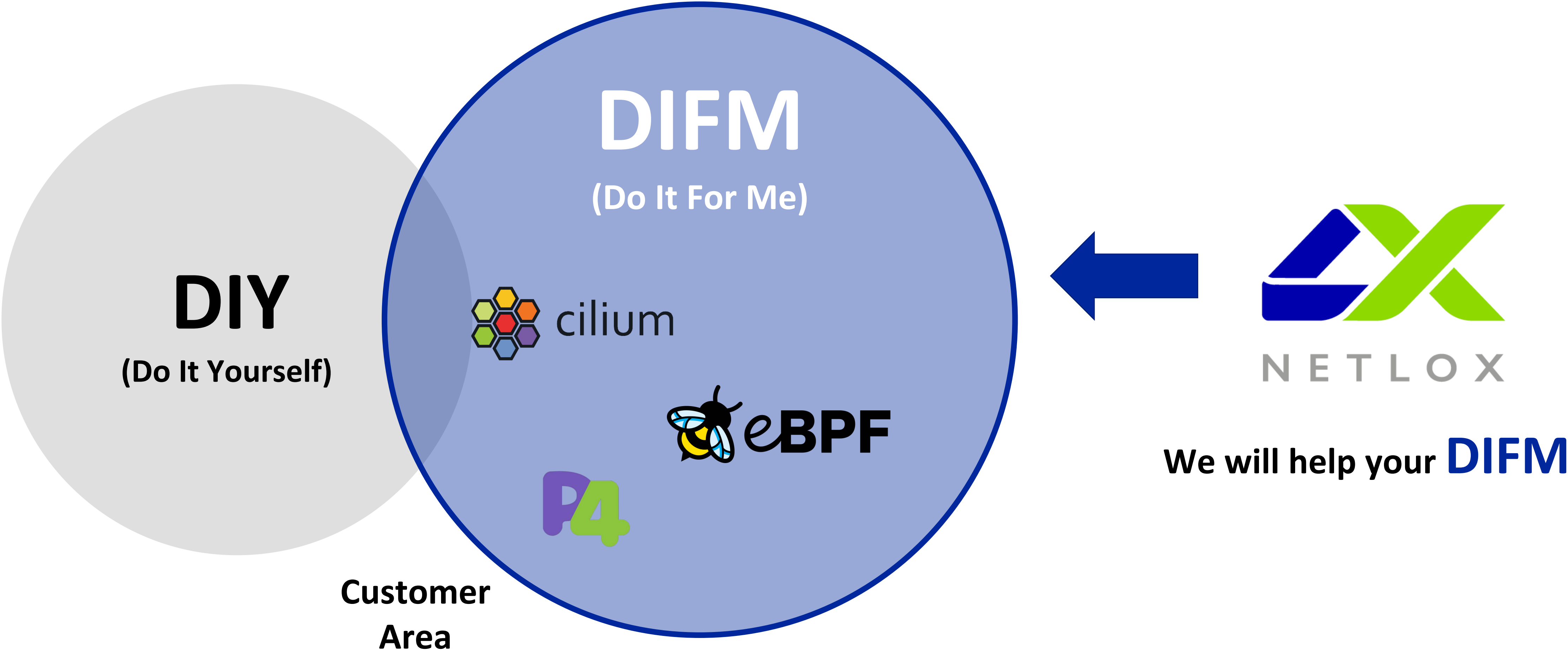
Pain Points When Adopt Open Sources in APAC



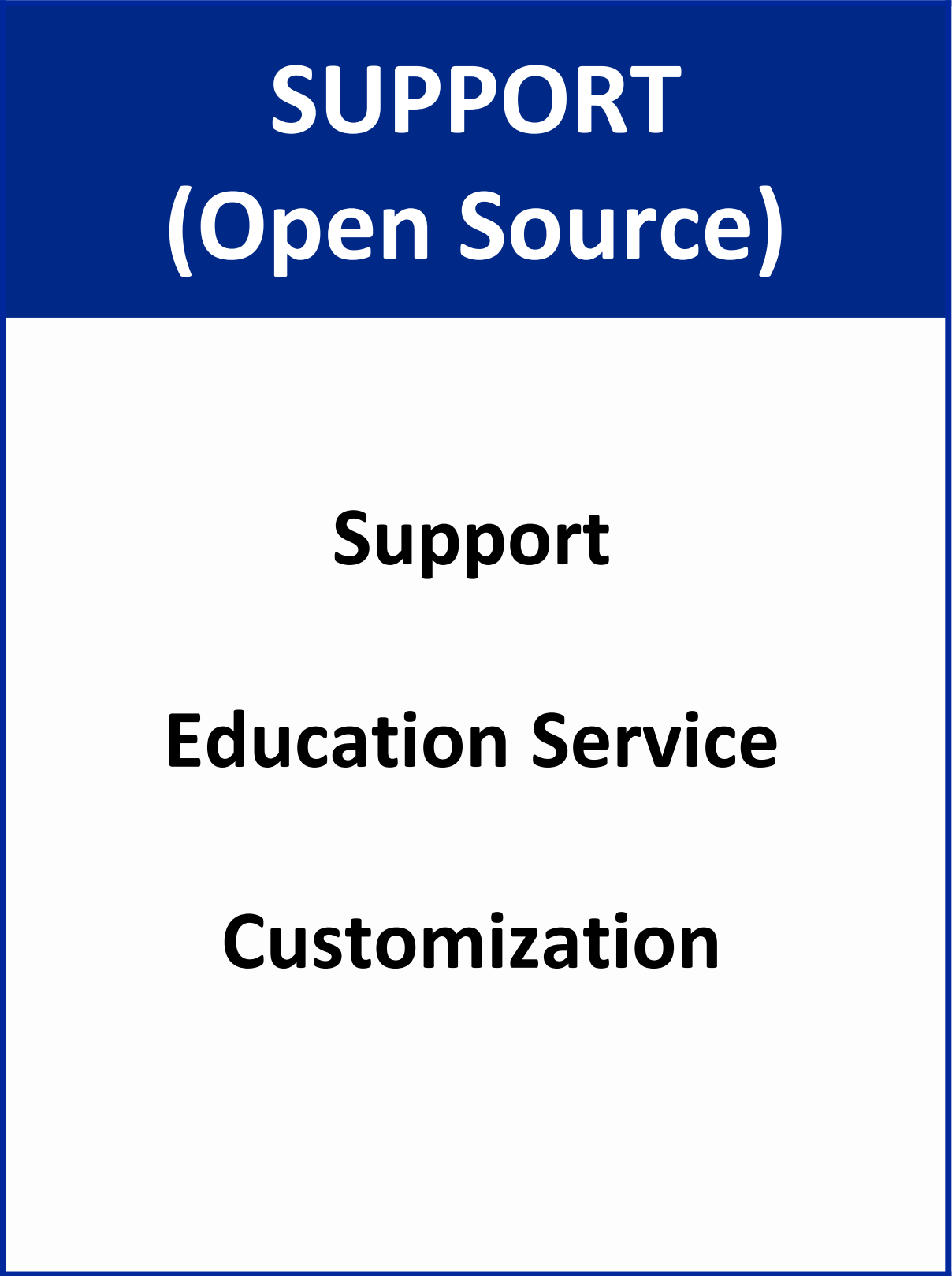
Ref: “The State of Enterprise Open Source”, A Red Hat Report. 2022. 02

Open Source Networking Curation Service

NetLOX who contributes to the open source community will help your adoption of open source networking with globally verified open sources (eBPF, Cilium, Intel P4, etc)



Business Model : Value-Market Fit BM



Current (2023 yr)



2024yr Target
(Currently also doing
the AWS LoxiLB(Open) registration)

TEAM

Mission

Democratize the 5G & cloud networking industry by providing best-in-class, most flexible and light-weight open source software for Industry 4.0 / 5G / Cloud / Metaverse and beyond

Company

Headquarters: Pangyo, Korea

Target Customers

Enterprise & Telecom/Cloud Service Providers

Investors & Promoters

Founders



Seokhwan Kong
CEO

- Ex-Founder Tech Startup (Cool Cloud)
- Yonsei University EE Ph. D
- Delivered Korea’s first and largest IP-SDN nationwide network
- Managed various prestigious Govt of Korea R&D projects
- Ministry of Science & ICT and Future Planning Award



Dipjyoti Saikia
CTO

- Ex-Founder Tech Startup (Cool Cloud)
- 20 years of experience in high-perf networking/software industry
- Led development of top-of-line products in Samsung, Juniper & Brocade
- Creator of highly scalable & top-ranked open SDN controller project
- Holds various patents in US/Korea in cloud networking



JaeHong Rim
CMO

- Sales & Marketing for Nortel Networks in Korea
- Led Sales & Marketing for Aruba Networks (to #1 in Korea)
- 20 years of brand marketing / global sales
- 20 years of global commercialization and marketing experience such as Aruba, Telstra, etc.





02

LoxiLB Project

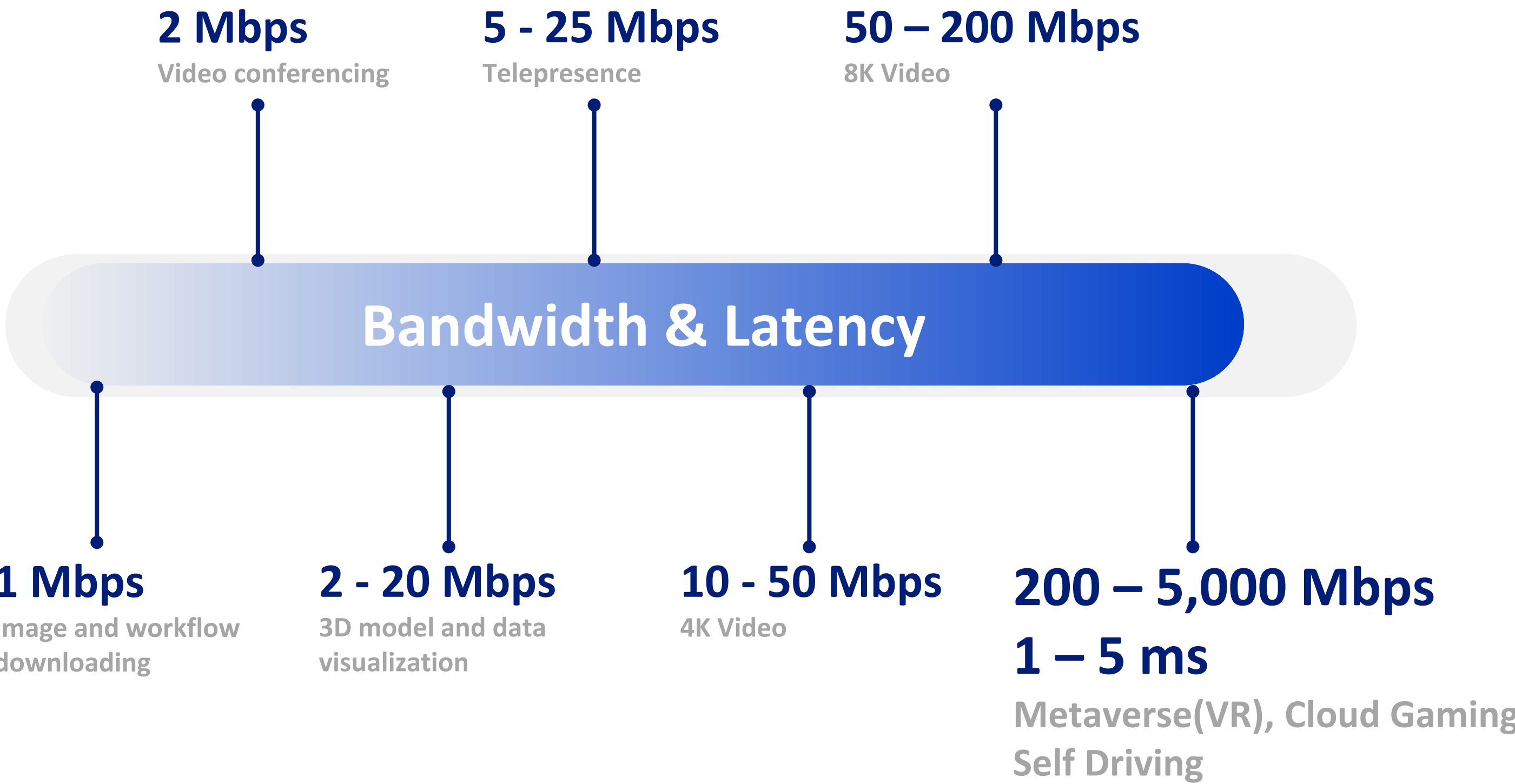
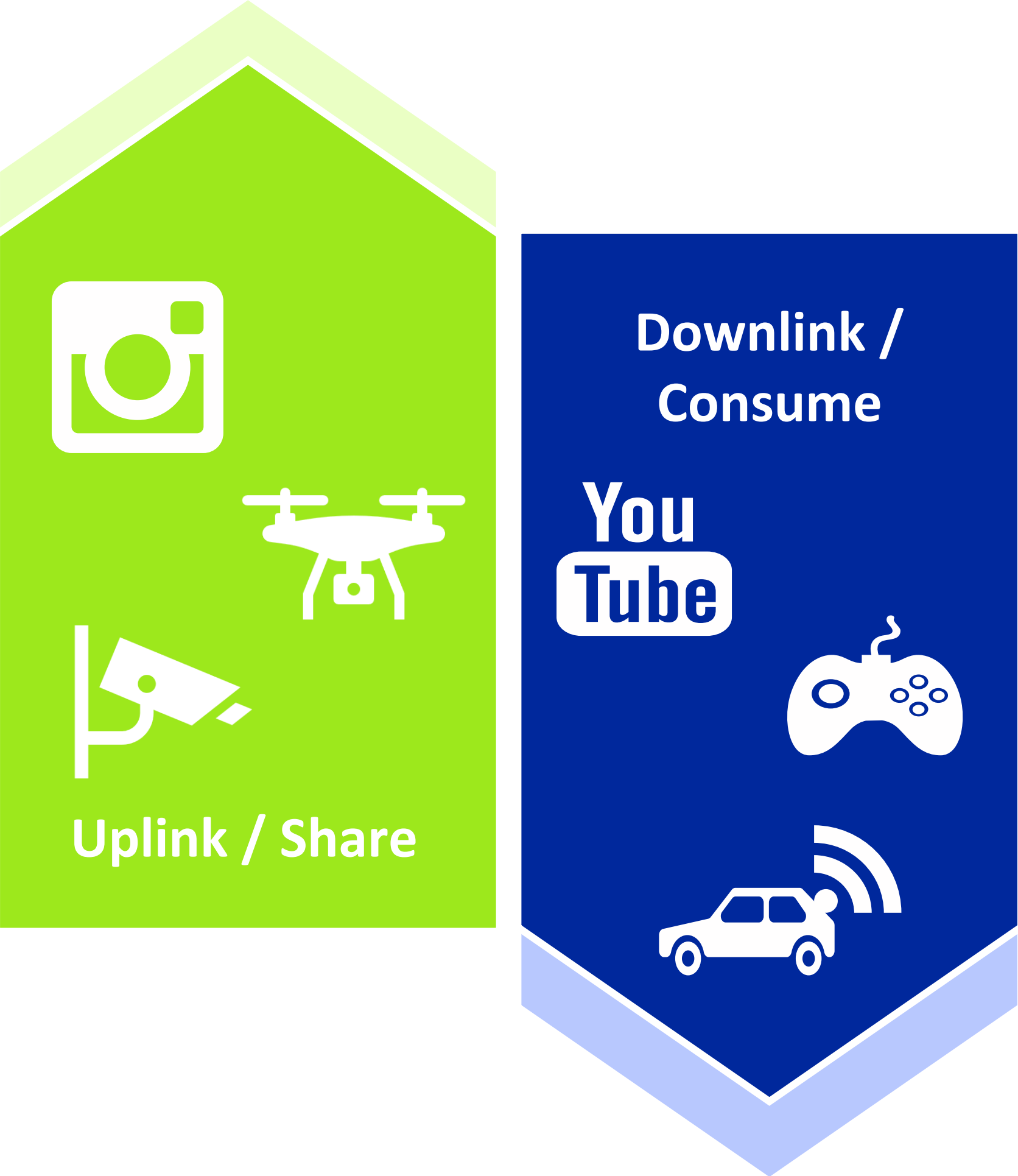
Introduction to LoxiLB (loxilb.io)



- LoxiLB is an open-source cloud-native "external" service load-balancer for cloud-native edge workloads using eBPF as its core-engine
- For on-prem and edge deployments, there is no service type - external load balancer provider by default in k8s
- Suitable for 5G/Edge specific scenarios

Performance Requirements for Next-Generation Services

- Quality requirements for 5G and cloud-based high-capacity ultra-low-latency immersive services are increasing
- In addition, efforts are needed to reduce costs as we move beyond the initial stage of 5G adoption.



Linux kernel networking reaching its limits

- All smart devices use linux in one form or other
- Linux kernel networking is far from suitable to handle service requirements of next-gen services

- Layers of legacy accumulated code over the years
- Complicated to optimize
- Frameworks like DPDK exists but are not energy efficient (Need core pinning and vendor PMD dependencies exists)

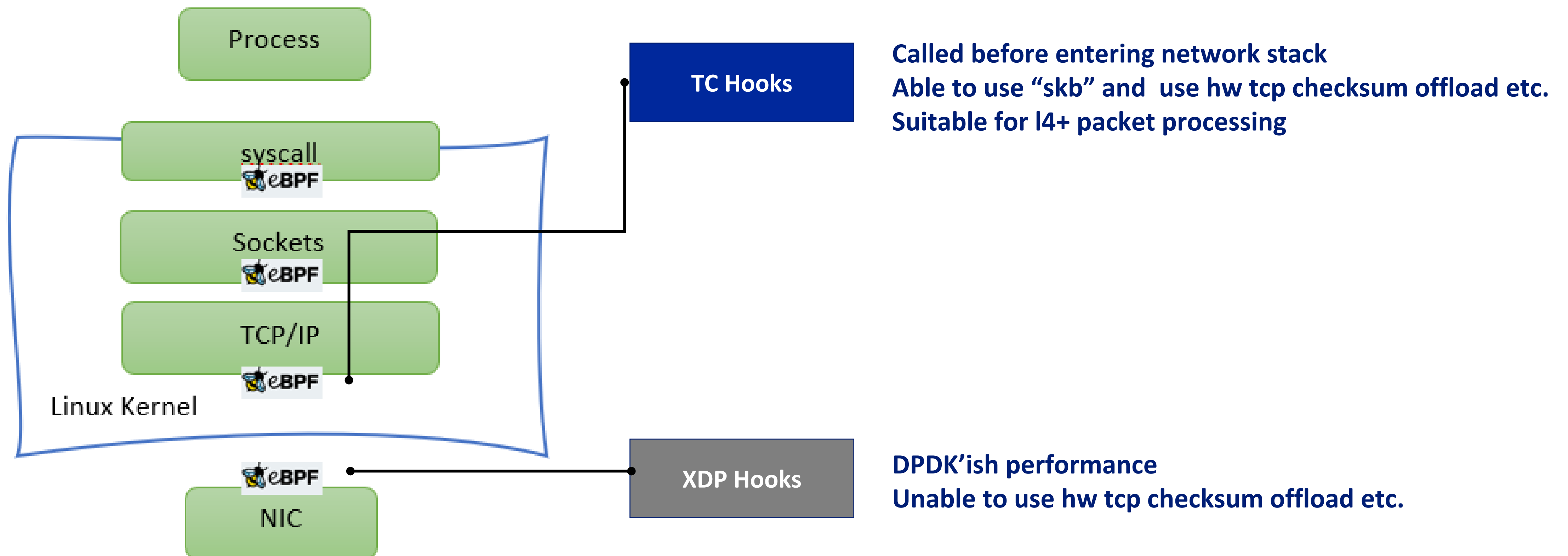
The diagram is a highly detailed flowchart representing the Linux kernel networking stack. It includes a legend on the left side with the following items:

- kernel entry point (rectangle with a dot)
- function (rectangle)
- function call (arrow)
- file in which function appears (rectangle with a dot)
- driver-specific function (rectangle with a dot)
- data of type T (cloud shape)
- data ownership (dotted line)
- data copy (dashed line)
- virtual function through pointer (diamond)
- thread scheduling (wavy line)
- schedulable thread (circle)

The main flowchart shows a complex web of interconnected functions and data structures, with many loops and conditional paths, illustrating the complexity of the Linux kernel networking code.

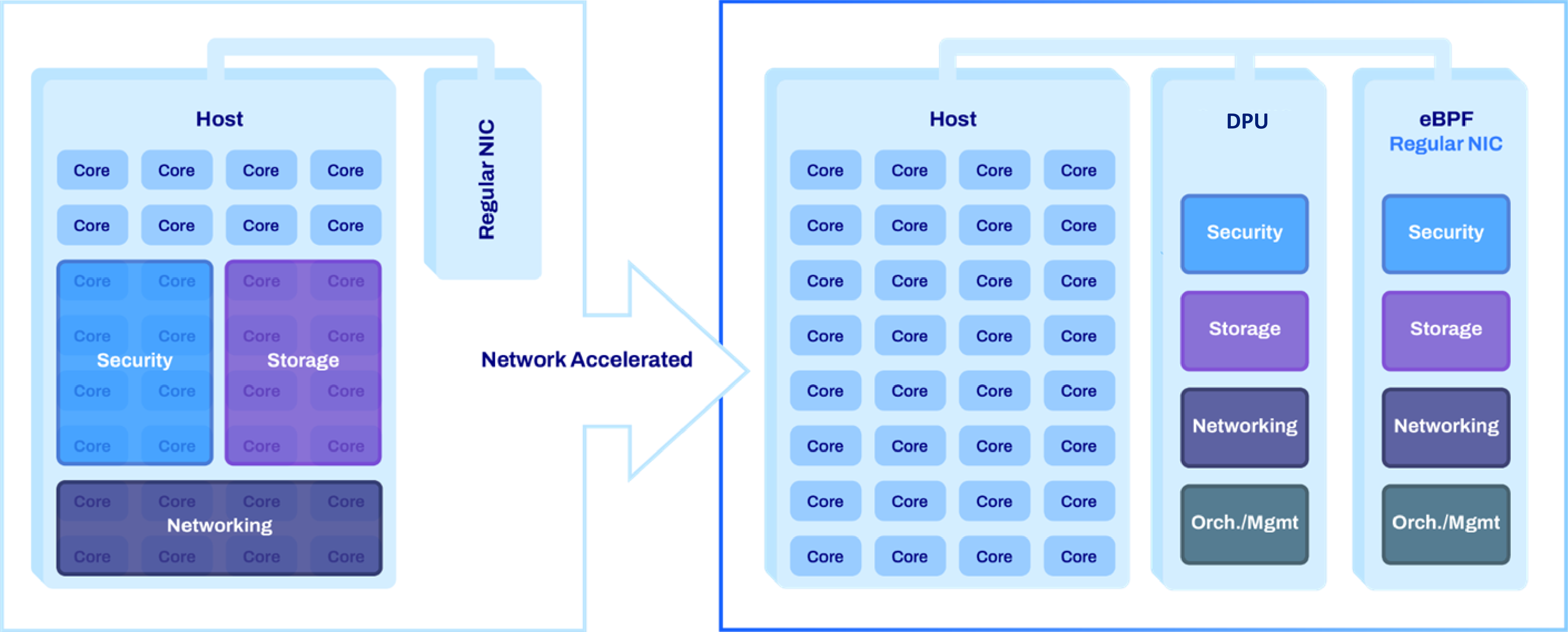
eBPF to the rescue ??

- eBPF is a revolutionary technology with origins in the Linux kernel that can run sandboxed programs in an OS kernel
- An elegant way to extend the linux (or windows) kernel without causing panic or corruption in the kernel
- Initially, eBPF was used to enhance system observability but increasingly used in **cloud-native** networking applications



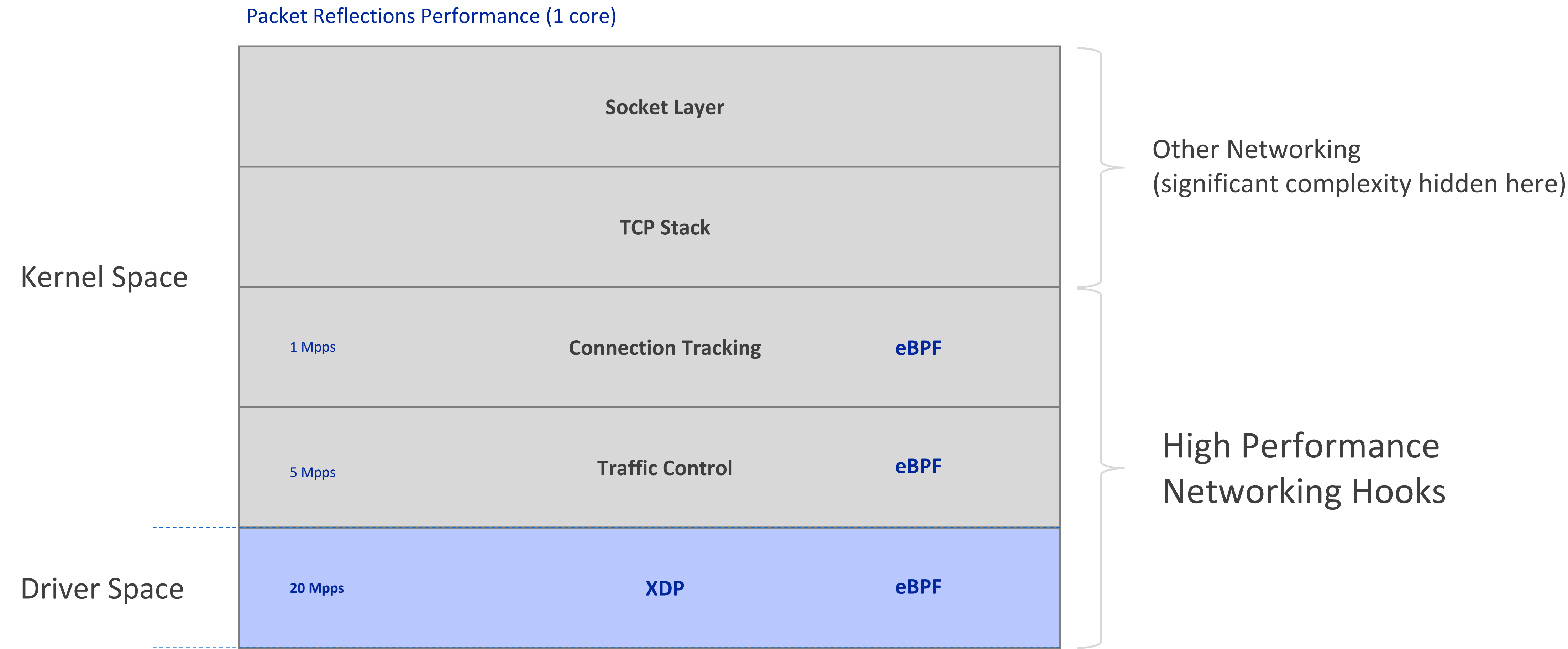
Optimized networking with eBPF

- 01 Improved Performance
- 02 Better CPU Utilization
- 03 Scalability

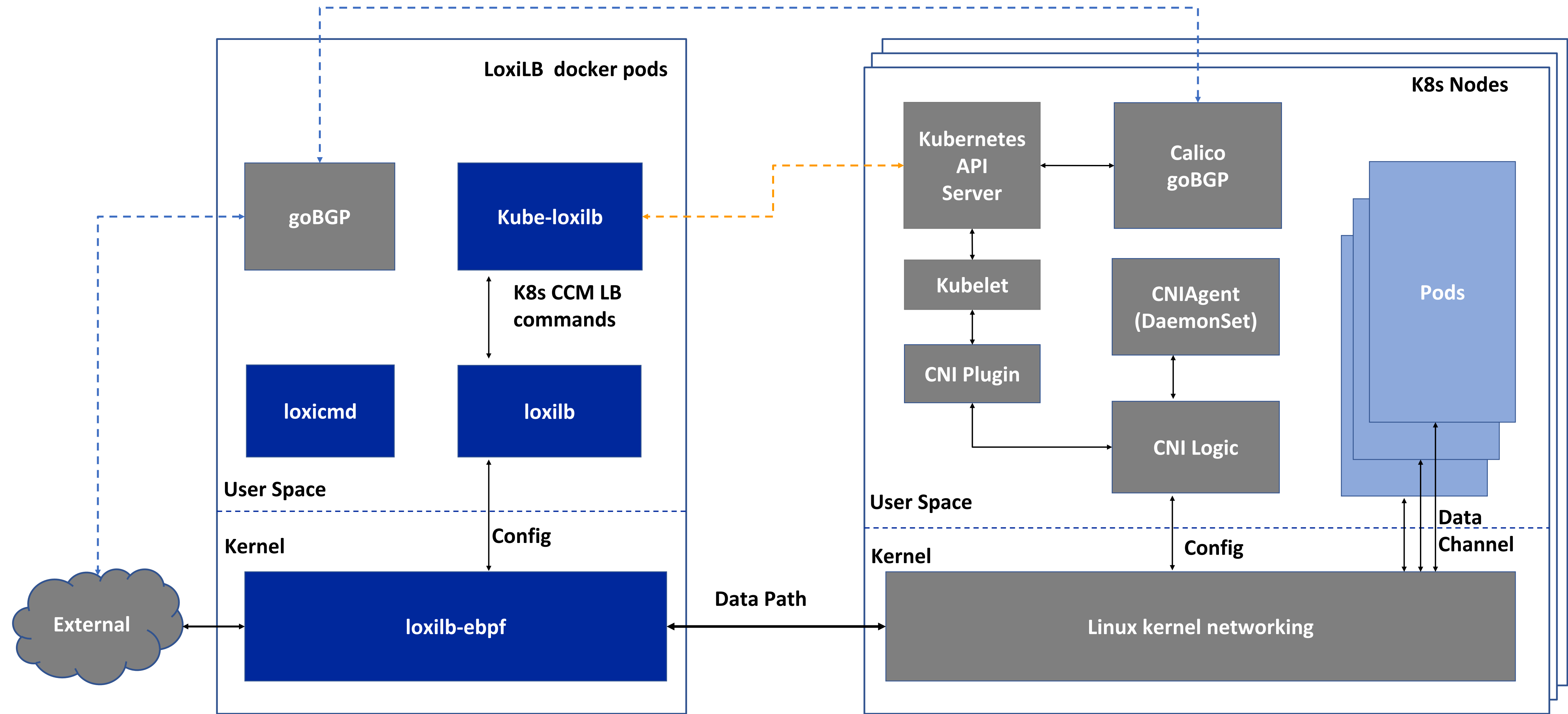


What eBPF can help ?

- 01 Performance
- 02 Programmability
- 03 Security



LoxiLB Architecture



Development Environments (OS, Language, Licenses...)

- OS
 - ✓ Ubuntu Focal 20.04 / 22.04 (LTS)
 - ✓ Fedora 36 (64bit)
 - ✓ RockyOS (64bit)
 - ✓ Linux Kernel > 5.1.0 (5.13.0-48 recommended)
- Language
 - ✓ C (eBPF) & Golang
- Supported kubernetes version
 - ✓ Kubernetes 1.19 ~ 1.24
- Opensource Repository & License
 - ✓ <https://github.com/loxilb-io/loxilb> (Apache-2.0 license)
 - ✓ <https://github.com/loxilb-io/loxilb-ebpf> (GPL-2.0 license)
 - ✓ <https://github.com/loxilb-io/loxicmd> (Apache-2.0 license)
 - ✓ <https://github.com/loxilb-io/kube-loxilb> (Apache-2.0 license)

How we are doing open source project management



LoxiLB Supported Features (v0.8.8)

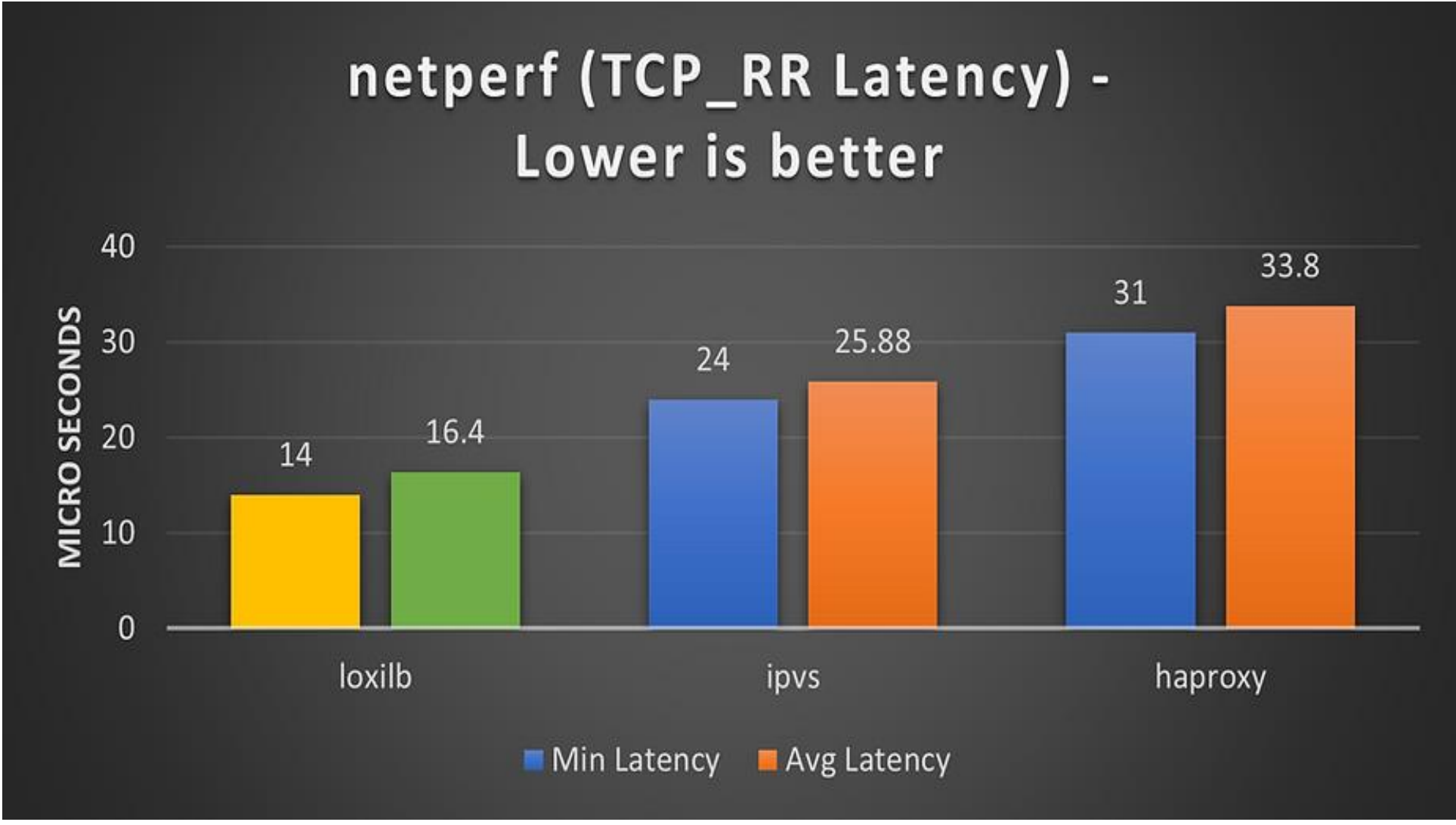
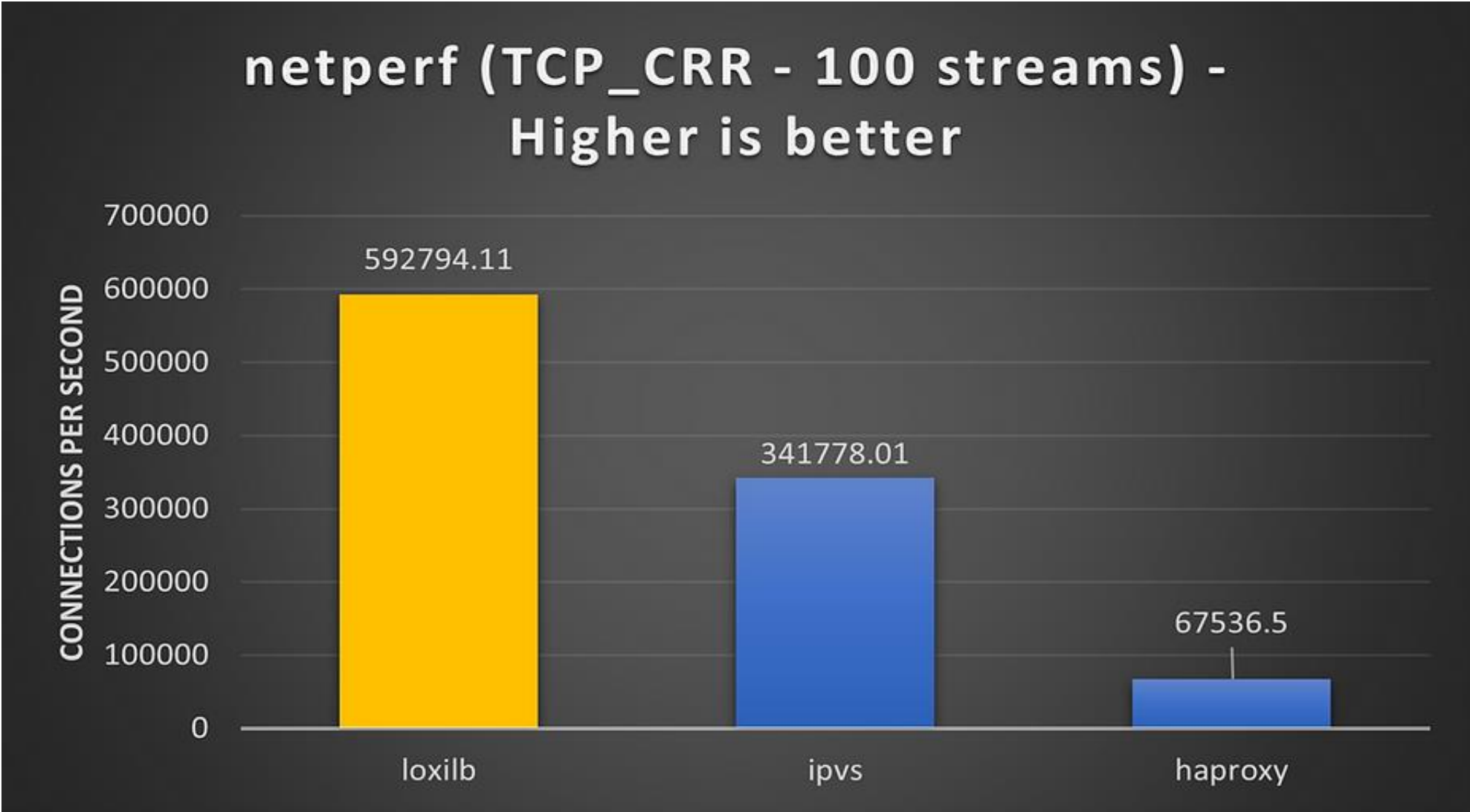
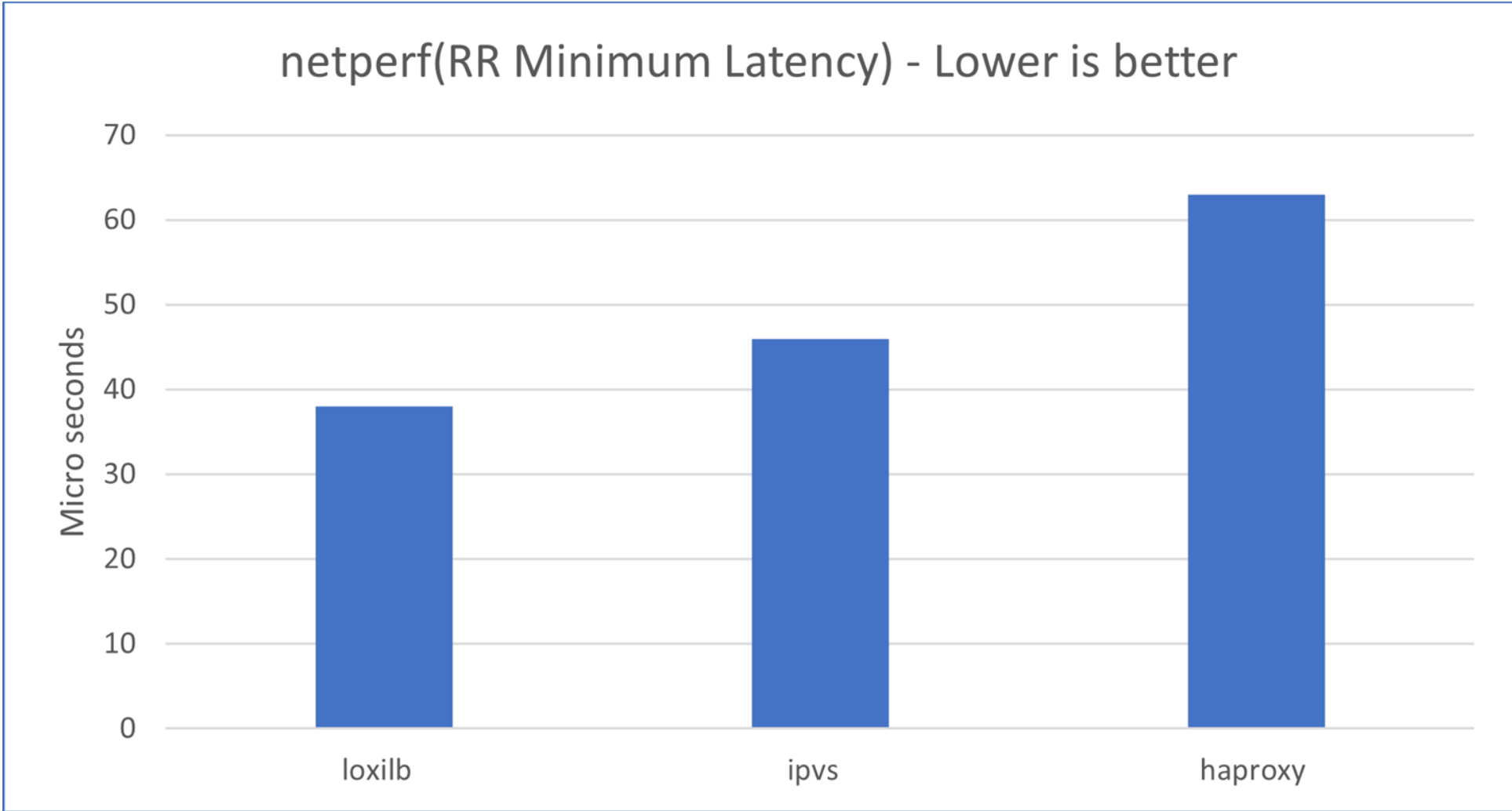
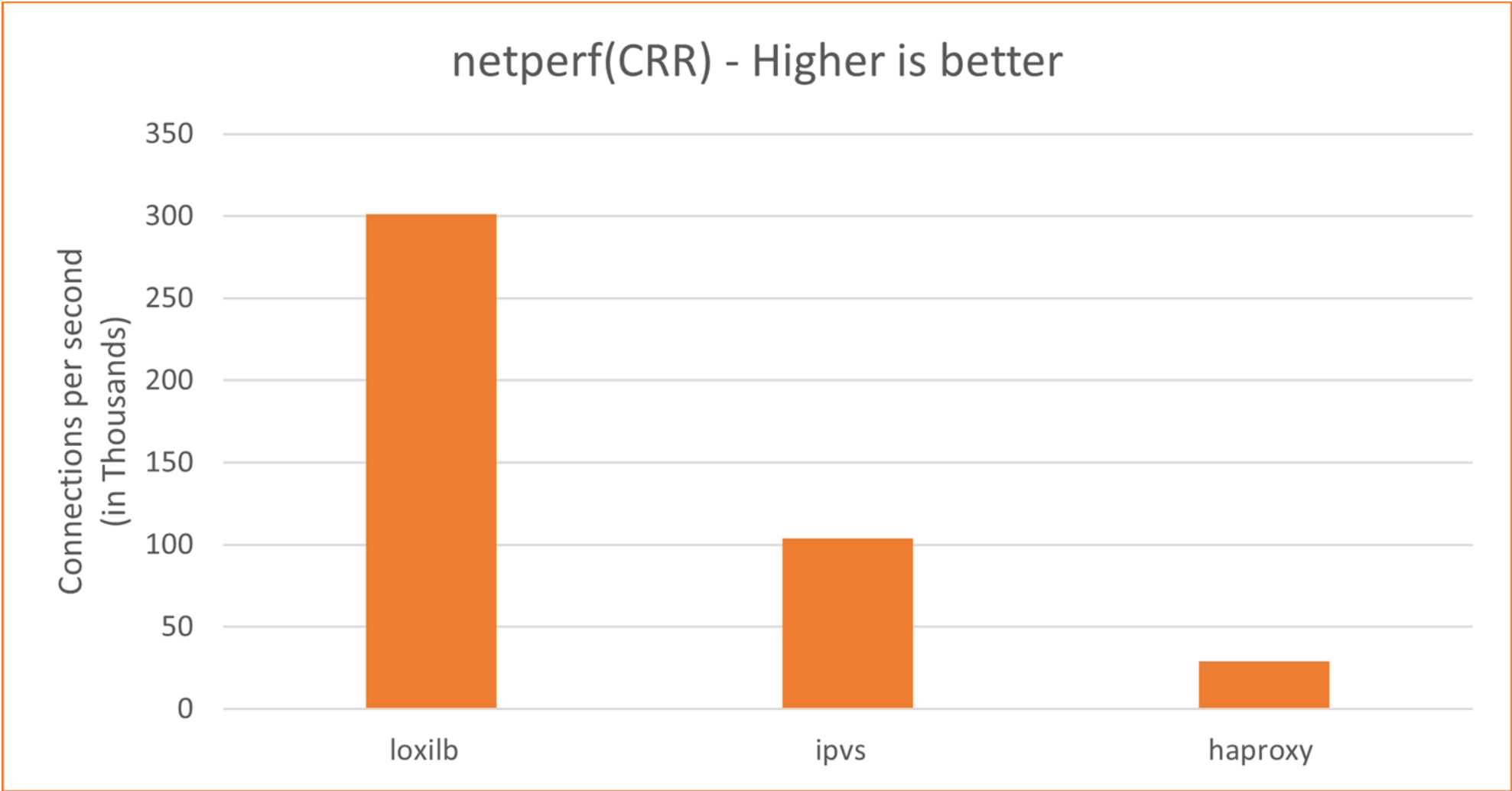
Feature	Description
L2	802.1q VLAN, Port Mirroring, LACP Link Aggregation, MAC Filter
L3	Static, OSPF, RIP, BGP, QoS, Multihoming
L4	Stateful Firewall, Server Load Balancing, Firewall/VPN Load Balancing, Cache Server Load Balancing, Gateway Load Balancing, Global Server Load Balancing, DNS Load Balancing, Inbound Load Balancing
Health Check	Link, ICMP, TCP, SCTP, UDP(Custom message), HTTP, HTTPs
Tunneling	VxLAN
Mirroring/TAP	Mirror to Broadcast Port-Group
Security	Wireguard / IPsec VPN
NAT	NAT44, NAT64, NAT66
Management	CLI, API, Syslog, Remote Syslog
Monitoring	Grafana (with Prometheus), Netflow (IPFIX Protocol)



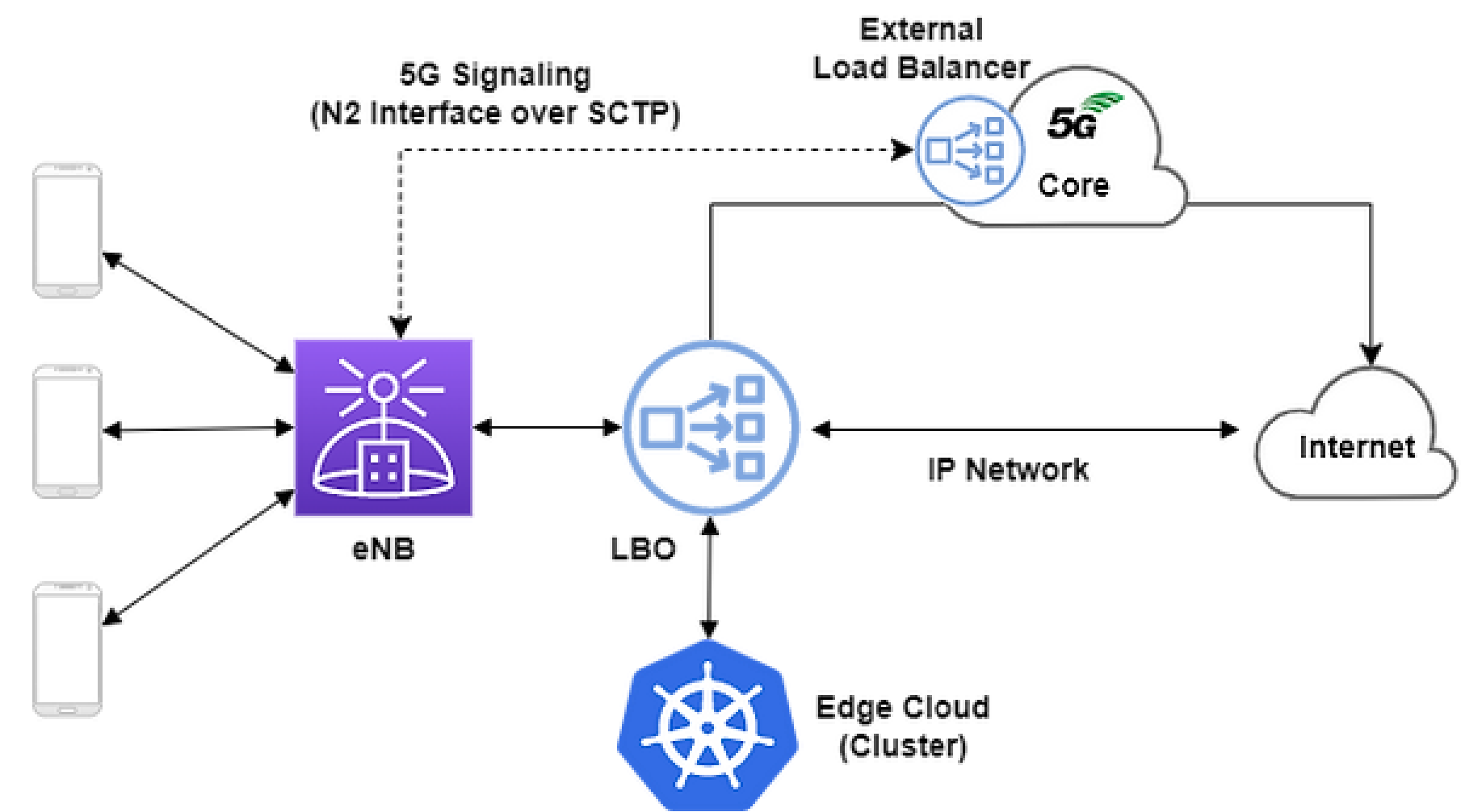
We will take the lead in reducing costs and spreading technology for 5G/6G and cloud services by providing next-generation cloud native networking technology using open source technology.

LoxiLB – Performance (Intel)

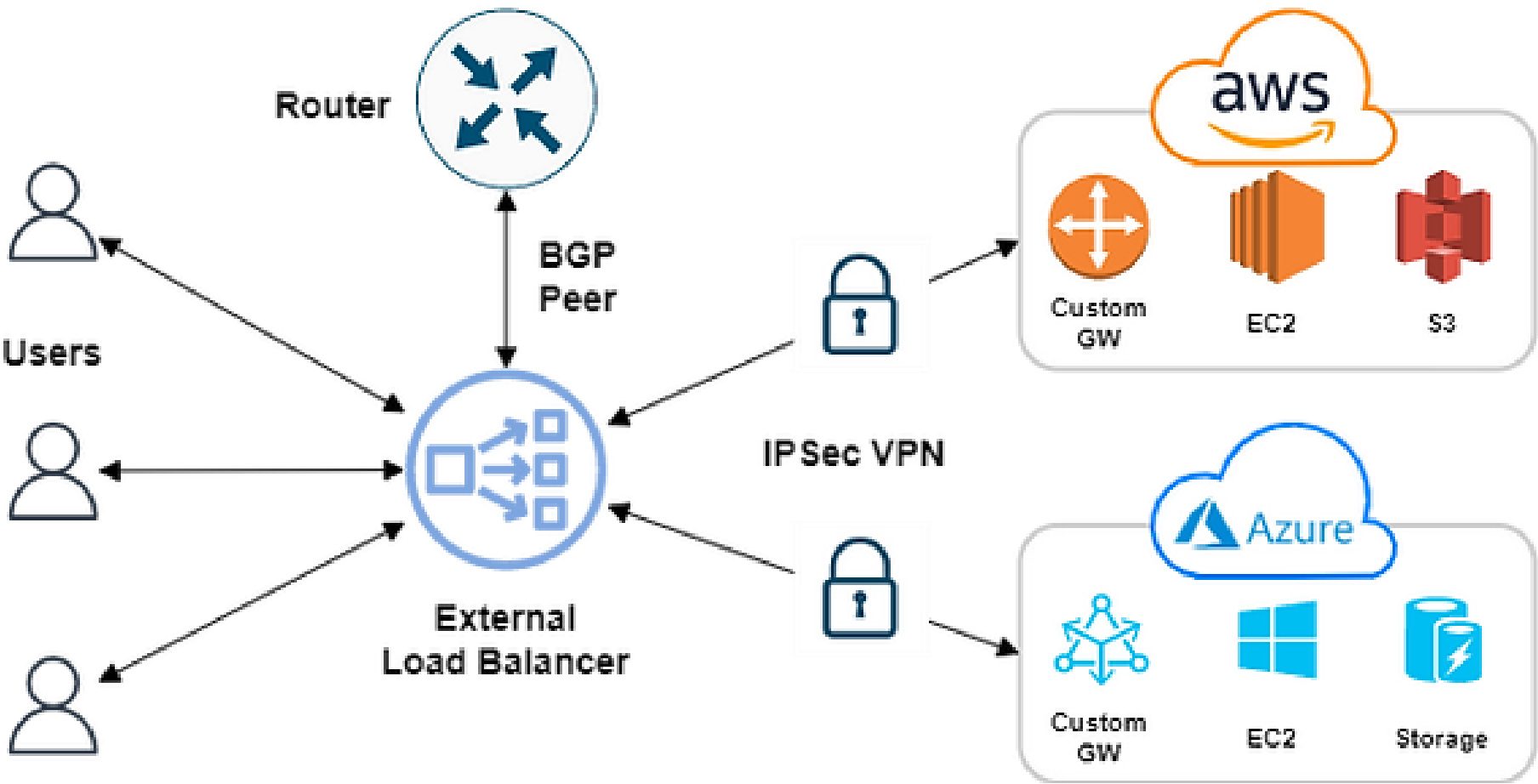
DUT : Intel(R) Xeon(R) Silver 4210R CPU @ 2.40GHz - 40 core RAM 125GB, Kernel 5.15.0-52-generic



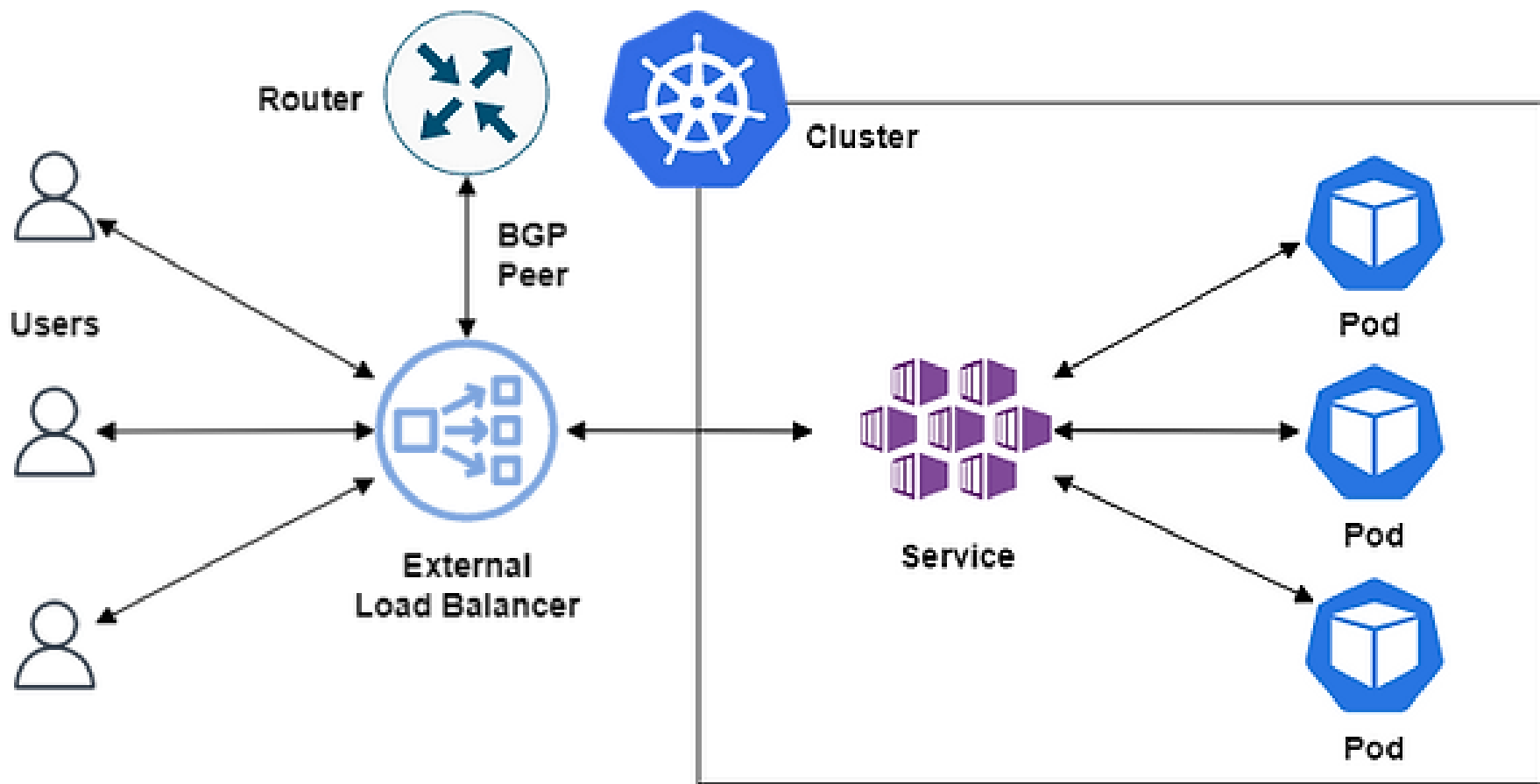
Use Cases



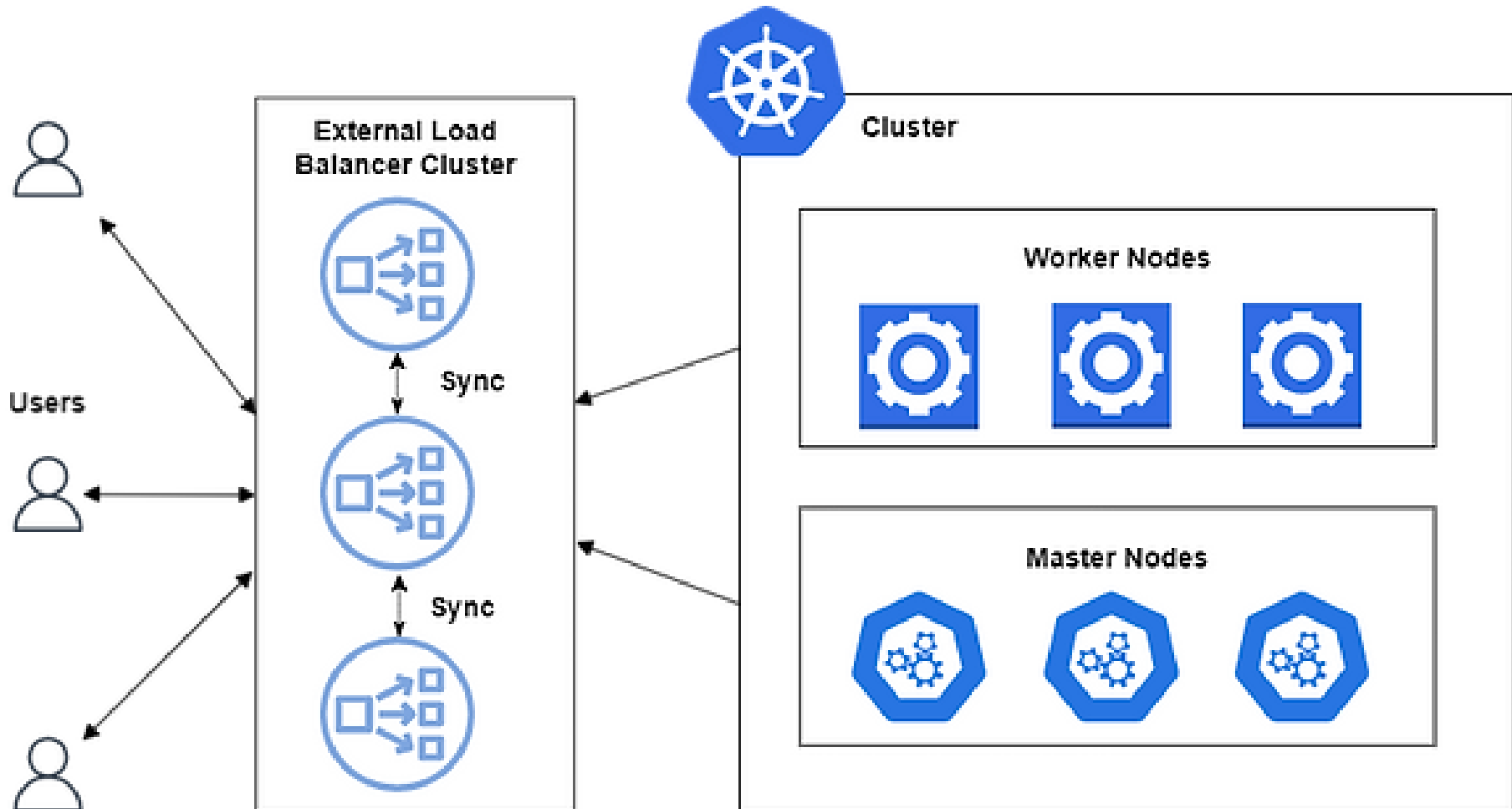
< 5G Edge LB with UL/CL Classification >



< Multi Cloud Inter Connection >



< K8S External Load Balancer Service >

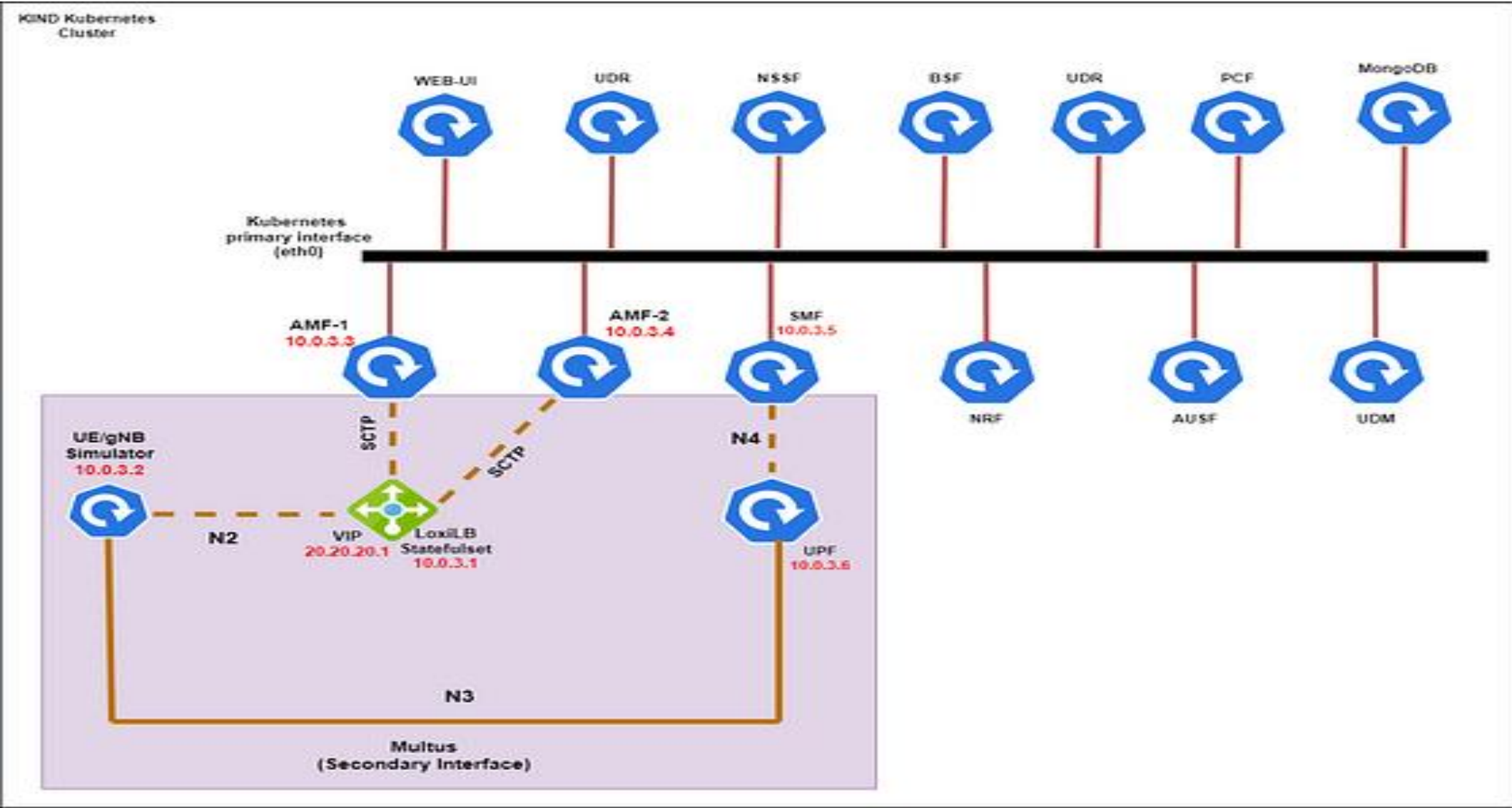
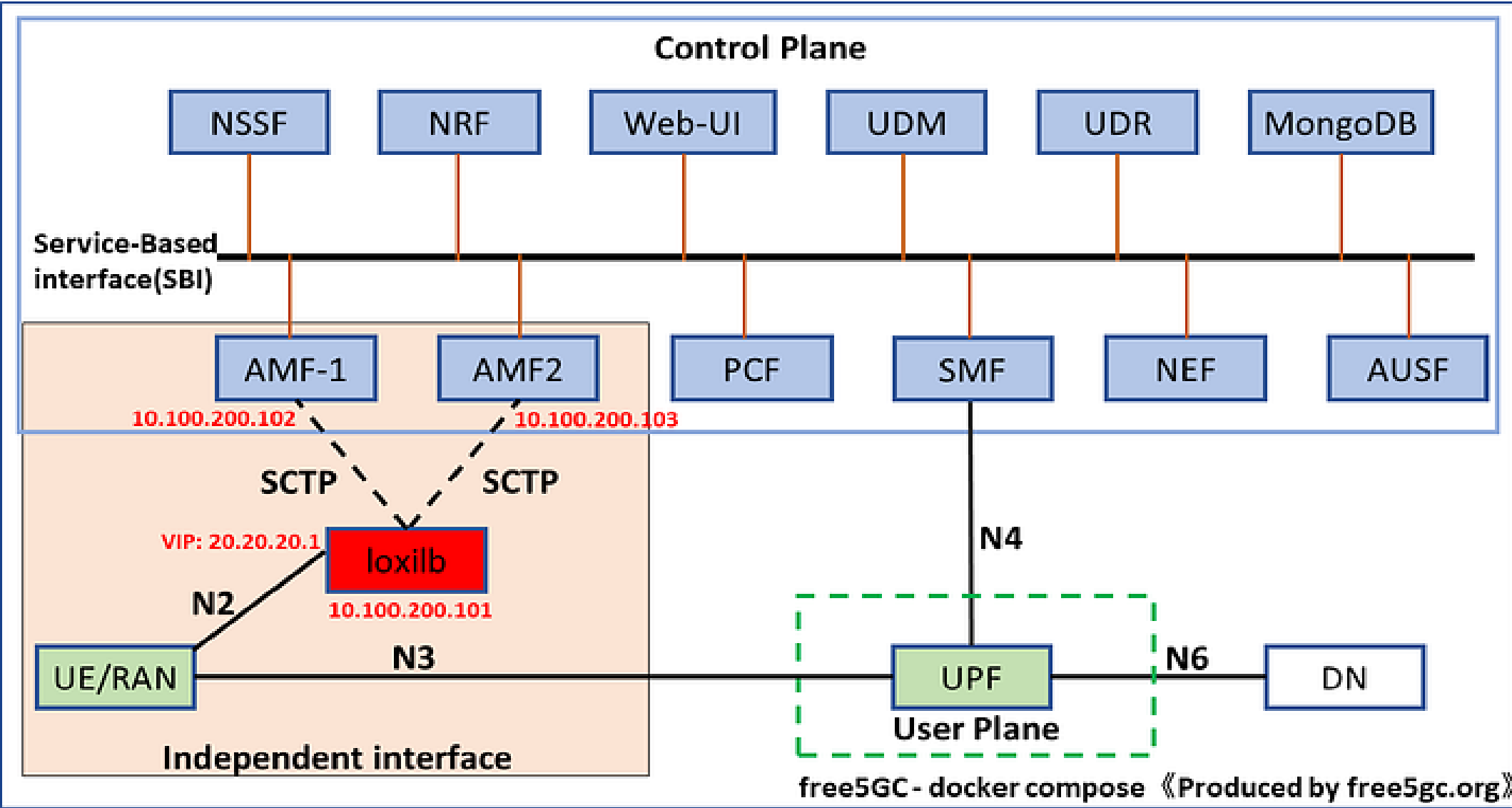


< Distributed Load Balancer >

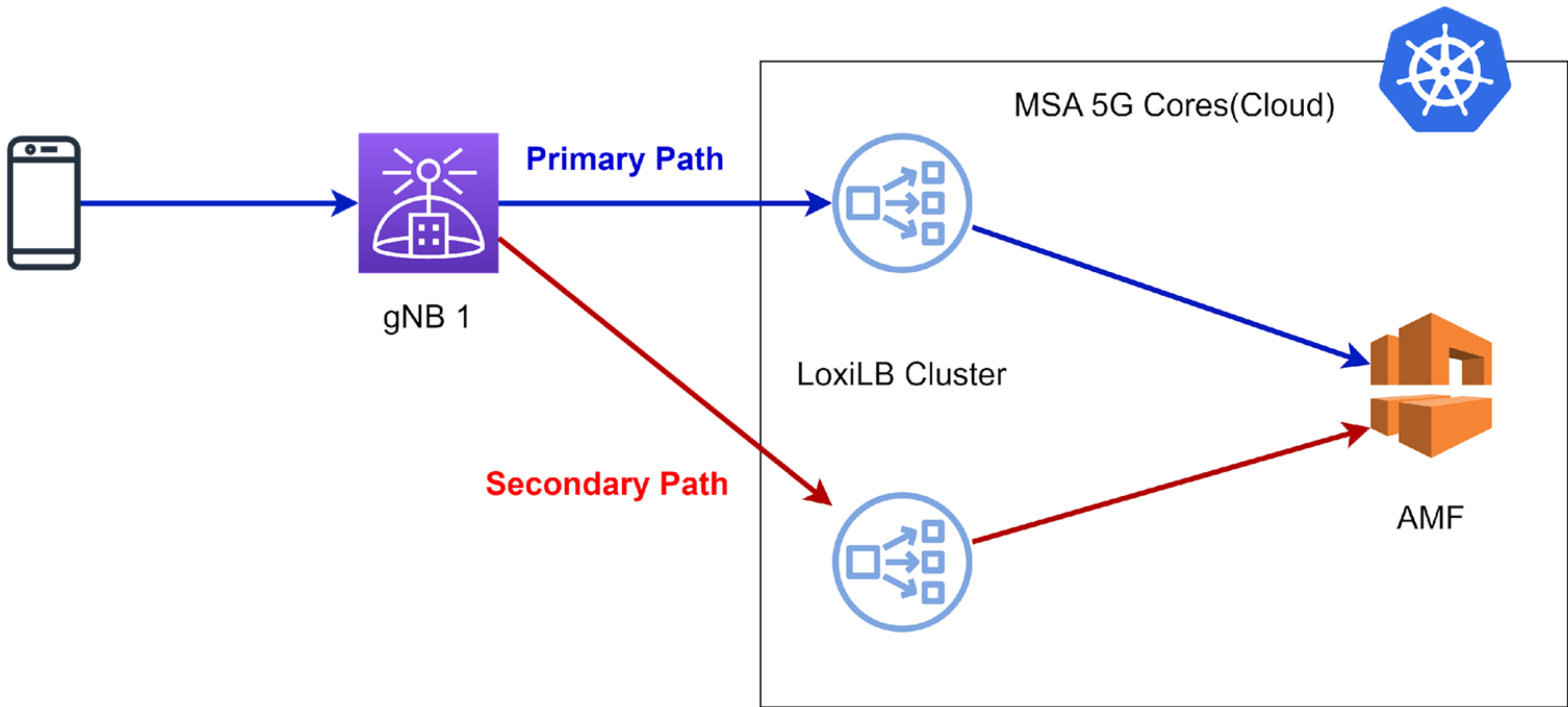
Users in LoxiLB Open Source Community



Private 5G Use-cases : LB for cloud native N2 interface



Private 5G Use-cases : LB for cloud native N2 interface with multi-homing



Roadmap – 2023 4Q Planned

- **Functional Features:**

- SRv6 support
- Rolling upgrades
- L7 proxy
- URL Filtering
- DNS caching
- IPSEC/Wireguard support
- GSLB

- **kube-loxilb Support:**

- Kubernetes 1.27
- BGP Mesh support
- Multi-cluster support
- ULCL filter integration

THANK YOU

<https://loxilb.io>

<https://github.com/loxilb-io>

<https://netlox.io>

contact@netlox.io

