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PAC experts

External

Edge Computing 가성비 최적화

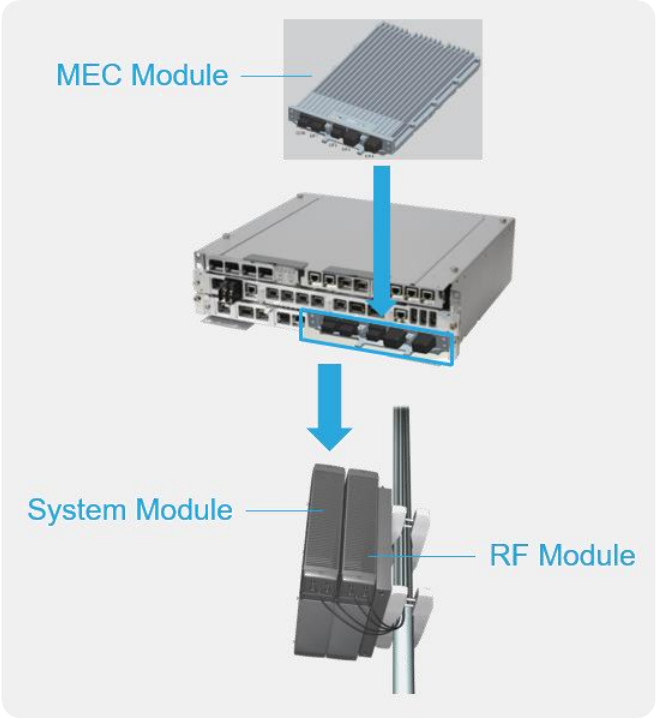
with Programmable Acceleration (PAC)

ONK2019 Fall, November 06, 2019

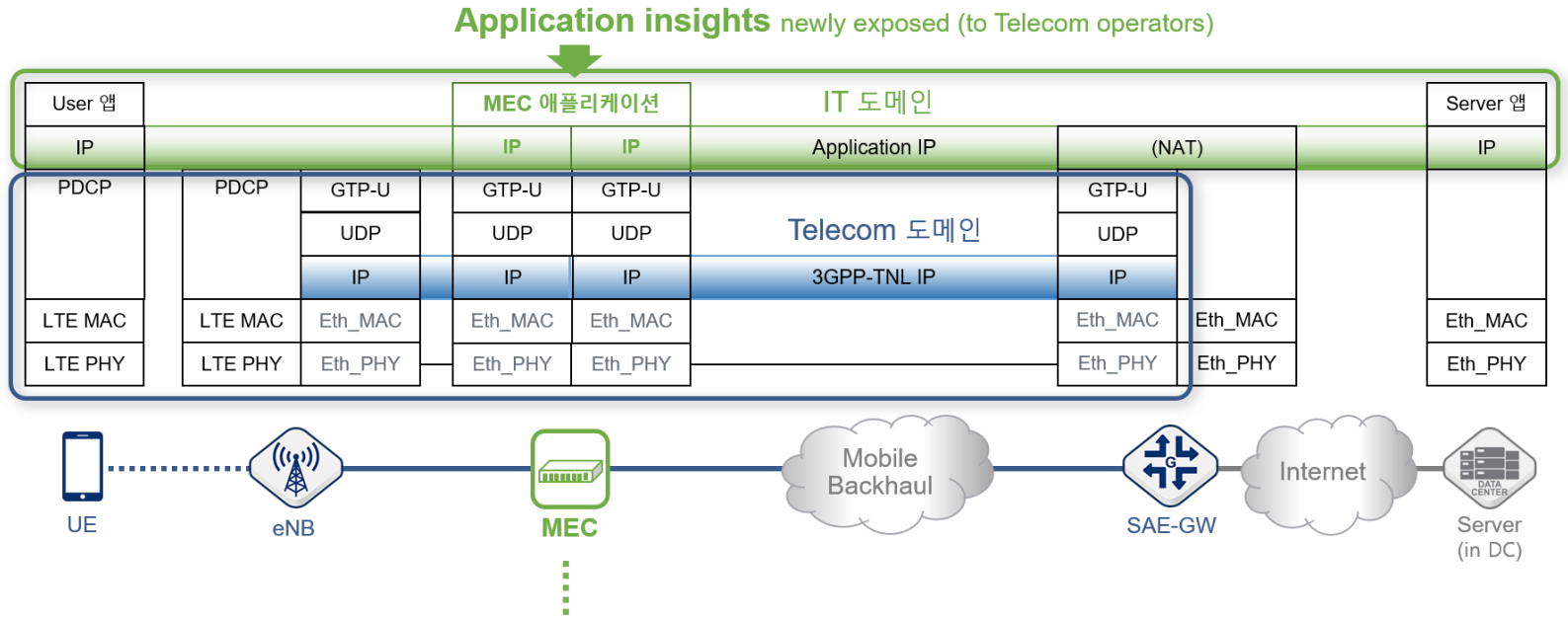
PAC Use Case

Multi-access Edge Computing (MEC)

4G LTE Deployment – 'In-line Attachment'



*Nokia's **Liquid Apps** w/ Flexi Multiradio 10 BTS
(SKT's on-site Edge (초엣지) 컨셉)



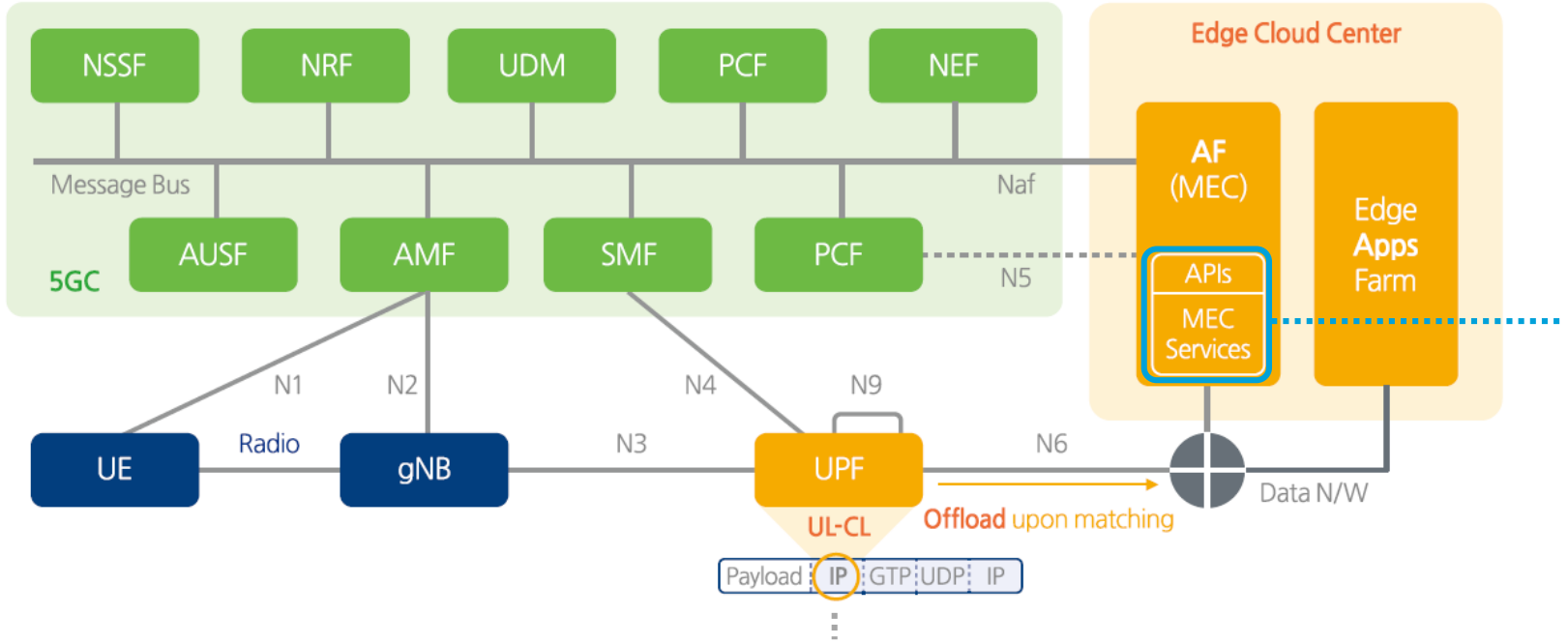
"Non-3GPP (Telco IT) Functions"

- LTE U-Plane interception
- U-Plane Packet manipulation – **drop, offload, exchange, augment**
- C-Plane tapping
- Traffic statistics – **RNIS** (Radio Network Information Service) APIs
- IPSec support

PAC Use Case

Multi-access Edge Computing (MEC)

5G NSA/NR Deployment – UPF & 'MEC Router'



- ME app management: stat. & ver.
- Mobility control
- RNIS (fed by MEC Router)
- SLA support (feat. minimal Jitter)
- Load balancing

Carrier-grade NFV support by **H/W**

DNS-query

Offload upon matching
(to a local DNS server)

under UPF:

MEC Router

(SmartNICs)

"3GPP Normative Functions"

- LTE U-Plane interception
- U-Plane Packet manipulation – **drop, offload, exchange, augment**
- C-Plane tapping
- Traffic statistics – **RNIS** (Radio Network Information e) APIs
- IPSec support

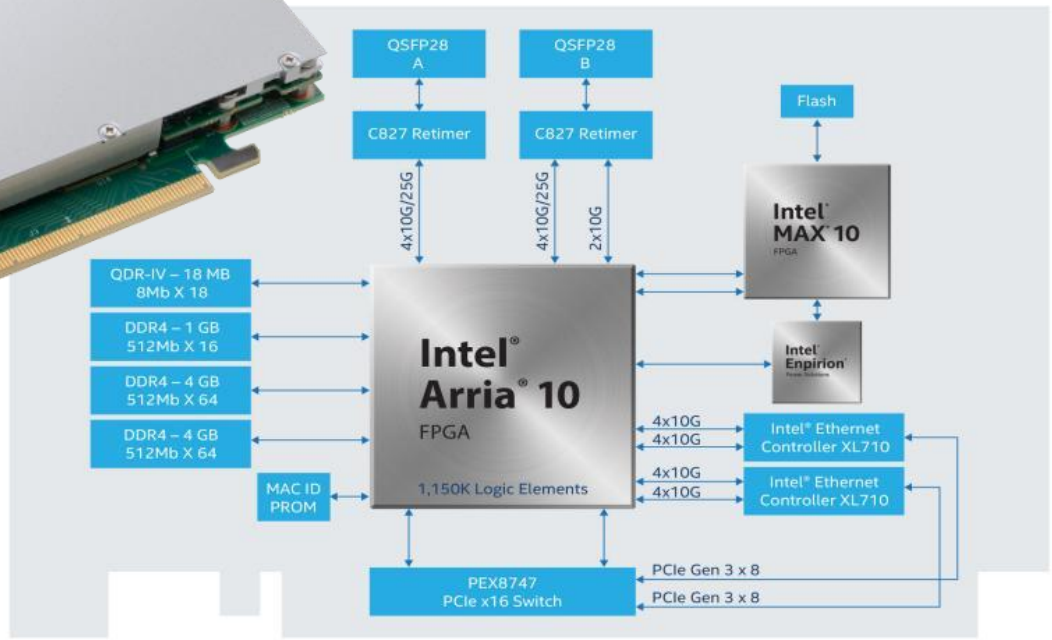
PAC in a nutshell (offloading compute to FPGA)

(플러그인 Hybrid vs. 일반 Hybrid)

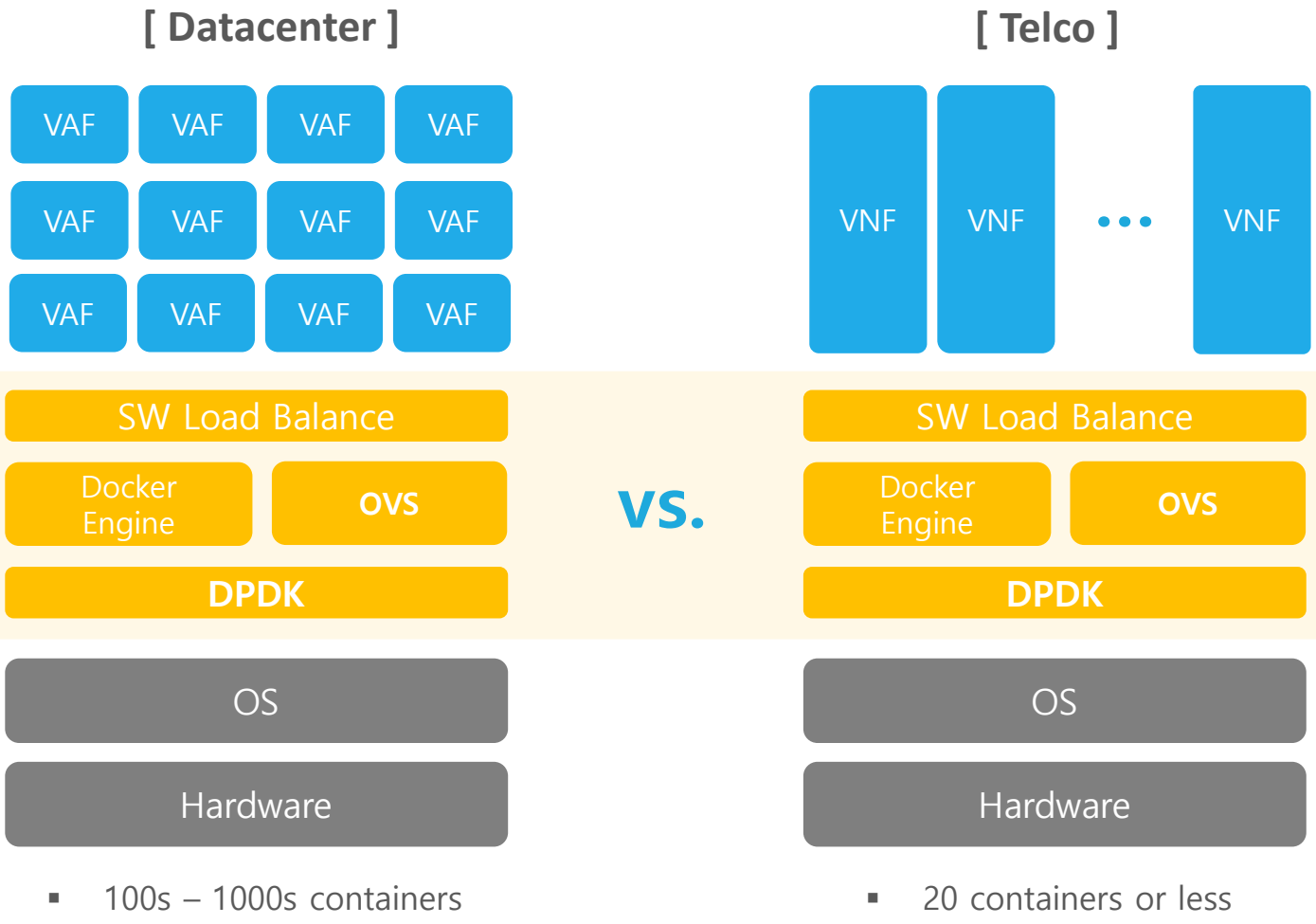
PAC vs. SmartNIC

- PCIe | OCP Mezzanine type daughter board
- Ethernet ports, as in (Smart)NICs
- Hi-capacity FPGA, typical 1M+ Element Logics (LEs), 16 to 7nm die
- Multiple AFUs: ML/DL inference, data analytics or video processing
- C/C++ compatible (open-source) libraries

[Intel N3000 PAC]



Modern Day Server-side



- 100s – 1000s containers
- 20 containers or less

Typical data plane:

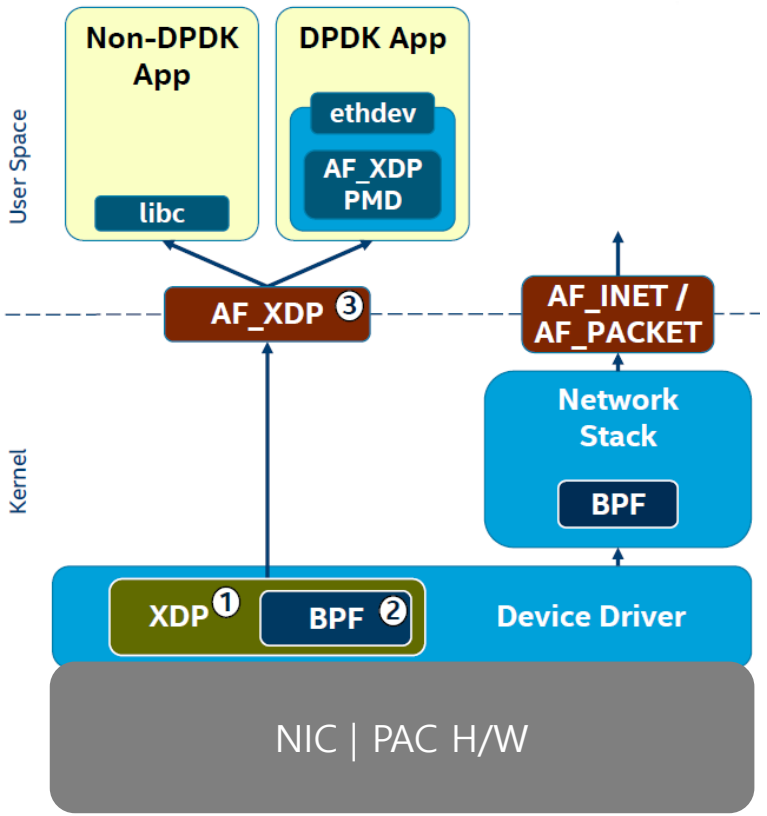
- Latency: 10 – 150μS
- Throughput: 8 – 19Gbps
- Run to completion model
- 1-4 cores to PMD, 1-2 cores to VNF
- PMD / VNF instance multiplication

- Latency being no more issues
- Sub-wire rate for >128B packets
- CPU cores abused

➡ **Motivations for PAC**

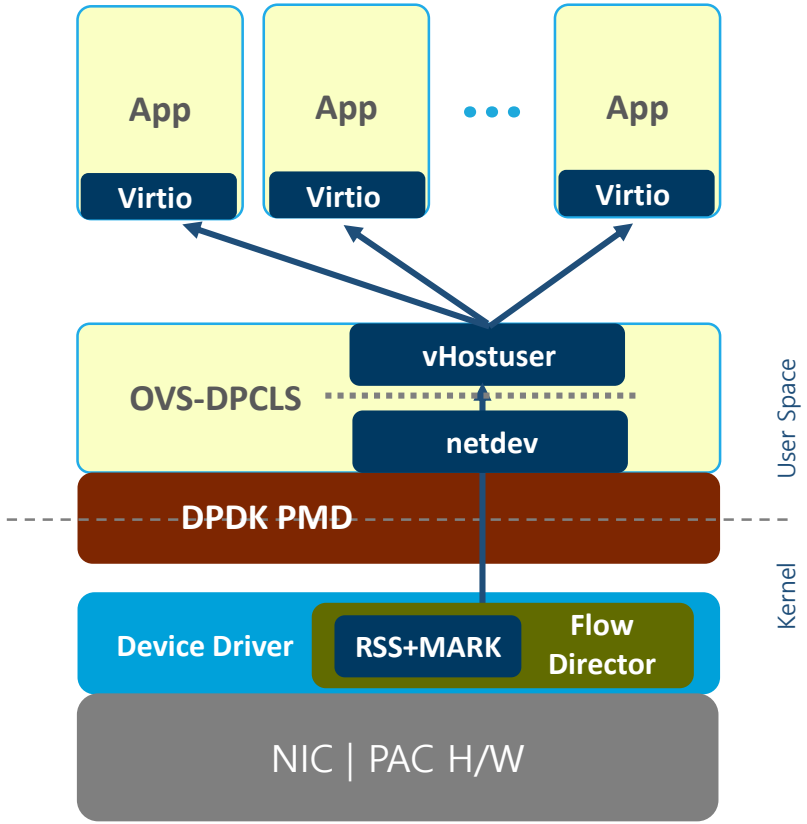
Data Plane Acceleration Choices

[Full Offload: AF_XDP*]



vs.

[Partial Offload: RSS+MARK]

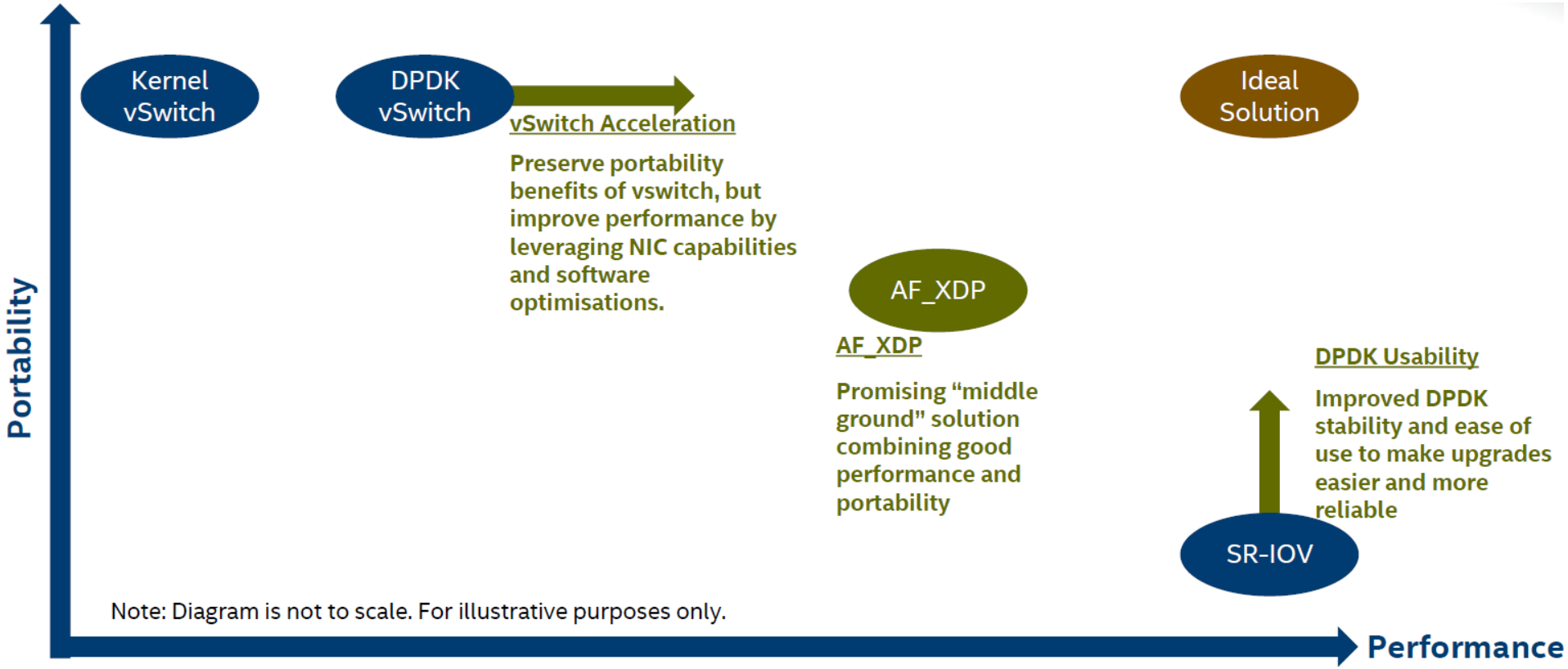


- Actions still executed on OVS
- (Slightly) Lower throughput, w/ higher portability
- No RSS+MARK for Tx: **Path duplication or Path-throu.**

*AF eXpress Data Path

*Credits to: "Balancing Application Portability and Performance", Tim O'Dricoll, Intel, June 2019

Performance vs. Portability



- Portability means the 'time to market' thus ECONOMY
- You may opt to sacrifice ECONOMY for performance, or vice versa.

*Credits to: "Balancing Application Portability and Performance", Tim O'Dricoll, Intel, June 2019

Reflections

What a carrier-grade MEC/NFV really means

- **Major opensource stack support** (e.g. DPDK, K8s, OpenStack)
- **Future-proof** (against ongoing protocol changes)
- **Latency in good hands** (when RTC applied)
- **Throughput at wire rate** (for small packets)
- **Latency-Throughput-Power trade-off in BALANCE**
- **Performance-Portability trade-off in BALANCE**
- **TCO improvement** (at least by 30+%, over baremetal)
- **PAC does all of them and more**

fox brings you to a carrier-grade

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