Cisco Silicon One:

Unifying Network Forwarding with P4 Programmability

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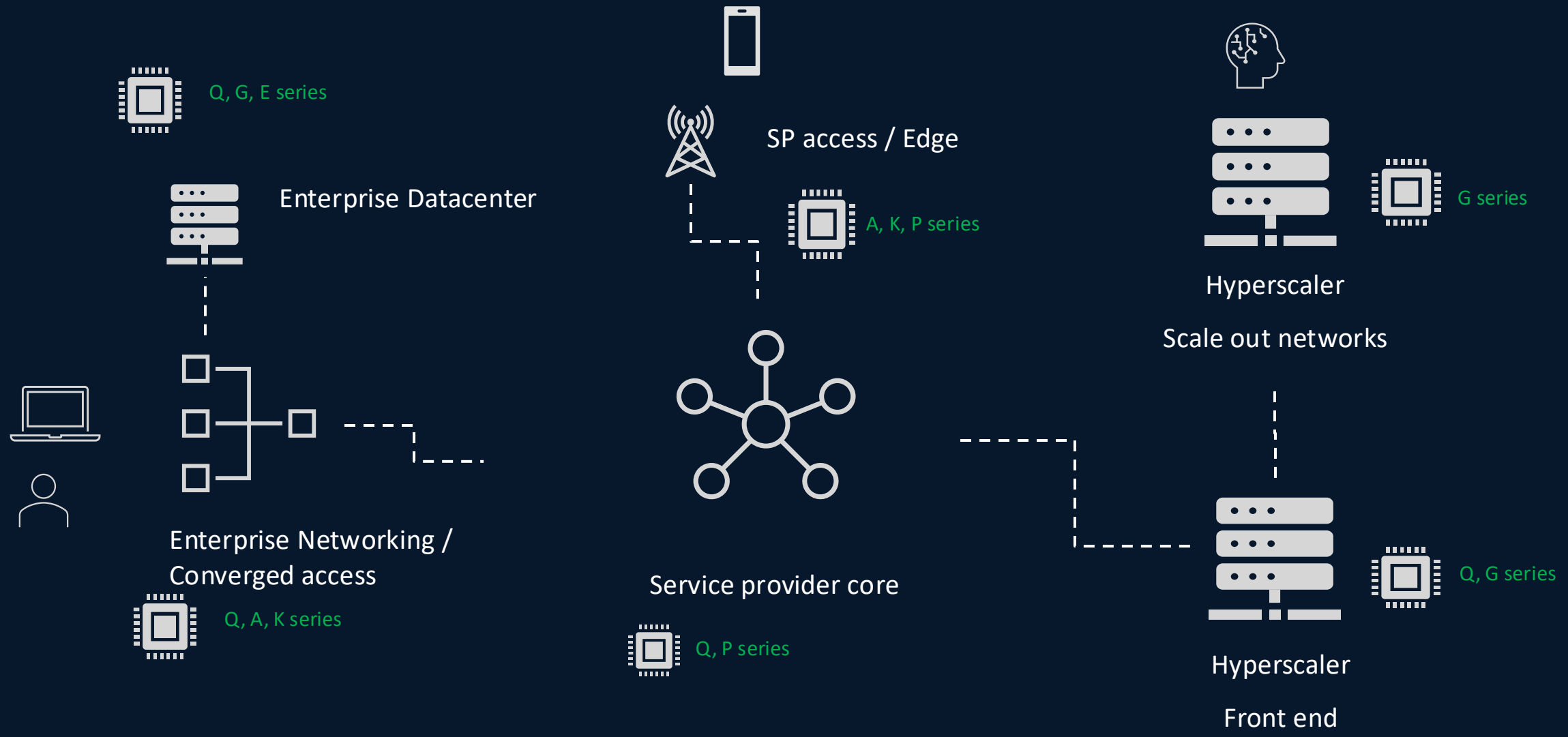
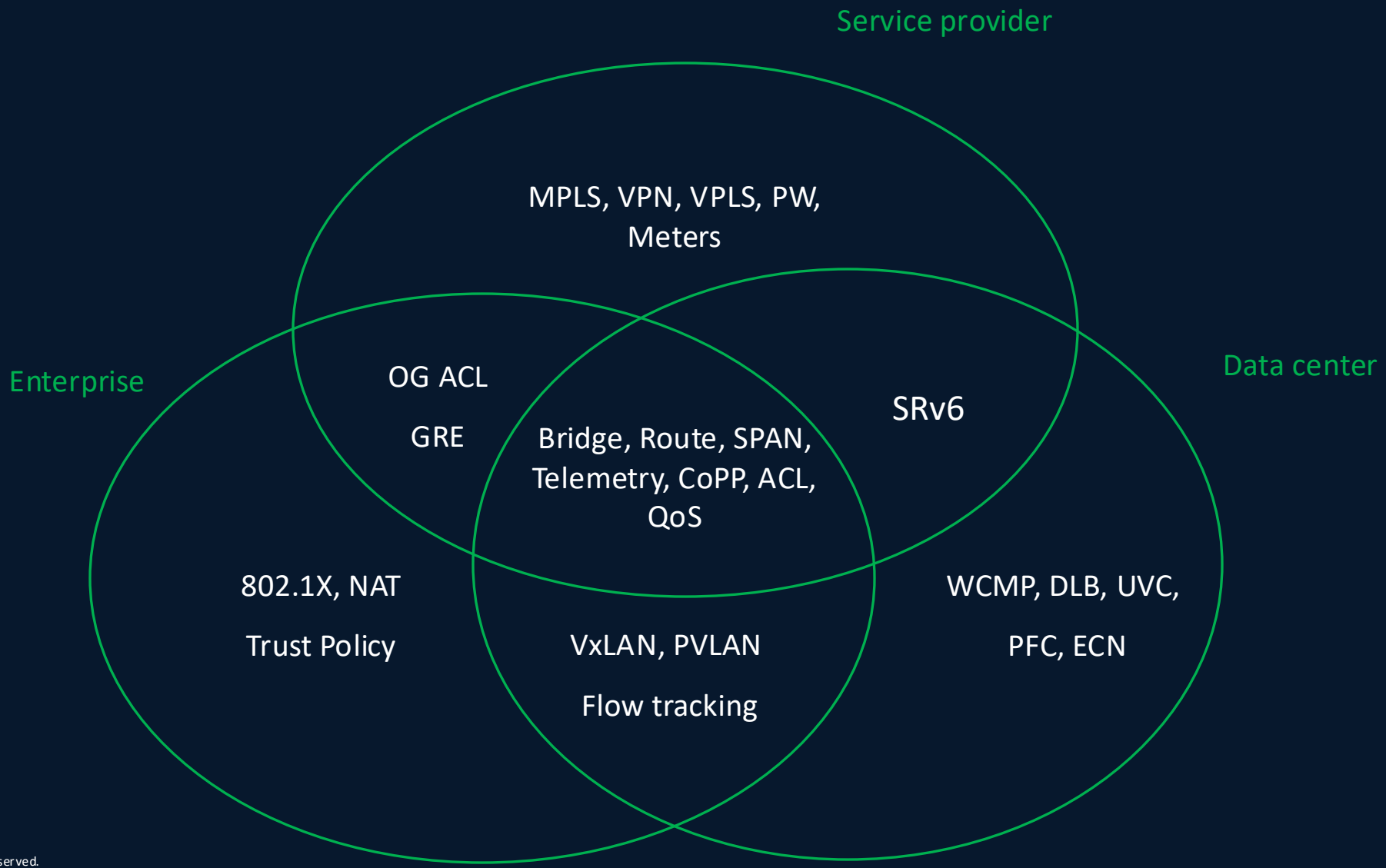
Omnipresent Silicon **One** Architecture

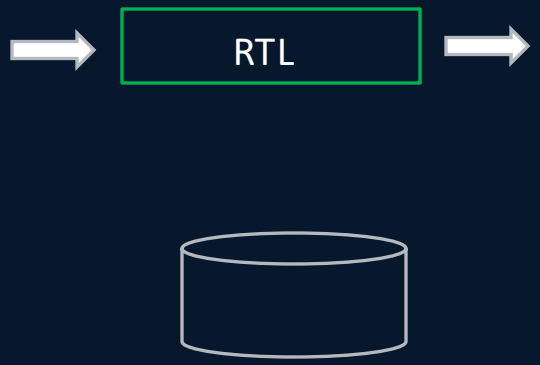


Features by Market



NPU Architectures

FIXED



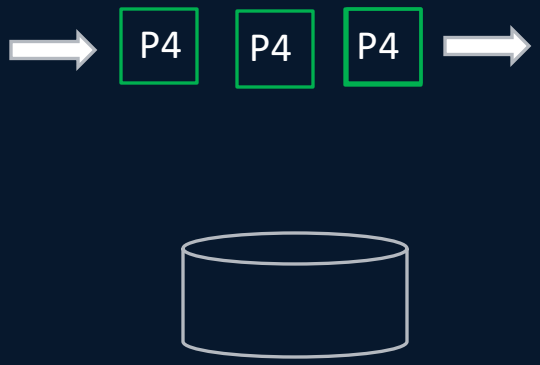
Ultra Low latency

Packet per clock

Inflexible

Fixed capacity

PROGRAMMABLE PIPELINE



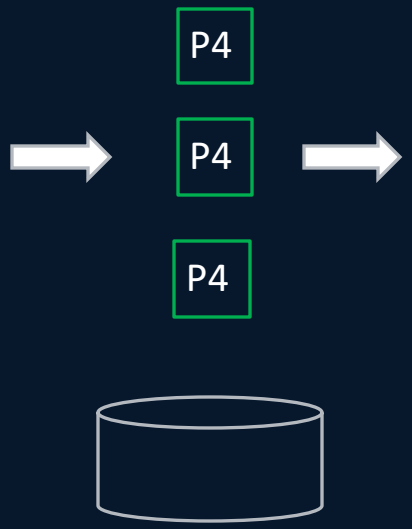
Low latency

Packet per clock

Flexible

Fixed capacity

RUN TO COMPLETE



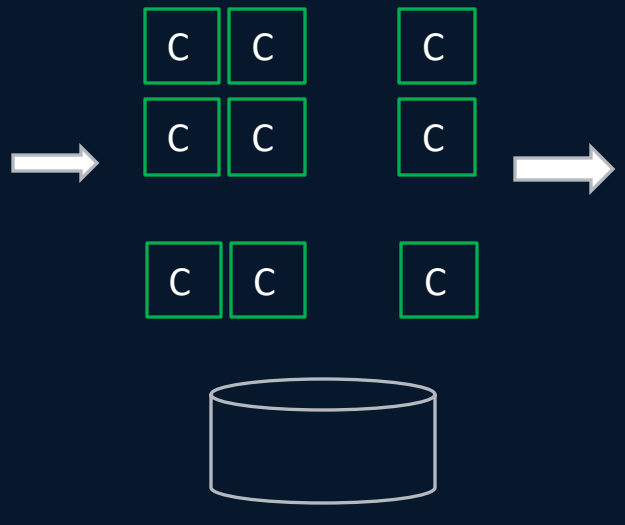
Low latency

Packet per clock

Flexible

Run to complete

CPU ARRAY



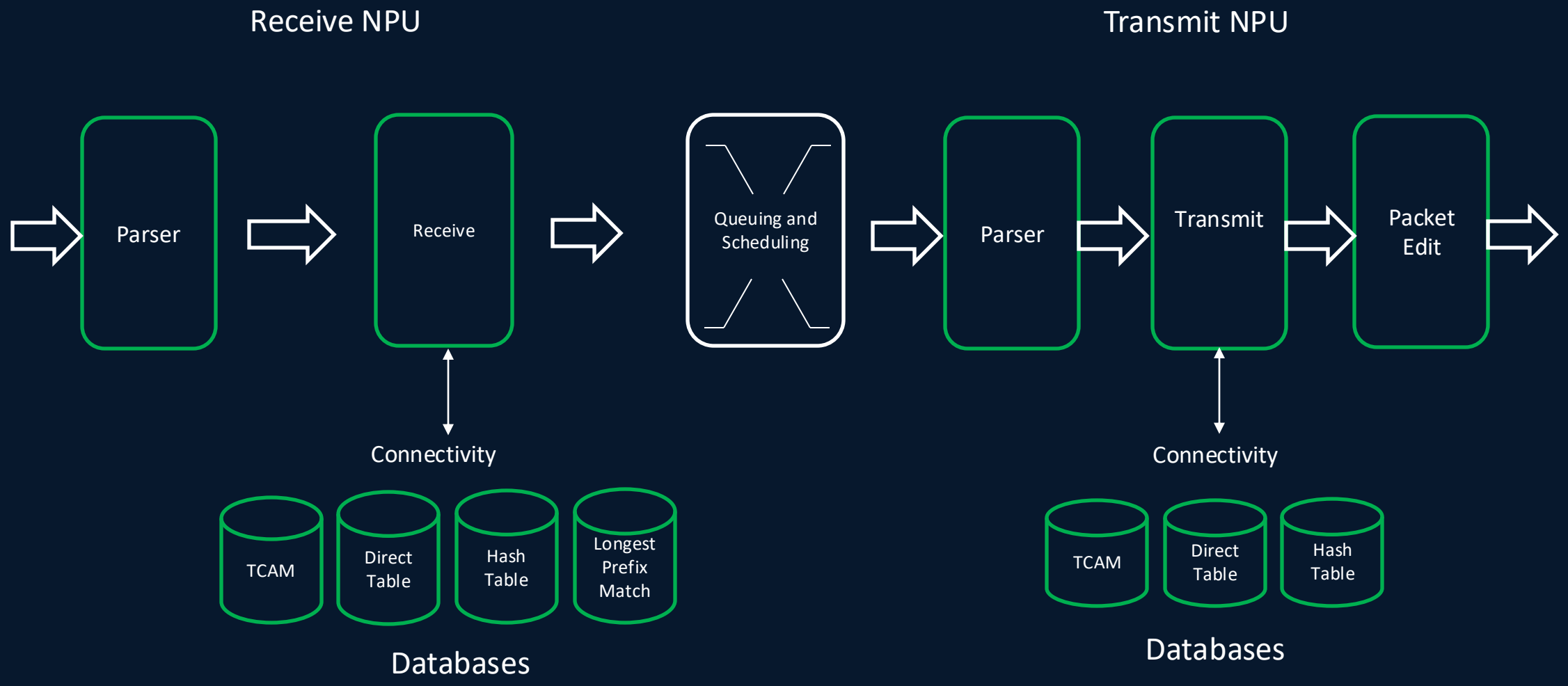
High latency

Packet per N clocks

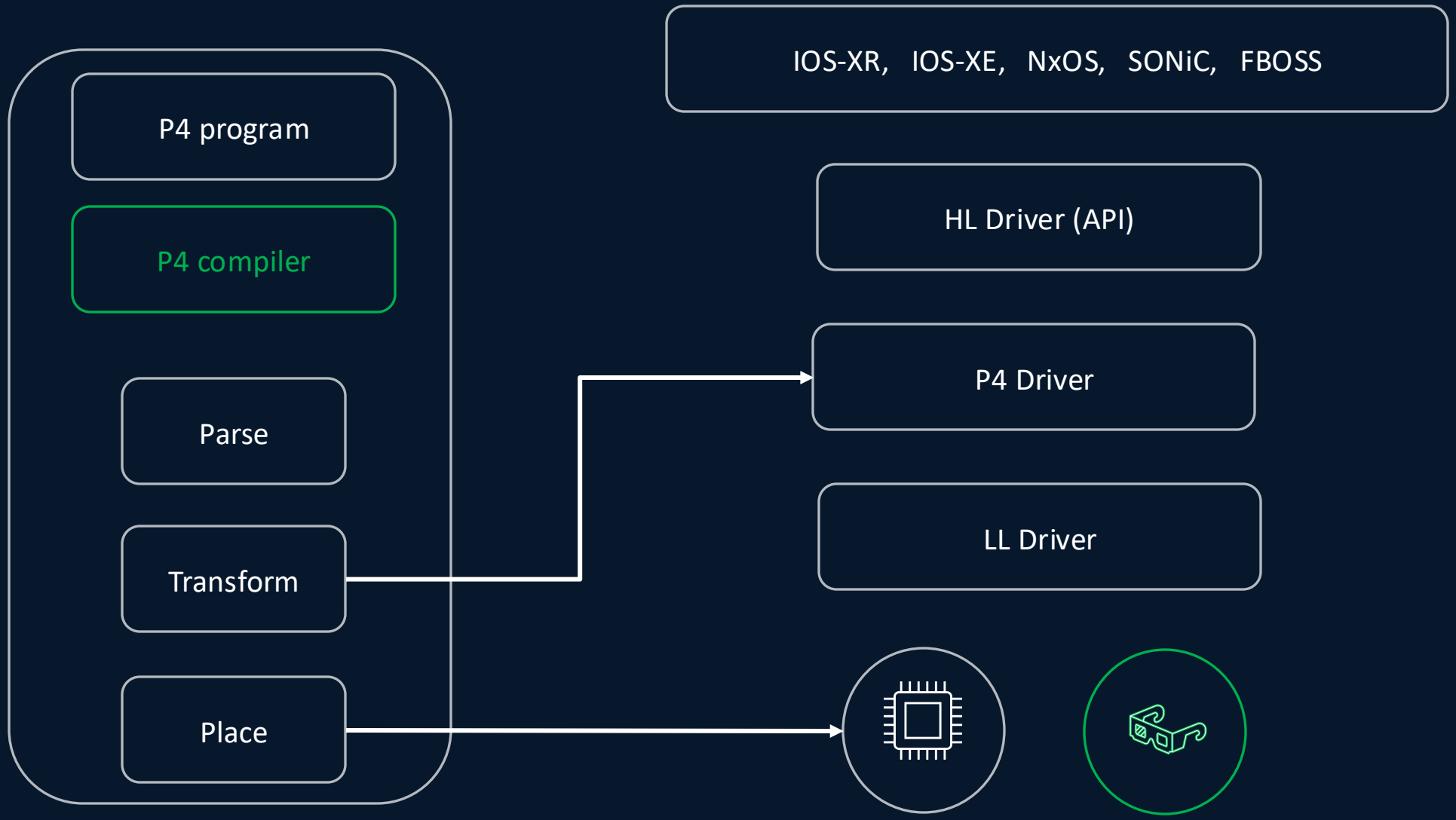
Flexible

Run to complete

Network Processor Overview (NPU)

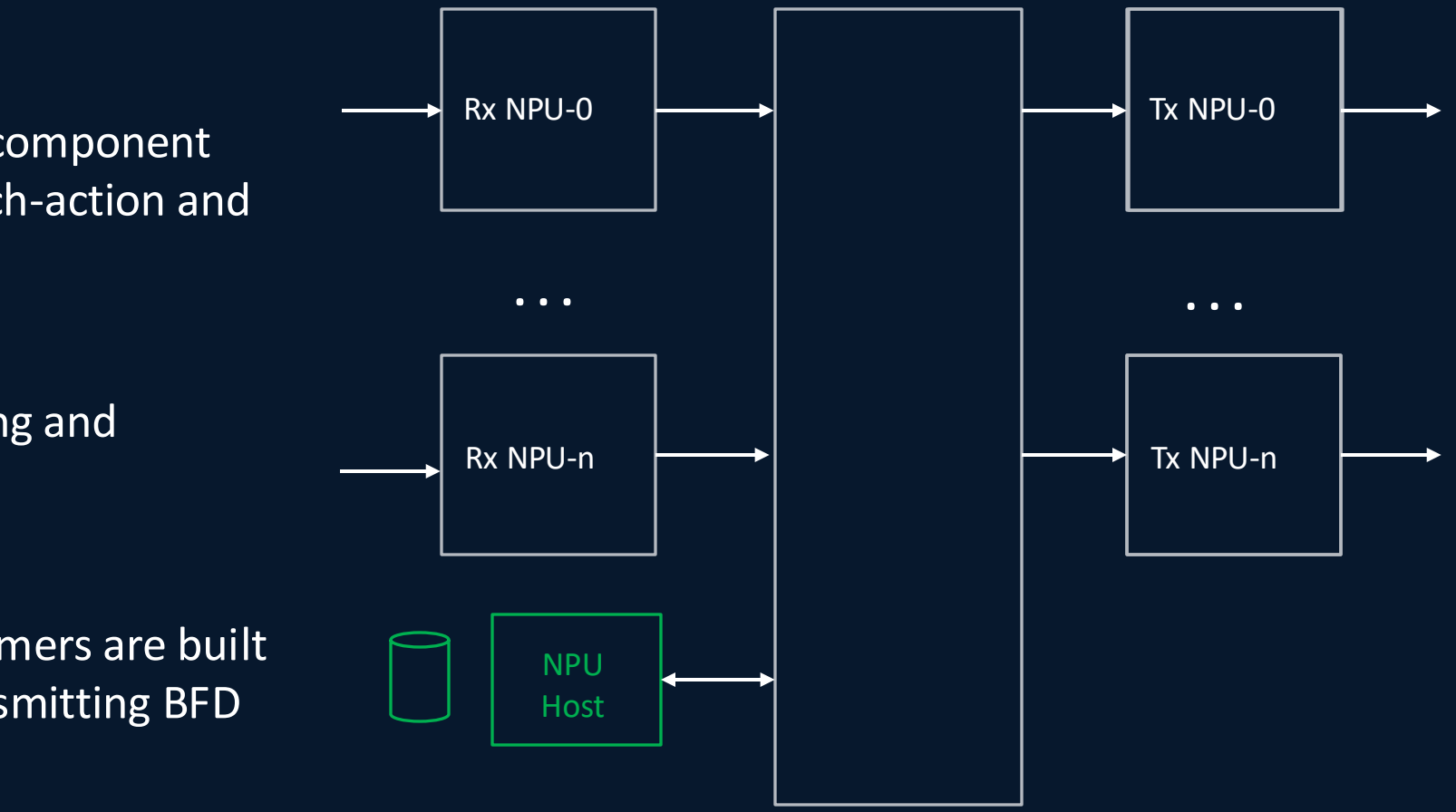


Programmability infrastructure



NPU Host

- NPU Host is a special programmable IP capable of running high bandwidth applications such as BFD, IPM, CFM.
- NPU host is built with identical component from the NPUs like Parser, Match-action and Editor functions
- NPU host is capable of generating and consuming packets.
- Special stateful databases like timers are built for special applications like transmitting BFD packets at periodic intervals



Benefits of unified programmable architecture

- Never say never / Time to market
  - OG-ACL, SRv6, TrustSec, NAT, Packet-trimming were implemented post Silicon tape-out based on customer need.
- Adjust to changing market needs / Investment protection
  - As newer markets such as AI evolve, have tools ready to get ahead
- Cross market reuse
  - Heavy leverage of features across markets.
- Bug-fixes
  - Post Silicon bugs avoided by creatively solving the problem in Silicon.

Benefits : Cross market reuse : ACL anywhere

- Customer A needed ACL as the first activity for security.
- Customer B needed ACL before forwarding to enable PBR set VRF.
- Customer C needed ACL after ECMP to include destination port in the ACL

Fixed pipeline

Cisco Silicon One code flow

Benefits : Never say Never : OG ACL

Allow 1000 prefixes in a system to talk to each other, deny all other traffic for these prefixes.

IP-1 to IP-2 Allow

..

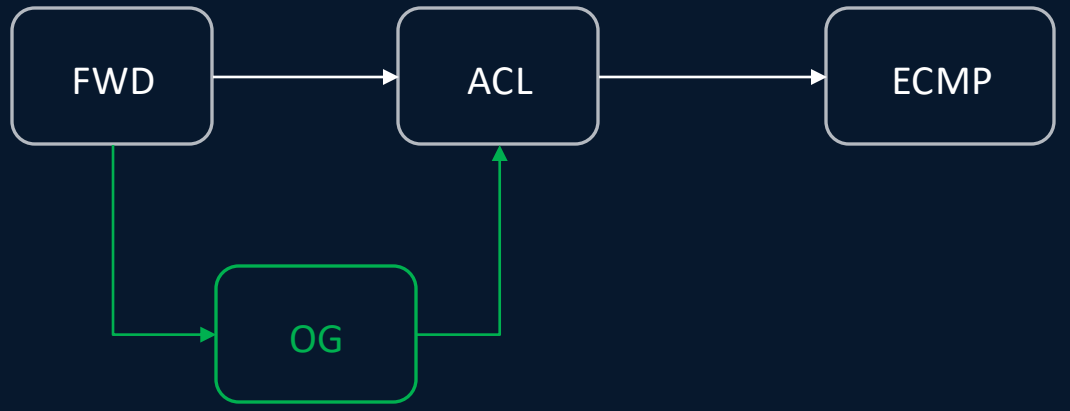
IP-1 to IP-1000 Allow

..

IP-1000 IP-999 Allow

Deny ALL

Million ACEs



Create OG-A

Add IP-1 OG-A

..

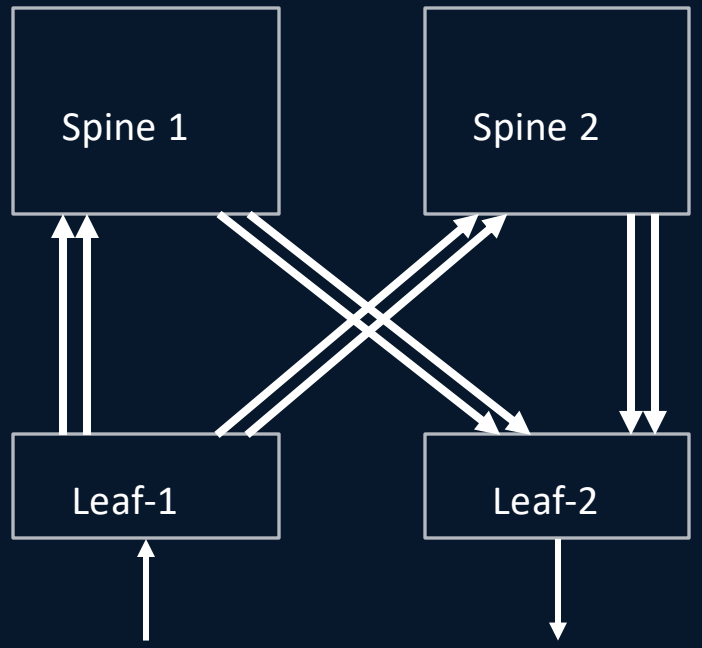
Add IP-1000 OG-A

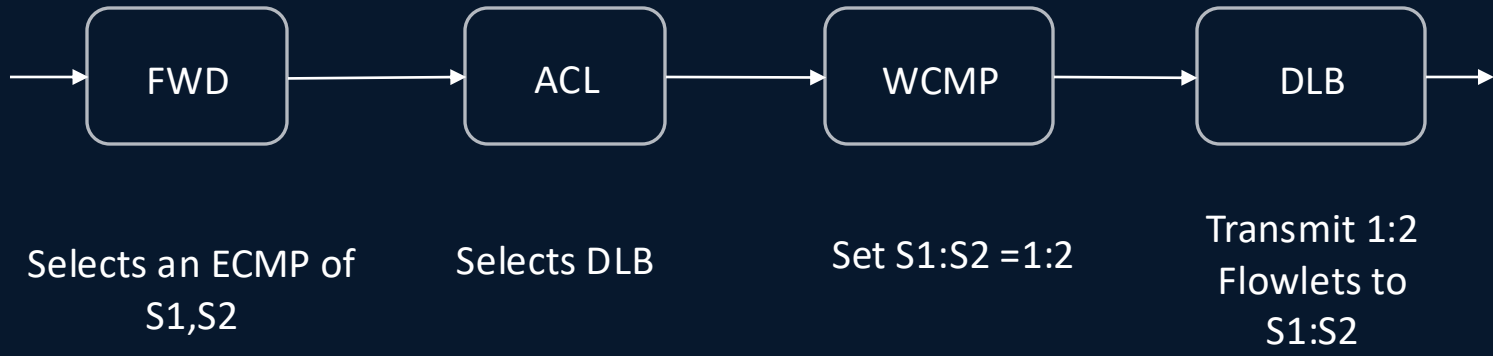
OG-A to OG-A Allow

Deny ALL

1000 LPM entries + 2 ACEs

Benefits : Never say Never : WCMP + DLB

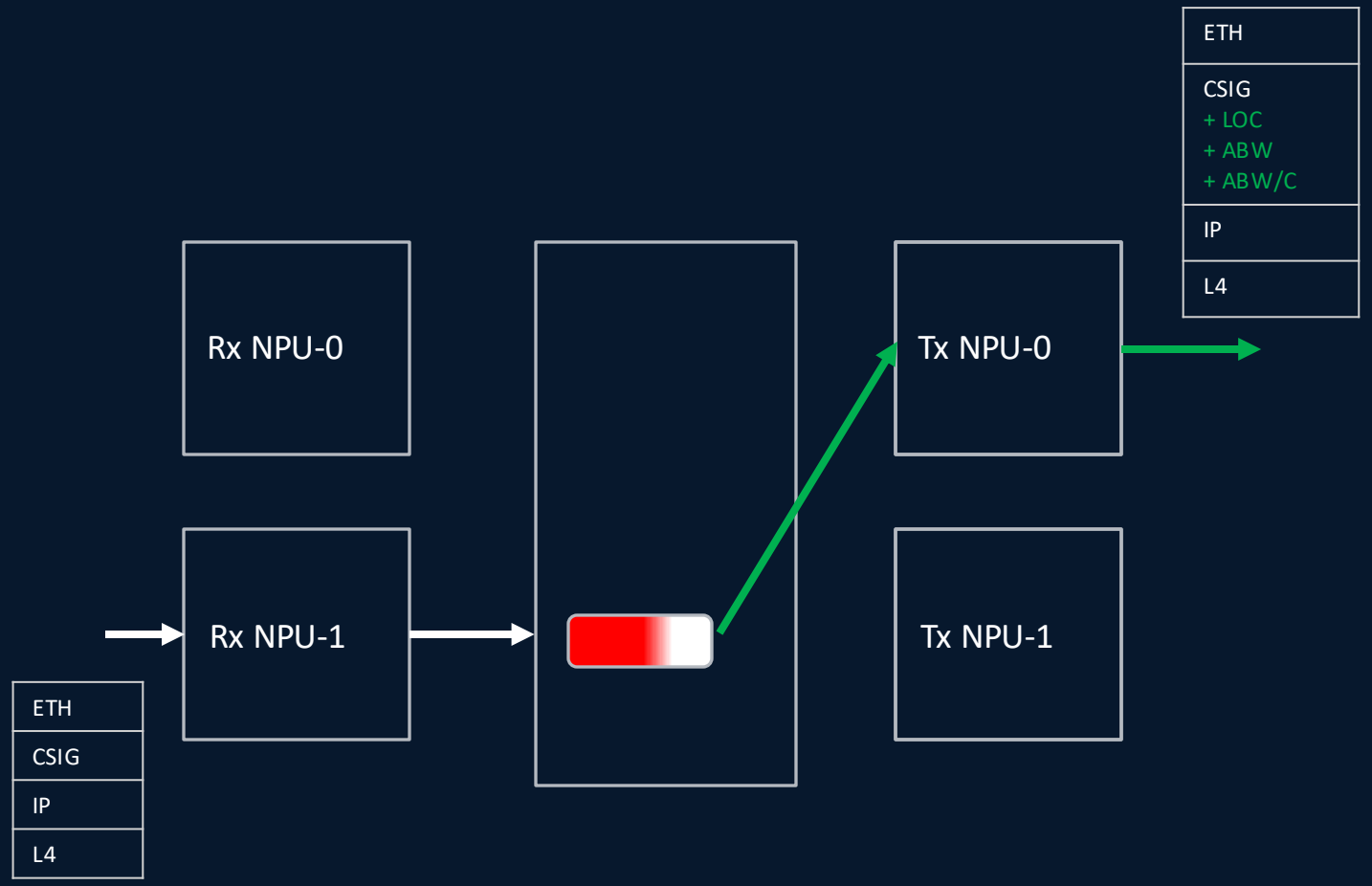




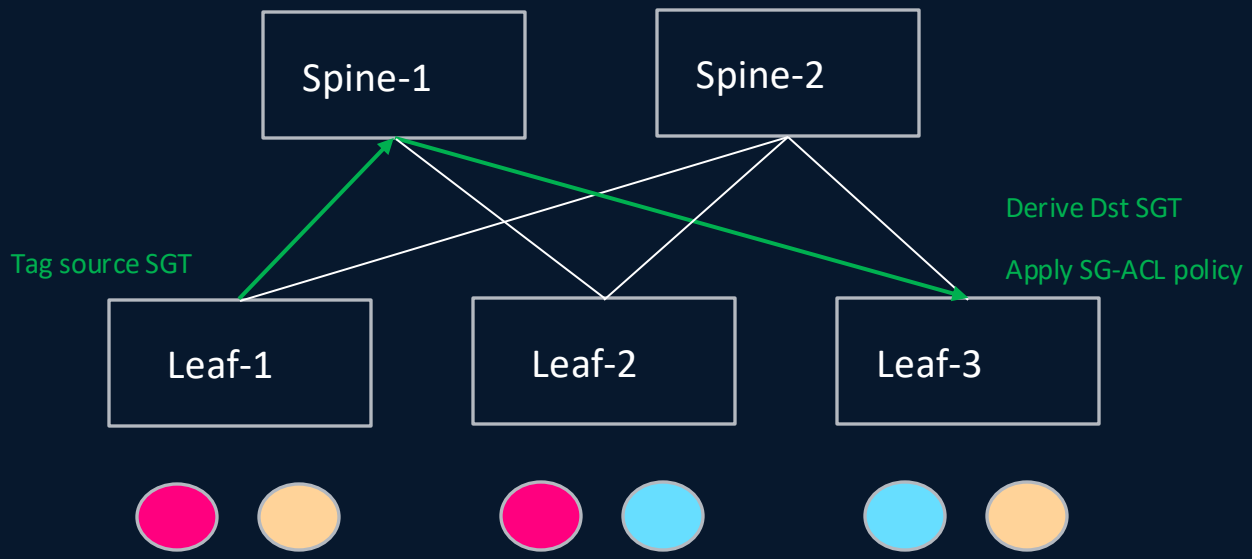
1. Support Flowlet Load balancing, where flow let definition includes RoCE Queue pair
2. Bias traffic towards S1,S2 in the ratio of 1:2 towards Leaf-2

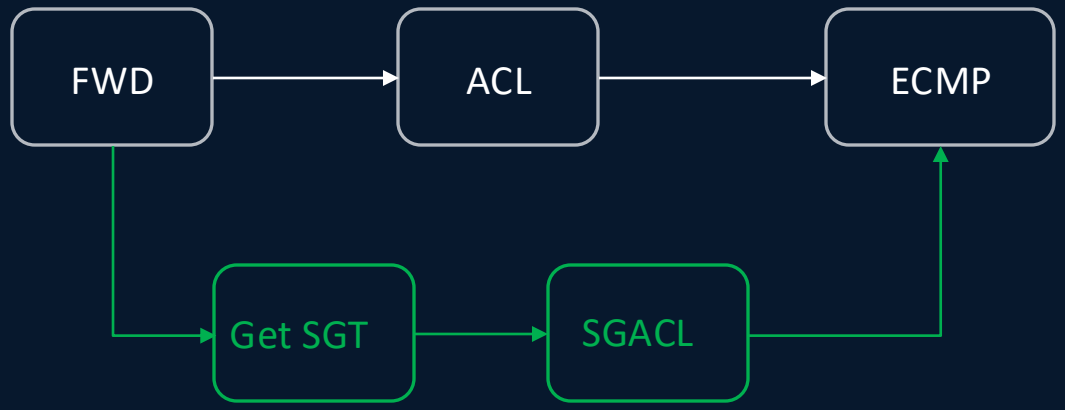
Benefits : Adjust to changing market needs : CSIG

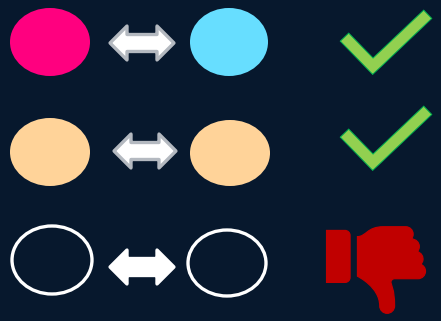
- CSIG provides lightweight, in-band congestion feedback in packet headers so endpoints can detect and react to bottlenecks.
- Switches are expected to update the CSIG tag with congestion status experienced by the packet.
- Feature was executed at full throughput by flexing the programmable engines.



Benefits : Cross market reuse : Cisco TrustSec







- VMs are mapped to a security group by the leaf to which the it is attached.
- Ingress leaf tags packet with the source security group (SGT)
- Egress leaf derives destination SGT and performs a policy lookup on the source and destination group tags.

Summary

- Cisco is shipping P4 based switches and routers to the 4 major markets (Enterprise-Campus, Enterprise-datacenter, Service provider, Hyperscalers)
- Programmability must be delivered efficiently—minimizing both power consumption and latency.
- Customers love programmable silicon.
- Run to complete, NPU host are powerful concepts
- P4 programmable silicon is enabling post tape-out data path innovation

Q&A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