5G Connected Edge Cloud for Industry 4.0 Transformation

Protect the Mobile Core and Unleash Scalable Innovation with Programmable MEC

Moderator: Marc LeClerc, NoviFlow
Speakers: Jesper Eriksson, NoviFlow
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Sven Freudenfeld, Lanner
Nicolas Thomas, Fortinet

2020

Today's Speakers

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VP Product Management
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FORTINET

Moderator:

Marc LeClerc,
VP Strategy and Marketing
NoviFlow

Agenda

The Programmable Network Fabric

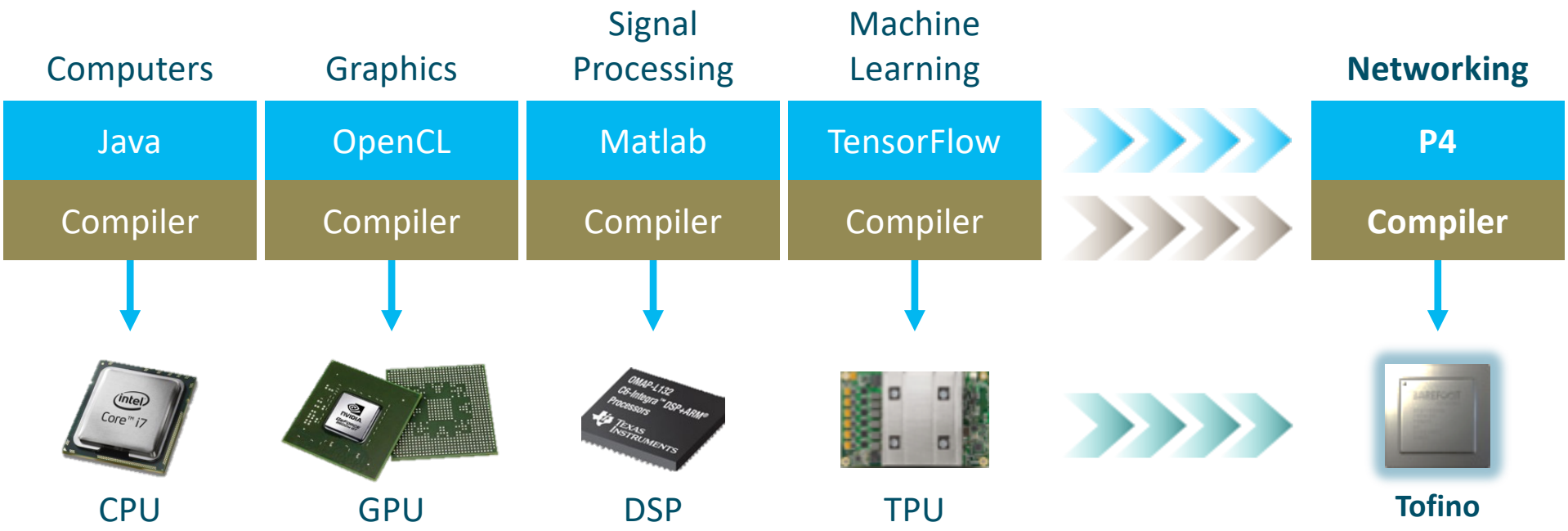
Converged MEC Smart Edge Platform

NOS, O&M, and MEC Platform Software

Virtualized, Scalable Security Software

Use Cases

General Industry Trend:
Rise of the Domain-Specific Architectures (DSAs)



P4 Community and ECOSYSTEM

- **Packet Headers**

```
header ethernet_h {
    bit<48>     dstAddr;
    bit<48>     srcAddr;
    bit<16>     etherType;
}
```

- **Match-Action Table**

```
table dmac {
    key = {
        ingress_metadata.bd : exact;
        ethernet.dstAddr    : exact;
    }
    actions = {
        dmac_hit;
        dmac_miss;
        dmac_redirect_to_cpu;
    }
    default_action = dmac_miss;
    size = 131072;
}
```

- **Actions**

```
action dmac_hit(bit<9> egress_port) {
     ig_intr_md_for_tm.ucast_egress_port = egress_port;
     l2_metadata.same_if_check =
             ig_intr_md.ingress_port ^ egress_port;
}
```

P4 Features

- Open Spec, Compiler, Test Frameworks, and more
- Protocol Independent
- Target Independent

Strong community

- 4000+ developers trained and growing
- 100+ member organizations
- Expanding across the globe

Accelerating adoption

- Expanding adoption by new vendors
- Switches, NICs, FPGA, Software Data Planes

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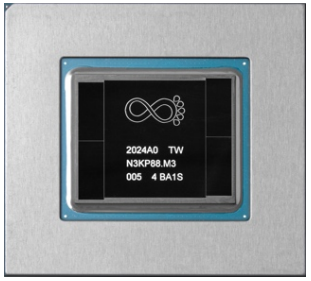
BAREFOOT PRODUCTS

1.2 <-> 6.4 Tb/s

Tofino

Family of P4-programmable Ethernet switch ASICs



4.0 <-> 12.8 Tb/s

Tofino 2

P4 Studio

State-of-the-art P4 compiler and Development Environment

P4 Insight

P4 Code Debug Tool

Deep Insight

Network performance monitoring and analytics software

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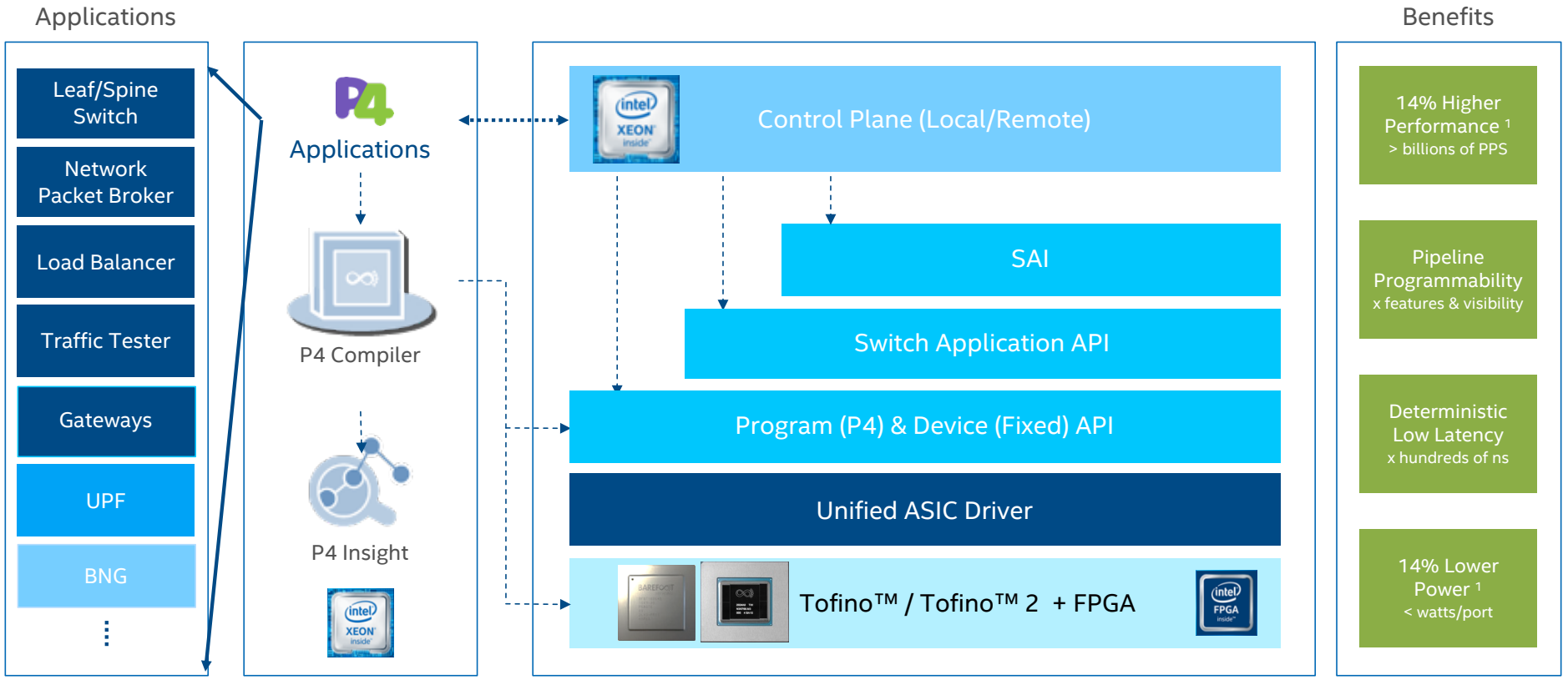
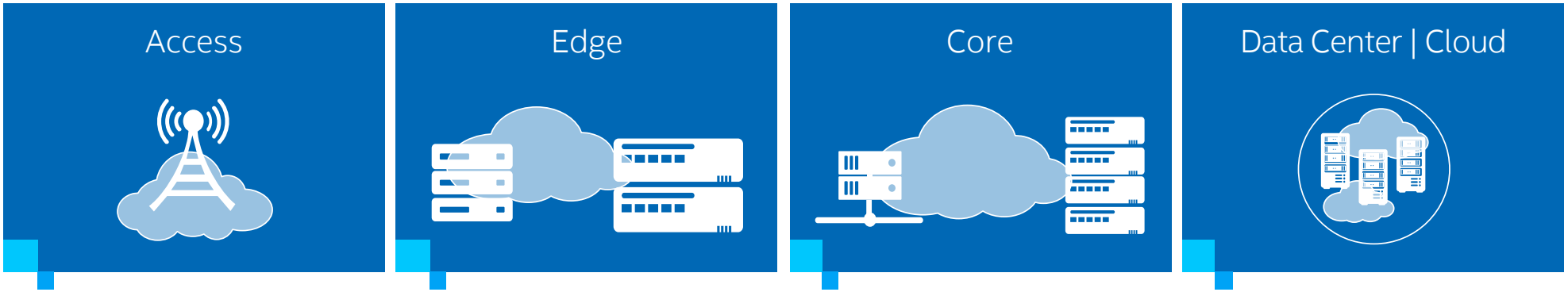
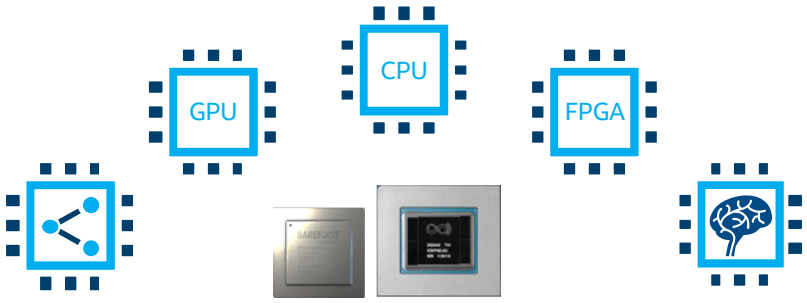
Benefits of P4 Programmable Switches



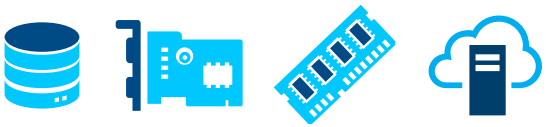
1. For more complete information about performance and benchmark results, visit www.intel.com/benchmarks. See configuration details at the following https://www.arista.com/assets/data/pdf/Datasheets/7170-Datasheet.pdf (uses Intel Tofino) https://www.arista.com/assets/data/pdf/Datasheets/7260X3_Datasheet.pdf (uses Broadcom Tomahawk 2). For optimization, please visit https://software.intel.com/en-us/articles/optimization-notice.

End-to-End Fabric with Programmable Components





P4-Programmable Fabric



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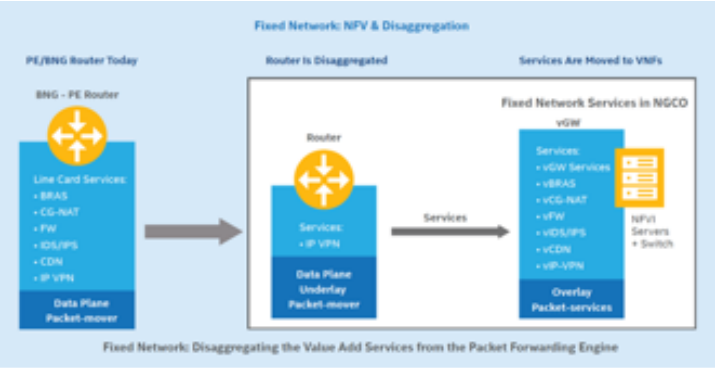
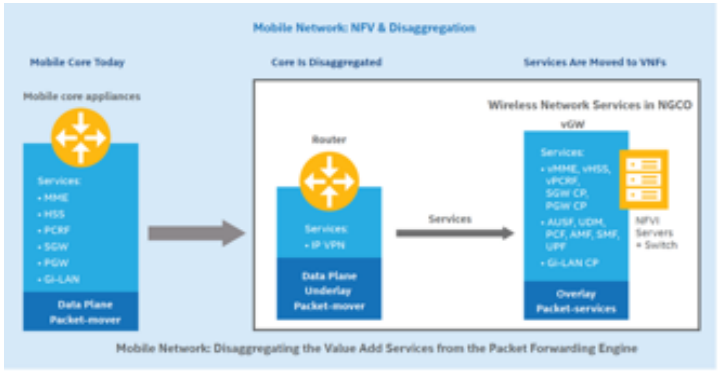
Forwarding Plane Convergence

Fixed Network



Mobile Network



Open programmable Whitebox

From this

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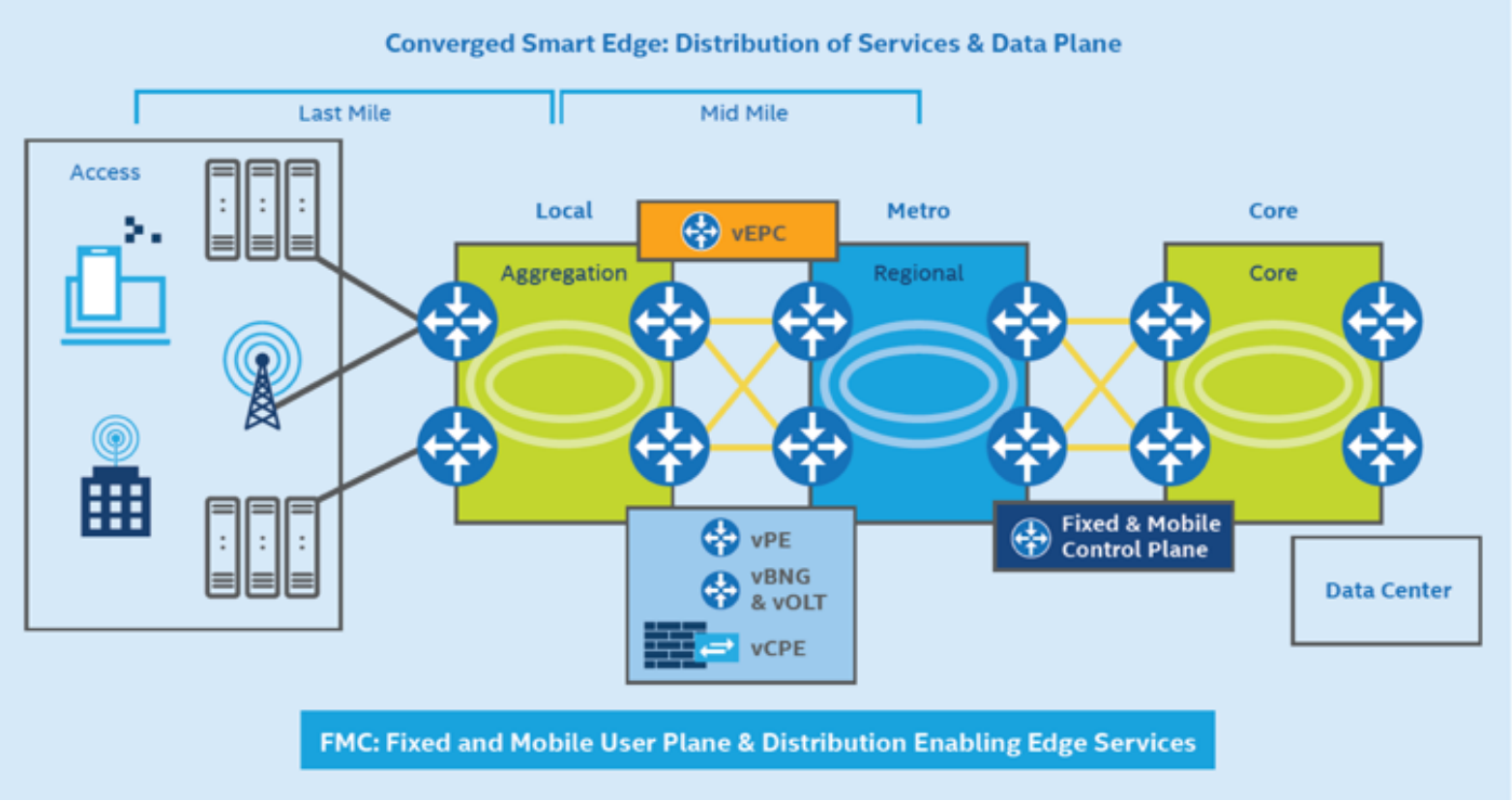
The Growing Strategic Importance of the Edge in Service Delivery



Lanner MEC Platform Overview

HTCA-6600: 2nd Gen Intel® Xeon® x86 / Barefoot Tofino™ Switch Integration

Application Ready MEC Platform

- Compute
- Network
- Storage
- Virtualization

P4 Programmable Edge

Legacy silicon relies on legacy protocols

Carrier Edge needs programmable networks not based on legacy protocols

- Adaptable to support new features
- Software defined for automation

Better Visibility

Provide visibility into the operational health of the platform and the performance of the VNFs

- In-band Network Telemetry (INT) for VNF performance
- Monitor the operational performance of the network

Scalable Architectures

Collapse multiple appliances on Tofino Scalable network, compute and applications

- NoviFlow uses the network to scale across multiple virtual machines and blades

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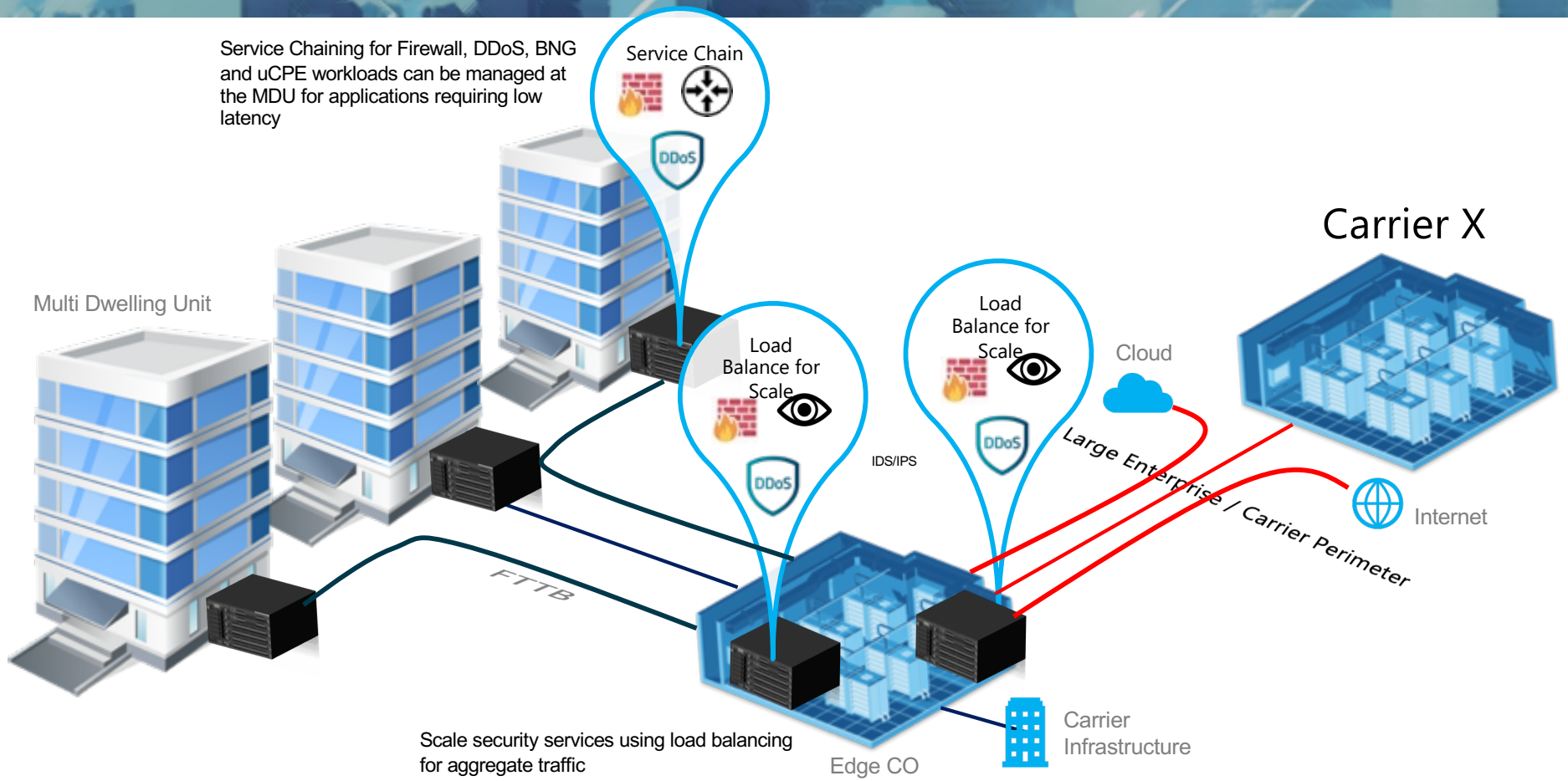
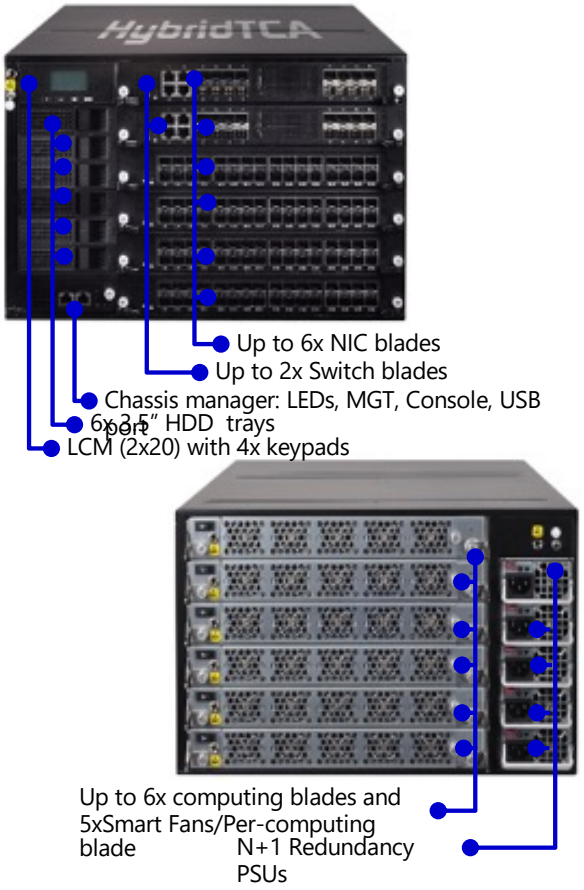
Lanner MEC Platform - Services at the Edge



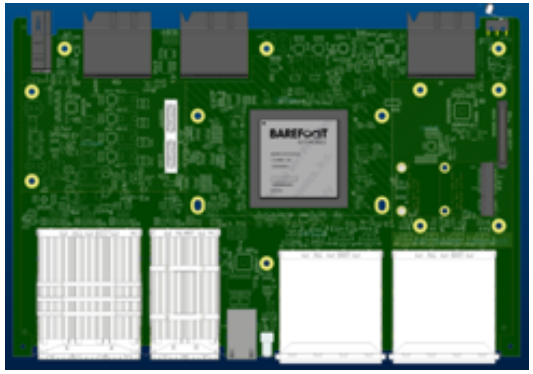
System Features: HTCA-6600

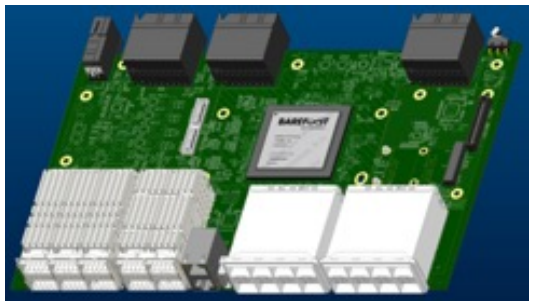


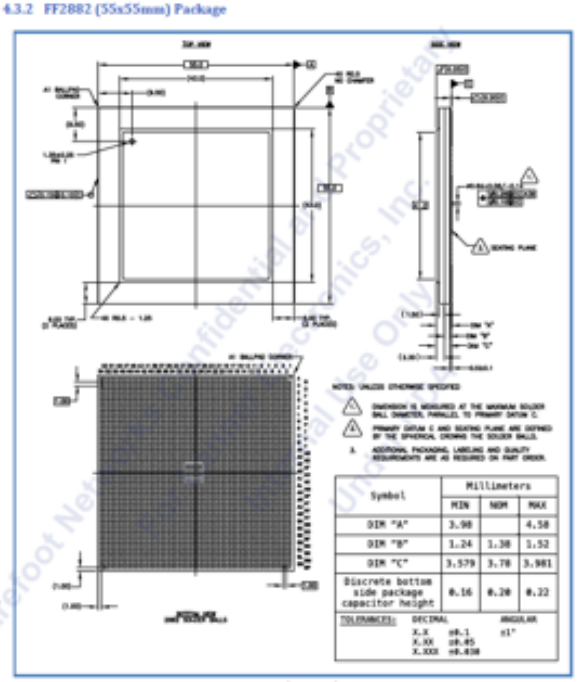
- Dual Barefoot Tofino™ switch blades for redundancy
- Six computing blades with dual Intel® Xeon® CPUs on each board, up to 44(2x22)/56(2x 28) cores per computing blade
- Memory supports up to 512GB Per-computing blade and 3072GB for 6U in total
- Each computing blade connects to the switch blade through 2x KR4 interface
- Six network blades with 10/40 ports
- Up to 192 ports 10G SFP+
- 6x2.5" HDD trays
- N+1 Redundant PSUs

Optimized for the Barefoot Tofino™

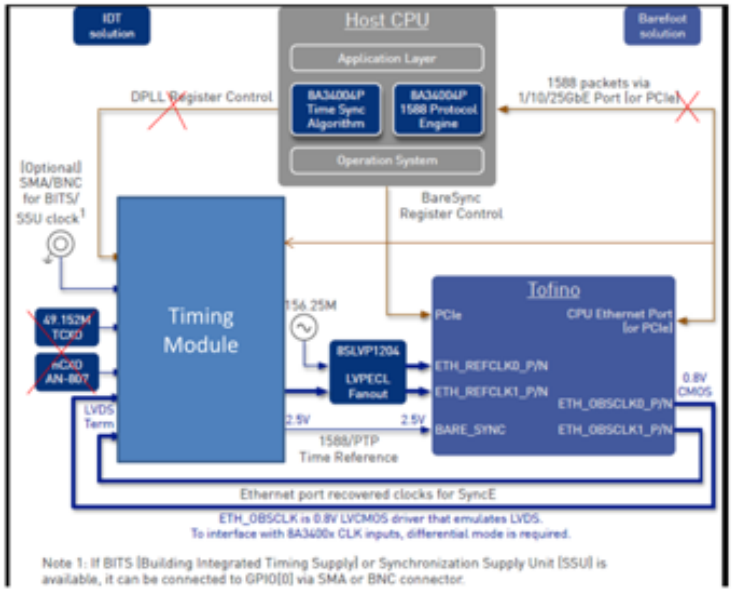
FF2882 (55.0x55.0mm) Tofino 3.2T







Timing Card Support



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NoviFlow Software for the Lanner HTCA- 6600

NoviWare™

- Mature switch NOS for even the largest deployments ported to the HTCA-6600 Tofino switch blades
- Supports P4Runtime and OpenFlow 1.5 standards
- Includes full range of OAM features
- Empowers the application programmer to define the forwarding behavior of the switch silicon to support the needs of the application

CyberMapper™

- Proven application providing services in carrier networks ported to the HTCA-6600 compute blades
- CyberMapper services:
  - Threat Intelligence Gateway
  - Traffic steering
  - Packet broker filtering
  - Sticky stateless load balancing
  - SRv6 Routing
  - Service chaining through SRv6

VisualAnalytics™

- New application that provides end-to-end view of the HTCA-6600 platform for hardware and software trouble shooting
- Simplifies OAM of the HTCA-6600 platform:
  - Avoid truck rolls
  - Preventive maintenance

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Elements of CyberElastic

NoviFlow

IBM Red Hat

FORTINET

NoviFlow

IBM Red Hat

Lanner

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NoviWare™ Inside

NoviFlow VisualAnalytics
Complete visibility of all performance and health metrics for the solution

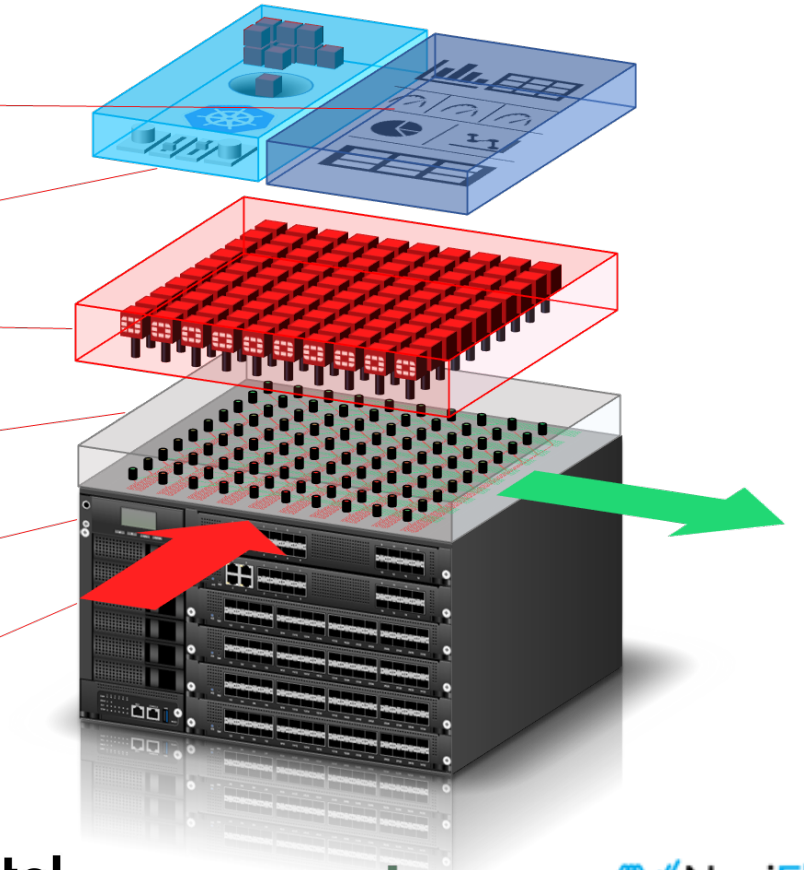
Red Hat OpenShift
Commercially supported Kubernetes Docker container management and orchestration

Fortinet FortiGate® Security Cluster
Elastically scale from 10s to 100s of virtual security appliances for 1Tbps throughput

NoviFlow CyberMapper Load Balancer
1.6 Tbps front panel I/O load balances 1.2 Tbps to the FortiGate security cluster.

Red Hat Enterprise Linux
Commercially supported Linux distribution.

Lanner HTCA Platform
Compute, storage and a programmable network all in one box.



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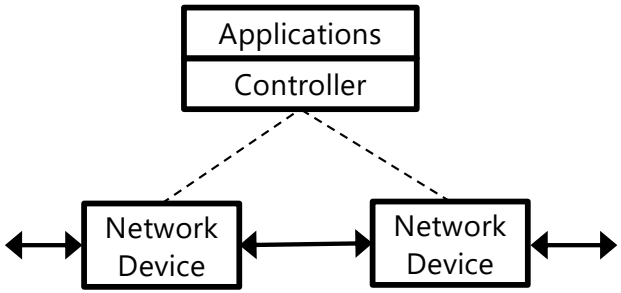
Programmable Networks

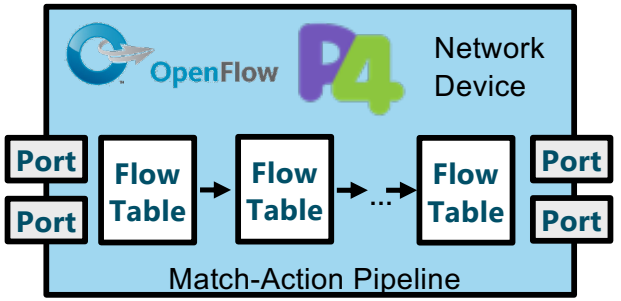
Orchestration: NETCONF/gNMI/YANG/OpenConfig

- Programming the configuration and state data in the network device
- The network device's configuration and state data is abstracted through a standardized YANG data model and this data may be pushed or read from the device through the NETCONF/gNMI protocols
- Benefits: Automate provisioning of legacy network devices



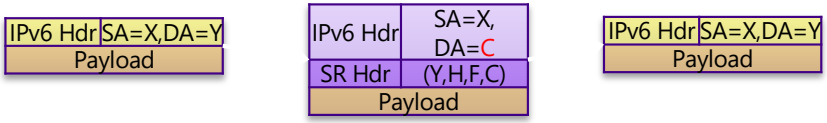
Match-Action Pipeline: OpenFlow/P4/P4Runtime

- Programming the match-action pipeline in the network device
- A set of match-action flow tables are programmatically defined through OpenFlow or P4. At runtime, a controller pushes flow entries into these flow tables. The match-action pipeline and flow entries define how a packet is processed by the network device
- Benefits: Allows the network device to evolve its functionality over time through software updates and it separates the PCE from the protocol stacks



Packet: Segment Routing over IPv6 (SRv6)/SR-MPLS

- Programming the packets as they enter the network (traditional or SDN)
- Insert into the packet a set of instructions for how the packet will be processed by the network
- Benefits: Traffic engineering, service chaining of addressable service resources



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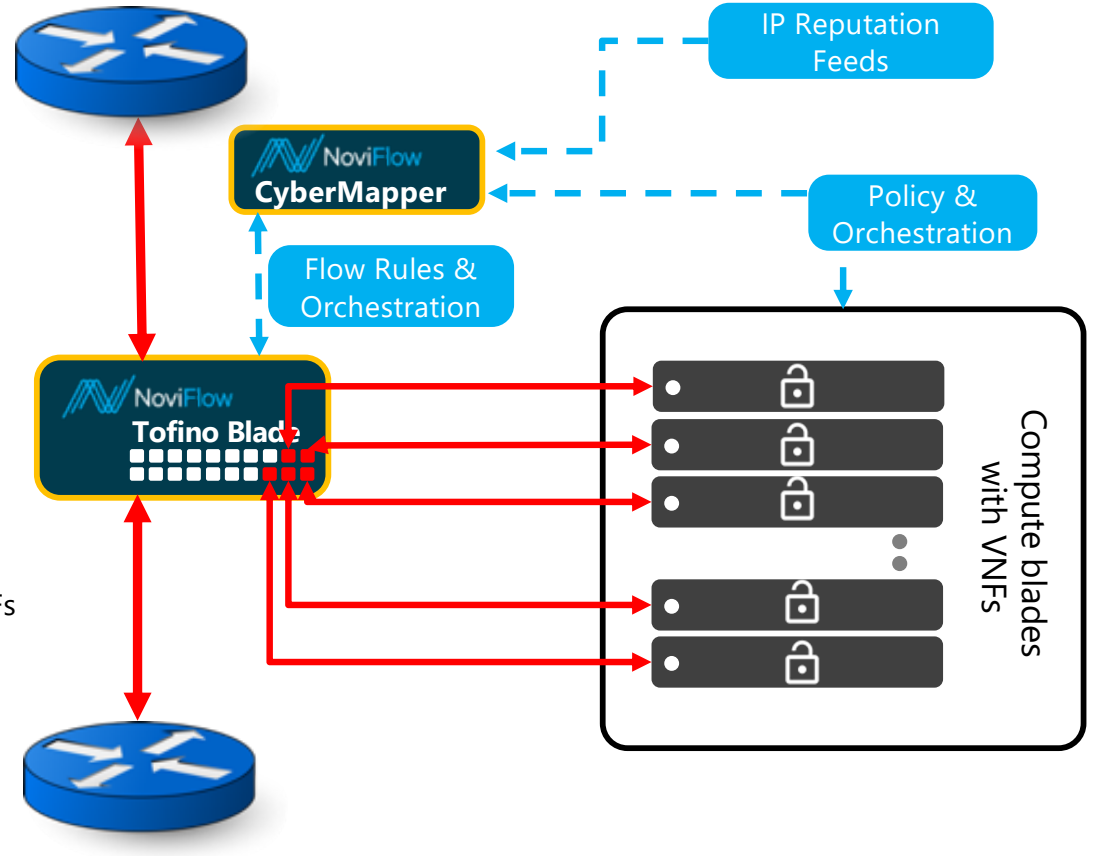
CyberMapper: Scaling Virtual Network Services at the Edge

- **Northbound Interfaces:**
  - Visual OPS (GUI) for OAMP
  - REST API for services provisioning
  - Interface to NMS
- **Services:**
  - **Threat Intelligence Gateway**
    - Sits ahead of the carrier's firewall to offload blacklisted traffic, e.g. IWF's blacklist
  - **Packet broker**
    - Filtering
    - Mirroring
    - Port-pairing
  - **Load balancing**
    - Sticky stateless load balancing
    - Proportional load balancing
    - Dynamically grow/shrink load balanced pool of VNFs
    - SR-IOV into the compute blade VNFs for maximum throughput
  - **Networking**
    - Traffic steering and aggregation
    - In-Band Network Telemetry (INT)
    - SRv6 Routing and Service Chaining
    - SRv6 security services proxy



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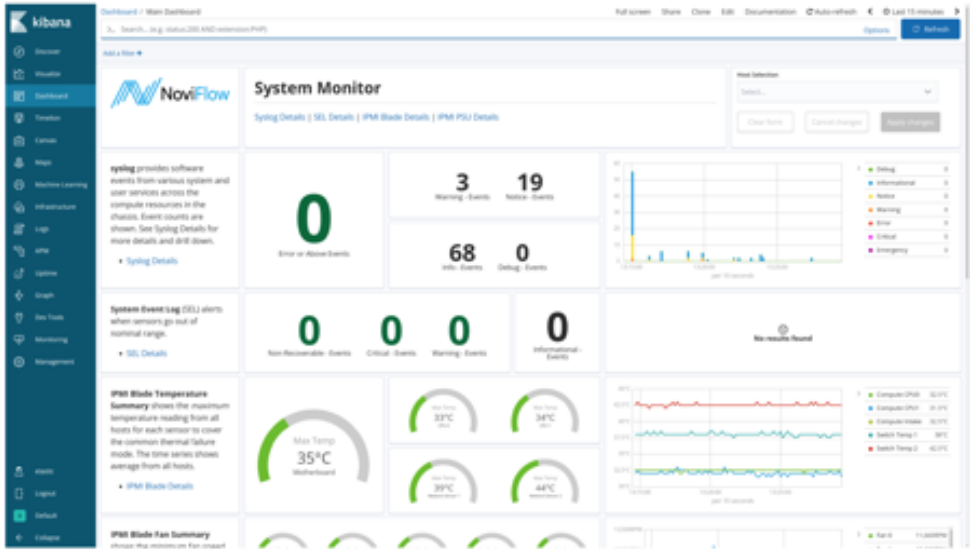
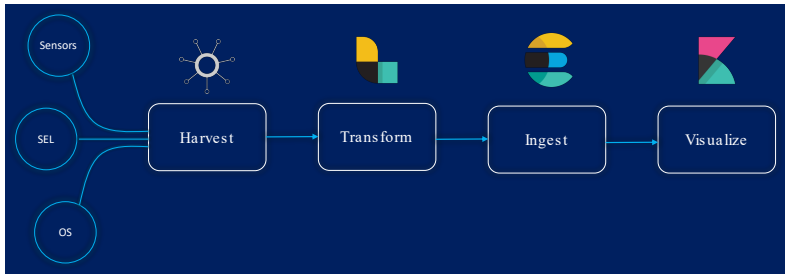
VisualAnalytics: Managing the Edge

- Provides an end-to-end view of the HTCA-6600 platform
- Simplifies the O&M of the HTCA-6600 platform:
  - Avoid truck rolls
  - Preventive maintenance
- How it works:
  - Harvests 1,000s of data points per minute from the HTCA-6600 hardware, the compute blade operating systems and the NoviFlow applications. VNF applications may be added later, e.g. FortiGate VNF
  - The data is transforms into its canonical form and ingested into a time series data lake residing on the HTCA-6600 platform
  - The data is intuitively organized and visualized for easy trouble shooting:
    - Identify key hardware and/or software events
    - Correlate events
    - Drill down into events





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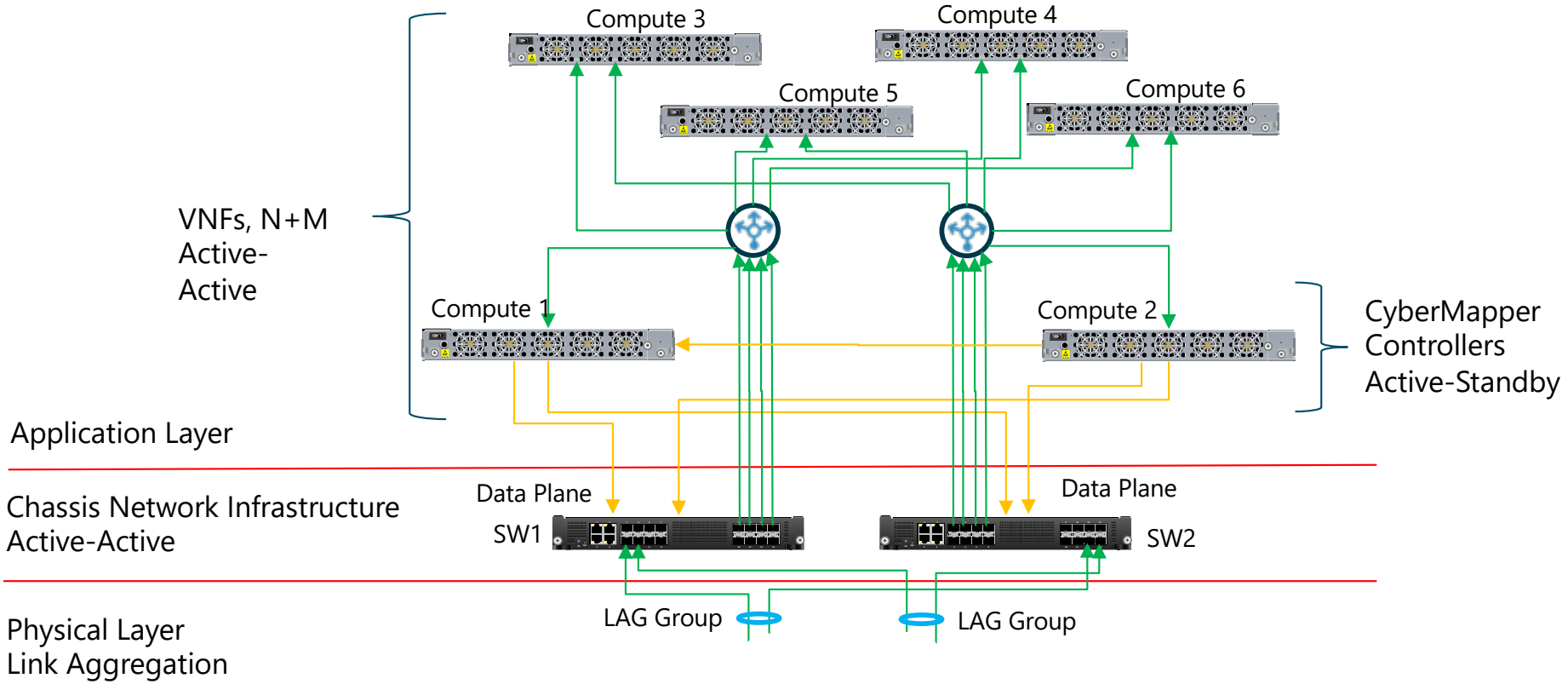
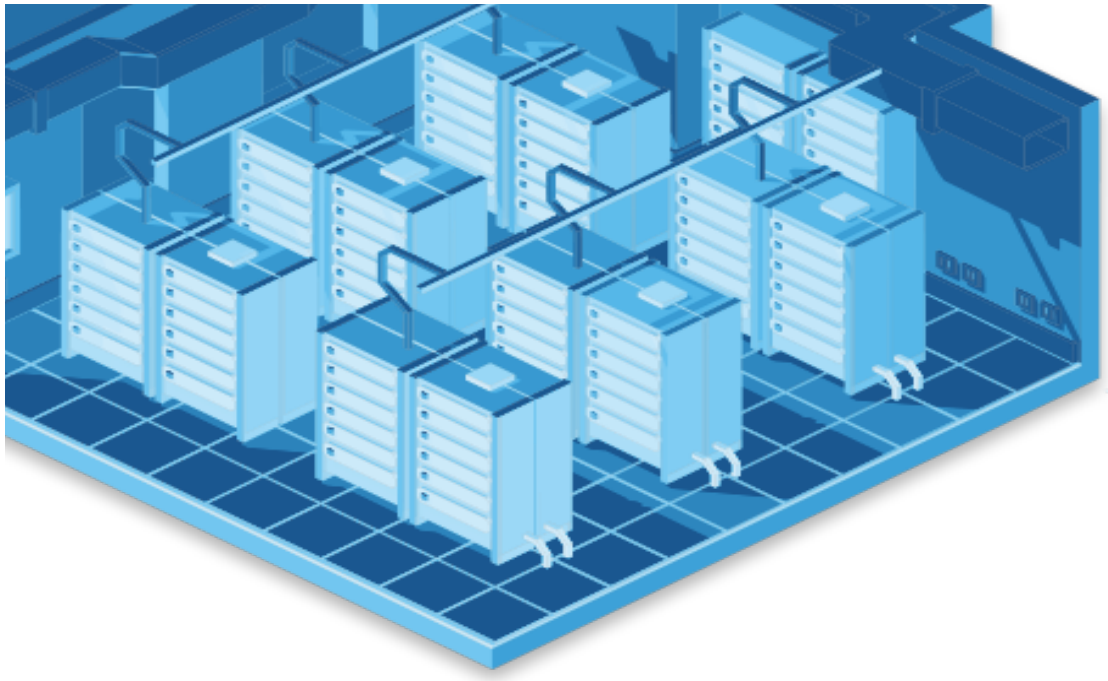
HTCA High Availability Architecture: Assuring the Edge





MEC Use Cases

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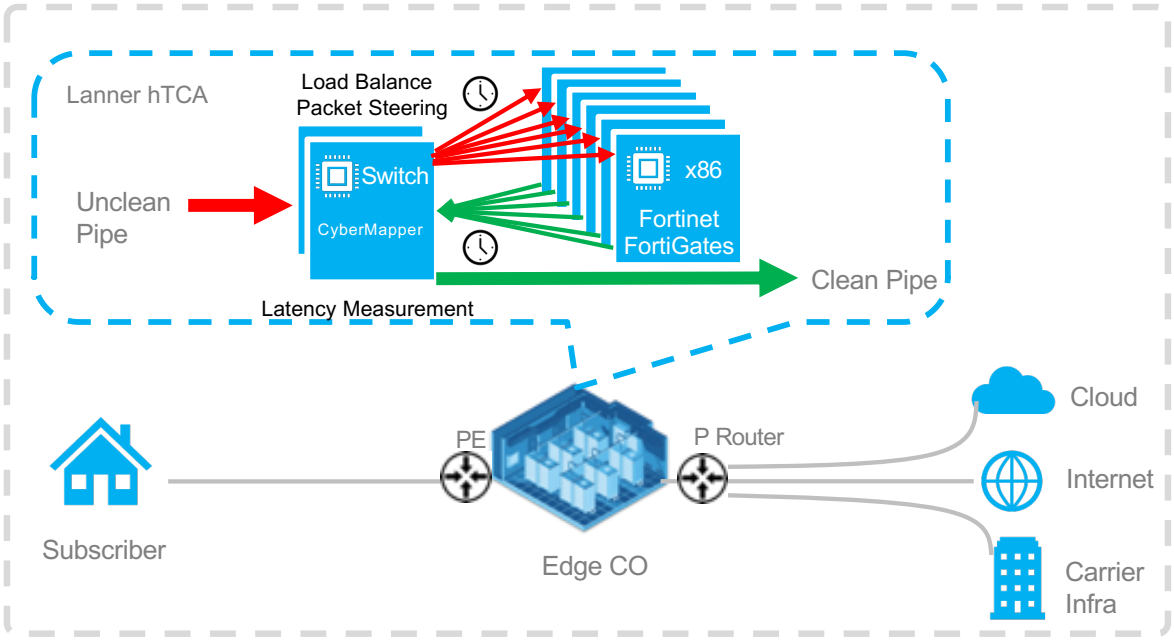
Lanner HTCA MEC Platform – Scalable Security Perimeter



Scalable edge services

- Scale security tools using load balancing, packet filtering, packet steering and service chaining
- Measure latency of security tools using INT for SLA compliance
- Simplify virtual appliance deployment with a network infrastructure designed for security tools:
  - Ex. DDoS, CGNAT, Firewalls and IDS/IPS

Performance Characteristics per HTCA platform

+ Firewall throughput scalable to >900Gbps

+ IPS Scalable to >400 Gbps

+ NGFW (FW + IPS) Scalable to >350Gbps

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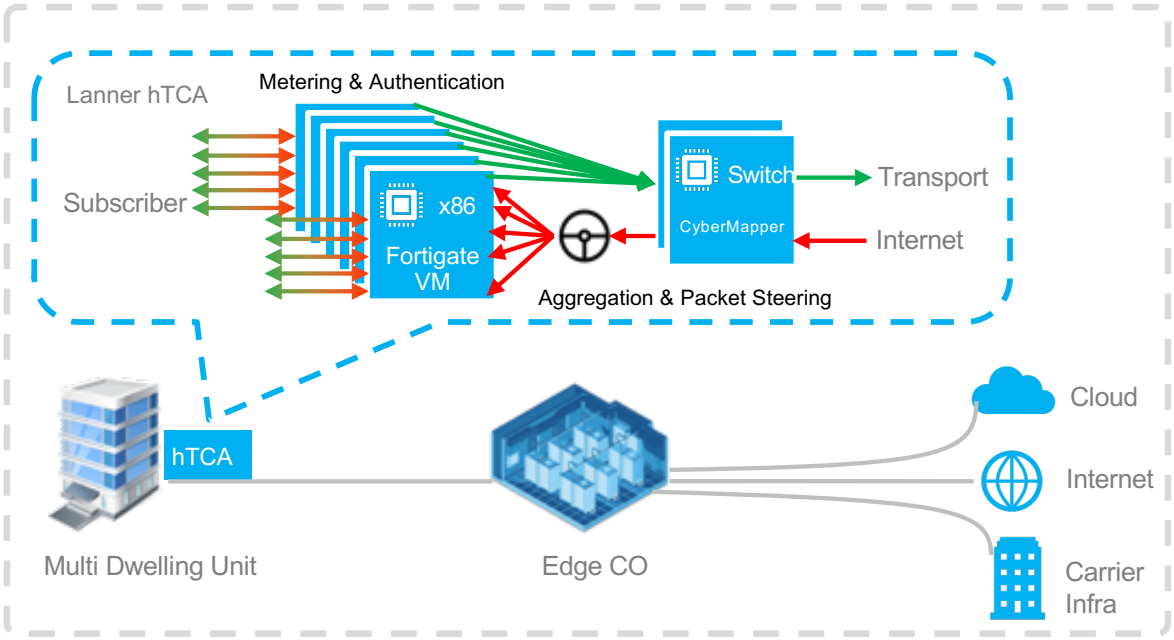
Lanner HTCA MEC Platform – Aggregation Use Case



Flexible edge services

- Multi-tenant, multiple edge services each individually configured
- Simplified, reduce CAPEX and create a smart multi-function edge
- Flexible deployment model, allows Carriers to put services closer to the customer
- Density, a single Lanner HTCA platform can service a whole building

Performance Characteristics per HTCA platform

- Scalable to >900 Gbps Firewall throughput
- Service over 500 customers Per HTCA chassis
- Each customer has their own Fortigate environment

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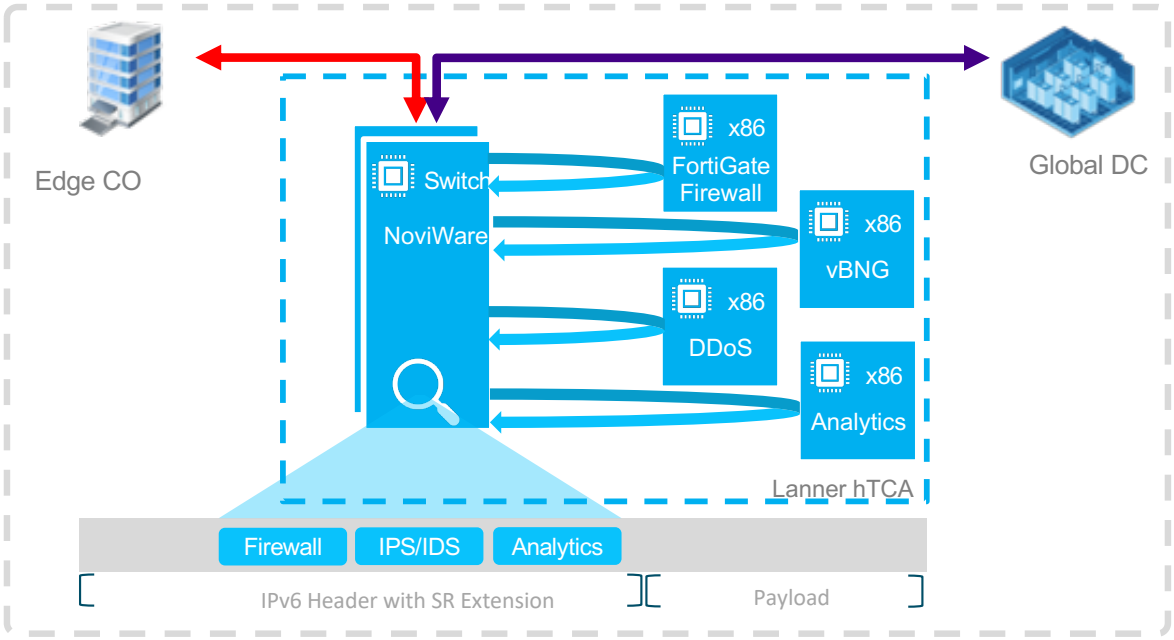
Lanner HTCA MEC Platform – SRv6 Service Chaining



Enabling edge services

- Reduce Cost, implemented on white box hardware, no need for dedicated appliances
- Flexible deployment model, allows Carriers to put services closer to the customer (micro) or chain across the network (macro)
- Density, host multiple revenue generating services in a single box

Performance Characteristics per HTCA platform

- High Bandwidth with > 1 Tbps network throughput
- High Performance with up to 336 x86 cores per chassis. Up to 672 vCores with HT
- Scalable modular architecture allows you to add capacity when needed

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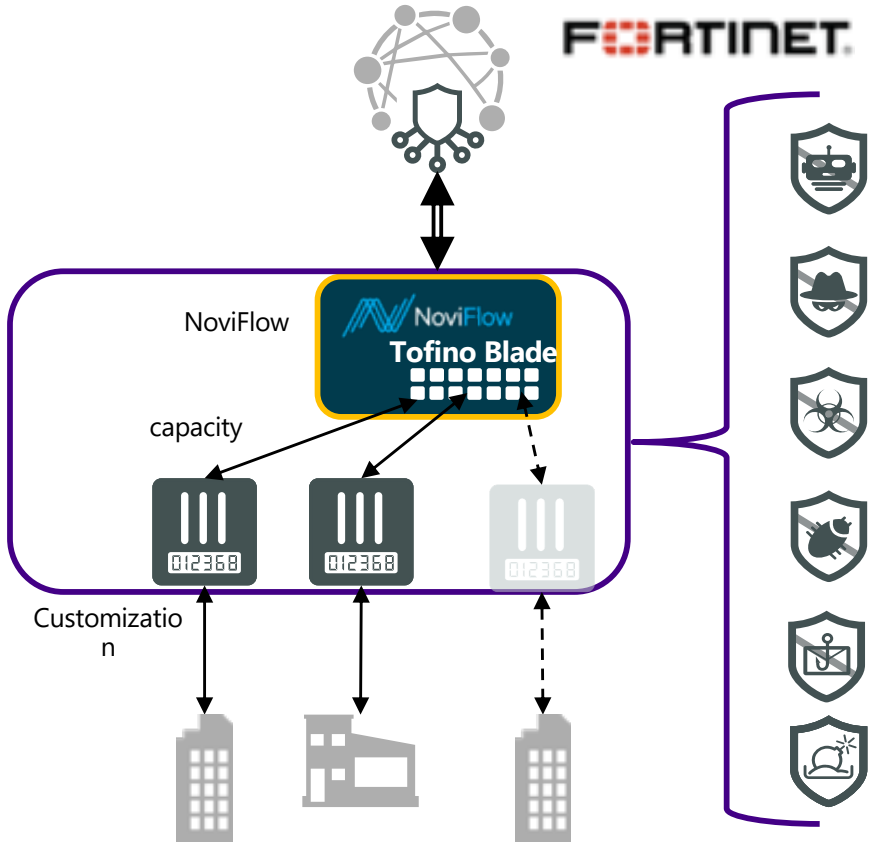
Use case: Clean pipes

Are we running out of resources?

- Clean Pipe
  - Security analysis and traffic inspection outsourced to MSSP from its customer
  - More customers demands
  - Existing customer demand
    - More and more bandwidth
    - More advanced security as services
    - Customization



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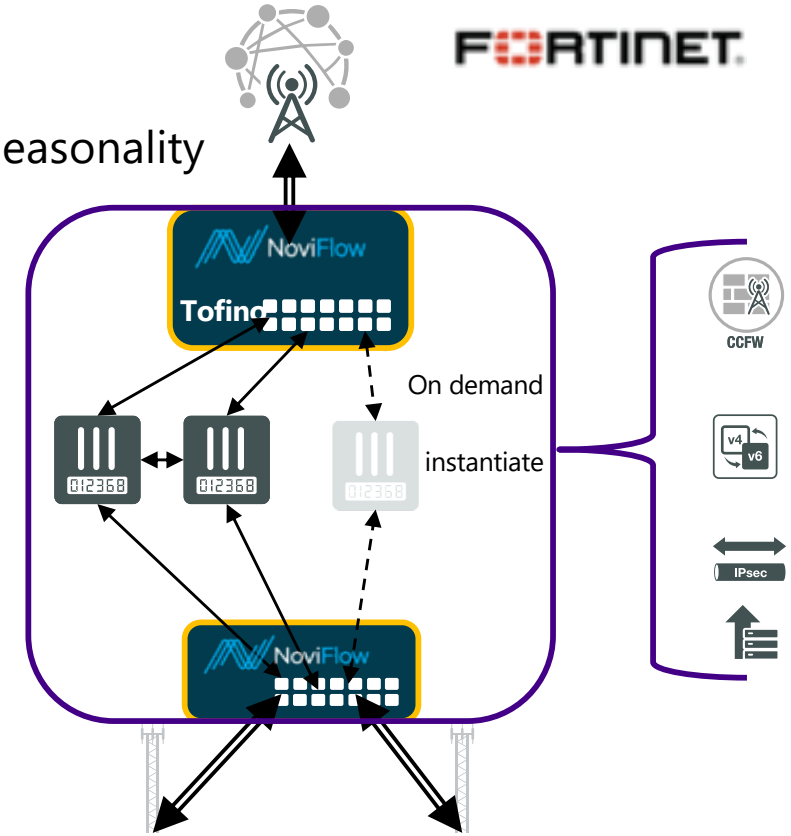
Use case: CGNAT

Are we running out of resources?

- CGNAT
  - Telco deals with constantly increasing traffic and seasonality
  - Increase # of devices, mobile, IoT, cars..
- Flexible and versatile framework
  - automated
  - efficient
  - scalable
  - adaptable
- SDN Based
  - relies on SDN switches, full P4 programmable
- Solution grows with customer needs



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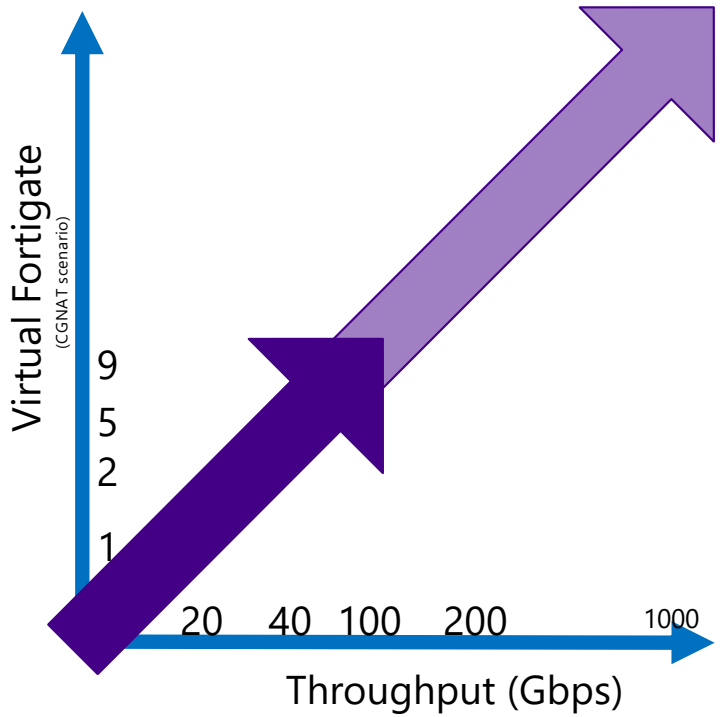
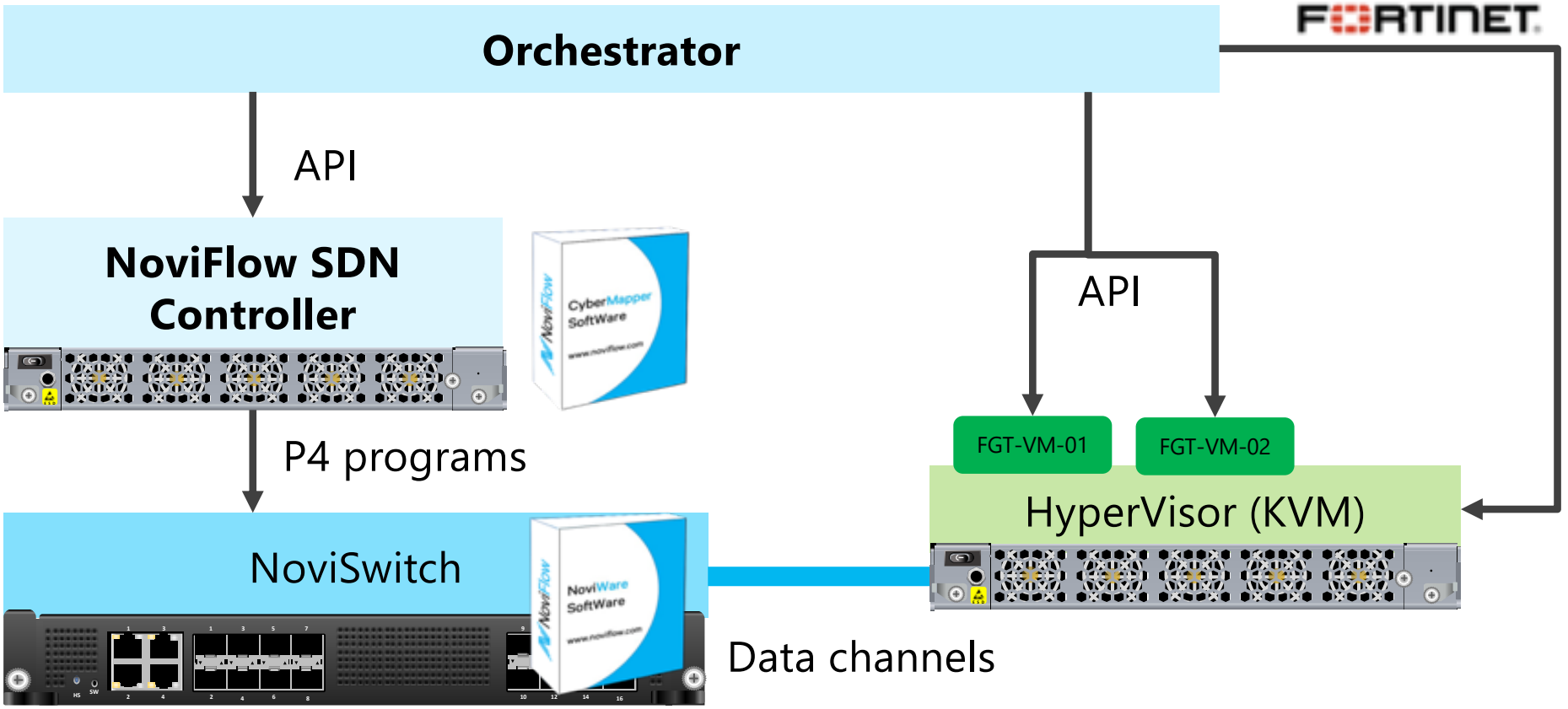
Massive Scale-Out

How real is this?

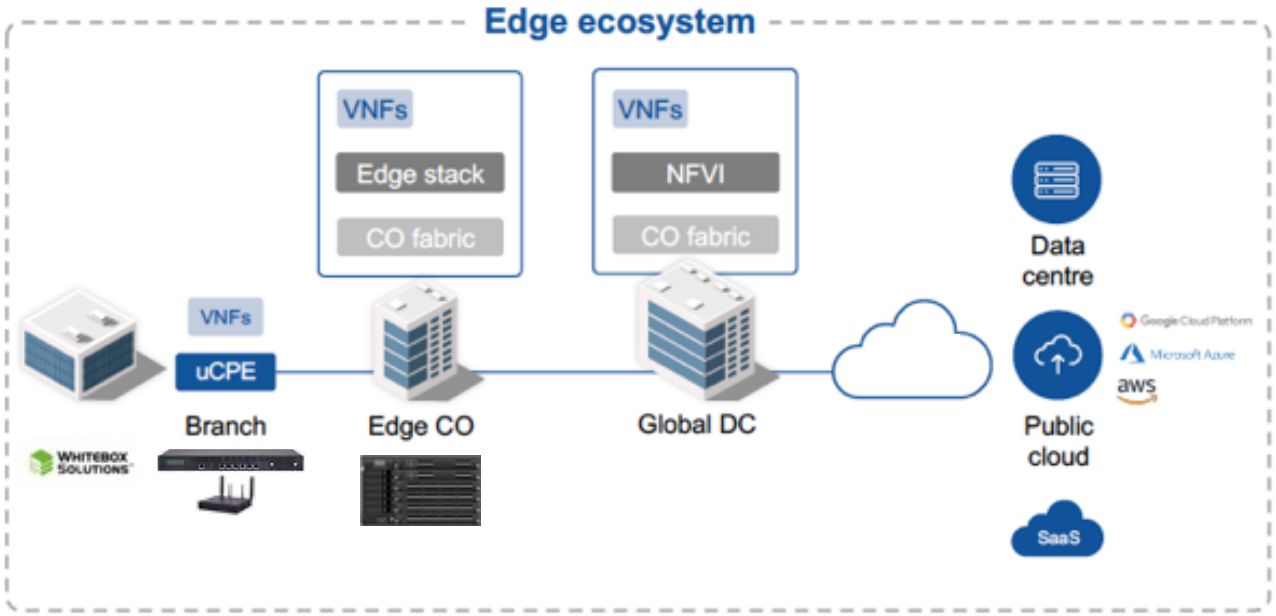
- Close to 200 Gbps at the moment (with 25Gbps NIC blades)
- Current Limitation(lab)
  - Traffic generators
  - Number of available computer nodes
- Expected huge improvement with DPDK (with same hardware)
- SDN Layer capable of 1Tbps
- Expected results : 1 Tbps



Solution Architecture



Lanner HTCA MEC Platform – MEC at North American Carrier



Decentralize and compute at the edge to:

- Enhance application performance
- Increase data collection
- Enable low-cost data processing at the edge
- Leverage analytics and AI
- Secure applications and data
- Facilitate dynamic end-to-end orchestration

the edge

- Enabling computing at the virtualized edge
- Deploying network-based capabilities in edge infrastructure
- Supporting orchestration across edge-to-cloud services chain

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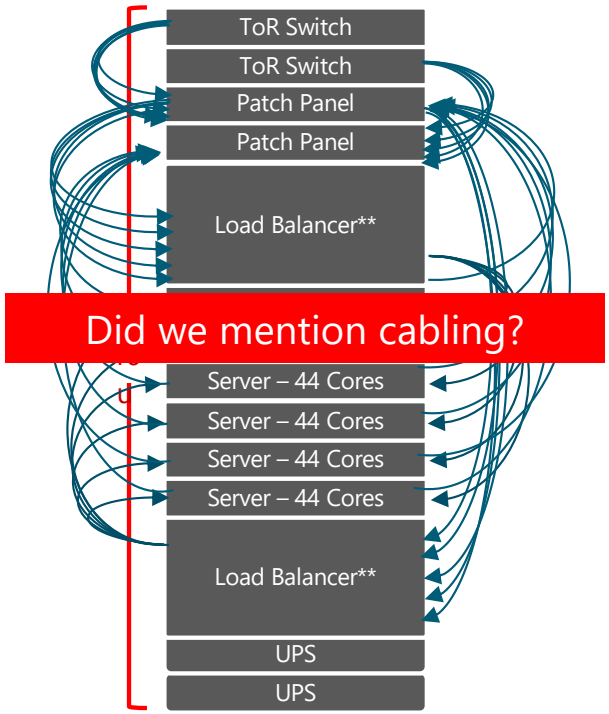
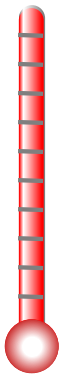
Cost Comparison: Compute platform with load balancing

Traditional Architecture

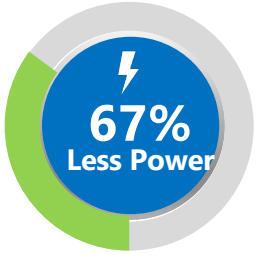


~$2.1 M USD*

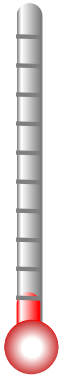


Total Cost

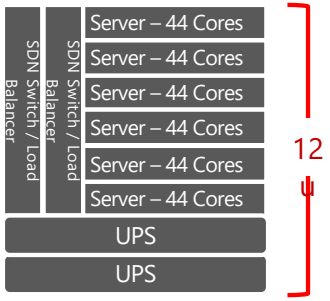
MEC Platform
Lanner/NoviFlow



~$236 K USD*



Total Cost



* List Prices ** "Sandwiched" configuration, single point of failure

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Why Us?

All-in-one, Scalable, true Zero-touch, Software Defined MEC platform leveraging Intel's compute and networking technology

Ready to Deploy

Flexible & Programmable Platform for Future Proof Deployment

89% CAPEX and OPEX Reduction!

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5G Connected Edge Cloud for Industry 4.0 Transformation

Thank You

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