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INTEL® NETWORK BUILDERS PARTNER
A GLOBAL ECOSYSTEM TRANSFORMING THE NETWORK WITH DIGITAL INNOVATION
intel.

Webinar: Extreme Automation at the Edge

Red Hat

KX

KEYSIGHT

An award-winning multi-vendor Intel 5G RAN testbed based on a secure edge gateway use-case. The testbed demonstrates dynamic configuration of Intel® Ethernet Controller E810 and network functions to optimize processing of secure packets, while significantly reducing resource requirements and energy consumption at scale.

FORTINET

Tech Mahindra

Presented January 31st, 2023

by

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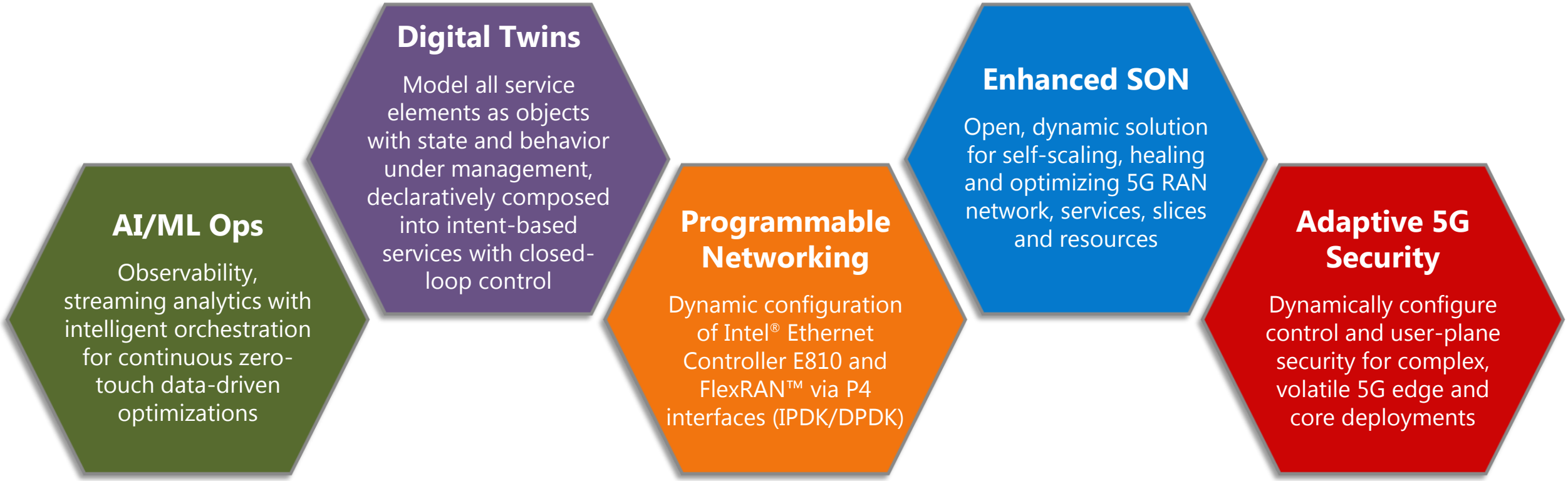
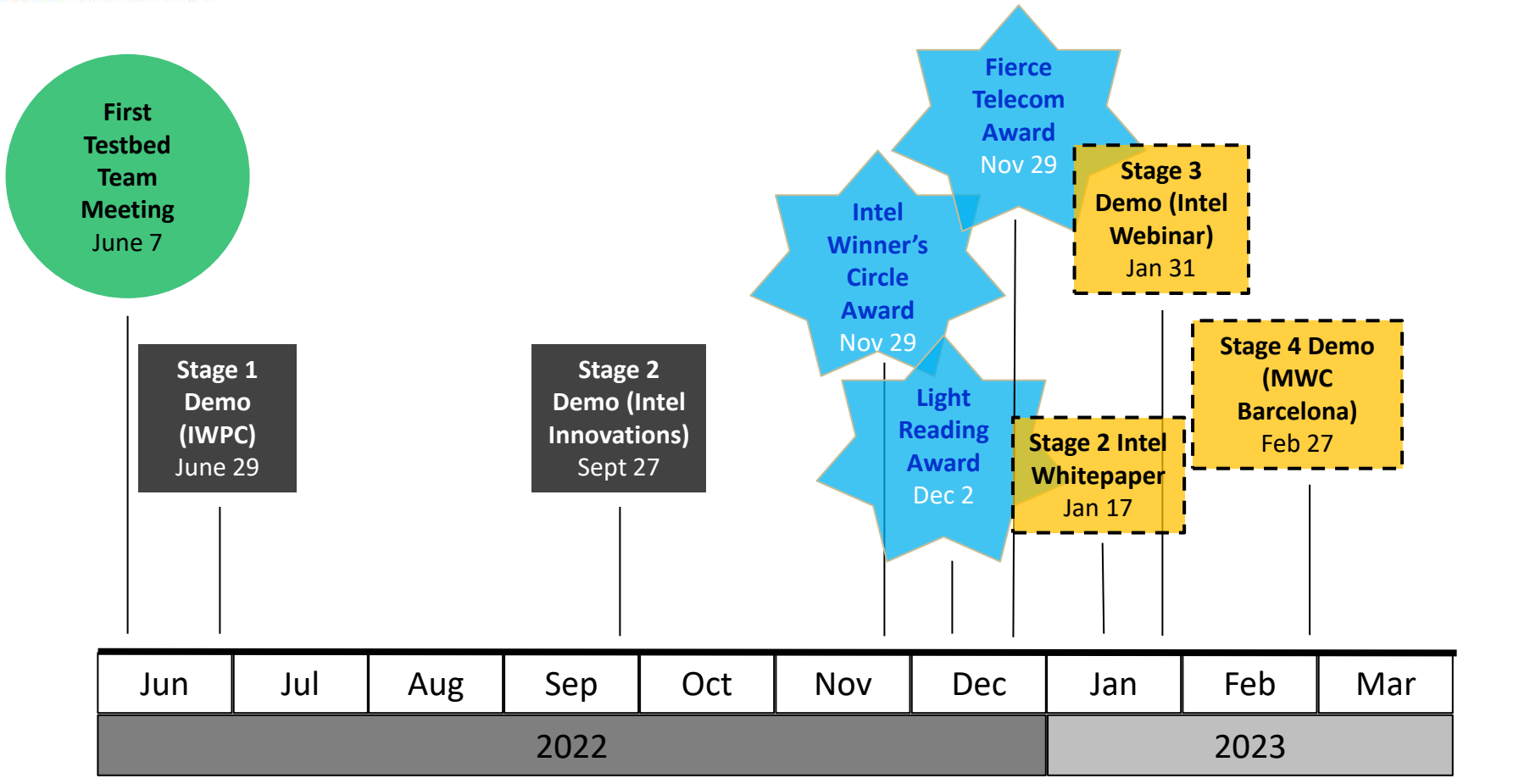
Key concepts implemented by multi-vendor solution



Autonomous Networking

Intel 5G RAN testbed timeline



What's new in Stage 3

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- Select FlexRAN™ libraries for use-case (will leverage more libraries when physical Radios are added)
  - FlexRAN™ replaces vanilla L1 and extends programmability for further optimization
    - Stage 3 – FlexRAN™ as source only, contributing to RAN optimization
    - Stage 4 – FlexRAN™ as source and config target to optimize RAN, Core & Transport

Keysight

- Keysight CyPerf is simulating 50Gbps of traffic (diverse personas, mix of Video, HTTP & REST traffic)
  - Added ZOOM meeting simulation
    - New QoS metrics for SON
  - Keysight emulates attack

Fortinet

- Added FortiWeb for Application & API security
  - Expands use-case to SASE
- FortiGate provides for SD-WAN and User-Plane security as per Stage 2

EnterpriseWeb & KX

- Increased scope for SON (open & extensible)
  - Wider (more sources – FlexRAN™, FortiWeb, Keysight QoS metrics)
  - Deeper (FlexRAN™ evaluation L1, exploiting SD-CORE more completely P4 routing)
  - Broader evaluation of network state refines automation response
    - Dynamic configuration of Intel(R) Ethernet Controller E810, SD-RAN & SD-Core
  - Negligible increase in solution overhead, more than offset by use-case resource & power optimization

Testbed Team

- Red Hat OpenShift infrastructure management
- Fortinet FortiGate SD-WAN & User Plane Security, FortiWeb Web Application Firewall (WAF) and API Protection Firewall
- Keysight CyPerf test agents & real-world simulation
- KX data services & streaming analytics (AI/ML)
- Intel® Ethernet Controller E810, FlexRAN™, IPDK/DPDK & testbed environment
- EnterpriseWeb CloudNFV e2e orchestrator with LCM & iPaaS plus SMO with non-RT RIC, NSMF/NSSMF
- Tech Mahindra is the testbed System Integration partner

The Testbed also incorporates open-source from the ONF (Aether SD-CORE and SD-RAN) and Grafana Labs (Prometheus and Grafana).

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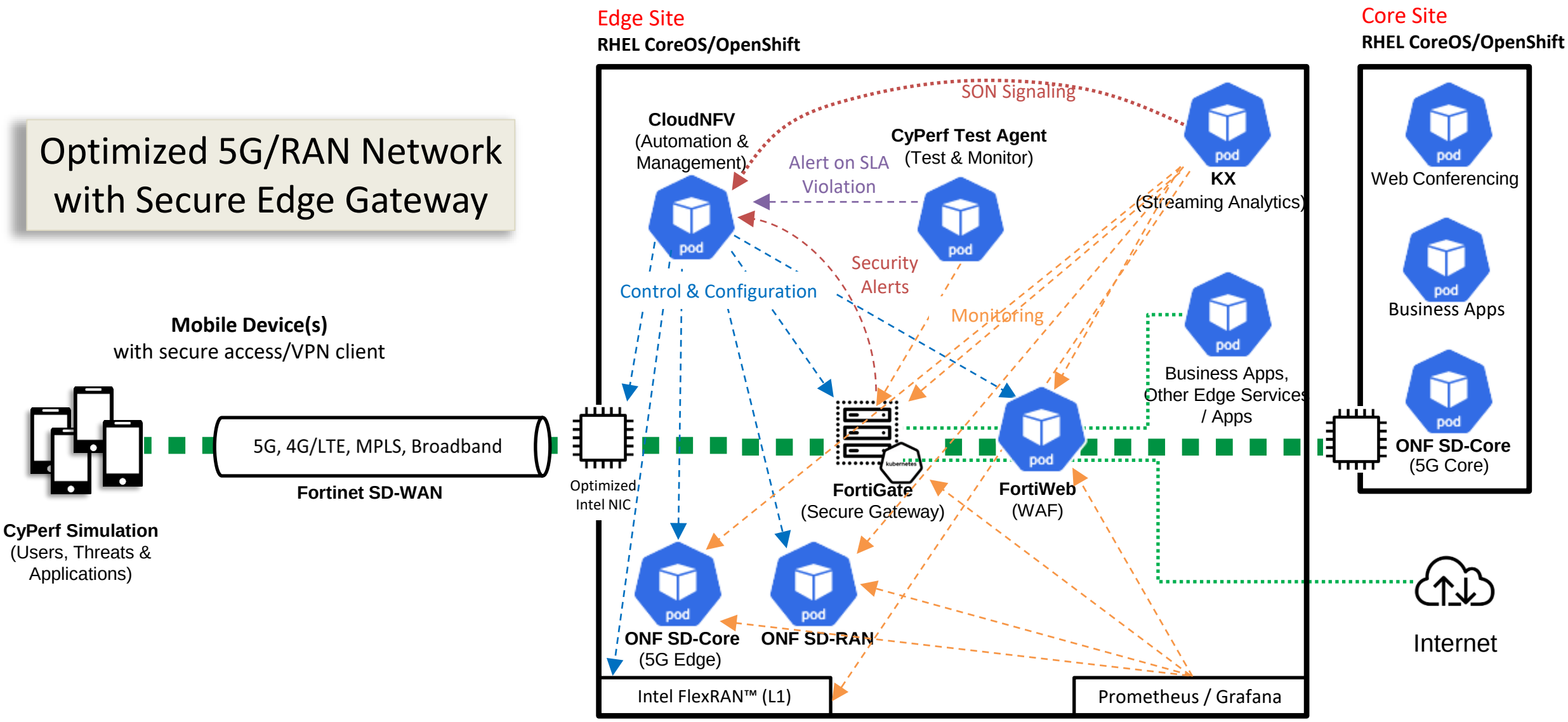
Testbed Service Topology

Optimized 5G/RAN Network with Secure Edge Gateway



Secure Encrypted Data

Enhanced SON: Self scaling, healing & optimizing

Test 1
Simulate 1000 concurrent users (50 Gbps)

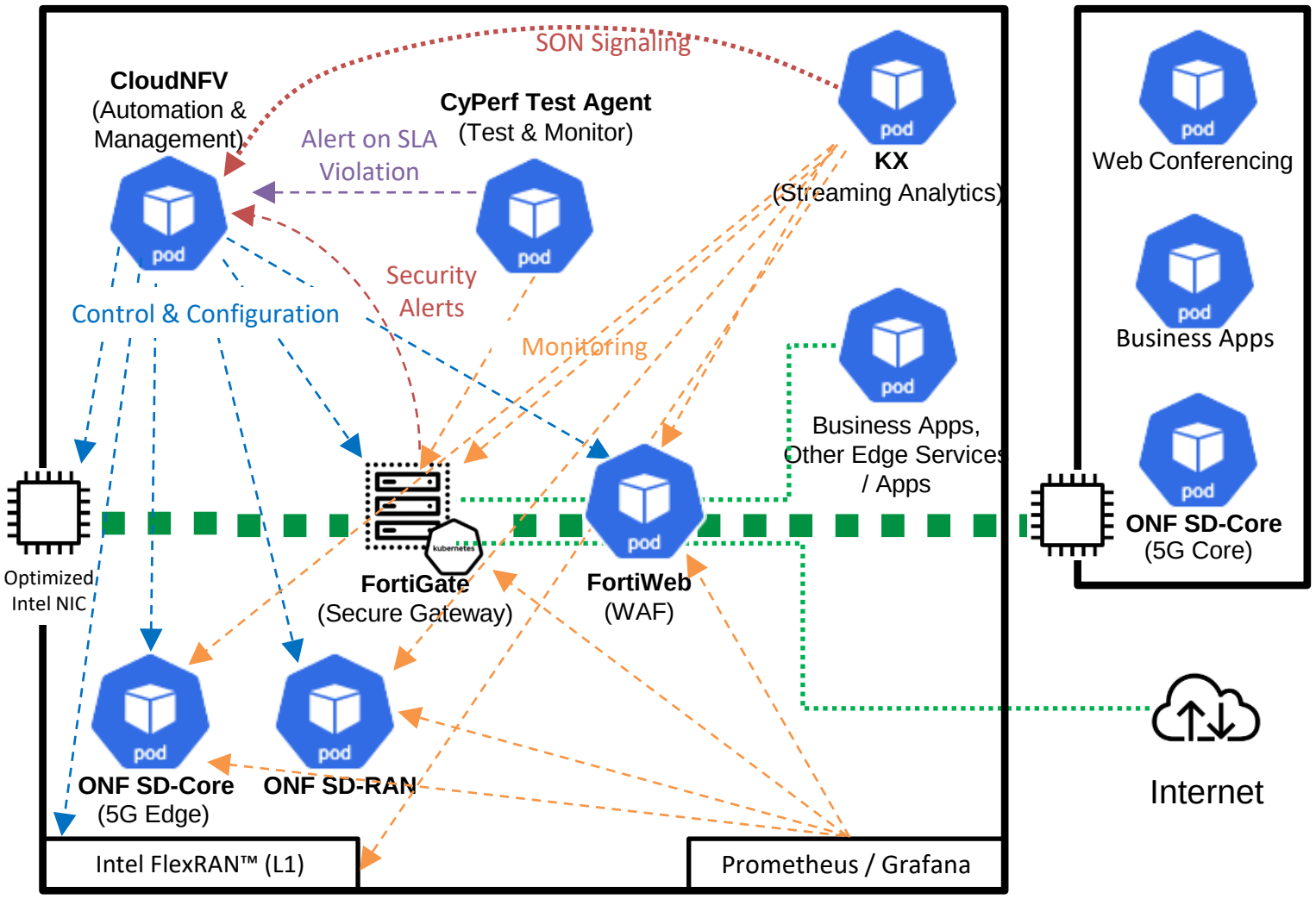
Mobile Device(s)
with secure access/VPN client

5G, 4G/LTE, MPLS, Broadband

Fortinet SD-WAN

Test 2
Insert Bad Actors

CyPerf Simulation
(Users, Threats & Applications)



Secure Encrypted Data

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Stage 3 Testbed Benchmarks

	Stage 1 Without SON	Stage 2 With SON	Stage 3 With SON	Total Difference Between Stage 1 baseline and Stage 3
Total Throughput (simulated mix of Video, HTTP & REST traffic)	1Gbps	10Gbps	**50Gbps**	**50x** more throughput
Latency	141µs	137µs	**116µs**	**19.1%** reduction in latency
Latency under Attack (simulated bad actor attempts exploits)	163µs	158µs	**123µs**	**25.1%** reduction in latency under attack
Block Rate	~98%	~98%	**~98%**	Consistently high level of security
MOS Call Quality Score (Zoom call quality under attack)	-	-	~4.7	*High QoS score with new metric*
Power Reduction from Optimizations*	26%	33%	**35%**	**9%** improvement in energy consumption
Power Consumption per Gbps Throughput	1069 kW/h	113 kW/h	**108 kW/h**	**9.5x** more energy efficient
CPU Consumption per Gbps Throughput	54 cores	7.1 cores	**6.9 cores**	**7x** more resource (CPU) efficient
RAM Consumption per Gbps Throughput	89 GB	11.7 GB	**10.1 GB**	**8x** more resource (RAM) efficient

* Average power consumption across all tests of unoptimized vs optimized traffic on otherwise identical hardware, network functions and workloads.

Note: Testbed is running in an Intel lab. There are no physical radios present. Traffic is simulated. Benefits reported are server-centric. Additional efficiencies are expected with RAN-specific SON optimizations.

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Block Rate	98%	98%	**98%**	Consistently high level of security
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Enhanced SON improves latency despite **50x** load even under attack while maintaining high security and QoS

Enhanced SON optimizes energy consumption

Enhanced SON optimizes physical resource consumption

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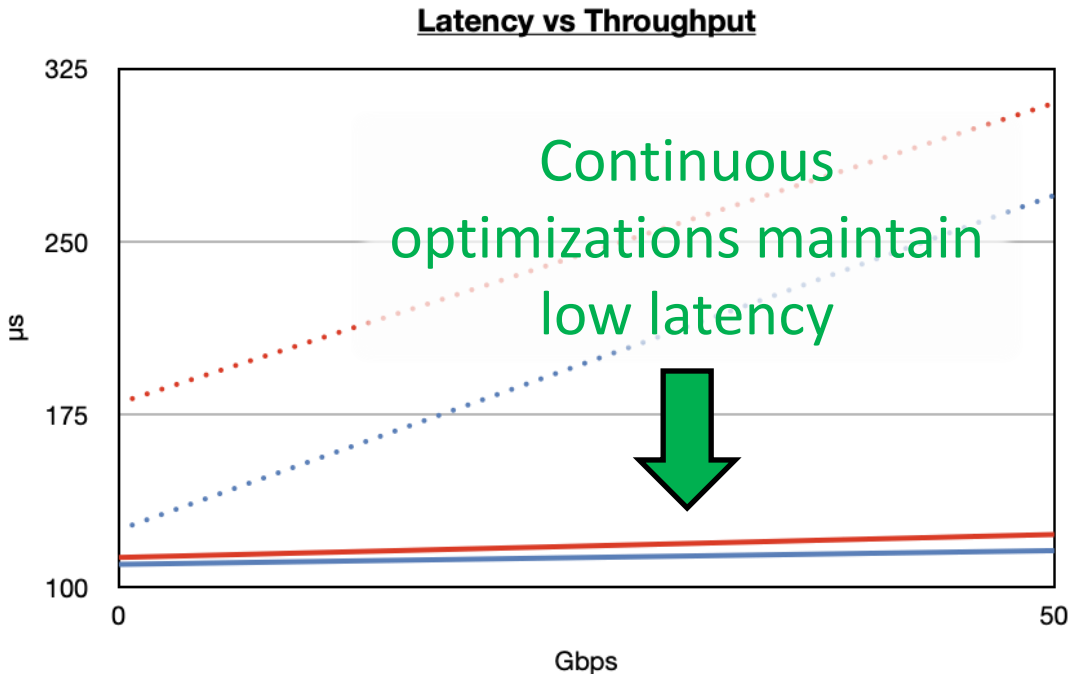
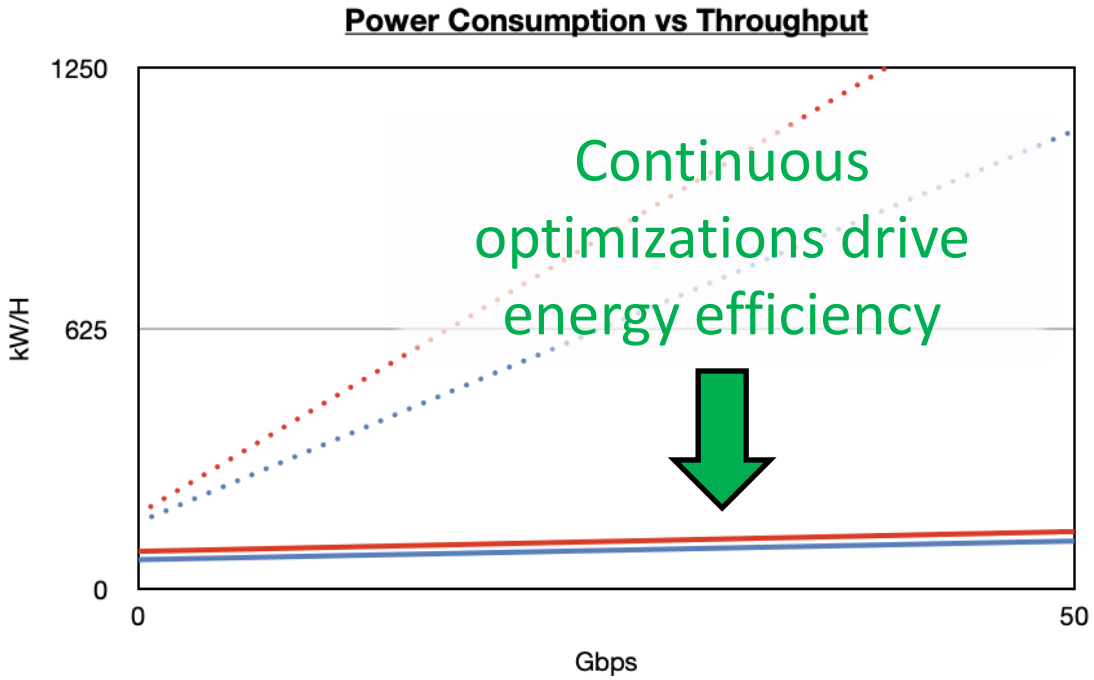
Stage 3 Testbed Key Findings

Do more with less!!!

Consistent, predictable low-latency and low-energy consumption at scale





Service (no optimizations)

Service Under Attack (no optimizations)

Service with enhanced SON

Service Under Attack with enhanced SON

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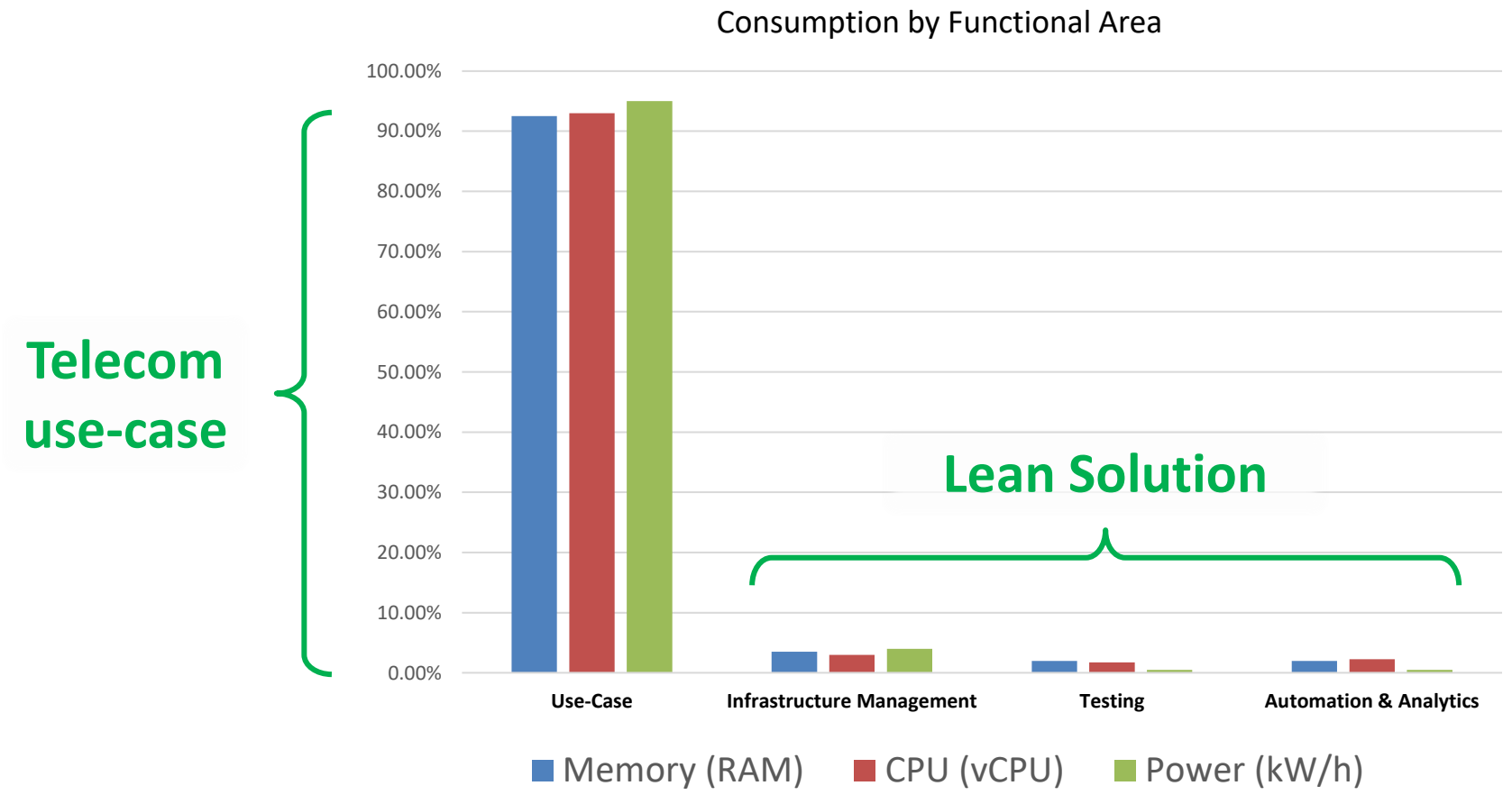
Stage 3 Testbed Key Findings

Do more with less!!!

Lean edge-optimized solution preserves compute & power for Telecom use-cases



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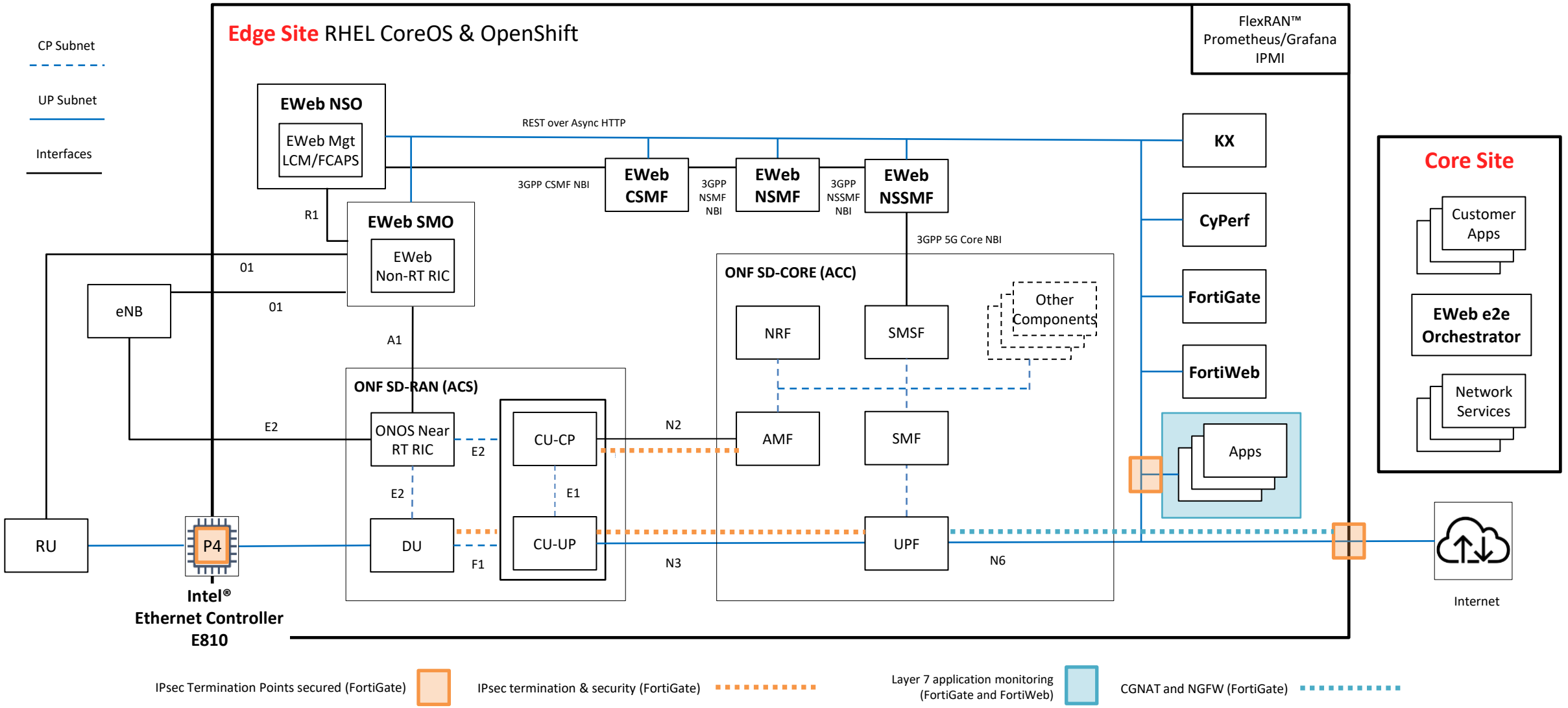
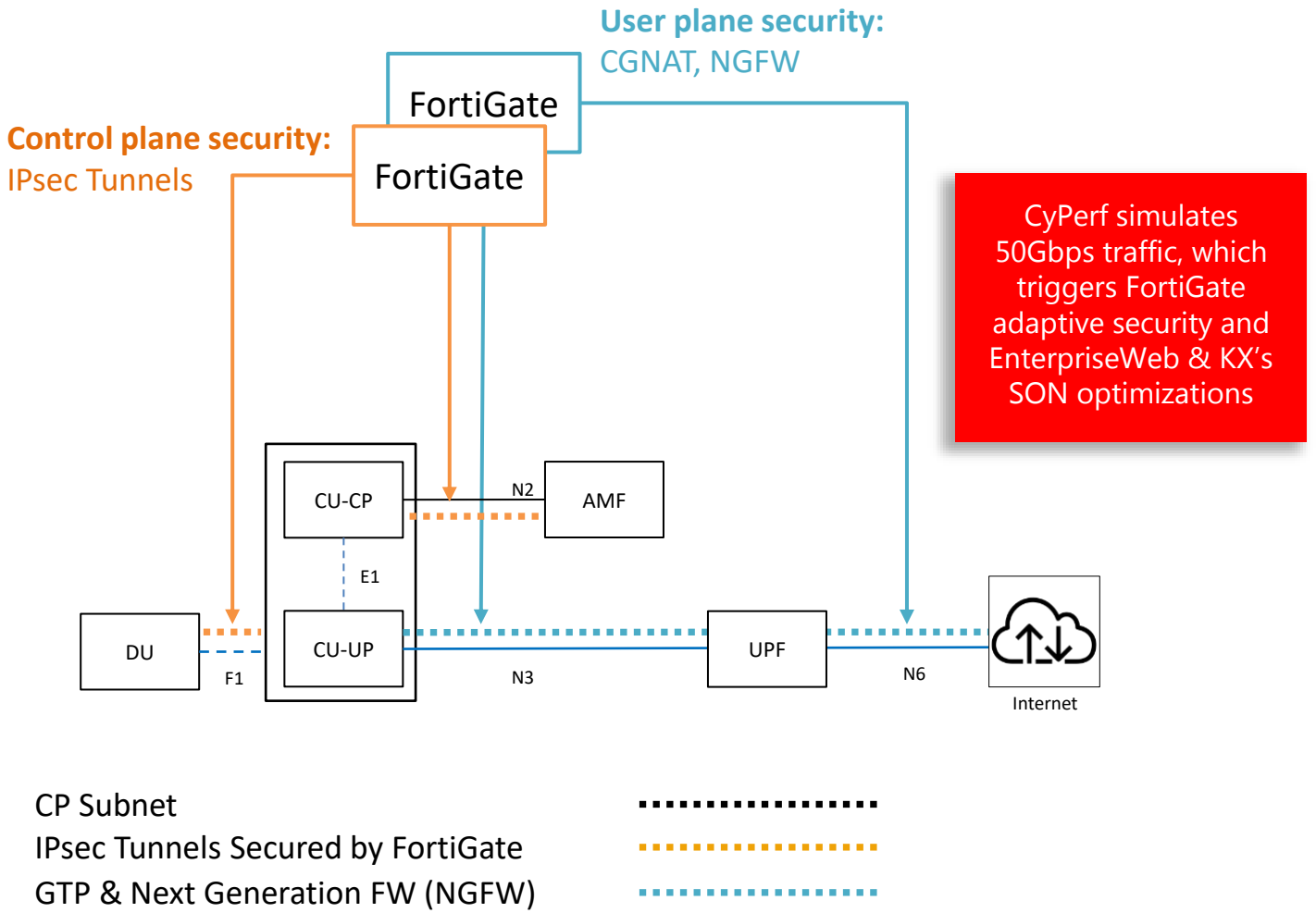
Solution architecture



Securing the Control & User Planes

Dynamic Security Configuration

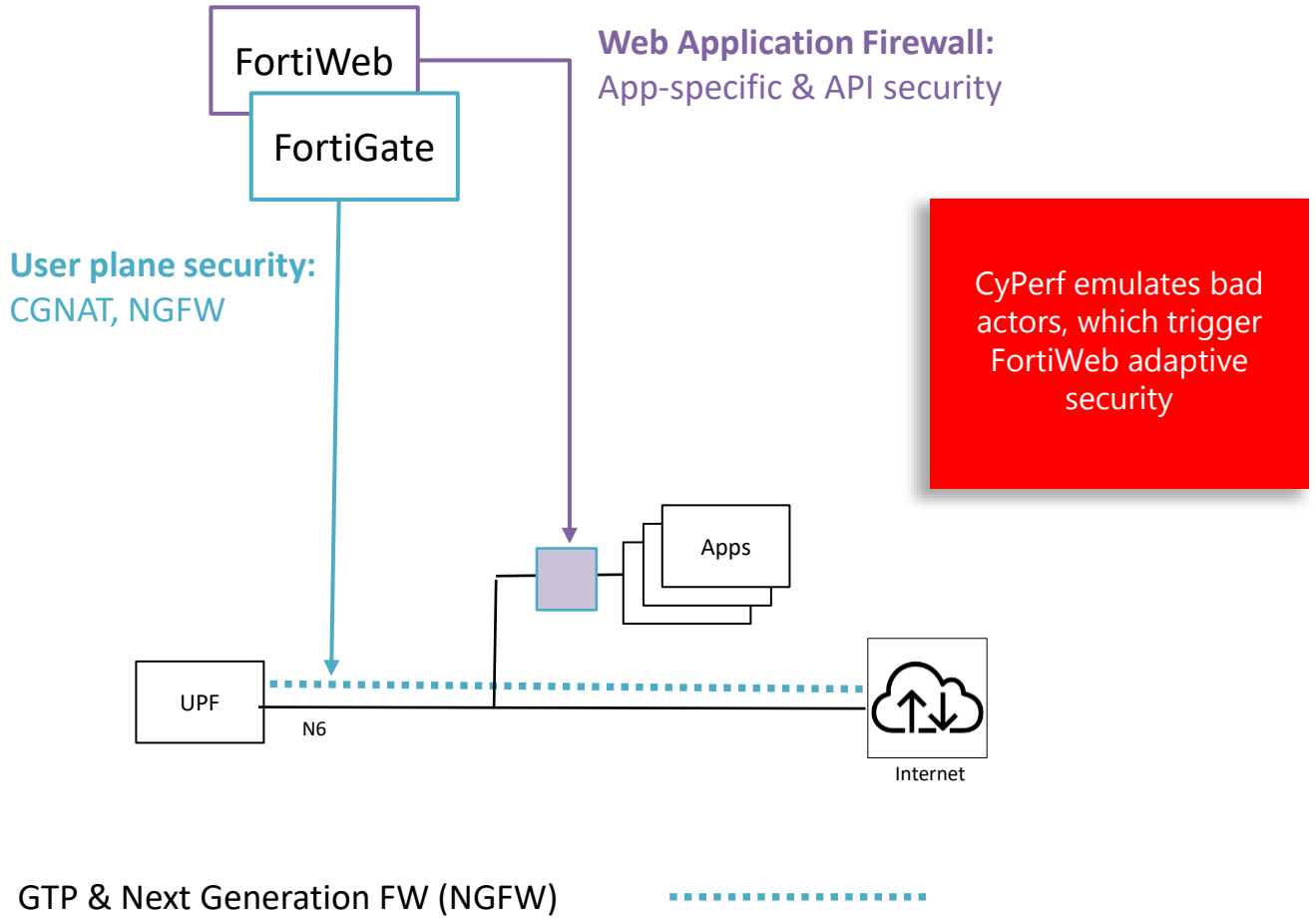
- Identify assigned CP Subnet(s) via OpenShift CNI Mapping (at time of initial deployment)
- For all Function / Component Pods and Containers identify virtual port assignments / IPs (translated from OpenShift APIs)
- Identify at SDN level IPsec Tunnels (Point-to-Point) between components (from underlying CNI, Service Mesh, ONOS)
- Dynamically configure FortiGate to monitor and secure each / all such tunnels, add and remove as the service evolves (scales, heals, etc.)
- As security demands change, scale FortiGate and/or adjust networking to prioritize traffic to reflect evolving application behavior



Securing Business Apps

Adaptive Application Security

- In addition to traditional negative and positive security models (attack signatures, IP address reputation, protocol validation, etc., FortiWeb applies a second layer of machine learning-based analytics to detect and block malicious anomalies while minimizing false positives
- FortiGate is dynamically configured to monitor and secure each / all tunnels to Business Apps (CGNAT, NGFW on N6 interfaces)
- FortiWeb is dynamically configured to provide App-specific and/or API security based on App(s) being secured



Advance Demo Setup:

- OpenShift with Prometheus/Grafana deployed to Intel Hardware running RHEL for Edge and Core
- CloudNFV deployed via OpenShift Operator to Edge
- CyPerf controller & KX analytics deployed to Core in KVM (outside the network for testing purposes)
- All solution elements onboarded/modeled, std interfaces generated, registered in CloudNFV's catalog

Design-Time Modeling

Declaratively compose enhanced 5G Core/RAN with Gateway, Firewall and Web Conferencing as intent-based Network Service

1. Model service graph, service chain, SLA and LCM policies
2. Platform generates deployment workflow along with OpenShift Operators for each element
3. Publish service to catalog / Expose API for ordering
4. Day 1: Platform runtime executes deployment plan & handles all implementation details
5. Day 2: Platform runtime enforces declared policies & provides zero-touch network & service management

Day 1 Deployment: Single platform-based workflow

An order triggers CloudNFV to execute the deployment workflow – Tasks are contextualized for Service Design

Stage 1

establish the infrastructure

- Call OpenShift APIs to provision service accounts, management network and storage
- Platform generates and deploys OpenShift Operators for all C/VNFs to edge and core
- Platform deployed and configures FlexRAN™ (L1 Networking)
- Call OpenShift with JSON payloads to provision application specific subnets

Parallel & Sequential Tasks
code-gen, orchestration, configuration
Messaging & Transaction Guarantees

Stage 2

instantiate the service

- Call OpenShift Operator to deploy ONF 5G-core and RAN as clusters of pods at core and edge
- Call OpenShift Operator to deploy FortiGate as a VM over containers at edge
- Call OpenShift Operator to deploy FortiWeb as a pod at edge
- Call OpenShift Operator to deploy CyPerf agent as a pod at edge
- Call OpenShift Operator to deploy Web Conferencing host as pod at core

Parallel & Sequential Tasks
code-gen, orchestration
Messaging & Transaction Guarantees

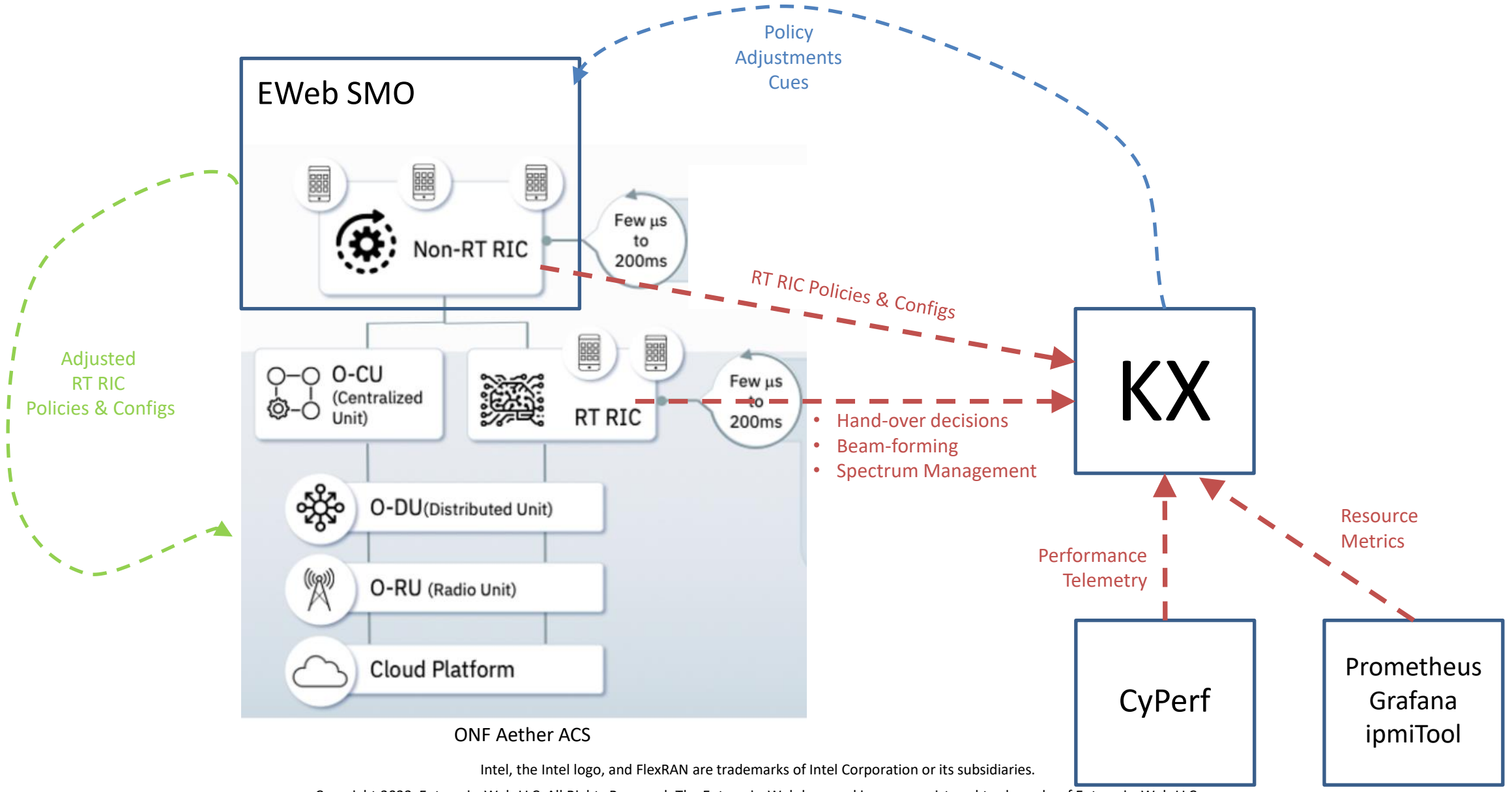
Stage 3

configure services

- Configure ONG 5G-core and RAN via REST
- Configure FortiGate via SSH
- Configure FortiWeb via SSH
- Configure Web Conferencing Host via YAML
- Register CyPerf Agent with CyPerf Controller and load testing profile via REST
- Configure DNS entries for service
- Configure Intel® Ethernet Controller E810 with optimized policies

Parallel & Sequential Tasks
code-gen, configuration
Messaging & Transaction Guarantees

Day 2 Operations: Closed-loop RAN Optimization



ONF Aether ACS

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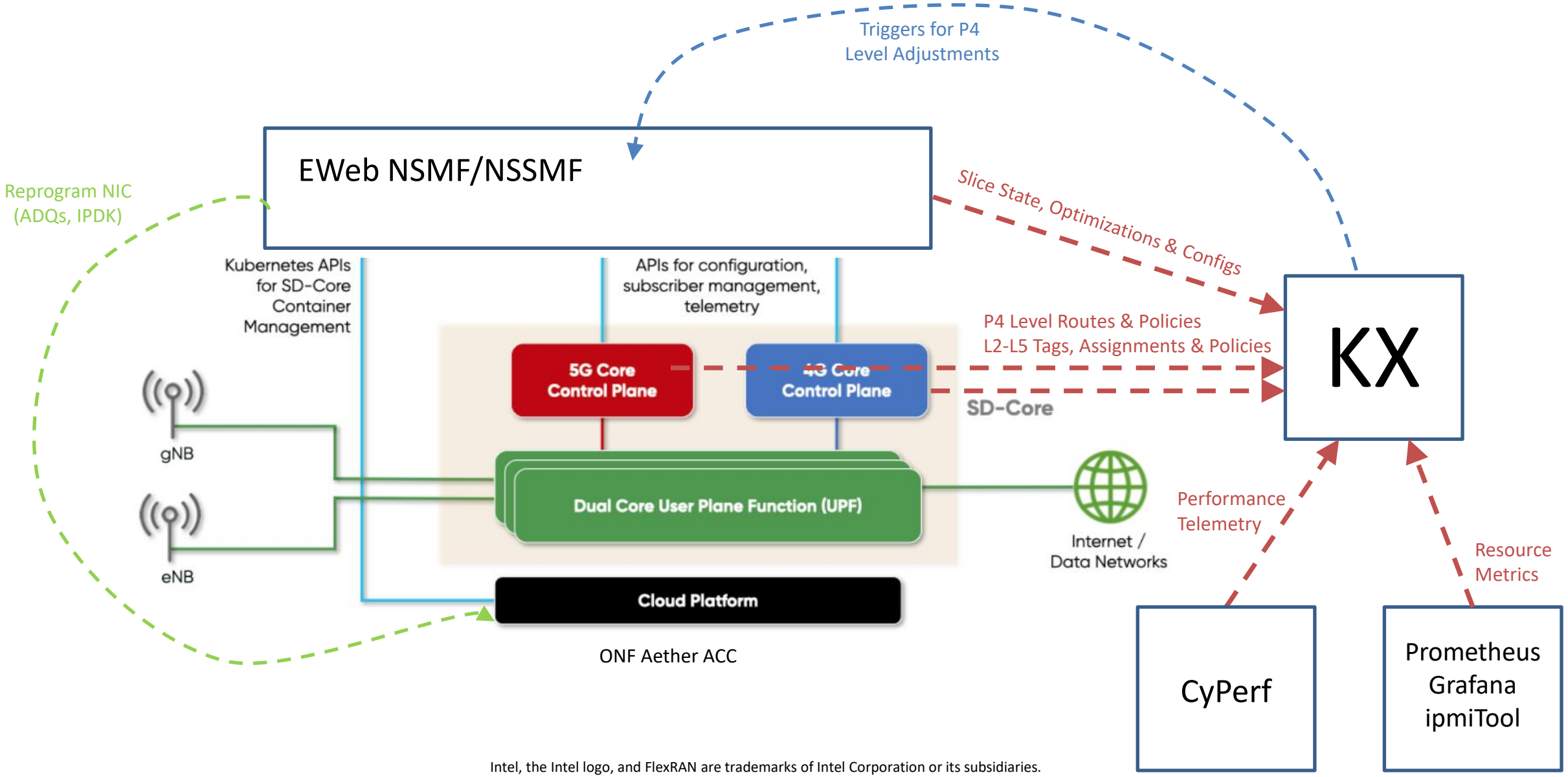
Day 2 Operations: Closed-loop 5G Core Optimization



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Thanks for attending!

See you in Barcelona!

Please stop by for a demo at the following partner booths:

Partner	Hall - Stand	Contact
Intel	Hall 3 – Stand 3E31	Waleed Badr waleed.badr@intel.com
Red Hat	Hall 2 – Stand 2F30	Shujaur Mufti Shujaur.mufti@redhat.com
Fortinet	Hall 5 - Stand 5C13	Ronen Shpirer rshpirer@fortinet.com
Keysight	Hall 5 - Stand 5E12	Michael Dieudonne michael_dieudonne@keysight.com
KX	Hall 7 – Stand 7B41	James Corcoran jcorcoran@kx.com
Tech Mahindra	Hall 6 – Stand 6C2	Nitish Nanda Nitish.Nanda@TechMahindra.com

For testbed information or to request a trial dave@enterpriseweb.com