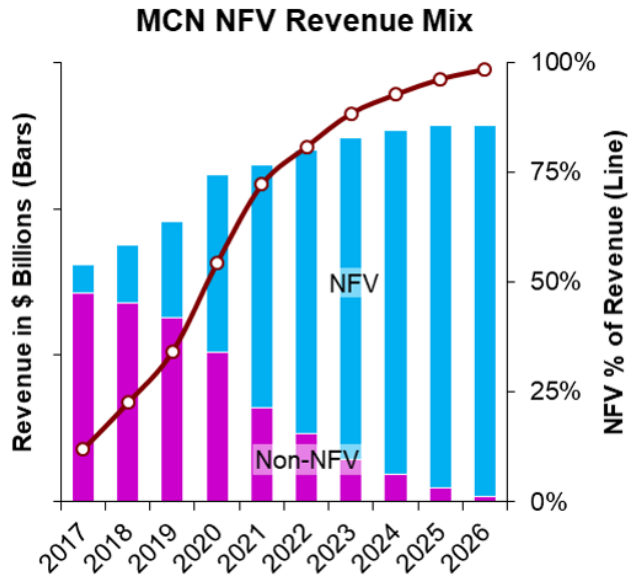
Intel® Network Builders Insights Series

Making Cloud Native Work for 5G Core

Chandresh Ruparel, Senior Director, Wireless Core Network Division, Intel
Eoin Walsh, Senior Architect, Wireless Core Network Division, Intel

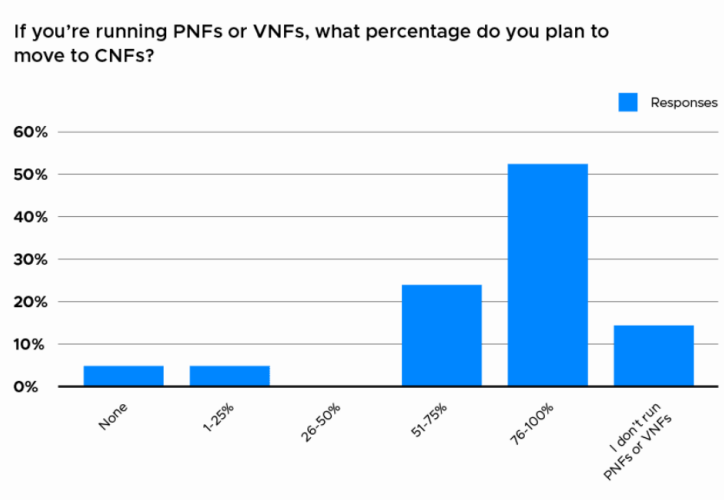
Evolving 5G Network Architectures

NFV Maturity



Dell'Oro Group January 2022 MCN & MEC Forecast Report

Cloud Native Momentum
76% of CoSPs migrating at least half of NFs



CNCF Microsurvey, Blog, August 2022

5G Monetization – New Opportunities

5G Will Transform Enterprises

5G Enterprise Market

31.55% CAGR

2021-2026

71.45B USD

Technavio Reports, April 2022

Balancing Operational Efficiency & 5G Core Monetization with Cloud Native

Cloud Native Solves Problems, Creates Complexity

3-4x increase in control plane latency from microservices, service mesh implementations

Multi-vendor, cloud native 5G SA networks have larger attack surfaces, potential vulnerabilities in distributed user plane

Sustainability initiatives to conserve power, earn green credits, reduce OPEX. CO/DC power limitations constrain capacity growth

Virtualization & cloud native environments make it more difficult to identify, correlate, and resolve root causes

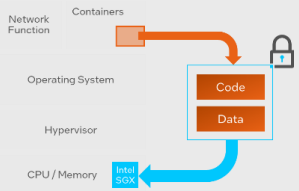
Platform Capabilities Address Cloud Native Requirements

TCO Leadership

5G UPF **42%** Gen-Gen Improvement *

Reduce Control Plane Latency, Optimize Service Mesh

Smallest Attack Surface



Crypto acceleration w/ Integrated QAT, V-AES

Protect data at rest, in-process, in-flight

Integrated Power Tuning

Telemetry Identifies Power Savings

Match Server, CPU Power Consumption to Network Traffic

Observe Network E2E

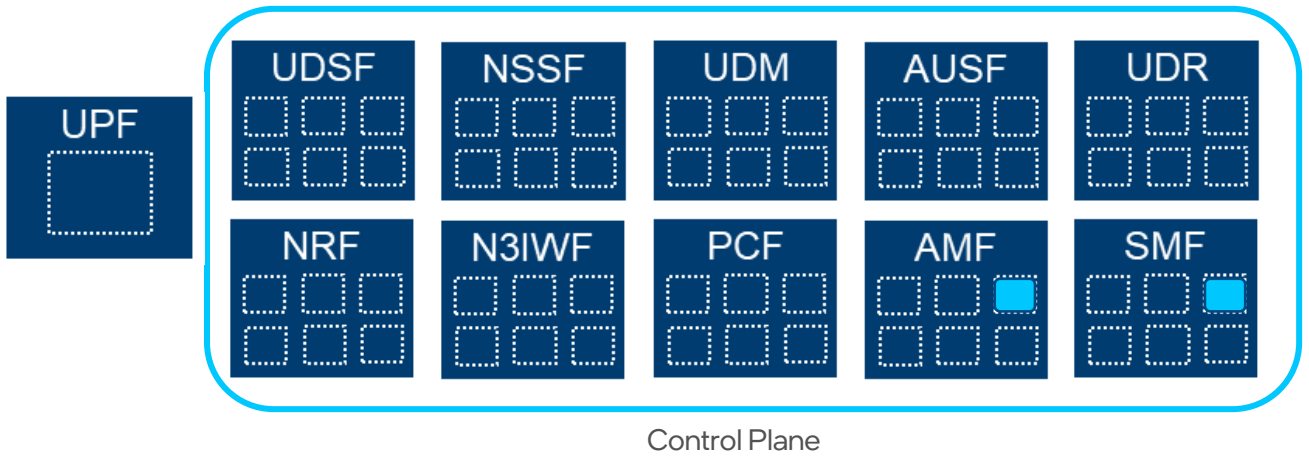
Infrastructure Telemetry + Observability

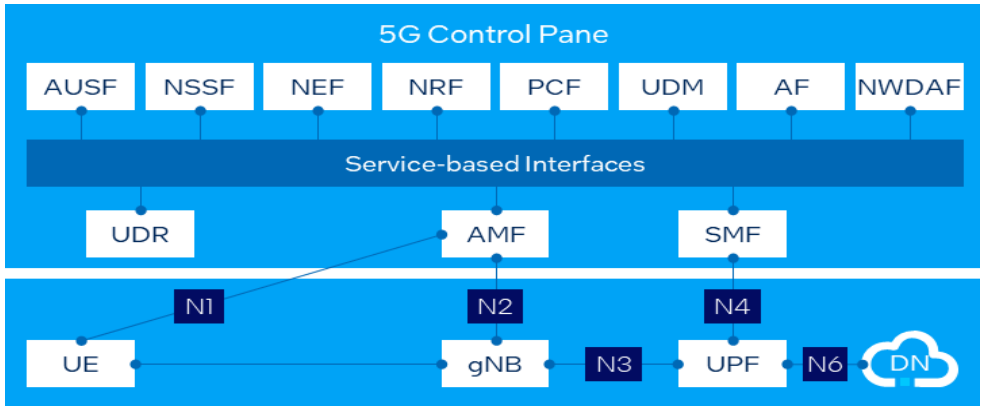
Better Contextualization, Correlation, and Resolution

* Performance varies by use, configuration and other factors. See [91] at www.intel.com/3gen-xeon-config

How Cloud Native Affects 5G Network Functions

5G Core Cloud Native Microservice-Based Network Functions





Breaks up monolithic VNFs into container/microservice pods that communicate via service mesh or Linux networking stack

Control plane: Increased latency and performance penalty from service mesh and inter-function communication, increases attack surface

User plane: Distributed but monolithic to satisfy demanding telco KPIs (performance, TCO, latency)

Consumable 5G Core Streamlines Cloud Native

5G Core Ref Architecture (BMRA)

Reference Stack Performance

UPF Optimization Software Modules

Secure Key Management Control Plane

User Plane Power Management

Power Telemetry

Telemetry Insights for Assurance

Performance, Latency

Intel® Crypto Acceleration (AES-NI)

Intel® QuickAssist Technology (Intel® QAT)

Intel® Advanced Vector Extensions 512 (Intel® AVX-512)
Hyperscan

Security

Intel® Software Guard Extensions (Intel® SGX)

Intel® Crypto Acceleration
Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI)

Intel® QAT

Power Management

Intel® Speed Select Technology

Granular P & C states

Linux Power Governors

Intel® Platform Telemetry Insights (CPU & NIC)

Service Assurance

OpenTelemetry

CollectD & Telegraf

Ansible scripts

Intel® Platform Telemetry Insights (CPU & NIC)

Breakthrough 5G UPF Performance

3rd Gen Intel® Xeon® Scalable Processors + Intel® Ethernet Controller & Enhanced DDP

5G UPF Improvement (6338N vs 6252N)

- 42.8% Performance improvement [1]
- 15% Performance/watt improvement [1]

Ecosystem Sets the Bar Higher

ZTE Boosts 5G UPF Performance with Cloud Native, Software


White Paper

intel

ZTE uses Intel Container Bare Metal Reference Architecture (BMRA) to Improve Performance in Cloud Native 5G Core UPF Solution

ZTE TECS Cloud Foundation, CNFs, Intel BMRA Boosts 5G UPF Performance

- 656 Gbps with the Intel Xeon Platinum 8380 processor [2]
- 42% year-over-year improvement, same SKU [2]

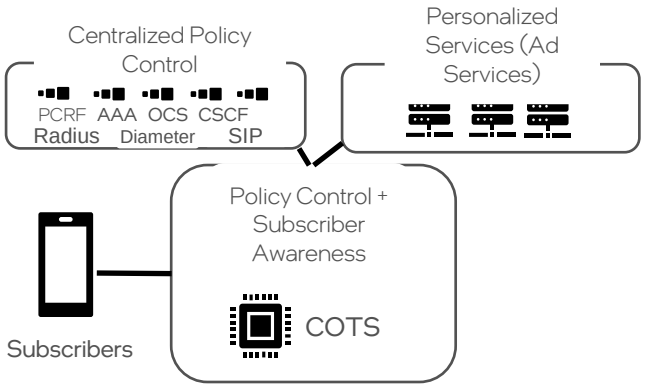
[1] Performance varies by use, configuration and other factors. Learn more at www.Intel.com/PerformanceIndex. Configurations in backup.

[2] Joint ZTE and Intel White Paper, "ZTE uses Intel Container Bare Metal Reference Architecture (BMRA) to Improve Performance in Cloud Native 5G Core UPF Solution," July 2022

Optimizing User Plane Functions on Intel® Architecture

Header Enrichment

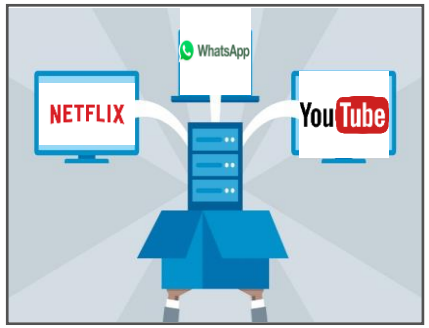
Insert data fields in HTTP header used by downstream servers to identify subscriber or device details. Ex: Targeted Ads, Add-on Services



HTTP parsers with Hyperscan leverage AVX512

TLS 1.1/1.2/1.3 based App Detection

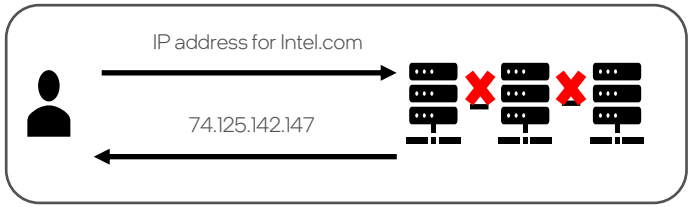
Identify and apply appropriate QoE and billing policy to each user's application



Hyperscan with Intel® AVX512

DNS Cache

Improve responsiveness to UE requests for web address resolution leading to faster page load times and better subscriber QoE

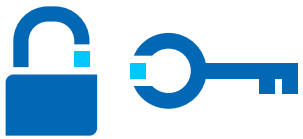


Algorithms (in VPP, DPDK) for runtime table look ups

Balance Performance and Security

Instruction-Level Relative Performance Gains in 3rd Gen Intel® Xeon® Scalable Processors

Public Key Encryption
(RSA, ECDHE, ECDSA)
includes multi-buffer support

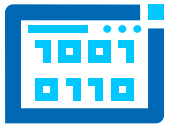


VPMADD52

Up to 5.6x
faster public key encryption and decryption [1]

Usages:
SSL Front End Web Server connections (NGINX, HA-Proxy, WordPress)

Advanced Encryption Standard
(CTR, CBC, XTS, AES-GCM)

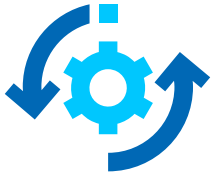


Vector AES-NI, Vector CLMUL

Up to 3.3x
faster and stronger AES-GCM encryption with Intel® AVX-512 [1]

Usages:
Encrypted data transfers, database encryption, cloud storage encryption

Hashing
(SHA-1 & SHA-256)



Secure Hash Algo-NI

Up to 4.2x
faster secure hash performance [1]

Usages:
SSL, TLS, IPSec, Data-Deduplication, etc.

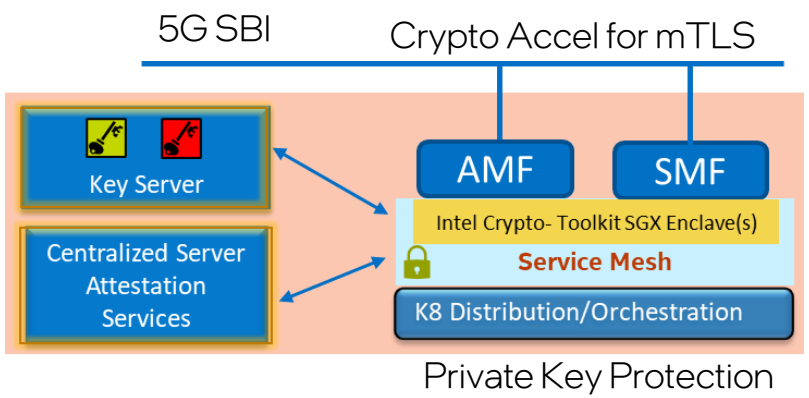
Improve Security and Reduce Compute Cycles

[1] See [70]. [71], and [90] at www.intel.com/3gen-xeon-config Performance and results may vary by use, configurations and other factors.

5G Control Plane Security: Hardware Based Security

Horizontal

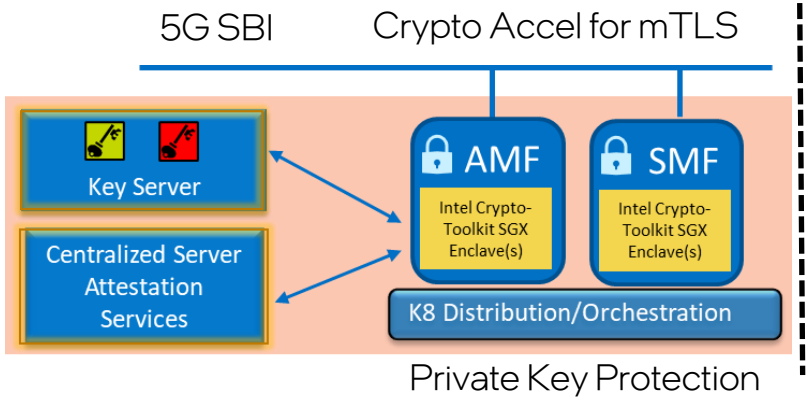
With Service Mesh



Horizontal Cloud Native Infrastructure
No CNF Mods Required

Vertical

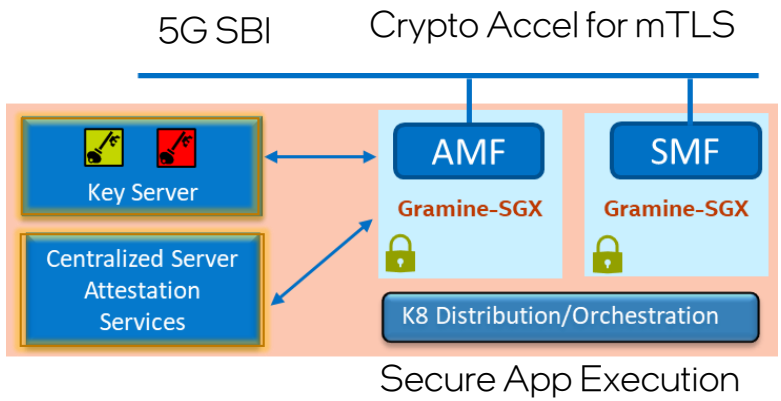
Without Service Mesh



Vertical CNF Cluster
Including Infrastructure

Run App in Enclave

With Gramine – Intel® SGX



Run Entire dCore in an
Intel® SGX Enclave

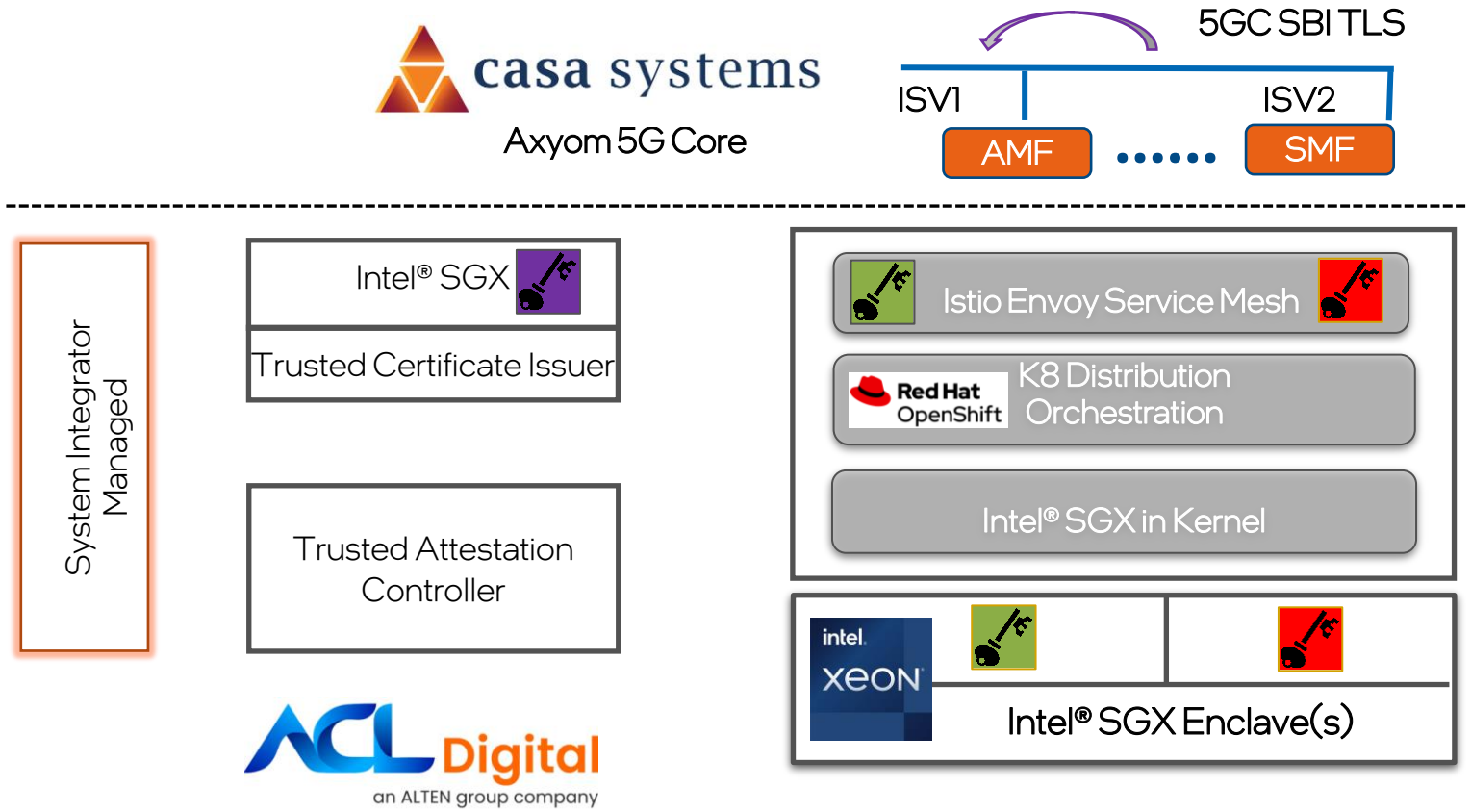
Key Benefits

- ✓ Smallest attack surface, hardware-based security
- ✓ Horizontally or vertically managed security for 5G Core
- ✓ Hardware crypto-acceleration for mTLS and IPSec

Control Plane Key Management Reference Architecture

Intel, ACL Digital, Casa Systems Proof Point

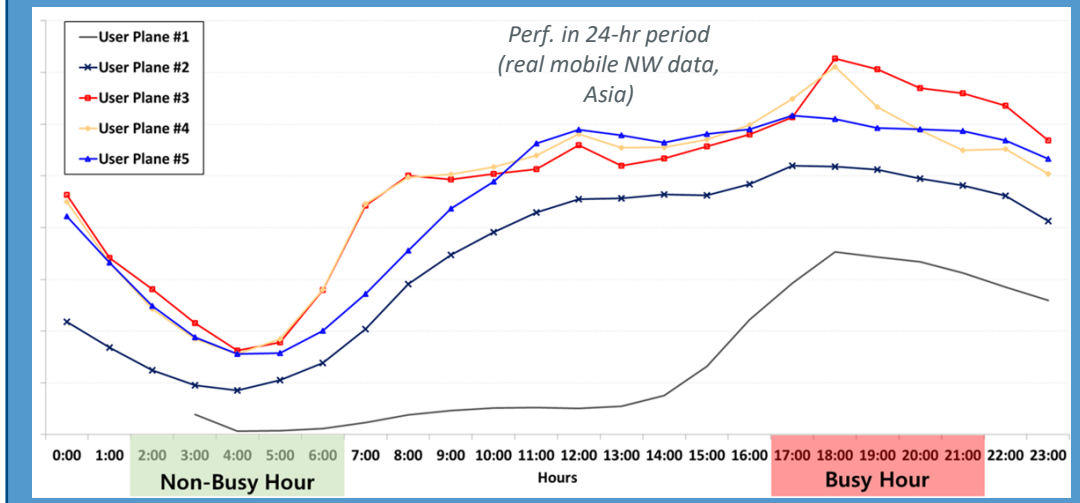
Secure Cloud Native 5G Core Control Plane

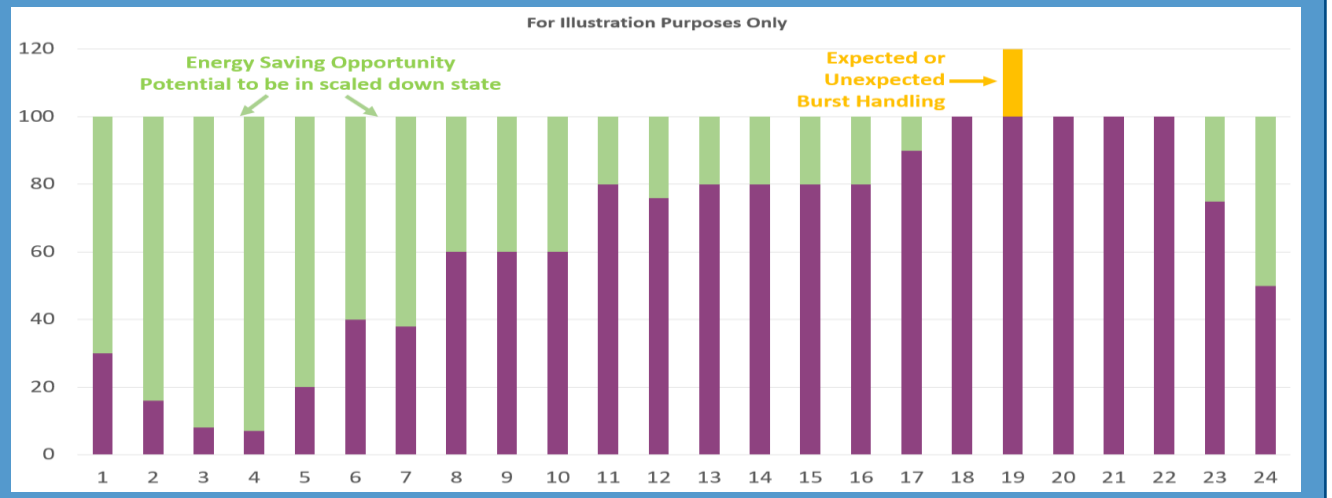


Key Benefits

- ✓ Smallest attack surface
- ✓ Horizontally managed security for 5G Core
- ✓ Minimal-to-no impact for 5G core NF ISVs

Match Power to Real-Time Traffic





Network servers, CPUs still draw full power during low-traffic periods

Intel® Platform Telemetry Insights, Utilization Reports Track CPU Power Consumption

Platform optimizations & software adjust frequency to accommodate traffic spikes, conserve energy

Contextual Visibility Addresses Network Blind Spots

73.5%
Enterprise SLAs Key to 5G Core Monetization [1]

98%
Customer-Impacting Events are Service Degradation vs Outages [2]

5X
More time to isolate fault domain (4G vs 5G) [3]

69%
Fault detection & correlation in cloud infrastructure difficult for CoSPs [3]

Correlate customer experience, network & infrastructure

- Intel® Platform Telemetry Insights. Comprehensive infrastructure telemetry, easily consumable for assurance
- Extensive telemetry experience in commercial, software-based, mobile networks and data centers
- Up-level insight streamed with context to reduce noise and trigger action when needed
- Eliminate or reduce blind spots in correlated root-cause analysis
- Intel library of platform test, checks with insights, investments in OpenTelemetry, Telegraf, Kafka

[1] "Survey Report: Intelligent and dynamic evolving service assurance for 5G standalone," Mobile World Live 2021
[2] "Nova SensAI" brochure from EXFO cites Heavy Reading custom survey, 2019
[3] "5G Troubleshooting and Fault Detection Study, North America and Western Europe 1Q22 Survey Analysis," Heavy Reading, March 2022

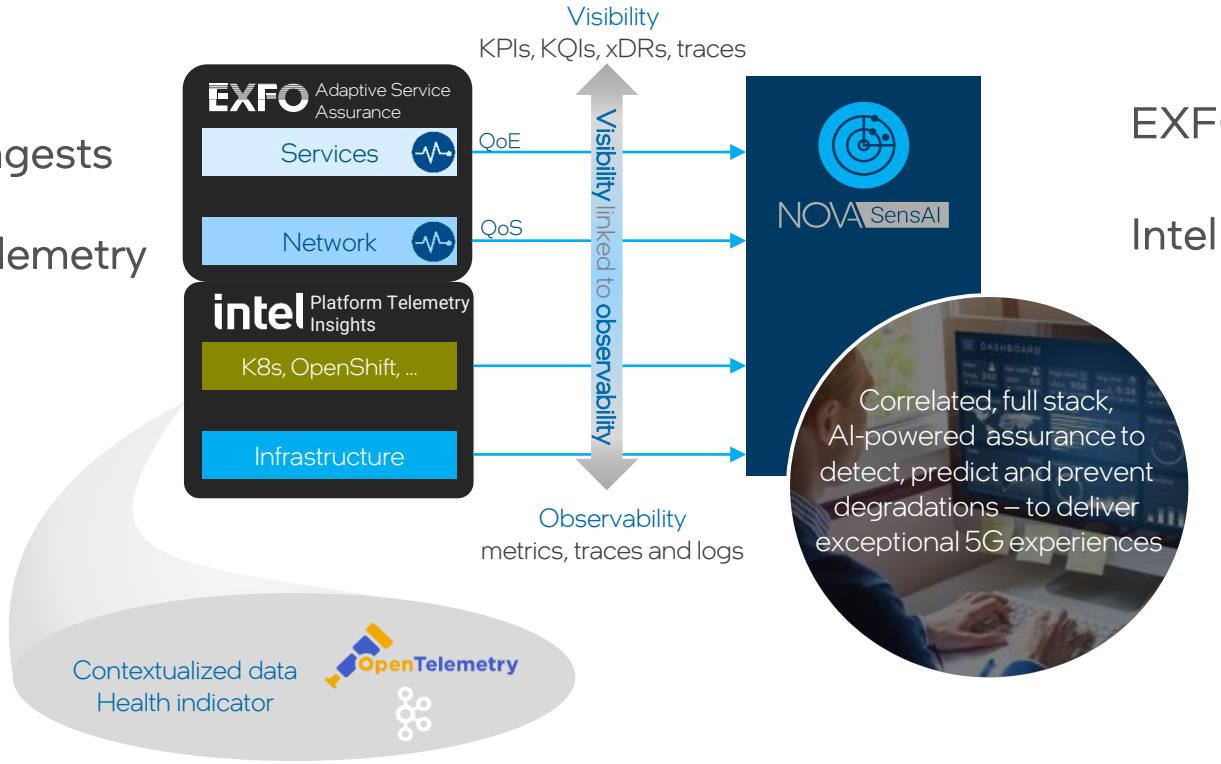
Full-Stack Observability & Assurance

Intel network expertise simplifies infrastructure observability for EXFO correlation mix

EXFO collects and ingests

All KPIs AND Intel telemetry

With context



EXFO SensAI "learns"

Intel and 5G thru use cases

Service-aware infrastructure performance assurance is important, valuable and unaddressed today.

Jennifer Clark, Principal analyst, Heavy Reading

Summary & Call to Action

- 5G SA is Cloud Native Inflection Point
- Performance is Foundational Security, Power, Service Assurance are Critical
- Match Server and CPU Power Consumption to Network Traffic
- Control Plane Security Start with Zero Trust
- Engage Intel Identify Your Requirements
- Act Now Tap Existing Platform Capabilities Engage in Trials
- Join Intel Advance Open Software Innovation
- Unlock Optimizations, Reference Architectures, More in Intel® DevZone

Notices & Disclaimers

- Performance varies by use, configuration and other factors. Learn more at www.Intel.com/PerformanceIndex
- Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. No product or component can be absolutely secure.
- Intel technologies may require enabled hardware, software or service activation.
- Your costs and results may vary.
- The demo contains information from a third party:
  - Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

Legal Notices and Disclaimers

For notices, disclaimers, and details about performance claims, visit www.intel.com/PerformanceIndex or scan the QR code:

Forward Looking Statements Disclaimer

Statements in this presentation that refer to future plans or expectations are forward-looking statements. These statements are based on current expectations and involve many risks and uncertainties that could cause actual results to differ materially from those expressed or implied in such statements. For more information on the factors that could cause actual results to differ materially, see our most recent earnings release and SEC filings at www.intc.com.

1.42x 5G User Plane Function

New: 1-node, 2(1 socket used)x Intel Xeon Gold 6338N on Whitley Coyote Pass 2U with 128 GB (8 slots/ 16GB/ 2666) total DDR4 memory, ucode 0x261, HT on, Turbo off, Ubuntu 18.04.5 LTS, 4.15.0-134-generic, 1x Intel 810 (Columbiaville), FlexCore 5G UPF, Jan' 2021 MD5 checksum: c4ad7f8422298ceb69d01e67419ff1c1, GCC 7.5.0, 5G UPF228 Gbps / 294 Gbps, test by Intel on 3/16/2021.

Baseline: 1-node, 2(1 socket used)x Intel Xeon Gold 6252N on SuperMicro* X11DPG-QT with 96 GB (6 slots/ 16GB/ 2934) total DDR4 memory, ucode 0x5003003, HT on, Turbo off, Ubuntu 18.04.5 LTS, 4.15.0-132-generic, 1x Intel 810 (Columbiaville), FlexCore 5G UPF, Jan' 2021 MD5 checksum: c4ad7f8422298ceb69d01e67419ff1c1, GCC 7.5.0, 5G UPF161 Gbps / 213 Gbps, test by Intel on 2/12/2021.

15% Performance/Watt Improvement Gen-over-Gen

Gen-over-Gen Comparison

	2nd Generation Intel® Xeon® Scalable (Gold 6252N)	3rd Generation Intel Xeon Scalable (Gold 6338N)	
5G UPF Performance	162	230	41.9% [1]
TDP (Watt)	150 [2]	185 [3]	
Performance/Watt [4]	1.08	1.24	15%

[1] Performance varies by use, configuration and other factors. Learn more [91, 92] www.intel.com/3gen-xeon-config

With Intel® 3rd Gen Xeon® Scalable processors, CoSP's can increase 5G UPF performance by 42%. Combined with Intel Ethernet 800 series adapters, they can deliver the performance, efficiency and trust for use cases that require low latency, including augmented reality, cloud-based gaming, discrete automation and even robotic-aided surgery.

1.42x 5G User Plane Function:

New: 1-node, 2(1 socket used)x Intel Xeon Gold 6338N on Whitley Coyote Pass 2U with 128 GB (8 slots/ 16GB/ 2666) total DDR4 memory, ucode 0x261, HT on, Turbo off, Ubuntu 18.04.5 LTS, 4.15.0-134-generic, 1x Intel 810 (Columbiaville), FlexCore 5G UPF, Jan' 2021 MD5 checksum: c4ad7f8422298ceb69d01e67419ff1c1, GCC 7.5.0, 5G UPF228 Gbps / 294 Gbps, test by Intel on 3/16/2021.

Baseline: 1-node, 2(1 socket used)x Intel Xeon Gold 6252N on SuperMicro* X11DPG-QT with 96 GB (6 slots/ 16GB/ 2934) total DDR4 memory, ucode 0x5003003, HT on, Turbo off, Ubuntu 18.04.5 LTS, 4.15.0-132-generic, 1x Intel 810 (Columbiaville), FlexCore 5G UPF, Jan' 2021 MD5 checksum: c4ad7f8422298ceb69d01e67419ff1c1, GCC 7.5.0, 5G UPF161 Gbps / 213 Gbps, test by Intel on 2/12/2021.

[2] https://www.intel.com/content/www/us/en/products/sku/193951/intel-xeon-gold-6252n-processor-35-75m-cache-2-30-ghz/specifications.html

[3] https://www.intel.com/content/www/us/en/products/docs/processors/xeon/3rd-gen-xeon-scalable-processors-brief.html

[4] performance/watt calculated as ratio of UPF perf/CPU TDP

Questions?

Xiaojun (Shawn) Li, Sales Director, Next Wave OEM & eODM
xiaojun.li@intel.com

Chandresh Ruparel, Senior Director
chandresh.ruparel@intel.com

Eoin Walsh, Senior Architect
eoin.walsh@intel.com

Join Us Next Time

December 7th @ 8am PDT


intel