
intel
EDGE CLOUD
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Network Platforms Group

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KEY DRIVERS FOR EDGE COMPUTING

Low latency that cannot be achieved by using centralized cloud

Reduction of movement of the massive amount of data generated by IoT devices to reduce cost and enable efficient use of resources

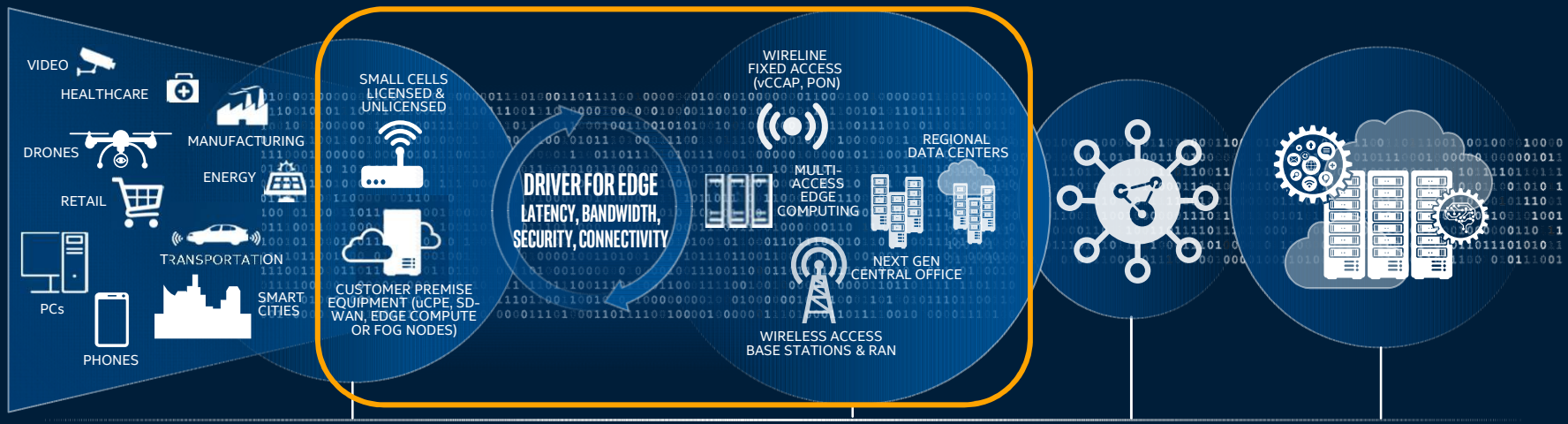
Data privacy and data sovereignty

Context awareness

Scenarios where connectivity is unreliable or limited

Better experience, faster transactions

DISTRIBUTING CLOUD TECHNOLOGIES & ECONOMICS TO THE EDGE CLOUD



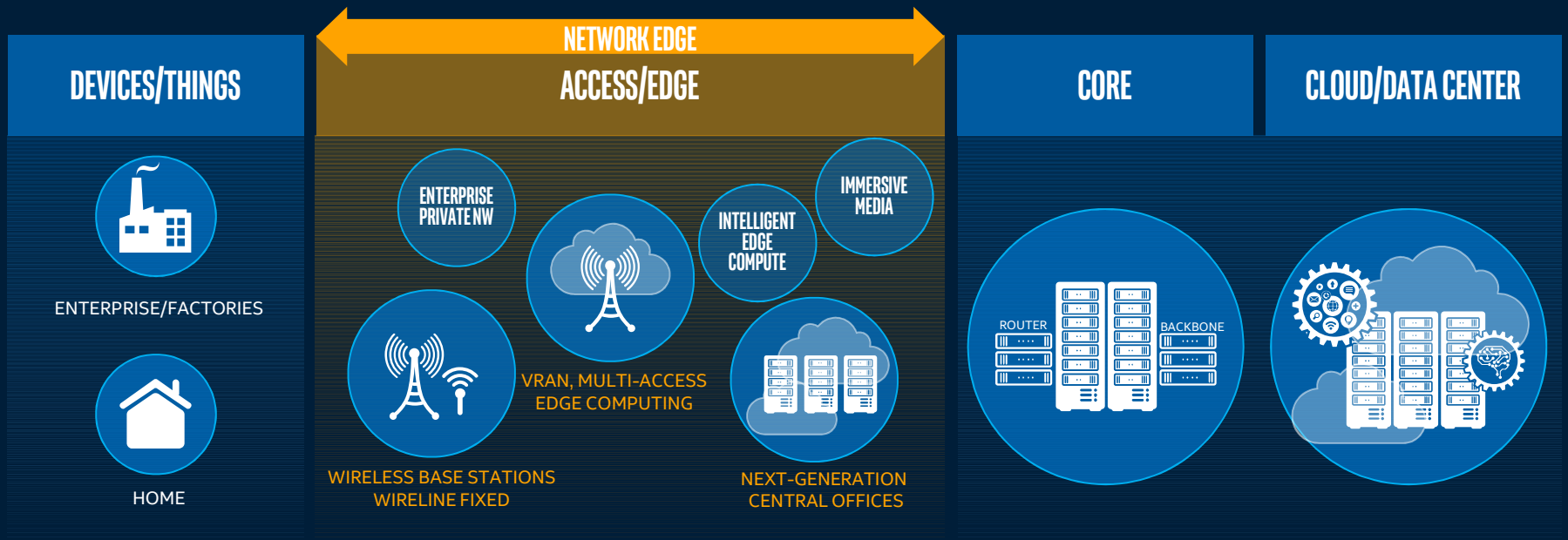
	DEVICES / THINGS	ON-PREMISE EDGE	NETWORK EDGE	NETWORK CORE	DATA CENTER / CLOUD
Latency expectation	Varies <1 ms	<5 ms	<10-40 ms	< 60 ms	~100 ms

MULTIPLE EDGE(S) & EDGE CLOUD LOCATIONS

PRIMARY FOCUS TODAY ON THE ON-PREMISE/ENTERPRISE EDGE & NETWORK EDGE

NOT INCLUSIVE OF DEVICE EDGE & CLOUD EDGE

COMPUTE WORKLOAD PLACEMENT AT OPTIMAL LOCATION OF HIGHEST RETURN



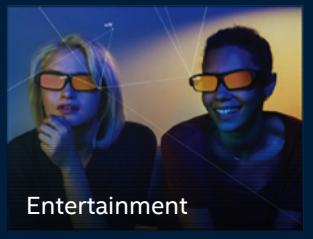
EDGE CLOUD SERVICES & APPLICATIONS CRITICAL TO DRIVE ROI ON EDGE INVESTMENT TO SERVICE PROVIDERS & ENTERPRISES

5G ACCELERATING EDGE COMPUTING

MISSION-CRITICAL IOT:
Ultra Reliability
& Low Latency

MASSIVE IOT:
Massive M2M
Connectivity

ENHANCED MOBILE BROADBAND

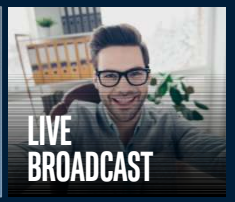


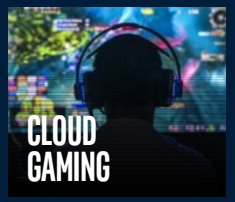
INTEL'S STRATEGIES FOR THE ON-PREMISE & NETWORK EDGE

3 ENABLE EDGE SERVICES

2 ENABLE NETWORK FUNCTIONS

1 OPTIMIZE THE PLATFORM





ENTERPRISE & CLOUD CPE

WIRELESS ACCESS

MULTI-ACCESS EDGE COMPUTING

EDGE CENTRAL OFFICES

CORE

0110 0110
1101 1011
0010 0100

HARDWARE TO MOVE, STORE & PROCESS THE DATA

SOFTWARE TO CONVERGE THE WORKLOADS

PARTNERSHIPS TO WIN WITH THE ECOSYSTEM

1 HARDWARE: MOVE, STORE & PROCESS THE DATA

PERFORMANCE

INTEL® XEON® SCALABLE PROCESSORS

UP TO **~600Gb/s** PACKET PROCESSING ON A DUAL SOCKET PLATFORM[1]

LOW LATENCY, MULTI-I/O SUPPORT (E.G., SATA)

INTEL® XEON® D PROCESSORS

UP TO **~200Gb/s** PACKET PROCESSING[2]

INTEGRATED ETHERNET & ACCELERATION

INTEL® CORE™ PROCESSORS

LONG LIFE SUPPORT

LEADING MEDIA IP PERFORMANCE (ENCODE/DECODE/TRANSCODE)

INTEL ATOM® PROCESSORS

UP TO **40Gb/s** PACKET PROCESSING[3]

4W+

INDUSTRIAL TEMP SUPPORT, TIME COORDINATED COMPUTING, INVESTING IN FUSA

POWER

ACCELERATION SOLUTIONS

FPGA | ASSP | Intel® eASIC™ Silicon | VPU | Custom

ADJACENT TECHNOLOGIES

Intel® Ethernet Controller

Intel® Silicon Photonics

Intel® OPTANE™ DC PERSISTENT MEMORY

Intel® OPTANE™ DC SOLID STATE DRIVE

Intel® QuickAssist Technology

USE CONSISTENT, SCALABLE & HIGHLY PROGRAMMABLE ARCHITECTURE FROM EDGE TO DATA CENTER

1. Up To 586Gb/s Packet Processing on a dual socket Platform: Results based on internal Intel testing as of 8/2/2018. Intel(R) Xeon(R) Platinum 8160 CPU @ 2.10GHz (DP), 12x Intel® XXV710-DA4 PCI Express Gen Dual Port 25GbE Ethernet controller (4x25GbE/card). Benchmark: DPDK v17.11 L3fwd sample application (IPv4, LPM, 3750000 flows). Score: 586Gbits/s packet forwarding at 512B packet size.
2. Up to 191Gb/s Packet Processing: Results based on internal Intel testing as of 5/1/2018. Intel(R) Xeon(R) D-2187NT CPU @ 2.0GHz, 4x Intel® XXV710-DA2 PCI Express Gen Dual Port 25GbE Ethernet controller (2x25GbE/card). Benchmark: DPDK v17.11 L3fwd sample application (IPv4, LPM, 2048 flows). Score: 191Gbits/s packet forwarding at 512B packet size.
3. Up to 40Gb/s Packet Processing: Results based on internal Intel testing as of 8/14/2017. Intel(R) Atom(tm) Processor C3958 @2.0GHz, 2x Intel® X710-DA2 PCI Express Gen Dual Port 10GbE Ethernet controller (2x10GbE/card). Benchmark: DPDK v17.02 L3fwd sample application (IPv4, LPM, 1024 flows). Score: 40Gbits/s packet forwarding at 512B packet size.

1 INTEL® SELECT SOLUTIONS

SIMPLIFY AND ACCELERATE DEPLOYMENT OF WORKLOAD-OPTIMIZED INFRASTRUCTURE

Verified solutions optimized for workloads across

COMPUTE, STORAGE AND NETWORK

In collaboration with the world's leading

DATA CENTER AND SERVICE PROVIDERS

Developed from rich Intel expertise with our

INDUSTRY ECOSYSTEM PARTNERS

SIMPLIFIED EVALUATION — Eliminates guesswork through tightly specified hardware and software components

FAST AND EASY TO DEPLOY — Smooth deployment with pre-defined settings and system-wide tuning

WORKLOAD OPTIMIZED — Designed and benchmarked for specific workloads to deliver optimal performance

intel select solution

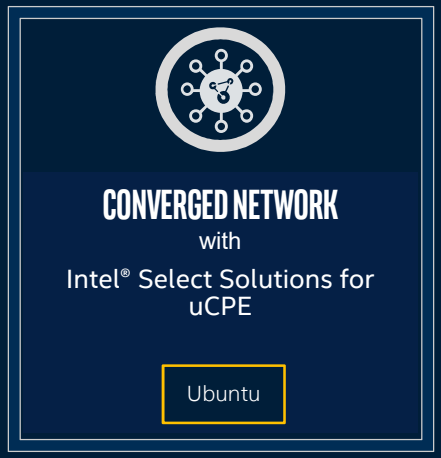
Faster. Easier. Optimized.

UPDATED FOR CASCADE LAKE PLATFORMS

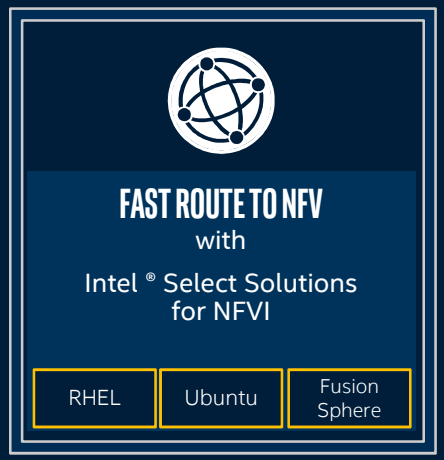
1 INTEL® SELECT SOLUTIONS FOR THE NETWORK

THE FAST PATH TO A VIRTUALIZED INFRASTRUCTURE

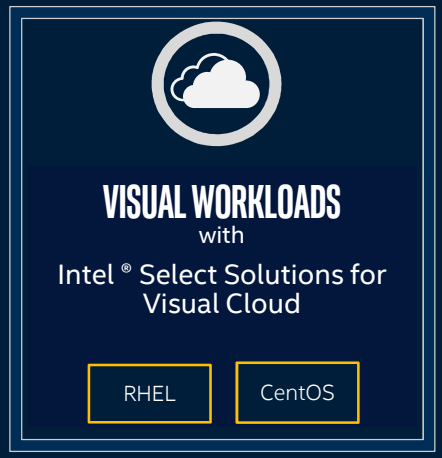
uCPE



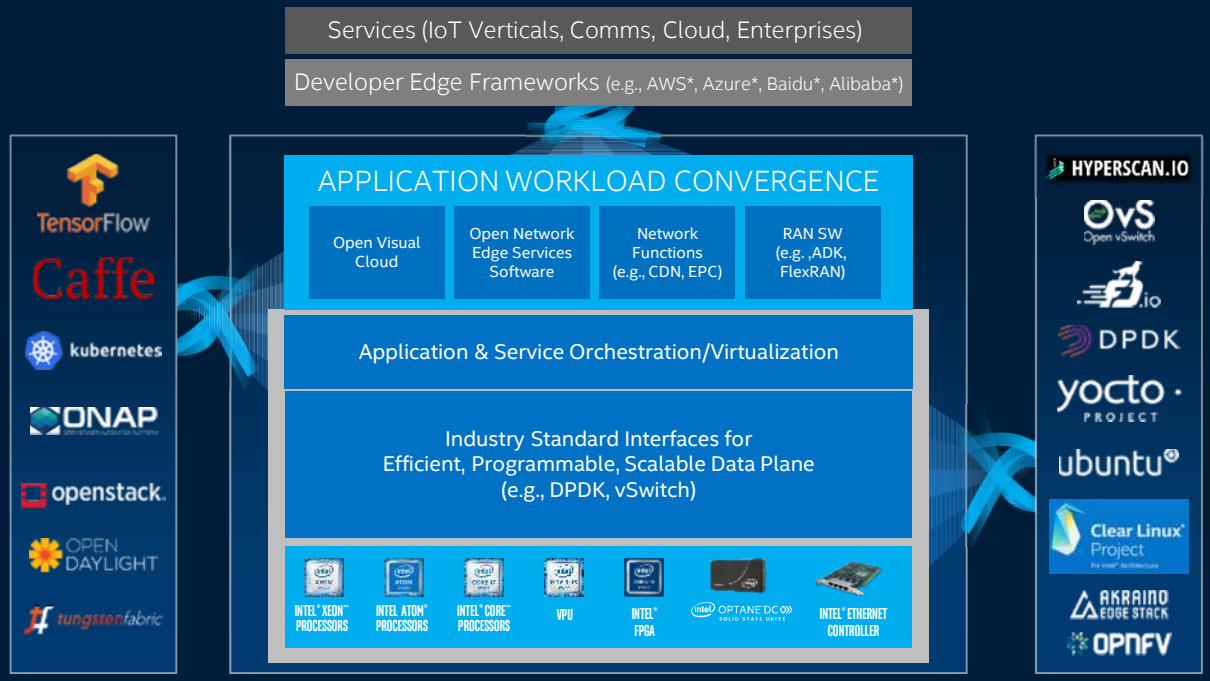
NFVI



VCD



1 SOFTWARE: CONVERGE THE WORKLOADS



1. Proven dataplane acceleration technologies
2. Integration of analytics, media, and networking SW technologies to ease developer adoption & programmability
3. Leveraging & contributing to industry-standard interfaces & open source software

USE RICH & FLEXIBLE SOFTWARE FRAMEWORKS FOR FASTER CUSTOMER SOLUTION READINESS & DEPLOYMENTS

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1 VISUAL CLOUD EDGE USE CASES: 5G & CLOUD READY PLATFORMS

DECODE

INFERENCE

RENDER

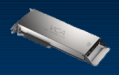
ENCODE

Intel® Rendering Framework	SVT-AV1/HEVC	OPEN SOURCE, FLEXIBLE BUILDING BLOCKS, FRAMEWORKS, & REFERENCE PIPELINES	OpenVINO™ Toolkit	Intel® Collaboration Suite for WebRTC

BROAD PLATFORM PORTFOLIO – SCALABILITY FOR POWER, DENSITY, QUALITY

Intel® Xeon® Processor

Intel® Xeon-D Processor



Intel® Visual Cloud Accelerator

Intel® Ethernet Adapter

Intel® FPGA

Intel® Optane™ Persistent Memory

Intel® Gen Graphics

8th Gen Intel® Core™ Processor Radeon graphics

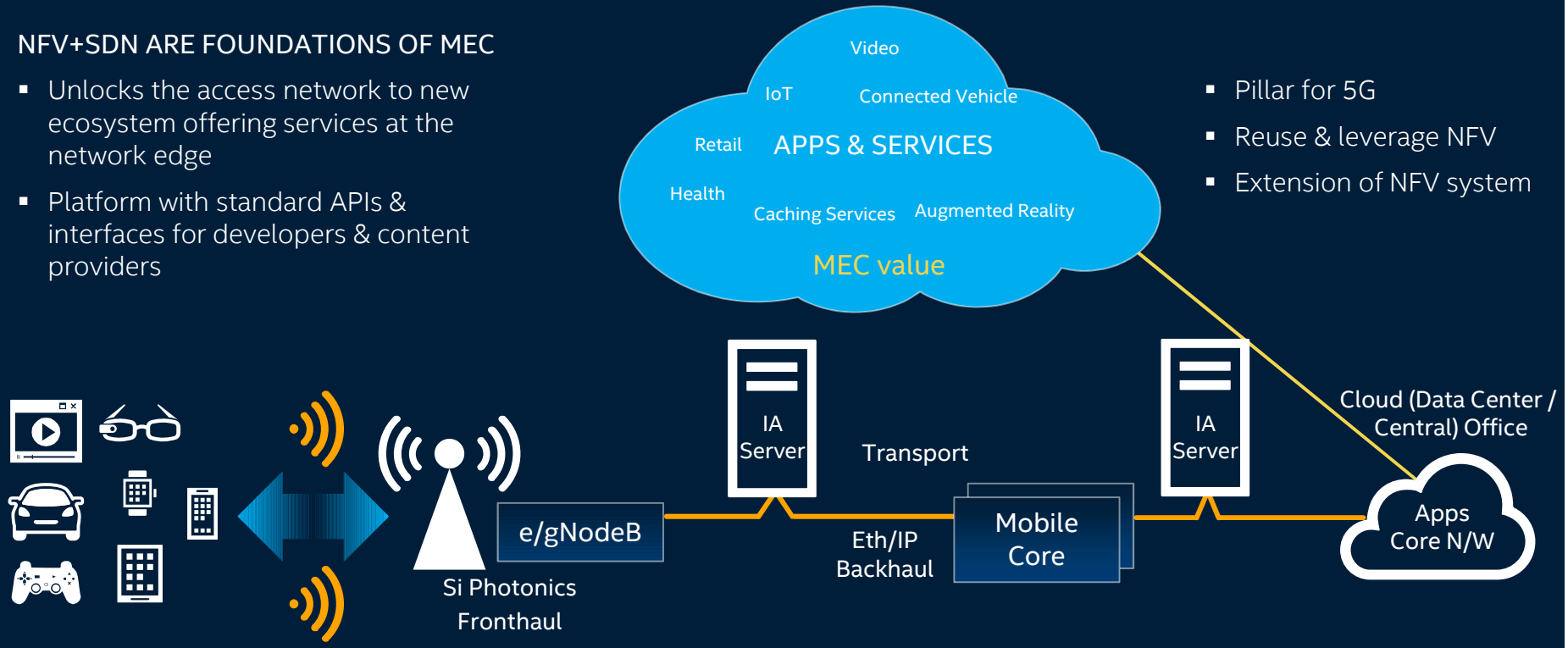
FOUR CORE BUILDING BLOCKS BUILD FIVE CORE SERVICES

LEVERAGE WORKLOAD & ECOSYSTEM PARTNERSHIPS

2 MULTI ACCESS EDGE COMPUTE (MEC)

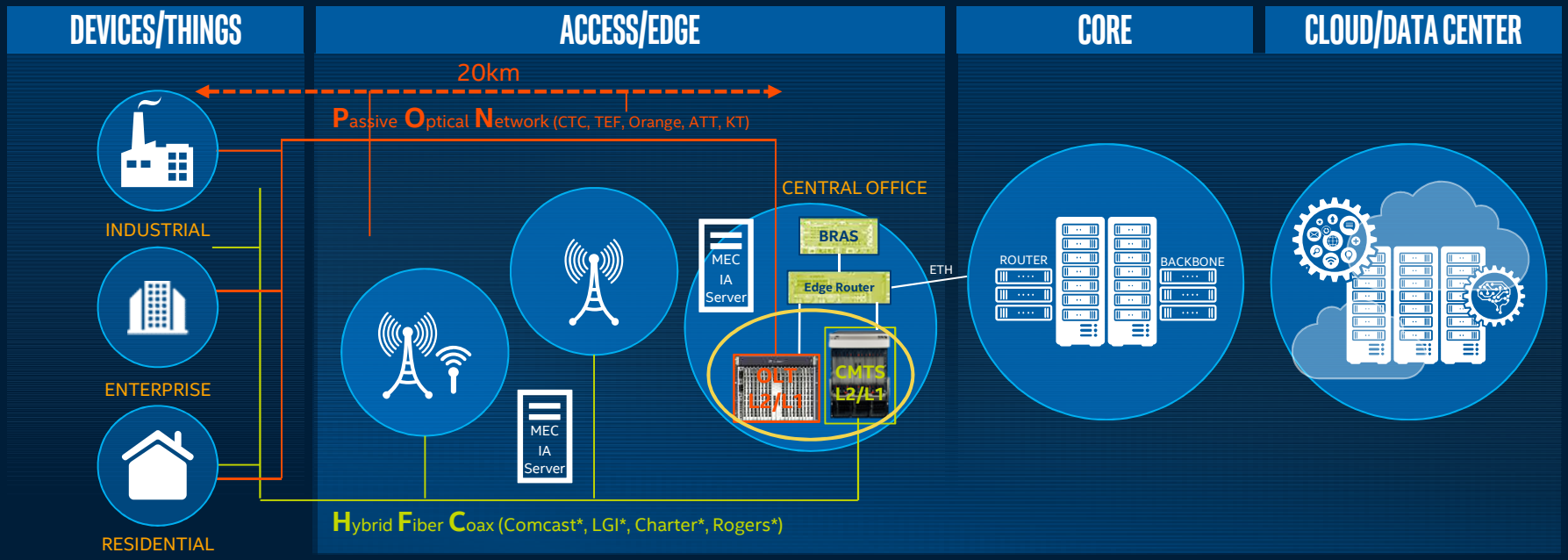
NFV+SDN ARE FOUNDATIONS OF MEC

- Unlocks the access network to new ecosystem offering services at the network edge
- Platform with standard APIs & interfaces for developers & content providers



- Pillar for 5G
- Reuse & leverage NFV
- Extension of NFV system

2 TELCO CO & CABLE MSO NETWORK INFRASTRUCTURE



LEVERAGE WORKLOAD ACCELERATION/OPTIMIZATION
& ECOSYSTEM PARTNERSHIPS

1 Source: IHS, Gartner, IDC, and Intel estimates
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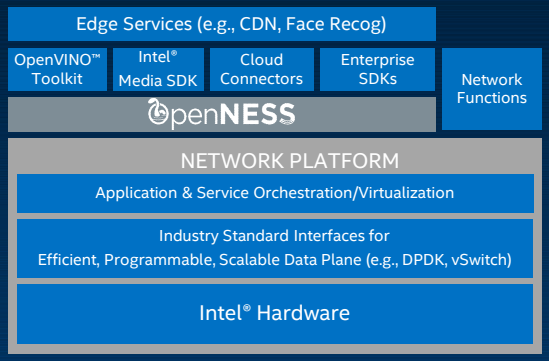
3 EDGE SERVICES: ENABLING ECOSYSTEM & DEVELOPERS

EDGE SERVICES REFERENCE SOFTWARE



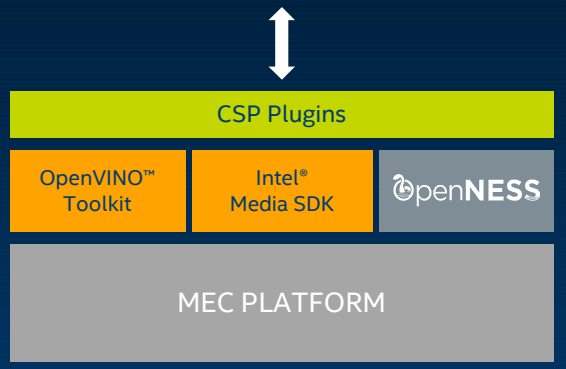
Make it easy for developers to create applications & services by abstracting the complexity of the network

MULTI LOCATION EDGE REFERENCE ARCHITECTURE

Enable convergence of application workloads (media, AI/analytics, networking)

DEVELOPER KITS

(Amazon*, Azure*, etc.)



Enable a diverse ecosystem (CoSP, CSP & Enterprises) on Intel® platforms

ADDRESS NEW SERVICES & APPLICATIONS IN TOP VERTICALS – MEDIA, INDUSTRIAL, RETAIL, SMART CITY & OTHERS

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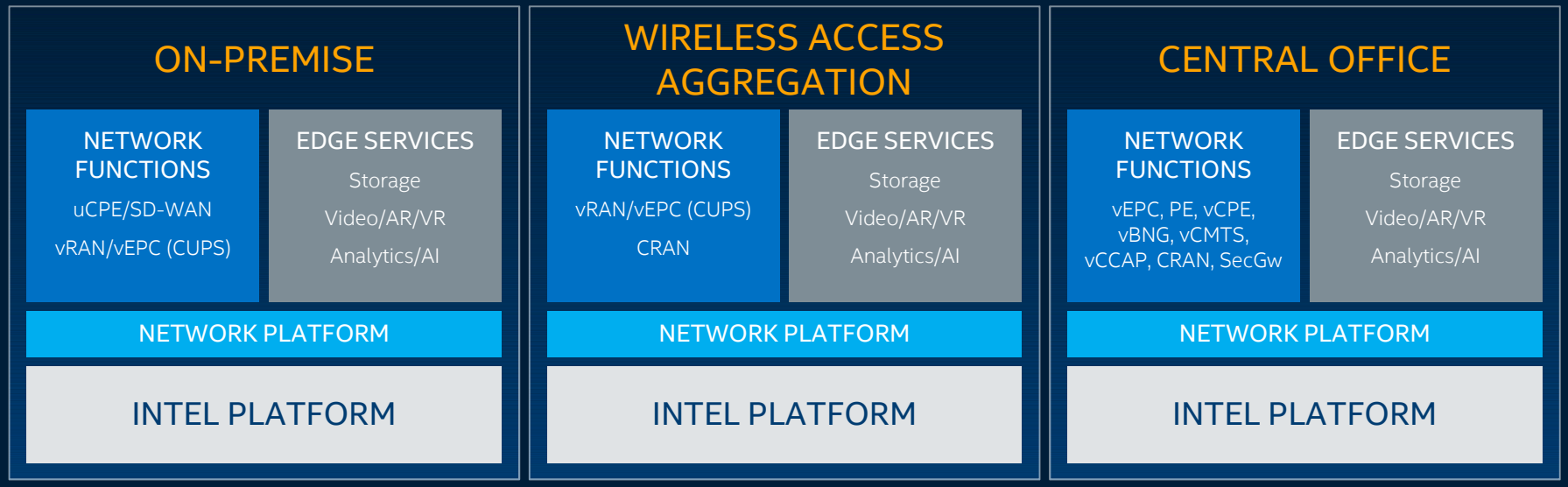
3 MULTI LOCATION EDGE REFERENCE ARCHITECTURE



SCALABLE HW + SW FRAMEWORK ACROSS EDGE LOCATIONS CRITICAL FOR DYNAMIC PLACEMENT AND MOVEMENT OF EDGE SERVICES ACROSS DIFFERENT LOCATIONS

SUMMARY

- EDGE COMPUTING IS THE PLACEMENT OF DATA CENTER-GRADE NETWORK, COMPUTE & STORAGE CLOSER TO ENDPOINT DEVICES TO IMPROVE SERVICE CAPABILITIES, OPTIMIZE TCO, COMPLY WITH DATA LOCALITY AND REDUCE APPLICATION LATENCY

- 5G USE CASES THAT REQUIRE ULTRA RELIABILITY AND LOW LATENCY, MASSIVE M2M CONNECTIVITY AND ENHANCED BROADBAND ARE ACCELERATING EDGE COMPUTING

- COMPUTE WORKLOAD PLACEMENT AT OPTIMAL LOCATION OF HIGHEST RETURN FOR EDGE CLOUD SERVICES AND APPLICATIONS CRITICAL TO DRIVE ROI ON EDGE INVESTMENT TO SERVICE PROVIDERS AND ENTERPRISES

- INTEL'S STRATEGY FOR ON-PREMISE AND NETWORK EDGE IS TO OPTIMIZE THE PLATFORM, ENABLE NETWORK FUNCTIONS AND ENABLE SERVICES

BACKUP

WHAT IS EDGE COMPUTING?

EDGE COMPUTING IS THE PLACEMENT OF DATA CENTER-GRADE NETWORK, COMPUTE & STORAGE

CLOSER TO ENDPOINT DEVICES

TO IMPROVE SERVICE CAPABILITIES

OPTIMIZE TCO

COMPLY WITH DATA LOCALITY

AND REDUCE APPLICATION LATENCY

THE EDGE IS THE

OUTMOST LAYERS OF

• • • •

PROCESSING OR NETWORK

BEFORE TRANSITION TO THE ENDPOINT OR ANOTHER NETWORK

VISUAL CLOUD USE CASES THAT REQUIRE HIGH BANDWIDTH & ULTRA-LOW LATENCY

EDGE GAMING

~20- 30MS
20-50MB/S

WIRELESS VR/MR

15-20MS
~50MB/S->1GB/S

Tethered to PC
aaS via GW / MEC /Cloud
AIO (compute in HMD)

E-SPORT / ADAPTIVE STREAMING

>250MB/S
<1 SEC

6K stereo video @60fps is 20x larger than full HD video with an average bit rate of 245Mbps

E-SPORT / ADAPTIVE STREAMING

50MB/S
-> 1GB/S

360 video 8k, 90+ fps, HDR, stereosc. 50-200Mb/s
Plus 6DoF video or point cloud: 200Mb/s-1Gb/s

VR/MR TELE-PRESENCE

50MB/S
-> 1GB/S

MOBILE GAMING

16->200MB/S

2D streaming – 16Mb/s
3D streaming -> 50-200Mb/s

Orange numbers possible via 5G

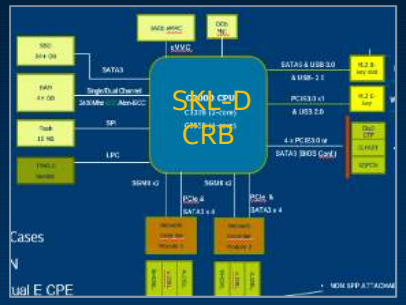
2 ON-PREMISE: OPTIMIZED UCPE FOR MANAGED ENTERPRISE SERVICES

OEM/ISV ECOSYSTEM

Check Point · Juniper Networks · paloalto · riverbed · Cisco · VERSA NETWORKS · silver peak · velocloud · FORTINET · CLOUDGENIX

...and more

INTEL



Benchmark Report for Intel

INTEL® SELECT SOLUTION FOR uCPE

paloalto · VERSA · silver peak

3rd party VNF examples

ADVANTECH · CASWELL · Lanner · SUPERMICRO

Customer Collateral

ENTERPRISES & SERVICE PROVIDERS

LEVERAGE TOP-BOTTOM SCALABILITY, ARCHITECTURAL CONSISTENCY, & ECOSYSTEM PARTNERSHIPS

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3 EDGE SERVICES SOFTWARE: OPENNESS OVERVIEW

OpenNESS
OPEN NETWORK EDGE SERVICES SOFTWARE

Open Network Edge Services Software (OpenNESS) is an open source reference toolkit to develop, securely on-board and manage new edge services on the On-Premise and Network Edge.

EDGE SERVICES SOFTWARE
Access termination, traffic steering, multi-tenancy for services, service registry, service authentication, telemetry, cloud and application frameworks

WHAT

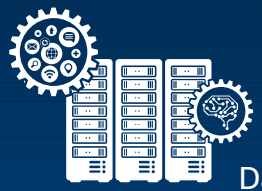
CONTROLLER SOFTWARE
Appliance discovery, control, policy management, exposed via standardized APIs with a web-based GUI for easy application onboarding

WHERE


uCPE


vRAN


NGCO


Data Center / Cloud