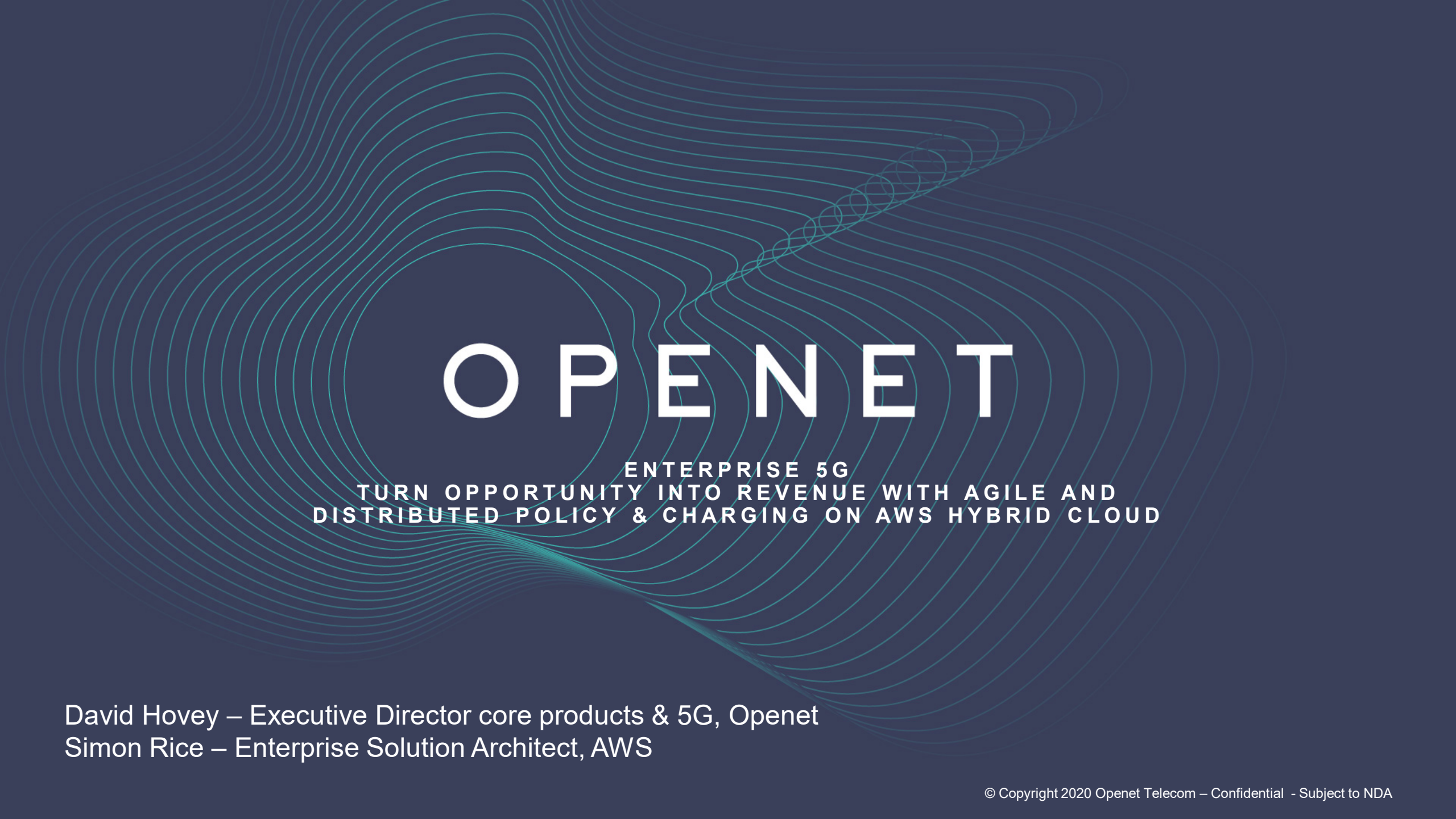


ENTERPRISE 5G
TURN OPPORTUNITY INTO REVENUE WITH AGILE AND DISTRIBUTED POLICY & CHARGING ON AWS HYBRID CLOUD

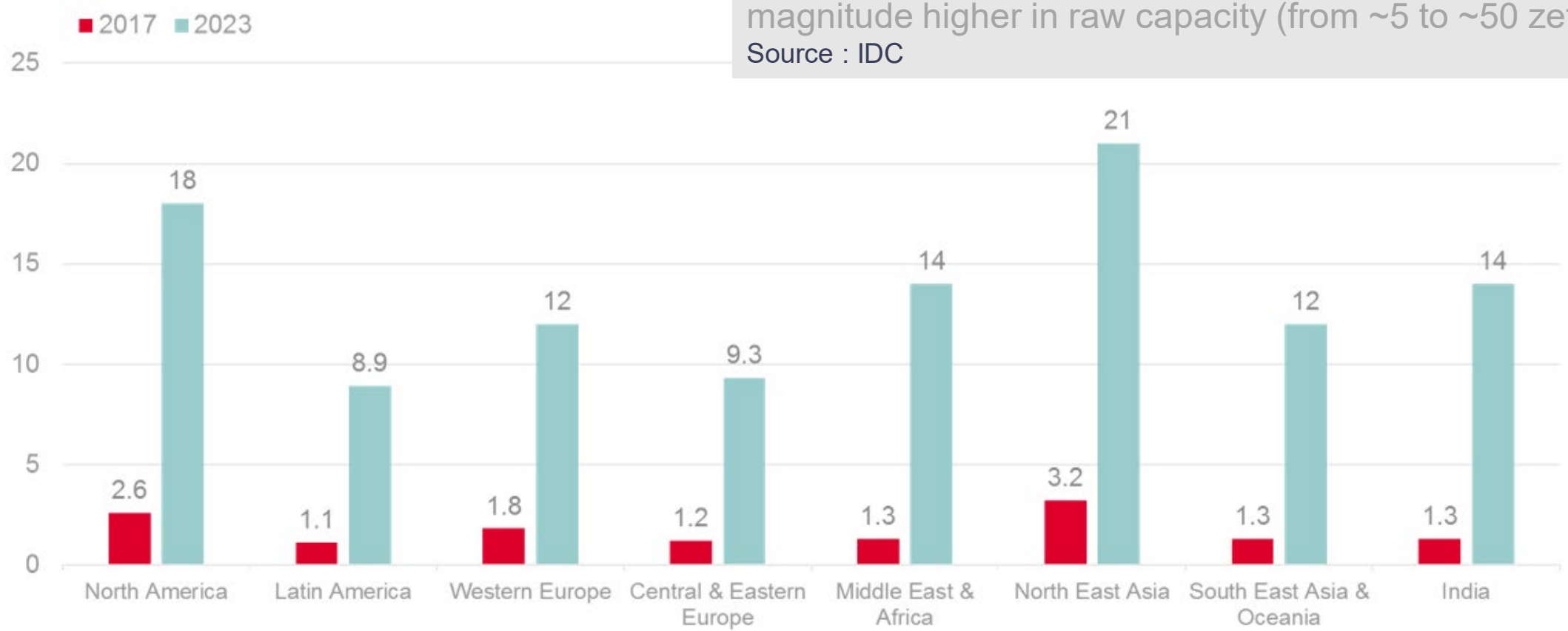
David Hovey – Executive Director core products & 5G, Openet
Simon Rice – Enterprise Solution Architect, AWS

Agenda

- 5G & the concept of ‘edge’
- Opportunity from Enterprise 5G
- The importance of network slicing
- Getting ready for the Edge - Distributed based PCC to support 1ms latency urLLC use cases
- Different slices, different policy rules, different prices – Port and Hospital example
- AWS in the telecommunications industry
- AWS Outposts at the 5G edge
- Openet PCC on AWS

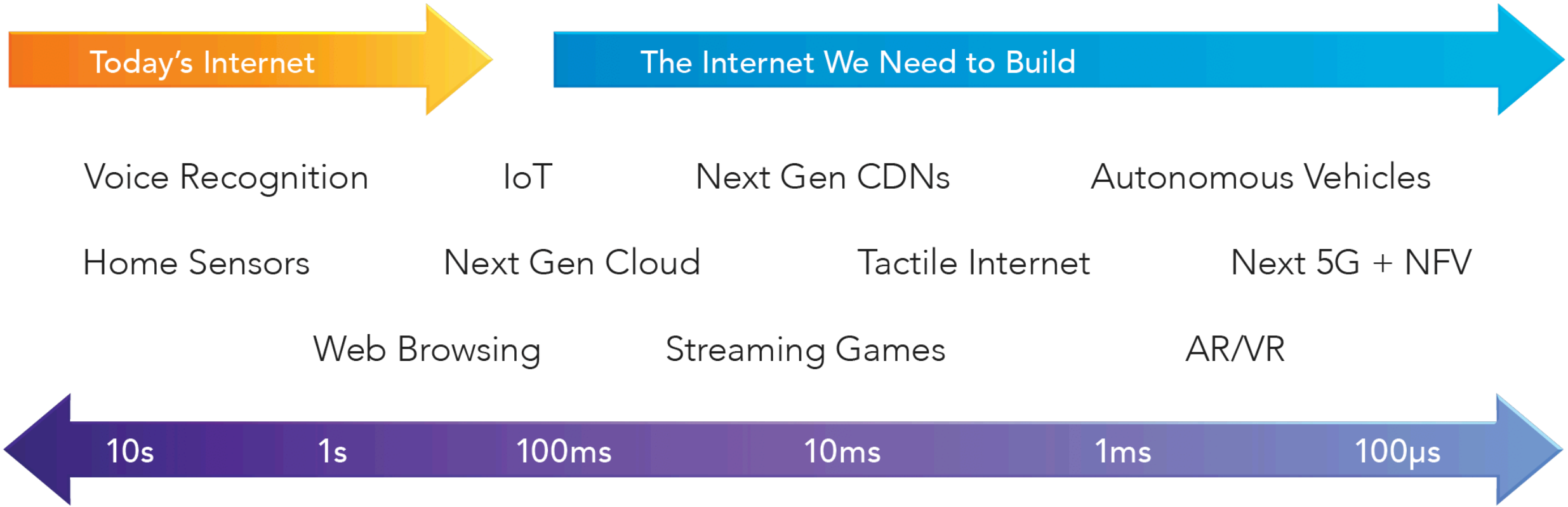
The inexorable rise of global mobile traffic

In 2017, real-time data was a mere 15% of all information created, captured, or replicated.
In 2025, it's expected to reach 30%. That's an order of magnitude higher in raw capacity (from ~5 to ~50 zettabytes).
Source : IDC



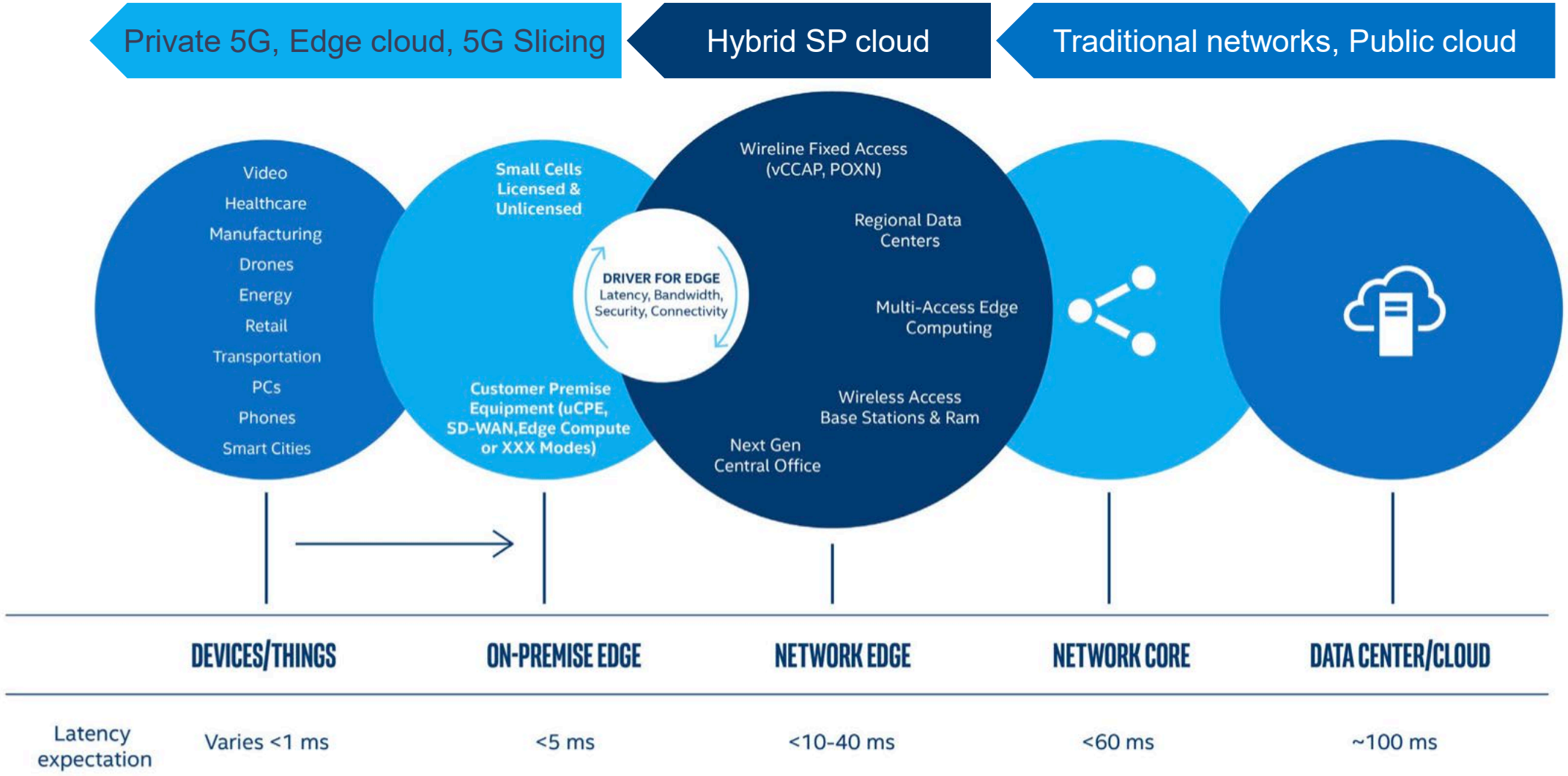
Source : Ericsson

5G inflection point : Edge-enabled internet that operates at machine speeds



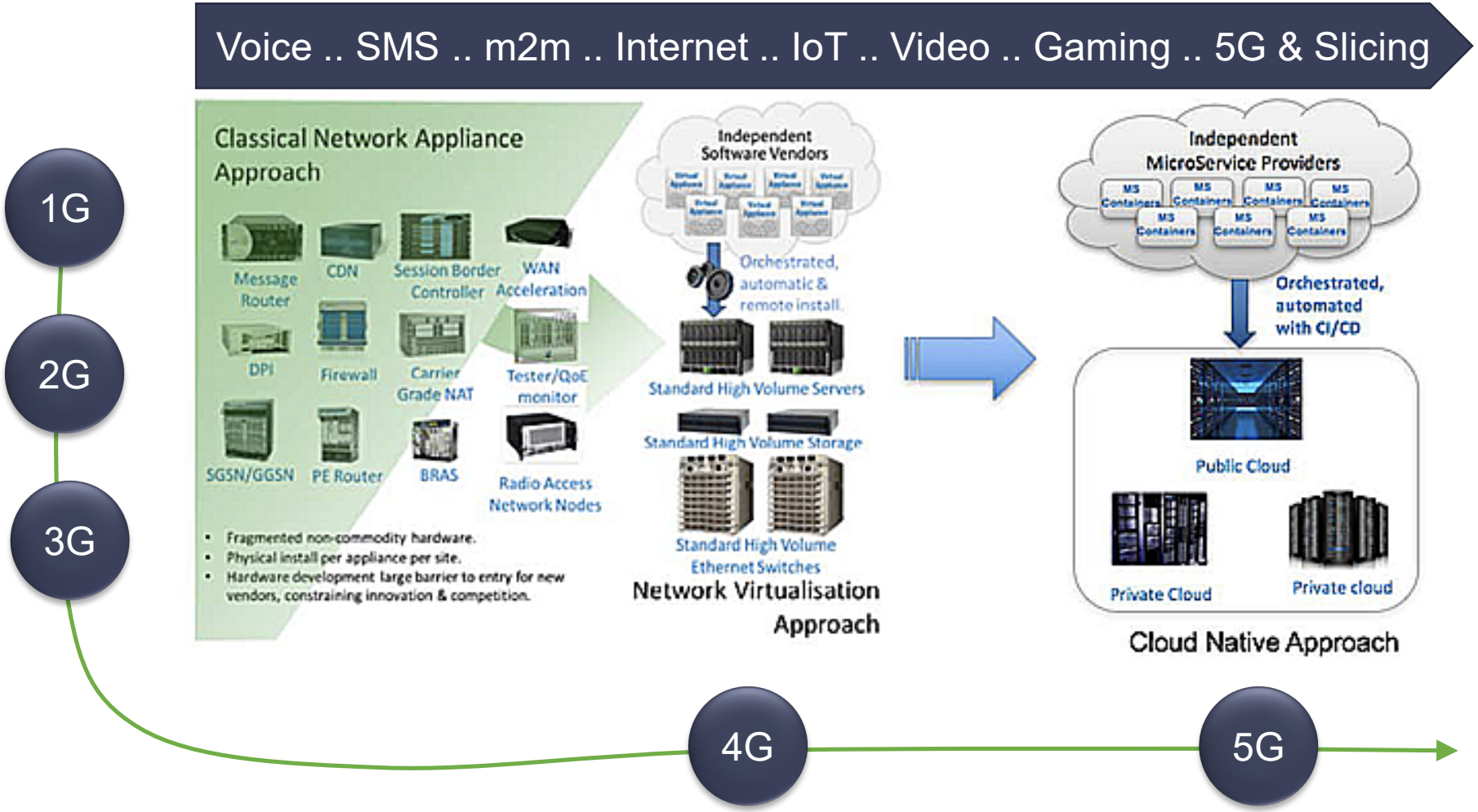
Source : State of the Edge 2020

But what do we mean by ‘Edge’ ?

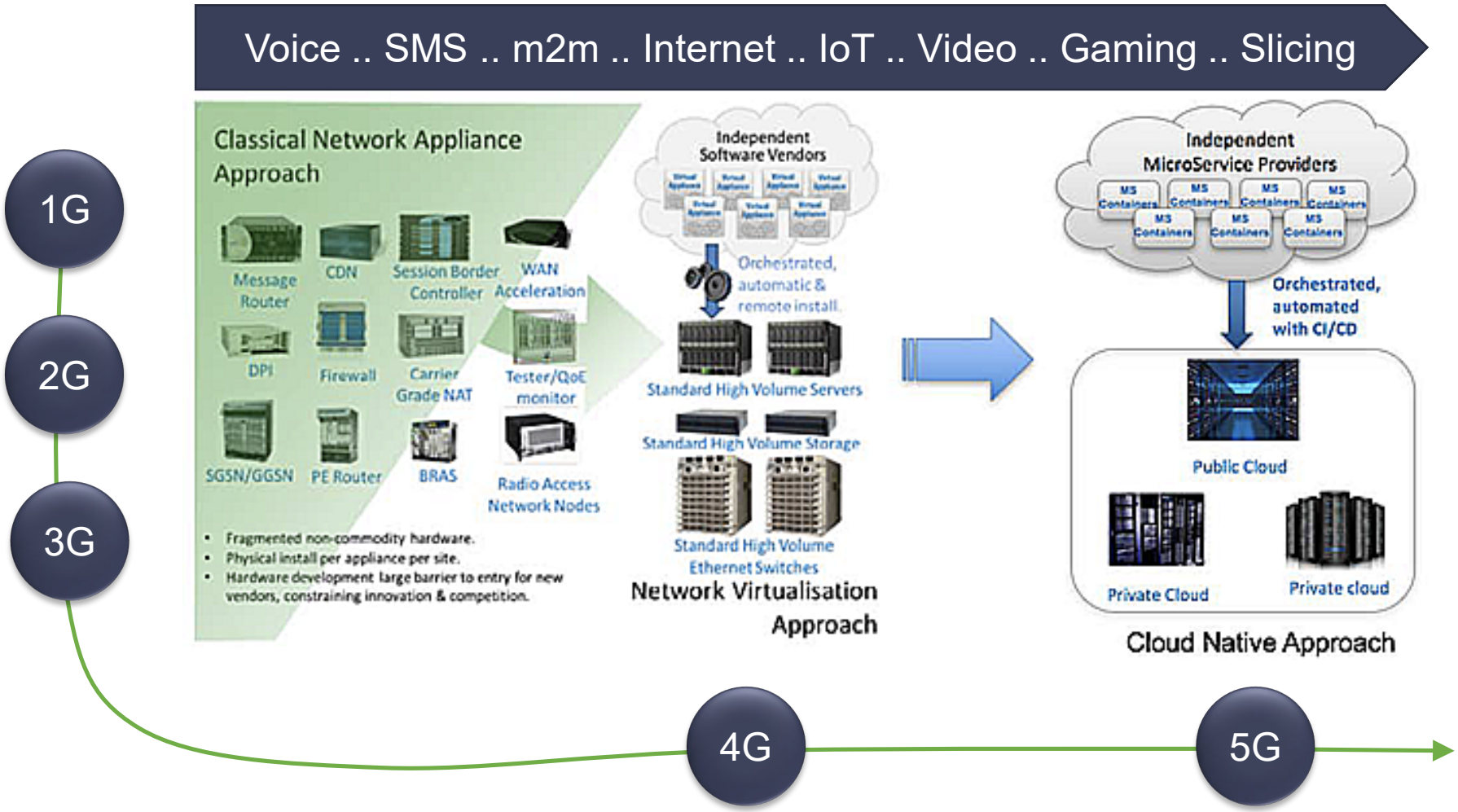


Source : Intel

Looking back & going forwards – how did we get to 5G on cloud?



Looking back & going forwards – how did we get to 5G on cloud?



OPENET Charging

OPENET Policy

OPENET Data

aws

AWS Outposts

Enterprise 5G – The Opportunity for CSPs

> " .. the addressable industry digitalisation market for service providers could grow to about ***US$700 billion by 2030..***"
>
> - Ericsson and Arthur D. Little - 5G for business: a 2030 market compass (October 2019)

"Figuring out how to tap the enterprise market will be critical to communications service providers' (CSPs') 5G success, but they must act fast as large companies in many industry verticals are considering whether to deploy their own private 5G networks …

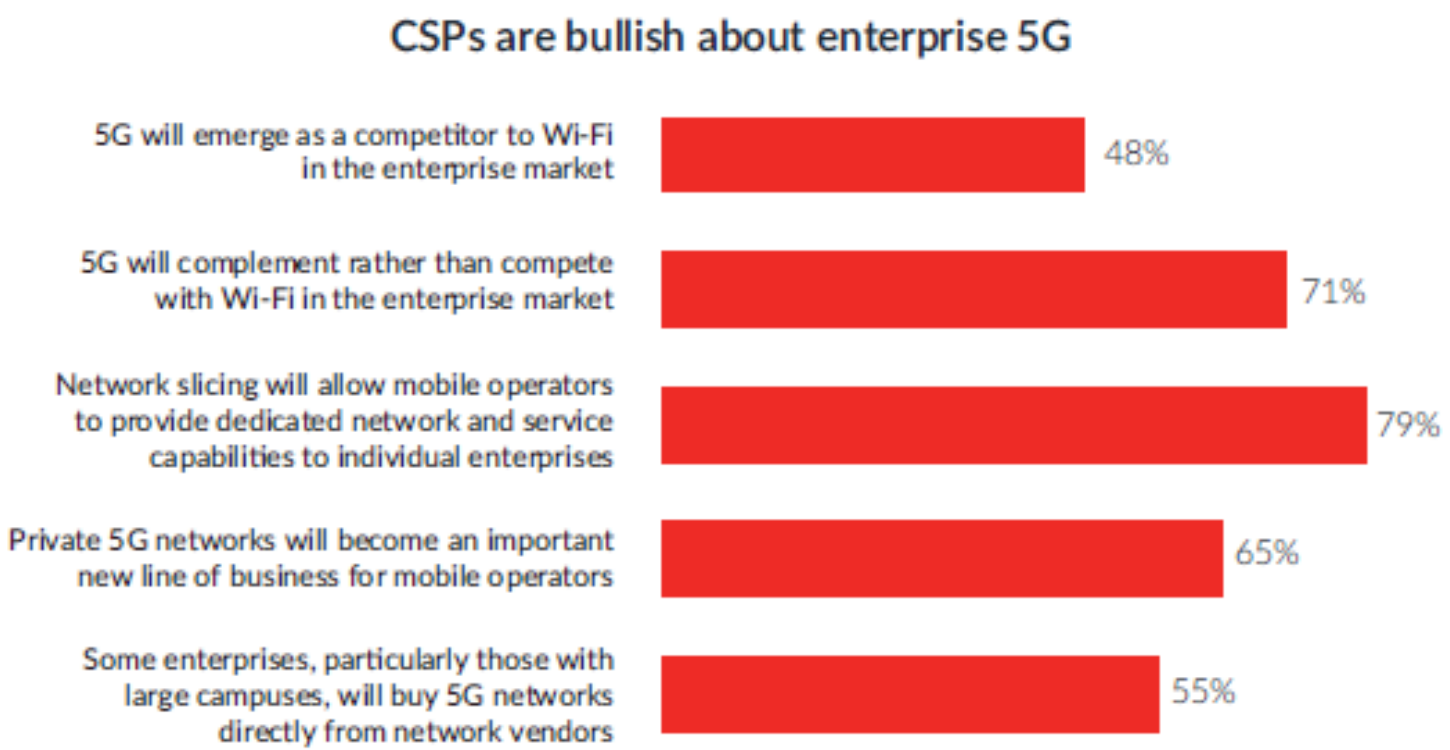
CSPs must collaborate with third-party providers to deliver automated, ultra-low latency services and customized performance backed by service level guarantees. If they can manage this, mobile operators may find the enterprise market to be a vast multiverse of opportunity with endless demand".

- TM Forum operator survey - 5G Future: Targeting The Enterprise (September 2019)

TM Forum Operator Survey Results on Enterprise 5G

"Why Enterprise 5G"? ?

… isn't Wi-Fi good enough?



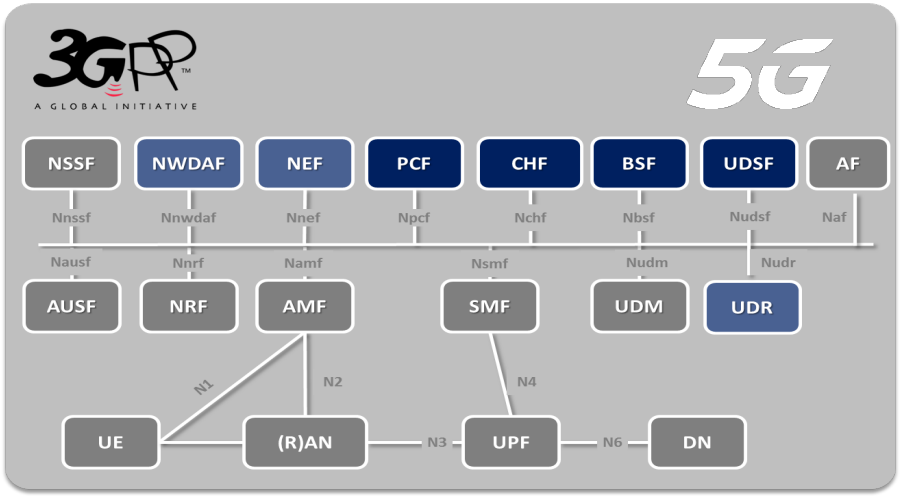
- Cost
- Carrier class
- Macro integration
- Concurrent users
- Quality of Service
- Zero interference
- Fast mobility
- Policy control
- Security robustness

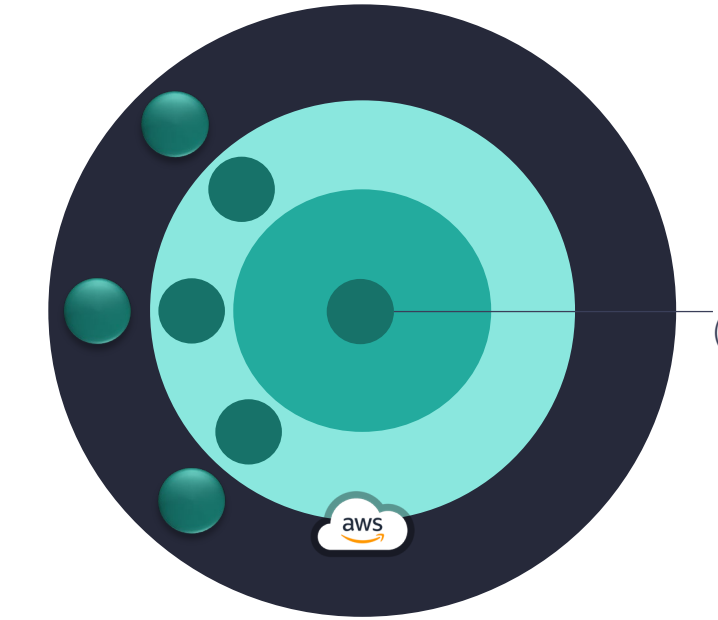
Delivering 5G across the domains

Openet provides key Monetization, Policy Control, Service Exposure and Data Management functions for new 5G Networks.

5G brings new challenges – and opportunities.

- To support explosion of 5G-enabled devices, Openet applications must be distributed
- To support low latency use cases, Openet applications must be deployed to the network edge
- To support dynamic needs of 5G applications, Openet applications must be cloud native and resilient.





4G/5G Core
(Mainly Centralized)

5G Core
(Distributed; Edge-based, Cloud & Hybrid)

5G Network Slicing

- Slices can be network-wide or geographically based
- Slicing enables creation of dedicated and specific capabilities, connectivity and policies for secure or demanding applications
- Operators need to use a Cloud Native architecture to:
  - Quickly assign distributed resources (compute, storage, processing) to specific business needs
  - Police and Monetize the availability of, modifications to and usage within purpose-built network slices
  - Geo-fence customer locations and provide secure, dedicated applications & connectivity
- Operators should move to enable a self-serve App Store to permit their enterprise customers to configure – and ultimately deploy – a network slice.

eMBB: Enhanced Mobile Broadband

- Consumer devices
- Fixed/Mobile
- Geography
- QoS

mM2MC: Massive M2M Communications

- Industry
- Dedicated (Secure, Geo-fenced)
- Geography
- Data Types

urLLC: Ultra Reliable Low Latency Communications

- Gaming
- AR (Mobile)
- VR (Fixed)
- Medicine

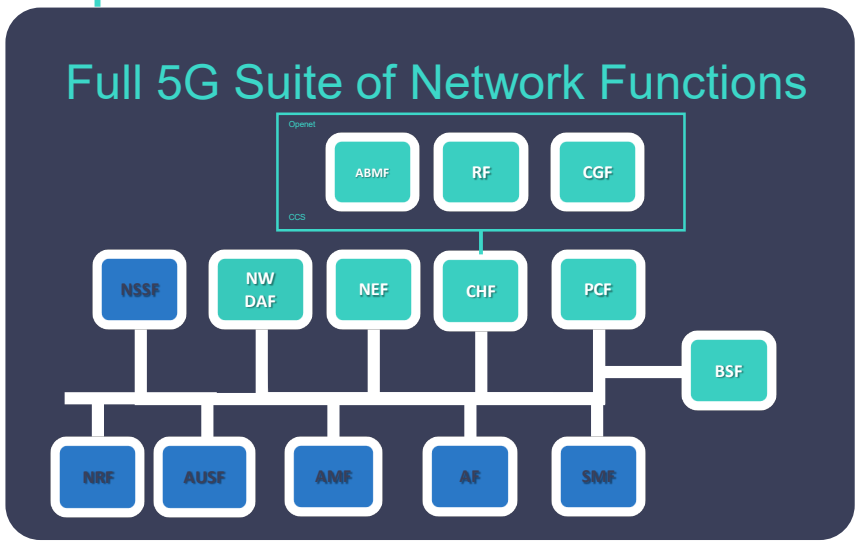
Distributing 5G NFs into slices

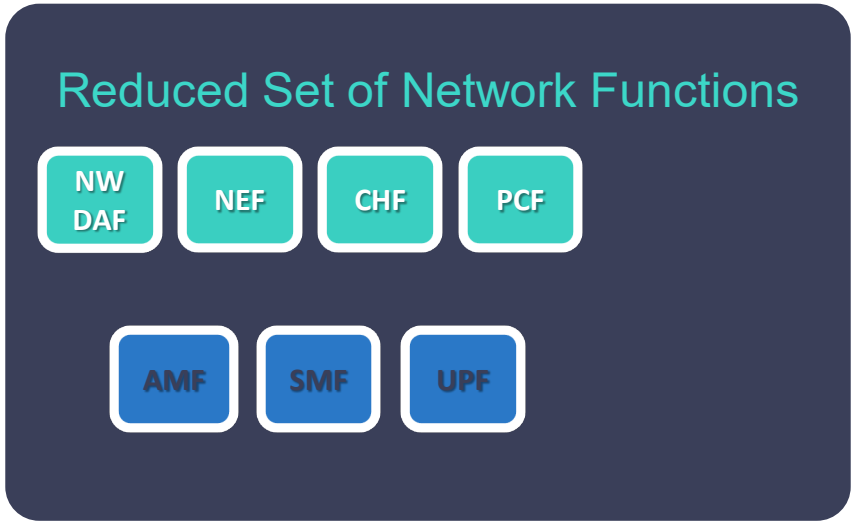
Slice		Edge			Core	
	Phone Slice				CU-UP, CU-CP UPF, SMF	CCS, PCF, BSF, CHF
	eMBB slice	CU-UP, UPF	Edge apps	CHF, NEF	CU-UP, CU-CP UPF, SMF	CCS, PCF, BSF
	Massive IoT Slice	CU-UP, UPF	CHF, PCF, NEF		CU-UP, CU-CP UPF, SMF	CCS, PCF, BSF
	Augmented reality slice	CU-UP, CU-CP, UPF, SMF, AMF		CHF, PCF, NEF		CCS, PCF, BSF

Note : non exhaustive representation of 5G NFs

Legend : Openet NFs

Operator Network Core





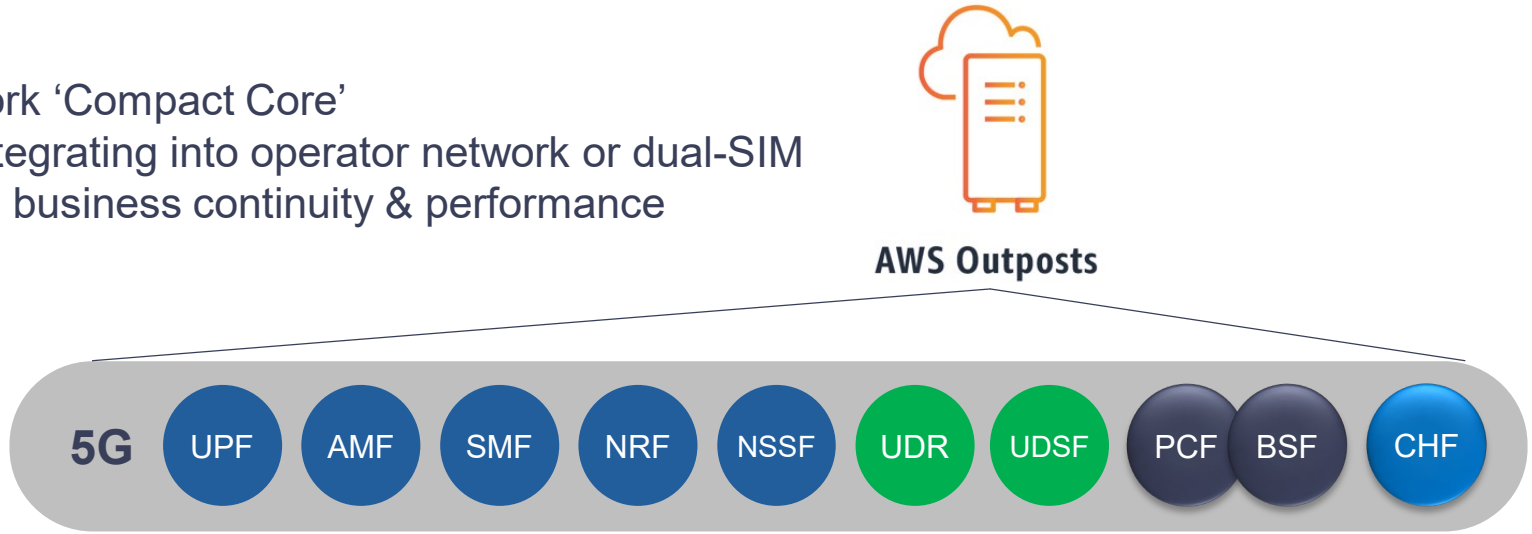
5G Edge Compute

Beyond the slice : 5G private network

Attributes of a Private Network:

- In-building DAS
- Small cells
- Operator or enterprise spectrum

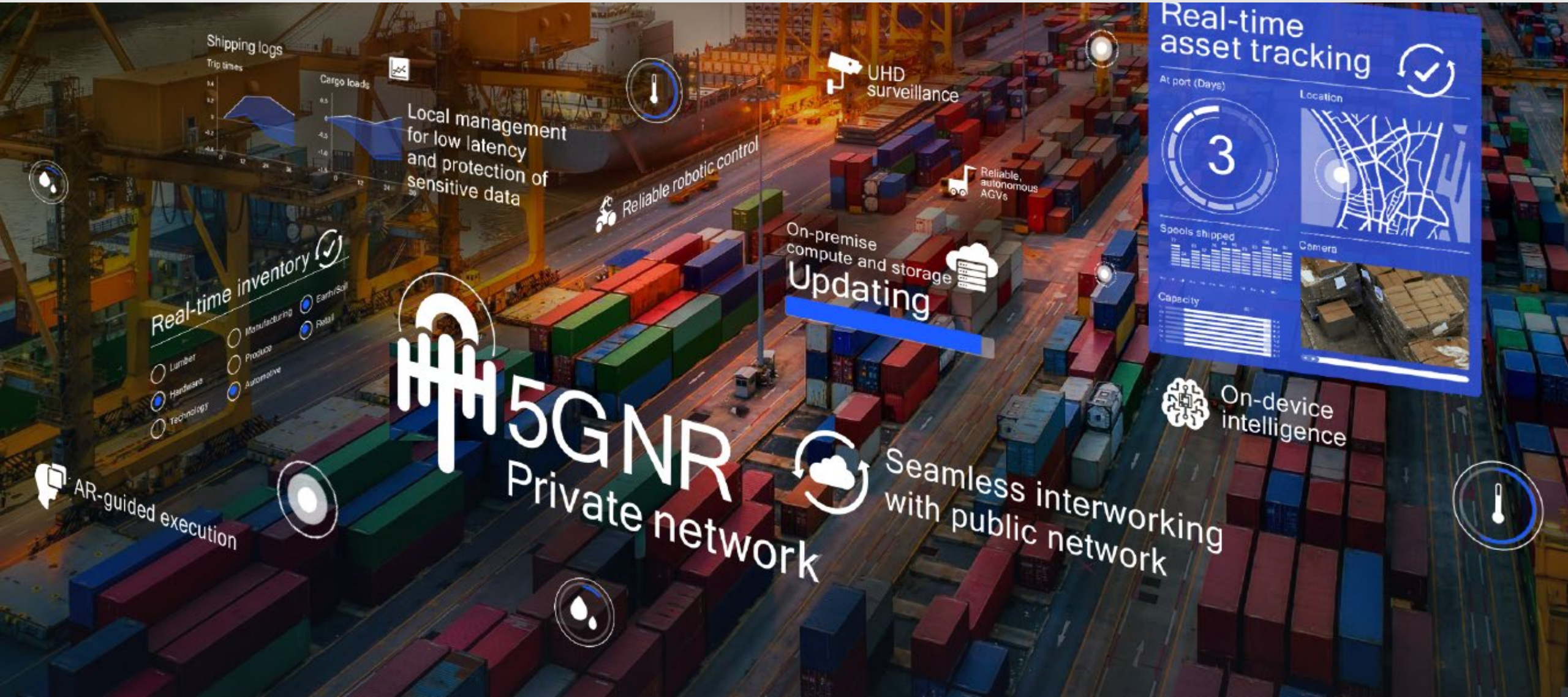
- Private Network ‘Compact Core’
- Options on integrating into operator network or dual-SIM
- Huge gains in business continuity & performance



Openet PCC microservices Library

- Common microservices
  - Data Management
  - Common Functionality
- Charging specific microservices
- Policy specific microservices

Example use cases for advanced, monetised 5G slices



Enterprise Example : Port Facility

QoS Differentiation & Control as it Applies to Various Needs; Active Management of:

- Personnel: Non-critical Comms and Rota-Handling
- Personnel: Critical Comms / Senior Personnel
- Non-Critical Machinery e.g. Environment Monitoring Telemetry
- Critical Machinery Monitoring
- Critical Machinery Remote Control e.g. Cranes Requiring Low Latency
- High Bandwidth e.g. Inventory Control, High Resolution Scanning and Security; VR Headsets
- Facility Access and Security
- Ship-to-Shore Comms
- Multiple Other Devices as they are Activated

Example: Port Facility – Different services, different slices, different prices

Use Case	Slice	Basis For Charging (Example)
Personnel: Non-critical Comms and Rota-Handling	1	Flat Rate Plan A Per Month
Personnel: Critical Comms / Senior Personnel	1	Flat Rate Plan B Per Month
Non-Critical Machinery e.g. Environment Monitoring Telemetry	1	Annual Rate C Per Device
Critical Machinery Monitoring	3	Minimum Per Month + $s per GB
Critical Machinery Remote Control e.g. Cranes; Low Latency	3	$s per GB Rate D
High Bandwidth e.g. Inventory Control, Scanning; VR Headsets	3	$s per GB Rate E
Facility Access and Security	2	Per Device per Month Rate Plan F
Ship-to-Shore Comms	4	Per Device per Month Rate Plan G

Port Charged For Slices and For Additional Device / User Type Plans Within Various Slices

Example: Critical Control of Hospital Environment

QoS Differentiation & Control as it Applies to Various Needs; Active Management of:

- Patients' Passive Needs e.g. Waiting Room TV / Entertainment
- Personnel: Non-critical Equipment for Comms and Rota-Handling
- Personnel: Critical Comms / Senior Personnel
- Non-Critical Machinery e.g. Environment Monitoring Telemetry
- Critical Machinery e.g. Patient Monitoring
- Critical Machinery (High Bandwidth) e.g. MRI/Echo, In-Surgery VR Headsets
- Facility Access and Security
- Multiple Other Devices as they are Activated

Example: Critical Control of Hospital Environment

QoS Differentiation, Control & Charging for Different Needs: Charging Examples

Use Case	Slice	Basis For Charging (Example)
Patients' Passive Needs e.g. Waiting Room TV / Entertainment	1	Flat Rate Plan A Per Month
Personnel: Non-critical Equipment for Comms and Rota	1	Flat Rate Plan B Per Month
Personnel: Critical Comms / Senior Personnel	1	Flat Rate Plan C Per Month
Non-Critical Machinery e.g. Environment Monitoring Telemetry	2	Annual Rate D Per Device
Critical Machinery Monitoring e.g. Patient Monitoring	3	Minimum Per Month + $s per GB
Critical Machinery High Bandwidth e.g. VR Surgery, Monitoring	3	$s per GB Rate E
Facility Access and Security	2	Per Device per Month Rate Plan F
Facility Comms	4	Per Device per Month Rate Plan G

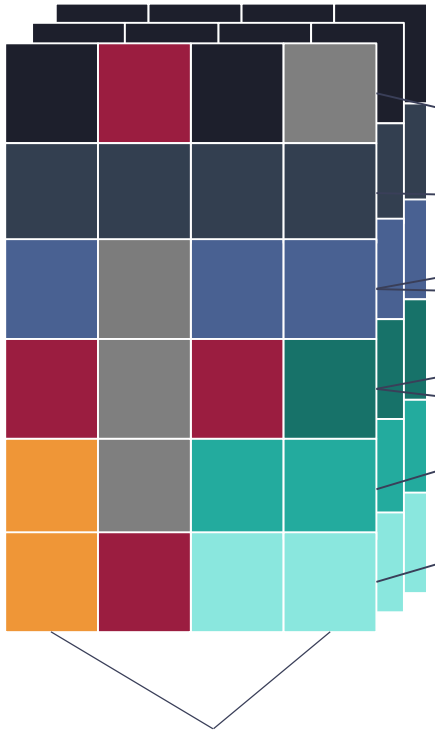
CCS deployed external to slice
PCF deployed external to slice

CCS is also deployed within the slice
PCF deployed within the slice

Hospital Charged For Slices and For Additional Device / User Type Plans Within Various Slices

5G Charging & Policy

Business Domains

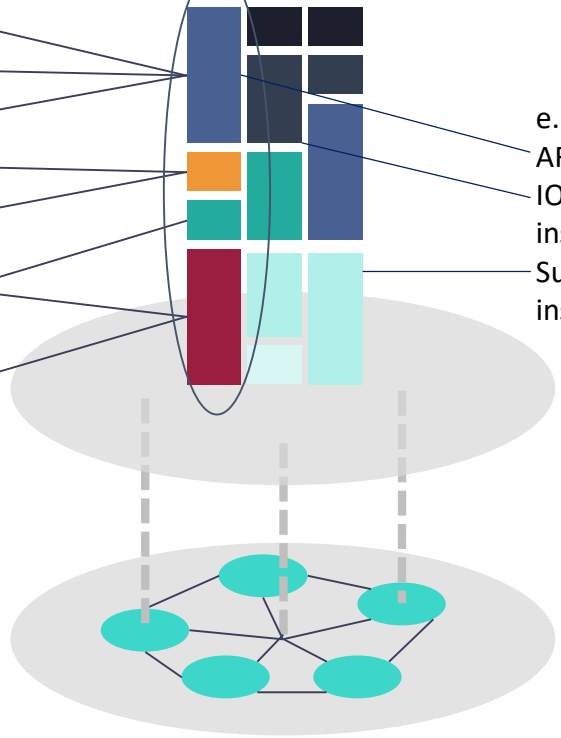


Microservices

Openet Charging & Policy (PCC) Microservices

Openet PCC Service Instances

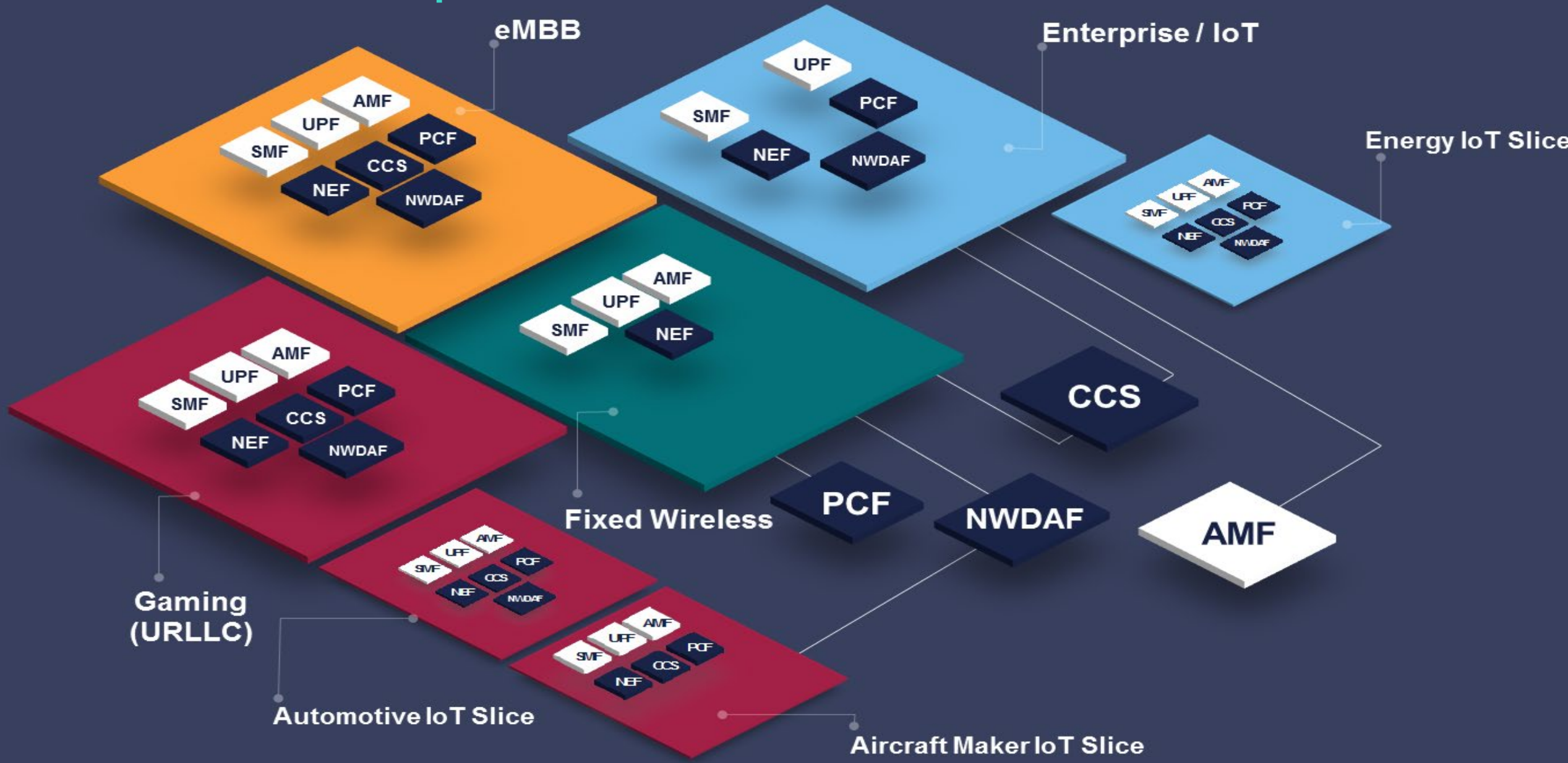
Provides the charging, rating & policy characteristics which are required by a Service Instance.
A Service Slice Instance may also be shared across multiple Service Instances provided by the network operator.



e.g.
AR/VR Charging Instance
IOT Heart Monitor Charging instance
Surveillance Cameras Charging instance

5G Network Slice

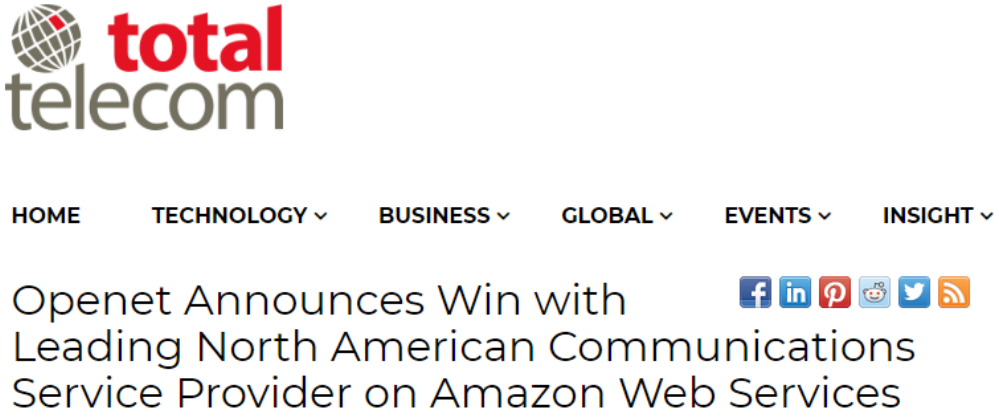
5G IoT Slice & Enterprise Slice Enablement



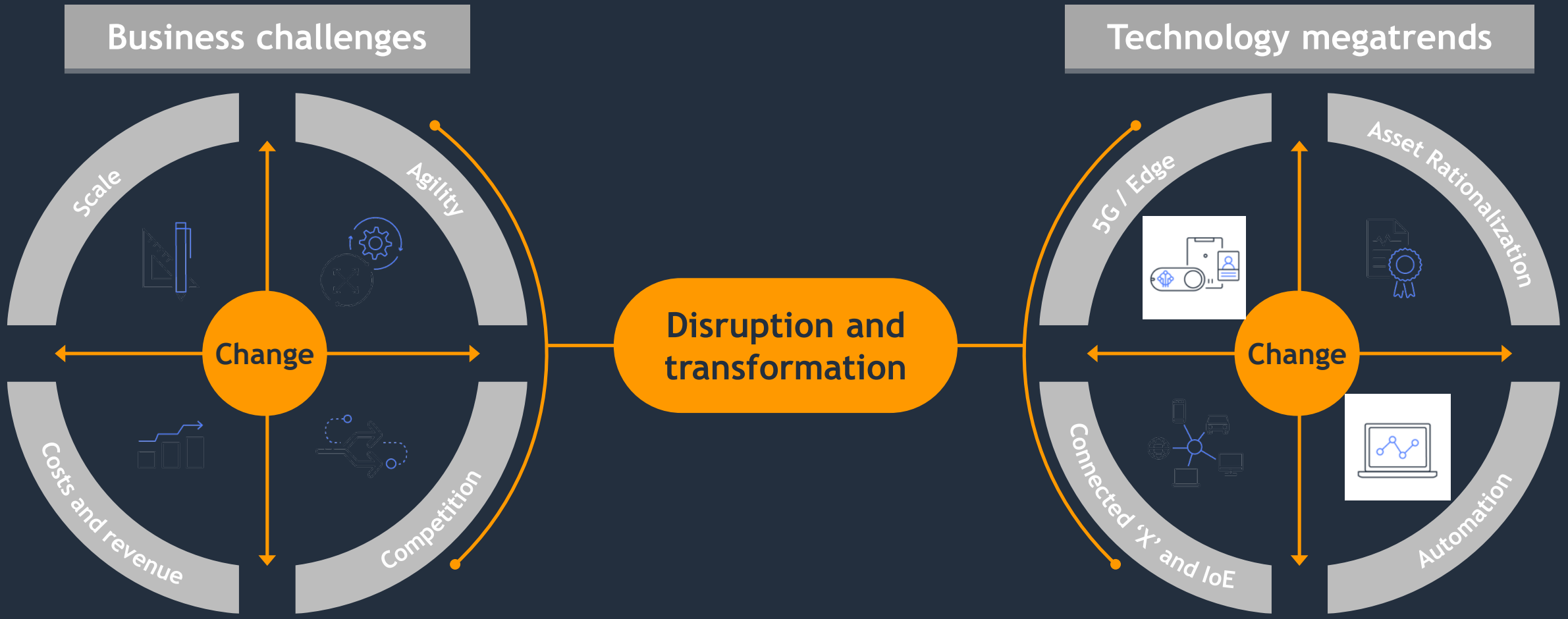
Openet and AWS

Openet Wins PCC Deal with Leading North American Operator on AWS

> **Tony Gillick, VP Product Management, Openet**
> We made the investment when needed, and we worked with AWS to get our portfolio fully cloud native and our platform live in an operator. While lots of companies talk about cloud ready systems, we have a cloud-native system running in a production environment for a customer.



Telecom industry dynamics



Top line (revenue) and bottom line (net income) pressures driving massive transformation initiatives across Telecom

Disruptive trends driving change in Telecommunications

CSP use of open-source software will enhance competitiveness and redefine vendor partnerships

> By 2022, 50% of tier-1 CSPs will contribute at least one open-source project directly or through partners."

Network virtualization initiatives will require CSPs to reinvent themselves first

> By 2020, 60% of network-based CSPs will face deficient outcomes from NFV/SDN implementation programs due to inadequate planning and collaboration."

Wireless edge computing will allow CSPs to participate in new cloud opportunities

> By 2020, over 50% of new wireless edge computing deployments in CSP networks will be driven by vertical-specific use cases."

AI will drive operational efficiencies and create new opportunities for CSPs

> By 2022, 25% of newly automated CSP processes will employ machine learning."

CSP workforce's adoption of new technologies and digital processes will determine future prospects

> By 2023, over 35% of roles in CSP organizations will either be new or redesigned."

Source: Gartner, 2018

aws

Why OSS/BSS on AWS?

Flexibility, Faster Time to Market

- **Rapid Provisioning:**
  Create new systems or environments for continuous experimentation, expansion and improvements
- **Increased Automation:**
  Pace of innovation, efficiency & decreased human errors with Infra as code and DevOps.
- **Innovations:**
  Leverage breadth and depth of AWS instead of building from scratch
- **Latest Technology:**
  Newest technology as it becomes available

Intelligent Operation

- **Scalable & Secure:**
  Innovate and expand while maintaining a secure environment.
- **Simplicity & Reliability:**
  Active & Passive, Active & Active to Cloud Native setups
- **Expertise:**
  Collaboration between partners & AWS with mutual investments to ensure success
- **Interoperability:**
  Deploy and integrate easily with solutions from AWS Marketplace

Cloud Economics

- **Grow (or shrink) as you go**:
  Scale-Up or Out your configuration in <1 hour
- **Consume:**
  Scale to meet demand and pay for only what you use
- **Low Cost of Entry:**
  Many pricing options such as on demand, reserved instances, spot and private pricing

aws

5G CHALLENGES FOR CSP's

- Increase in Radio and **Transport needs** requiring Edge Cloud
- **Virtualization** extension to Radio network (RAN) in addition to Core Network
- Complexity of **orchestration** multiplied due to diverse ecosystem and need for new applications
- Need for **5G Monetization** models beyond mobile consumers

AWS APPROACH TO 5G & EDGE CLOUD

- Creating a ubiquitous cloud programming model by extending AWS to edge
- Enabling service slicing i.e. orchestration of network slices & services
- Enable AWS community to leverage and accelerate Telco monetization of 5G

    Build an Edge Cloud infrastructure that can drive innovative use cases leveraging the vast existing ISV/Developer/Customer community

- Solving for data load balancing between edge and public cloud

Single Edge Cloud for Telco Network, IT & 5G Edge Monetization

aws

INTRODUCING AWS OUTPOSTS

Fully integrated and fully managed AWS infrastructure on-premises

Building on the security, performance & power of the Nitro system

Offering the same APIs and functionality as in public AWS regions

Automatically monitored, updated and patched as part of AWS regions

AWS Outposts rack

- Industry standard 42U rack
- Fully assembled, ready to be rolled into final position
- Installed by AWS, simply plugged into power and network
- Centralized redundant power conversion unit and DC distribution system for higher reliability, energy efficiency, easier serviceability
- Redundant active components including top of rack switches and hot spare hosts

Supported regions

Local AWS Services for Low Latency Applications

Amazon EC2 services, including VPC, subnets, route tables, network gateways, and EBS volumes

AWS services including EC2, RDS, ECS, EBS, EKS, and EMR (S3 coming later this year)

DRIVERS FOR DISTRIBUTED CHARGING

- 5G enhanced experience with low latency
- Device scaling (IoT and others)
- Regulatory/data residency
- Dynamic orchestration (traffic handling)
- Multi-site operator edge integration with CSP (Gaming and VR applications)
- Multi-site dedicated edge integration with CSP (Industrial IoT)

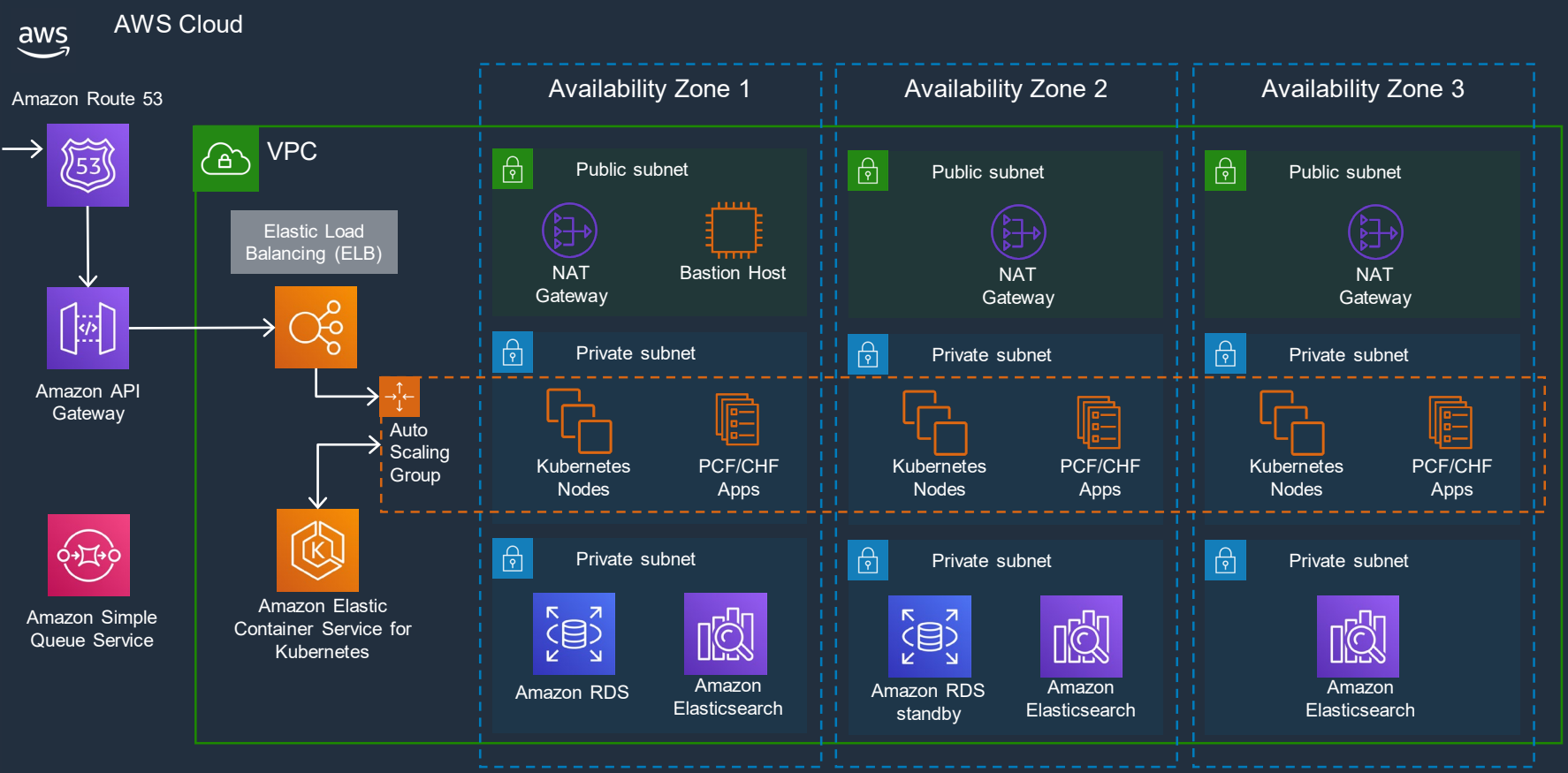
5G will drive distribution of charging control (CHF, CCS), usage and rating functions

aws

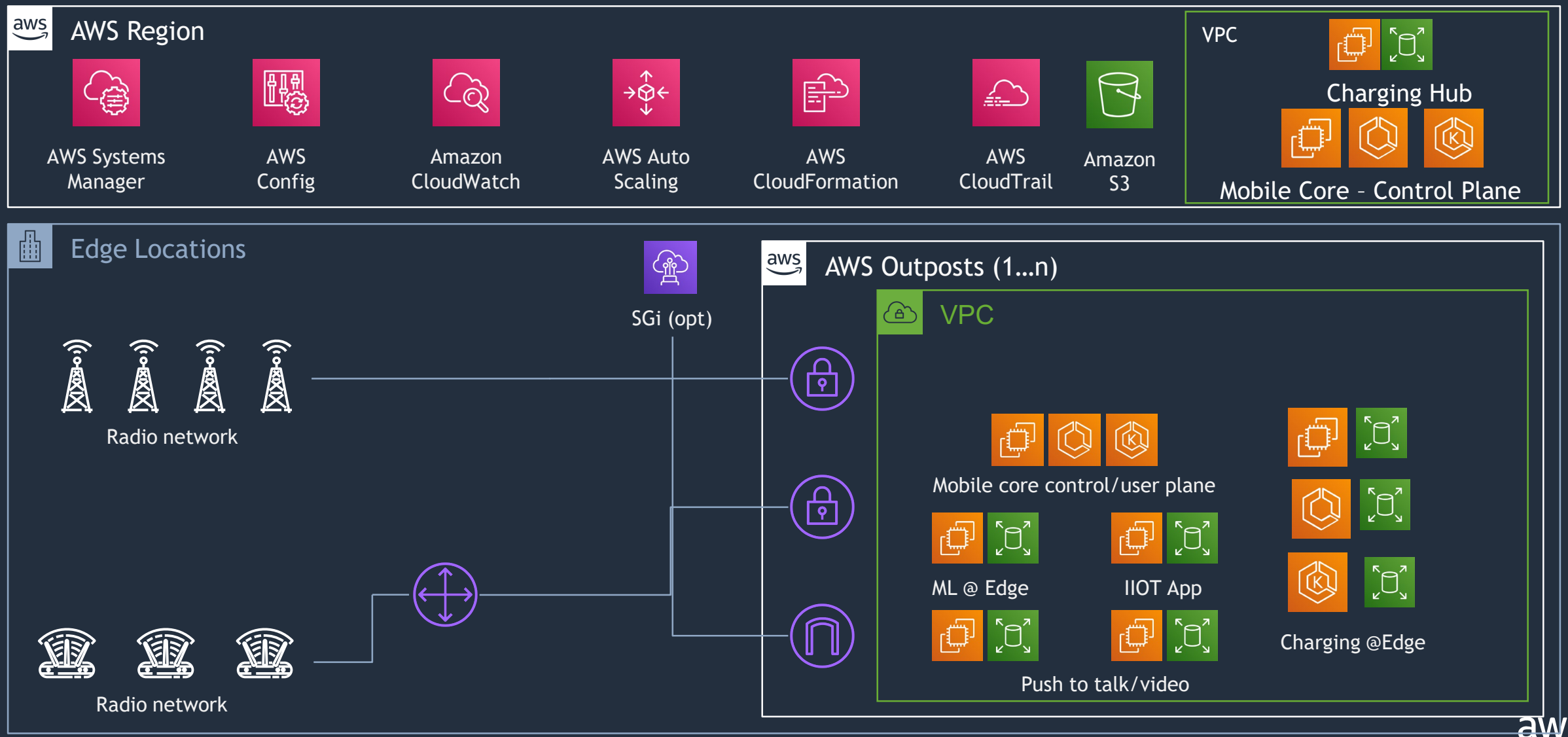
Policy and Charging Framework for 5G

AWS Services

- EKS
- ELB
- EC2
- VPC
- RDS
- CloudWatch
- CloudTrail
- Systems Manager
- ElasticSearch
- SQS
- SES



Distributed Mobile Edge Architecture w/PCC@Edge



Contact us at info@openet.com

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THANK YOU

BUILT FOR CHANGE