통신사업자용 엣지 클라우드

배철민 팀장

Enterprise services drive the edge strategy

Edge infrastructure is evolved to support enterprise and consumer services

Enterprise services have the biggest impact on the edge investments and architecture

By 2030 up to USD 700 billion of the 5G-enabled, enterprise value could be addressed by CSPs.

Edge is an enabler for enterprise offerings.

Edge locations depend on app requirements – use case examples

Use cases (non-exhaustive)	General overview	Locations: On-prem	Locations: Access	Locations: Regional DC	Locations: National DC
CDN-related cases	Latency: 100ms - 1s+ // Bandwidth: high Moving into CSP and venues	Very relevant location	Not likely	Very relevant location	Very relevant location
Video processing[1]	Latency: 100 - 200ms // Bandwidth: high Safety and regulations	Very relevant location	Less relevant location	Very relevant location	Relevant location
Enterprise and industrial applications	Latency: 1ms - 1s // Bandwidth: variable Reliability, regulations, data privacy	Very relevant location	Relevant location	Less relevant location	Not likely
Gaming services	Latency: 30 - 250ms // Bandwidth: high Global deployments	Not likely	Not likely	Very relevant location	Very relevant location
Data collection and processing (incl. AI/ML)	Latency: 100ms -1s // Bandwidth: high Data processing distributed	Very relevant location	Less relevant location	Very relevant location	Relevant location
Autonomous vehicles	Latency: 10ms - 100ms // Bandwidth: mid/high From private cars to AGVs	Very relevant location	Less relevant location	Very relevant location	Not likely
XR (AR/VR/MR)	Latency: 10ms - 50ms // Bandwidth: high Availability and complex processing	Very relevant location	Not likely	Less relevant location	Very relevant location

1. E.g. CCTV - surveillance camera images to be processed in the edge.

"**Edge computing** provides computing and storage closer to end users."

"**Distributed cloud** is an execution environment for apps over multiple sites, including connectivity managed as one solution

Application placement location

- Very relevant location
- Relevant location
- Less relevant location
- Not likely

Many edge computing players in the deployment setup

Enterprise application requirements

Key players in edge

App developers

Enterprises

CSPs

Hyperscale cloud providers

IT/SI vendors

Considerations

- Technical
- Cost
- Scale
- Local / Global
- Trust
- Time to market

Device vendors

Tower and co-location companies

Network vendors

Operations technology vendors

CDN players

Value stack

- Services
- Systems integration
- Application development
- Edge deployment platform
- Edge infrastructure: SW, HW
- Connectivity[1]: Mobile, Fixed
- Site

- Edge deployment and business setup
- Partner assessments
- Deployment options
- Investment and business case assessments
- Business models

1. Connectivity includes both last-mile and mid-mile transport/interconnect

What roles to play in edge computing?

Edge deployment set-ups for CSPs

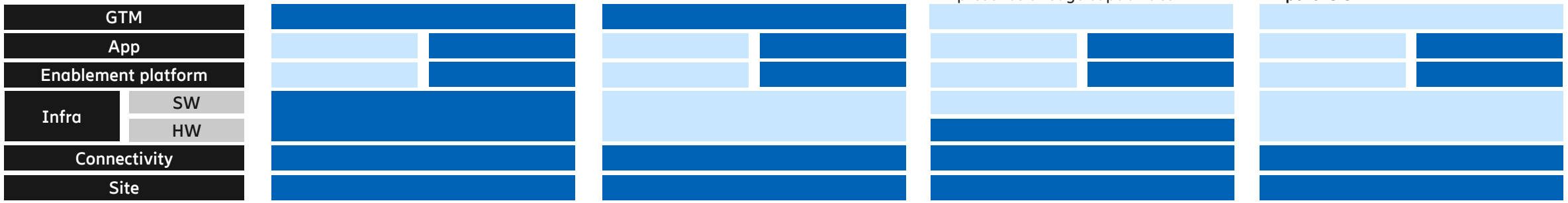
Choice of enterprise ambition

Enterprise edge strategy	Role in value chain	Description
CSPs front and offer edge services directly to enterprises	Full edge	• CSPs invest in enterprise Go-To-Market • **Provide full edge solution, orchestration, exposure, edge infrastructure** • Commit to service SLAs
	Partner edge	• CSPs front enterprise with strong Go-To-Market • **Provide connectivity, resell edge solutions** from HCPs* /OTs*/SI* • Commit to service SLAs
CSPs don't front enterprises directly and offer edge services	Aggregator edge	• **Aggregators front enterprises and offer edge solutions and share revenue** with CSPs through aaS model • CSP aggregators commit to SLAs • **CSPs provide edge HW**
	Limited edge	• **HCPs/OTs/SI front enterprises and offer edge solution** • **CSPs offer connectivity** and/or co-location • HCP, OT*, and SI vendors commit to service SLAs

*HCP=Hyperscale Cloud Providers, OT=Operations Technology Vendors, SI=System Integrator

Key opportunities, challenges and success factors per deployment model

	Full edge	Partner edge	Aggregator edge	Limited edge
Opportunities	• Strongest position/most value • **Full control** and brand/trust to enterprise long term • Easier to replicate solutions	• Strong position/more value • **"Ride" on partner capabilities** • Less initial investments/risks	• **"Ride" on aggr. capabilities** for enterprise GTM and edge solutions • Limited initial investments/risks	• **"Ride" on partner capabilities** • **Least effort/risk** • Limited initial investments
Challenges	• Enterprise trust and GTM • Skills for GTM and integration • Higher initial investments/risks	• Enterprise trust and GTM • Control and brand/trust • Skills for GTM and integration	• No enterprise GTM • Dependency to aggregators • Lower revenue opportunity	• Limited value and risk of becoming the bit pipe • Dependency/brand value
Success factors	• **Enterprise GTM and skills for integration** • Capabilities **to engage with app dev eco-system** and compete	• **Enterprise GTM and skills for integration** • Capabilities **to engage with partners**	• **Aggr. capabilities** for enterprise GTM and edge solutions • Focus on use cases requiring global presence of edge capabilities	• **Partner.capabilities** for enterprise GTM and edge solutions • Capabilities **to engage with partners**



CSP to provide | Others to provide

Service exposure is key for CSP differentiation and value creation

Activate network capabilities

- Standard nw capabilities activated and exposed
- Exposed internally and externally
- APIs defined by standards from e.g. 3GPP, TMF

Create service APIs

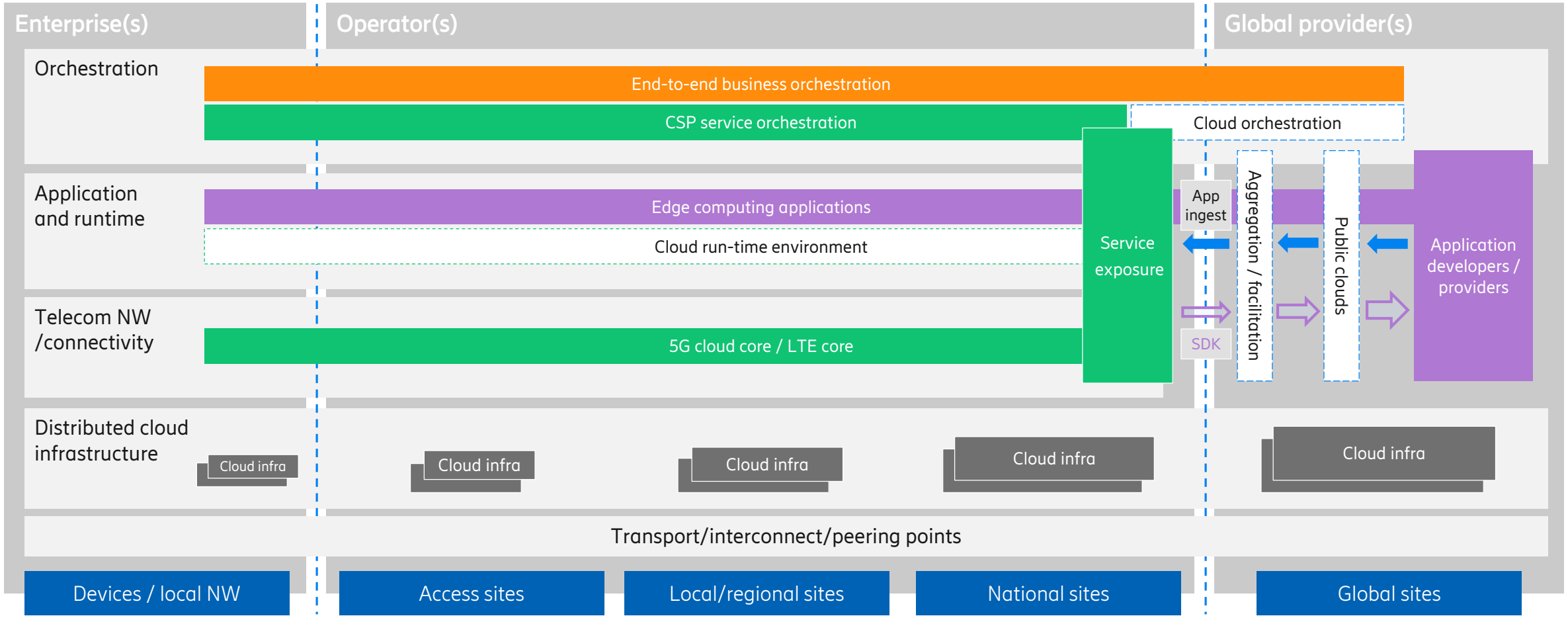
- Use cases supported by composition of technical APIs
- Enabling creation of service APIs tailored for specific use cases
- Service APIs adopted de-facto when proved valuable

Expose service APIs

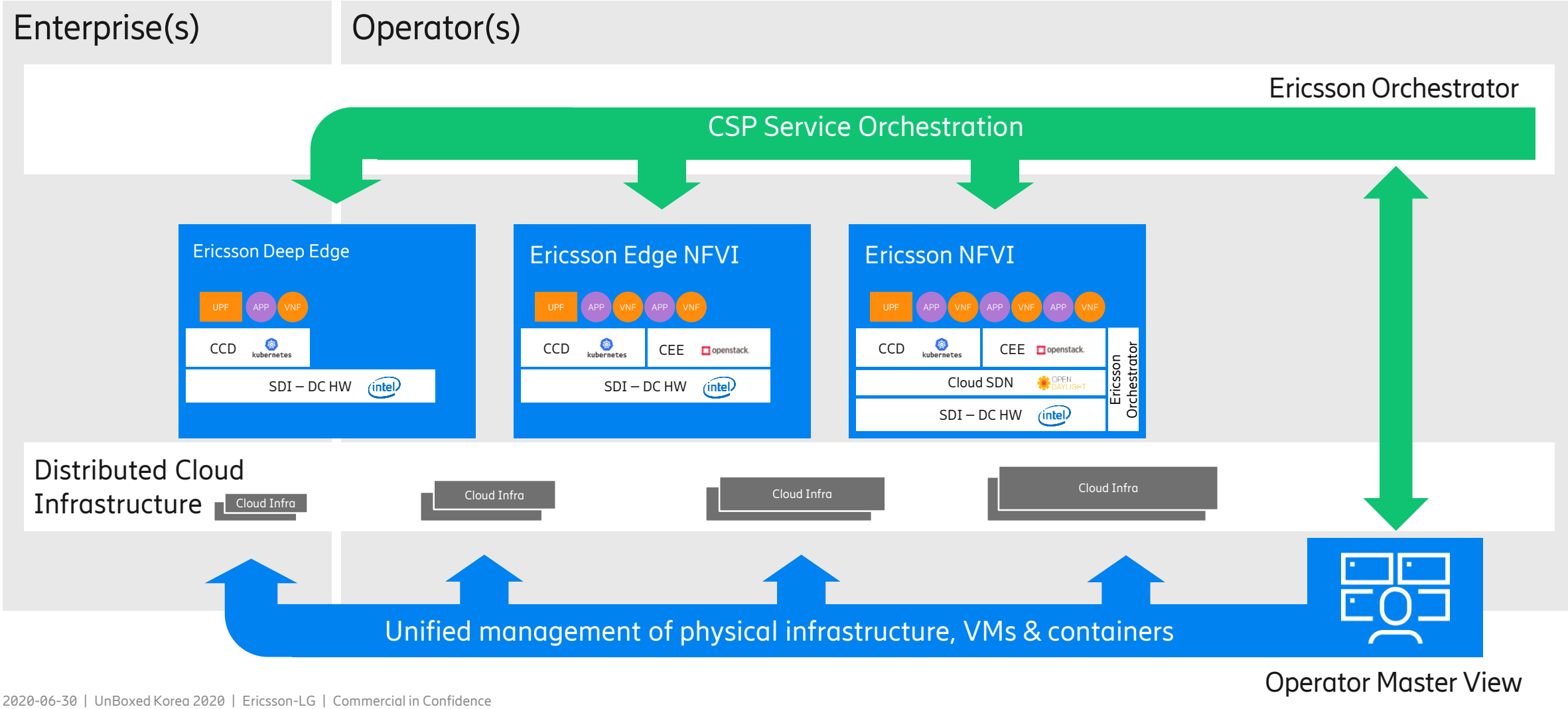
- Integration with HCP and OT vendor developer environments
- APIs secure pricing, LCM and security mechanisms
- Integration done based on SDK and APIs

Based on standards where available and efficient
Strive for de-facto adoption and open source based to ensure momentum

Edge computing architecture

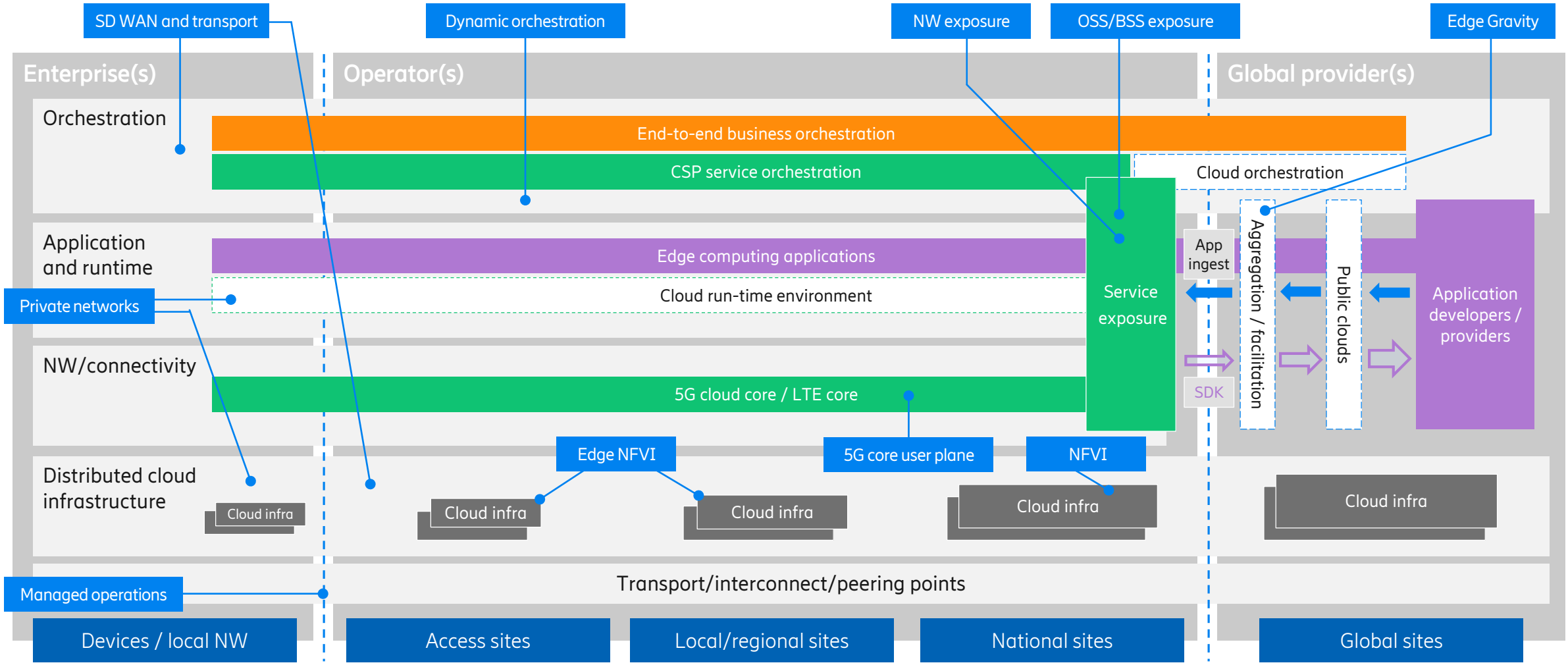


5G distributed cloud infrastructure architecture

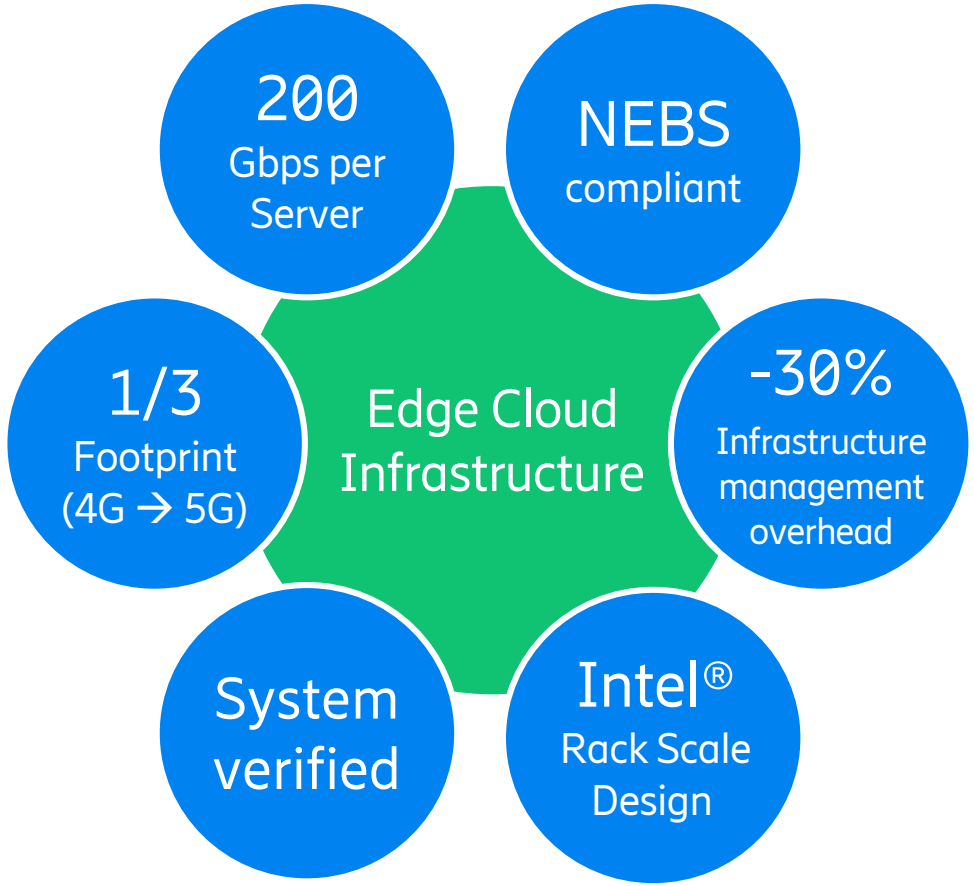


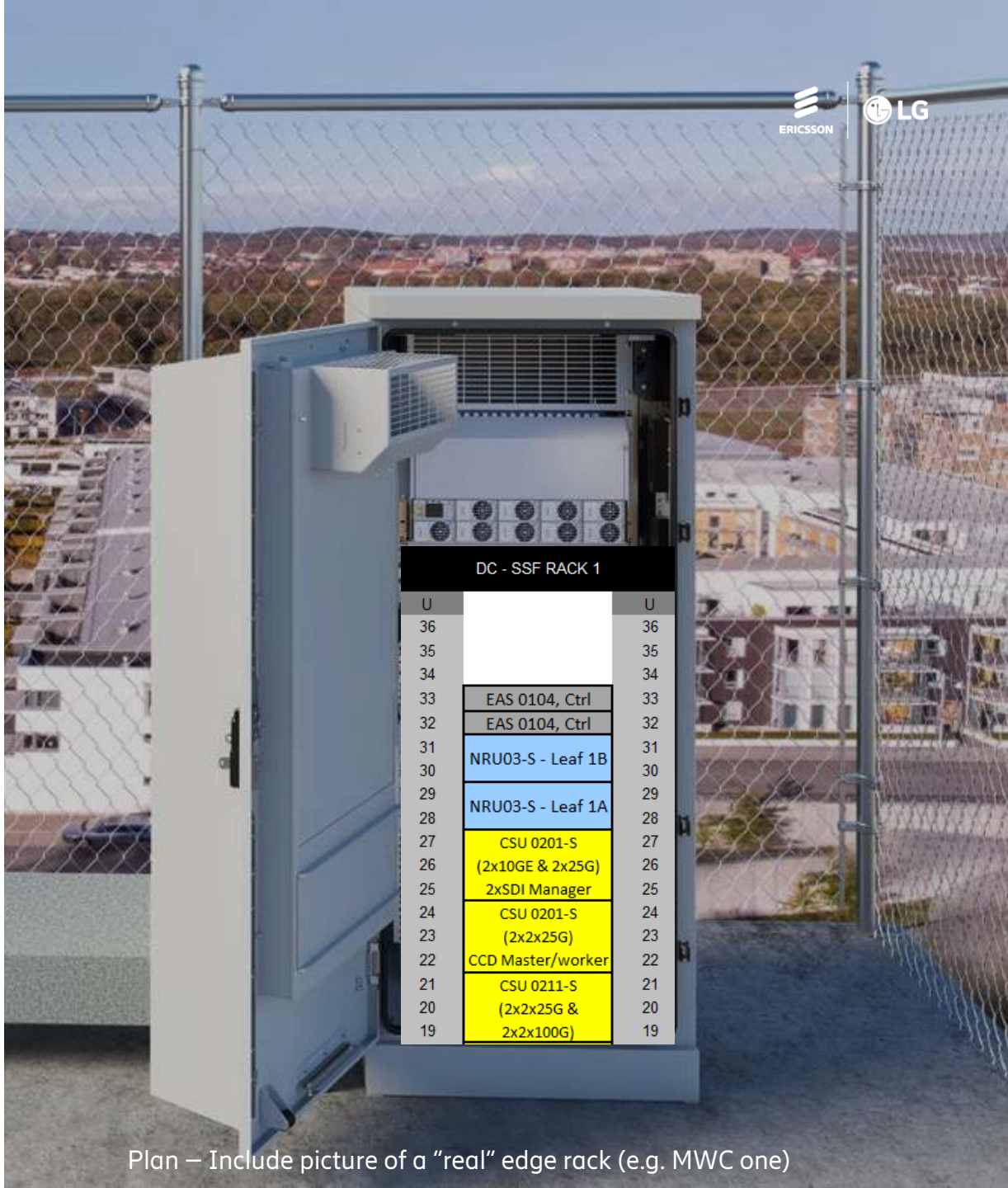
Operator Master View

Ericsson solutions



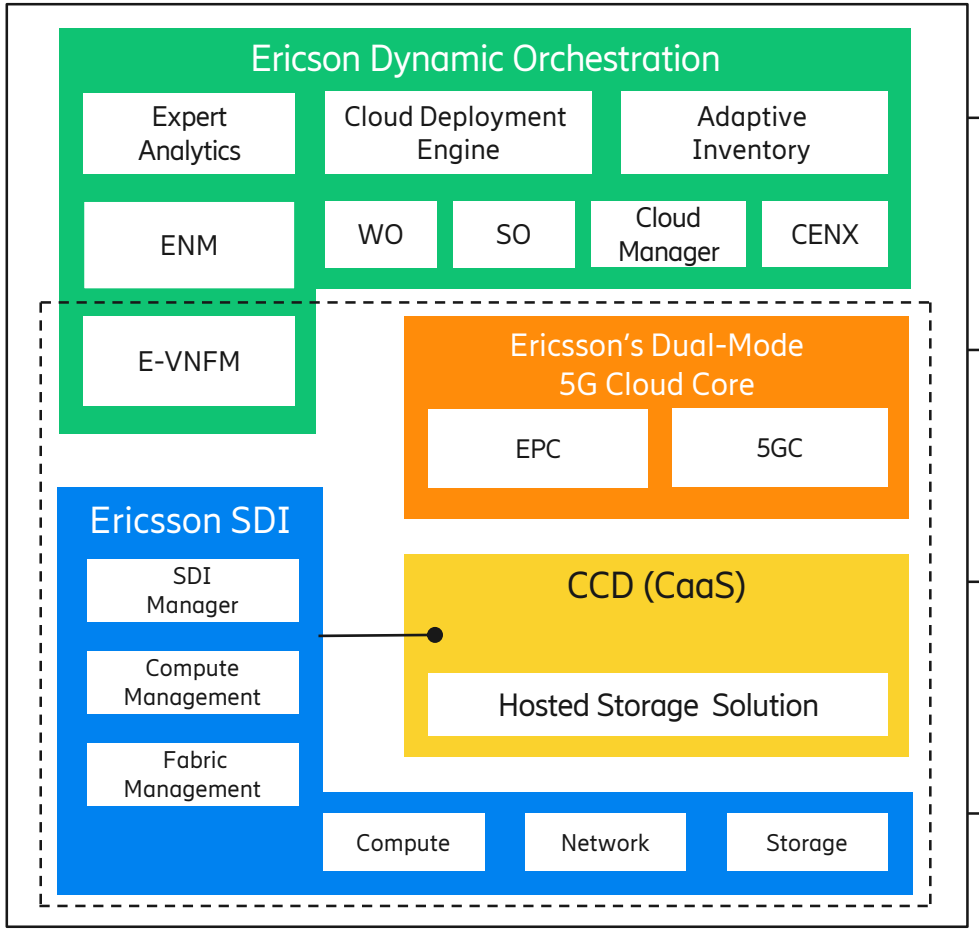
5G edge cloud infrastructure





Plan – Include picture of a "real" edge rack (e.g. MWC one)

Cloud Native 5GC over Bare-Metal Cloud Infrastructure



Network Slicing & Orchestration

- Intelligent Orchestration operations including Network Slicing for Cloud Native Networks through EDO Solution
- Closed Loop Operations enabled with CENX along with centralized Fault & Performance Management as part of the Dynamic Orchestration Solution.

Ericsson's Dual-mode 5G Cloud Core

- Efficient deployment with single platform for (5G) EPC and 5G Core
- Common cloud native/microservice software architecture across products
- New 5G services through network exposure, distribution, low latency, high performance and managing peak rates

CNCF Certified CaaS

- CNCF certified CaaS Optimized for Telco CNF's
- Hyperconverged hosted storage solution providing highly resilient and redundant storage
- High performance throughput using Data path Network Acceleration

Ericsson SDI

- System verified, pre-integrated software defined cloud infrastructure offering standards-based telco-grade platform ready for 5G
- Scalable through Central, Edge & deep edge sites for different use cases
- Support for Ericsson & 3PP computes and fabric

Applications benefiting from hardware acceleration on the edge, examples

3D rendering for Virtual Reality (VR) or Augmented Reality (AR) using a GPU

→ Cannot work without hardware acceleration

Databases using Persistent Memory (PMEM) instead of Solid State Disks (SSD)

→ Faster read/writes than SSD, lower price point than RAM

Analytics with artificial intelligence / Machine learning using a GPU

→ Increased power efficiency with hardware acceleration

Routing, Deep Packet Inspection (DPI) or other types of traffic processing using a SmartNIC.

→ Faster processing, lower latency with hardware acceleration

For small or large datacenters, at the network edge or in the core

For network functions (VNFs) or non-telco applications, from Ericsson or third parties

Ericsson is active in main industry forums for edge computing and distributed cloud

Ericsson is active in main industry forums for edge computing and distributed cloud

- 3GPP
- LF Edge

Ericsson is engaged to drive cross-industry aligned ecosystem

- CSPs
- HCPs
- Industry verticals
- Application developer ecosystems

Standardization bodies	Open source foras	Industry alliances
PARTICIPANT Network Functions Virtualisation ISG (NFV) ETSI World Class Standards	CLOUD NATIVE COMPUTING FOUNDATION	5GAA Automotive Association
	LF EDGE	AECC
tmforum	ONAP OPEN NETWORK AUTOMATION PLATFORM	5GACIA 5G Alliance for Connected Industries and Automation
3GPP	openstack. Edge Computing Group	industrial internet CONSORTIUM

Summary

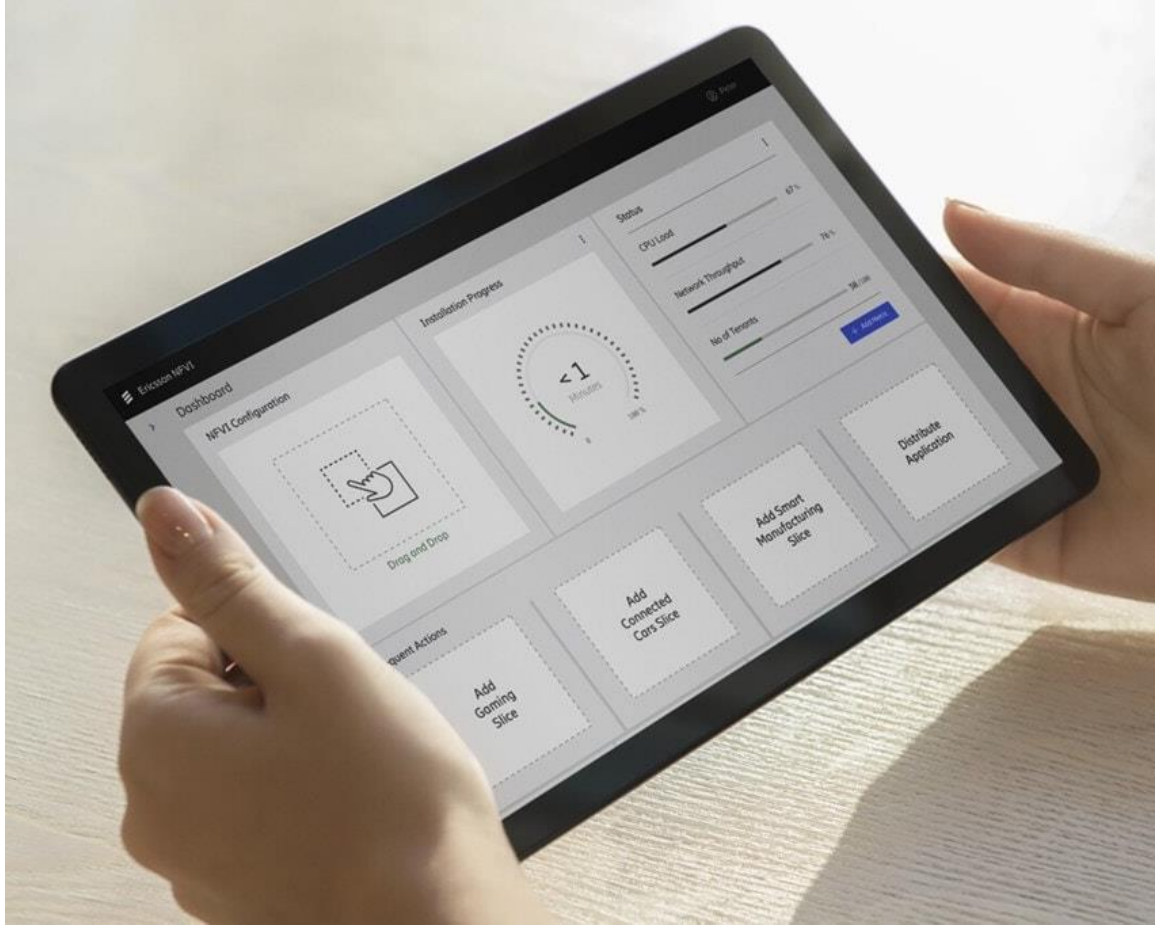
Edge enables enterprise offerings to monetize 5G beyond MBB

CSPs can use four deployment tracks to address opportunities

Exposure and orchestration are fundamental with services partners

Access to app development ecosystems is a must

Ericsson has deep understanding of edge and solutions across the stack



ERICSSON | LG