

The Nokia logo is positioned in the top left corner of the slide. The background of the entire slide is a low-angle, upward-looking shot of a modern glass skyscraper against a bright blue sky with scattered white clouds. The building's facade is composed of a grid of glass panels and metal frames, creating a strong sense of verticality and architectural scale.

**NOKIA**

# Nokia Edge Cloud

## Enablers and opportunities of 5G edge cloud

**Sami Hoisko**  
Nokia CTO, Head of Technology APJ

# Nokia 5G Vision – Where are we heading?

*"Macro network to the limits"*

**100 Gbps BTS**  
30-60x capacity

Maximize performance

*"All-in-one mmWave cells"*

**1 Tbps/km<sup>2</sup>**  
200 cells/km<sup>2</sup>

Optimized deployment

*"Critical services on public network"*

**1 ms & 99.999% slicing**

Guaranteed e2e solution

*"Next big thing in enterprise radio"*

**10 Gbps wireless Ethernet**

Simple and low cost

*"100 Bn connected devices"*

**1M/km<sup>2</sup> and 1M setups/BTS/hour**

Maximize connectivity



**100 Mbps**

**1 Gbps**

**1 ms + 99.999%**

**10 Gbps**

**<1 EUR**

# The importance of the Edge

1 Latency, slicing, applications, content and processing at the edge

2 Platform for webscale collaboration

Bloomberg Opinion • Analysis

## Amazon Lives on the Edge, and Telecoms Should Tremble

By Alex Webb | Bloomberg  
June 21

5G networks will allow va  
means more money for m  
hitch. Cloud giants such a

## Telstra Already in Edge Battle With Web Giants

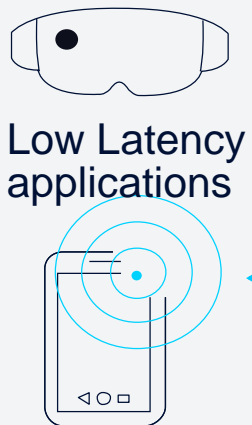


NEWS ANALYSIS  
IAIN MORRIS,  
International Editor

LONDON – 5G World – Australia's Telstra has been approached by web giants and offered "exclusive deals" to partner on edge services if it restricts its role to that of connectivity provider.

The operator appears to have spurned those offers as it eyes a much bigger role in the market for edge computing, one of the main opportunities associated with the rollout of next-generation 5G mobile networks.

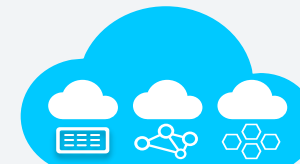
The revelation came at this week's 5G World event in London and highlights the



Low Latency applications



Far Edge



Aggregated Edge



OTT applications

CSP strategies

OTT ambition

# How does the Nokia Edge Solution Support the Vision?

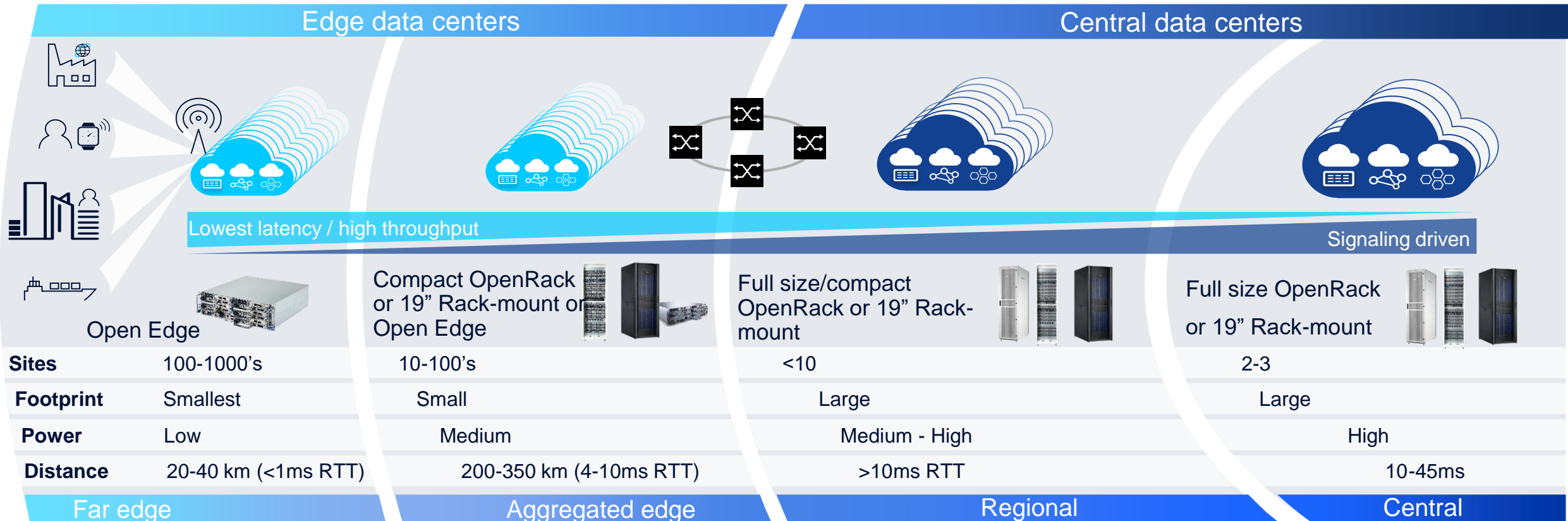
## Datacenter portfolio for all deployments from Far Edge to HyperScale

Edge cloud enables new business opportunities

Layered architecture enables lowest latency and data locality

Transport cost optimization can be achieved with layered architecture

Centralized data centers offer best cost efficiency



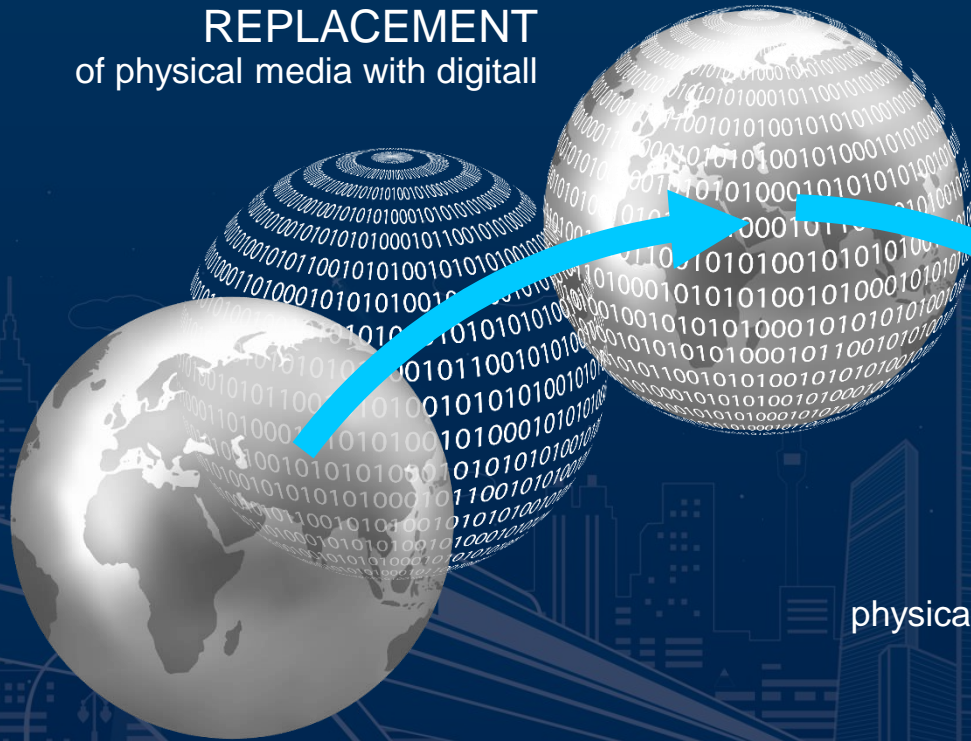
# Why far edge and 5G latency reduction?

## Control becomes digital and wireless



# THE JOURNEY TO INDUSTRY 4.0

TO DATE  
REPLACEMENT  
of physical media with digital



INDUSTRY 4.0  
CONTROLLING  
physical using wireless and digital

5G

URLLC

Wireless Ethernet

Cloud

Scalability

Automation

# Key drivers for Converged Edge Cloud with Open RAN

## RAN Cloudification

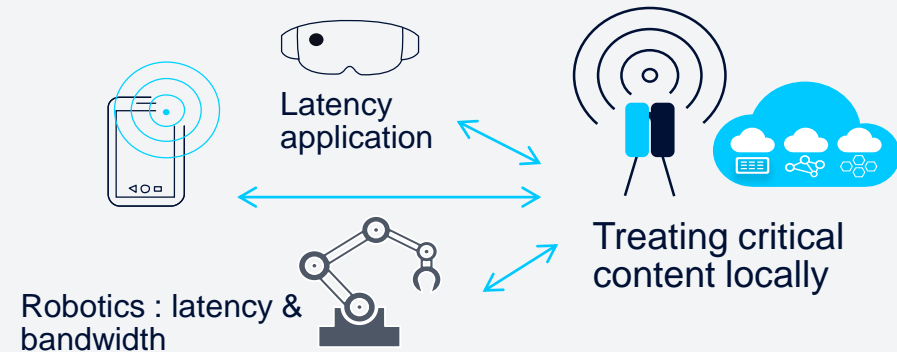


## Cloud RAN software provides



- Cloud Flexibility intelligence
- Cloud automation
- Dynamic scalability
- Improved radio performance
- Seamless evolution to 5G

## MEC and APPs @ Edge



## Open Ecosystem at Edge



- ORAN/RIC based xApp
- MEC API, OpenAPI for Multi-vendor ecosystem
- AI/ML based Service awareness @ Edge
- Enables new services and business model

# OpenEdge builds compute at the network edge



Compact Design



Outdoor & indoor



OpenEdge Sled



PCIe Accelerator

L1Hi/ L2/ Scheduler

## Compute & Power efficiency:

High performance cloud computing platform supporting Telco VNFs

2nd Generation Intel® Xeon® Scalable processor family CPU up to 28 cores, 400W per 1U sled and 700W per 2U sled.

## Deployment Flexibility

Deployable at radio site (D-RAN) and at Far Edge (C-RAN)

Cooling optimization, Re-use of AirScale indoor/outdoor cabinets

## Fronthaul GW to enable eCPRI with legacy radios

eCPRI/ORAN to CPRI/OBSAI conversion with SoC & FPGA accelerators to connect legacy RRH

## Virtualized real-time with targeted Acceleration:

PCIe add-on card with FPGA hardware accelerator for generic acceleration for 4G/5G L1 and real-time VNFs (L1Hi/ L2/ Scheduler)

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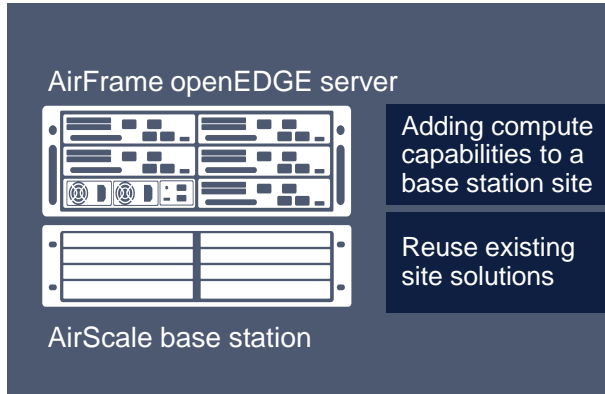
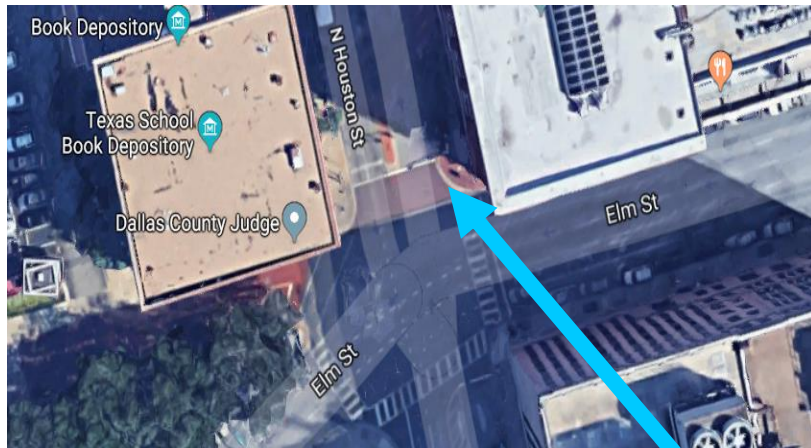
OpenEdge Platform is purpose built for Far Edge, differentiating with performance and innovation



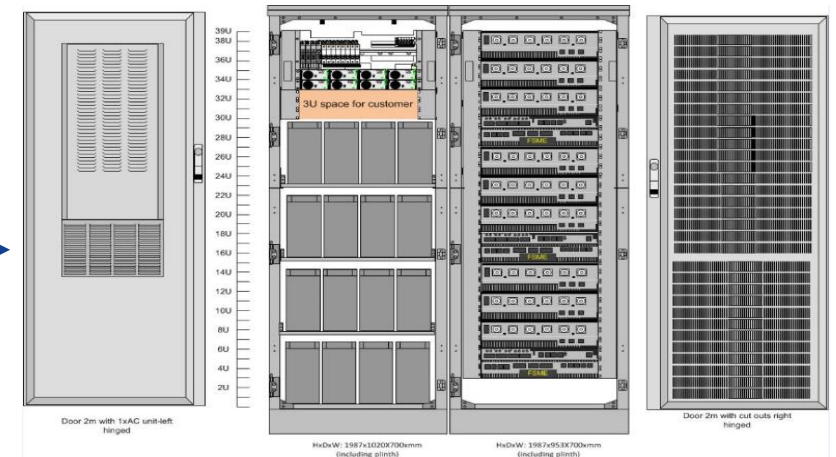
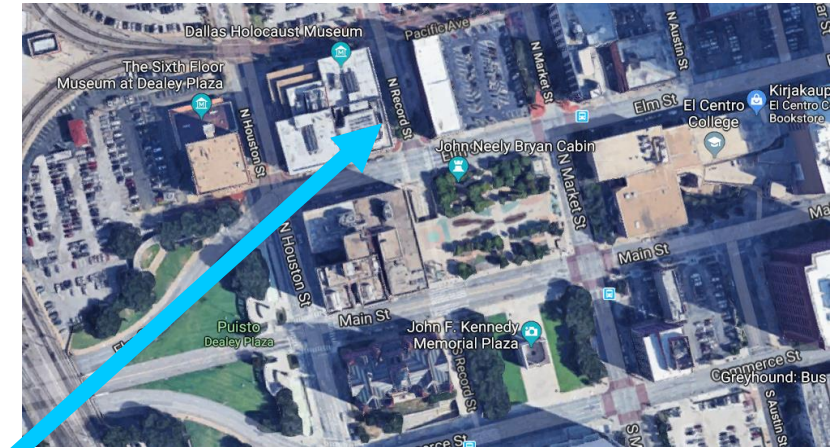
# Far Edge Deployment Options

Reuse existing BBU/Cellsite Cabinet Options

Intersection Case Configuration



Block Case Configuration

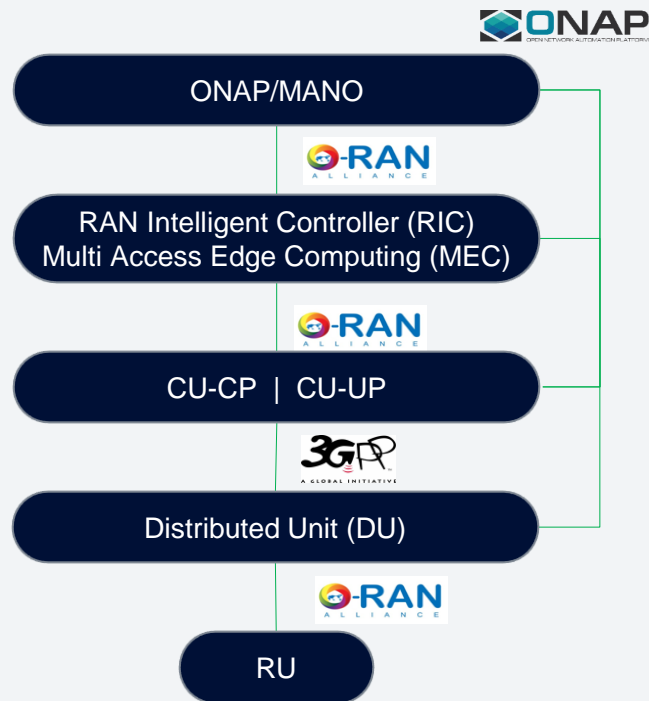


FCOB Flexi Outdoor cabinet

Dual/Street Cabinet Solution

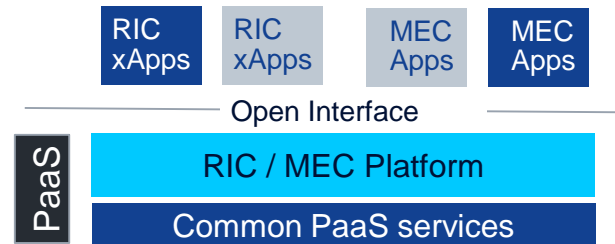
# RAN Openness and Converged Edge Cloud enables new services @ Edge

ORAN is bringing openness and programmability to the Cloud RAN



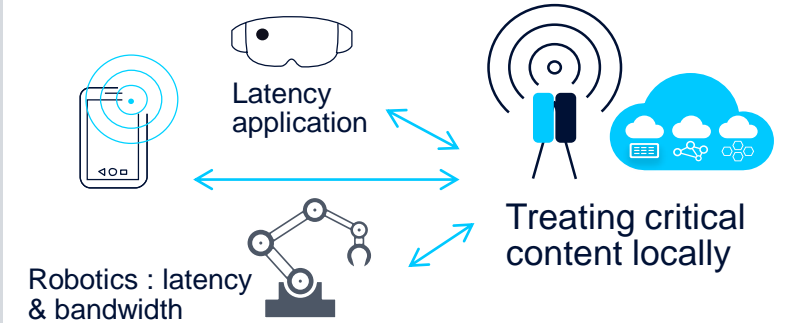
RAN Openness for 3rd party applications with RIC and MEC

RAN Programmability for Customization, Slice management, Service optimization and Artificial intelligence



**GTI** Innovative Mobile Service and Application Award 2019 for MEC Application  
Global TD-LTE Initiative

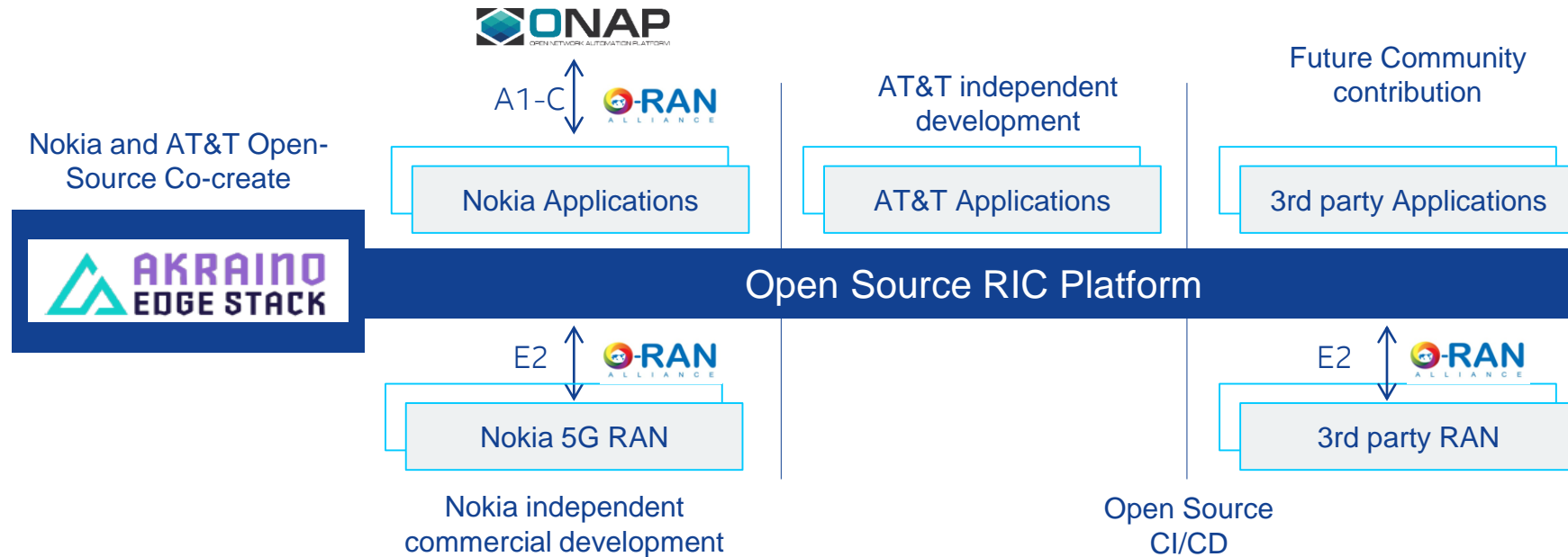
MEC Application @ Edge



ORAN/RIC based xAPP @ Edge



# Nokia is driving ORAN/RIC/Akraino in a co-creation partnership with AT&T



## Strategic Importance:

Nokia is sole co-creation partner for AT&T, supporting open ecosystem for RAN

Akraino is Edge Solution blueprint reusable for Telco, Enterprise and IoT Use cases

Akraino Edge Middleware, SDKs and apps enable 3rd party ecosystem play

Akraino is a modular VIM which, through building blocks, allows customization of the infrastructure for a particular application. The REC is the Radio Edge Cloud version of Akraino. There are expected to be several Akraino variants, and REC is the blueprint for the RIC (and probably Cloud-RAN). In other words, REC will be that specific combination of Akraino building blocks needed for the edge cloud VIM.

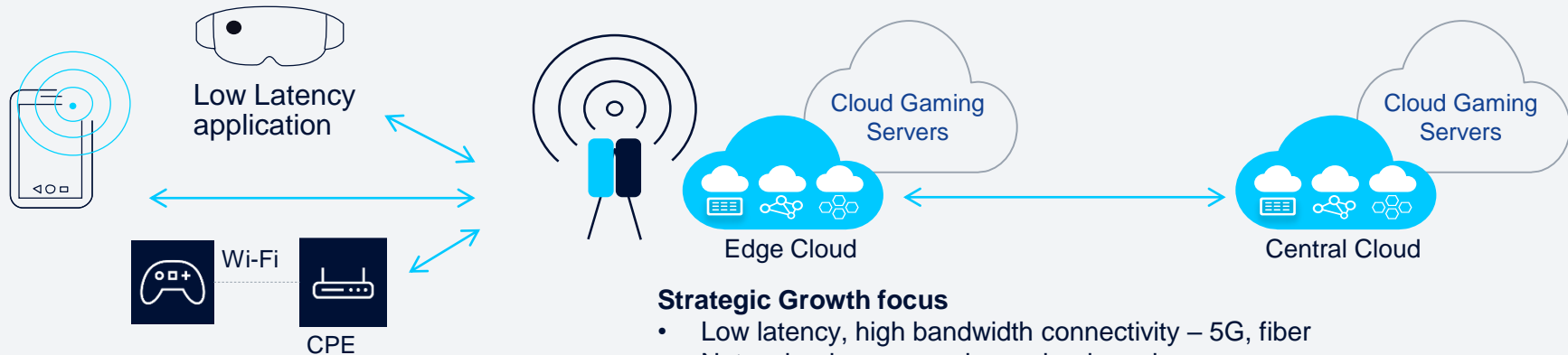
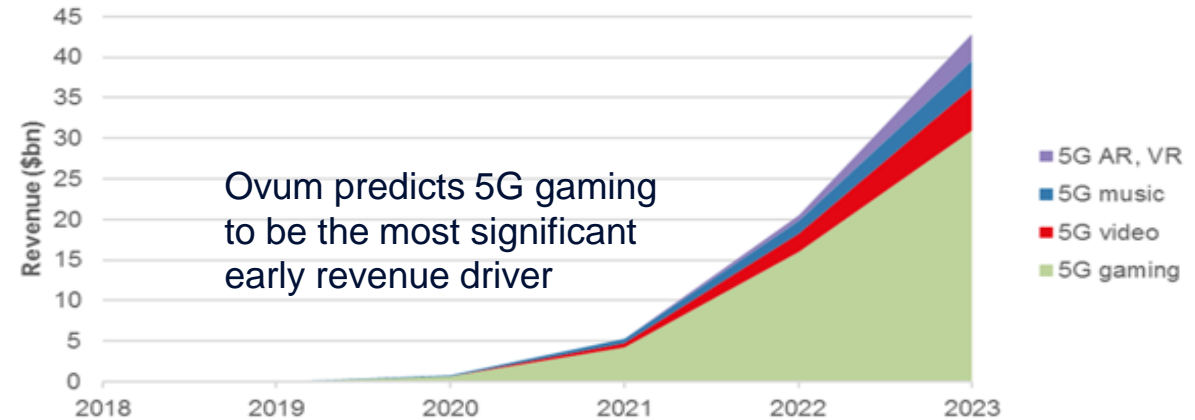
# Example: Solution for Cloud Gaming & Entertainment @ Edge Cloud

## Gaming as a Service – Thin Client, Cloud-based



- Heavy graphical processing at the cloud in real-time
- Cloud gaming consumes 20-47Mbps constantly (on PC)
- Latency requirement are <30ms

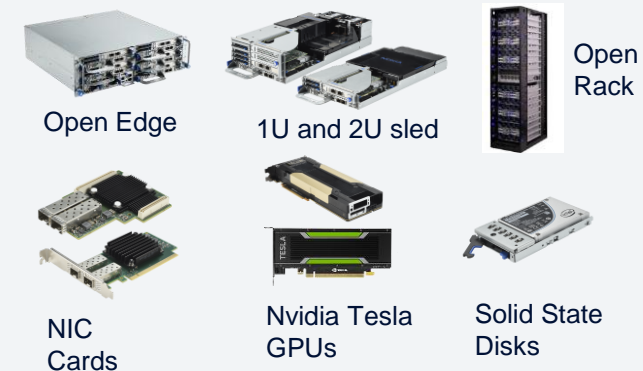
## Operator's opportunity with gaming partnerships and content



### Strategic Growth focus

- Low latency, high bandwidth connectivity – 5G, fiber
- Network edge processing – cloud gaming
- Network edge analytics – visual and other analysis
- Data security for transmission and storage

Nokia DC solution includes On-server Storage, NICs & Accelerators for Cloud Gaming



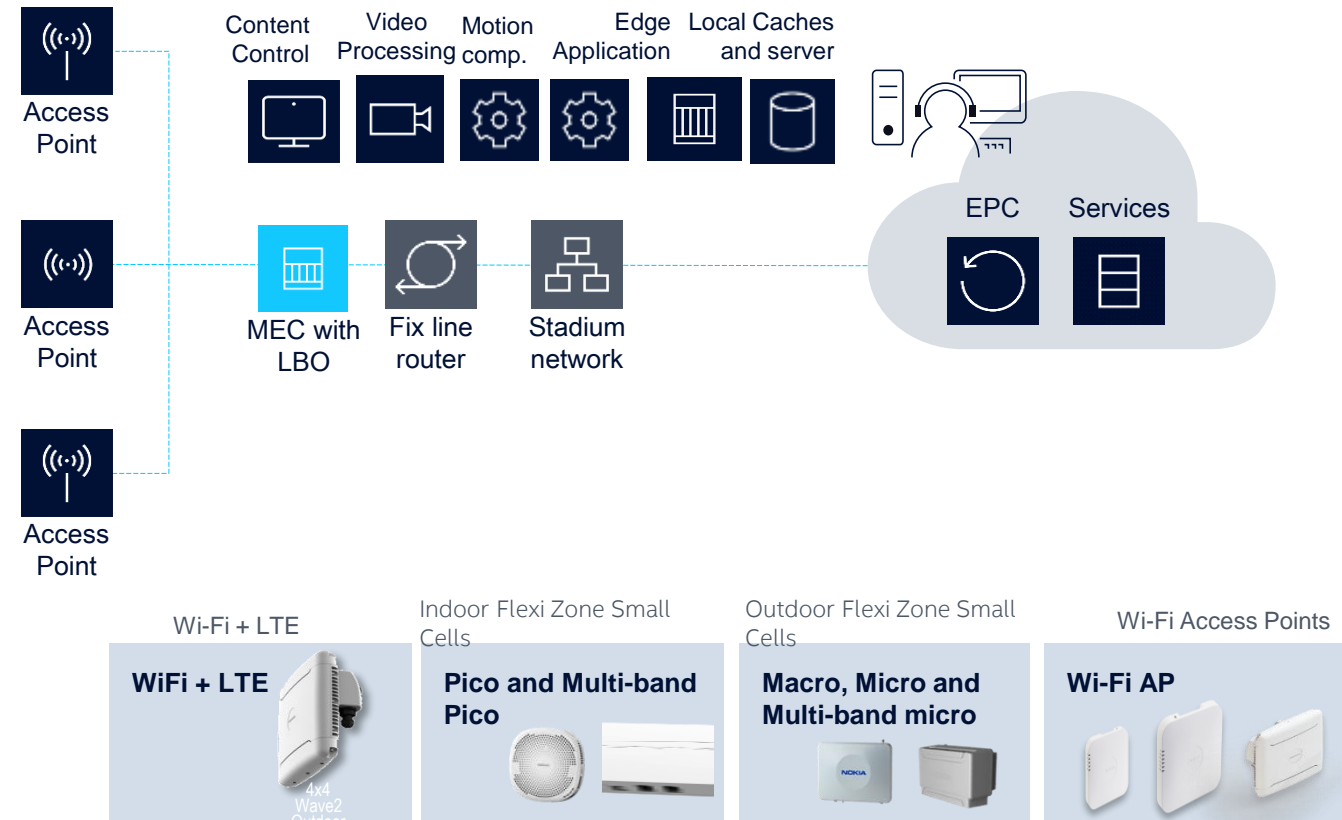
# Example: Solution for Digital venue and Edge Video Orchestration

Nokia provided a 5G-like experience powered by small cells and MEC for Digital Venue

Digital venue delivers a unique digital experience to venue visitors, drives visitor engagement, and allows for efficient venue management



## Multi-access Edge Computing (MEC) with local content



Thank you!

NOOK

