NOKIA: ONE PLATFORM FOR INDUSTRIAL DIGITALIZATION

WILLIE KOPP

HEAD OF EDGE CAMPUS ENTERPRISE SALES

NOKIA

NOKIA

future
TECHNOLOGIES

TECHNOLOGY
SUMMIT
2024

Future Tech Summit

Service provider

Going beyond
telecommunicat...

€22.3

Net sales in 2...

~13

countries of op...

...chnology licensees

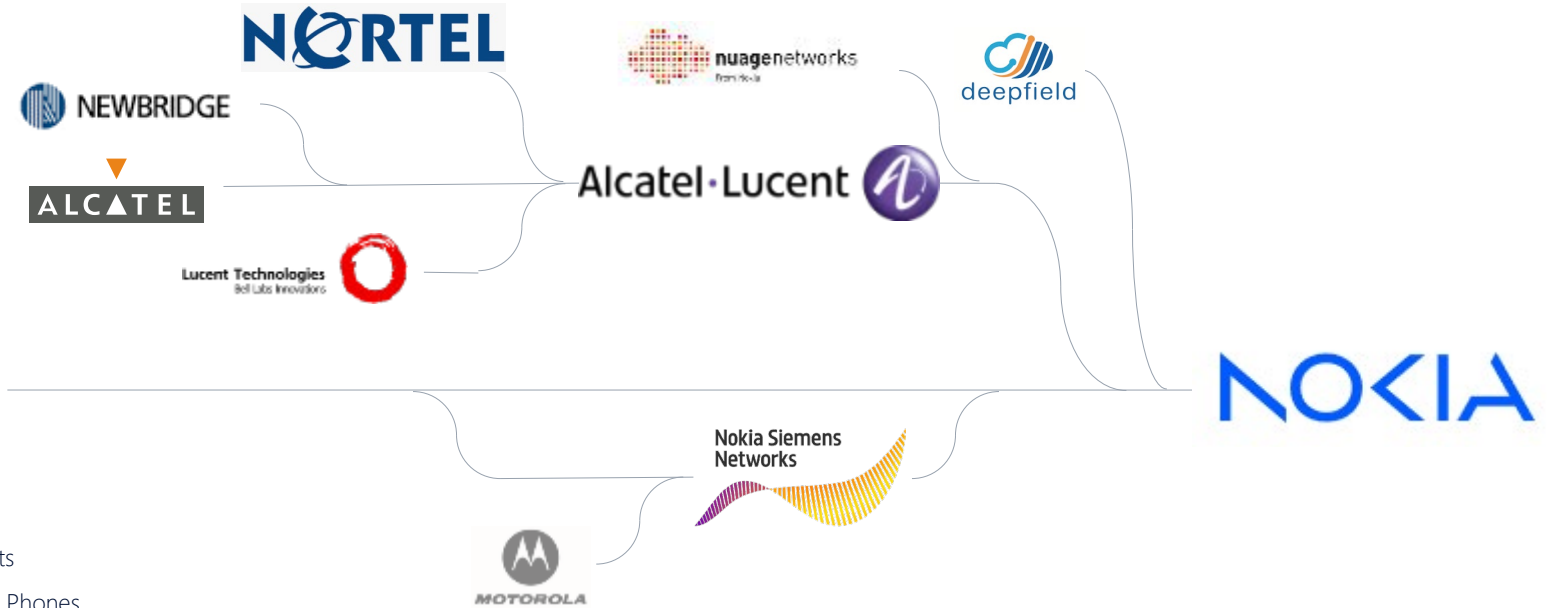...opting cutting-
...ge technology

6k+

...amilies declared
...ential to 5G

~20k

...tent families

NOKIA

155 Years of Market Leadership

Founded: 1865

Pulp, Paper, Rubber Boots

Early Bell System, Mobile Phones

End-to-End Portfolio Leadership

Network Infrastructure

- IP Networks
- Optical Networks
- Fixed Networks
- Services

€8.0 bn net sales 2023

Mobile Networks

- Radio Access Networks
- Microwave Networks
- Network management software and services

€9.8 bn net sales 2023

Cloud and Network Services

- Enterprise Solutions
- Business Applications
- Core Networks
- Cloud Services

€3.2 bn net sales 2023

Nokia Technologies

- Patent Licensing
- Technology Licensing
- Brand Licensing

€1.1 bn net sales 2023

NOKIA BELL LABS

- Core Research
- Solutions Research

€150bn+ invested in R&D since 2000

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Our Corporate Strategy

Our pillars

1 Grow CSP business faster than market

2 Expand the share of enterprise

3 Actively manage our portfolio

4 Secure business longevity in Nokia Technologies

5 Build new business models

6 Develop ESG into a competitive advantage

Our enablers

1 Develop future-fit talent

2 Invest in long-term research

3 Digitalize our own operations

4 Refresh our brand

Expand the share of Enterprise

Grow enterprise and private wireless networks and move into automation

|	
Business Automation Integration	Predictive maintenance, 3rd Party Clouds
Expand in Industrial Automation	Industrial automation, Positioning, Video analytics
Expand in Private Wireless and Campus Edge	Local edge, Multi-Cloud, Hybrid cloud
Scale Enterprise Physical Networks	

>70% enterprise are investing in IIoT today

49% IT are reporting working closer with OT on IoT projects (32% in 2018)
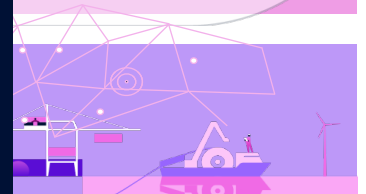
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Nokia ECE Evolution

From industry first in Private Wireless towards an Industrial Digitalization platform

Industry first
private wireless deployment

Development of enterprise centric private wireless solution

Rio Tinto, Australia MPW

Industry first
private wireless as-a-service solution

Digital Automation Cloud (DAC)

Industry first
private wireless solution integrated digitalization enabler platform

DAC edge application framework

Industry first
off the shelf mission critical edge designed for cross-OT industrial needs

MX Industrial Edge

Industry first
hyper interconnected OT edge & micro-Edge AI/ML platform as a service

Gen AI LLM OT assistant

MX Workmate + MX GRID

From 2011

2019

2020

2021

2024

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760+ private wireless customers

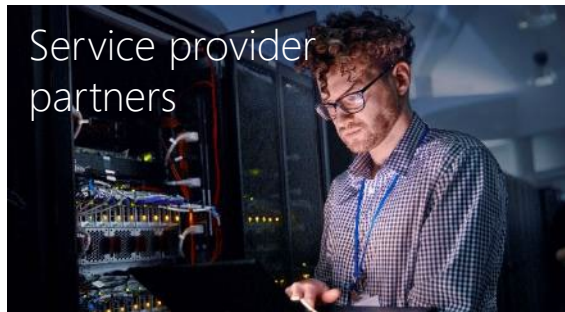## Uncontested market leader in private wireless – 54% MS*
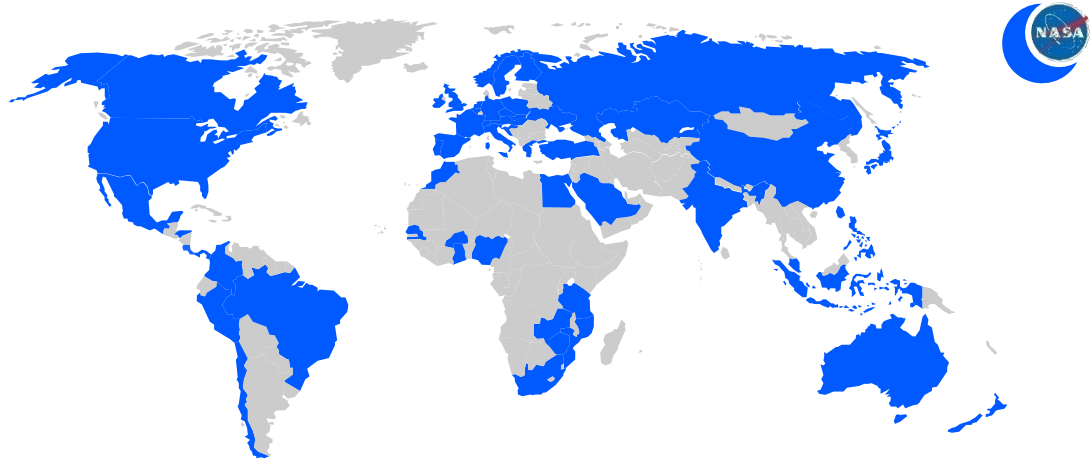
Recent new logos

*Supported by latest publicly released data from key analyst firms.

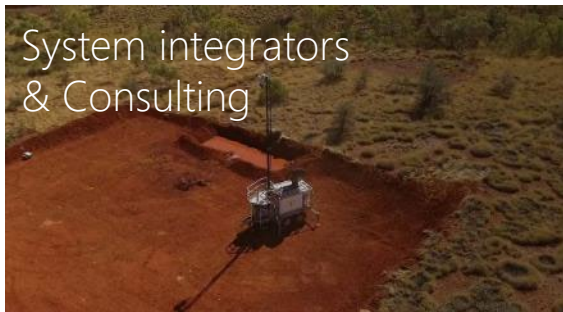**Please note that the pw references in Russia are legacy wins that may still be in operation, but no longer supported by Nokia.

Nokia collaborating with entire ecosystem to drive Industry 4.0

Service provider partners

Expertise in building & operating mobile network or public clouds, spectrum partners

System integrators & Consulting

Deeper industry expertise and specialised channel to market

Broadening the sphere of influence

Industrial bodies and ecosystem partners
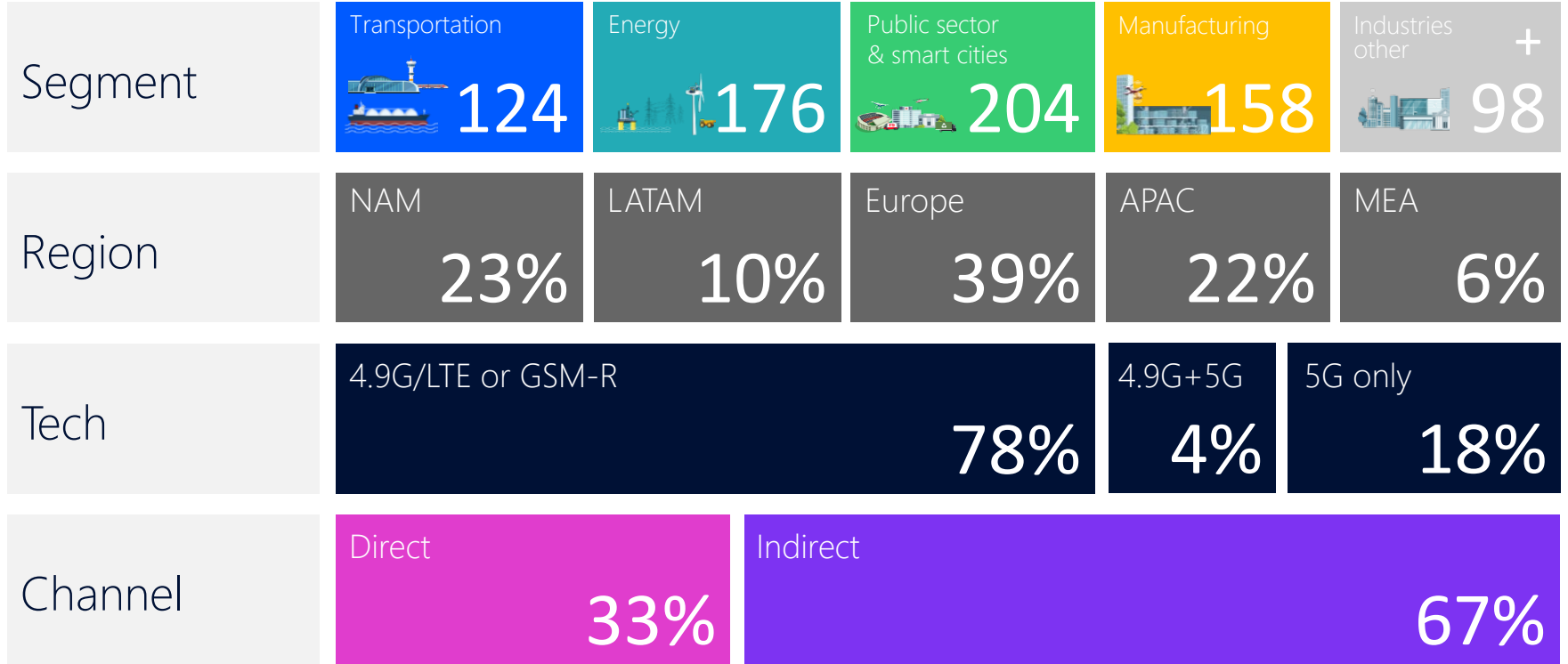

Kick starting the industry with more LTE and future 5G industrial connected things

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Nokia private wireless customer statistics Q3-2024

Segment	Transportation	Energy	Public sector & smart cities	Manufacturing	Industries other +
	124	176	204	158	98

Region	NAM	LATAM	Europe	APAC	MEA
	23%	10%	39%	22%	6%

Tech	4.9G/LTE or GSM-R	4.9G+5G	5G only
	78%	4%	18%

Channel	Direct	Indirect
	33%	67%

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Nokia One Platform for Industrial Digitalization

The nervous system of your I4.0 transformation

- Tap into the industry's best OT digitalization applications
- Easily & cost effectively implement new tested industry 4.0 use cases
- Create the interface to your northbound and cloud systems

- Keep the control without unnecessary complexity
- Maximum reliability and performance
- Easily scale, replicate to many sites & integrate with IT systems & processes

- Easily interface with your heterogenous industrial systems
- Exploit real-time IIoT data
- Empower your worker with AI assistance guidance

- Easily connect all OT assets & workers with deterministic performance & highest reliability
- Tap into innovative I4.0 use cases with AI enabled micro-edge
- Maximize your legacy assets

One Platform for Industrial Digitalization business benefits

Percentage of early adopters that see 10%+ improvement

90%
Increase worker collaboration

Connected worker
Critical team comms
Analytics

79%
Reduce emissions

Condition Monitoring
Drones
Industrial IoT

75%
Increase productivity

Connected worker
Video analytics
Worker safety apps

73%
Reduce Operational cost

Robotics & mechatronics
Industrial IoT
Condition monitoring

65%
Worker safety

Geofencing and alarms
Connected worker
Robotics

80% see ROI within 6 months, 100% within 2 years

Source: GlobalData, Feb 2024

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CASE STUDIES

CLIENT FORTUNE 100

INDUSTRY MANUFACTURING

ADVANCED USE CASES

- Autonomous Mobile Robots
- X,000,000 Square Feet Total Coverage

CLIENT FORTUNE 500

INDUSTRY UTILITY

COVERAGE & ADVANCED USE CASES

- Industrial Automation
- Connected Worker
- Fleet Management

CLIENT FORTUNE 5000

INDUSTRY Chemical

COVERAGE & ADVANCED USE CASES

- Connected Worker
- Remote Worker
- Industrial Automation

CLIENT FORTUNE 500

INDUSTRY OIL & GAS

COVERAGE & ADVANCED USE CASES

- Industrial Automation
- Connected Worker

CLIENT FORTUNE 5000

INDUSTRY PORTS

COVERAGE & ADVANCED USE CASES

- Industrial Automation
- Connected Worker
- Lift Device Automation & Connectivity

CLIENT U.S. DEPT OF DEFENSE

INDUSTRY TEST & TRAINING

COVERAGE & ADVANCED USE CASES

- 2,500 Miles of Private Network Coverage
- Connected Warfighter & Augmented Reality
- Drone Solutions

Backup slides

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Nokia private wireless solutions

2 private wireless solutions to suit all segments' requirements

Own, OT dedicated 4.9G/LTE & 5G network bringing deterministic wireless connectivity

As-a-service

Nokia Digital Automation Cloud (NDAC)

- Packaged Plug&Play as-a-service solution
- Digitalization/automation platform with ready-to-run applications
- Low entry point, easy to scale with enterprise-friendly O&M

Modular

Nokia Modular Private Wireless (MPW)

- Customizable architecture, choice of solution elements and network O&M approach
- Focused on fully owned
- Carrier networks integration capabilities

Latest generation 4.9G/LTE with smooth 5G evolution/addition OR start with 5G SA

End-2-End private wireless
- E2E mgt & orchestration
- Pre-integrated & tested

Largest range of spectrum
- Spectrum partnership
- Exotic spectrum bands
- Complete CBRS offering
- Unlicensed options (MLF & LTE-U

Leading SC portfolio
- 4.9G/LTE and 5G
- All-in-one or distributed
- Macro capacity
- Macro s/w parity

Most deployed pW solutions
- MPW deployed since 2011
- DAC most popular aaS pW solution with >600 deployments

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Nokia Industrial devices
Ruggedized and reliable, bringing value beyond connectivity

Provides connectivity to workers - live communication, digital-twin view , worker safety, etc.
Brings 4.9G/LTE or 5G communication capabilities to sensors, machines, or any industrial systems

4G portfolio	B38, B42, B43, CBRS, Globalstar B53
	B46/240
	410-430/450-470 MHz
	B31/72/87
	Global bands

Handhelds
IP68

Dongles
IP67

Field routers
IP67 and IP32

Indoor unit

Hotspots

Indoor gateway

5G portfolio	Support for global 4G and 5G bands
	Sub 6 GHz
	SA and NSA
	Relevant certifications

Smartphones
ATEX,
IP68, MIL-810

Dongles
IP65

Field routers
IP67 and IP32

CPEs

5G video camera
IP67

Pre-configured for Nokia private wireless networks, bringing you an end-to-end solution with simplicity and guaranteed performance.

Ruggedized for harsh conditions
- Designed and developed to meet demanding needs
- Purposefully built with high IP protection

Support most frequency bands
- 4.9G/LTE and 5G
- CBRS
- MulteFire
- Unlicensed spectrum

Easy management
- Inbuilt Nokia Industrial device management for smart and IoT devices
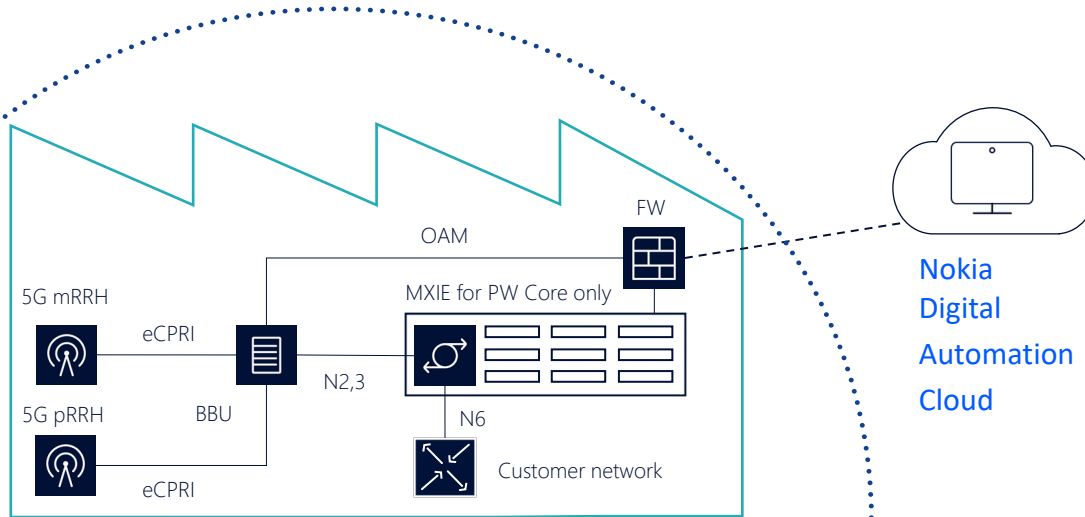- Zero-touch onboarding , tracking and remote mgt

Many types
- Handhelds, smartphones, workpads, dongles, fieldrouters, hotspots, cameras, and accessories

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Nokia DAC PW Compact
5G CBRS as a Service for small industrial sites (NAM focused a.t.m)

Full-fledged pW functionality – deterministic reliability and performance in terms of radio coverage, throughput, MU capacity and mobility – in small form factor

FW

OAM

MXIE for PW Core only

5G mRRH

eCPRI

N2,3

N6

5G pRRH

BBU

eCPRI

Customer network

Nokia Digital Automation Cloud

Nokia DAC PW Compact

- Optimized form factor - minimum footprint, energy consumption and cooling

- Zero upfront investment - no initial CAPEX, pW as a Service consumption-based model – minimum TCO

- Ease of use - plug and play deployment and IT native operability

- Competitive TCO vs Wi-Fi - all private wireless benefits for a TCO comparable with Wi-Fi even in smaller sites

- Best in class Nokia AirScale radio platform – enabling demanding industrial use cases

- Easy scale up coverage via adding only RRHs and upgrade to normal Nokia DAC

- 4G use cases can be added on the same infrastructure

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Nokia DAC Wi-Fi
Complementary OT connectivity layer

Bringing more connectivity options:
Connect all Wi-Fi legacy assets and complement private wireless capacity for non-critical operations use cases

Nokia Digital Automation Cloud

MX Industrial Edge
- Wi-Fi Manager
- Wi-Fi AAA

Nokia DAC manager
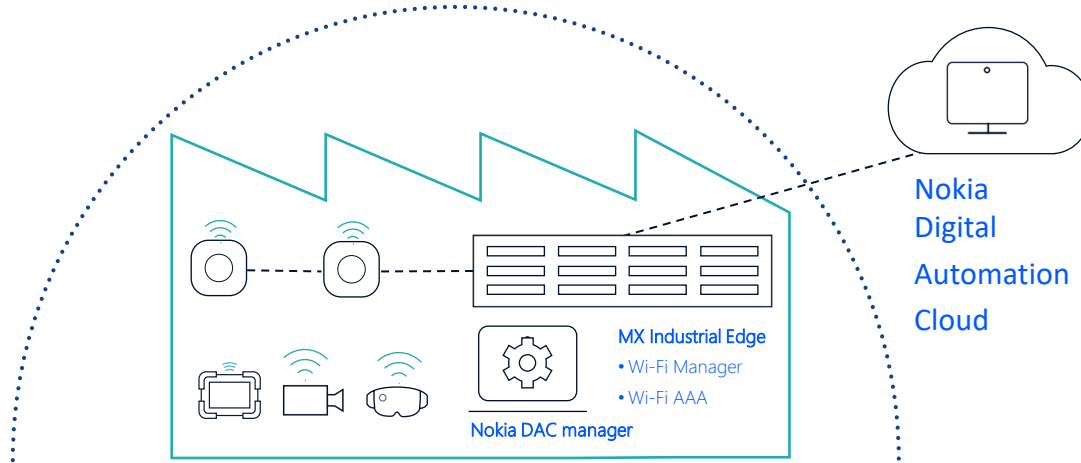
Nokia Digital Automation Cloud (DAC) all-in encompassing wireless OT connectivity and digitalization capabilities enhanced with optional Wi-Fi 6/6E connectivity
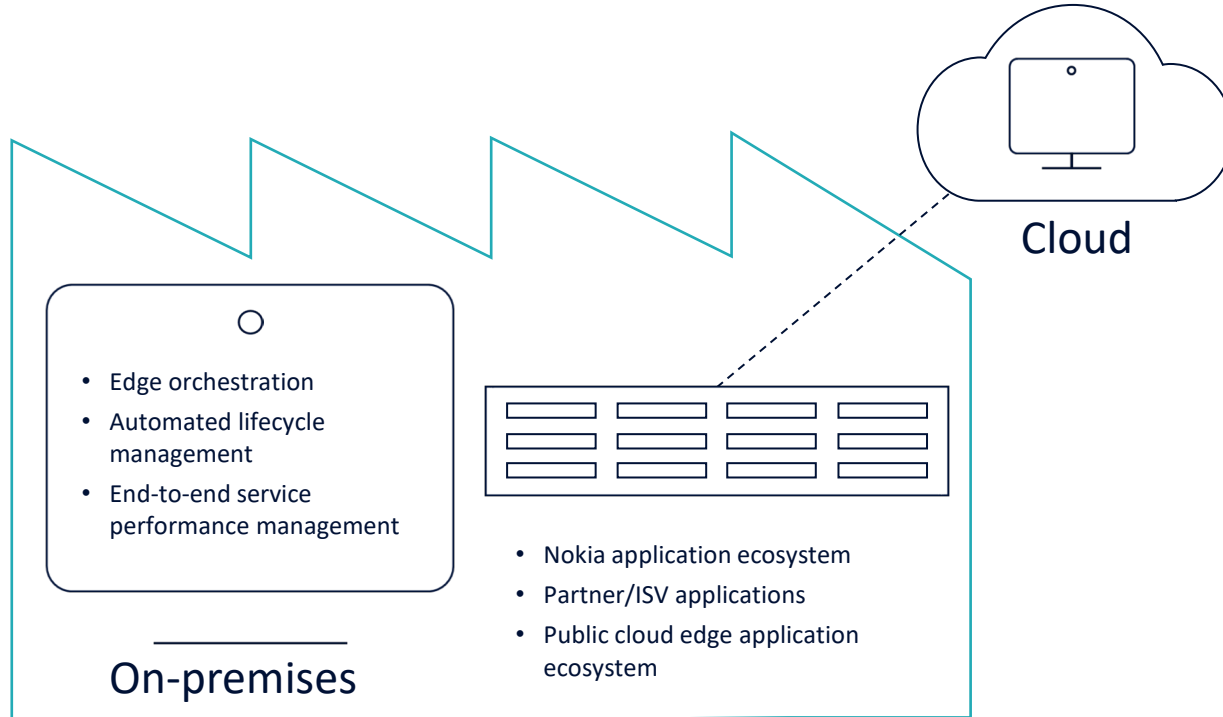
Nokia DAC Wi-Fi

- Plug&Play, as-a-Service
- E2E, scalable, replicable
- Edge centric: data security

- Easy evolution to private wireless
  - Cellular LTE/5G -Wi-Fi interworking function

  - SIM-based authentication

- Further performance and reliability via MX Boost

- Unified O&M by Nokia DAC

- Competitive TCO – hybrid commercial model – APs via merchant plus subscription

Nokia MX Industrial Edge
On-prem edge solution to accelerate OT digitalization for I4.0 use cases

On-premise industrial edge for low latency, reliable & secure OT use case data processing.
Allows easy interfacing with other industrial key systems (machines, DT, MES, etc…)

Cloud

- Edge orchestration
- Automated lifecycle management
- End-to-end service performance management

On-premises

- Nokia application ecosystem
- Partner/ISV applications
- Public cloud edge application ecosystem

For tapping into the massive enterprise edge business opportunity. Beyond connectivity

Off-the-shelf

Offered as-a-service

High performace, resilient and secure architecture
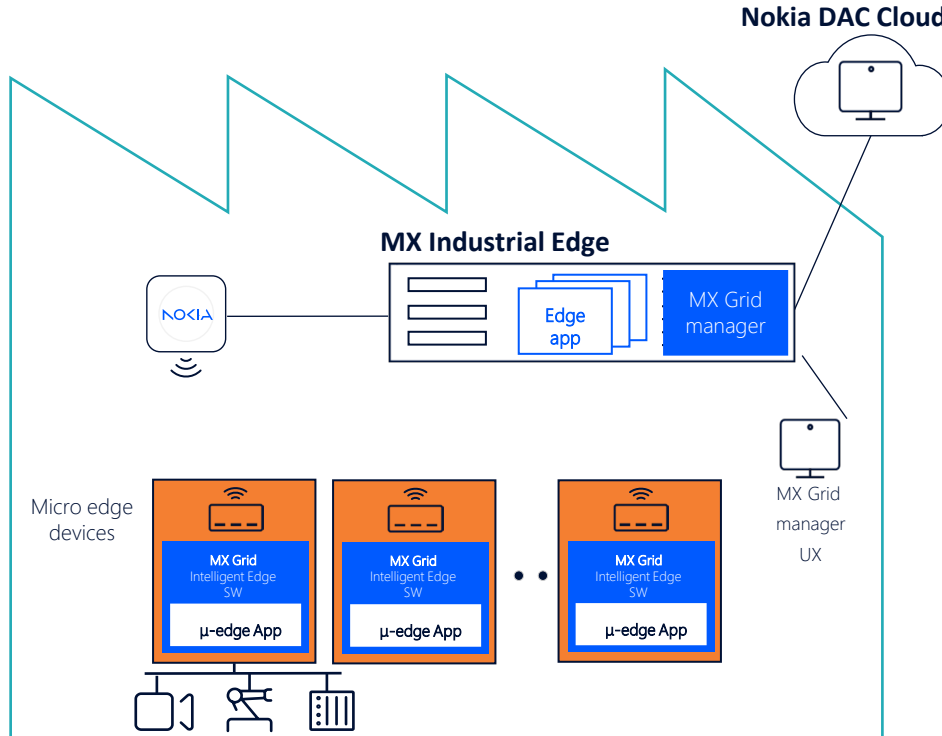
Runs Kubernetes and VM based workloads

Total control over customer data

Ecosystem neutral

- Comes with set of apps from Nokia including private wireless and Wi-Fi connectivity
- Comes with connectors to webscale and industrial ecosystems
- Enables onboarding 3rd party apps technically and commercially with marketplace business model

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Nokia MX Grid

Extending intelligent edge processing the closest to the OT data source

Nokia DAC Cloud

MX Industrial Edge

Edge app

MX Grid manager

MX Grid manager UX

Micro edge devices

MX Grid Intelligent Edge SW

μ-edge App

MX Grid Intelligent Edge SW

μ-edge App

MX Grid Intelligent Edge SW

μ-edge App

- Complements MXIE compute power with de-centralized decision making & intelligence using <u>connected micro edges</u>

- Managed and orchestrated by MXIE using reliable wireless connectivity
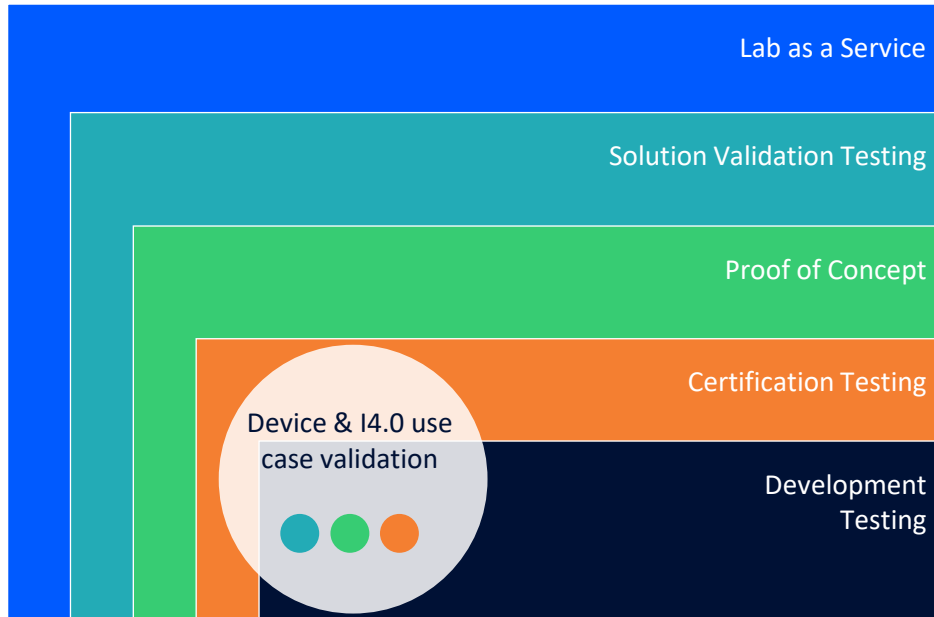
- Optimizes network utilization

Processing capability examples
- Collect real time OT data and execute protocol translation and encapsulation
- Compress, encode video streams
- Perform analytics or/and AI workloads on real time OT data or video stream
- Execute specialized software to improve network quality (e.g. MX Boost)

Nokia Lab as a Service

Ensuring I4.0 use cases, application, device and network performance through testing

As a service end-to-end solution, certification, device and development testing

Lab as a Service

Solution Validation Testing

Proof of Concept

Certification Testing

Device & I4.0 use case validation

Development Testing

Nokia Lab as a Service

4.9G/5G private wireless network test beds available 'as a service'

- Accelerate time to market
- Resolve 'real world' issues at early stage for critical reliability and performance
- Flexible deployment options
- Fully operated and maintained by Nokia
- 6 labs covering major geographies
- New enterprise specific testing solutions

Access to Nokia technical testing expertise

- Test strategy, execution and troubleshooting
- 20 years of testing experience
- 560+ private wireless customers across industry verticals

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