



Network Infrastructure progress update

NOKIA

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Welcome



Federico Guillén
President, Network
Infrastructure

1. A strong year in 2021
2. What's next for Network Infrastructure
3. Your questions

1. A strong year in 2021

2021 built the foundation to deliver on our strategic priorities

Recap of March CMD '21 plan:

Strategy for growth

- ✓ Deliver portfolio innovation
- ✓ Strengthen CSP foundation
- ✓ Accelerate non-CSP growth

Progress in 2021:

Launched Nokia's 5th generation FP5 IP routing silicon

PSE-V optical platform gaining momentum

Technology leadership drove strong outperformance against market, particularly in Fixed Networks

Increasing engagement with web-scalers

A strong performance in 2021

Outperforming the market and continuing to gain share across our businesses

Network Infrastructure
Net Sales (2021)

€7.7bn

+15% y-o-y at constant currency

IP Networks
Net Sales (2021)

+5%

% y-o-y constant currency

Optical Networks
Net Sales (2021)

+2%

% y-o-y constant currency

Network Infrastructure
Operating margin (2021)

10.2%

+340 bps y-o-y

Fixed Networks
Net Sales (2021)

+35%

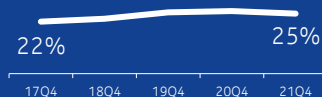
% y-o-y constant currency

Submarine Networks
Net Sales (2021)

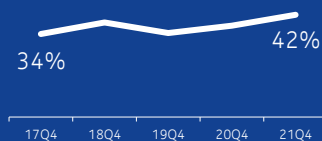
+33%

% y-o-y constant currency

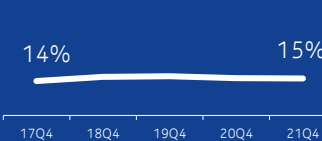
SP Routing Market share*



Fibre (OLT) Access Market Share*



Optical Networking Market Share**



All data 4 quarter rolling global ex. China market share

* Dell'Oro ** OMDIA WDM (excl SLTE) + Aggregation

2. What's next

Industry pressures driving market demand

Network Infrastructure
Addressable market*
growth** 2020-2021

y-o-y

5%

Network Infrastructure
Addressable market*
growth** 2021-2024

CSP CAGR: 2%
Enterprise CAGR: 3%

CAGR 3%



5G infrastructure
& services



Enterprise digital
transformation & cloud



Pandemic-accelerated
residential broadband



Industry 4.0

Critical networks are underpinning
industry transformation

* Does not include submarine cables or DC switching

** at constant currency

Our response is based on three focus areas...

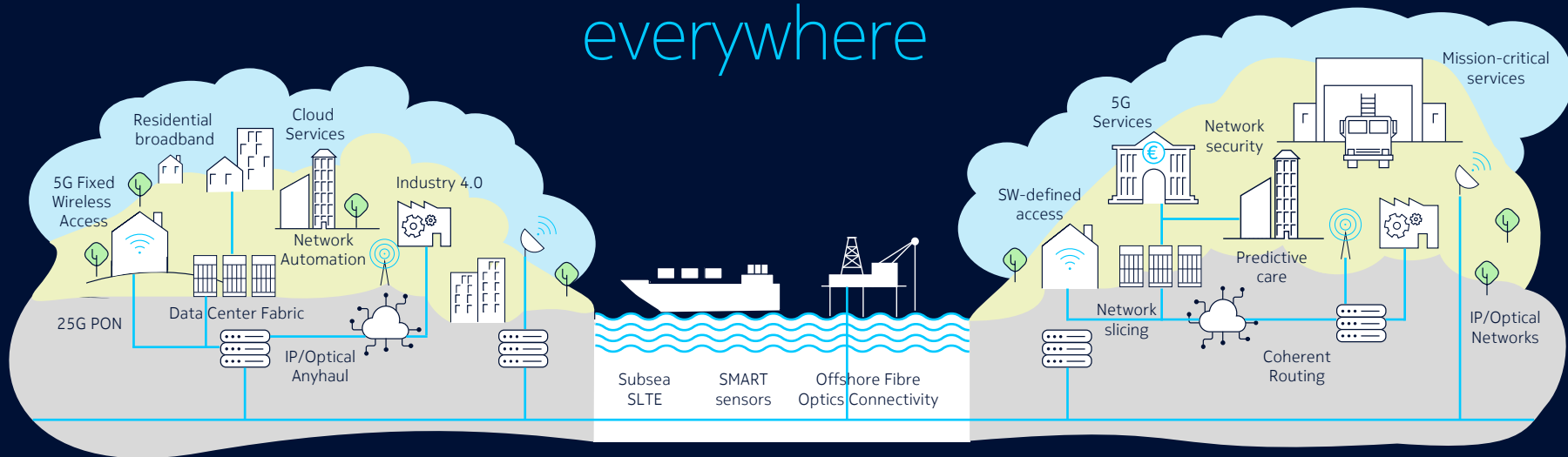
Innovation

Customers

Sustainability

Networks that inspire...

Everyone and everything, everywhere



Fixed Networks

A history of innovation leadership in Fixed Networks

1990's 2000's	2009	2010	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021
1 st ADSL on market	1 st green DSL on market	1 st Gigabit fiber platform	1 st 10G GPON solution	1 st Zero-Touch Vectoring	1 st Vectoring Micro-nodes	1 st large-scale PSTN transform	1 st Vplus	1 st 10-PON fronthaul	Long Reach VDSL2	Quillion chipset	Innovations for low latency Wifi 6	1 st 100G demo (with Vodafone)
1 st IP access node on market	1 st 10G GPON +LTE demo	1 st Phantom Mode demo	1 st VDSL Vectoring (100Mb/s)	1 st G.fast Vectoring Demo 1.1G	1 st Vplus Demo	1 st 40G TWDM-PON	1 st XG-FAST Demo 10G	1 st vDAA and unified cable access	Nokia WiFi	25G PON demo	1 st fiber platform fit for 5G era	1 st live 25G PON (with Proximus)
1 st VDSL on market	1 st VDSL2 Vectoring Demo				1 st TWDM-PON trial	1 st Universal TWDM-PON	1 st XGS-PON deployment	1 st SDAN use cases	1 st SDAN based PON interoperability	5G FWA (28-39GHz)	1 st with 25G PON	1 st triple coexistence: GPON + 10G + 25G
							1 st TWDM and G.fast deployment	1 st FDX-DOCSIS trial	5G FWA (sub-6GHz)	1 st SDAN based network slicing	5G midhaul on XGS-PON	1 st 5G backhaul with 25G PON

DSL broadband
 Ultra-broadband
 Gigabit broadband
 Massive scale access in 5G era

Our industry's ambition: Broadband Zero

Zero left behind

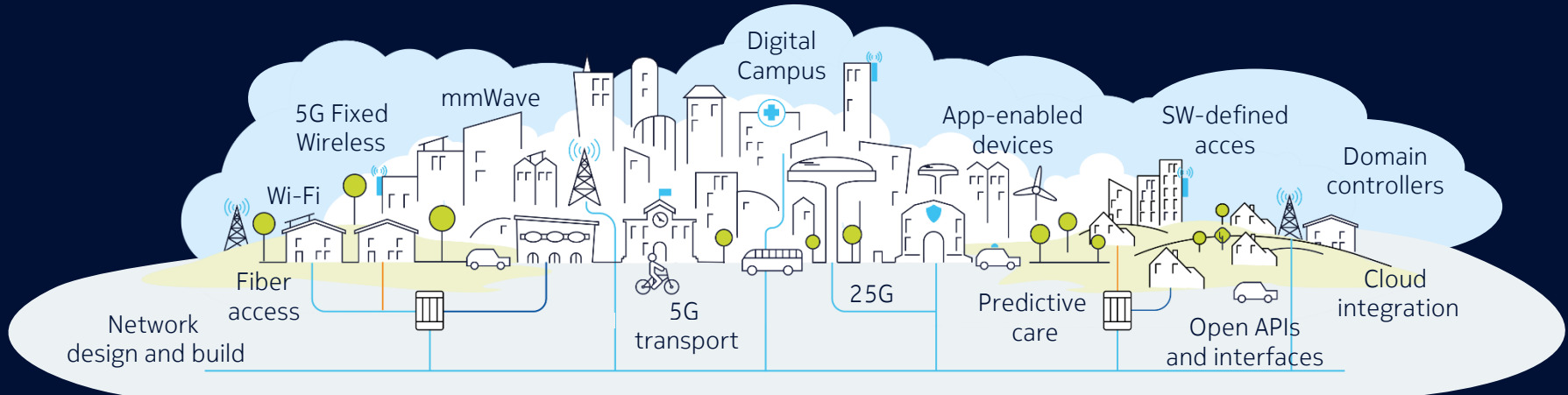
Connect everyone
and everything

Zero limits

Innovative technologies for new
use cases and business models

Zero touch

Automate and optimize
the network



Zero waste

Delivering the benefits of broadband while minimizing environmental impact

Opportunities for Fixed Networks in 2022 and beyond

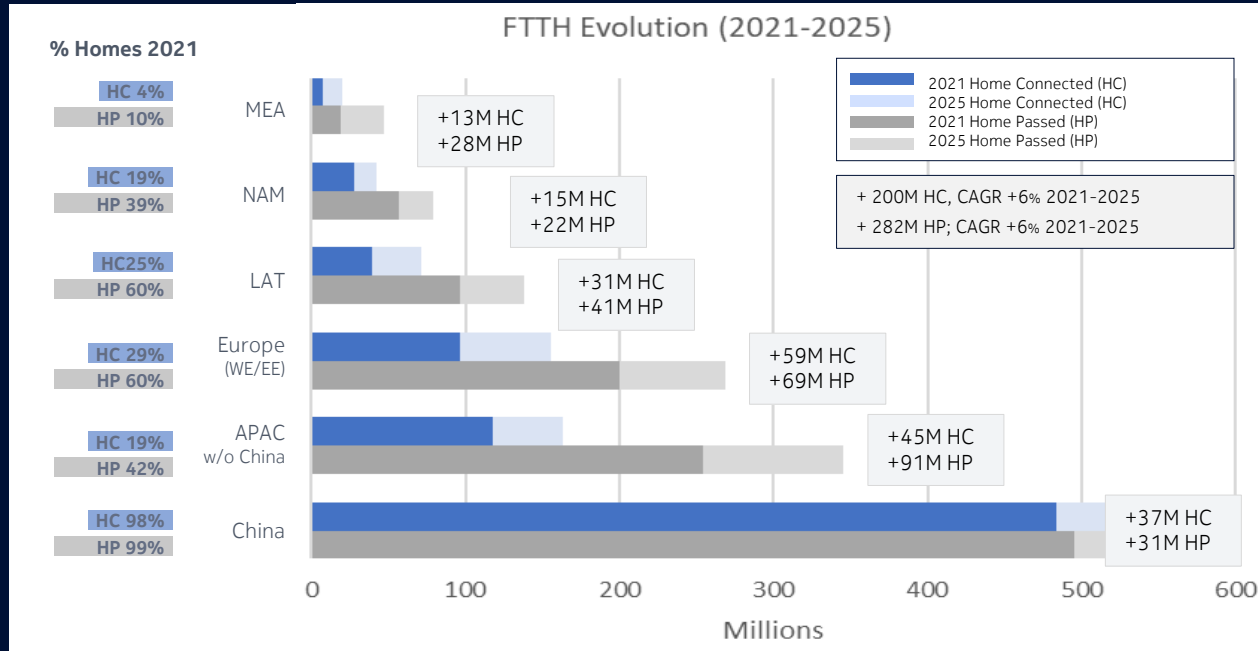
Continuing
opportunity for
fiber penetration

Neutral hosts

FWA / 5G FWA

Potential for further fiber deployment remains strong

Broadband access potential: Europe and APAC (w/o China) to drive demand

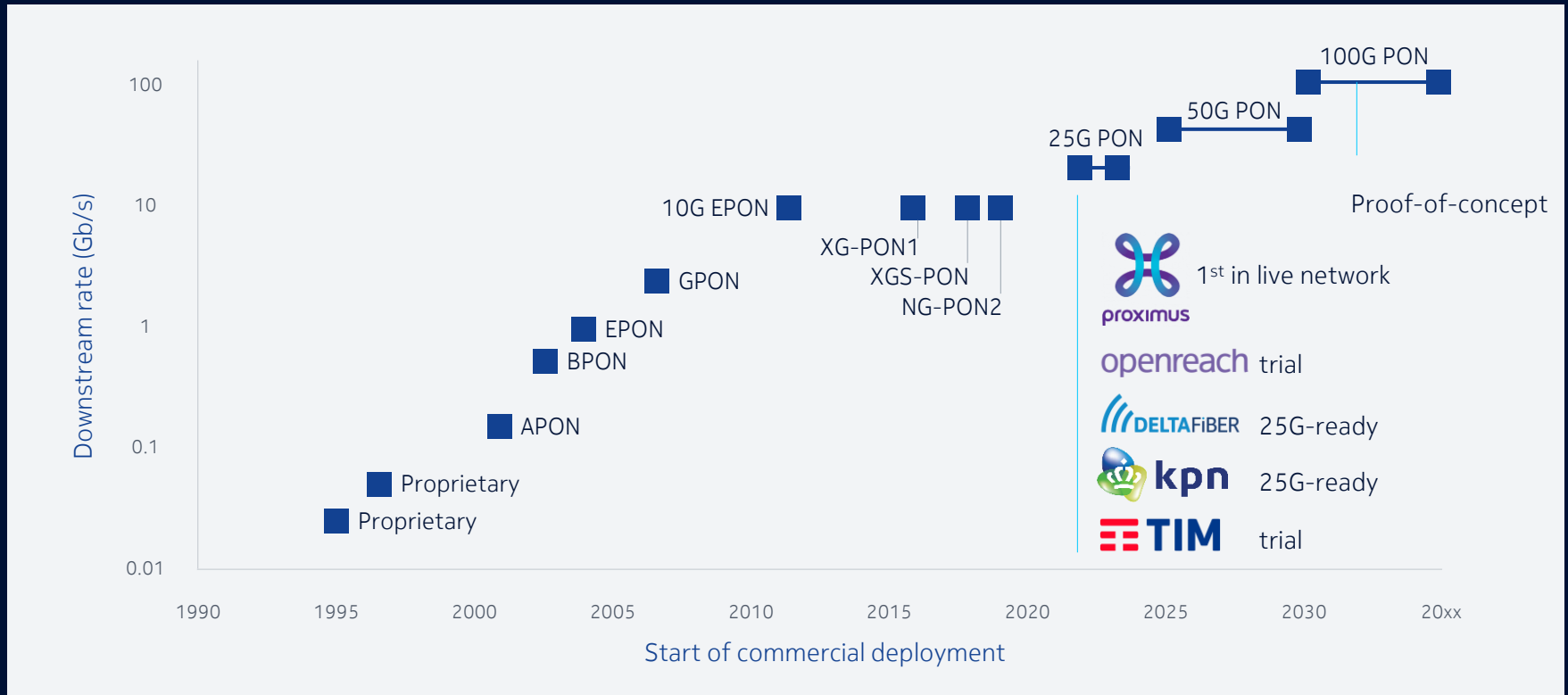


- 200M new homes to be connected by 2025 (opportunity for OLT, ONT and Wi-Fi)
- 280M+ new home to be passed by 2025 (opportunities for OLT and Services (including SIOP))
- Europe and APAC (excluding China) will drive the growth
- China's growth potential is lower, but refresh of installed base to 10G (XGS-PON) will represent 18% of new connections by 2025
- Potential beyond 2025 (not shown) continues especially for regions with later deployments

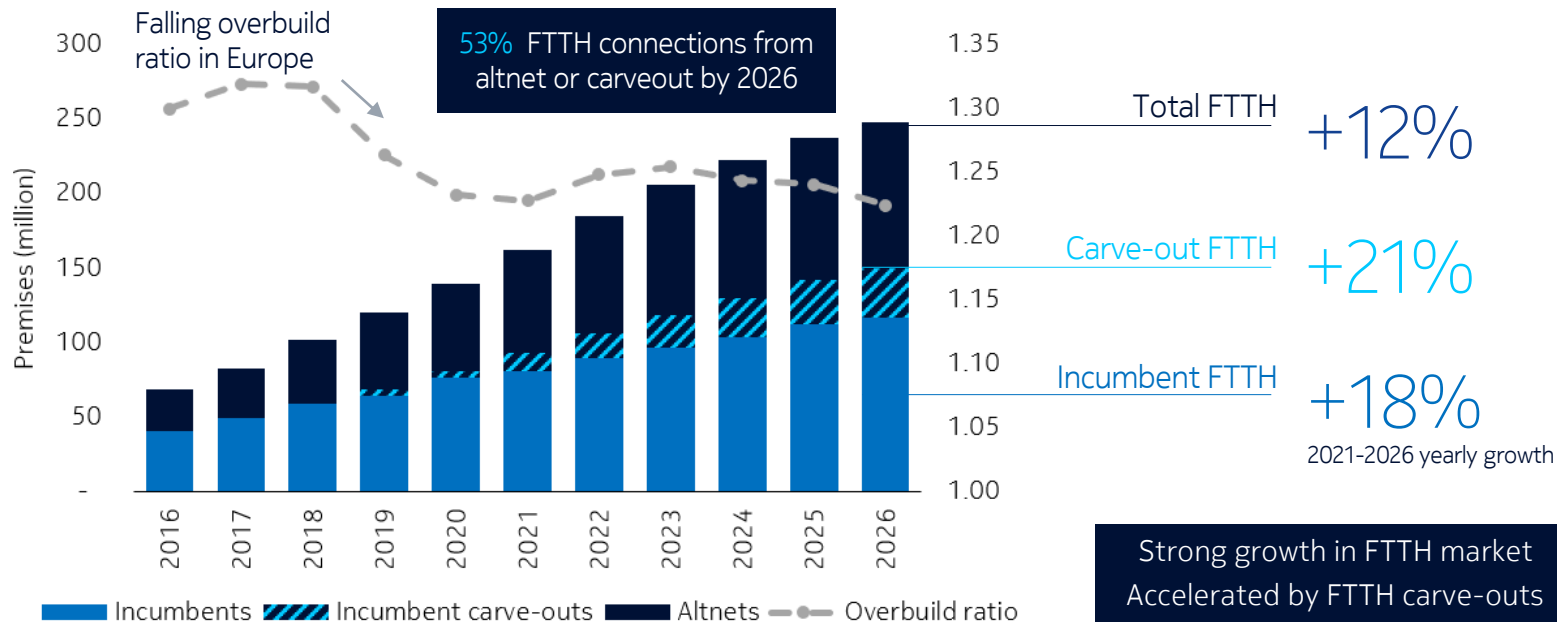
Source: IDATE World FTTX market, Dec 2021.

Home connected: Home with BB services over fiber. **Home passed:** Home in an area where fiber exists and can be connected to the BB service

Fiber technology continues to evolve



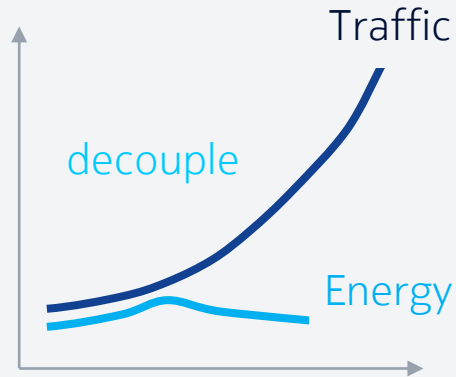
New investments and neutral host networks gain relevance in FTTH market



Forecast EU27+4, Analysys Mason 2021

Fixed access contributes to greenhouse gas emission reduction targets

Fixed access promise



60x energy efficiency

12x capacity [Gbps]
Same energy [Watt]

Shift from
copper to fiber

5x capacity [Gbps]
2x energy [Watt]

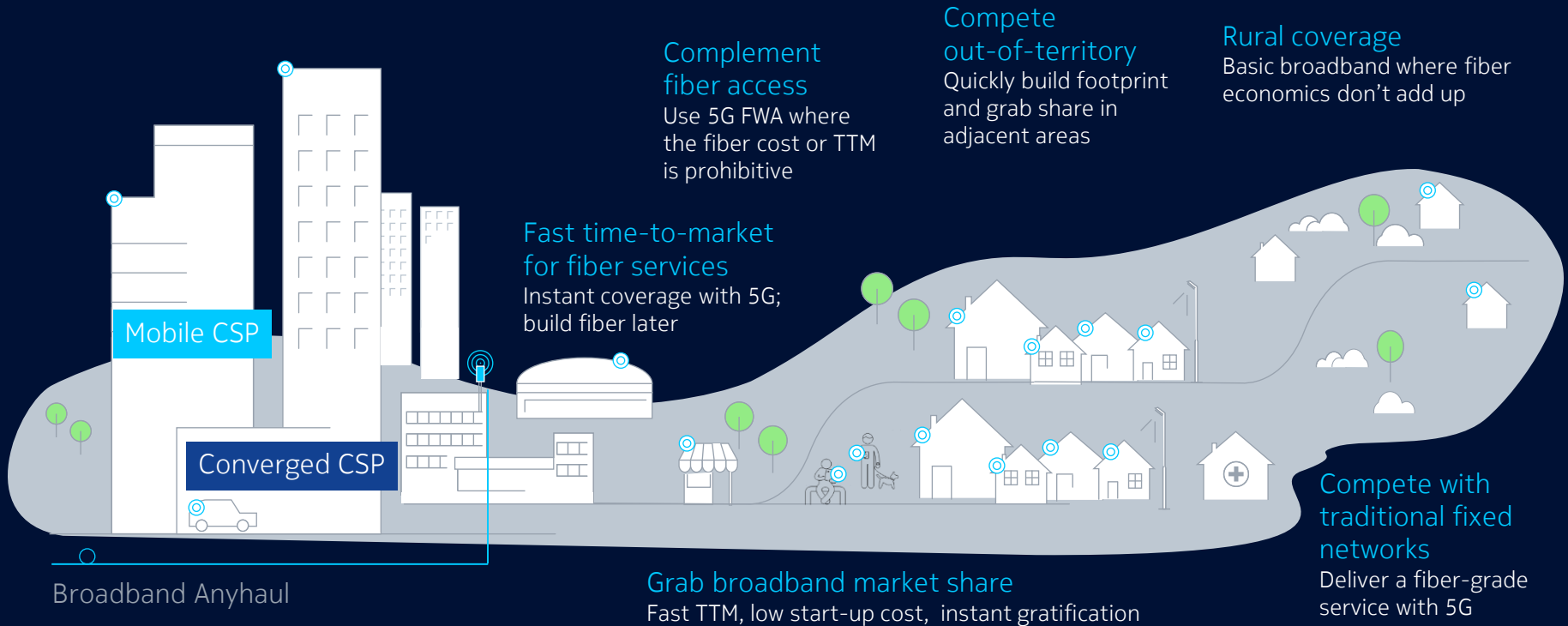
10G PON & beyond
speed evolutions

Same capacity [Gbps]
0.5x energy [Watt]

Quillion chipset
power savings

5G Fixed Wireless Access

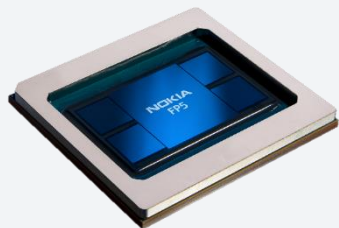
Benefits all operators



IP Networks

IP Routing

Deterministic performance, mature portfolio, extended life cycle



#1

Global SP
edge routing

1.4m

Service routers
shipped

- FP silicon for scalable capacity, power efficiency, network security
- Operational simplicity from proven SR OS software used across all platforms
- Model-driven for simplified automation, programmability
- Systems designed for growth and longevity
- Platform choice for best fit

elisa

BT

orange

vodafone

LG U+



CSP WAN



Digital industry



Government

IP Networks market drivers

5G



Residential
broadband



Cloud



Industry 4.0



Fast service delivery

New SLA capabilities

Improved operations efficiency

Deterministic performance, reliability, scalability,
network security

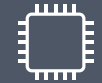
Power savings, investment protection



Automation
and tools



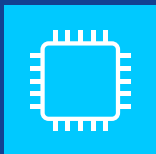
Software
excellence



Silicon and
systems

Foundational elements

Delivering an agile, secure and sustainable IP Network



Silicon and systems

We build the right systems with the right silicon foundation for the right places in the network enabling optimum network performance and efficiency

- FP routing silicon
- Broad router portfolio



Software excellence

Software quality is the heart of what we do - developed 100% in-house for total control, proven predictability, and demonstrated quality

- SR OS router software
- SR Linux network OS

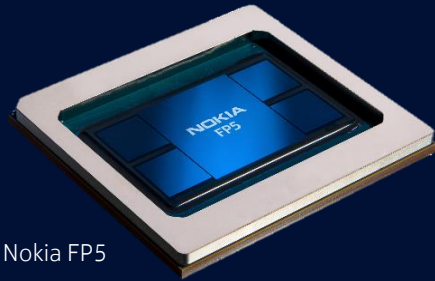


Automation and tools

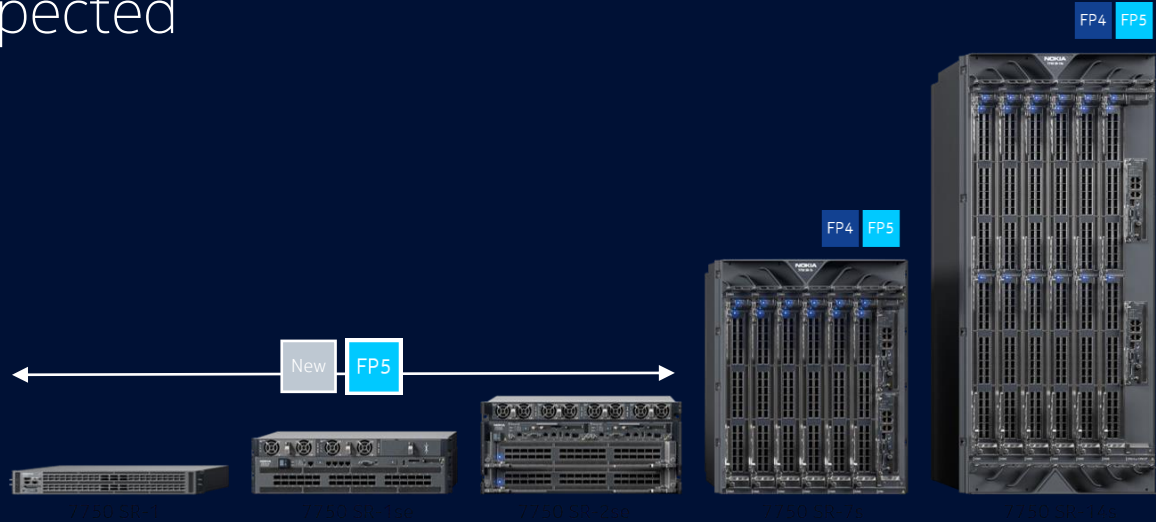
Open APIs, fully integrated real-time analytics, assurance, and closed-loop automation are critical to address increasing network scale and complexity

- NSP
- Fabric Services System
- Deepfield

FP5 – master the unexpected



Nokia FP5



Easily adapt to new services and growing traffic demand

- 1st with 800GE interfaces
- Upgrade to 3X capacity
- Fully programmable



Protect against escalating network security threats

- New ANYsec flow-based encryption
- Enhanced DDoS protection and mitigation



Reduce carbon footprint of networking equipment

- 75% reduction in power consumption



IP Networks priorities: 2022 and beyond

Take Share in CSPs

- Continue to win in 5G IP transport
- Deliver on FP5
- Differentiate through collaboration with FN and ON
- Adaptive Cloud Networks

Expand in enterprise

- Export success into new geographies
- Expand into new verticals
- Bring new enterprise solutions to market

Drive webscale

- Build on success
- Develop tier 2 business
- Offer broad range of solutions

Deliver fundamentals

- Execute on fundamentals
- Continuing commitment to technology leadership

Optical Networks

Strong momentum in 2021

Networkwide migration



Sole supplier breakthrough
for NEWTON



Successful 914Km trial with
13 hops and 4 ROADMs



Data center interconnect
across the Middle East



IP/MPLS and DWDM, SDH
network replacement

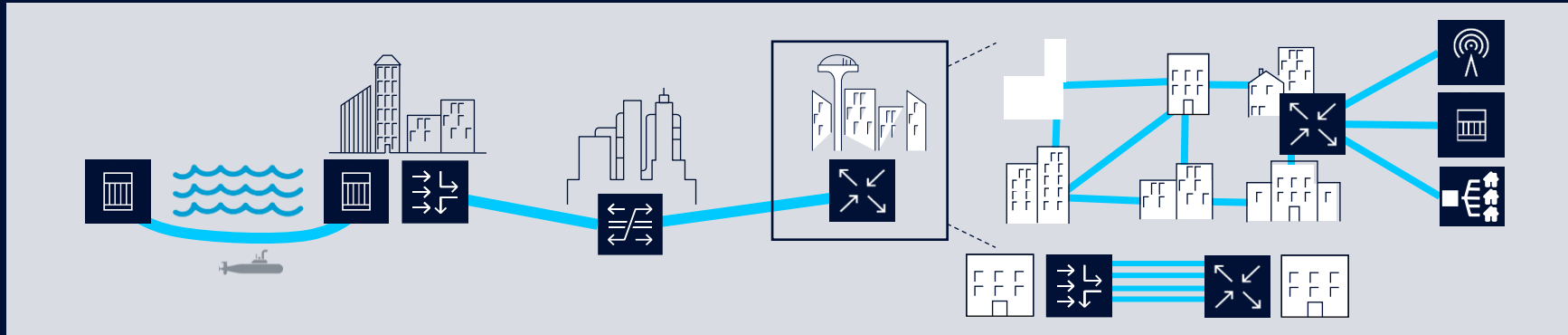


Modular data center
interconnect solution



Optical Networks are the foundation of all networked services

Networked
traffic



Scaling from edge to core

Network Automation



- Open and Transformative Software
- Connected NaaS Partner Ecosystem
- Value-added Professional Services

1830 ONE

Edge P-OTN and ROADM family



WaveLite

Multiservice CPE and WDM transport family



1830 PSD

10G CPE



1830 VWM

Access WDM family



1830 PSI-M



Compact Modular
Disaggregated transponder/SLTE

1830 PSI-L/CL



Open Optical
Disaggregated line systems

1830 PSS



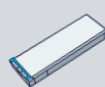
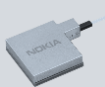
Optical Transport
Transponders
packet transport
and ROADMs

1830 PSS-x



P-OTN Switching
ODUk switching with
Integrated WDM

Photonic Service Engines (PSE)



Vertically integrated coherent
opto-electronics
and pluggable DCOs

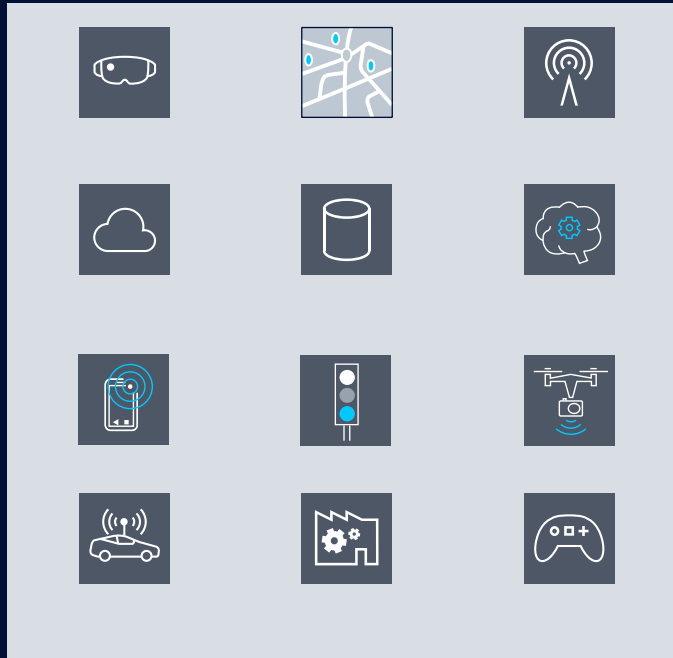
Access / Edge

Disaggregated

Core / Backbone

Delivering scale, efficiency and business outcomes

Building networks that inspire



Scalable solutions from edge to core

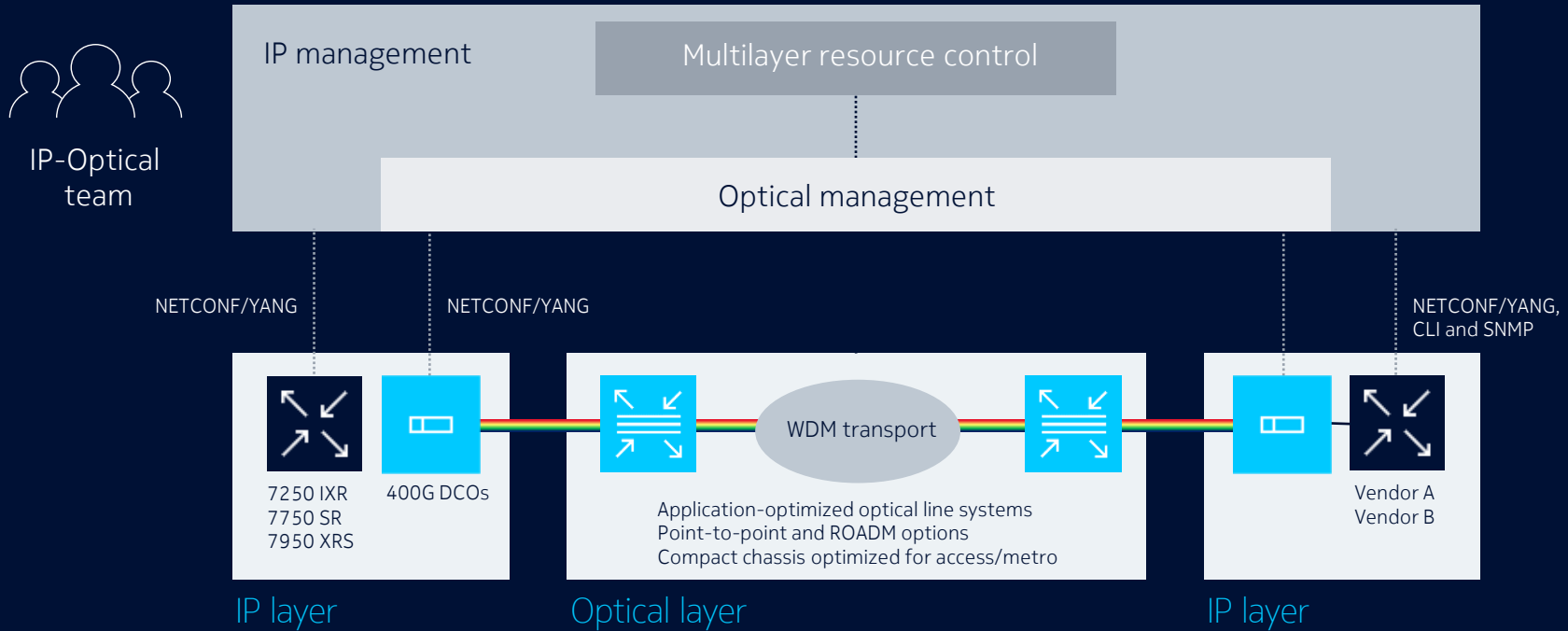
Enabling new services and revenue streams

Efficient network scaling through automation

Differentiated features and capabilities

Power/space savings and investment protection

End-to-end IP/optical management coordination and automation



NETwork CONFiguration Protocol = NETCONF, YANG is a language used to describe data models of network devices.

Submarine Networks

The customer base for subsea projects has changed radically

Internet traffic
through submarine
cables

99%

Hyperscaler
investment in
recent years

~2x

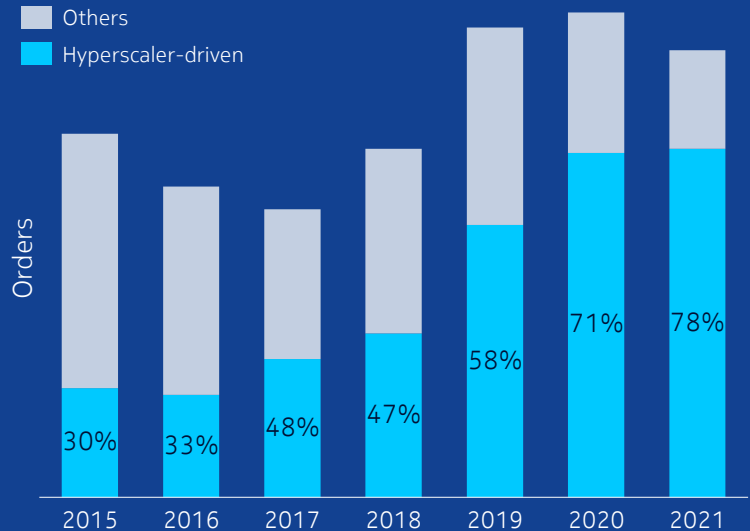
Nokia leadership
position, expertise,
experience and
capability

#1

Continuous actions
to retain leadership

Delivery capacity
Innovation
Digitalization

Telecom submarine
long-haul projects*



* Source Nokia: orders for telecom submarine long-haul projects

Success based on continuous innovation and operational excellence

2Africa CV

45,000km
Q1 2021

Bifrost

18,000km
Q1 2021

Europe-MEA
-India

9,000km
Q3 2021

O&G

Fiber Optic
Connectivity
2021

Continuous innovation

Manufacturing and
Marine operations

Focused actions to retain our leadership position

Continuous
innovation

Business
transformation

Operational
excellence

Networks that inspire

Differentiation
through
innovation

Protecting
customer
investment

Sustainability
and power
efficiency

3. Your questions

NOKIA

The word "NOKIA" is rendered in a large, bold, sans-serif font against a dark blue background. Each letter is filled with a different aerial night-time photograph of a highway or road interchange. The 'N' shows a multi-lane road with a median. The 'O' is a rounded rectangle containing a road with a central divider. The 'K' features a road with white directional arrows. The 'A' shows a road with a central green island. The other letters also depict various road scenes with lane markings and some greenery.