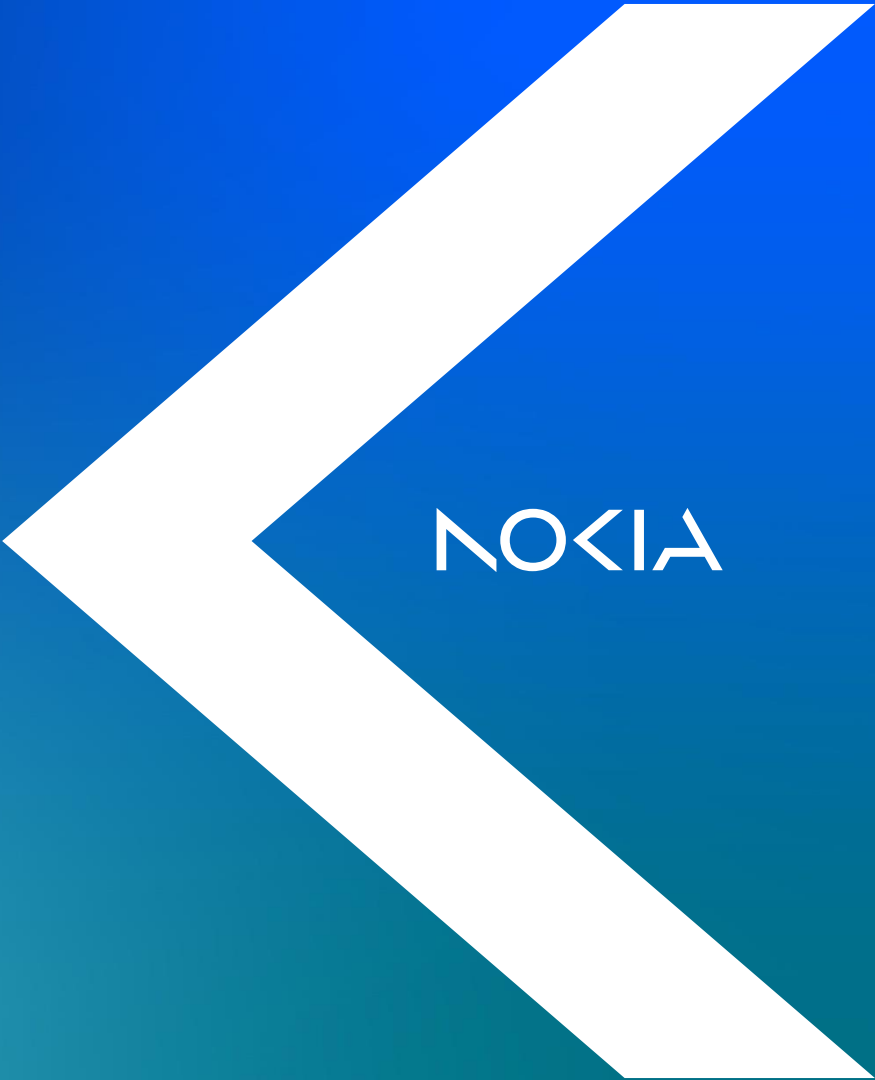


Nokia Optical LAN portfolio



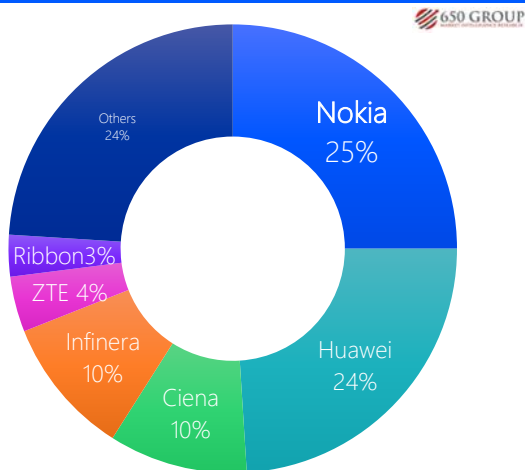
NOKIA

June 2024

Market traction validates Nokia Network Infrastructure strategy

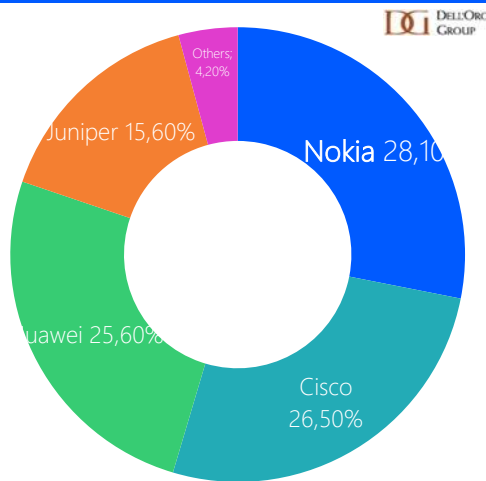
Decades of investment build leadership position in Europe

#1 Optical networks Europe



Nokia #1 optical vendor in Europe

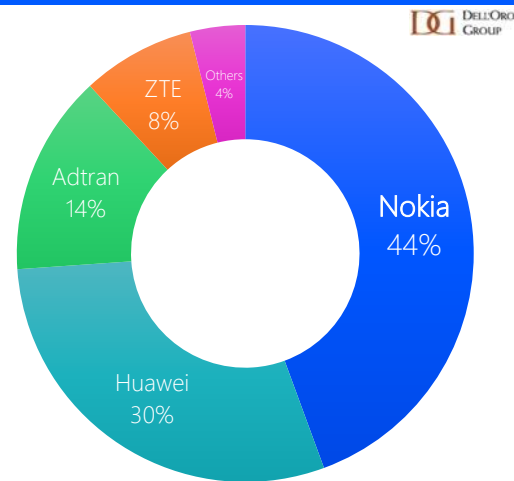
#1 IP total routing EMEA



Nokia finishing #1 IP in EMEA for 6th consecutive year

Dell'Oro: Service provider router & switch quarterly report 4Q23

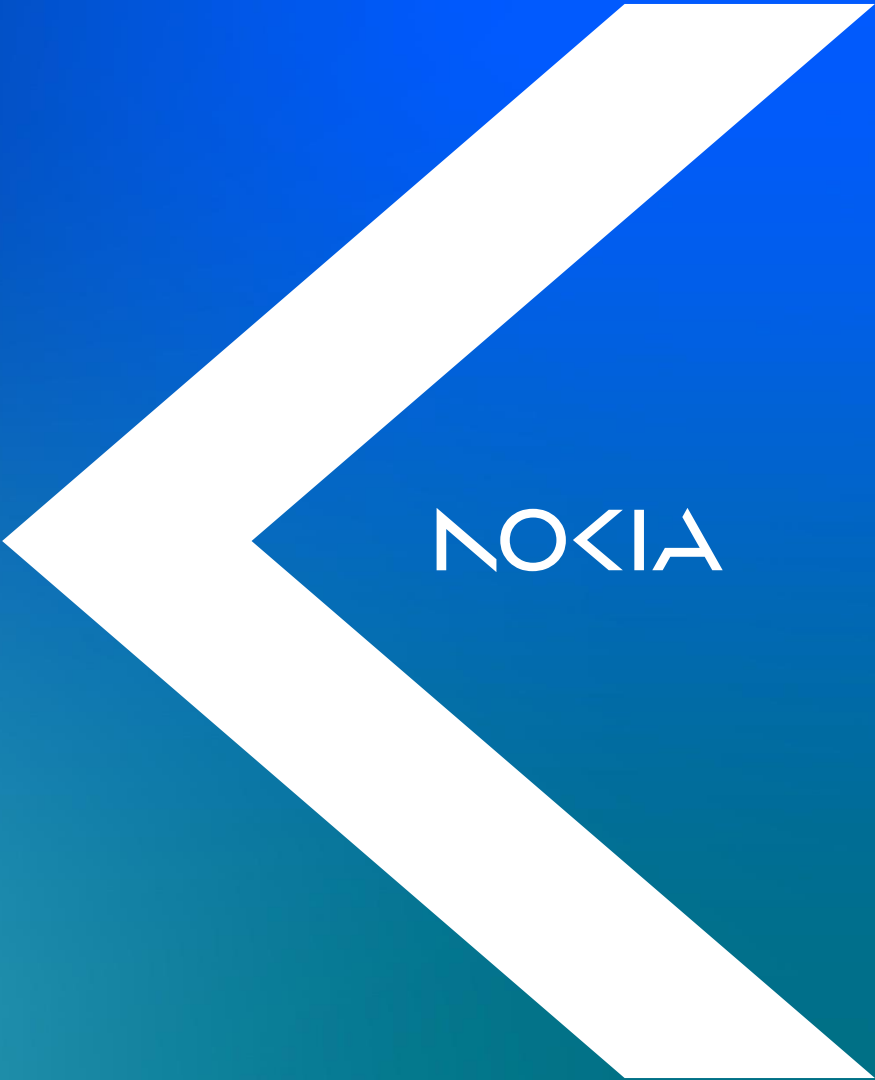
#1 PON OLT in EMEA



Nokia sustains long-term #1 leadership PON in EMEA

Dell'Oro: Broadband access reports 4Q23

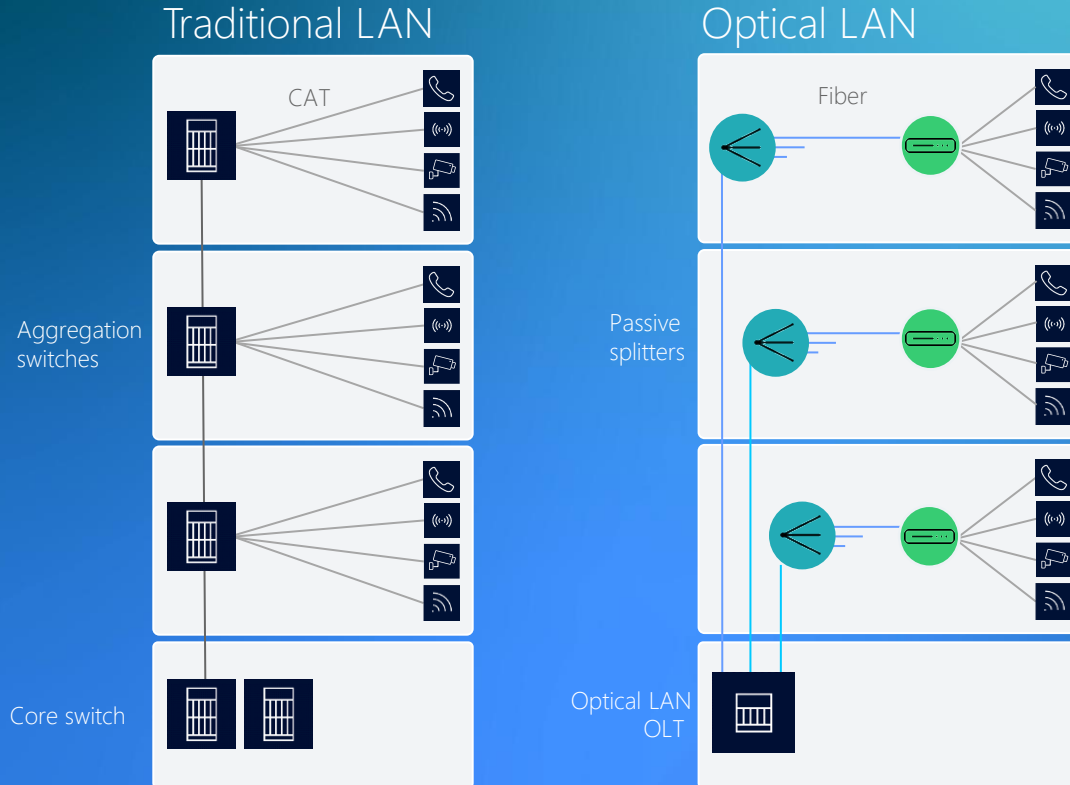
What is Optical LAN

The Nokia logo is positioned on the right side of the slide, centered vertically. It is a white, stylized wordmark. The background of the slide features a large, white, double-lined chevron shape pointing to the left, which frames the Nokia logo. The overall background is a gradient of blue and teal.

NOKIA

What is Optical LAN?

A smarter way to structure the network based on PON technology

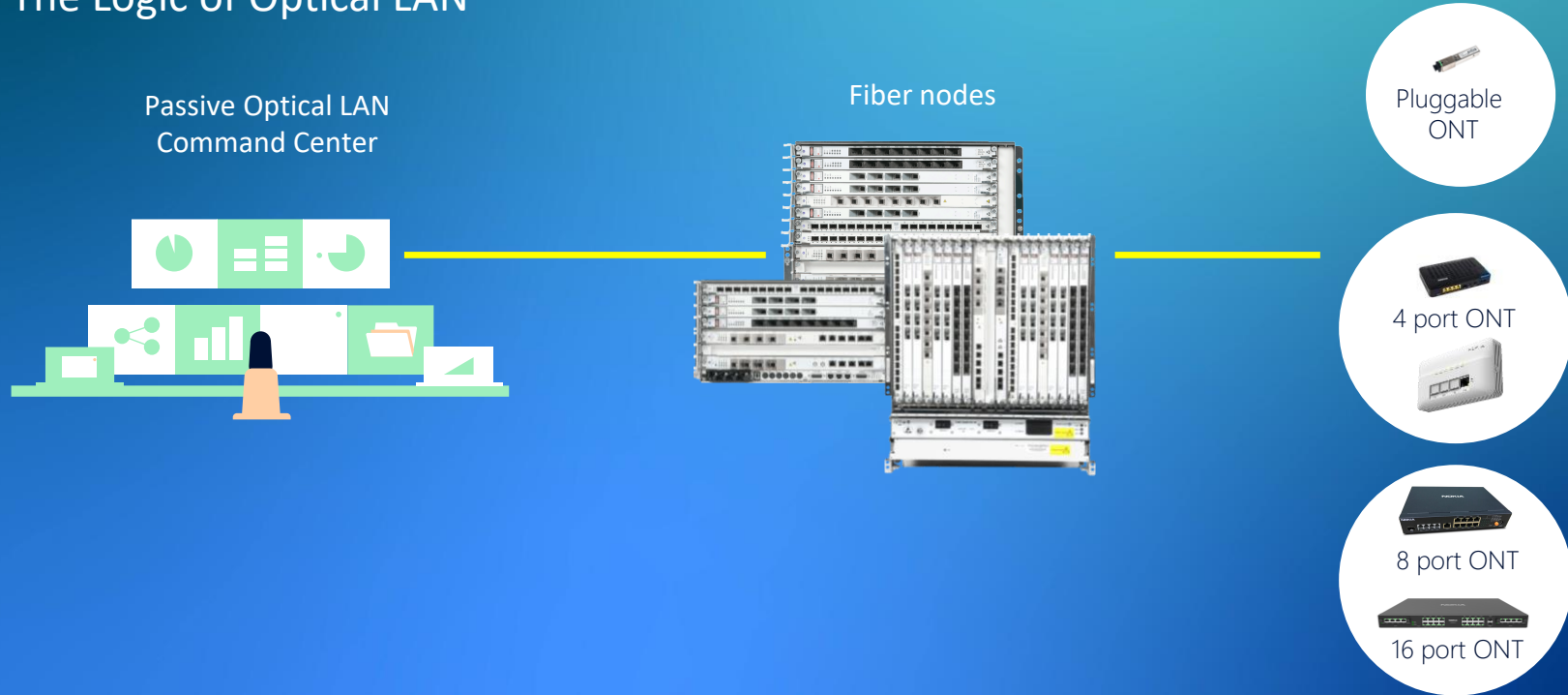


KEY BENEFITS

- Less equipment , less cables
- Less floor space
- Less power consumption
- Easier maintenance
- Cost-efficient upgrades
- Carrier grade reliability
- Military grade security

Nokia Optical LAN

The Logic of Optical LAN



Optical LAN: more benefits at a lower cost

Huge Capacity

2.5 Gbps
10 Gbps
25 Gbps

Lower TCO

Up to 50% savings

Investment protection

More value and
lifespan of
50+ years

Green network

7x

Smaller cable
volume

40%

Energy savings

90%

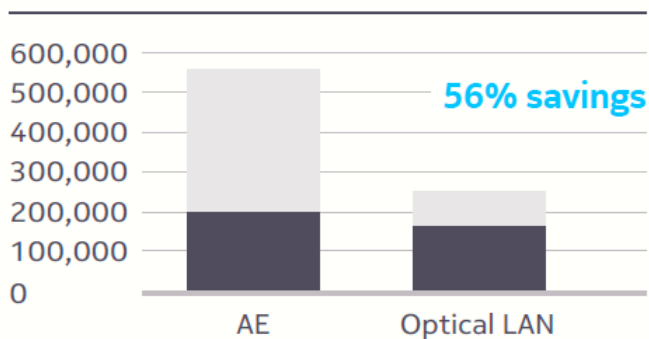
IT floor space
reduction

Based on a network with 620 end-points

CAPEX and OPEX savings

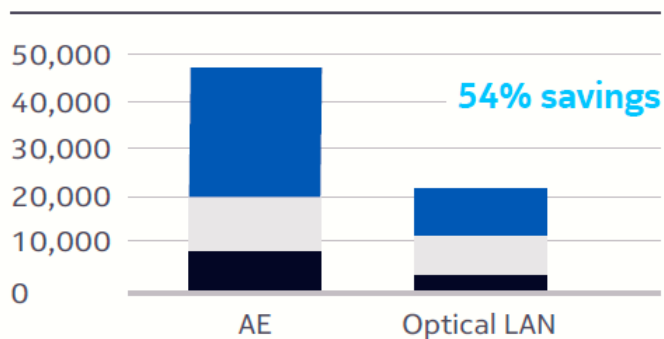
Optical LAN vs Ethernet LAN: cost comparison for 2,000 end-points over 10 floors

CAPEX (\$)



■ Cabling
■ Electronics

OPEX (\$)



■ Maintenance
■ Energy
■ Floor space

>50% savings in year 1!

Benefits of Nokia Optical LAN

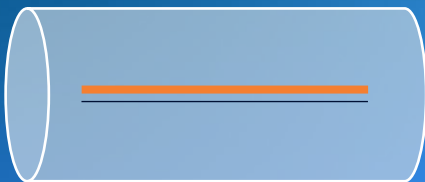
NOKIA

Benefits

All PON technologies over a single fiber

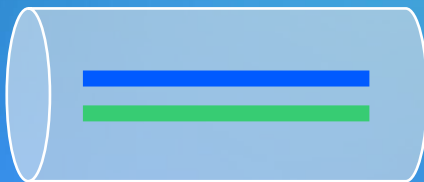
GPON

- 2.5Gbps downstream
- 1.2Gbps upstream



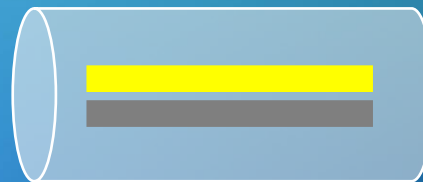
XGS-PON

- 10Gbps downstream
- 10Gbps upstream



25 GPON

- 25Gbps downstream
- 10 or 25Gbps upstream



Be ready for the future

- Boost bandwidth & performance
- Choice of split ratio and splitter stages
- Increase number of users



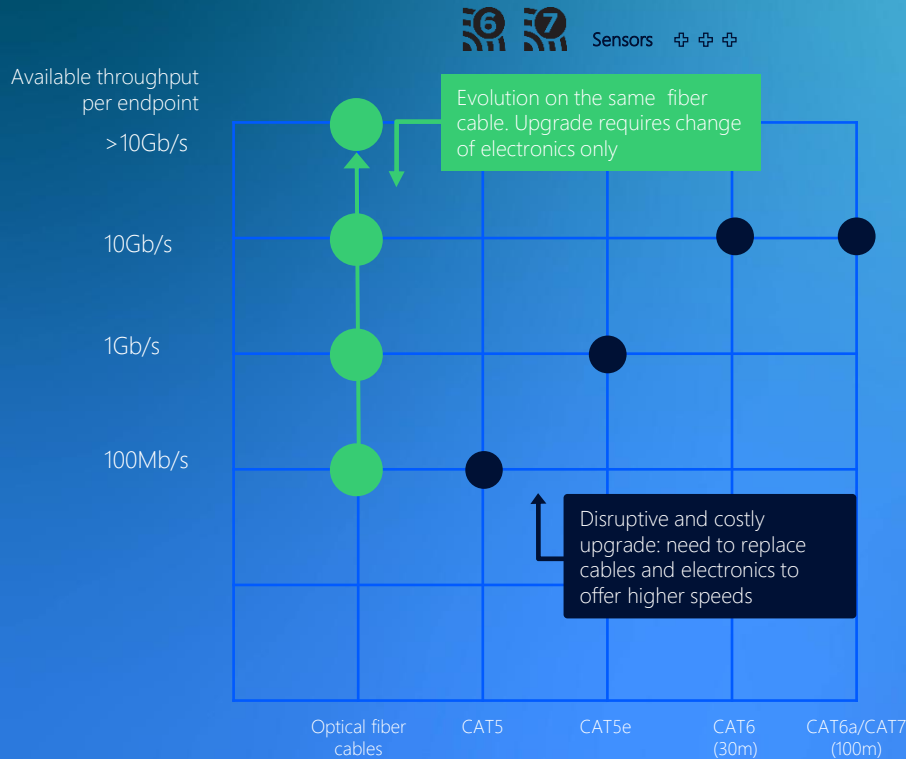
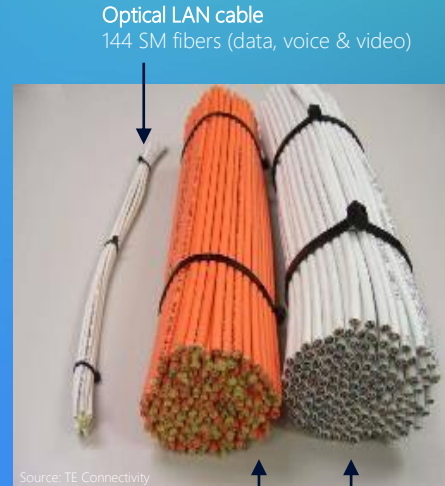
On existing infrastructure

- Same fiber, splitter & OLT
- Can be deployed on top of GPON
- Full-service separation on same network



Benefits

Less Cables, more throughput



Conventional cables
144 MM fiber pairs (data)
144 copper cables (4-pair, voice)

Replacing passive cable infrastructure comes with huge costs

Optical LAN allows to **protect the investment** for a much longer time compared to traditional LAN



NOKIA

Benefits

Investment protection



Deploy and ready infrastructure for the future

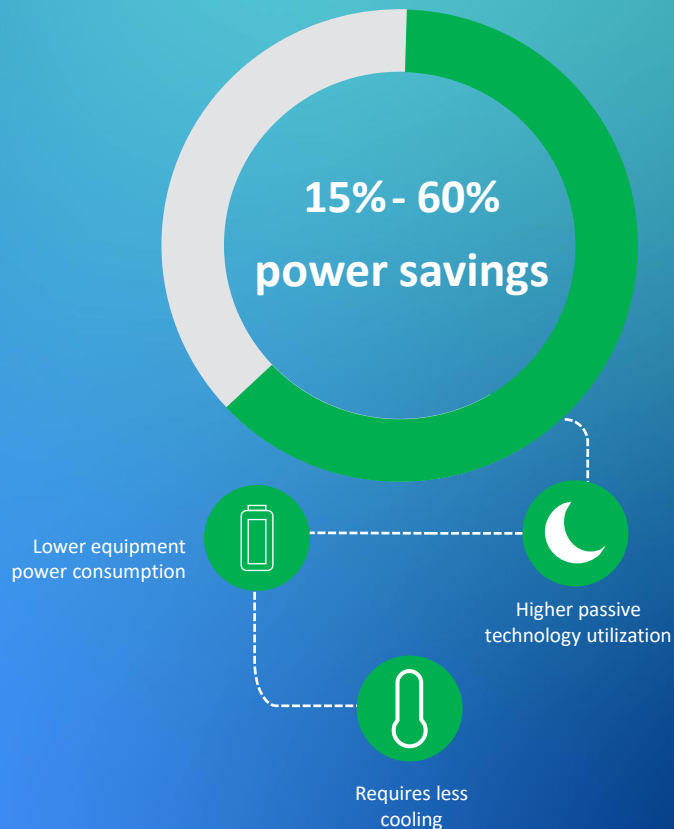
- Fiber longevity beyond 50+ years
- Ease of deployment and robustness vs traditional copper cables
- Network evolutions are graceful, cost efficient and without a forklift upgrade. From GPON to XGS-PON to 25GS-PON and beyond on the same fiber (no impact on fiber plant)

Benefits

Sustainability

Optical LAN

- eliminates the need for midspan electronics, power, and cooling infrastructure
- uses smaller, lighter, less expensive Single Mode Fiber (SMF) cables to reduce pathway and space requirements
- virtually eliminates the need to refresh cabling infrastructures every few years



Benefits

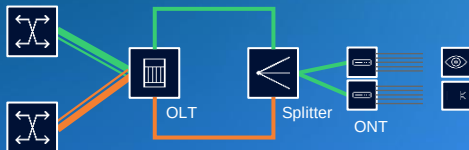
Reliability, redundancy, security & QoS

Reliability & redundancy

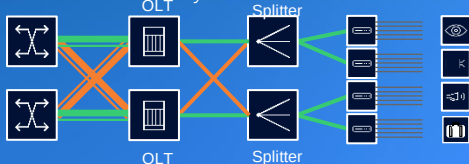
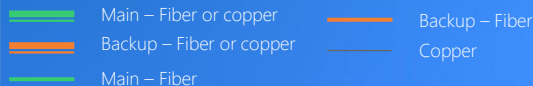
Carrier grade performance and 5 x 9 service availability

Redundancy

- Intra-chassis



- Geo redundancy



Security

Intrinsic built-in security features

- Military-grade security with AES-128 data encryption
- Fine grain mgt control with role & resource-based access control
- Fiber optic is inherently a more secure medium & difficult to tap-in, not subject to EMI nor does it introduce EMI
- ONTs are thin-client devices: can't be managed and accessed locally (unlike switches)

Specific Compliance

- US Government Security standard: FIPS PUB 140-2
- US Department of Defense Joint Interoperability Test Command (JITC)

QoS

Nokia Optical LAN QoS

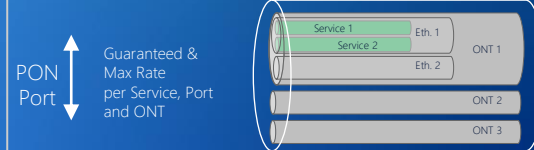
- GPON Standard implementation
- Per ONT, Ethernet Port, VLAN

Allows to define various types of services with different priority

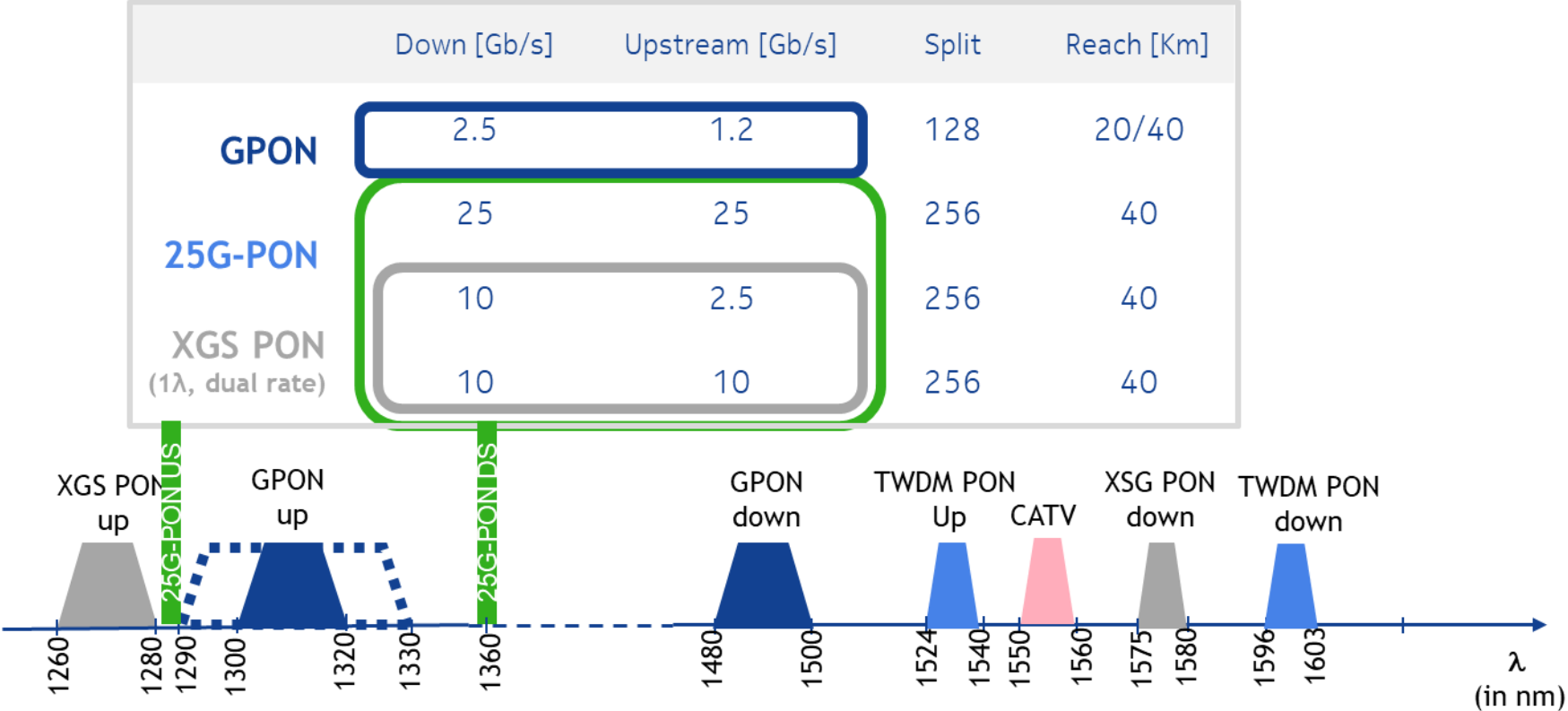
- Uplink traffic



- Downlink traffic



Evolution to Next-Generation possible on same fiber network



Nokia POL products overview

OLT portfolio

OLT portfolio for any deployment and any service

Powered by



FX-16



FX-8



FX-4



SF-8



DF-16



DF-32



MF-2



MF-14

Large central office
deployments

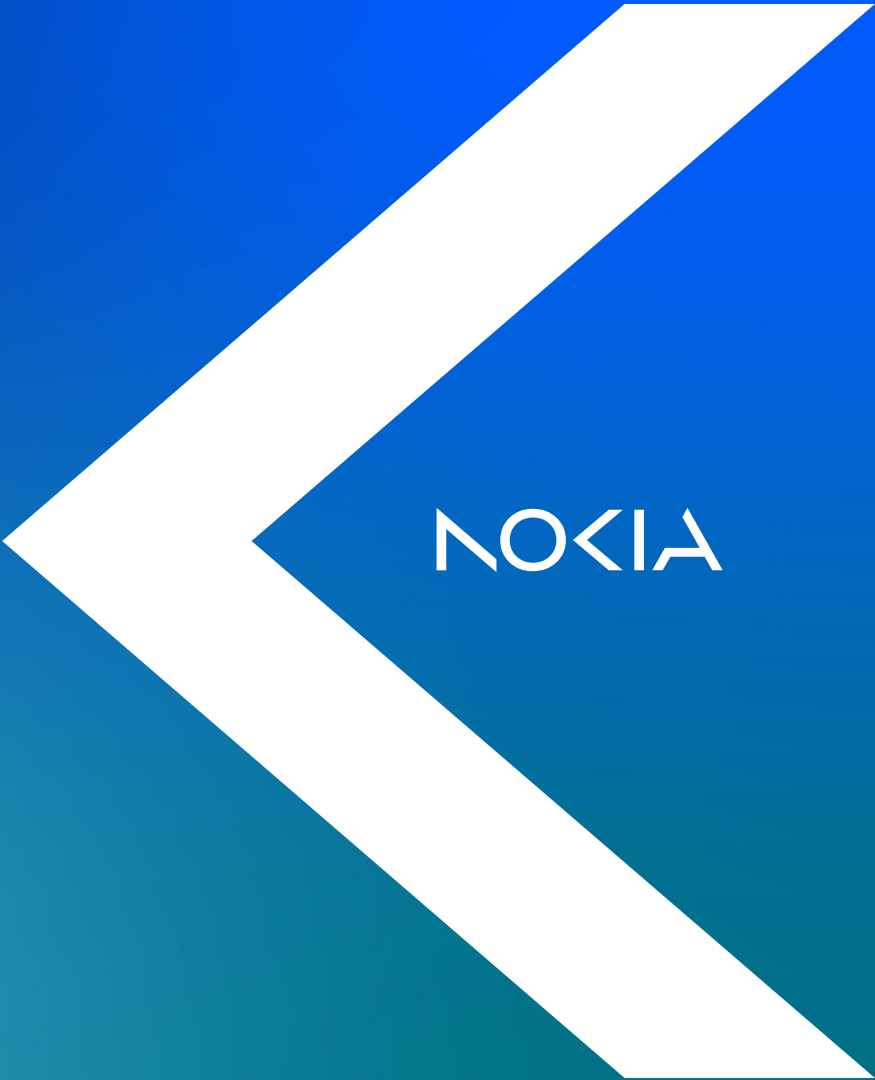
Outside
deployments

Low density
deployments

Massive delivery of 25G
and beyond

Nokia POL products overview

ONT portfolio

The Nokia logo is positioned within a large, white, stylized arrow graphic that points to the left. The arrow is composed of two parallel diagonal lines forming a chevron shape. The background of the slide is a gradient of blue, transitioning from a darker shade at the top to a lighter shade at the bottom.

NOKIA

Nokia Optical LAN

ONU Terminals



G-040P-Q



G-040P-R



SFP ONT



G-240G-A



U-490XP-P



G-010G-R / XS-010X-Q



G/XS-2425/6G-A



Features

- Depending on variant
 - Uplink: GPON or XGS PON
 - User interface: 1.4 x 1G, 2.5G, 5G, 10G
 - POE: G-040P-Q PoE+, compliant with IEEE 802.3af and IEEE 802.3at; Locally or remotely powered
 - POTS Interfaces
 - Extended Temperature Range (G-040G-A)
 - Desktop or wall mountable
 - Residential WiFi

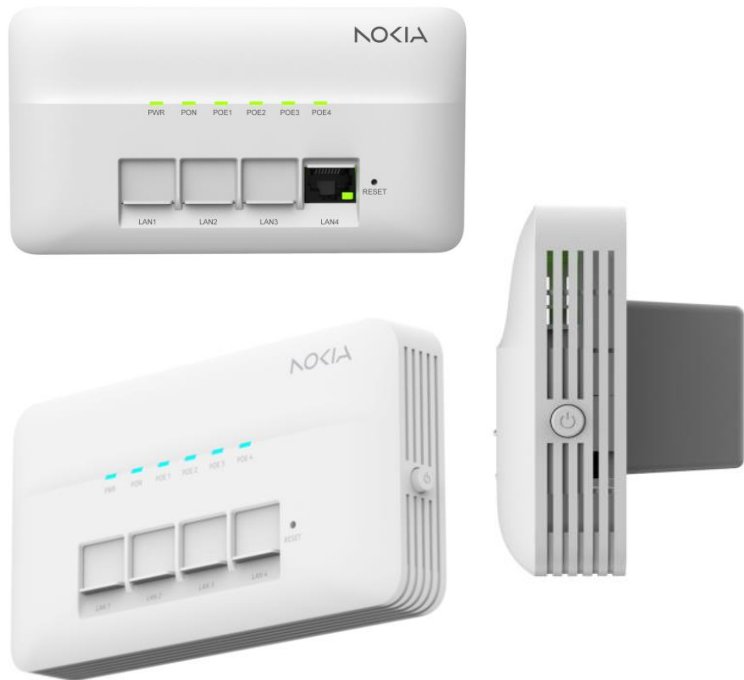
Benefits

- Gigabit speeds to Ethernet devices
- Prioritizes services per user with the ability to burst up to the full line rate through advanced dynamic bandwidth management
- Guarantees very high quality of service (QoS) and security

NOKIA

Nokia Optical LAN

ONU G-040P-R



NEW
2024

Features

- Uplink: GPON
- User interface: 4x 10/100/1000
- In-wall mounting
- Local or Remote powering
- 802.3af PoE/Type2 802.3at POE+/802.3bt PoE++
- Temperature (-5°C to +45°C)
- Up to 60W per LAN port and 130W across the LAN ports

Benefits

- Integrated SFU device for GPON Network
- 2P Services: Data IPTV
- Economical GPON-to-Ethernet converter

Nokia Optical LAN

ONU G-010G-R

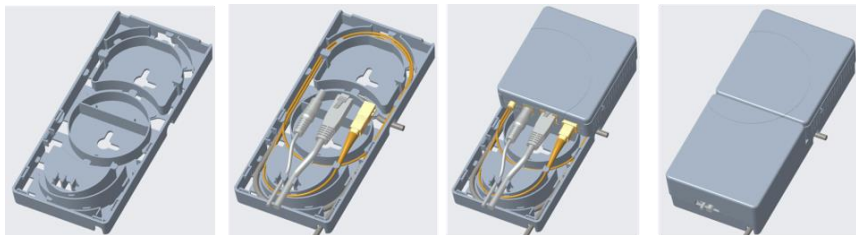


Features

- Uplink: GPON
- User interface: 1/2.5G
- Desktop or wall mountable (bracket possible)

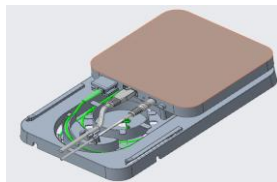
Benefits

- Low power consumption (<3.4W)
- Economical GPON-to-Ethernet converter



Nokia Optical LAN

ONU XS-010X-Q



Features

- Uplink: XGS PON
- User interfaces: 10Gbps

Benefits

- Gigabit speed to Ethernet devices
- Prioritizes services per user with the ability to burst up to the full line rate through advanced dynamic bandwidth management
- Guarantees very high quality of service (QoS) and security

Nokia Optical LAN

ONU G-040P-Q



4 x 1G Eth Interfaces

GPON

Features

- Uplink: GPON with class B+ optics
- User interface: 4 x 1G
- PoE+, compliant with IEEE 802.3af and IEEE 802.3at
- Locally or remotely powered
- Desktop or wall mountable

Benefits

- Gigabit speed to Ethernet devices
- Prioritizes services per user with the ability to burst up to the full line rate through advanced dynamic bandwidth management
- Guarantees very high quality of service (QoS) and security

Nokia Optical LAN

ONU U-490XP-P



GPON or XGSPON



4 x POTS



1 x 10G Eth Interface



8 x 1G Eth Interfaces



56V DC Input

Features

- Uplink: GPON or XGS-PON
- Interface: 8 x GE or 1 x 10GE, 4 x POTS
- Locally powered
- PoE to devices
- Ceiling, wall or desk mounted
- Temperature hardened (-25°C to +55°C)

Benefits

- Gigabit speed to Ethernet devices
- Prioritizes services per user with the ability to burst up to the full line rate through advanced dynamic bandwidth management
- Guarantees very high quality of service (QoS) and security

Nokia Optical LAN

ONU XS-230X-A



Features

- Uplink: XGS-PON
- Interfaces:
 - 2xGE, 1X 100M/1G/2.5G/10G
 - 2xPOTS
- Locally powered
- Wall or desk mounted
- Temperature hardened (-40°C to +65°C)

Benefits

- Triple play services
- Embedded Nokia WiFi Mesh
- Intelligent Routing
- Service per port configuration

Nokia Optical LAN

ONU XS/G-2426G-A



Features

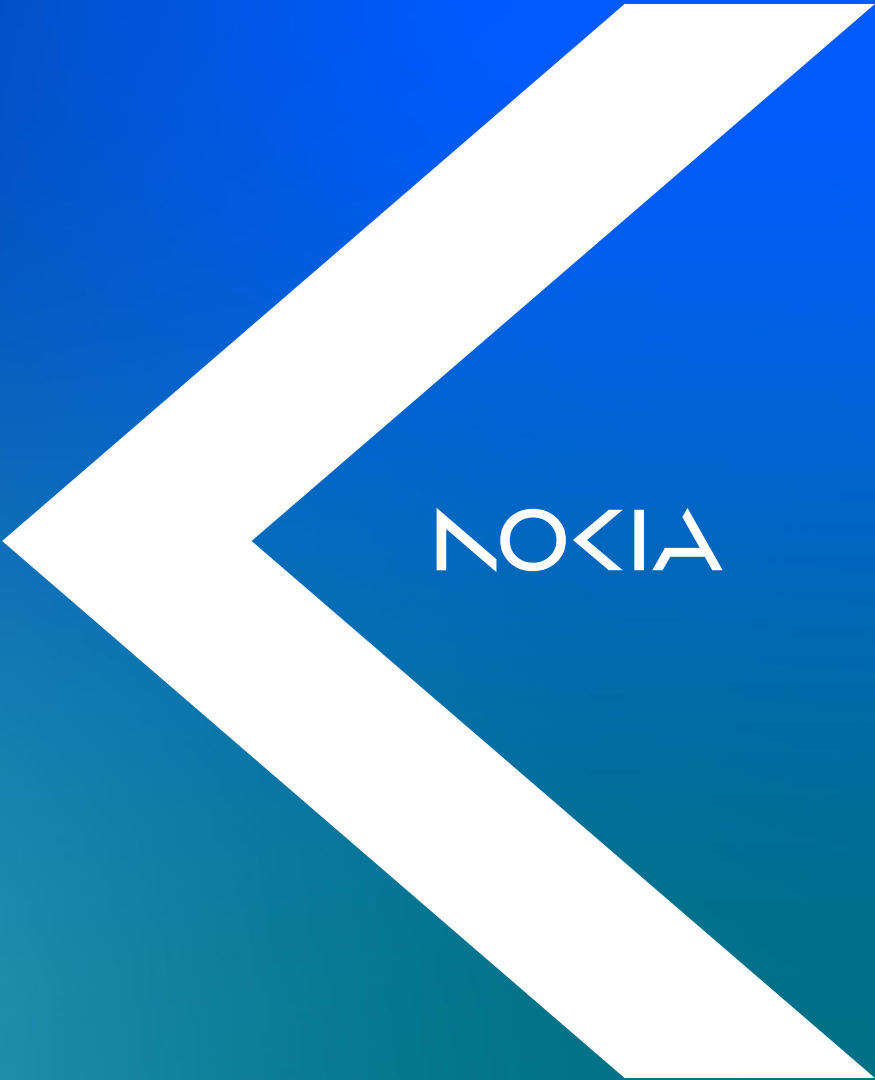
- Uplink: XGS/G-PON
- Interface: 2xPOTS; 4xGE
- Locally powered
- WiFi 6 RGW
- Wall or desk mounted
- Commercial temperature (-5°C to +45°C)

Benefits

- Triple play services
- Embedded Nokia WiFi Mesh
- Intelligent Routing
- Service per port configuration

POL command Center

PCC 5571

The Nokia logo is positioned on the right side of the slide, centered vertically. It is a white, stylized wordmark that reads "NOKIA". The logo is set against a large, white, double-lined chevron graphic that points to the left, which is superimposed on a blue background that transitions from a darker blue at the top to a lighter teal at the bottom.

NOKIA

5571 PCC – realistic network view

Easily customize for your environment

- Upload your floor plans
- Display ONTs in their actual location

Multiple ways to navigate to ONTs

- By floor plan: displays aggregated stats
- By Tile view
- Filtered from a list

ONT detail view

- Services
- OLT shelf, Line Termination (LT) Card and the port it is connected to
- Alarms



The floor plan gives a real time network status view, which in-turn helps in network planning & augmentation. It assists with quick reactivity to network issues.

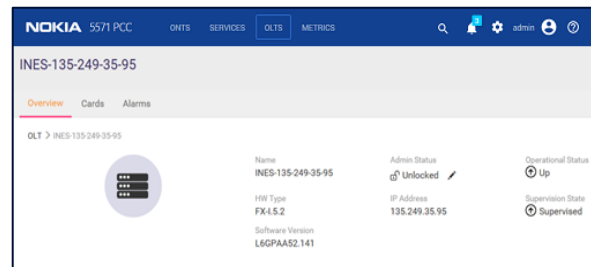
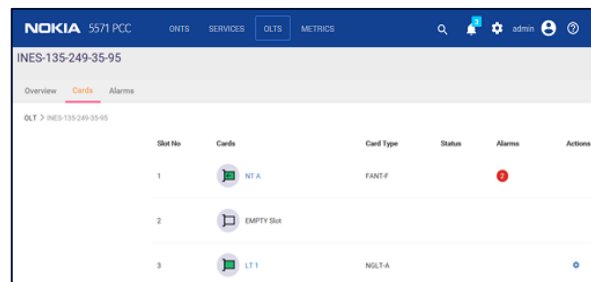
Optical Line Terminal (OLT) Configuration

Add an OLT with one easy step

OLT automatically discovered based on specified IP address or address range

OLT is automatically supervised by PCC

PCC pushes pre-defined POL configuration to the OLT based on cards installed



Single touch OLT provisioning

Optical Network Terminal (ONT) Operations

ONT Activation

- Connect ONT to the fiber network
- POL Command Center recognizes the ONT and activates automatically
- Configures the ONT and associated ports
- Based on your default service definition
- Its that simple

Follow-up activities

- Manually assign an alternate service definition
- Modify service mapping
- Assign ONT to a location on a floor plan

Replace or Copy an ONT



Zero touch provisioning & easy management of ONTs

Troubleshooting & alarms

PCC specific troubleshooting tasks are provided

- Fully compatible with touch and mobile devices for people on the move

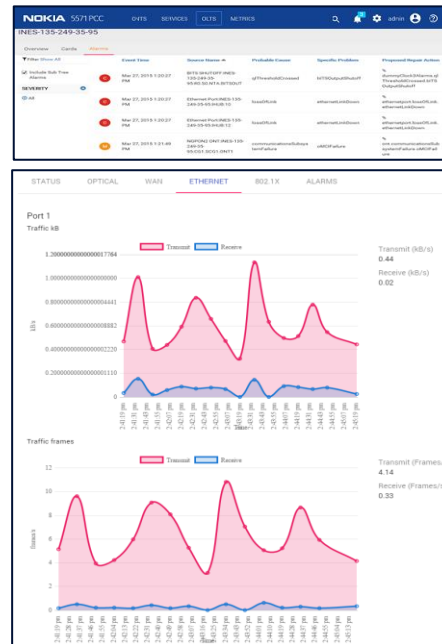
Common types of faults:

- ONT down
- Cable fault
- LT card unplugged
- OLT fault

Relevant alarms shown in each view

Active alarms views at:

- OLT
- OLT card
- ONT
- service levels



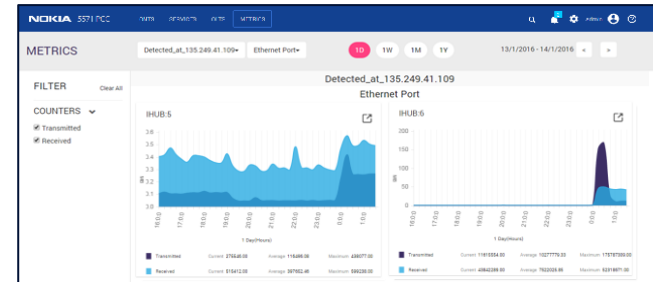
Metrics

Continuously monitor and visualize performance using its metric data

Metrics provide an overview of the overall network health at different intervals

Metrics based on:

- Alarms
- Ethernet Uplink Ports
- L2 Services
- IP System Parameters



POL market references

NOKIA

Nokia Optical LAN ... for all use cases



600+ Global references



Hospitality

Global Hotel Chain

Country: Romania

Project Description:

- 200 rooms hotel part of Accor Group
- 24+7km CAT6+RF Cable vs 7km Fiber Cable

Services & Applications:

- Room Internet
- CATV transport (RF Overlay)
- Analog Telephony
- IP Telephony
- WiFi APs connectivity
- Internal LAN



Office LAN



VoIP
telephony



High
Speed
Internet



Analog
Phone

Project Scope	OLT	PON Port	ONT	5571 PCC
QTY	1	6	130	YES





Hospitality

Sheraton Hotel Rome

Country: Italy Date: 2023

Project description:

- Nokia POL is installed in the hotel, BBQ area, parking area and their office.

Services & applications:

- CCTV
- Wi-Fi
- Internet Access
- Office LAN
- IPTV
- Control Access
- VoIP Telephony



Office LAN



VoIP telephony



High speed internet



Wi-Fi Access



IPTV



CCTV



IPTV

Project Scope	OLT	PON Port	ONT	5571 PCC
QTY	1	32	422	YES





Education

33 Schools

Country: Romania Date: 2022/23

Project Description:

- Project for Deployment of Smart Classes in 33 Schools.
- GPON used as backhauling for WiFi Extension. Demand of optical fiber was to minimize impact of structured cabling.
- Predefined standard packages, for 30 classes schools, including SmartClass Equipment (SmartBoard, projector, WiFi AP, Tablets, school cabling with OF, LTs, ONTs).
- WiFi backhauling is based on 7362 DF-8 + 30 x G-120G-E. Several projects further supervision will be based on 5520 AMS Starter, service delivered as part of Maintenance.
- Nokia GPON is completed on routing/FW part with EU supplied router (MikroTik)

KSF:

- Easy deployment of Optical Fiber versus copper (no cable trays, subracks etc)
- Effective TCO, easy installation and scalability of network capacity

Services & Applications:

- WiFi backhauling
- CCTV for classroom surveillance to be introduced as a second step.



Wi-fi
Access



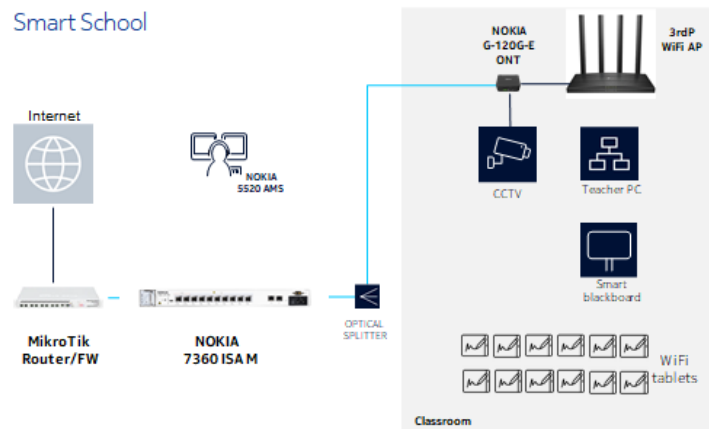
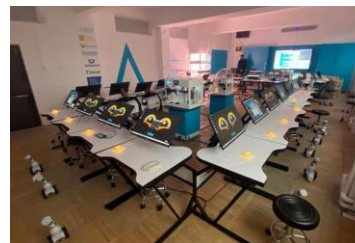
CCTV



Analog
Phone

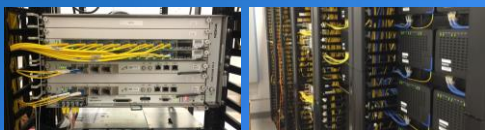
Project Scope	OLT	PON Port	ONT	5571 PCC
QTY	33	264	990	5520 AMS

Smart School

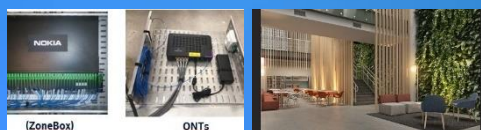


Fly Your Own Jets

Nokia NAM HQ
Cypress Waters USA



Nokia LATAM HQ
Sao Paulo Brazil



Nokia office
Chengdu China



Other locations: Stuttgart, Singapore, Bangkok and more

Paris cyber campus

The challenge

- Deliver an advanced IT solution for cyber security space, bring together the main national and international players, such as Orange Cyber Defense, ANSSI... and more than 60 others

The solution

- Nokia will deploy its passive optical Lan (POL) solution to deliver a secure, fiber-based in-building network for connectivity.
- Office LAN, VoIP, HSI, Wi-Fi, access door security, IPTV & CCTV
- Redundancy through type B Protection

The benefits

POL Command Center (PCC) –
easy making changes or
replacements for large

Resilient access based on
Type-B 2:N architecture

Large bandwidth available



Singapore's Changi Airport with Optical LAN

The challenge

- Enhance security and improve operational efficiencies by connecting massive amount of CCTV cameras
- Address growing data demands securely and cost-efficiently
- Smaller IT footprint with greater coverage and capacity

The solution

- Optical LAN provides 200x better coverage from a single central location
- Optical LAN converges all video, voice and data requirements on a single fiber infra

The benefits

POL Command Center (PCC) – intuitive network management platform

Full geo redundancy for terminals 1,2,3

Large capacity can be expanded to handle more use cases, services and devices

Press release: [Nokia, Beacon advance digital transformation of Singapore's Changi Airport with Optical LAN](#)



Nokia and Orange France deploy Optical LAN solution over 20 sites

Project description

- POL replaces the existing copper-based LAN, connecting more than 5,000 end points including Wi-Fi and hard-wired terminals
- Switching from traditional LAN to POL technology means a more compact solution, with less energy consumption and much better performance proving the best possible user experience.

The solution

- Nokia Optical LAN

The benefits

Superior user experiences and offers a low energy solution for in-building and campus connectivity

Long-term value, easy and cost-efficiently upgradable to increase speed and capacity

[Press release: Nokia and Orange France deploy Optical LAN solution over 20 sites](#)



Ministry of Defense Egypt



The challenge

- IT infrastructure for VoIP in military staff housing, buildings, healthcare, training and education facilities on large campuses.
- Some of the challenges they face are: Large distances, Security, Address growing data demands, IT cost, trusted supplier

The solution

- Nokia Optical LAN for in-building and extended campus connectivity
- Greater reach than traditional copper IT technology
- Built-in data encryption
- High capacity (future-proof)
- Cost-effective

The benefits

HA and flexible IT infra, 200x better coverage from single location, ready to scale for future requirements.

Secure solution: built-in AES-128 encryption, fiber optic cabling difficult to tap, ONTs are thin-client devices with no local mgt access, role and resource access control

Less active components and cabling, reduced power consumption, simplified network operation.



NOKIA