

Como integrar as soluções de GPON e DWDM NOKIA em uma planta chinesa existente.

Leandro Kuhn

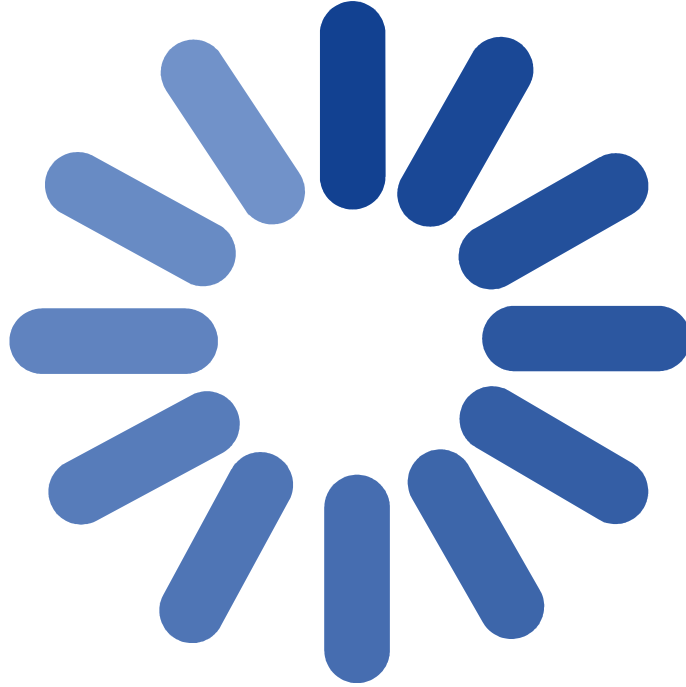
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Setembro de 2019



NOKIA

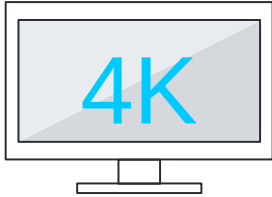
The killer app for a gigabit
Human impatience



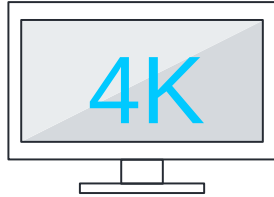
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Tomorrow's killer app : laziness

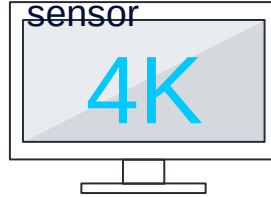
Tomorrow's
fridge



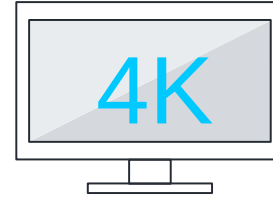
Tomorrow's
parking management



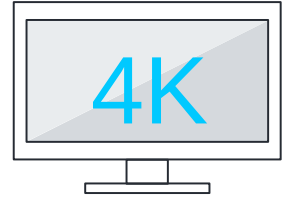
Tomorrow's
smoke
sensor



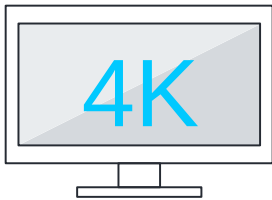
Tomorrow's
door sensor



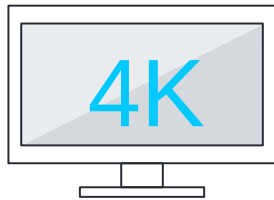
Tomorrow's
motion detector



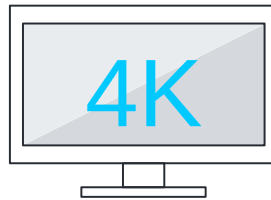
Tomorrow's
crowd control



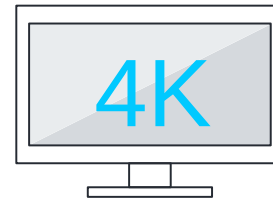
Tomorrow's
traffic management



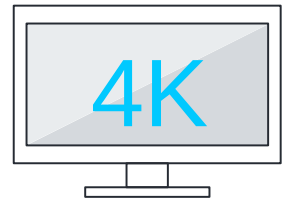
Tomorrow's
retail analytics



Tomorrow's
self check-out



Tomorrow's
quality inspection



GIGABIT UP AND DOWN

+1000%
Internet Video
Surveillance Traffic
Growth 2015~2020

82%
of Internet traffic will
be for IP video in
2020

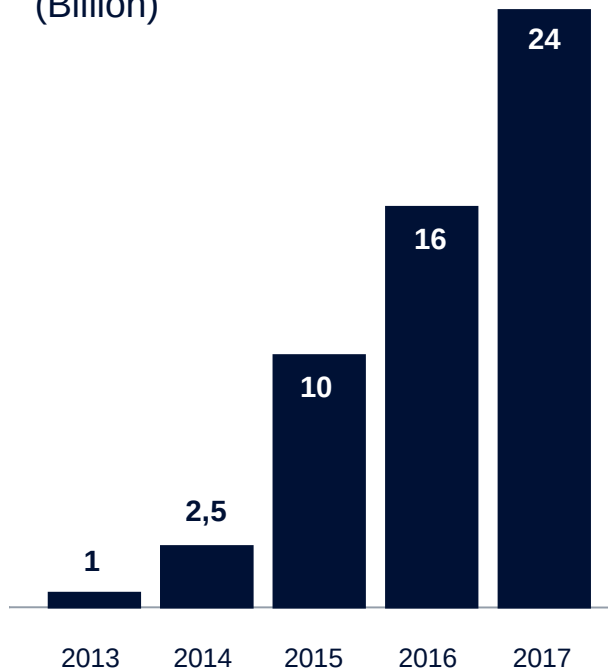
1million
minutes of video
transmitted every
second in 2020

200million
VR Headsets to be
sold by 2020

5million
years to watch all
the video shared
every month in 2019

And it is only going to get worse...

Wi-Fi Devices Shipments
(Billion)



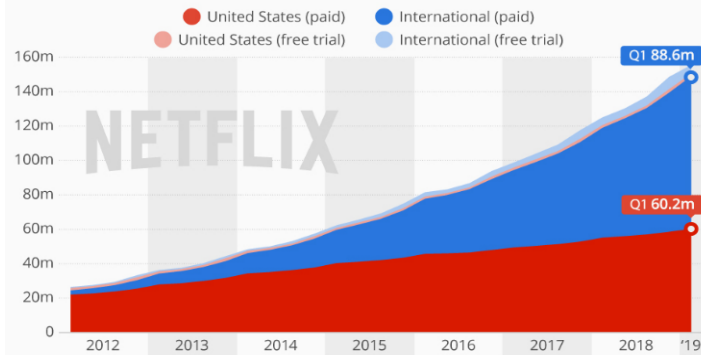
Streaming
music



Streaming
video

Netflix Reaches 149 Million Paid Subscribers

Netflix's worldwide streaming subscribers at the end of the respective period



The challenge
a gigabit
to everyone
and everything
up and down



The 10G PON game is on

Today

Operators worldwide are testing or deploying 10G PON



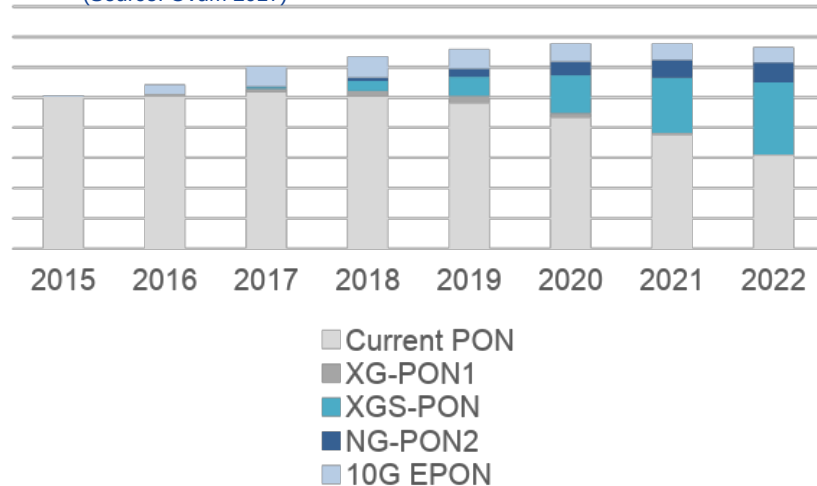
Drivers:

- 5G readiness
- Market leading speeds
- Service convergence
- Technology proof of concept

Future

By 2022: 10G PON may overtake current PON

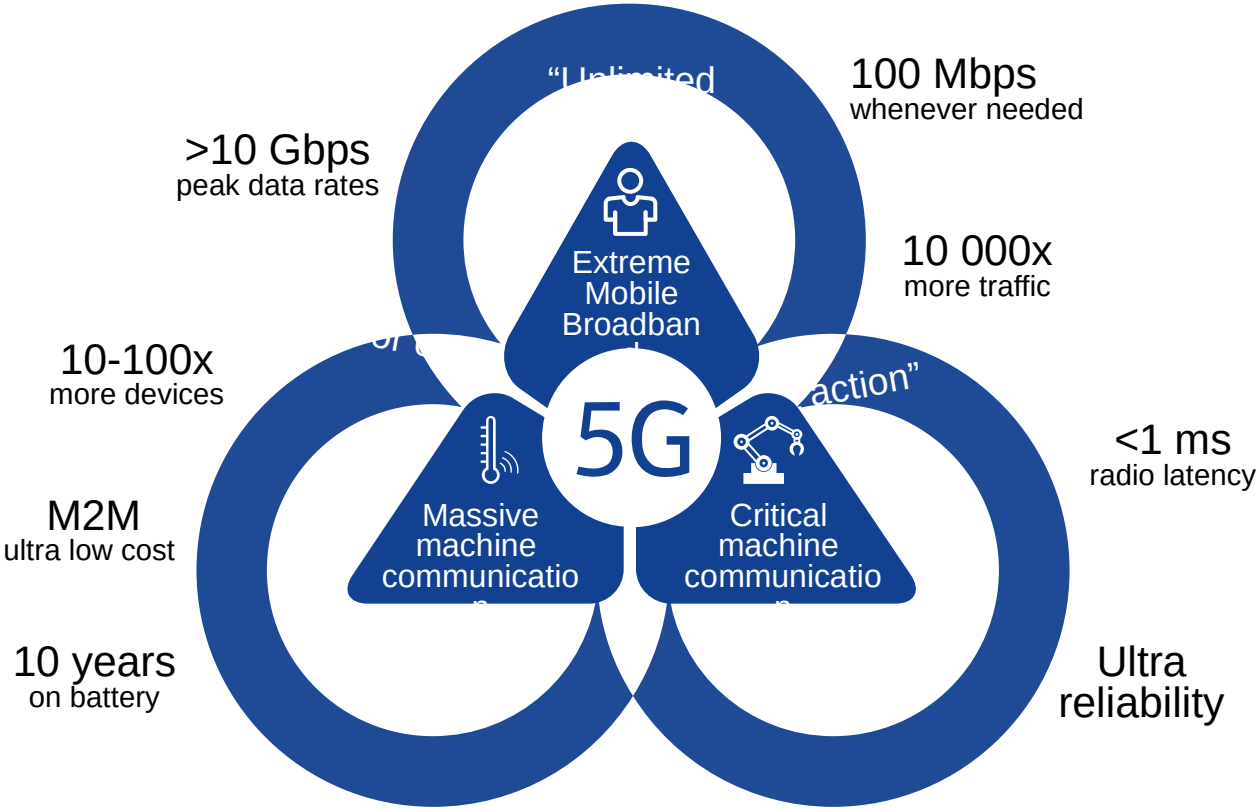
(Source: Ovum 2017)



Common analysts' view:

- 10G PON is growing
- XGS prevails – Symmetric traffic is a must
- XG-PON1 and 10G EPON flattering out

5G will change everything



Fiber access scales with the mobile network densification



	Traffic today	LTE Advanced	5G cm spectrum	5G mm spectrum
Throughput	100 Mb/s	150-300 Mb/s	1 Gb/s	10 Gb/s
Intercell distance	225m / 246yd	140m / 153yd	80m / 87yd	57m / 62yd
Sites per km ² /mi ²	15 / 39	50 / 129	150 / 388	300 / 777

x3

x3

x2

=10%
of residential FTTH
in urban area

Improving the business case for FTTH



Slicing enables network sharing

- Converging multiple services
- Co-investing & wholesale

Multi-vendor ONU Connect solves PON interop

- Virtualized ONU management
- Supports any ONU/OMCI stack

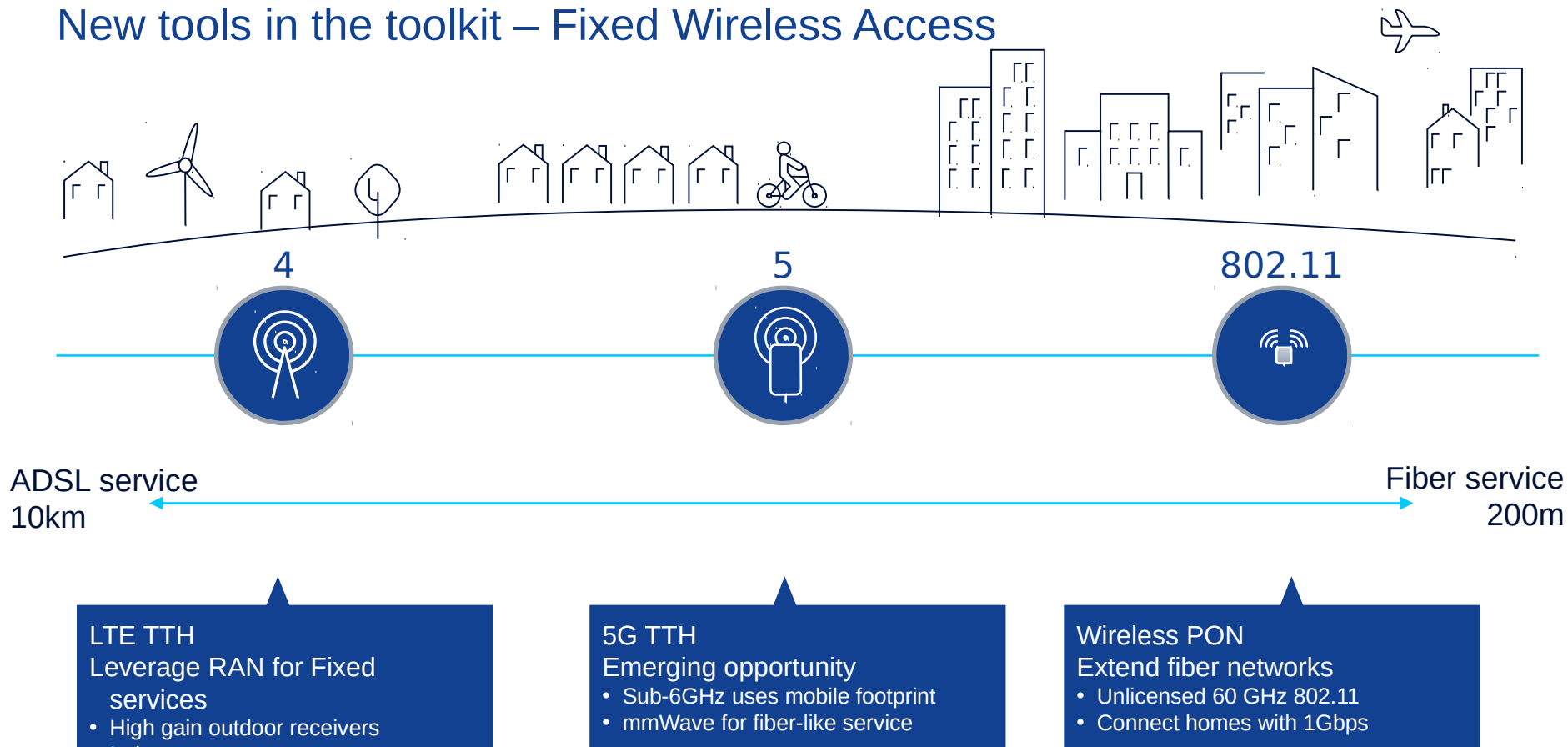
5G anyhaul over FTTH reduces TCO

- Backhaul & fronthaul
- Developing low-latency PON

25G standardization ensures future evolution

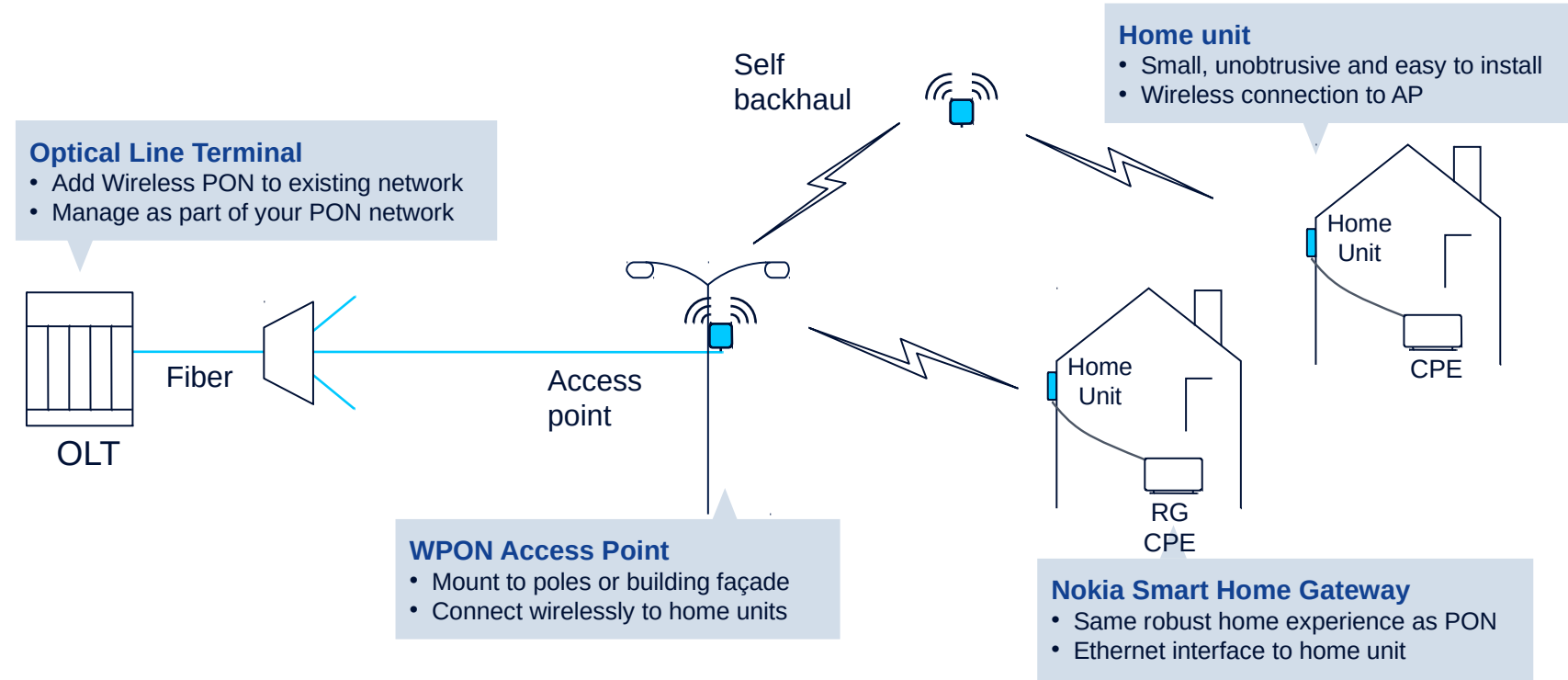
- leverage datacenter optics
- Meets TTM & cost targets

New tools in the toolkit – Fixed Wireless Access



Nokia Wireless PON

Bring gigabit speeds to where no fiber has gone before



Wireless PON Access Point (AP)

Key Features:

- Connect up to eight homes from one access point
- Beam forming antennas reduce interference and increase performance
- GPON or P2P uplink with SFP
- 180 horizontal x 30° vertical FOV
- Mount two AP back to back on a pole for 360° FOV



Where fiber is
costly to deploy

1/4th
of FTTH
upfront costs

-50%
Lower TCO
(25 years)

Wireless PON Home Unit

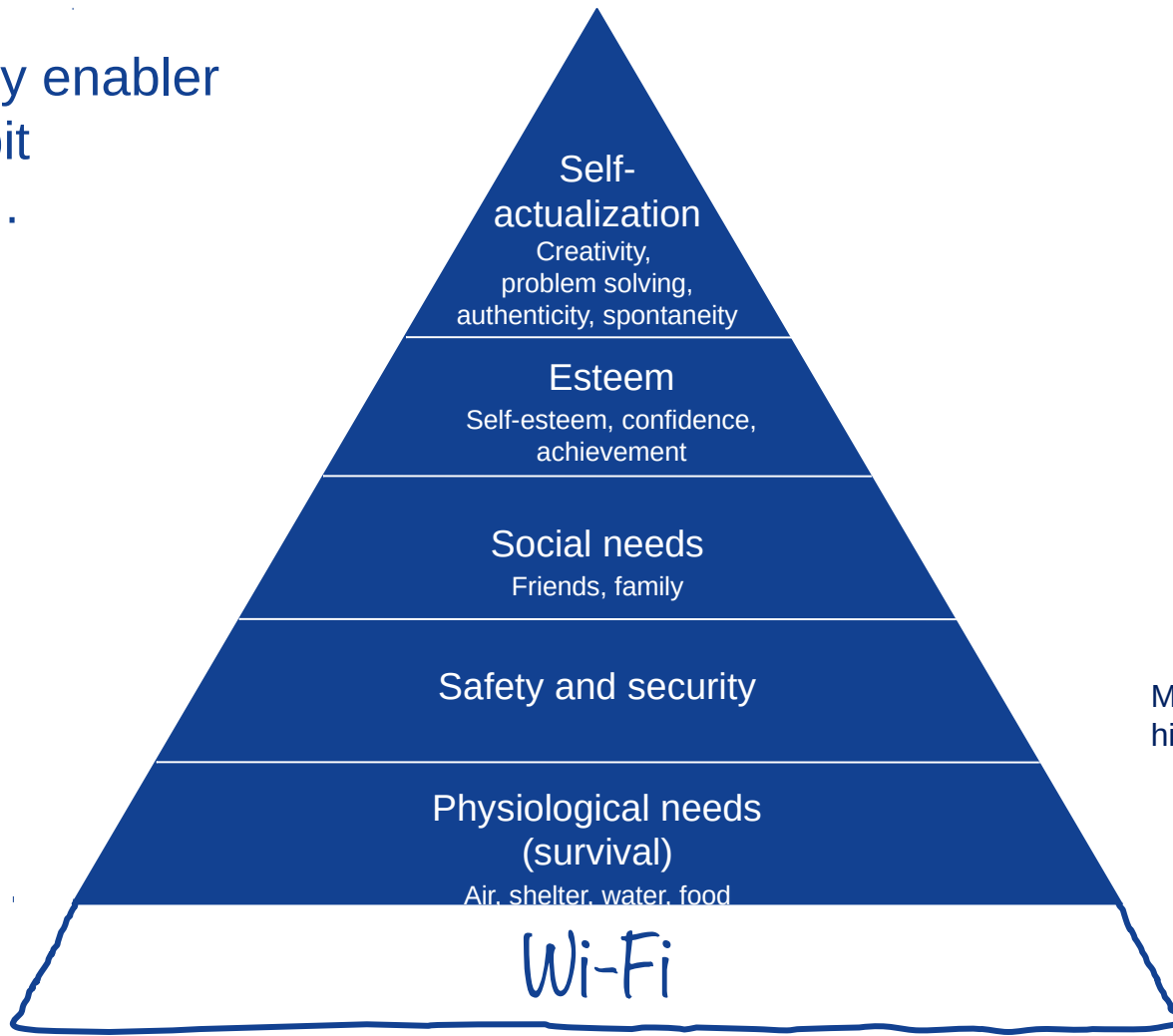


Key Features

- Small, unobtrusive design
- 1Gbps Aggregate at 100m from the AP
- Beam forming for reduced interference and increased performance
- No need to aim with 180 horizontal x 30° vertical FOV
- PoE fed from the residence



Wi-Fi is a key enabler
for the gigabit
experience...

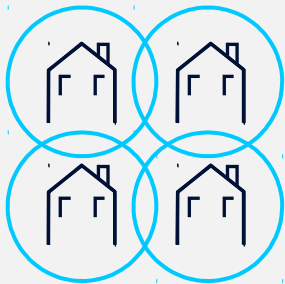


Maslow's
hierarchy of needs

Gigabit bandwidth required to and into the home

But Wi-Fi is the weakest link

Neighboring interference



30%

of helpdesk calls
are Wi-Fi related

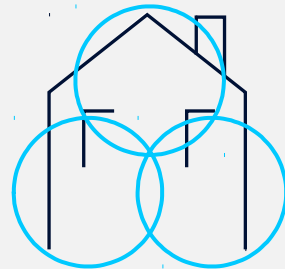
Dead spots



\$26

Average cost to
resolve a Wi-Fi call

Sticky clients



10%

of calls result
in truck-roll

A gig to and into the home with meshed WiFi





1

Download
Nokia App



2

Scan QR
Code



3

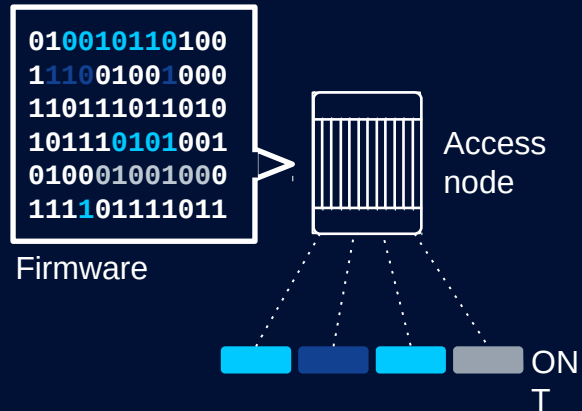
Power
On

Interoperabilidade da sua Rede PON

Use a ONU de qualquer fabricante
com a OLT da NOKIA

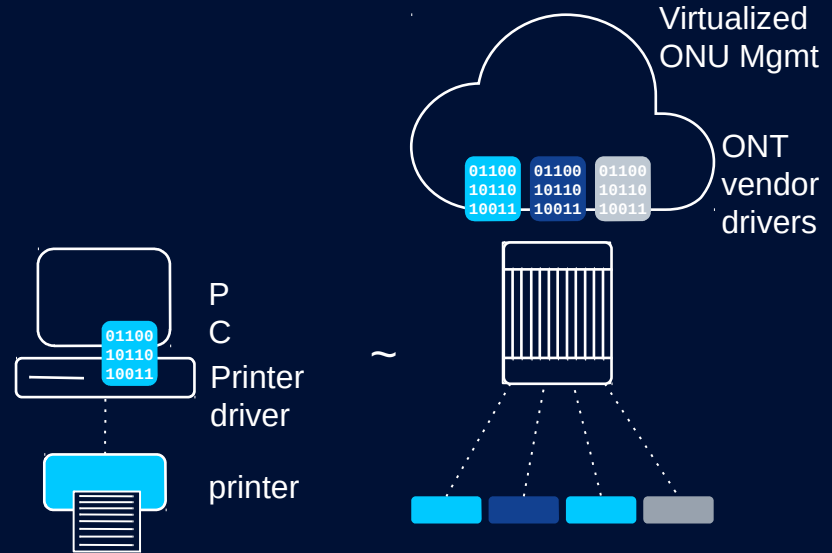
Solving GPON interop

Multi-vendor ONU Connect



Traditional interop
always possible, never easy

- Hardcode proprietary ONT quirks in proprietary access node firmware
- 3-6 months



Multi-vendor ONU Connect
guarantees interop

- "driver" supplied by ONU vendor
- Virtualized ONU Management

Arquitetura da ONT

ONT/OLT - E2E features

• Features suportadas:

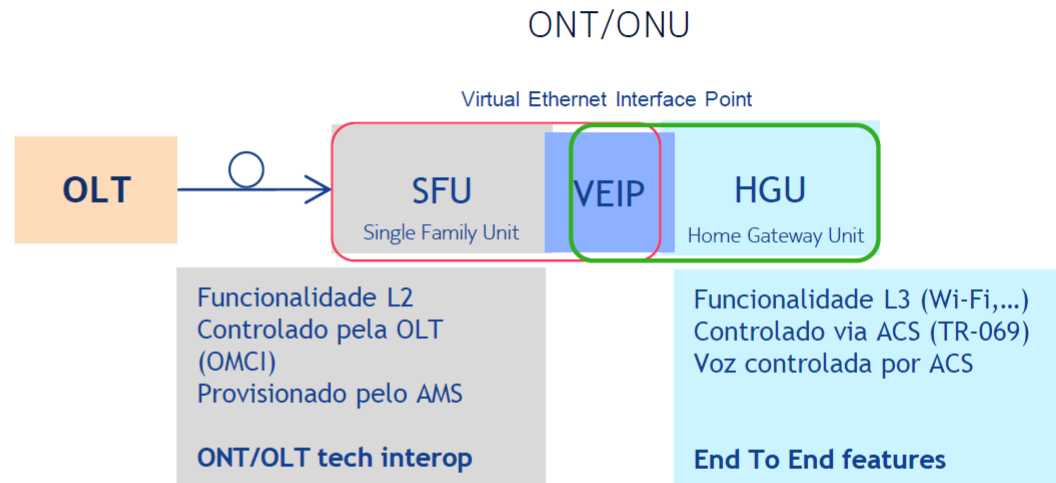
- A funcionalidade descrita em TR-101
- Pode ser implantado em uma arquitetura TR-156
- Gerenciamento básico da ONT SW (download / ativação / etc.)
- Setup genérico serviço de dados (VLANs, p-bits)
- Aprovisionamento do serviço de Multicast
- GE port ou VEIP

• Features não suportadas:

- OLT Nokia possui recursos proprietários para configurações SW ONT: delta/preconfig download, XML download

→ Voz gerenciada via TR-104

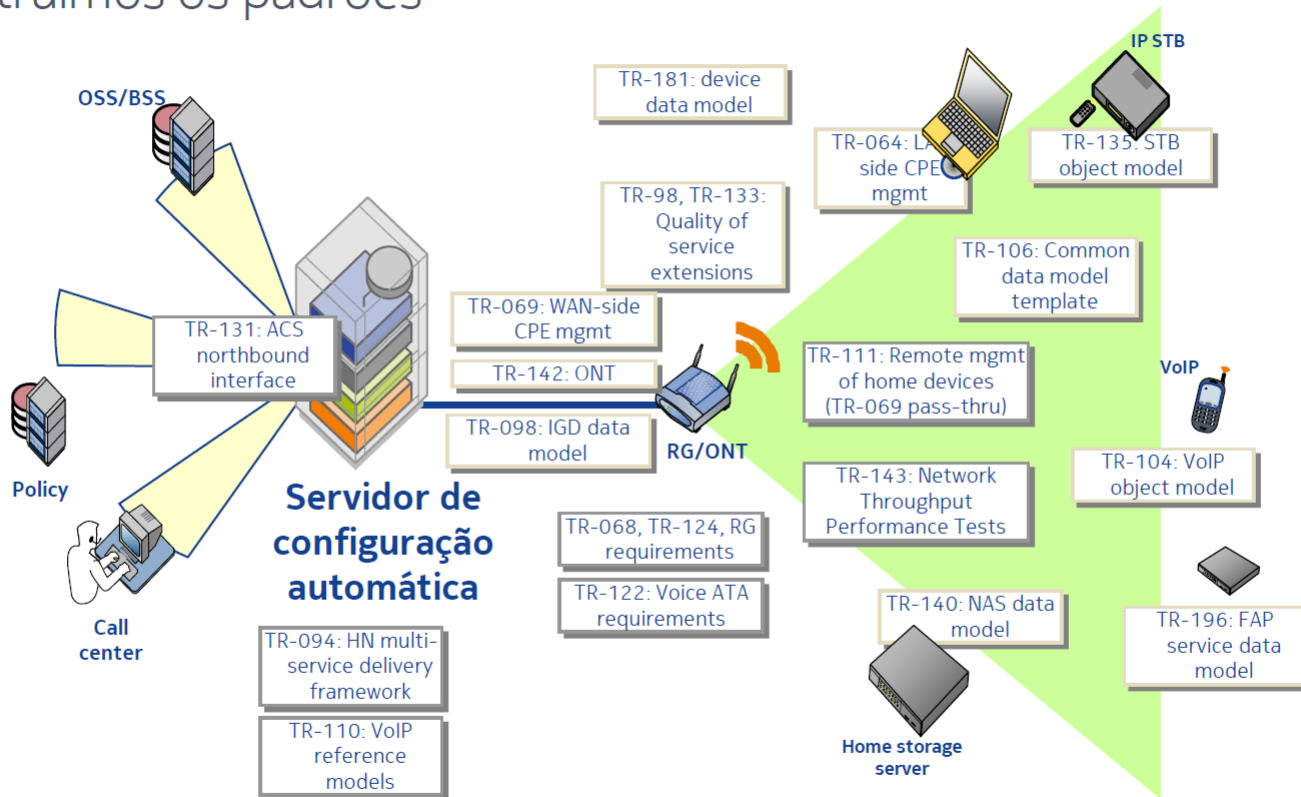
→ Outras feature devem ser avaliadas pela Nokia.



Terminal de Rede Óptica (Optical Network Terminal, ONT) – Dentro da residência do cliente.
Unidade de Rede Óptica (Optical Network Unit, ONU) – Na rede externa.





Liderança no Broadband Forum

Nós construímos os padrões



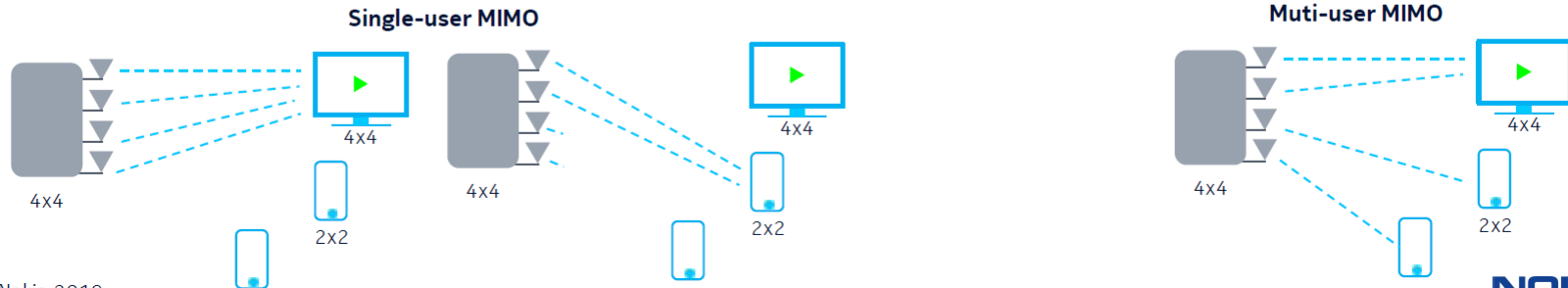
Gerações do Wi-Fi (Wi-Fi alliance)

Nomenclatura amigável ao consumidor para gerações de Wi-Fi

Se a tecnologia mais avançada é suportada a definição é...	Definição da Geração	Proposta visual pela Wi-Fi Alliance	Logo da certificação
802.11n	Wi-Fi 4		
802.11ac	Wi-Fi 5		
802.11ax	Wi-Fi 6		


















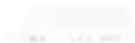


Múltipla-entrada múltipla-saída (MIMO)

- Múltiplos transmissores e receptores para transferir mais dados simultaneamente. Assim atinge velocidades mais elevadas.
- Tanto o AP quanto o dispositivo necessitam suportar MIMO, caso contrário a velocidade não será alcançada.
- MIMO aumenta o poder de captação de sinal do receptor, permitindo que as antenas combinem fluxos de dados que chegam de diferentes caminhos e em momentos diferentes.
- A quantidade de antenas permite maiores velocidades. Assim o roteador/ONT com duas antenas atinge velocidades menores do que uma ONT com 4 antenas. Um dispositivo MIMO 4×4 possui quatro antenas para quatro fluxos de dados simultâneos, enquanto um MIMO 2×2 possui dois.
- MU-MIMO “entrada múltipla multiusuário, saída múltipla”. Um roteador 4×4 MU-MIMO possui quatro antenas nas quais pode se comunicar ao mesmo tempo. Se você tivesse vários dispositivos MIMO 4×4 conectados a esse roteador, todos eles manteriam uma conexão de quatro fluxos de dados simultâneos. Ou, se você tiver um laptop com MIMO 3×3 eles poderão se conectar a um ponto de acesso MIMO 4×4 com três fluxos de dados simultâneos. No entanto, se você tiver um telefone com Wi-Fi MIMO 2×2 ou um laptop com MIMO 3×3 e conectá-lo a um roteador que não suporta MIMO, ele receberá apenas um único fluxo de dados. Se você conectar um dispositivo MIMO 3×3 a um roteador MIMO 2×2 , ele usará apenas dois fluxos de dados.



Digital Home - Overview

Conecte qualquer pessoa, em qualquer lugar

GPON data ONT		GPON data & voice	GPON RGW (802.11b/g/n)	GPON RGW (802.11b/g/n/ac)	GPON Nokia Wi-Fi 11ac + RF Scan	
G-010S	G-010G	G-440G G-240G G-120G	G-120W G-240W G-241W A	G-140W G-240W	Gateway 3	
 SFP						
(10G)EPON / NGPON2		G.FAST/DSL / Hybrid		Ethernet	SPECIAL	
10G EPON	XGSPON XGPON1	G.FAST L2	G.FAST L3	Beacon 3	MOCA/HPNA	E1/T1
 XE-040G-A XE-010X-A	 XS-240W-A XS/XG-250W-A XS-250X XS-010X	 F-010G	 F-240W		 •2POTS/1GE/ 1MOCA •2POTS/2GE/ 1HPNA	 B-0404G
EPON	XGS MBH Universal	Rev Power	Hybrid DSL/LTE	Beacon 1, 6, 11	MBH	SOHO/SME
 E-240G-B E-240W	U-050X				 G-080P	 

7368 ISAM ONT G-040P-Q

GPON SFU ONT with PoE



Key Features

- GPON Uplink, G.984, G.988 series standard compliant
- Four RJ-45 10/100/1000 auto negotiating Ethernet ports
- PoE/PoE+ IEEE 802.3af-2003 and 802.3at-draft 3.1 compliant
- Dynamic Bandwidth Allocation (DBA)
- IPTV, IGMPv2 and IGMPv3
- AMS Managed
- Optical RSSI, advanced PMs and statistics support
- Per-subscriber, per-service bandwidth control



Key Benefits

- Great for **Passive Optical LAN (POL)**
- 2-box solution → Powering POE supporting RGW CPEs
- Powering Public WiFi for GPON backhaul
- Powering Enterprise device for broadband access.
- Full range of fault management, configuration, accounting, performance, and security (FCAPS) functions



G-040P-Q

4GE

Power Over Ethernet (PoE)

Dimensions	209*130*40mm/8.2*5.1*1.6in
Weight	300g
Operating Temp	-5°C to 45°C
Mounting	Desktop or Wall Mount
Power Spec.	54V DC (with external AC/DC adapter)
Power Consumption	<80W
LEDs	PWR/UPS, PON, LOS, LAN 1-4, POE 1-4

7368 ISAM ONT G-010G-P

GPON SFU ONT



Key Features

- GPON Uplink, G.984, G.988 series standard compliant
- 1x RJ-45 10/100/1000 auto negotiating Ethernet ports
- Dynamic Bandwidth Allocation (DBA)
- IPTV, IGMPv2 and IGMPv3
- AMS Managed
- Optical RSSI, advanced PMs and statistics support
- Per-subscriber, per-service bandwidth control



Key Benefits

- Eco-sustainability in line with “green” tendencies: low power consumption
- Economical GPON-to-Ethernet converter for a two box solution

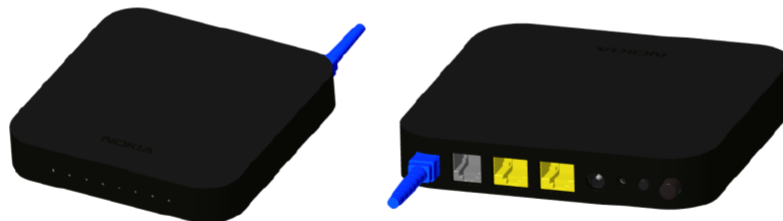


Dimensions	120x90x27 mm (4.7x3.5x1.1 in)
Weight	120 g (0.26 lb)
Operating Temp	-5 °C to 45 °C\
Mounting	Desk or wall mounted
Power Spec.	+12V (with external AC/DC adapter)
Power Consumption	<3W
LEDs	POWER, ALARM, CONNECTION, ETH

7368 ISAM ONT G-120G-E

GPON ONT

- G-120G-E (HDR5601a): 1 POTS port, 1 GE, 1 **FE**
- Feature parity with G-240G-E
- PPPoE



7368 ISAM ONT G-120G-E, G-120W-F GPON ONT

- G-120W-F (HDR5601b): 1 POTS port, 1 GE, 1 **FE**, 2x2 802.11b/g/n with 5dBi external antenna
- **No USB** port
- Feature parity with G-240W-F



7368 ISAM ONT G-240W-F

GPON RGW ONT



Key Features

- **GPON** Uplink, G.984, G.988 series standard compliant
- **2 POTS ports**
- **4 RJ-45 10/100/1000 auto negotiating Ethernet ports**
- Dynamic Bandwidth Allocation (DBA)
- IPTV, IGMPv2 and IGMPv3
- Optical RSSI, advanced PMs and statistics support
- Per-subscriber, per-service bandwidth control
- Support bridge Mode or routed Mode for each Ethernet port
- TR-069 support, TR-142 compliant
- Supports **2x2 MIMO** system for **802.11b/g/n**
- Supports **200mW (HDR57) for 802.11b/g/n**
- **2x USB 2.0**
- External **5dBi** antenna, not detachable
- WPS support
- Firewall, NAT, PPPoE, DHCP
- 802.1x, CFM not supported
- Fiber management and lock included (not visible in picture)



Key Benefits

- Integrated **residential gateway** for GPON Network, one box solution for FTTH deployment. Supports full triple play services: voice, Data, IPTV.
- Full range of fault management, configuration, accounting, performance, and security (FCAPS) functions



7368 ISAM ONT G-240W-C

GPON RGW ONT



Key Features

- **GPON** Uplink, G.984, G.988 series standard compliant
- **2 POTS ports**
- **4 RJ-45 10/100/1000 auto negotiating Ethernet** ports
- Dynamic Bandwidth Allocation (DBA)
- IPTV, IGMPv2 and IGMPv3
- Optical RSSI, advanced PMs and statistics support
- Per-subscriber, per-service bandwidth control
- Support bridge Mode or routed Mode for each Ethernet port
- TR-069 support, TR-142 compliant, TR-143
- Supports dual concurrent 802.11ac at 5GHz and 802.11b/g/n at 2.4GHz
- Supports **4x4 MIMO 802.11ac**, **2x2 MIMO** system for **802.11b/g/n**
- Internal Antenna configuration
- Supports **200mW (CALA) for 802.11b/g/n**, **500mW for 802.11ac**
- **2x USB 2.0**
- WPS support
- Firewall, NAT, PPPoE, DHCP, WiFi-offload via GRE/VLAN Tunnel



Key Benefits

- Integrated residential gateway for GPON Network, one box solution for FTTH deployment. Supports full triple play services: voice, Data, IPTV.
- Full range of fault management, configuration, accounting, performance, and security (FCAPS) functions



Dimensions	280*170*40 mm/ 11.0*6.7*1.6 in.
Weight	644g (1.42lb)
Operating Temp	-5C to 45C
Mounting	Desk or wall mounted
Power Spec.	+12V (with external AC/DC adapter)
Power Consumption	<30W
LEDs	Power, Link, Auth, LAN1-4, TEL 1-2, VOIP, WPS 2.4G/5G, WLAN 2.4G/5G, USB, INTERNET

7368 ISAM ONT G-240W-G

GPON RGW ONT



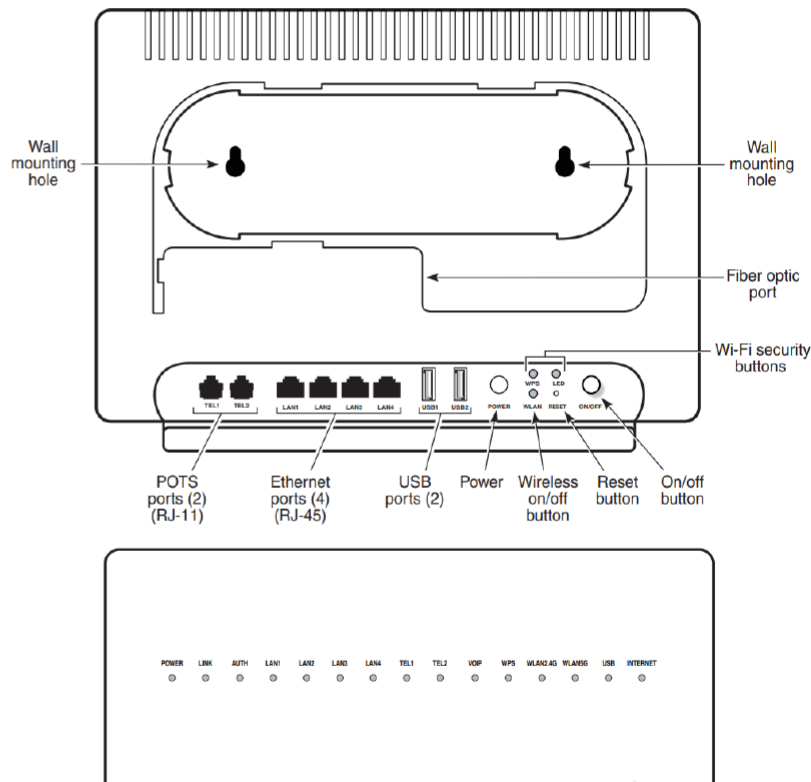
Key Features

- **GPON** Uplink, G.984, G.988 series standard compliant
- **2 POTS ports**
- **4 RJ-45 10/100/1000 auto negotiating Ethernet** ports
- Dynamic Bandwidth Allocation (DBA)
- IPTV, IGMPv2 and IGMPv3
- Optical RSSI, advanced PMs and statistics support
- Per-subscriber, per-service bandwidth control
- Support bridge Mode or routed Mode for each Ethernet port
- TR-069 support, TR-142 compliant
- Supports dual concurrent 802.11ac at 5GHz and 802.11b/g/n at 2.4GHz
- Supports **3x3 MIMO 802.11ac**, **2x2 MIMO** system for **802.11b/g/n**
- **3dBi internal antenna**
- Supports for 802.11b/g/n, for 802.11ac
- **1x USB 2.0**
- **Nokia WiFi mesh support in HDR62**
- Fiber management and lock included (not visible in picture)



Key Benefits

- Integrated residential gateway for GPON Network, one box solution for FTTH deployment. Supports full triple play services: voice, Data, IPTV.
- Full range of fault management, configuration, accounting, performance, and security (FCAPS) functions



G-140W-H: Dual Band 2+2 GPON RGW with Mesh



Key ONT Features

- GPON Uplink, G.984, G.988 series standard compliant
- **1 POTS** ports with 3Ren
- **4 UNI RJ-45** 10/100/1000 **auto negotiating Ethernet** ports
- 2 USB 2.0 ports
- Support **2x2** 802.11 b/g/n **2.4Ghz** WLAN interface,
- Support **2x2** 802.11ac **MIMO 5Ghz** WLAN interface,
- **300Mbps** PHY Rate for 2.4Ghz, and **866Mbps** PHY rate for 5Ghz
- Internal antenna with 3dBi gain for each
- max EIRP on **2.4Ghz** up to **500mw**, and **5GHz** up to **1000mW**
- Bridge and router mode, TR-069 support, feature parity with Nokia RGW gateway mainstream
- embedded Nokia Whole Home Wi-Fi middle ware
- CE and FCC compliance



Key Benefits

- Premium overall traffic throughput, fully utilize GPON bandwidth
- Embedded Nokia Wi-Fi Mesh stack supporting seamless roaming, Wi-Fi management and analytics inside home
- Intelligent Routing and network self-healing
- Cloud portal management system easier the O&M for the WiFi mesh network
- Allows service-per-port configurations
- Supports full triple play services, including voice, video and data
- Supports IP video distribution

2x2 11n 2.4Ghz



2x2 11ac 5Ghz



G-140W-H

Dimensions	~120*140*30(mm)
Weight	Less than 400g
Operating Temp	-5C to 45C
Mounting	Desk
Power Spec.	+12V (with external AC/DC adapter)
Power Consumption	<24W
LEDs	Power, PON, VoIP, LAN1-4, USB, WPS, 2.4G and 5G WLAN, Internet

Disponibilidade de Beacons no Brasil



Beacon 1

- Funciona como roteador sem fio ou beacon em uma rede mesh
- Dual-band concurrent **IEEE 802.11b/g/n 2x2 2.4 GHz** e **802.11ac 2x2 5 GHz (AC1200)**
- **1x LAN 10/100/1000Base-T** interfaces with RJ-45 connectors
- **1x WAN 10/100/1000Base-T**
- Nokia intelligent mesh
- Embedded analytics optimize network performance in real time
- Real-time wireless spectrum analysis

PHY rate up to **300 Mb/s** for 2.4 GHz and **867 Mb/s** for 5 GHz.

Maximum effective isotropic radiated power (EIRP) on **2.4 GHz** up to **500 mW** and **5 GHz** up to **1 W**



Beacon 3

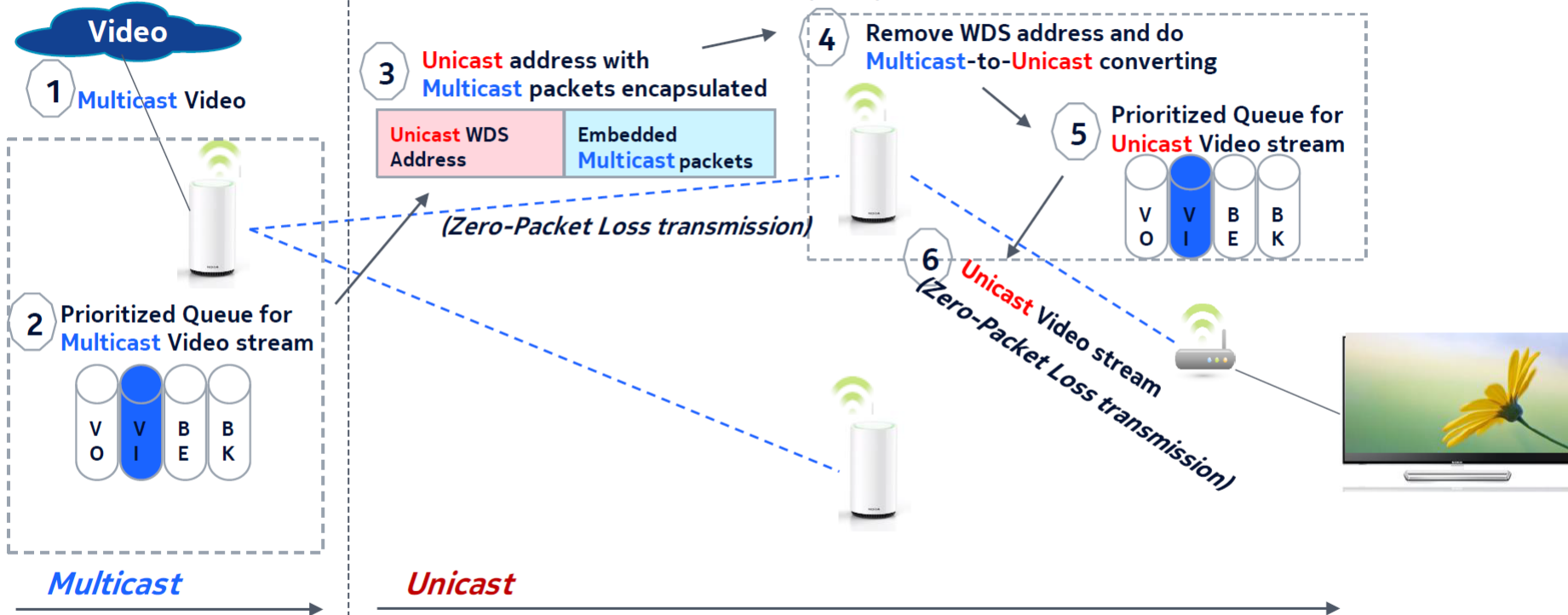
- Funciona como roteador sem fio ou beacon em uma rede mesh
- Dual-band concurrent **IEEE 802.11b/g/n 3x3 2.4 GHz** e **802.11ac 4x4 5 GHz (AC3000)**
- **3x LAN 10/100/1000Base-T** interfaces with RJ-45 connectors
- **1x WAN 10/100/1000Base-T**
- Nokia intelligent mesh
- Embedded analytics optimize network performance in real time
- Real-time wireless spectrum analysis

PHY rate up to **750 Mb/s** for 2.4 GHz and **2170 Mb/s** for 5 GHz.

Maximum effective isotropic radiated power (EIRP) on **2.4 GHz** up to **500 mW** and **5 GHz** up to **1 W**

Nokia WiFi mesh

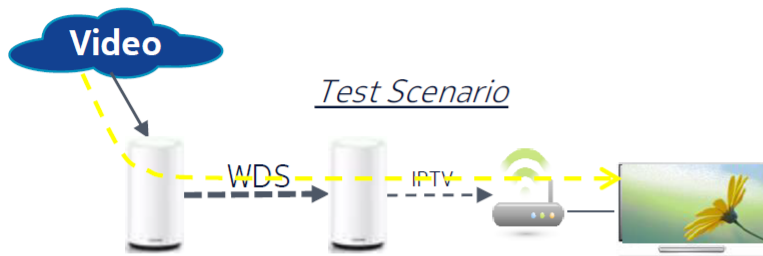
Melhoria de vídeo multicast sobre mesh (1/2)



- Solução de QoS aprimorada para vídeo multicast através da rede Nokia Wi-Fi Mesh.
- Transmissão de vídeo confiável com Multicast-Unicast convertido e fluxo priorizado.

Video Over Mesh

Melhoria de vídeo multicast sobre mesh (2/2)



- Prioriza o fluxo multicast e força o fluxo de vídeo transmitido na fila VI no backhaul WDS e no front-end WiFi, o que reduzirá a interferência do tráfego de dados com prioridade BE.
- ZPL(Zero Packet Loss) estiver ativado no backhaul WDS e no front-end Wi-Fi, também reduzirá a perda de pacotes em ambiente aberto.
- Aumenta o tamanho do buffer de recebimento do link WDS, o que também reduz a perda de pacotes durante o burst.

HDR600e

Qualidade	Resolução da tela	Quadros por segundo	Compressão de banda	Taxa de quadros Ethernet	Número de canais suportado
SD	640x480	15-30	1-2 Mbps	100-200	15
HD	1280x720	30-60	2-4 Mbps	200-400	6
FHD	1920x1080	30-60	5-9 Mbps	400-800	3
UHD	3840x2160	30-60	10-25 Mbps	800-1600	Freeze/Pixelization with one channel

NWF190100

Qualidade	Resolução da tela	Quadros por segundo	Compressão de banda	Taxa de quadros Ethernet	Número de canais suportado
SD	640x480	15-30	1-2 Mbps	100-200	25
HD	1280x720	30-60	2-4 Mbps	200-400	12
FHD	1920x1080	30-60	5-9 Mbps	400-800	5
UHD	3840x2160	30-60	10-25 Mbps	800-1600	1

Nokia's Bundle Solution – Support operators to upsell WHW service

GOOD



Beacon

Dual Band 2+2 GPON RGW (2.4Ghz EIRP: 500mW, 5Ghz EIRP: 1W)
B1: 2+2 Access Point (2.4Ghz EIRP: 500mW, 5Ghz EIRP: 1W)
Nokia Mesh Embedded

BETTER



Beacon

Dual Band 2+3 GPON RGW (2.4Ghz EIRP: 500mW, 5Ghz EIRP: 1W)
B1: 2+2 Access Point (2.4Ghz EIRP: 500mW, 5Ghz EIRP: 1W)
Nokia Mesh Embedded

BEST



Gateway 3



Beacon 3

Dual Band 3+4 GPON RGW (2.4Ghz EIRP: 500mW, 5Ghz EIRP: >1W)
Beacon 3: 2+2 Access Point (2.4Ghz EIRP: 500mW, 5Ghz EIRP: >1W)
Nokia Mesh Embedded

OBRIGADO!!!

NOKIA

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