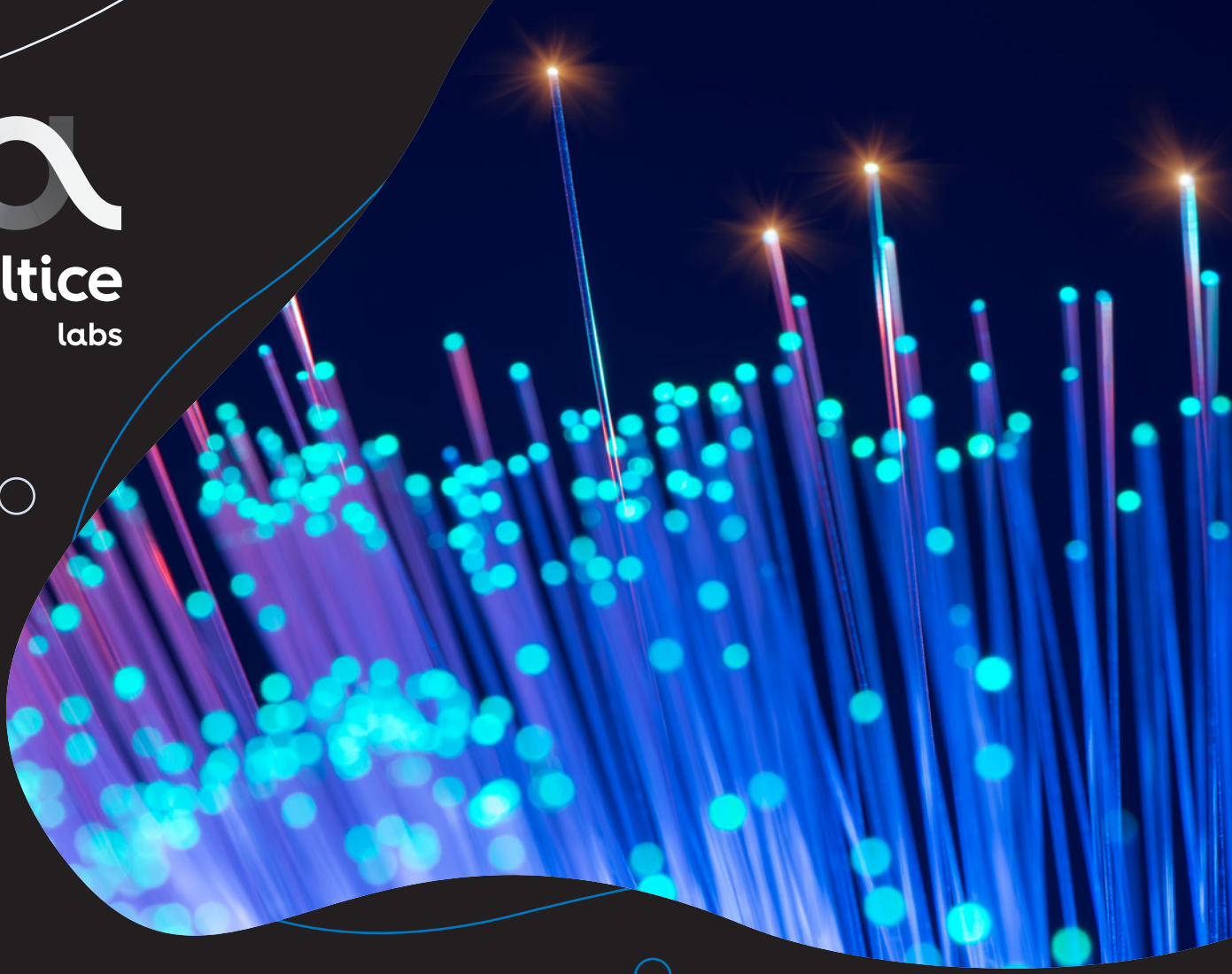
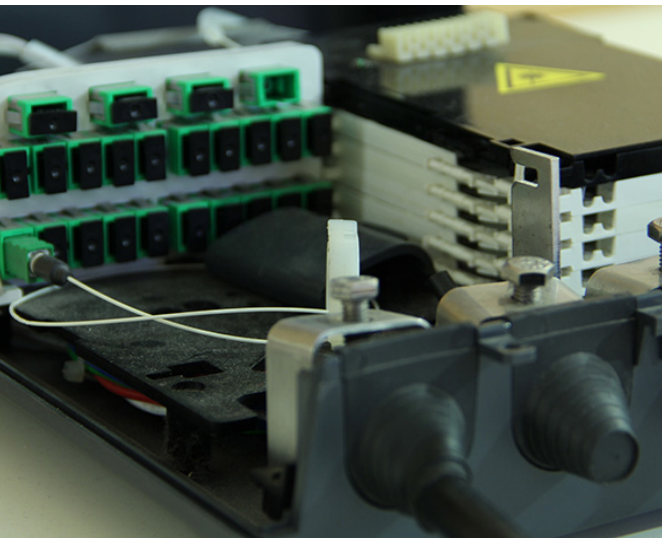
altice labs



Ultra-Fast Broadband



Altice Labs
Headquarters
and R&D Facilities,
Aveiro - Portugal

Altice Labs

Formally launched in January 2016, Altice Labs owns over 70 years of technical expertise in developing Telecom equipment and solutions with carrier-grade performance, operating under different market brands.

Altice Labs is currently one of today's European reference suppliers for the Telecom market, holding and evolving a solid portfolio in the end-to-end access network domain.

Having built a dynamic innovation ecosystem over the past decades, Altice Labs relies on strong cooperation with key stakeholders, including universities and academia, R&D institutions, regulatory and standardization bodies, reference customers, and market vendors.

Customer Footprint

Altice Labs' footprint on the technology market covers the globe, representing a final customer base of around 250 million end users.


Russia
Norway
Sweden
Denmark
Netherlands
Germany
Poland
Czech Republic
Slovakia
Hungary
Italy
Cyprus
Israel
Egypt
Malta
Macau
United Arab Emirates
India
Malasyia
Guam
Saudi Arabia
Singapore
Ethiopia
Kenya
Tanzania
East Timor
Fiji
Mauritius
Reunion
New Zealand
Malawi
Australia
South Africa
Mozambique

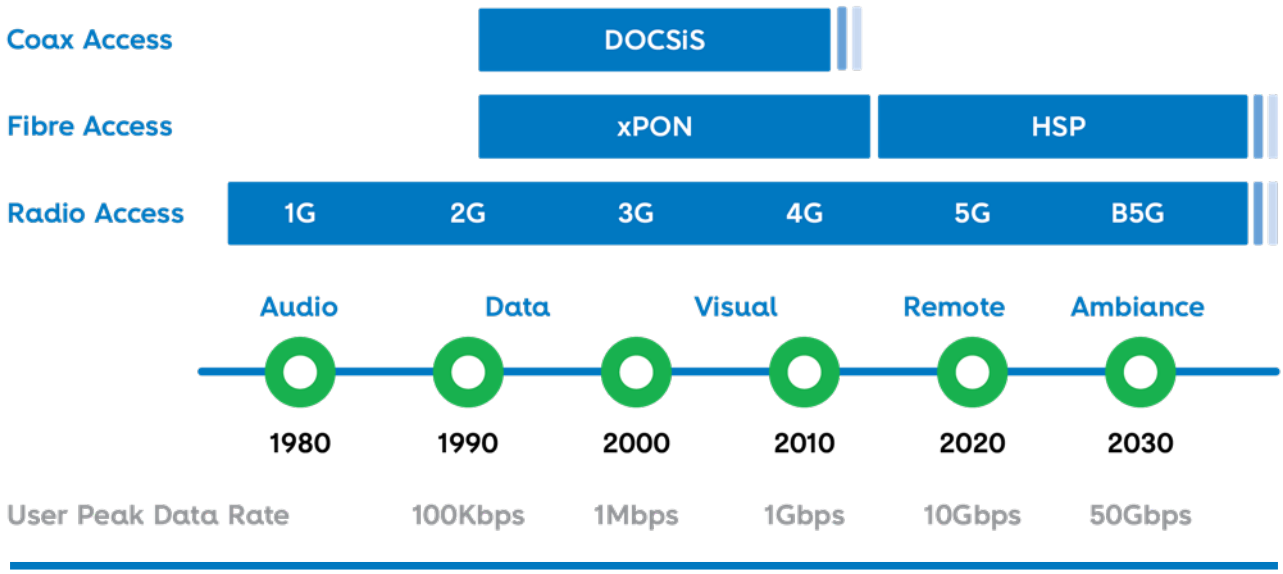
For the Upcoming Future

Tools	Trends
 • New services with optimized agents focusing on individuals • Cross-Industry / Cross-layer integrated comunications • Merge computing, navigation, and perception	• Smart cities • Mobility as a Service (MaaS) • Mixed Reality • User-centric service integration
 • AI-driven decision-making • New data-driven values and services • Security	• Big Data • AI • Real-Time Signal processing • Pattern and semantic data analysis
 • Everything is connected and generates data • Open network that aims to create and integrate new ecosystems • Network as a commodity, seamlessly integrated into the OS environment • Fber network as a major component	• Humans • Devices • Infrastructures

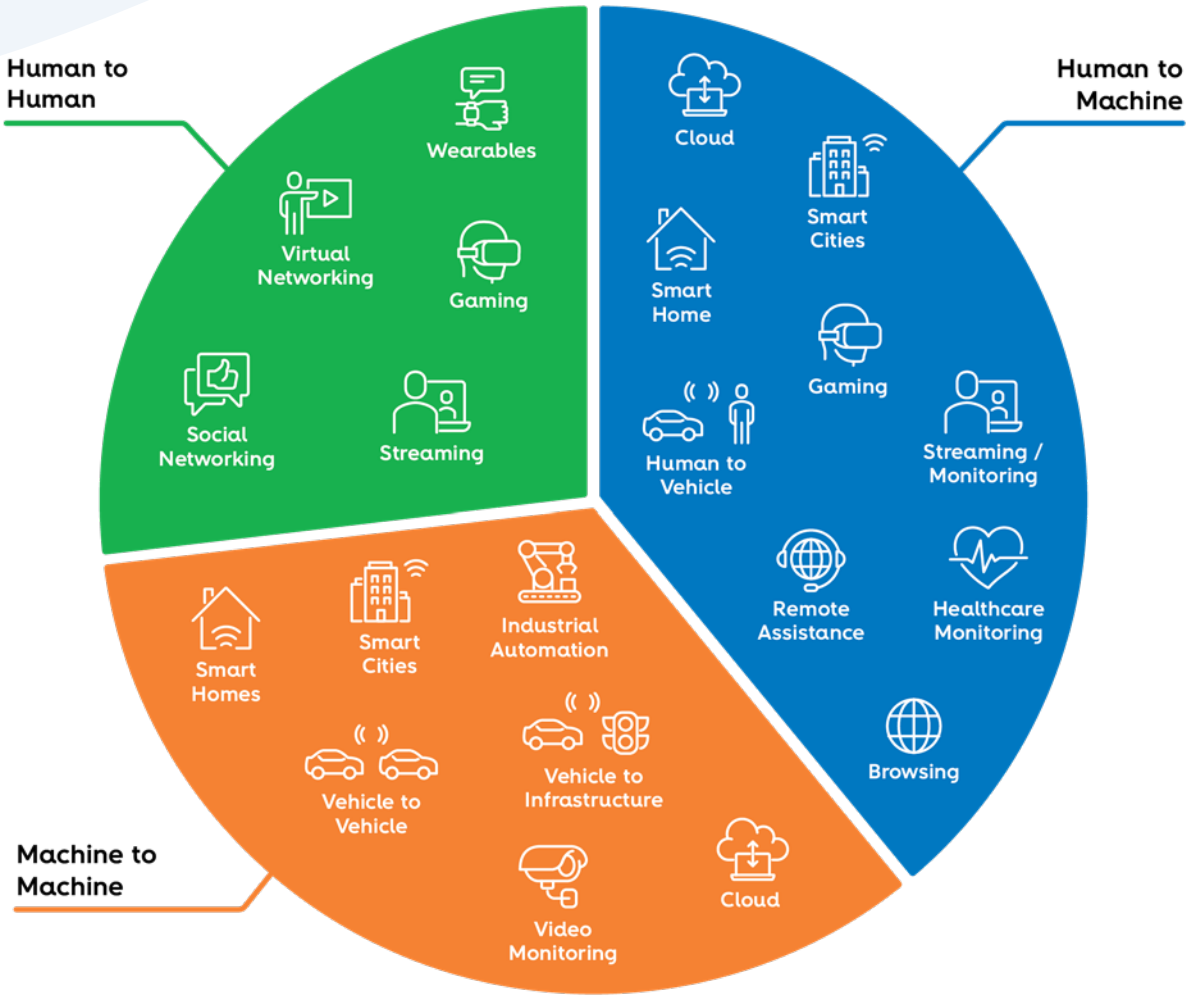
Technology and Service Evolution

Telecom networks have become crucial for everyday life activities and services.

Businesses and individuals expect and rely on extremely high availability performance for their present and future project plans.



Technology history



Service portfolio

A Single Brand, a Full Set of Solutions

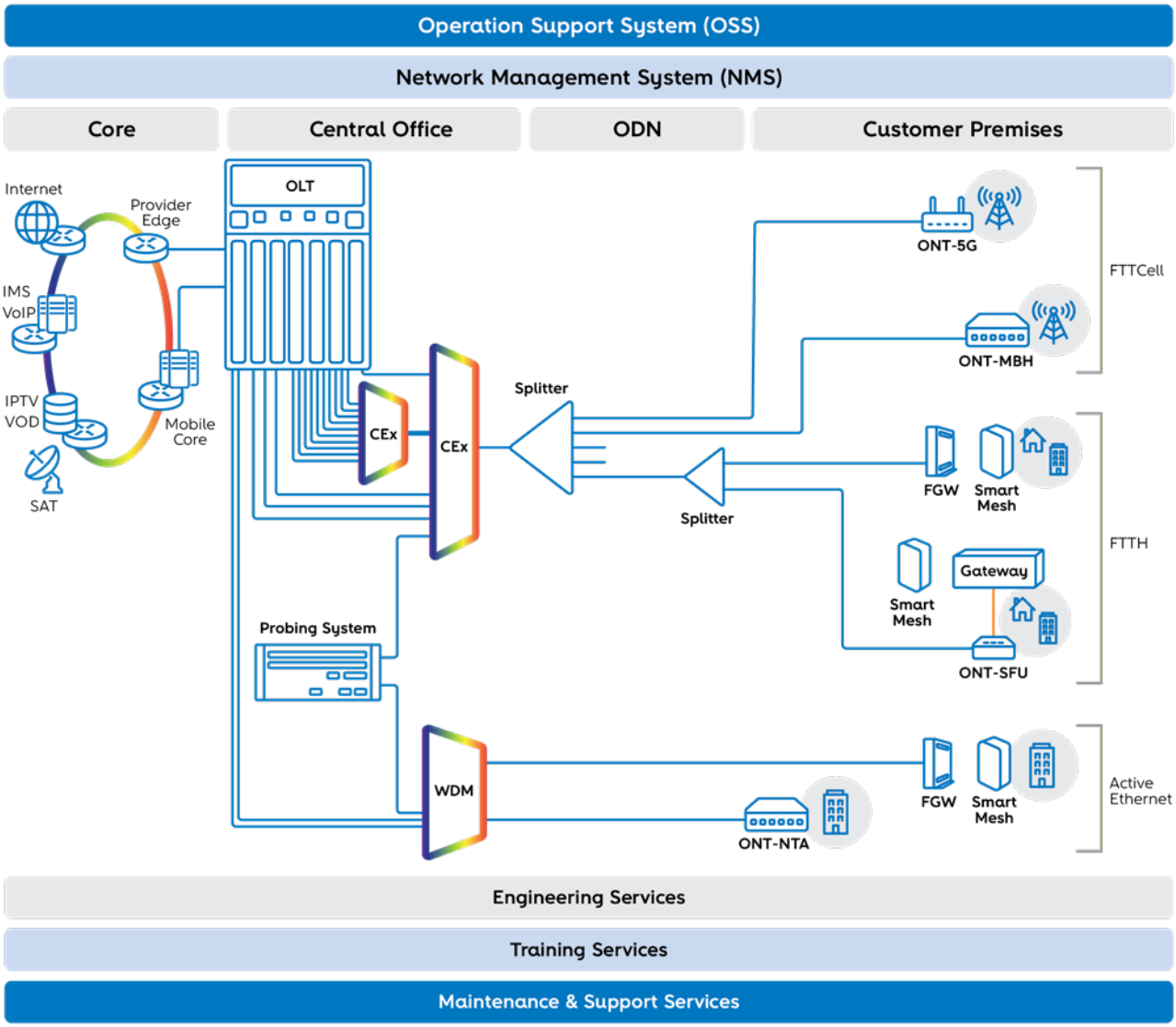
Altice Labs' portfolio is composed of central office active and passive hardware equipment, customer premises equipment, Outside Distribution Network elements, a Network Management System, Operation Support Systems, and Professional Engineering Services that include delivery, setup, configuration, go live, training, maintenance, and support services 24/7.

Table of Contents

FTTx Architecture

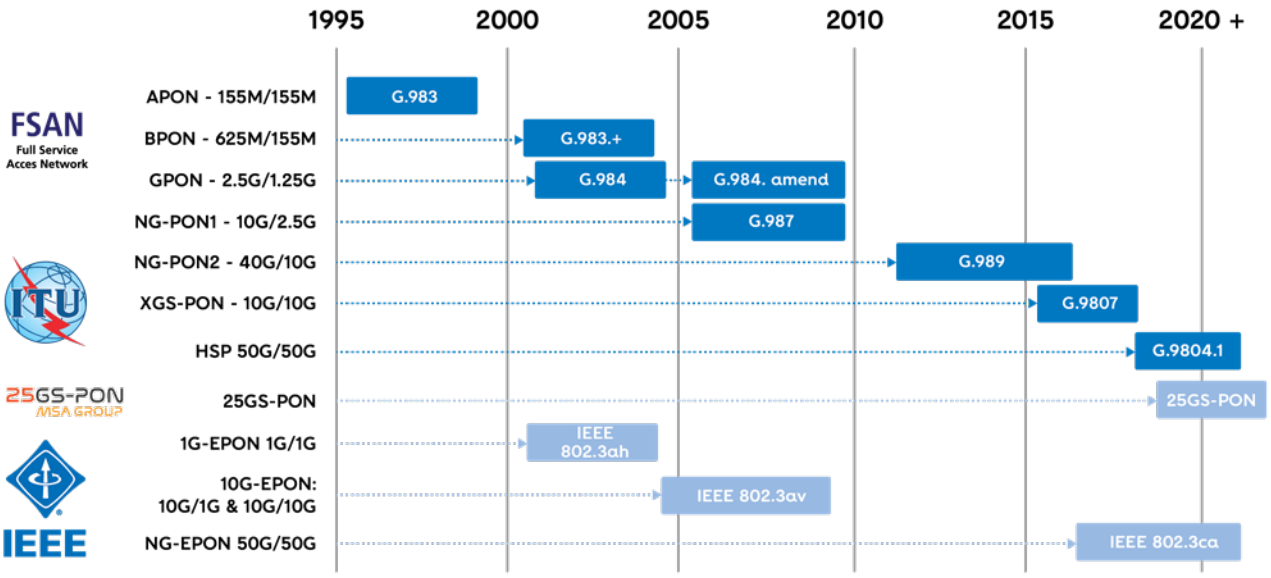
Altice Labs holds relevant experience in FTTx deployments worldwide, acting as a market vendor with a full suite xPON portfolio that includes hardware, software, and highly skilled engineering services, ensuring resilient and future-proof network implementations with optimized TCO.

Altice Labs' solutions solve the entire fiber access network domain, simultaneously attending **Retail**, **Wholesale**, and **Mobile** market segments.


Operation Support System (OSS)
Network Management System (NMS)
Core
Central Office
ODN
Customer Premises
Internet
Provider Edge
IMS VoIP
IPTV VOD
SAT
Mobile Core
OLT
CEx
CEx
Splitter
Splitter
Probing System
WDM
ONT-5G
ONT-MBH
FTTCell
FGW
Smart Mesh
Gateway
Smart Mesh
ONT-SFU
FTTH
ONT-NTA
FGW
Smart Mesh
Active Ethernet
Engineering Services
Training Services
Maintenance & Support Services

PON Standard Evolution

PON has been massively adopted in access network deployments worldwide and is today the most suitable and reliable option for FTTx networks. Due to its resilience and high-capacity performance, it is the prime choice to support the ever-increasing need for services such as IPTV, OTT high-quality video streaming, landline, and mobile data.



PON standard evolution

Altice Labs' product portfolio aligns with the reference standardization bodies and relevant technical forums, pursuing the most suitable technology selection and full product conformity.

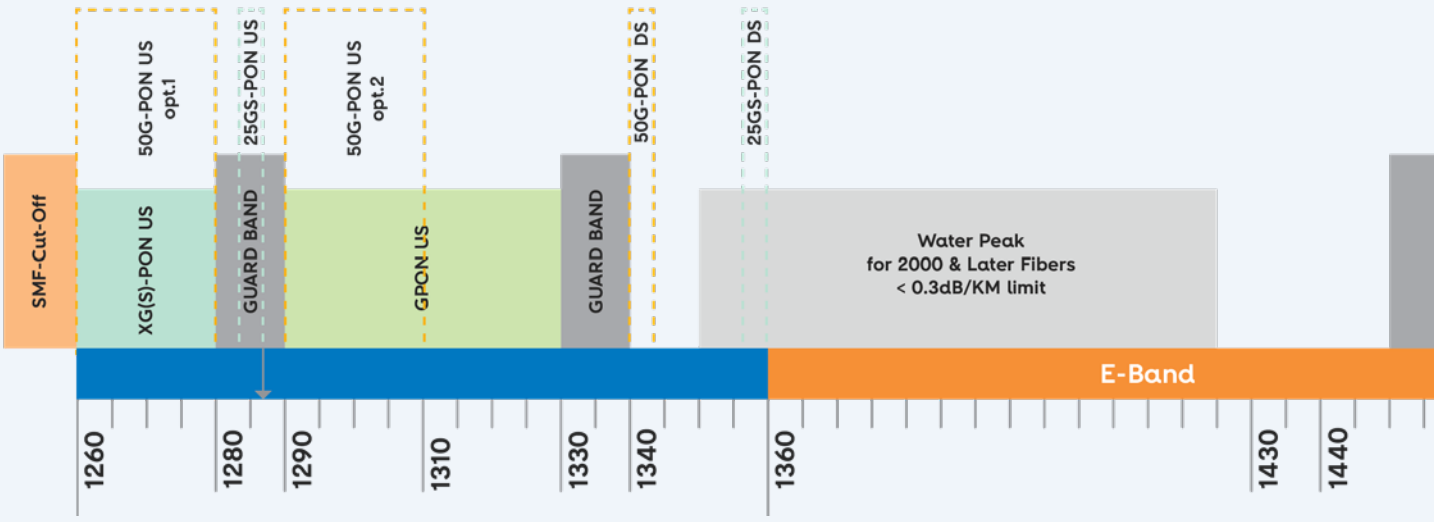
From the central office to the customer premises, active equipment solutions follow the current xPON ITU recommendations supporting GPON (ITU-T G.984), XGS-PON (ITU-T G.9807), and NG-PON2 (ITU-T G.989). The product roadmap also aligns with 25GS-PON from the MSA group and Higher Speed PON HSP (ITU-T G.9804) recommendations.

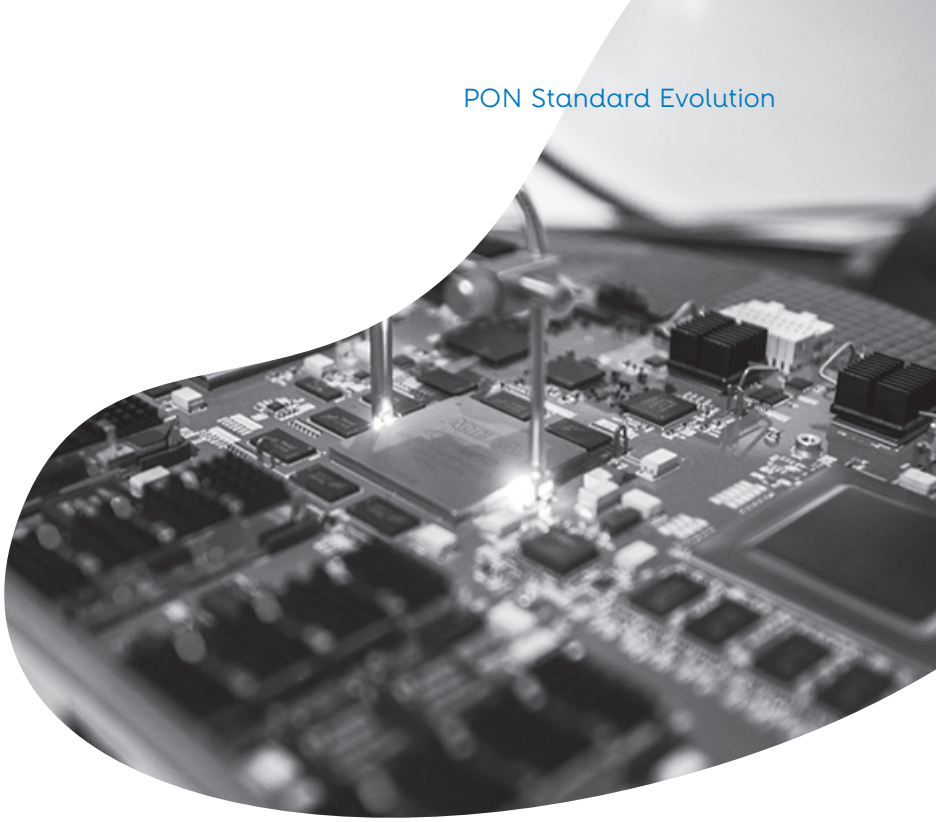
	Bit Rates Gbps (DS/US)*		Wavelengths (nm) (DS/US)*		Optics	Power Budget	Frame Structure
GPON	2.5	1.25	1490	1310	Fixed Wavelength	B+ (28dB) C+ (32dB) D (35dB)	GEM
XG-PON	10	2.5	1577	1270	Fixed Wavelength	B+ (28dB) C+ (32dB) D (35dB)	XGEM
XGS-PON	10	10	1577	1270	Fixed Wavelength	B+ (28dB) C+ (32dB) D (35dB)	XGEM
NGPON2	4x10 4x10 Could go till 8 wavelengths	4x2.5 4x10 Could go till 8 wavelengths	1596.34 1597.19 1598.04 1598.89	1532.68 1533.47 1534.25 1535.04	Fixed or Tunable Wavelength	N1 (29dB), N2 (31dB)	XGEM
25GS-PON	25	25/10	1358	1286 +1/-2	Fixed	N1 (29dB) N2 (31 dB)	XGEM
50G-PON	50	50/25/12.5	1342	1310 / 1270	Fixed	N1 (29dB) N2 (31 dB)	XGEM

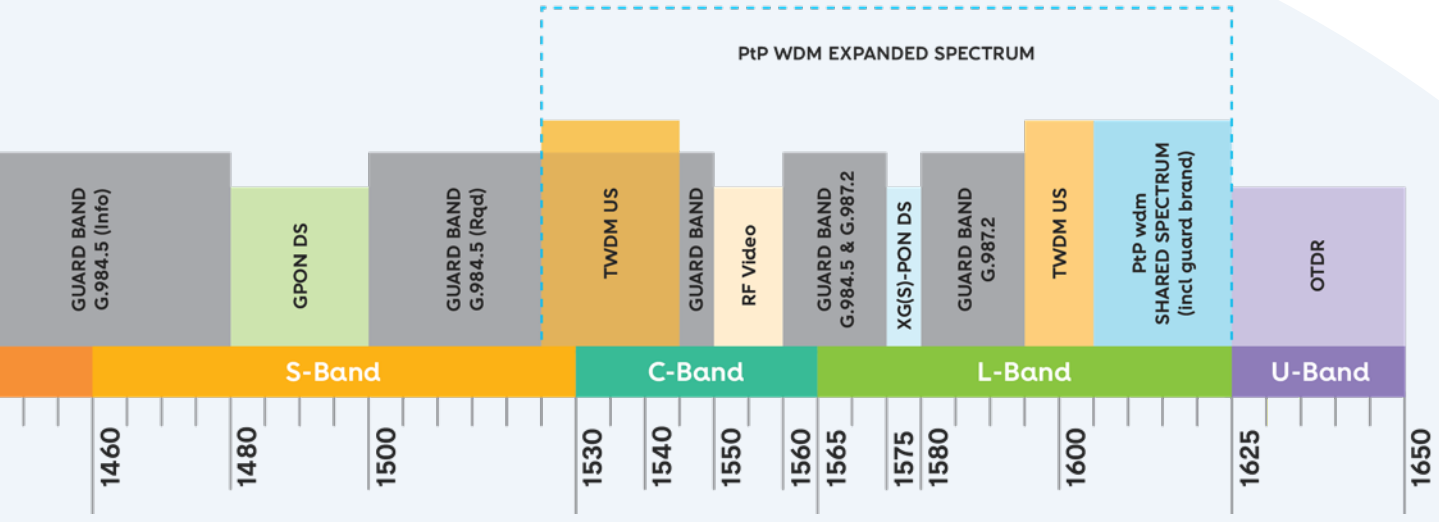
PON technology comparison

** DS - Downstream, US - Upstream*

Coexistence Along the ODN






PtP WDM EXPANDED SPECTRUM
GUARD BAND G.984.5 (Info)
GPON DS
GUARD BAND G.984.5 (Rqd)
TWDM US
GUARD BAND
RF Video
GUARD BAND G.984.5 & G.987.2
XG(S)-PON DS
GUARD BAND G.987.2
TWDM US
PtP wdm SHARED SPECTRUM (incl guard brand)
OTDR
S-Band
C-Band
L-Band
U-Band
1460
1480
1500
1530
1540
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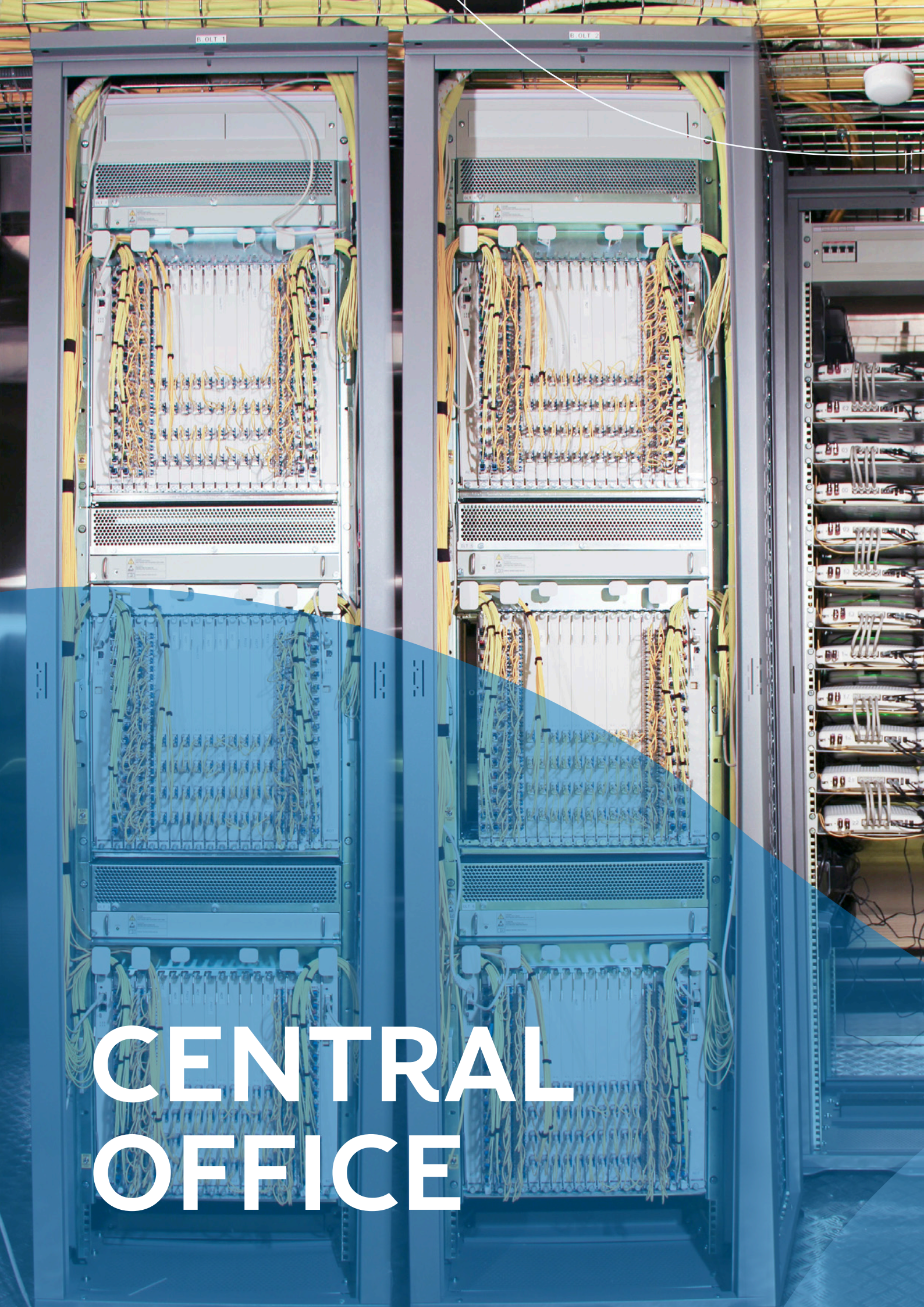
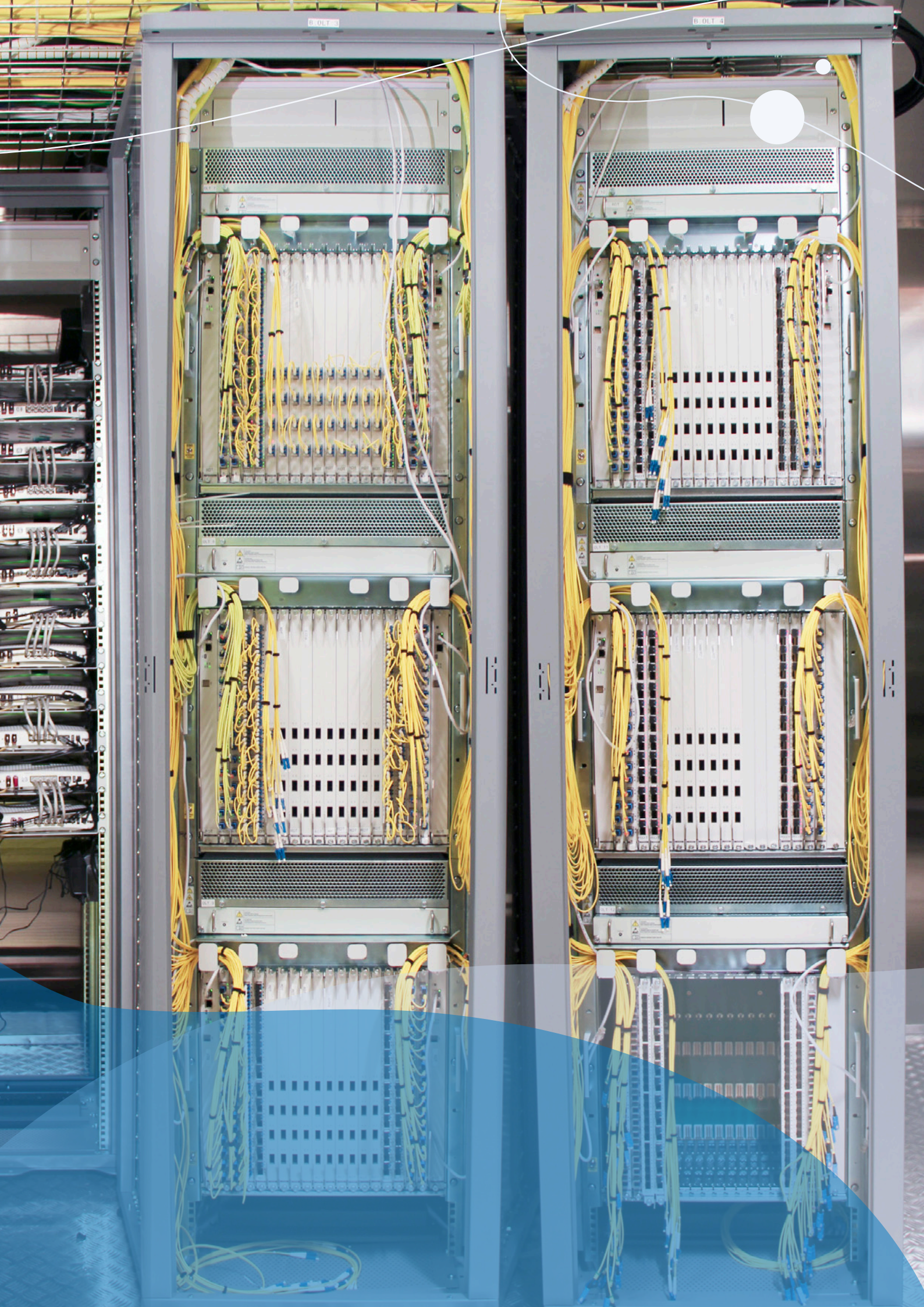
1560
1565
1575
1580
1600
1625
1650



CENTRAL OFFICE

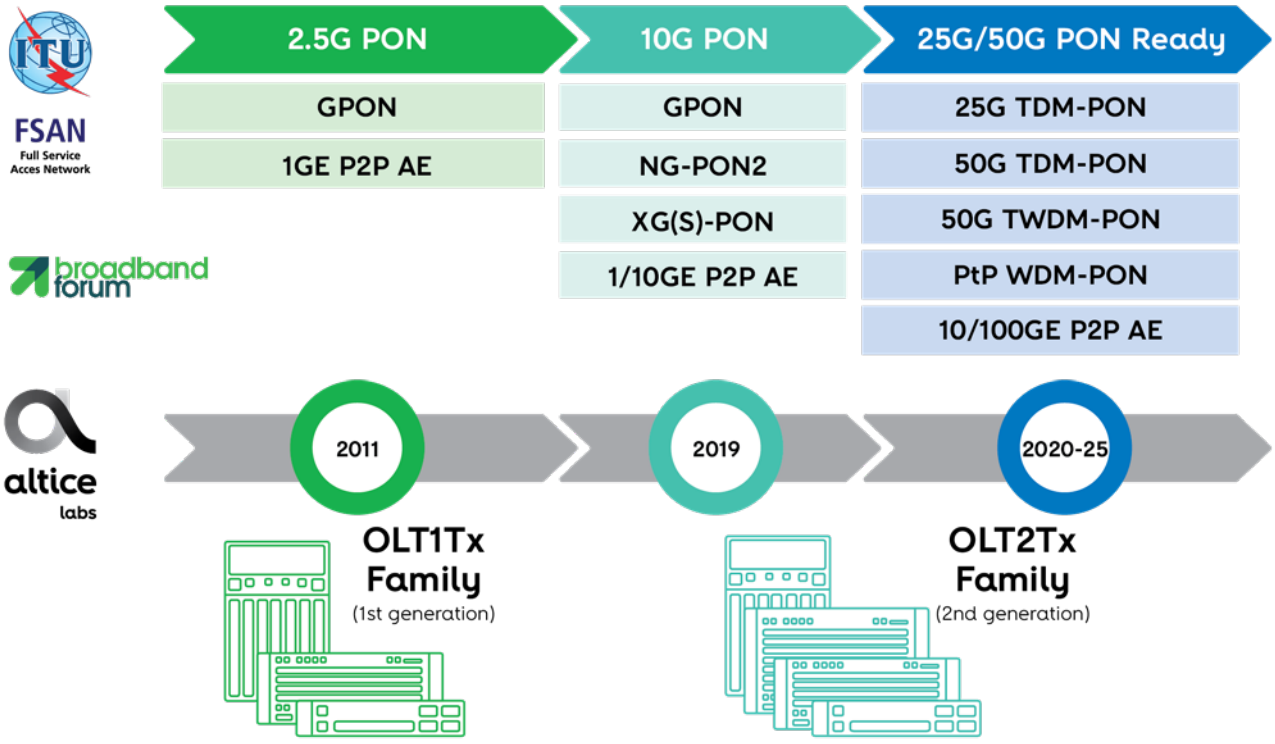

B-OLT-3
B-OLT-4

Central Office Overview

Altice Labs' Optical Line Terminal (OLT) equipment is one of today's most suitable and scalable solutions, offering Network Operators and Service Providers a flexible and cost-effective approach to implement Passive Optical Networks (xPON).

This equipment supports all the fiber access needs of Fixed, Mobile, and Convergent networks, supporting Video (IPTV, OTT TV, and RF Overlay), Data, High-Speed Internet (HSI), and Voice (VoIP) services.

Initially based on the ITU-T G.984.x GPON recommendation, Altice Labs' OLT solution fully supports next-generation PON architectures as defined by the ITU-T G.987.x (XG-PON1), ITU-T G.9807.1 (XGS-PON), ITU-T G.989.x (NG-PON2) and ITU-T G.9804 (Higher Speed PON) recommendations.



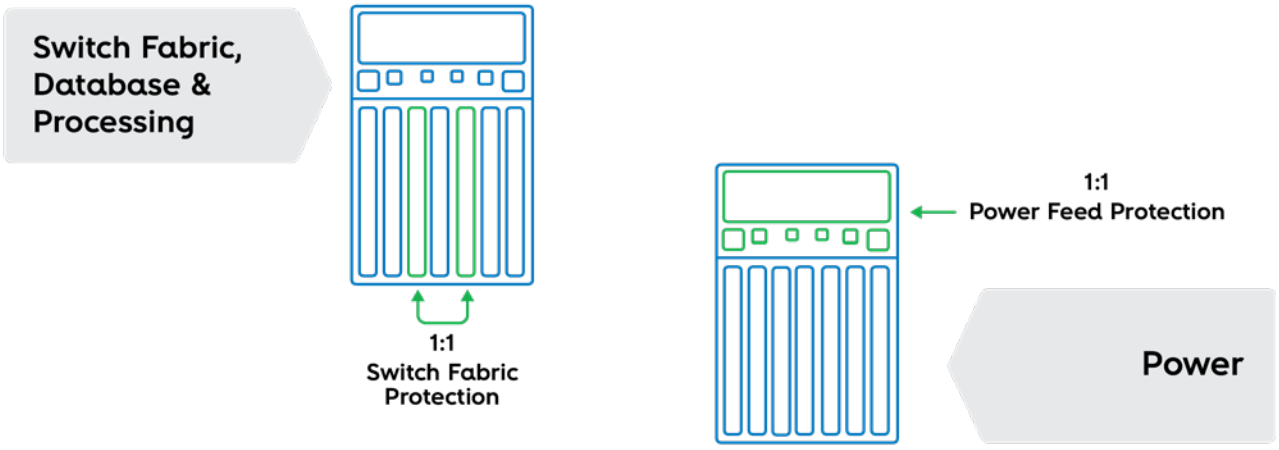
Altice Labs Central Office overview

Main Benefits and Added Value

Density	Leading density: 256 xPON / 256 10GE / 768 1GE ports from a single node		Improved cost efficiency & flexibility
Versatility	GPON, XG(S)-PON, TWDM-PON from the same chassis. Multi-PON Modules (MPM) available. Ethernet P2P (1GE, 10GE, 100GE) interfacing available.		Management of all customers on the same platform
Redundancy	Common element protection, ring and link aggregation protection, Type B network protection		Extreme availability performance
Manageability	End-to-end Zero Touch Provisioning (ZTP) capabilities		Increased operation efficiency
Interoperability	Fully interoperable with 3rd party ONTs		Freedom to choose: true multi-vendor
Virtualization	Seamless evolution towards a fully compliant SDN/NFV environment		Ready for virtualization
Future-Proof	Allowing next-gen 25G/50G Higher Speed PON technologies		Investment protection
Slicing	Virtual Network Operators (VNOs) can share the same physical infras-tructure		New business models

Altice Labs PON portfolio overview

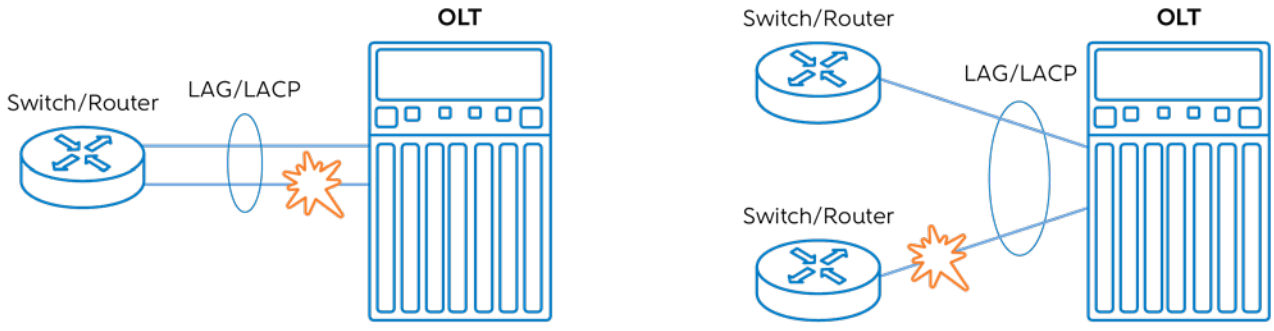
Common Element Protection



Common Element Protection

Automatic Protection Switching is achieved in less than 50ms.

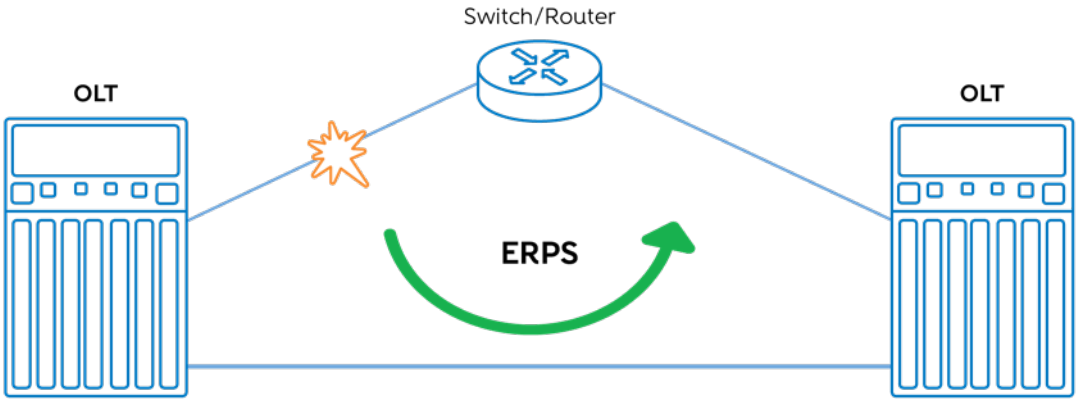
Link Aggregation



Link Aggregation

- Traffic at the uplink ports is configured to flow through different physical ports simultaneously (typically 50/50).
- In the case of LOS in one of the uplink ports, the traffic still flows, although with just half of the capacity.

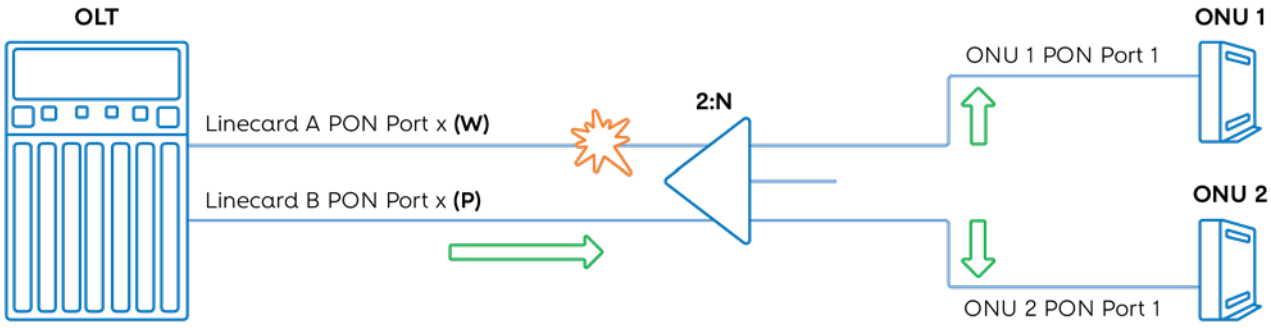
Ring Protection



Ring Protection

When a LOS signal is detected within an OLT uplink port, the traffic is entirely forwarded in the opposite direction, in less than 50ms, according to Ethernet Ring Protection Switching (ERPS ITU-T G.8032).

Type B Protection

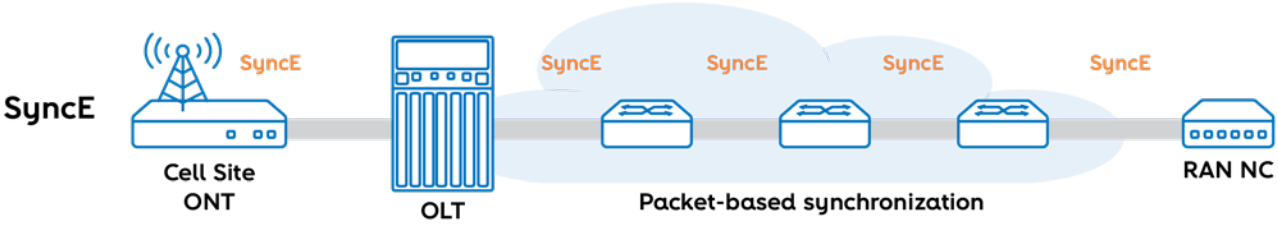


Type B Protection

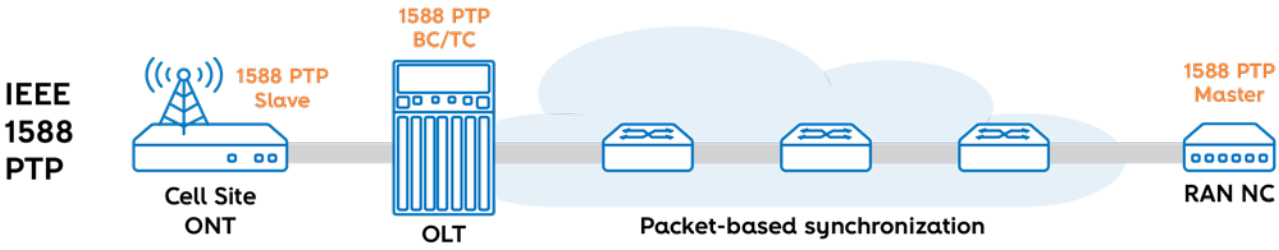
- The OLT uses two PON ports (Working and Protection).
- In the case of LOS in the W port, the traffic will automatically switch to the P port in less than 50ms.

Synchronization

Synchronization is a relevant aspect of all communication devices. The Synchronous Ethernet (SyncE) ITU-T G.826x and the Precision Time Protocol (PTP) of IEEE 1588v2, with relevant profile parameters attributes defined in ITU G.827X, are available and ready to be configured to improve network timing performance parameters, especially in critical application scenarios where latency variation and network consistency are prime issues.



SyncE Synchronization



1588 PTP Synchronization - OLT as a Border Controller (BC)

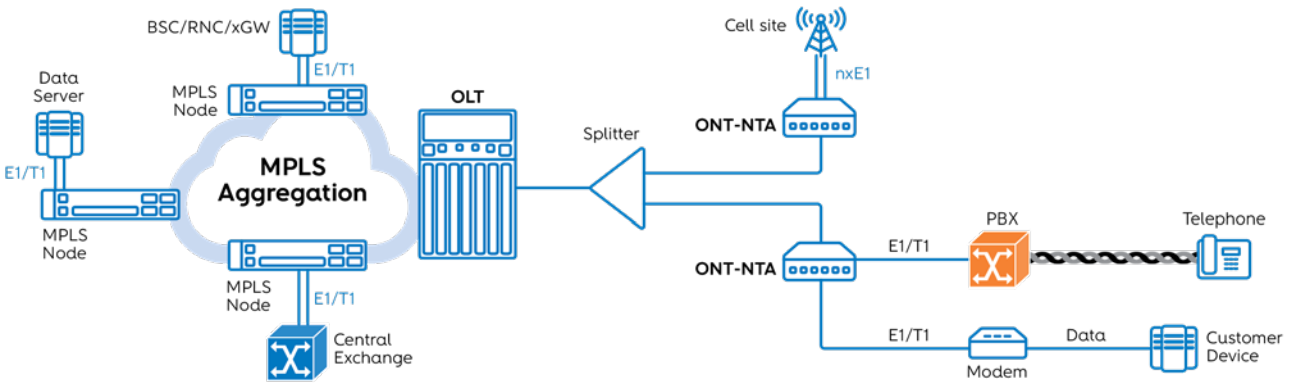
Time and phase synchronization over PON - OLT as a telecom boundary clock (T-BC)

SyncE	IEEE 1588V2 (PTP)
Initially deployed to save dedicated sync TDM E1 circuits	Initially deployed for critical sync industrial applications
Delivers Frequency reference	Delivers Frequency, Phase and Time references
Ethernet Physical Layer dependent	Physical Layer independent
Not affected by packet network traffic constraints	Affected by packet network traffic constraints (e.g. Frame delay)
Not for legacy networks (hardware/interfaces need to be upgraded). Constraints between operators and national borders	Improved latency and jitter resiliency, achieving nanoseconds high precision
Both may coexist (SyncE for frequency reference delivery and IEEE 1588 for time reference delivery)	

PON technology comparison

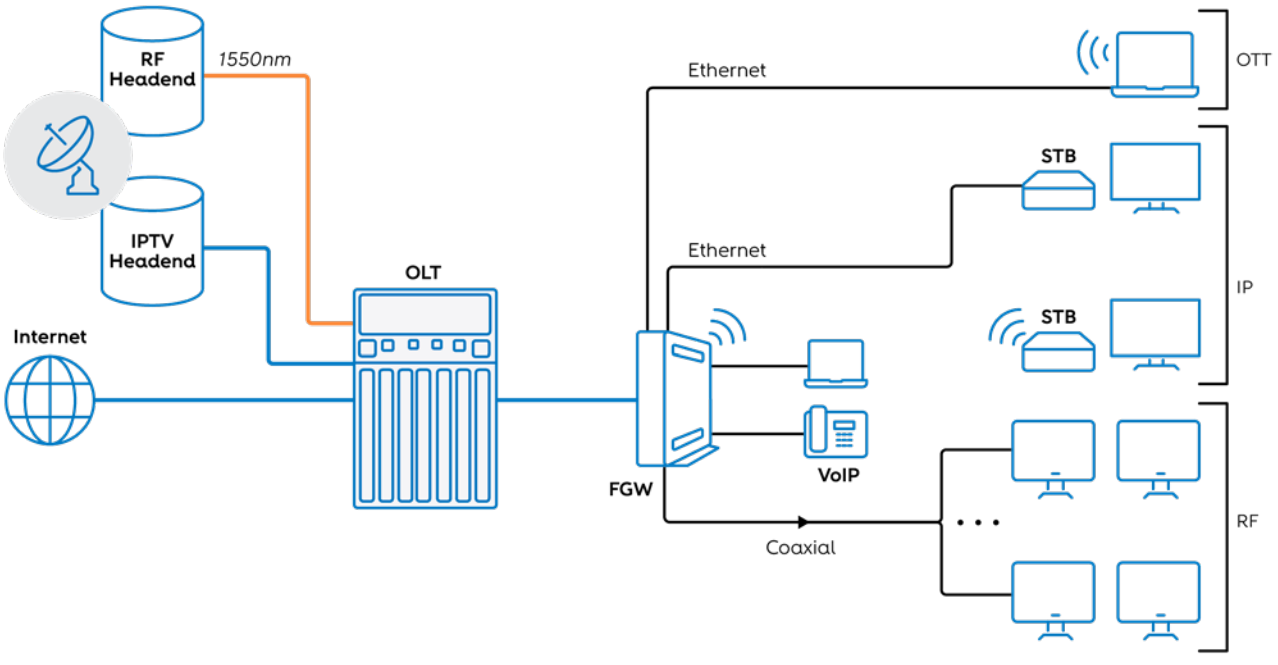
SyncE and PTP are necessary to support stringent Midhaul/Fronthaul scenarios

Circuit Emulation



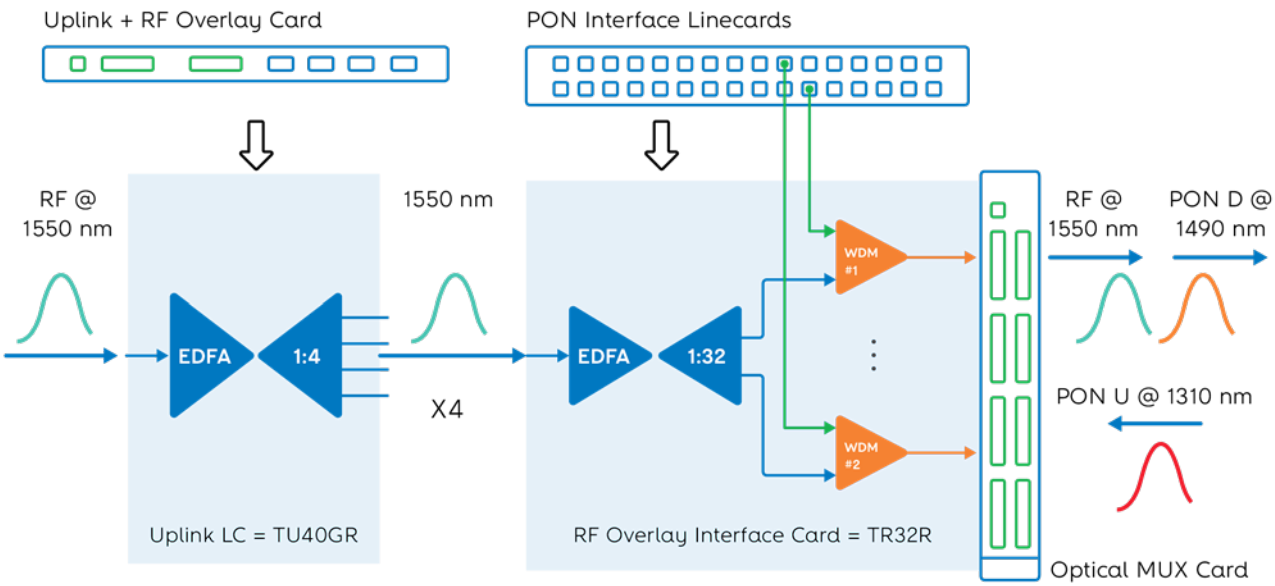
TDM E1/T1 Circuit Emulation

TV Business Model



Video service delivery

RF Overlay Features

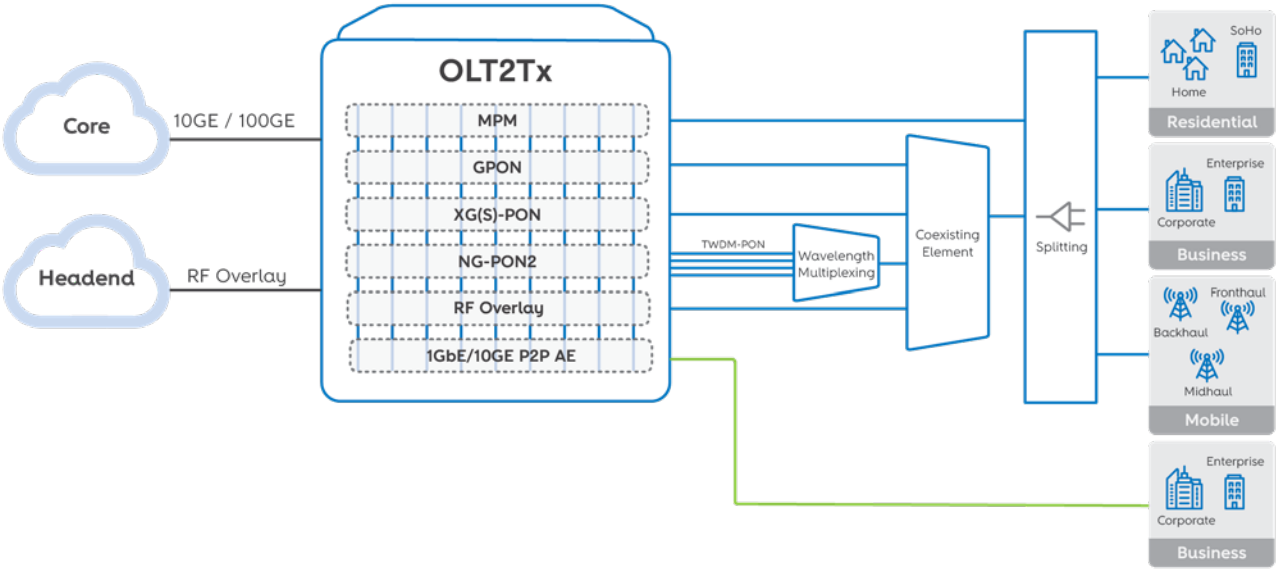


RF Overlay Capabilities (xPON use case)

The 1550nm optical RF Overlay signal received at the OLT is preamplified, split, and multiplexed with an xPON signal delivered to the Outside Distribution Network (ODN).

- RF Overlay optical distribution over xPON through integrated functions of the OLT.
- Up to 128 xPON ports with integrated RF Overlay.

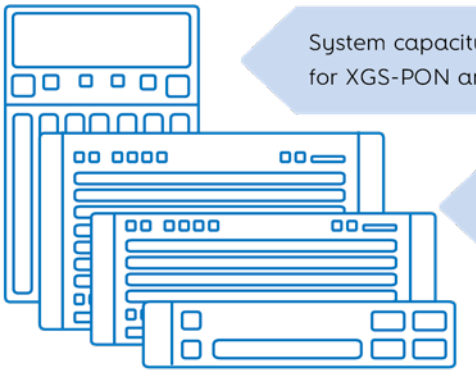
OLT2Tx Interconnection



OLT2Tx Central Office

The OLT2Tx equipment supports GPON, XG(S)-PON, NG-PON2, and PtP 1GE/10GE to solve the entire needs of the access network domain, covering Residential, Business, and Mobile market segments. The OLT2Tx chassis are also prepared for next-generation PON technologies such as 25GS PON (MSA) or 50G PON (g.hsp).

OLT2Tx Future-Proof Platforms



System capacity increase towards native support for XGS-PON and NG-PON2 technologies

Single node service integration (B2C, B2B and MBH)

Multi-Terabit Optical Access

Ultra-high bandwidth

- High-speed PON ready (25GS-PON/50G PON)
- Up to 400Gbps/slot backplane capacity
- Nx100GE Uplink Interfacing
- NG-PON2 / XGS-PON / GPON
- Active Ethernet (PtP) 10G/1G

High reliability

- Common parts redundancy (Power / Switch Fabric / Uplinks)
- LAG / LACP Uplink Protection
- Type B Protection for the ODN side

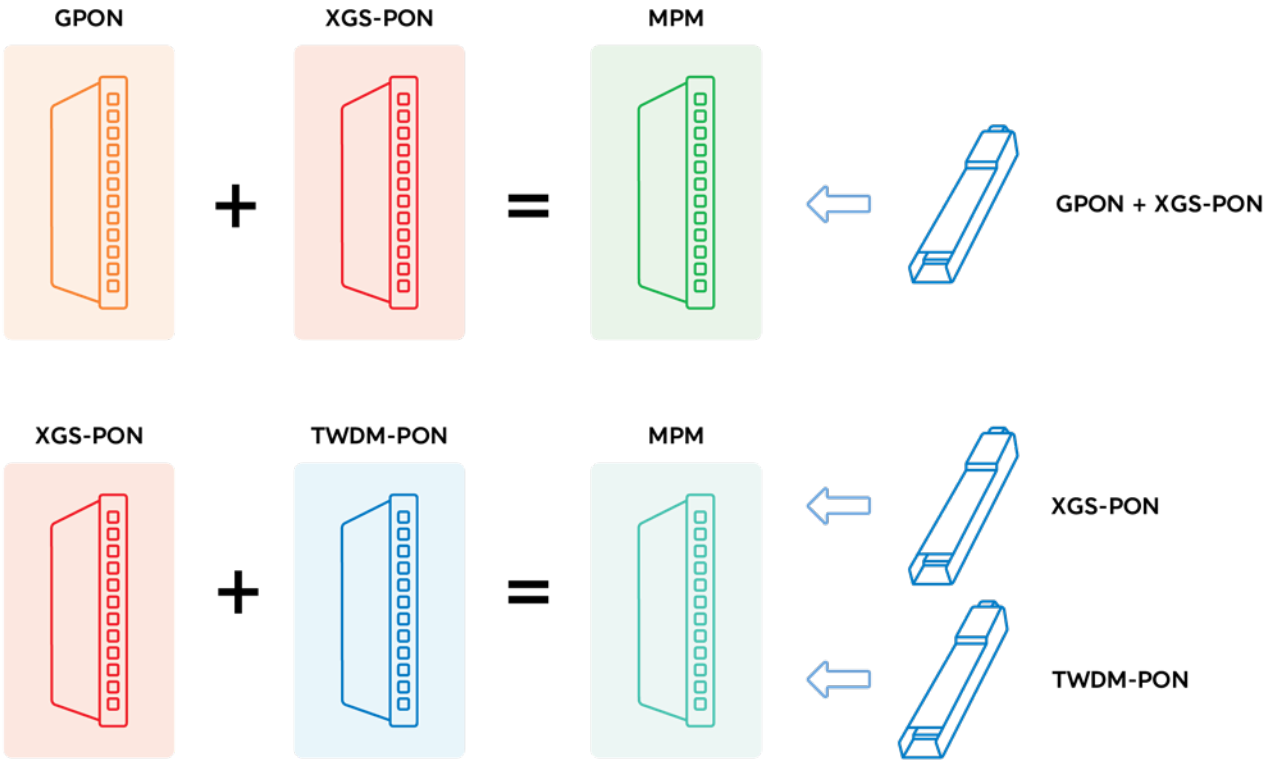
Virtualization & Slicing

- Seamless migration towards a fully virtualized network environment
- Several Virtual Network Operators can share the same infrastructure

OLT2Tx motivation requirements

High Level of Flexibility Multi PON Modules

Save your investments and achieve a smooth technology migration by delivering more than one technology within the same line card.

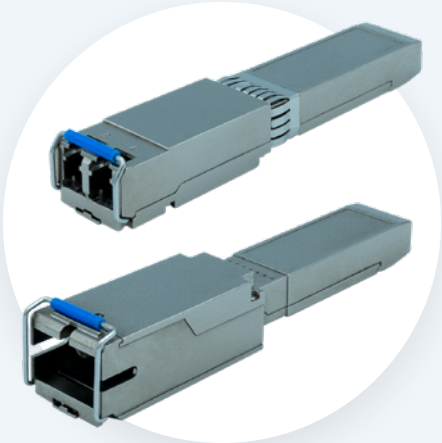


High level line card flexibility

High-Density PON

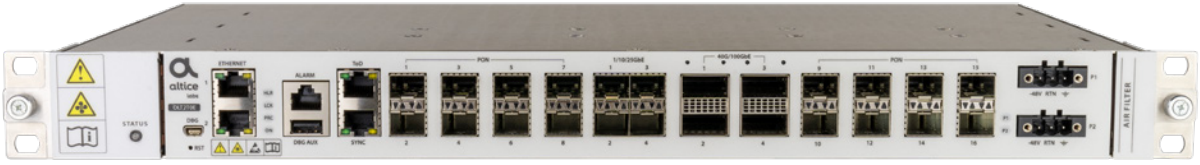
Altice Labs has recently revealed a market-patented novel Dual SFP that can duplicate PON port density over a regular GPON or XGS-PON interface.

- The first PON SFP in the market with double density;
- Combines two OLT transceivers in a single SFP housing;
- For the GPON technology employs two 1490 nm CW downlink DFB lasers operating at 2.488Gbps and two 1310 nm optical burst mode receivers incorporating ADP/TIA optics for maximum sensitivity;
- For the XGS-PON technology employs two 1577 nm CW downlink EML lasers operating at 9.953 Gbps and two 1270 nm optical burst mode receivers incorporating ADP/TIA optics for maximum sensitivity.



For example, our OLT2T0E 1 rack unit equipment will be able to deliver not 16 but 32x GPON or 32x XGS-PON interfaces.

OLT2T0E



32x GPON or 32x XGSPON

10G PON Central Office

Download datasheet
Scan the QR code to view more information

OLT2T4

- Multi-Terabit Optical Access Shelf | Dual Star High Availability Architecture
- Dual redundant switch fabric and uplink modules
- 16 Service slots | 2 Uplink slots | 2 Switch fabric and uplink slots
- Size: 19" x 15RU x 240mm/9.4'' (WxHxD)
- Redundant power supply and removable fan tray
- Controlled Environment: 5% - 95% Humidity and -5°C to +45° Temperature Range
- Service slots: 256x GPON/XG(S)-PON (MPM), 256x NGPON2, 768x FE/GE, 256x 10GE

10G PON Central Office

Download datasheet
Scan the QR code to view more information

OLT2T3

- Multi-Terabit Optical Access Shelf | Dual Star High Availability Architecture
- Dual redundant switch fabric and uplink modules
- 8 Service slots | 2 Switch fabric and uplink slots
- Size: 19” x 7RU x 240mm/9.4” (WxHxD)
- Redundant power supply and removable fan tray
- Hardened Environment: 5% - 95% Humidity and -40°C to +65° Temperature Range
- Service slots: 128x GPON/XG(S)-PON (MPM), 128x NGPON2, 384x FE/GE, 128x 10GE

10G PON Central Office

Download datasheet
Scan the QR code to view more information

OLT2T2

- Multi-Terabit Optical Access Shelf | Dual Star High Availability Architecture
- Dual redundant switch fabric and uplink modules
- 4 Service slots | 2 Switch fabric and uplink slots
- Size: 19” x 4RU x 240mm/9.4’’ (WxHxD)
- Redundant power supply and removable fan tray
- Hardened Environment: 5% - 95% Humidity and -40°C to +65° Temperature Range
- Service slots: 64x GPON/XG(S)-PON (MPM), 64x NGPON2, 192x FE/GE, 64x 10GE

Download datasheet
Scan the QR code to view more information

OLT2T0E

- Compact Optical Access Shelf
- Size: 19” x 1RU x 240mm/9.4’’ (WxHxD)
- Redundant power supply and removable fan tray
- Hardened Environment: 5% - 95% Humidity and -40°C to +65° Temperature Range
- Service slots: 16x GPON/XG(S)-PON (MPM)

10G PON Central Office

Download datasheet
Scan the QR code to view more information

OLT2T0

- Compact Optical Access Shelf
- Size: 19” x 1RU x 240mm/9.4” (WxHxD)
- Redundant power supply and removable fan tray
- Hardened Environment: 5% - 95% Humidity and -40°C to +65° Temperature Range
- Service slots: 8x GPON/XG(S)-PON (MPM)

GPON Central Office

Download datasheet
Scan the QR code to view more information

OLT1T3

- Multi-Terabit Optical Access Shelf | Dual Star High Availability Architecture
- Dual redundant switch fabric modules
- 18 Service/Network slots ("Any Card / Any Slot") | 2 Switch fabric slots | 2 Uplink slots
- Size: 19" x 14RU x 240mm/9.4'' (WxHxD)
- Redundant power supply and removable fan tray
- Controlled Environment: 5% - 95% Humidity and -5°C to +45° Temperature Range
- Service slots: 256x GPON, 768x FE/GE

GPON Central Office

Download datasheet
Scan the QR code to view more information

OLT1T1

- Multi-Terabit Optical Access Shelf | Dual Star High Availability Architecture
- Dual redundant switch fabric modules
- 3 Service slots | 2 Switch fabric and uplink slots
- Size: 19” x 3RU x 240mm/9.4’’ (WxHxD)
- Redundant power supply and removable fan tray
- Hardened Environment: 5% - 95% Humidity and -40°C to +65° Temperature Range
- Service slots: 48x GPON, 144x FE/GE

Download datasheet
Scan the QR code to view more information

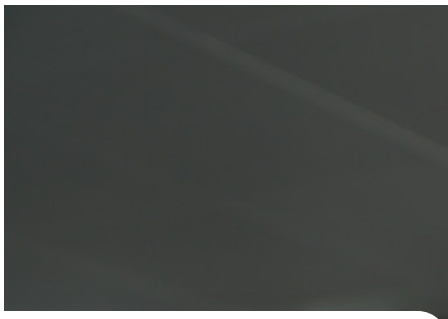
OLT1T0

- Compact Optical Access Shelf
- Size: 19” x 1RU x 240mm/9.4” (WxHxD)
- Redundant power supply and removable fan tray
- Hardened Environment: 5% - 95% Humidity and -40°C to +65° Temperature Range
- Service slots: 8x GPON

CUSTOMER PREMISES EQUIPMENT

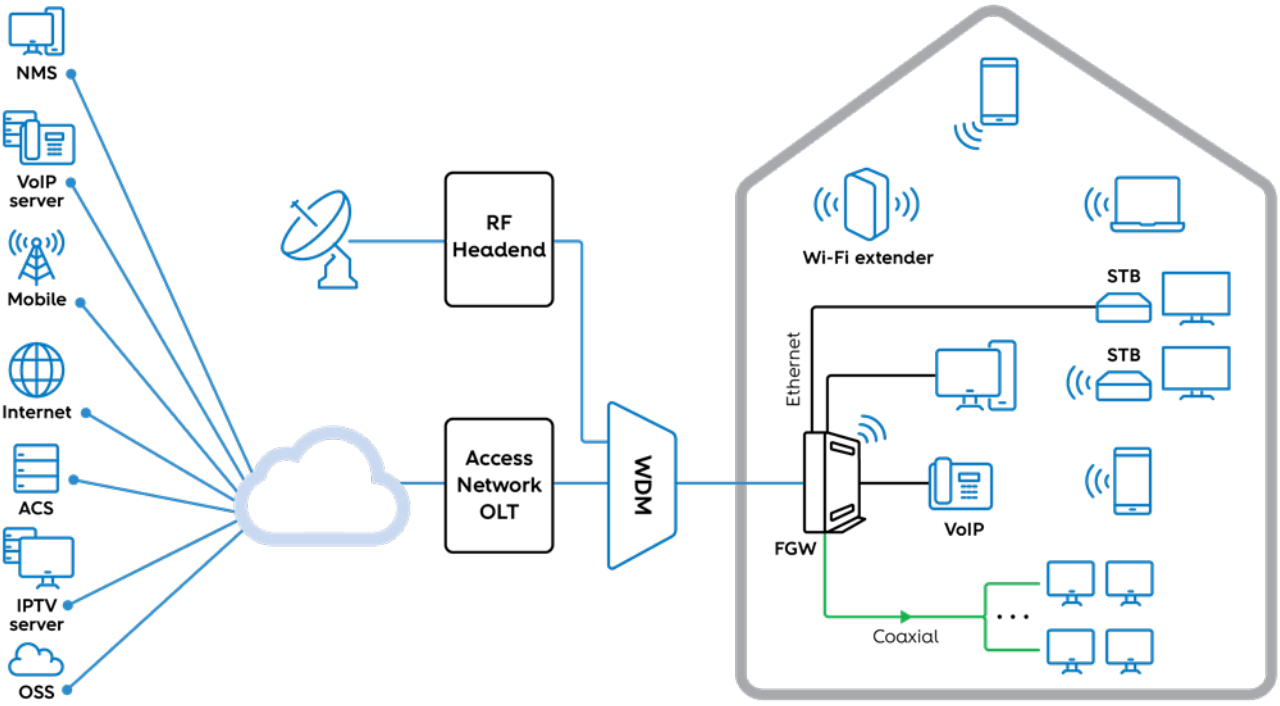

PON
INTERNET
WPS
WIFI
TEL
POWER
WPS
WIFI

Customer Premises Equipment



Altice Labs has significant experience developing Customer Premises Equipment solutions targeting home, business, and mobile environments, mainly focused on Passive Optical Network (xPON) terminal equipment.

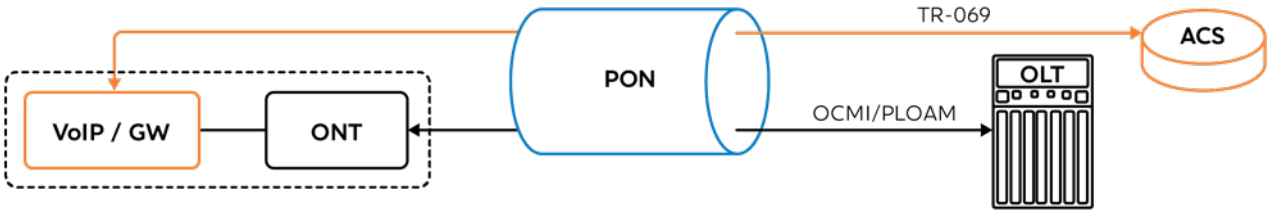
At the xPON level, the ONT equipment supports multi-play services based on ITU-T rec. G.984 (GPON), G.987 (XG-PON), G.9807.1 (XGS-PON), and G.989 (NG-PON2) standards, enabling High-Speed Internet (HSI), IPTV, VoIP, RF Overlay and Wi-Fi services via standardized interfaces.



In-house networking


RESET
TEL
LAN
USB
ON/OFF
PWR
PON
altice
Wi-Fi EXTENDER
D2150G
PWR
LAN
12VDC/1A
1
2

The ONT Management and Control Interface (OMCI) is available at the management level according to the corresponding ITU standards. The TR-069 protocol is also available and allows for L3 features to be remotely mass-configured, troubleshoot, and managed by an Auto Configuration Server (ACS).

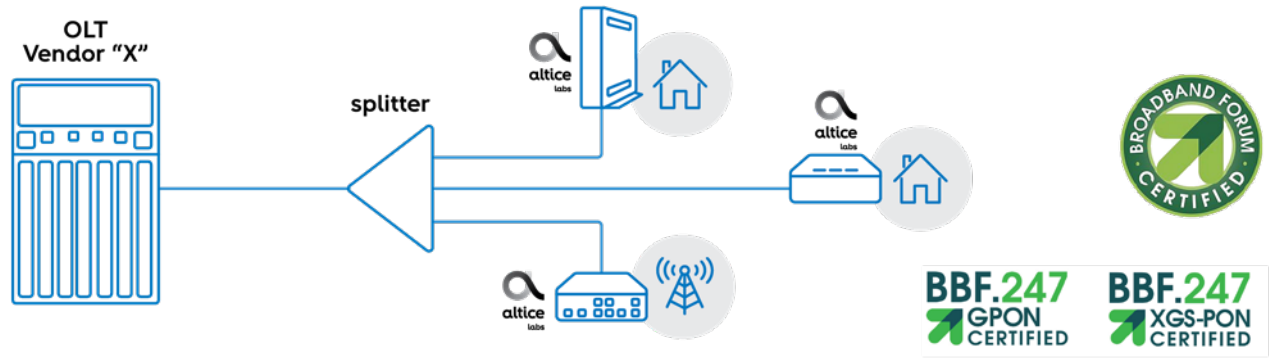


Remote management through TR-069

Mass remote management through OMCI and TR-069 standards offers full remote control without user intervention; TR-142 defines a Virtual UNI between the OMCI and TR-069 management domains.

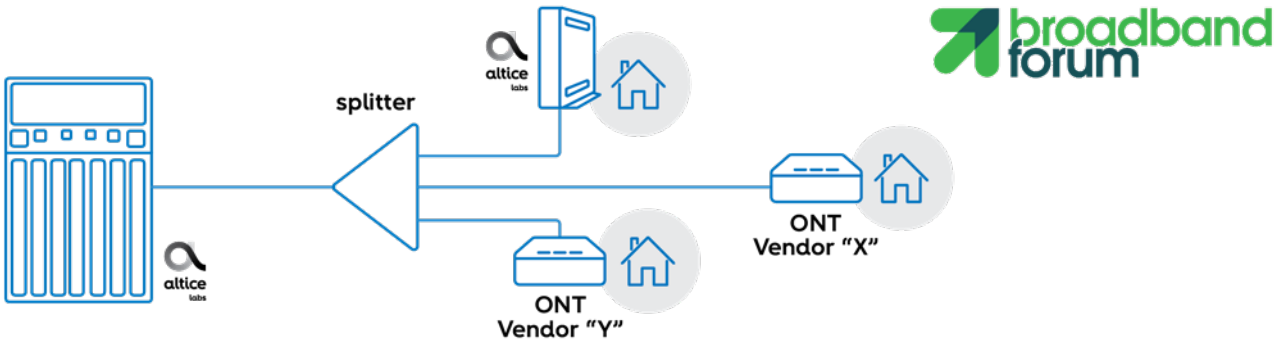
NADM is Altice Labs' ACS platform devoted to retail and wholesale markets that can manage millions of devices in real time.

Altice Labs was one of the first vendors worldwide to achieve the Broadband Forum BBF.247 certification at the ONT level, allowing and promoting a truly multi-vendor environment that can be easily configured to differentiate the residential and business offers.



ONT interoperability scenario

The multi-vendor ONT scenario, as defined by Broadband Forum WT-255, is also supported by our OLT portfolio.



OLT interoperability scenario

Regardless of 1G PON or 10G PON equipment families, Altice Labs fits Fiber-to-the-Home (FTTH), Fiber-to-the-Cell (FTTC), and Fiber-to-the-Distribution Point (FTTDP) deployment scenarios. At the same time, some of our CPE devices may simultaneously cover Active Ethernet scenarios.

The ONT portfolio may also be classified into three different equipment segments:

Bridging Family (simple L2 bridging devices) - This equipment family is suitable for low-cost xPON fast deployments, delivering a reliable service using a third-party gateway or a network termination point for mobile backhaul scenarios.

Gateway Family (with L2/L3 gateway features) - This equipment family is the right choice for full in-house multi-play service delivery, enabling Voice, Video, and Data over a single PON terminal equipment. This equipment family has built-in routing features that avoid needing an external third-party gateway. It also shows several wireless standard interface options, essential for complete and enhanced in-house/in-building Wi-Fi coverage. Wi-Fi 802.11 b/g/n/ac/ax/be standards cover 2.4GHz, 5GHz, and 6GHz bands complying with the Wi-Fi 7 standard.

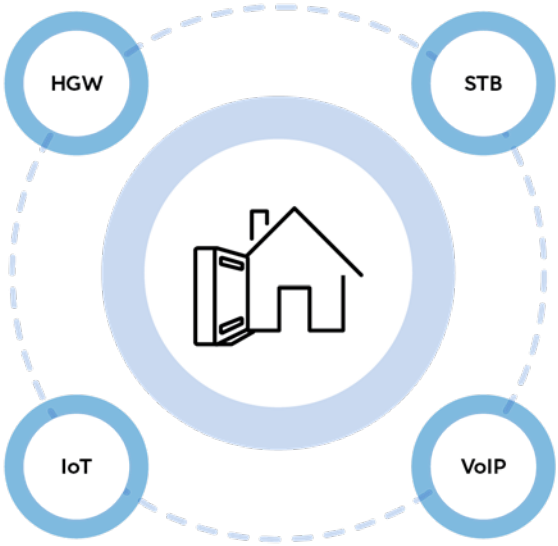
Dedicated Services Family (legacy traffic transport) - This equipment family brings dedicated terminals into next-generation xPON infrastructures. Circuits like E1/T1 and IoT standardized interfaces may be collected and transported over a point-to-point/point-to-multipoint logical circuit scenario. In addition, dedicated synchronous protocols such as SYNC-E and PTP1588v2 are available for mobile backhaul and wholesale applications.

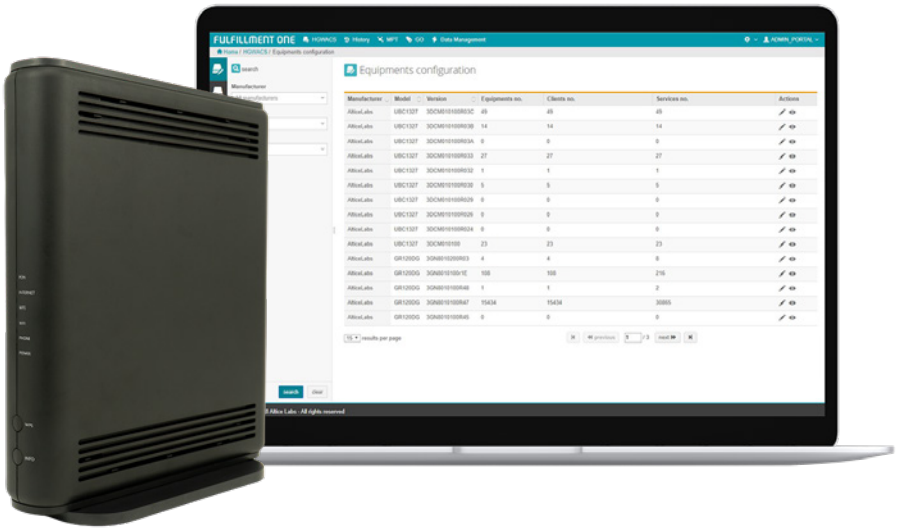
Device Management Solution

Altice Labs' Device Management solution applies to residential and corporate networks. It supports several device types and vendors, enabling real-time management of millions of devices.

This solution is ready to support CPE virtualization scenarios (vCPE, uCPE), combining the configuration of physical (PNF) and virtual (VNF) components of a device, allowing the composition of services that span across both domains in a transparent and seamless approach. This solution provides APIs for easy integration with OSS fulfillment and assurance processes.

- CPEs Management
- Easy deployment of new services supported by CPEs
- Optimized bulk operations
- Complete protocol support for integrations
- Ready for the virtualization of CPE functions - NFV



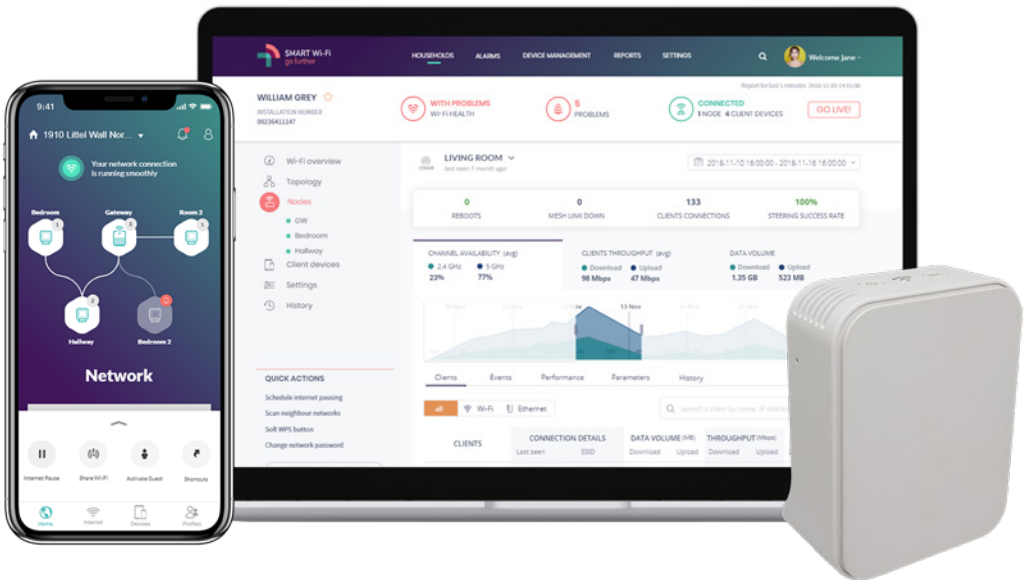


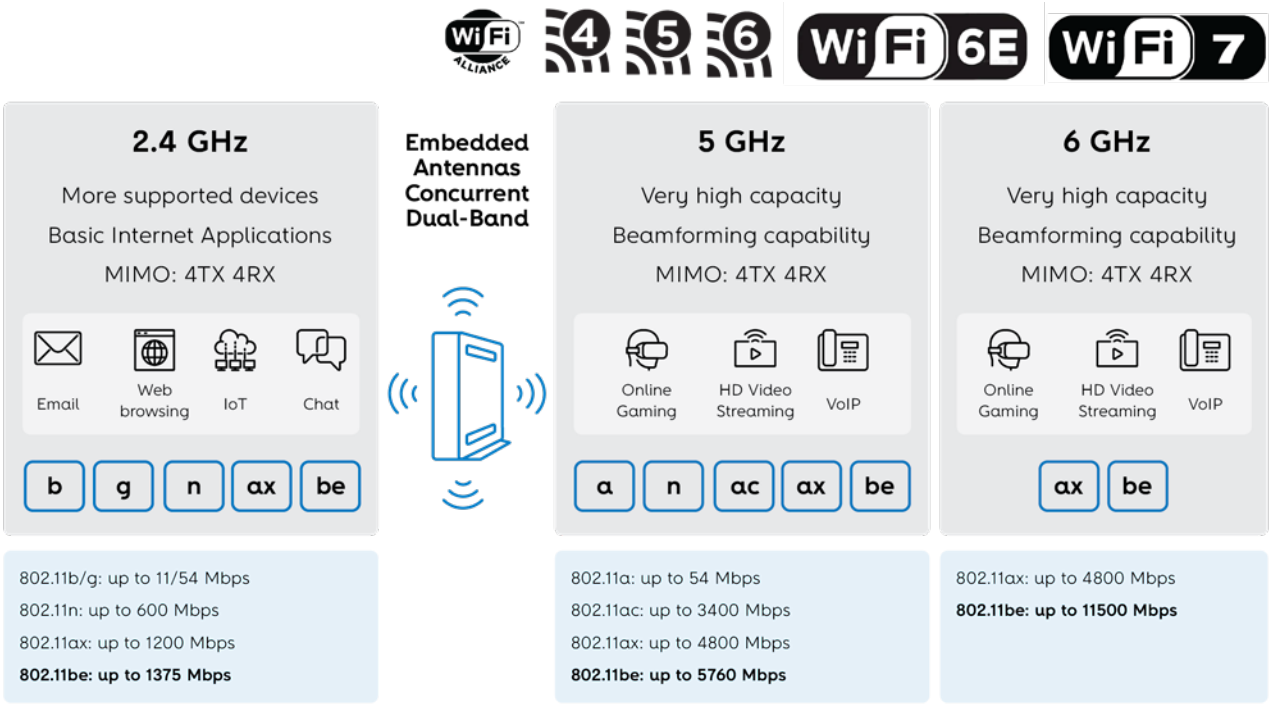
Smart Wi-Fi Solution

Wi-Fi is a crucial service in every home that is expected to ensure fast and reliable network access while providing a quality user experience.

The Wi-Fi service is challenging for the operator since the visibility of quality and problem-solving within consumers' homes is limited. Altice Labs' Smart Wi-Fi solution bridges this gap with a cloud platform that provides high visibility of the Wi-Fi service in every home. This solution allows you to leverage Wi-Fi remote control services from an intuitive mobile app and a cloud portal for operator and end-user profiles.

- Management platform for Wi-Fi mesh networks
- Real-time monitoring, diagnosis, and optimization
- Improvement of steering algorithms through analytics & machine learning
- Controls for operators and end customers
- Extenders & HGW device management





Wi-Fi specifications

To boost the CPE portfolio specifications, the RDK-B software framework has been added to the Fiber Gateway equipment family. RDK-B is an open-source software development framework and a market reference for network operators.

With RDK-B running inside the CPE product family, Altice Labs looks forward to optimizing and unifying the CPE software development procedures along with the Wi-Fi, xPON, and DOCSiS products, taking significant profit from its main technical advantages.

RDK-B drastically increases flexibility and unification in the product development cycle while decreasing the product Time-to-Market. This new feature is also an opportunity for CPE enrichment with IoT, Analytics, SDN, and other 3rd party applications now available for straightforward integration within the box.

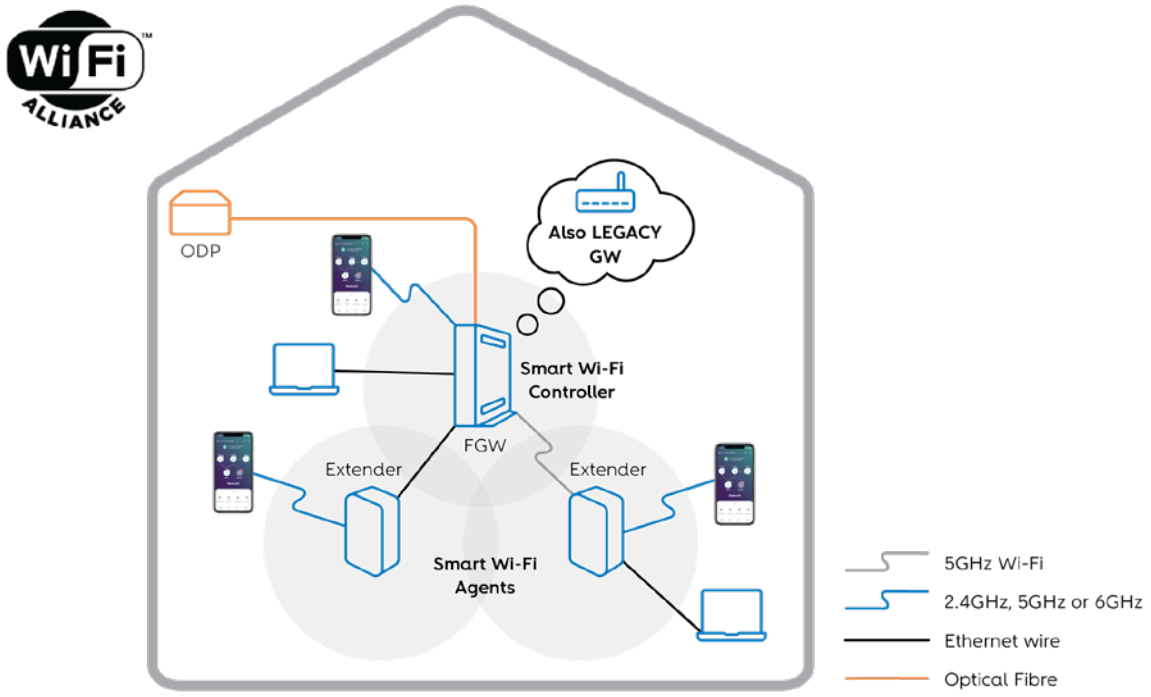
Smart Mesh Wi-Fi, an Enhanced Wireless Experience

The massive increase in connected devices has resulted in a drastic demand for Wi-Fi connectivity throughout the house. Consumers own multiple mobile devices, including IoT and smart home--connected products that require quality airtime and uniform Wi-Fi coverage in house and outdoor areas. Traditionally, home Wi-Fi deployments include a single Wi-Fi Access Point (AP) or router, which may or may not fully envelop the desired capacity and coverage area. Increased mobility and throughput, improved efficiency and capacity, reduced interference, easier AP placement, and network configuration are vital for enhancing Wi-Fi networks.

Altice Labs has dedicated significant attention to in-house Wi-Fi coverage scenarios and has developed a Smart Mesh Wi-Fi certified solution based on Wi-Fi EasyMesh™ from Wi-Fi Alliance®. The solution incorporates hardware (main router, e.g., FGW, and Smart Mesh Wi-Fi AP extenders), a mobile user app (Android & iOS), and a unified cloud-based portal to configure, manage and report the Wi-Fi mesh ecosystem. The FGW and Smart Mesh Wi-Fi APs run local software (local Controller, local Agent, and a Smart Mesh Wi-Fi Management agent) to provide a high-performance state-of-the-art Wi-Fi network.

Wi-Fi EasyMesh™ networks utilize multiple APs that work together to ensure complete Wi-Fi coverage, with full user mobility, in all home areas, keeping a consistent performance and a high-quality user experience.

Smart Mesh Wi-Fi Cloud Platform & Mobile App



Smart Mesh Wi-Fi network topology

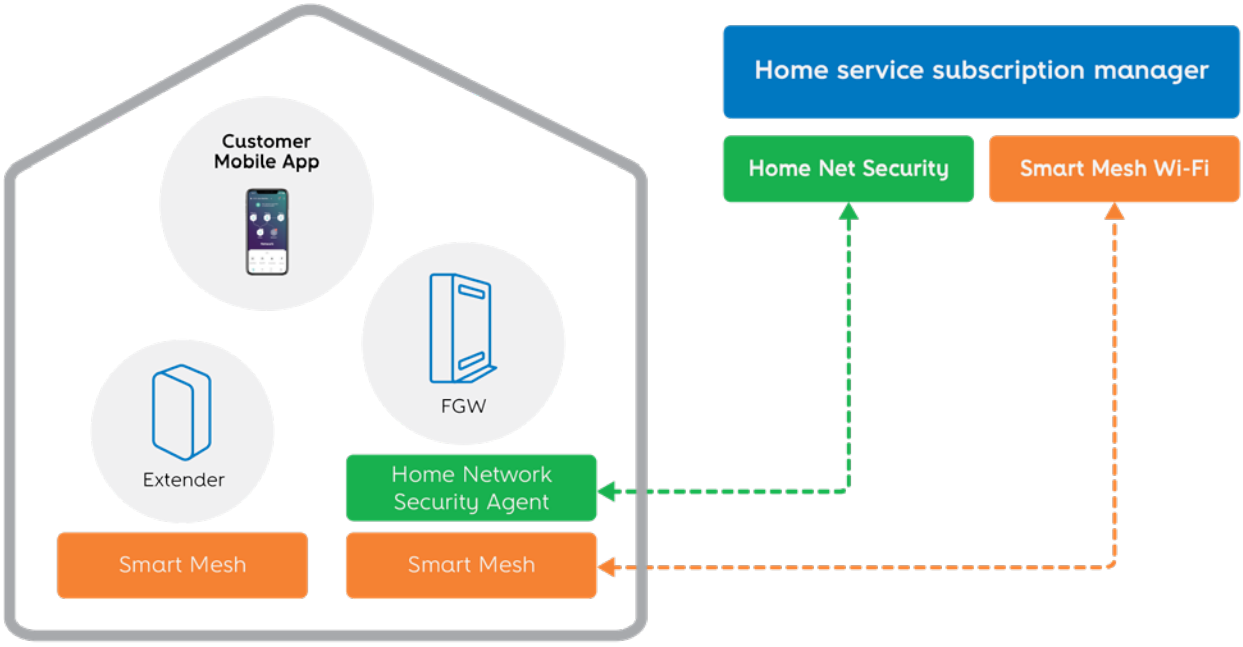
Hardware Extenders

- High-performance HW solution based on the new IEEE 802.11ax @ 2.4GHz, 5GHz and 6GHz
- Interoperable mesh solution compliant with Wi-Fi Alliance® Multi-AP specification
- Optimal QoS and throughput performance
- Wireless and wireline (Ethernet) backhaul connections used to link the extenders to the FGW
- Patented enhanced steering and traffic load balance features

Cloud Platform & Mobile App

- Central monitoring, diagnostics and optimization of the Smart Mesh Wi-Fi
- Remote control of network devices
- Intelligence provided to the Wi-Fi mesh through analytics
- Live troubleshooting, device management, and full visibility of home networks and CPEs
- Smart Wi-Fi management through the mobile app everywhere inside and outside the home network

Home Network Security (HNS)



Alongside the Smart Mesh Wi-Fi functionalities, which include service connectivity and monitoring aspects, the Home Network Security component provides new security features:

- Device fingerprinting
- Antivirus integration
- Browsing protection
- Virtual Hot Patching
- Home LAN protection
- Internet Parental Control
- On-the-go Security

These features may be enabled and controlled through the customer mobile app that uses the home service subscription manager as the real-time service broker.

GPON

GS0100G

GS0110G

GS1000G

GS1100G

ONT-SFU

- L2 Based service
- Options for RF Overlay and voice interfaces
- Multi-play service support
- ITU-T G.984.x and G.988 compliant
- Size: 35/1.4 x 143/5.6 x 103/4.1 (HxWxD mm/")
- Weight: 158 g / 0.35 lb

Download datasheet
Scan the QR code to view more information

GPON

GR241AG

Download datasheet
Scan the QR code to view more information

GR140CG

Download datasheet
Scan the QR code to view more information

Fiber Gateway Wi-Fi 5

- L2 + L3 Based service
- Wi-Fi 5: Wi-Fi 802.11 b/g/n @2.4GHz + 802.11 n/a/ac @5GHz
- FXS Voice
- 10/100/1000Base-T LAN interfacing
- USB
- RF Overlay (optional)
- Multi-play support
- Embedded Voice, RF Overlay, Wi-Fi and USB interfacing
- Mass remote management through OMCI (G.988) and TR-069 standards, offering full remote control without user intervention

GPON

GR141DG

GR140DG

Download datasheet
Scan the QR code to view more information

Fiber Gateway Wi-Fi 6

- L2 + L3 based services
- ITU-T G.984.x and ITU-T G.988 compliant and TR-069 supported
- Multi-play service support
- 4x 10/100/1000Base-T LAN interfacing (1Gbps LAN wire speed)
- 1x FXS Voice interfacing
- 1x USB Type C
- 1x RF Overlay (Optional)
- Wi-Fi 6: Wi-Fi 802.11 b/g/n/ax @2.4GHz + 802.11 n/a/ac/ax @5GHz
- Size: 245.8/9.7 x 44.8/1.8 (80.6/3.2 including base) x 210.0/8.3 (HxWxD mm/")
- Weight: 800 / 1.76 (g/lb)

GPON

GR240JH

Download datasheet
Scan the QR code to view more information

Fiber Gateway Wi-Fi 6E

- L2 + L3 based services
- ITU-T G.984.x and ITU-T G.988 compliant and TR-069 supported
- Multi-play service support
- 3x 10/100/1000Base-T LAN interfacing (1Gbps LAN wire speed)
- 1x 2.5GBase-T LAN interfacing
- 2x FXS Voice interfacing
- 1x USB Type A
- Wi-Fi 6E: Wi-Fi 802.11 b/g/n/ax @2.4GHz + 802.11 n/a/ac/ax @5GHz + 802.11 ax @6GHz
- Size: 245/9.7 x 80/3.2 x 210/8.3 (HxWxD mm/")
- Weight: 745 / 1.64 (g/lb)

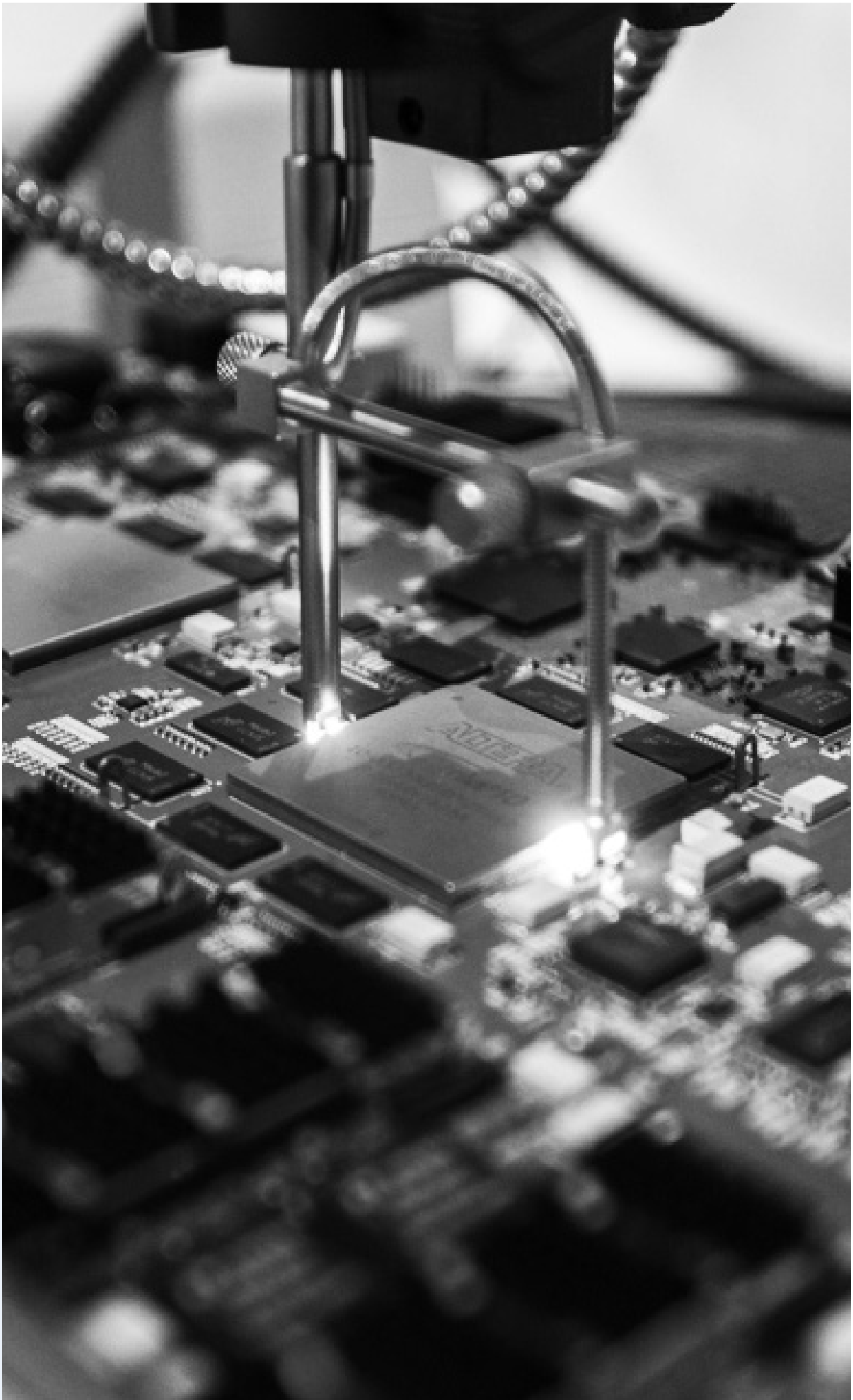
GPON

GR240NHR

Download datasheet
Scan the QR code to view more information

Fiber Gateway Wi-Fi 7

- L2 + L3 based services
- ITU-T G.984.x and ITU-T G.988 compliant
- Matter and TR-069/098/104/111/140/142/143 /181 supported
- Multi-play service support
- 3x 10/100/1000Base-T LAN interfacing (1Gbps LAN wire speed)
- 1x 2.5GBase-T LAN interfacing
- 2x FXS Voice interfacing
- 1x USB Type C
- Wi-Fi 7: Wi-Fi 802.11 b/g/n/ax/be @2.4GHz + 802.11 n/a/ac/ax/be @5GHz + 802.11 ax/be @6GHz
- Size: [192.8 x 92.6 (base) x 185]mm/ [7.6 x 3.6 (base) x 7.3]”
- Weight: 1081/2.4 (g/lb)



10 GPON

XSS0200I

XSS0100K

XSS0200J

ONT-SFU

- L2 based services
- ITU-T G.9807.1 and ITU-T G.988 compliant
- Multi-play service support
- 10Gbps LAN interfacing
- Size: 40/1.6 x 210/8.3 x 210/8.3 (HxWxD mm/")
- Weight: 483/1.06 (g/lb)

Download datasheet
Scan the QR code to view more information

XSS0100KP

ONT-SFU-KP

- L2 based services
- ITU-T G.9807.1 and ITU-T G.988 compliant
- Multi-play service support
- 10Gbps LAN interfacing
- Size: 27/1.1 x 102/4.0 x 102/4.0 (HxWxD mm/")
- Weight: 131/0.29 (g/lb)

Download datasheet
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10 GPON

XSR150DX

XSR151DK

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Fiber Gateway Wi-Fi 6

- L2 + L3 based services
- ITU-T G.9807.1 and ITU-T G.988 compliant and TR-069 supported
- Multi-play service support
- 4x 10/100/1000Base-T LAN interfacing (1Gbps LAN wire speed)
- 1x 1/2.5/5/10G SFP (1/10GBase-T/X)
- 1x FXS Voice interfacing
- 1x USB Type C
- 1x RF Overlay (Optional)
- Wi-Fi 6: Wi-Fi 802.11 b/g/n/ax @2.4GHz + 802.11 n/a/ac/ax @5GHz
- Size: 245.8/9.7 x 44.8/1.8 (80.6/3.2 including base) x 210.0/8.3 (HxWxD mm/")
- Weight: 800/1.76 (g/lb)

10 GPON

XSR250GK

Download datasheet
Scan the QR code to view more information

Fiber Gateway Wi-Fi 6E

- L2 + L3 based services
- ITU-T G.9807.1 and ITU-T G.988 compliant and TR-069 supported
- Multi-play service support
- 4x 10/100/1000Base-T LAN interfacing (1Gbps LAN wire speed)
- 1x 10GBase-T LAN interfacing
- 2x FXS Voice interfacing
- 1x USB Type A
- 1x RF Overlay (Optional)
- Wi-Fi 6E: Wi-Fi 802.11 b/g/n/ax @2.4GHz + 802.11 n/a/ac/ax @5GHz + 802.11 ax @6GHz
- Size: 245/9.7 x 80/3.2 x 210/8.3 (HxWxD mm/")
- Weight: 957 / 2.13 (g/lb)

10 GPON

XSR140LNR

XSR240LNR

Download datasheet
Scan the QR code to view more information

Fiber Gateway Wi-Fi 7

- L2 + L3 based services
- ITU-T G.9807.1 and ITU-T G.988 compliant and TR-069 supported
- Matter and TR-069/098/104/111/140/142/143 /181 supported
- Multi-play service support
- 2x 10/100/1000Base-T LAN interfacing (1Gbps LAN wire speed)
- 2x 10GBase-T LAN interfacing
- 1x 2.5GBase-T + 1x 10GBase-T / 2x 10Gbase-T (optional)
- 1/2x FXS Voice interfacing
- 1x USB Type C
- Wi-Fi 7: Wi-Fi 802.11 b/g/n/ax/be @2.4GHz + 802.11 n/a/ac/ax/be @5GHz + 802.11 ax/be @6GHz
- Size: [192.8 x 92.6 (base) x 185]mm/ [7.6 x 3.6 (base) x 7.3]"
- Weight: 1081/2.4 (g/lb)

10 GPON

Download datasheet
Scan the QR code to view more information

ONT-MBH

- L2 based services
- ITU-T G.984.x, ITU-T G.9807.1 and ITU-T G.988 compliant
- 19'' Rackmount option
- 10Gbps LAN interfacing
- SYNC-E & 1588v2 synchronization protocols
- Redundant power feed
- Size: 45/1.8 x 315/12.4 x 205/8.1 (HxWxD mm/'')
- Weight: 994/2.19 (g/lb)

Wi-Fi Extenders

D2150G

Download datasheet
Scan the QR code to view more information

Wi-Fi 5 Extender

- Access Point + Controller features
- Wi-Fi Alliance® Multi-AP Specification Embedded
- Wi-Fi 5: Wi-Fi 802.11 b/g/n @2.4GHz + 802.11 n/a/ac @5GHz
- 2x 10/100/1000Base-T interfacing
- Size: 113/4.45 x 86/3.39 x 40/1.57 (HxWxD mm/")
- Weight: 210/0.46 (g/lb)

Wi-Fi Extenders

D2260G

Download datasheet
Scan the QR code to view more information

Wi-Fi 6 Extender

- Access Point + Controller features
- Wi-Fi Alliance® Multi-AP Specification Embedded
- Wi-Fi 6: Wi-Fi 802.11 b/g/n/ax @2.4GHz + 802.11 n/a/ac/ax @5GHz
- 2x 10/100/1000Base-T interfacing
- Size: 113/4.45 x 86/3.39 x 40/1.57 (HxWxD mm/")
- Weight: 210/0.46 (g/lb)

Wi-Fi Extenders

D222AH

Download datasheet
Scan the QR code to view more information

Wi-Fi 6E Extender

- Access Point + Controller features
- Wi-Fi Alliance® Multi-AP Specification Embedded
- Wi-Fi 6E: Wi-Fi 802.11 b/g/n/ax @2.4GHz + 802.11 n/a/ac/ax @5GHz + 802.11 ax @6GHz
- 1x 10/100/1000Base-T
- 1x 1/2.5GBase-T interfacing
- Size: 198/7.80 x 94/3.70 x 185/7.28 (HxWxD mm/")
- Weight: 422/0.93 (g/lb)

Wi-Fi Extenders

D27GBHP

Download datasheet
Scan the QR code to view more information

Wi-Fi 7 Extender

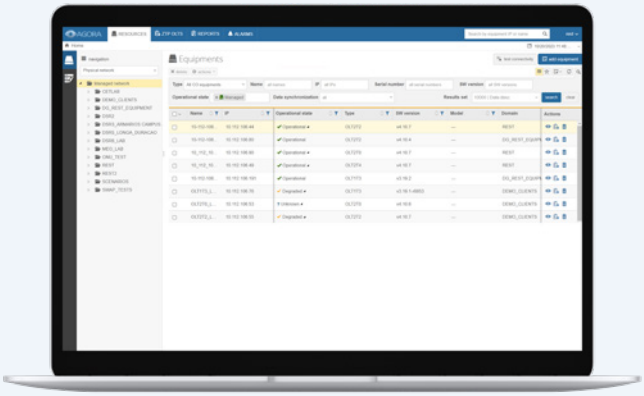
- Access Point + Controller features
- Wi-Fi Alliance® Multi-AP Specification Embedded
- Wi-Fi 7: Wi-Fi 802.11 b/g/n/ax/be @2.4GHz + 802.11 n/a/ac/ax/be @5GHz + 802.11 ax/be @6GHz
- 1x 10/100/1000Base-T interfacing
- 1x 2.5GBase-T interfacing
- Size: [174.3 x 71.6 (base) x 170]mm / [6.9 x 2.8 (base) x 6.7]"
- Weight: 500/1.10 (g/lb)

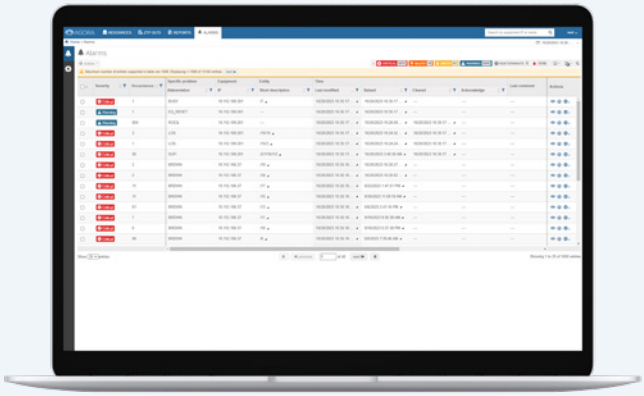
NETWORK MANAGEMENT SYSTEM

Network Manager and Controller

Optimizing Network Operations represents a critical challenge for telecom stakeholders and investors today, as it allows significant value from live network infrastructures without compromising service quality.

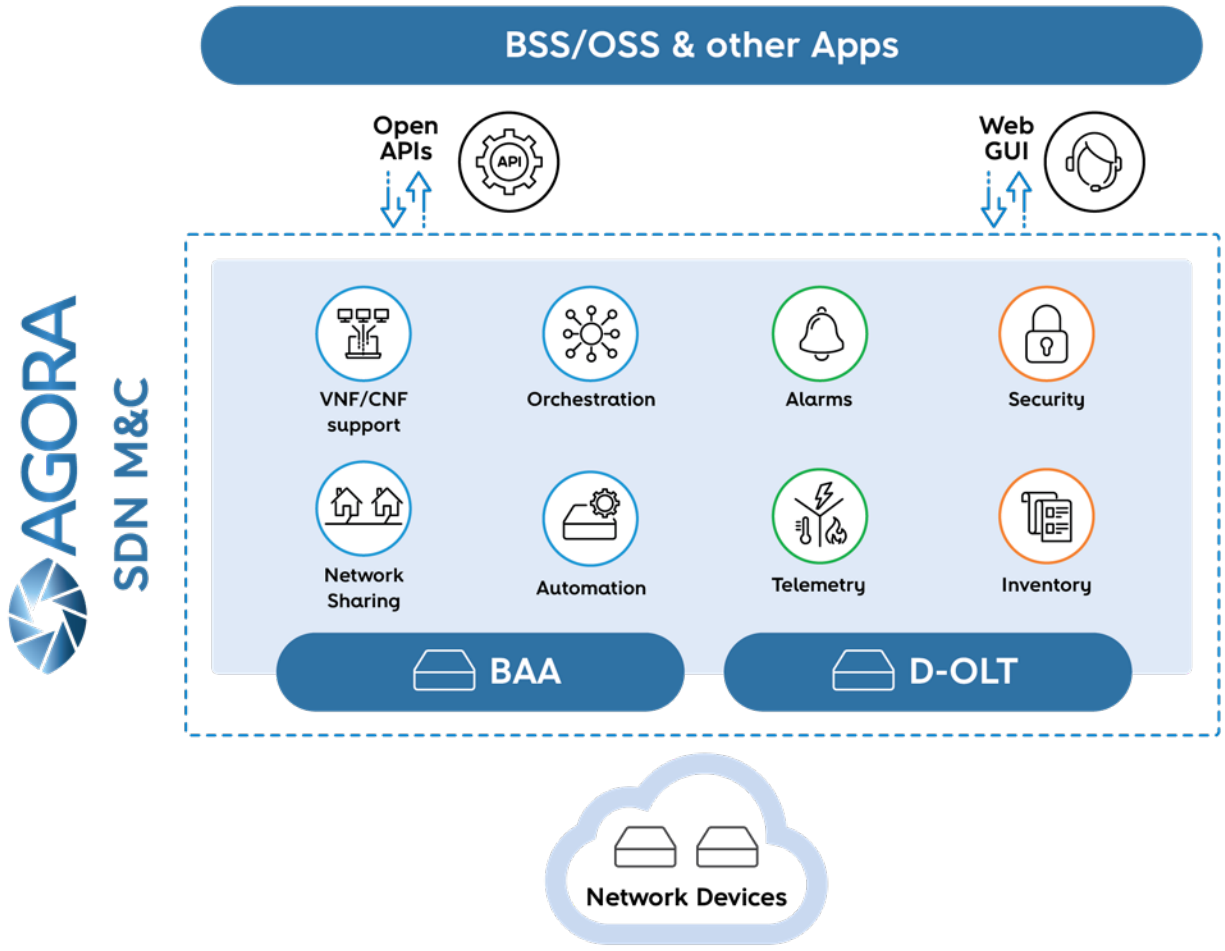
Altice Labs' Management and Control platform is the solution to manage all network resources centrally and remotely in a reliable and efficient manner. Offering a suite of web-based applications supported by current industry standard technologies, AGORA aims to provide a set of key features for network management operations, including network provisioning, maintenance, and monitoring, providing all Fault, Configuration, Accounting, Performance, and Security (FCAPS) functionalities for all network elements.





AGORA can fully manage network infrastructures, from basic serial and IP devices to more complex access network technologies such as xPON. Small dozens to millions of devices can be centrally and remotely managed in a "pay-as-you-grow" model, scaling along with the business.

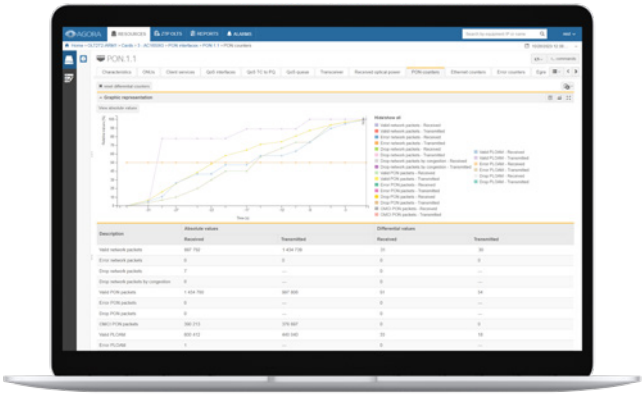
AGORA's applications and services infrastructure level can be available in bare metal, Virtual Machine (VM), or micro-service cloud-based environments, customized to meet the specific needs of each customer via a modular, flexible, and scalable delivery model.

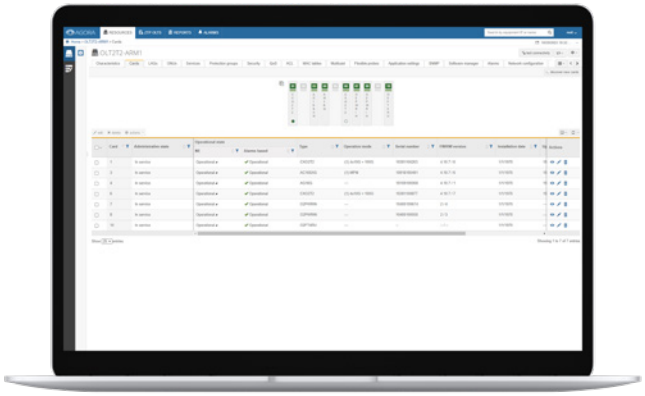


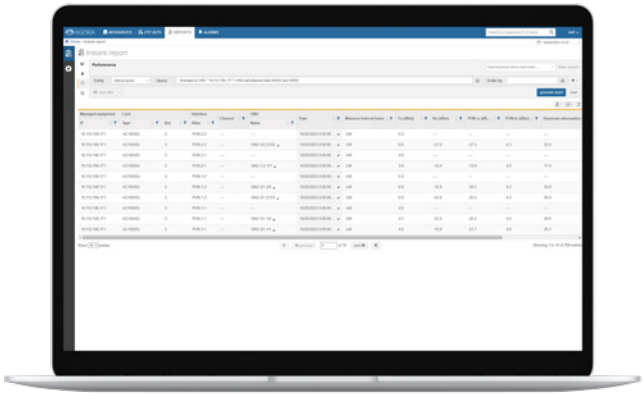
A fully featured standardized set of Northbound Interfaces (NBI) and open APIs enable network programmability and automation processes, promoting a simple and fast integration with external Operation Support Systems (OSSs) and Business Support Systems (BSSs).

An intuitive, customizable, and user-friendly web-based interface simplifies and optimizes all network operations, focusing on each user group.

Southbound Interfaces (SBI) handle complete Fault, Configuration, Accounting, Performance, and Security tasks for the management domain of multi-technology network elements coexisting within a single or across several management domains. AGORA leverages the potential of next-generation access Software Defined Networks (SDNs), providing the operator a common platform to manage legacy or third-party devices using a Broadband Access Abstraction (BAA) Layer and Disaggregated OLT (D-OLT) access nodes, supporting Virtual Network Functions (VNFs) or Containerized Network Functions (CNFs), such as a TR-477 compliant Disaggregated-OLT. AGORA promotes a seamless coexistence and evolution of new management architectures, avoiding the disruption between the past, present, and future xPON field deployments, totally aligning with major relevant technical forums such as the Broadband Forum (BBF) and the Open Networking Foundation (ONF).







VNF/CNF support

The support of D-OLT nodes extends to new Virtual Containerized Network Functions, allowing faster and more flexible rollouts of network infrastructures.

Network Sharing

Network infrastructure sharing among several Virtual Network Operators (VNOs) supports new and optimized business models.

Orchestration

All the collected data feeds the orchestration engines, optimizing operational procedures and enhancing overall network performance and efficiency.

Automation

Closed-loop operations, mainly targeted for carrier-class management of large-scale deployments, improve network efficiency and responsiveness.

Alarms

Powerful and centralized alarm management allows quick identification and response to issues, ensuring uninterrupted service delivery.

Telemetry

Comprehensive environmental metrics monitoring covers network components, including indoor racks, outdoor cabinets, and other passive entities and infrastructures, ensuring optimal network operation in different conditions.

Security

All tasks are executed with highly granular authorization control and the most recent and updated secure communication protocols; this protects against potential threats by ensuring only authorized users can access specific functionalities.

Inventory

The system maintains an up-to-date network component inventory (together with alarm management), allowing efficient operation by tracking the status and location of the network elements.

OPERATIONS SUPPORT SYSTEMS

NOSSIS One

Overview

NOSSIS One is a complete OSS "best of breed" suite following the best market practices for this area.

With a cloud-native, open, and modular architecture, NOSSIS One exposes standard APIs and provides off-the-shelf multi-technology packs for a large number of network vendors, enabling a fast integration with the ecosystems where it operates.

NOSSIS One supports the main operational processes covering the Inventory, Fulfillment, and Assurance functional areas, being ready for traditional telco (fixed, mobile) networks, IT networks, and even new virtualized ones.

Using AI/ML across multiple domains, NOSSIS One enables automation, bringing autonomy and streamlining the operations.

The NOSSIS portfolio also includes specific solutions for device management scenarios for new home networks and CPEs (including TR069 and other dedicated protocols) and emerging technologies like the Smart Mesh Wi-Fi with a Smart Wi-Fi management solution.

NOSSIS One architecture

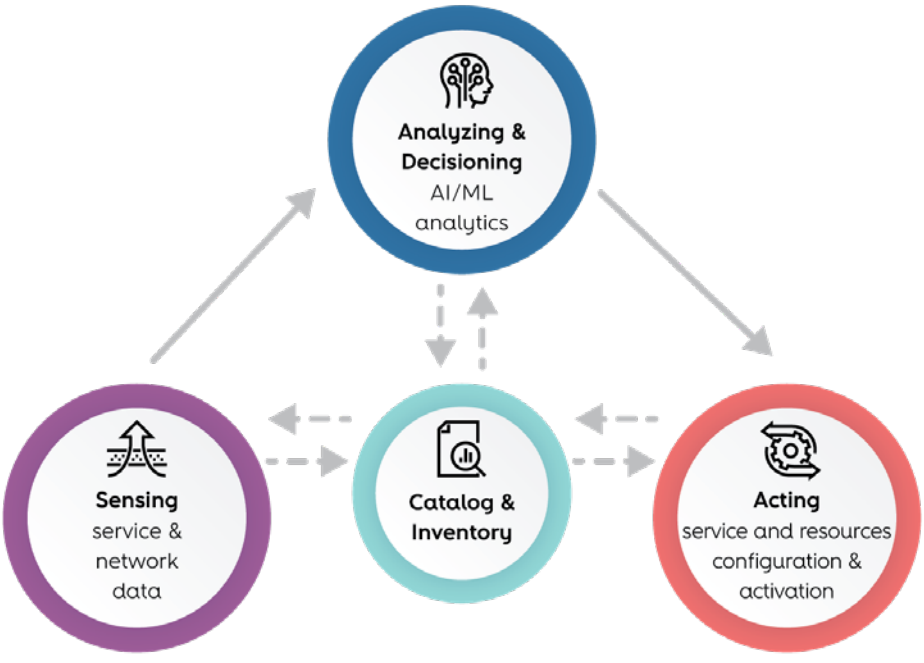
With a new architecture and new paradigms, NOSSIS One is ready for the challenges of managing the latest Ultra-Fast Broadband technologies and service requests. The main benefits that the more evolved OSS solution provides (enabling autonomous and intelligent operations) are the following:

- **High flexibility** and **cost-effective** solutions built in a cloud-native platform
- Complete OSS functional areas enabling **closed loop** operations
- **Time-to-market** delivery speed supporting new services and technologies
- **AIOps** powering smarter operations
- Ready for **5G** and **virtualization**
- **Smooth and fast integration** through Standard APIs

OPEN API CERTIFIED

The Autonomous Operations Concept

Autonomy is the ultimate step on the evolutionary path of operations. The goal is to implement a fully automatic and autonomous cycle (sense, analyze, decide, and act) across multiple network domains and services without human intervention. NOSSIS One helps operators pursue and follow this path, addressing the new challenges of elasticity and agility needed to simultaneously support new network technologies and adapt to an always-evolving ecosystem of new network interactions and business rules. With a cognitive layer powered by advanced AI/ML analytics over live data, NOSSIS One addresses what is happening, why it is happening, and recommends what needs to be done.



"Autonomous Operations" concept

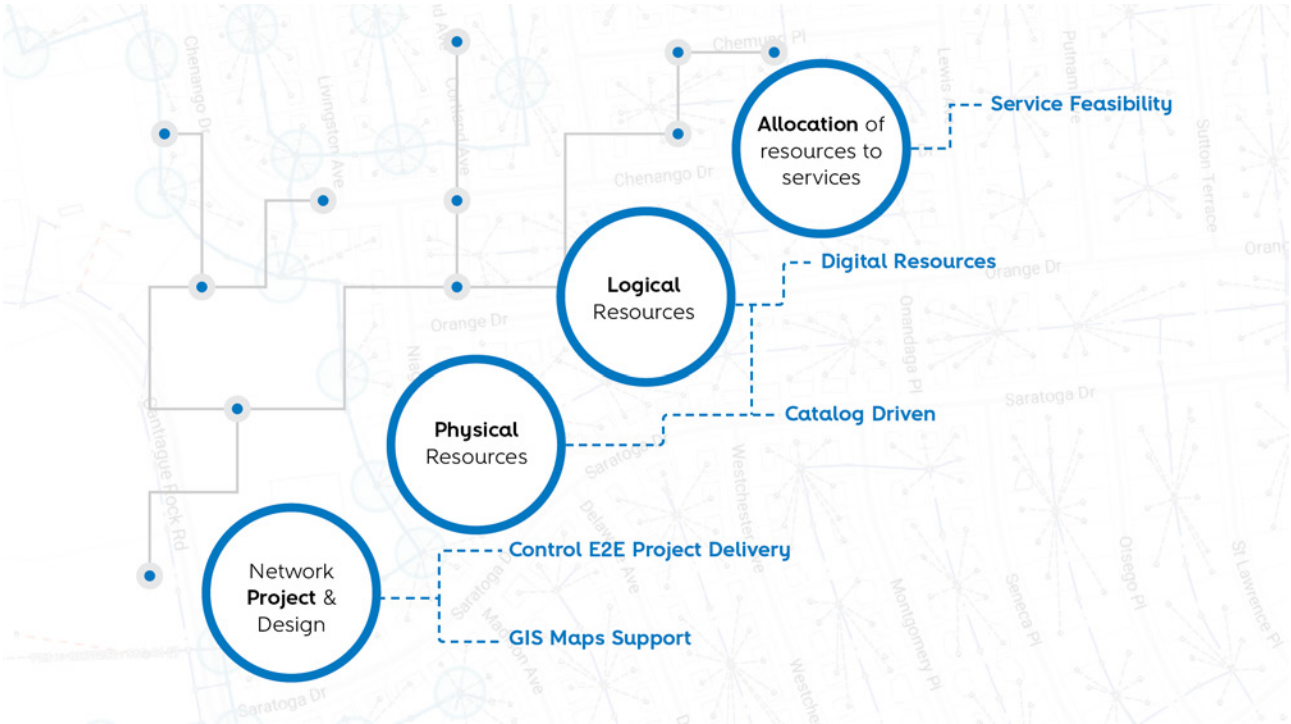
An automated orchestration enables the creation of services across different network domains and, combined with AI analytics, allows full closed loop automation, therefore reducing network and services' operation costs, minimizing human intervention, and implementing self-healing while proactively fixing any detected problems.

NOSSIS Inventory

A centralized and unified catalog supports all the services and resources (from "traditional" CSPs and Digital Services), enabling an agile onboarding of new services for the new Ultra-Fast BB.

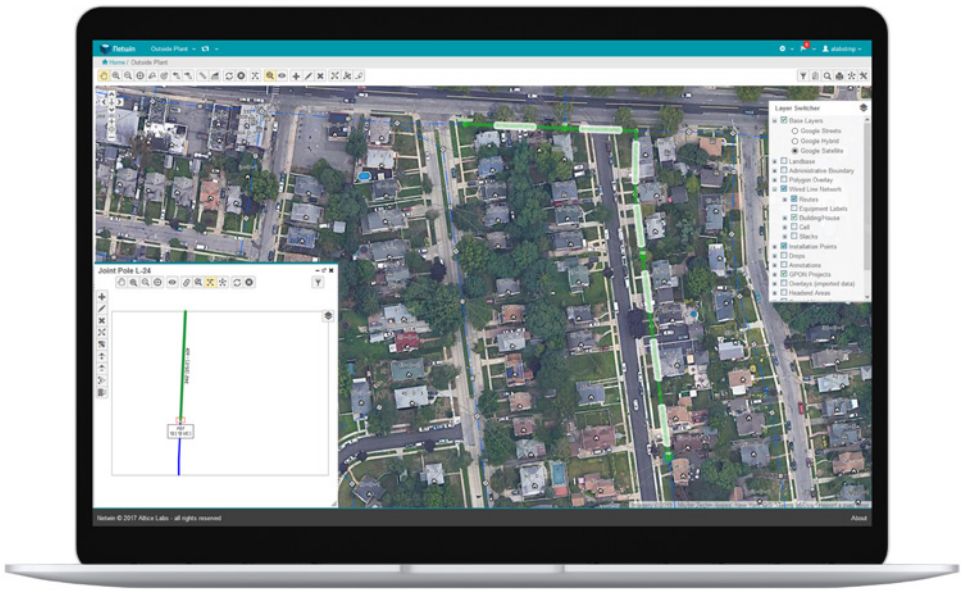
Dynamic inventory with up-to-date information, new virtualized networks, and real-time data, exposing APIs to be used by all operational activities and automated processes.

An Intelligent Network Development support tool provides operational efficiency whenever new (physical) infrastructures are needed.



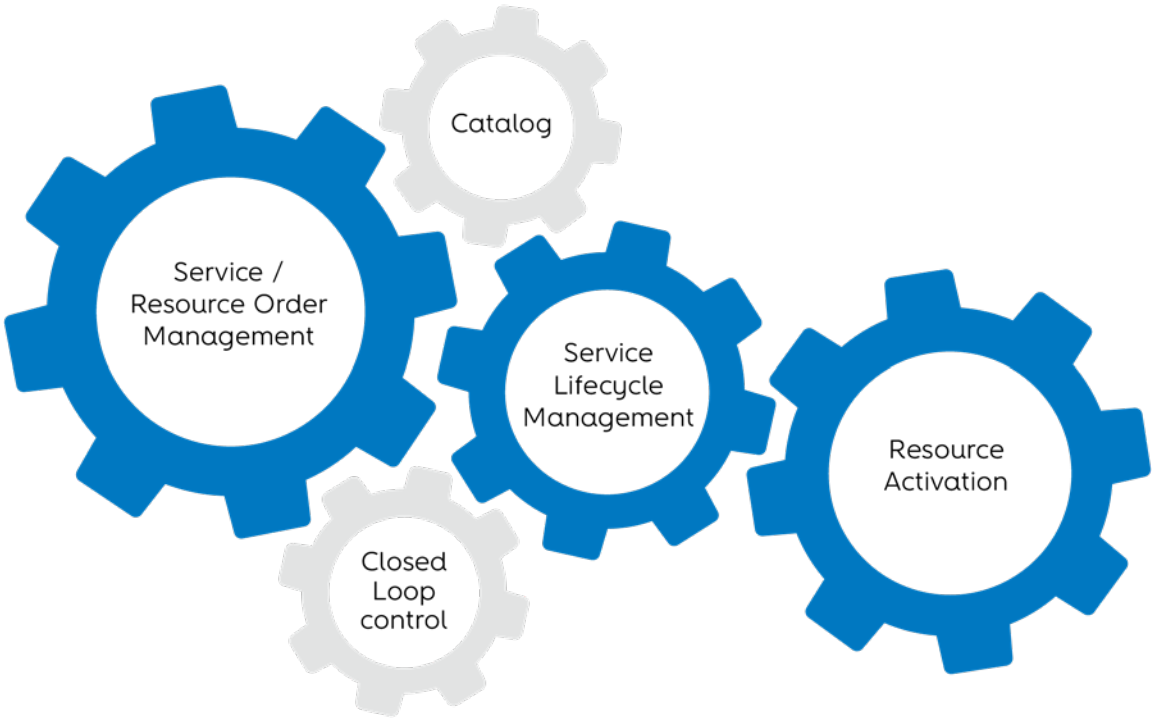
NOSSIS Inventory Main Features

- Service & resource catalogs
- Intelligent network planning & designing tools
- Multilayer inventory from physical to logical resources
- Multi-technology for physical & virtualized networks
- Feasibility and resource allocation
- Exposed APIs for resource/service inventory



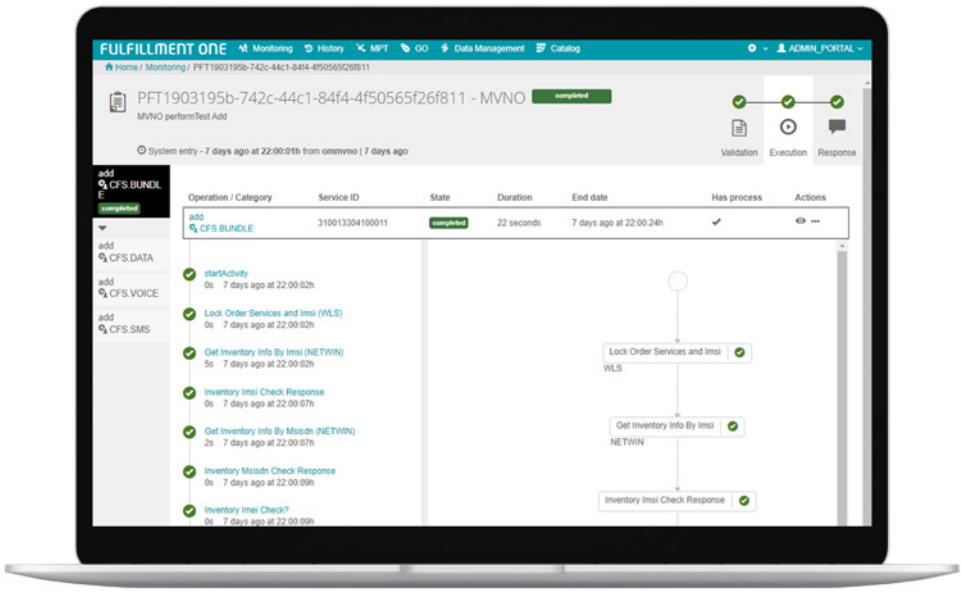
NOSSIS Fulfillment

NOSSIS Fulfillment coordinates the full range of technical provisioning activities with an orchestration of complex cross-domain services over traditional telco networks as well as SDN, NFV, and cloud. It manages automatic and manual activities, ensuring the correct delivery of a service or group of services (bundle). It relies on a modular architecture that allows fast onboarding of new services through a catalog-driven approach and exposed APIs that enable fast integrations. A full stack service is prepared for the new Ultra-Fast BB Provision needs.



NOSSIS Fulfillment Main Features

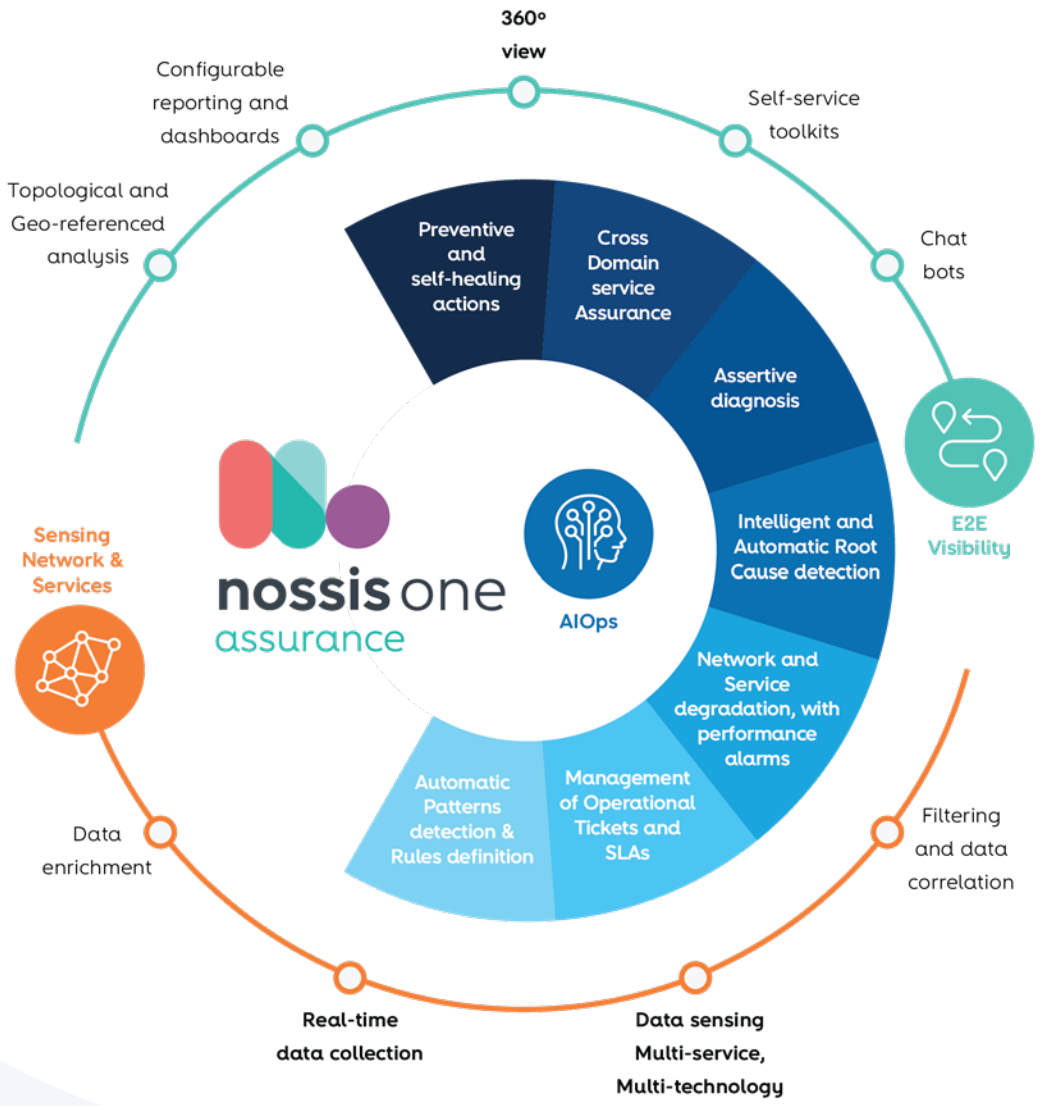
- Multi-domain service/resource order orchestration
- End-to-end service lifecycle management
- Service catalog driven
- Workflows definition and management
- Manual tasks and manual error handling support
- Closed loop control, auto-repair and self-healing
- Multi-protocol service activation plug-ins
- Open NBI APIs enabling easy integration



NOSSIS Assurance

NOSSIS Assurance manages complex multi-technology and multi-domain networks, prioritizing the customer experience.

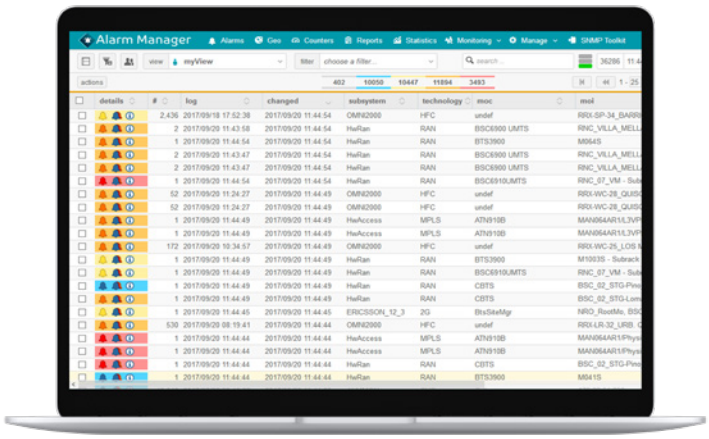
With the NOSSIS Assurance module, you can get excellence in E2E visibility, providing your teams with assertive diagnostics, accurate performance KPIs and alerts, automated root cause detection and operational tickets, and SLAs management, leveraging and/or anticipating real-time service alarm. With powerful, configurable dashboards and an intelligent AI/ML engine, this module provides insights that enable an automatic preventive and self-healing actuation, closing the loop.



NOSSIS Assurance Main Features

Fault and Problem Management

- Real-time data collection and heterogeneous events acquisition
- Centralized collection and filtering
- Intelligent and automatic root cause detection
- Alarm correlation for root cause detection
- Prediction scenarios enabled by intelligence
- Toolkits for self-customization of new data sources and correlation rules
- TTK creation and integration
- Management of all operational tickets and SLAs
- Highly configurable & strongly auditable
- Configurable reports and dashboards

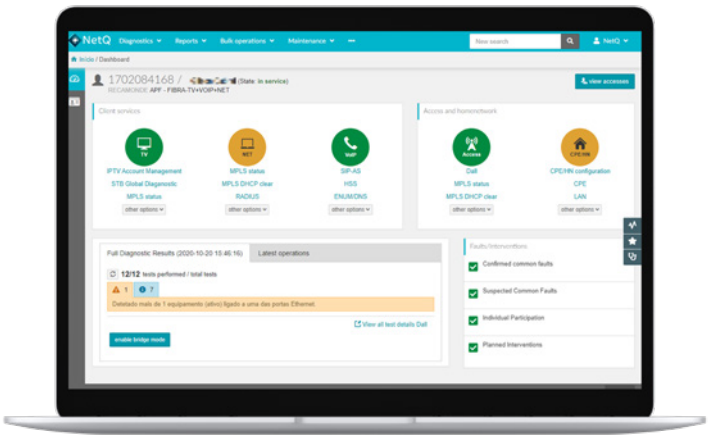


Performance and QoS

- Intelligent E2E monitoring & performance management
- Powerful analytics through KPIs/ KQIs
- Off-the-shelf performance packs
- Network and Service degradation, with performance alarms
- Proactive supervision
- Toolkit for data collection (Network Telemetry)

Test & Diagnostic

- Automated E2E diagnostic
- Tests & diagnostics in real time
- Specialized front-ends for FO, BO and Field Force
- Guiding scripts for problem solving
- Suggestions for automated repair actions
- Off-the-shelf BOTs, and self-care integrations




5G SOLUTIONS

A Novel Approach to Boost 5G Deployments

The next decade is expected to be heavily impacted by 5G. The evolution towards 5G represents a landmark in terms of the convergence of infrastructures, networks, services, and applications.

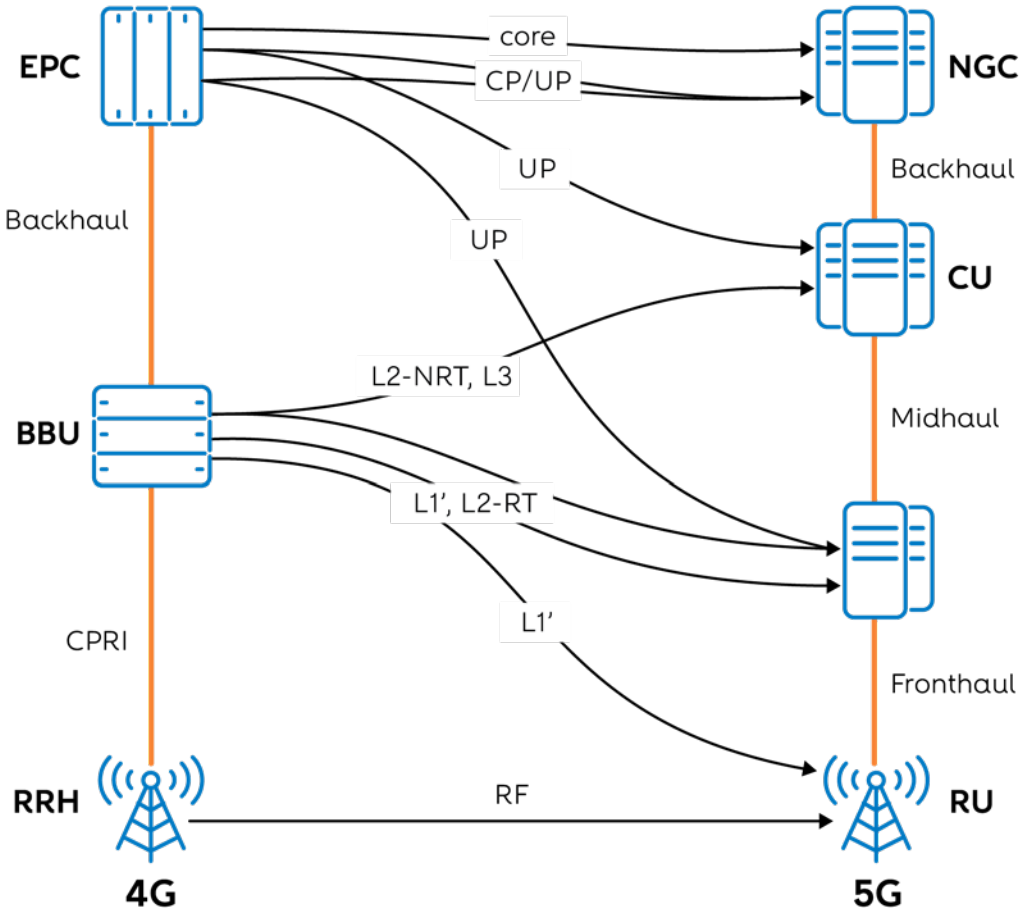
Enabling the entire 5G environment presents challenges for network topologies and supporting technologies. Fixed and Mobile Networks and infrastructures must evolve to accommodate the imminent needs.

To guarantee the desired Quality of Service (QoS), mainly in terms of throughput, latency, and capacity demands, the deployment of the 5G technology must make use of a combination of the low and high-frequency spectrum, which requires a much higher degree of cell densification (a smaller cell size consequently leads to a higher number of cell sites needed to provide coverage for the same geographical area). Promoting an easy and cost--efficient 5G network densification is vital for the (mass) deployment of small cells and micro-coverage scenarios, which are considered part of 5G and Beyond 5G (B5G) fast rollout.

The flexibility in the 5G Radio Access Network (RAN) architecture and virtualization will put additional pressure on the landline infrastructure in terms of capillarity and capacity; converged transport architectures (xHaul) and, in particular, fiber structures and technologies will become the strongest allies of 5G and B5G technologies to cope with the increasing demands.

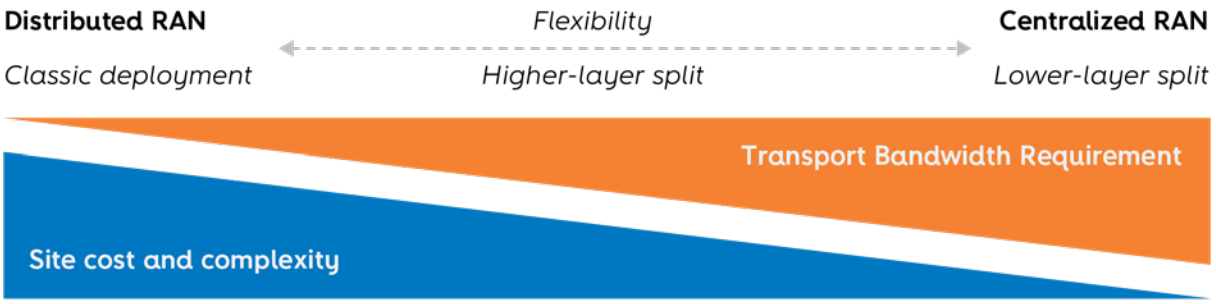
Evolving from a 4G to a 5G architecture

The mobile network evolution from the 4G eNB architecture promotes a disaggregation of the 5G gNB into Central Unit (CU), Distributed Unit (DU), and Radio Unit (RU) network components. This new architecture facilitates the Radio Access Network (RAN) virtualization, adjusts computing resource assignment across network entities, and increases flexibility in the fronthaul/midhaul line rate requirements and solution complexity, while meeting latency and capacity demands. This new architecture also builds upon the deployment of the RAN using open interfaces (Open Radio Access Network) to promote interoperability between the various RAN components.



Evolution from 4G eNB to 5G gNB based on ITU-SG15 Q2

The optimal location for each network component of the RAN is a trade-off between coordination gain from functional centralization and latency and bandwidth requirements in the transport network (see figure below). Centralizing the RAN functions requires high transport capabilities (both high bandwidth and low latency), which allows for the centralization of all high-layer processing functions and coordination gain. Contrarily, a distributed RAN architecture softens transport requirements but implies higher site cost, complexity, and limited coordination between cells.



Complexity/Cost vs. Transport Bandwidth requirements trade-off based on the functional splitting point

	Fronthaul Split 7.2	Fronthaul Split 6	Midhaul	Backhaul
Medium	eCPRI	eCPRI	Ethernet	IP
Protocol	Open Fronthaul interface 7.2x	nFAPI	F1 Interface	NG/S1 Interface
Range	Up to 20 kms	Up to 80 km	Up to 80 km	Up to 200 kms
Latency	< 250µs	< 250µs	< 1ms	< 40ms
Bandwidth	Up to 86 Gbps	Up to 4 Gbps	Up to 4 Gbps	Mostly, user data traffic

5G main architecture options to be considered

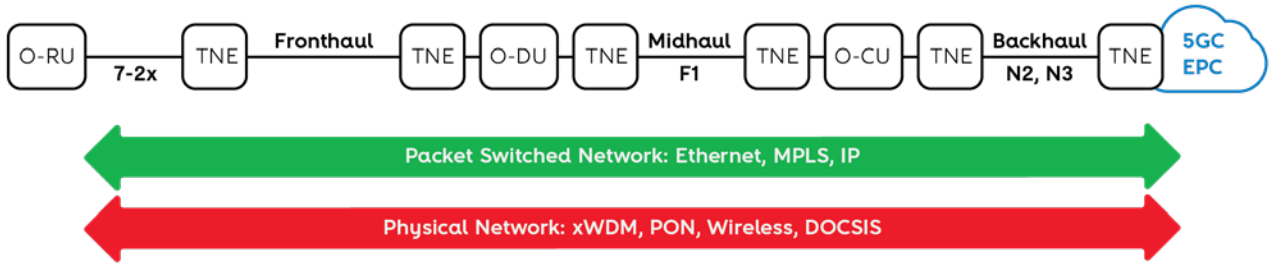
5G networks will enable a new set of services that can be categorized into three different classes: enhanced Mobile Broadband (eMBB), Ultra Reliable Low Latency Communications (URLLC), and massive Machine Type Communications (mMTC). This diversity of new services and their different (and, often, antagonist) requirements imply the need for new or enhanced versions of RAN and transport networks.

These requirements will have significant impacts on the underlying network. To achieve the massive 5G deployment of the number of cell sites necessary to meet the demand for new eMBB services, the MNOs need to rely as much as possible on the expansion and capillarity of the transport network. To host the new uRLLC and mMTC applications efficiently, the MNOs face additional challenges in terms of latency and reliability demand while managing a vast number of connected devices - they need to integrate regional data centers and distributed computing seamlessly - closer to the endpoints in the network.

The most flexible and efficient transport architecture to meet these requirements leans on a converged transport network architecture comprising the fronthaul, midhaul, and backhaul (xHaul).

Transport Slice	Description	Transport Flows	Bandwidth Requirement	Timing Sensitivity Requirement	Reliability Requirement
TS-1	Fronthaul	7.2x CUS-plane, RoE	High	High	High
TS-2_1	Data plane for Backhaul of URLLC service of Operator A	F1-U, S1-U, N3, X2/Xn-U	Medium	High	High
TS-2_2	Data plane for Midhaul, Backhaul of Operator A	F1-U, S1-U, N3, X2/Xn-U	Medium	Medium	High
TS-3	Control plane for Midhaul, Backhaul, Management plane	7.2x M-Plane, F1-C, S1-C, N2, X2/Xn-C, Management	Low	Low	Low

The transport network could be deployed in different ways to support an xHaul architecture. Either solely using packet-switched solutions (deployed from cell site to core network, e.g., MPLS, Ethernet, or IP-based) or mixing it with other technologies (e.g., xWDM, PON, DOCSIS or Microwave radio links in the access to develop the end-to-end network).

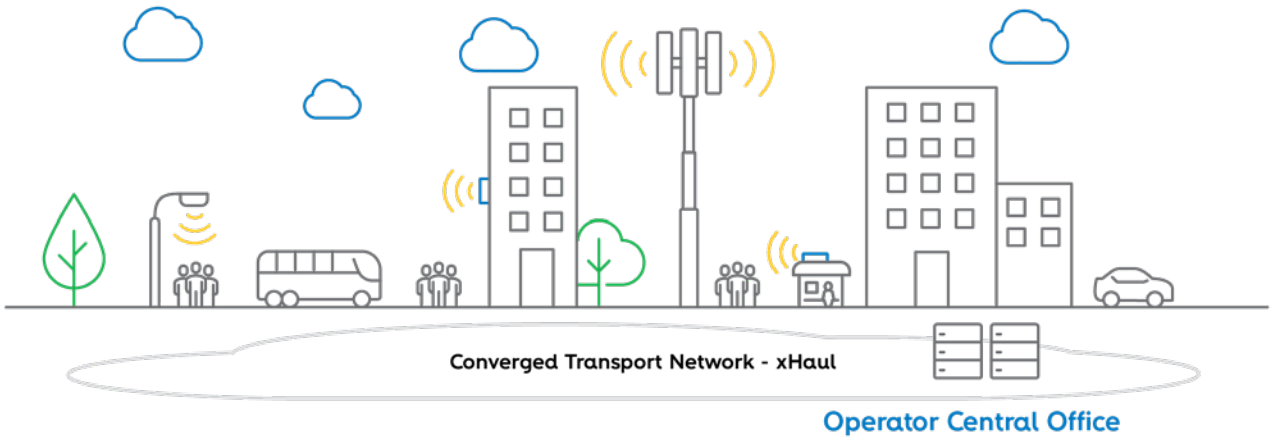


5G Small Cells Deployment Scenarios

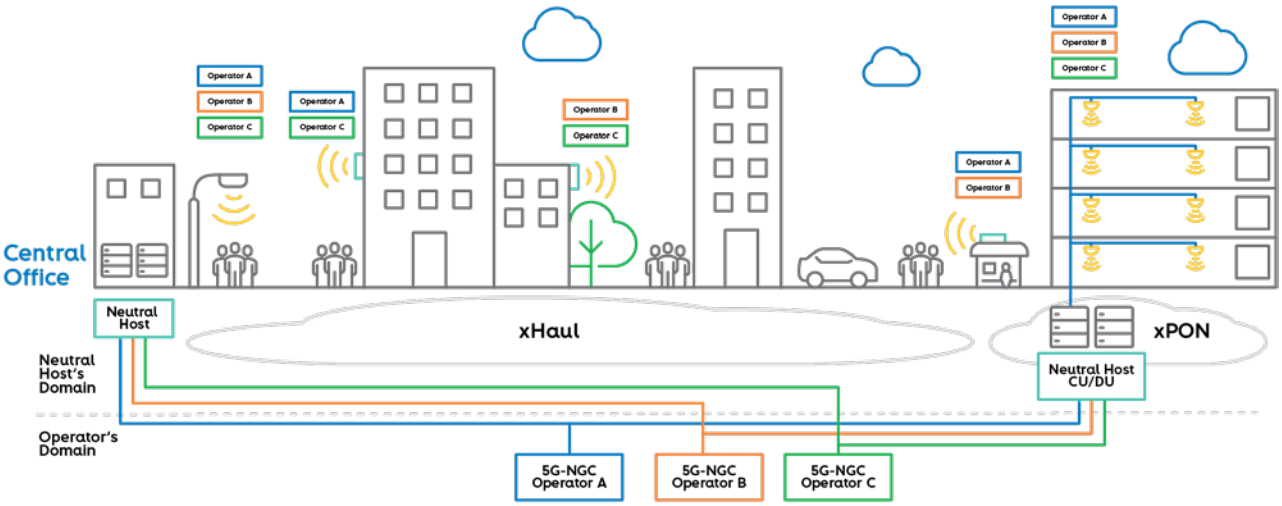
The previously mentioned 5G deployment approach can be relevant in many practical use cases. Besides network operators that aim to promote 5G cell densification and extend the coverage of their current mobile networks, Neutral Host Providers (NHP) and private network owners are two additional interested parties.

Network operators will rely on small cell deployment to capitalize on the following:

- The possibility of a more manageable and less expensive 5G network densification through the deployment of outdoor 5G small cells;
- Increased network flexibility (capacity/coverage enhancement and interoperation with installed technologies) and reduced network expansion complexity (easier to deploy and adaptable to aesthetically sensible areas - concealable solution).

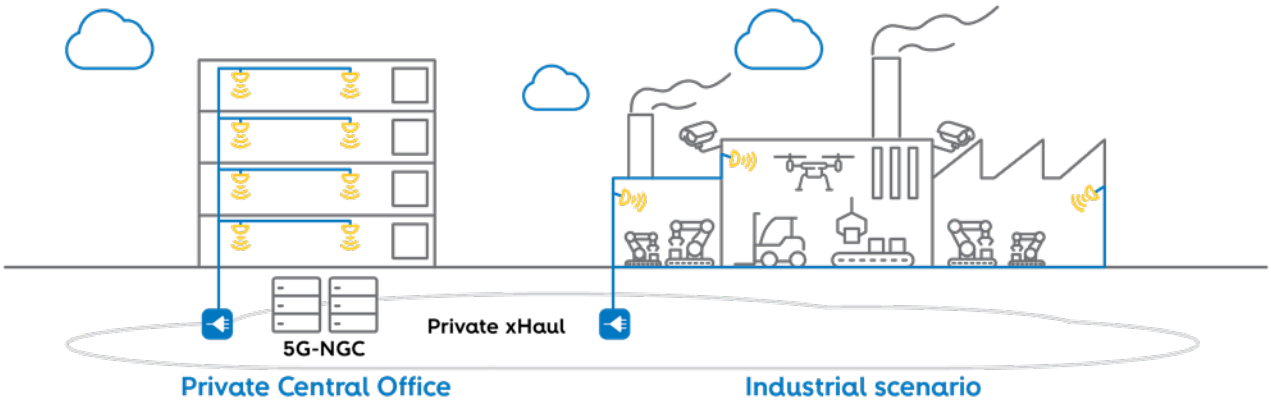


NHP, a third-party non-operator entity, will arise especially to deploy 5G small cells in urban centers, historical downtowns, or public buildings. Considering the lack of business cases for large MNOs to invest in their own network densification or local regulation constraints, an opportunity is presented for NHPs to deploy a network to be rented to the different MNOs and potentially reduce operators' OPEX and CAPEX.



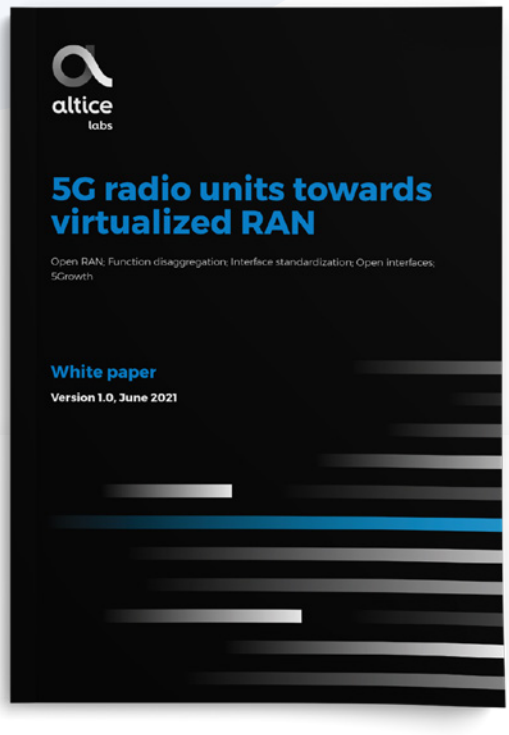
Many large enterprises, businesses, and public entities who want to control security or guarantee QoS are exploring private 5G networks, independent E2E small/medium-sized 5G networks, and recurring to the 5G small cells, which may be of interest, particularly in the following context:

- Industrial centers that require critical communications - availability, reliability, QoS, and security;
- Large companies and facility owners that require secure networks, high throughput, and QoS;
- Municipalities aiming to deploy smart city solutions.



Altice Labs is positioned to deliver an efficient, scalable, and integrated xHaul architecture. Agnostic to the adopted transport technology, we provide a complete end-to-end 5G small cell solution, leveraging in-house developed 5G Radio Units to cope with fully flavored 5G and Beyond 5G (B5G) mobile networks.

White Paper
"5G radio units towards virtualized RAN"



The arrival of 5G is being regarded as the engine to enable Communication Service Providers (CSPs) to reconsider the traditional models. CSPs are exploring innovations and new operating models to drive fundamental changes in the way new networks are built.

In this context, the virtualization of Radio Access Network (RAN) and the adoption of open interfaces are hot topics with growing market interest.

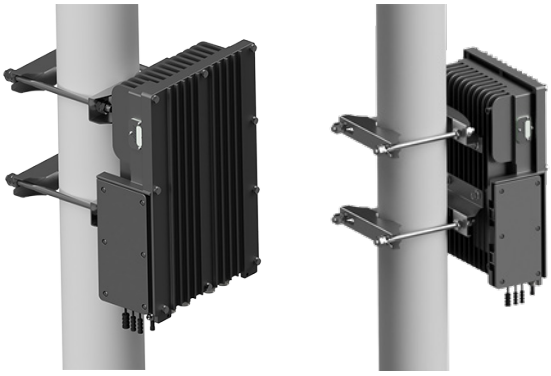
Download whitepaper
Scan the QR code to read this whitepaper

5G Small Cells

Download datasheet
Scan the QR code to view more information

5G-A700A2/5G-A700B2/5G-A700C2

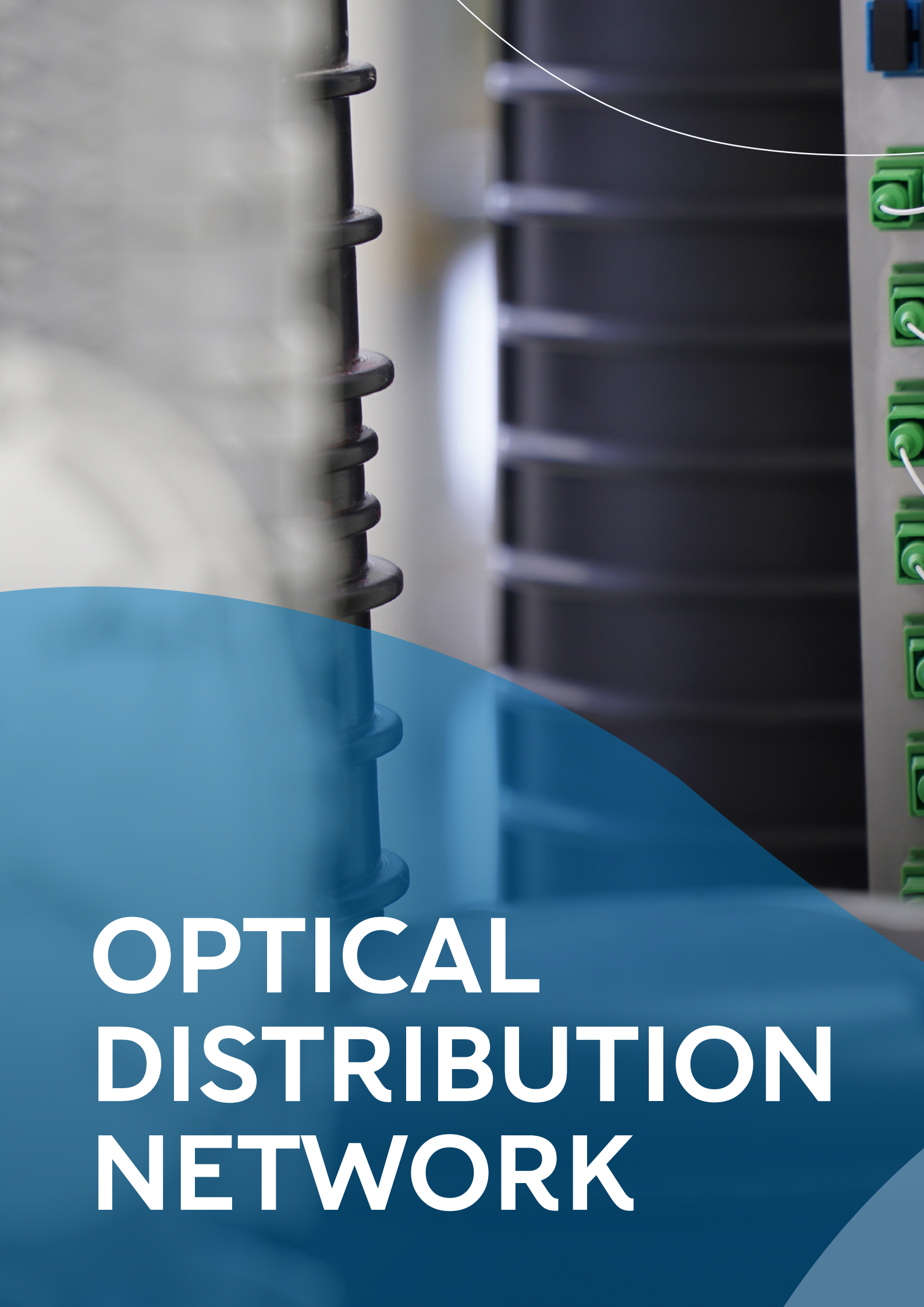
- Indoor 5G small cells for n78 band
- MIMO 4x4 (BW up to 100MHz)
- 256QAM / 64QAM (DL/UL)
- Electrical (RJ45) and optical (SFP+) interface for fronthaul (split7.2@O-RAN)
- Sync: LLS-C3 (PTP)
- Integrated antennas
- 235/9.25 x 235/9.25 x 69/2.72 (HxWxD mm/")
- <2.15Kg / 4.74lb



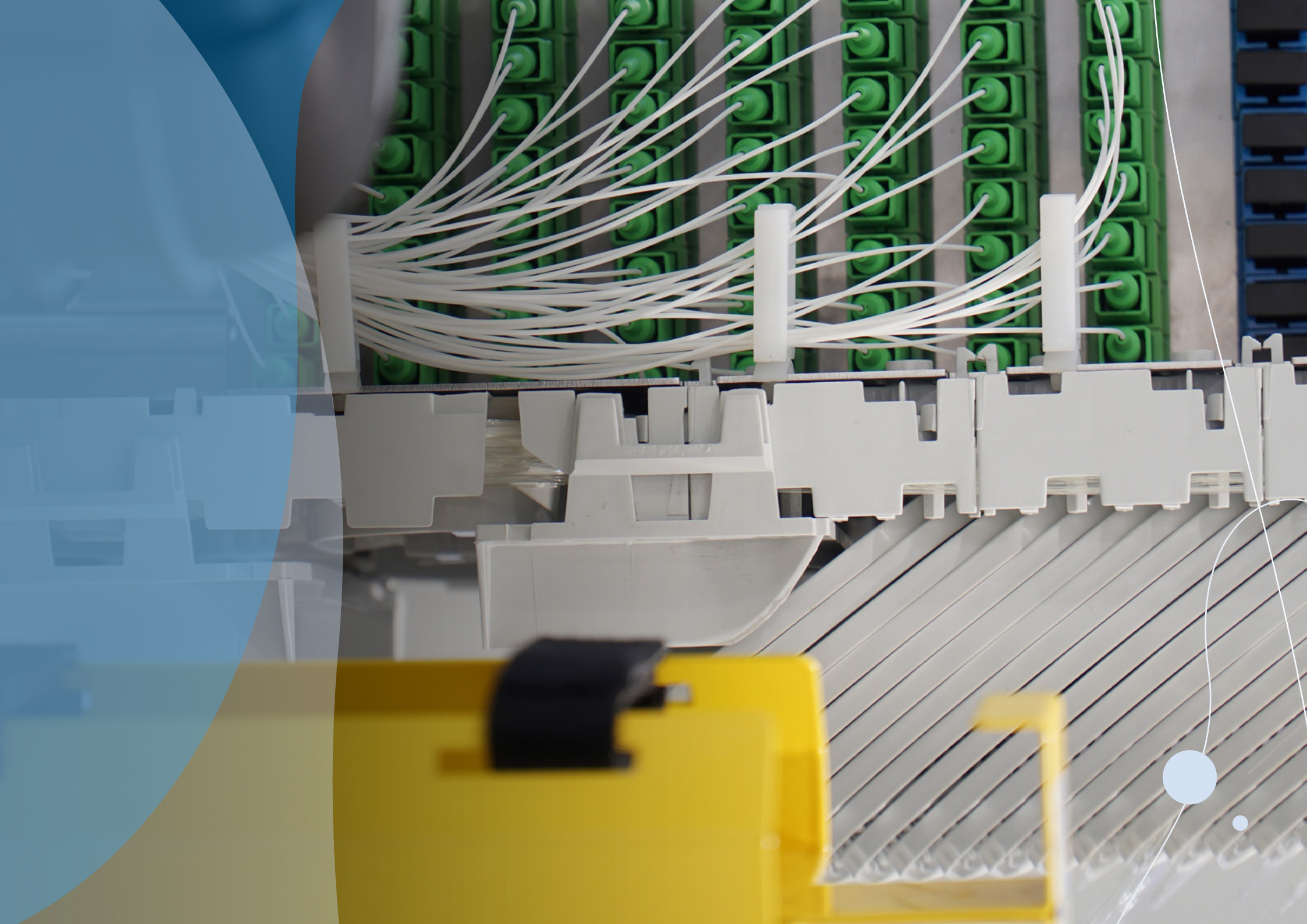
Download datasheet
Scan the QR code to view more information

5G-Y720A3/5G-Y720B3/5G-Y720C3

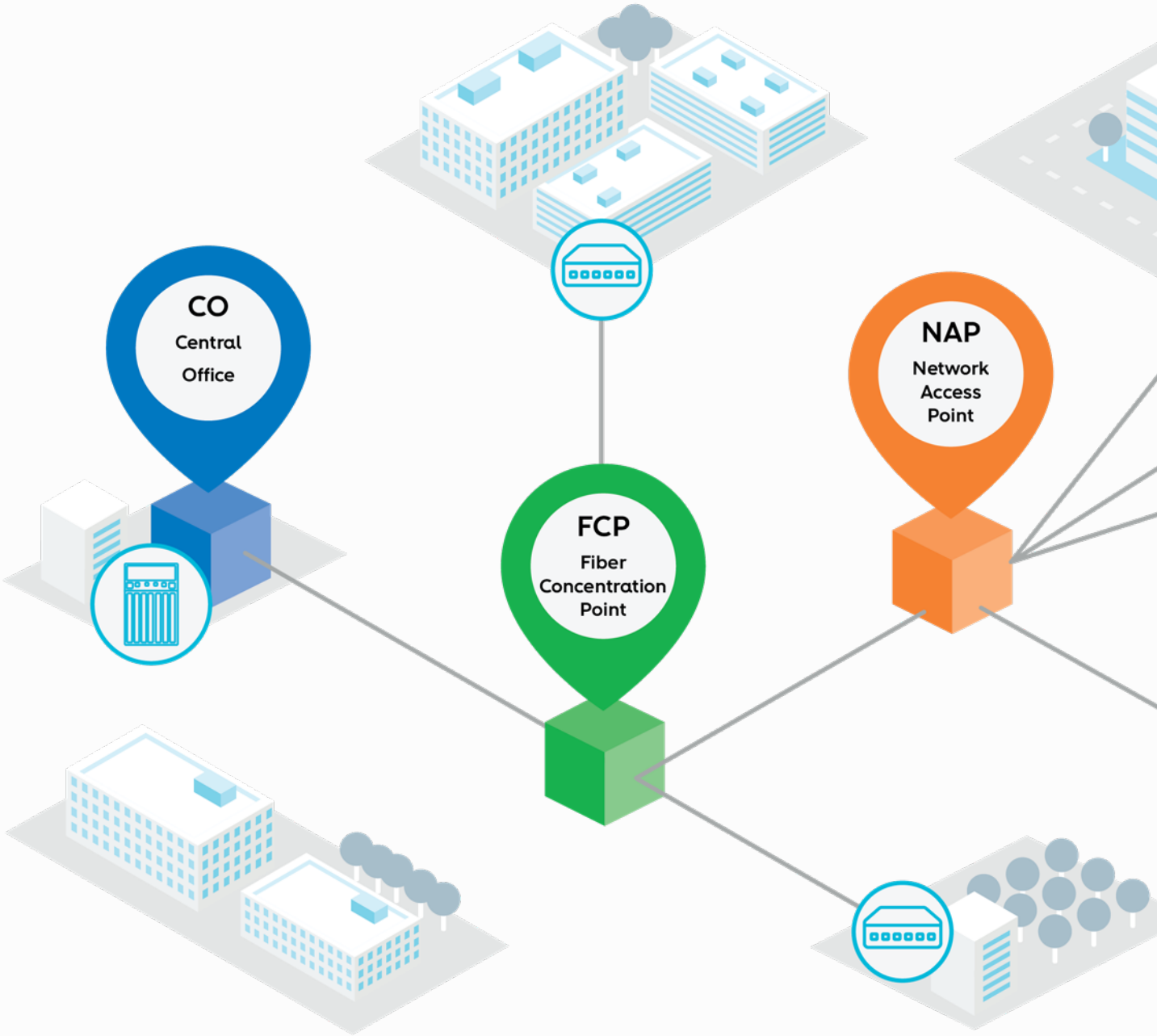
- Outdoor 5G small cells for n78 band
- MIMO 4x4 (BW up to 100MHz)
- 256QAM / 64QAM (DL/UL)
- 2x SFP+ (10Gbps interface)
- Sync:LLS-C3 (PTP)
- 385x250x120 mm
- 8/17.6 (9/19.8 with mounting kit)

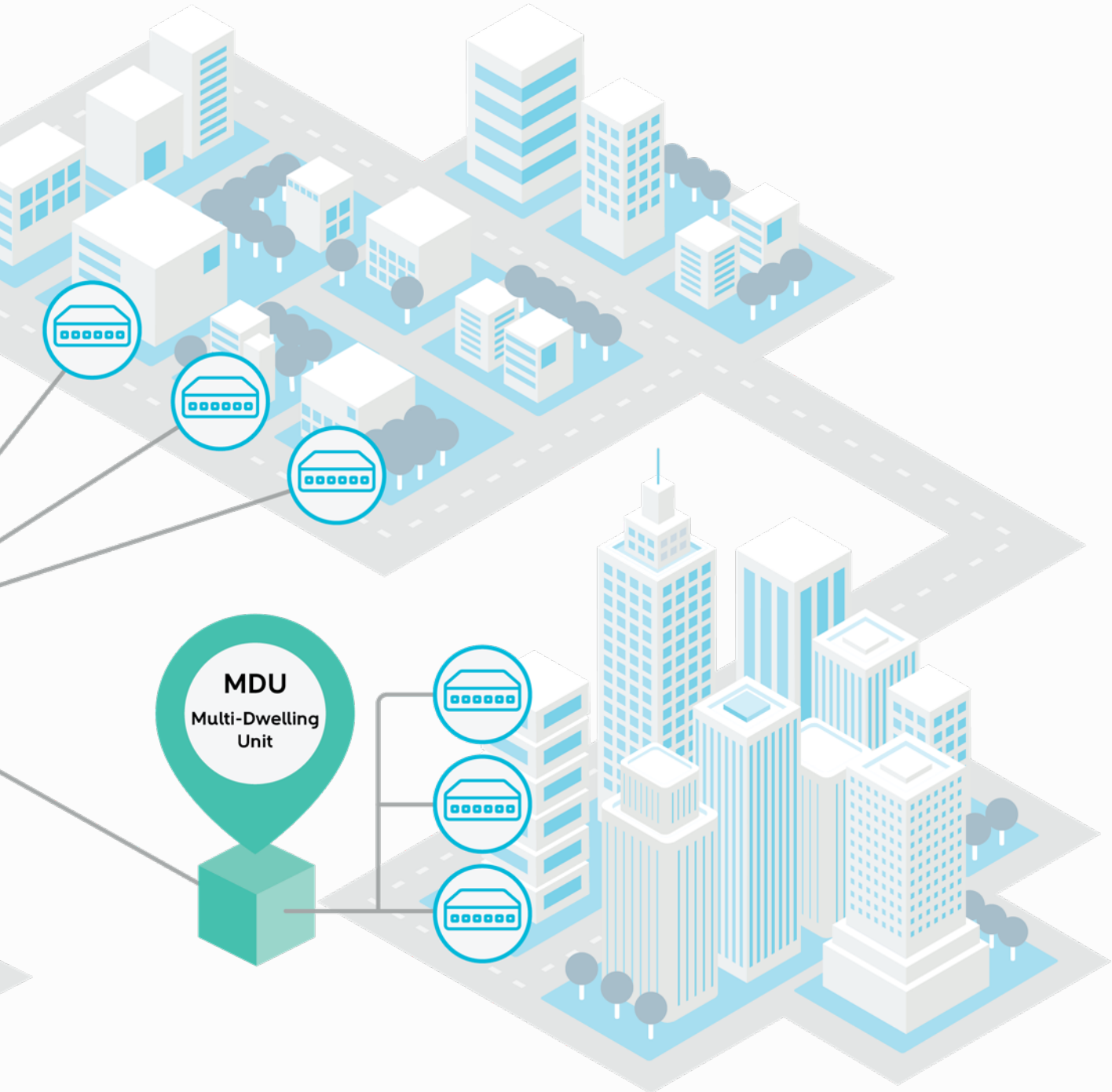


OPTICAL DISTRIBUTION NETWORK

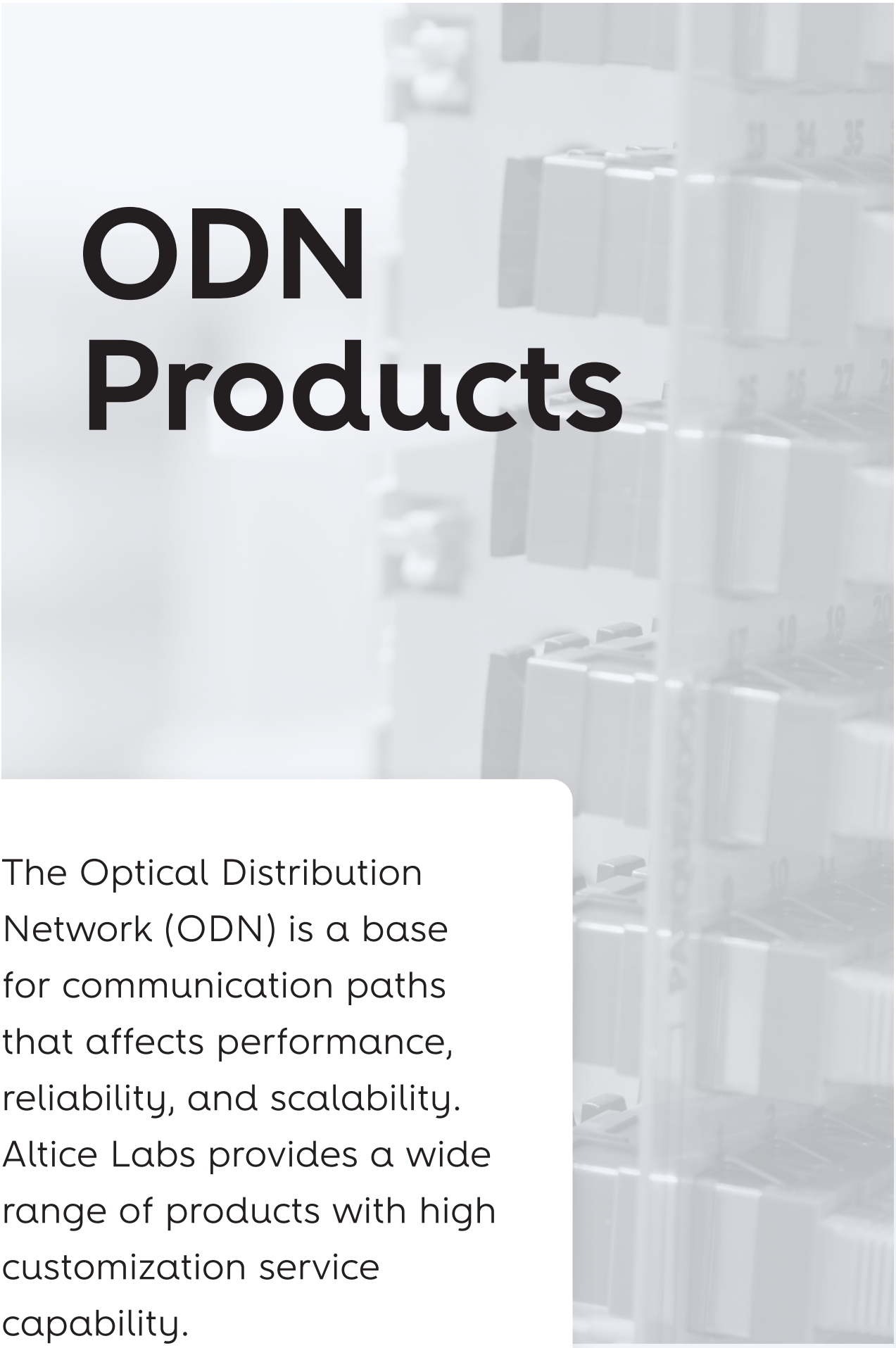


Optical Distribution Network (ODN) Products




MDU
Multi-Dwelling
Unit

ODN Products



The Optical Distribution Network (ODN) is a base for communication paths that affects performance, reliability, and scalability. Altice Labs provides a wide range of products with high customization service capability.

Central Office

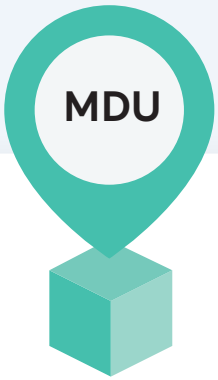
- Racks, Sub-Racks;
- Splitters;
- Optical Distribution Frames (ODF);
- Outside Cabinets for Distributed Central Office.

Fiber Concentration Point

- Feeders to distribution networks;
- Splitting and splicing closures;
- Pole, duct or cabinet mounting;
- Modular solutions extensible up to 1120 splices.

Network Access Point

- Distribution to drop networks (ODP);
- Modular solutions extensible up to 144 splices;
- G.652D cabling compatible;
- IP54 / IP67 dust and water intrusion certified.



Multi Dwelling Unit

- Single or multi-operator;
- Extensible modular solutions (48 up to 192 splices, 12 to 144 SC/APC);
- G.652D cabling compatible;
- IP54 / IP67 dust and water intrusion certified.

Central Office

The Central Office (CO) is the nucleus of the network; it starts all the fiber cables and hosts the active equipment (OLTs and others). It is designed to optimize resources and be flexible, simplifying future expansions.

General features:

- Scalability;
- Compact solutions;
- Easy installation and maintenance;
- Integrated fiber management/patching;
- ETSI;19/21" standards.

Standardized or highly customized solutions:

Co-created with our customers and optimized over several years of field operation.

Central Office

Racks

OLT Rack

- Fully customizable to OLT systems;
- Integrated power distribution unit;
- Power and alarm cabling system;
- Different locking system possibilities;
- Cabling management;
- Customizable color (std: RAL7035).

Download datasheet
Scan the QR code to view more information

Type	Dimensions(HxWxD)mm	Capacity
33000NG	2000x600x300mm	42RU 19”
36000NG	2200x600x300mm	47RU 19”
B300	2200x600x300mm	47RU 19”
B600	2200x600x600mm	47RU 19”

Central Office

Racks

Datacenter Rack

- Datacenter;
- Front doors with removable side covers;
- Roof and bottom with adjustable opening and protective foam for cable entry,
- Adjustable feet;
- Manufactured according to IEC 60297-1, DIN 41494, BS 5954 e EIA-310-D;
- Left side mats, with socket strip fixation in all height;
- Maximum capacity of 500Kg with wheels and 1300 Kg with feet;
- Customizable color (std: RAL9005).

Download datasheet
Scan the QR code to view more information

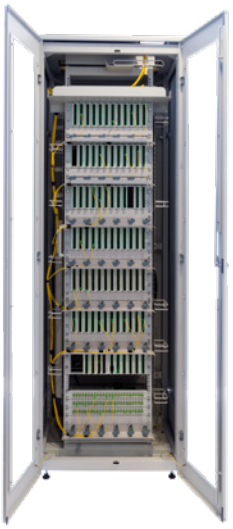
Type	Dimensions(HxWxD)mm	Capacity
Datacenter	2200x800x1100mm	47RU 19”
Datacenter	2200x800x1200mm	47RU 19”
Datacenter	2200x600x1100mm	47RU 19”
Datacenter	2000x800x1100mm	42RU 19”
Datacenter	2000x600x1000mm	42RU 19”
Datacenter	2000x800x1000mm	42RU 19”
Datacenter	2000x600x600 mm	42RU 19”
Datacenter	2000x800x600 mm	47RU 19”

Central Office

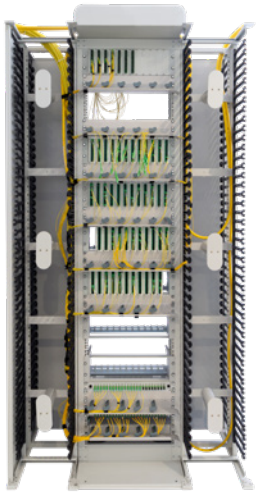
Racks

Optical Distribution Rack

- Optical distribution frames;
- Double frontal door system with transparent glass or mesh holes and with key lock;
- Removable side and back panels for easy access;
- Optical fiber guidance with R > 30mm;
- Frontal patch cord organizers;
- Ceiling for cable input with adjustable opening and protective foam;
- Inner rotating structure for ease of user access to the installed equipment;
- Customizable color (std: RAL7035).



BSP / ODF Series



OGC Series

Download datasheet
Scan the QR code to view more information

Type	Dimensions(HxWxD)mm	Capacity
720 BSP/ODF	2000x800x600mm	38RU 19”
720 OGC	2000x800x600mm	38RU 19”
1150 BSP/ODF	2200x800x600mm	43RU 19”
1150 OGC	2200x800x600mm	43RU 19”
OGC RT	2200x1000x600mm	43RU 19”

Central Office

Wall Mounting Rack

Rack Mounting 6/9 RU | Rack Wall Fixing 3/5 RU

- Installment of telecommunications equipment;
- Material zincor/galvanized steel;
- Prepared for wall mounting/fixing;
- Customizable color (std: RAL7035).

Download datasheet
Scan the QR code to view more information

Rack Mounting 6RU

Rack Wall Fixing 3/5 RU

Type	Dimensions(HxWxD)mm	Capacity
Rack Mounting	350x555x500mm	6RU 19”
Rack Mounting	400x600x500mm	9RU 19”
Rack Wall Fixing	146x487x352mm	3RU 19”
Rack Wall Fixing	234x487x352mm	5RU 19”

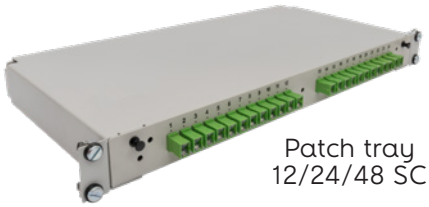
Central Office

Patch/ Splice/ Split Panels

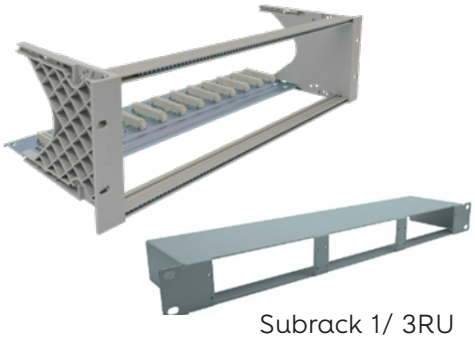
Patch tray 12/24/48 SC | Subrack 1/ 3RU - 4/ 7/ 14 HP | Patch panel 24 SC

- Fiber termination, patching and splitting shelfs;
- Material plastic/zincor;
- Fitted with or without optical adapters;
- Port identification;
- Fixing accessories;
- Customizable color (std: RAL7035).

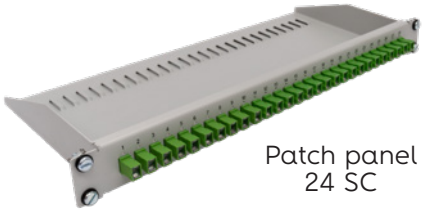
Download datasheet
Scan the QR code to view more information



Patch tray
12/24/48 SC



Subrack 1/ 3RU
- 4/ 7/ 14 HP



Patch panel
24 SC

Type	Dimensions(HxWxD)mm	Capacity
Patch tray	44x490x230mm	1RU 19" 12/24 or 48
Subrack	44x490x50mm	1RU 19" 24HP for splice/split modules
Subrack	130x490x200mm	3RU 19" 84HP for splice/split modules
Patch panel	44x490x200mm	1RU 19" 24

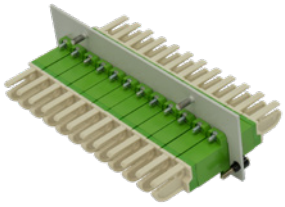
Central Office

Patch/ Splice/ Split Modules

Splice Mod 3RU 4/ 7HP 12SC | Patch Mod 3RU 7HP 12Adapt | Split Mod 3RU 4/ 7/ 14HP | Split Mod 3RU 4/ 7HP Pre-connect

- Fiber termination, patching and splitting frames;
- 4, 7 or 14HP options;
- Includes pigtails, adapters, splice tray or splitters;
- Port identification customizable;
- Fixing accessories.

Splice Mod 3RU 4/ 7HP 12SC



Patch Mod 3RU 7HP 12Adapt

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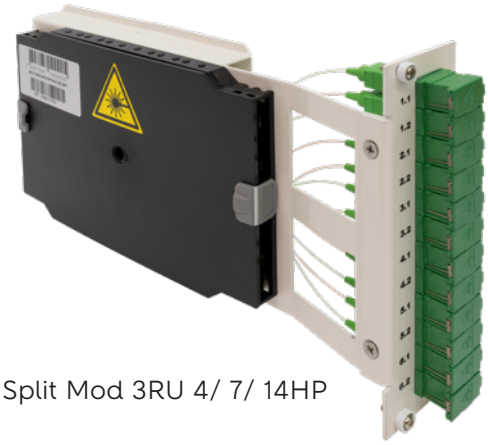
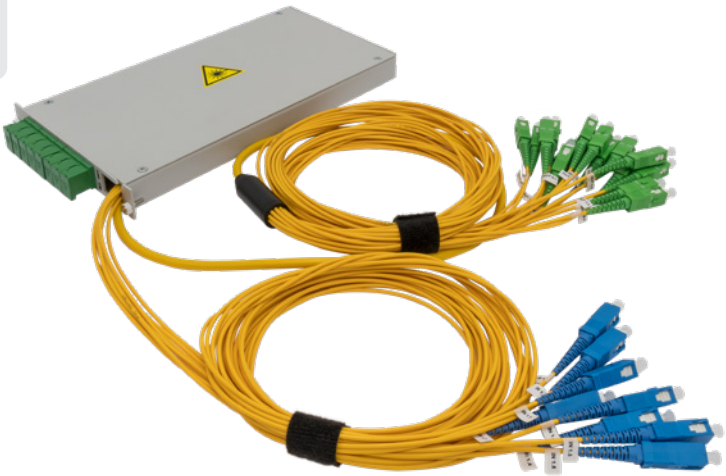


Split Mod 3RU 4/ 7/ 14HP



Split Mod 3RU 4/ 7HP Pre-connect

Central Office

Patch/ Splice/ Split Modules

Type	Dimensions(HxWxD)mm	Capacity
Splice mod	130x35x220mm	3RU 7HP with 12 SC/APC adapters G.652D
Splice mod	130x35x220mm	3RU 7HP with 12 SC/APC adapters G.657A1
Splice mod	130x20x220mm	3RU 4HP with 12 SC/APC adapters G.652D
Splice mod	130x35x220mm	3RU 7HP with 12 E2000 adapters G.652D
Split mod	130x35x230mm	3RU 7HP with 6x2:2 SC/APC
Split mod	130x70x230mm	3RU 14HP with 1x2:16 SC/APC
Split mod	130x35x230mm	3RU 7HP with 2x1:2 SC/APC
Split mod	130x70x230mm	3RU 14HP with 1x1:32 SC/APC
Split mod	130x35x120mm	3RU 7HP with 2x1:4 SC/APC in 2mm patch cord with 3M in ABS box
Split mod	130x35x120mm	3RU 7HP with 1x1:32 SC/APC in 2mm patch cord with 3M in ABS box
Split mod	130x20x220mm	3RU 4HP with 8x2:2 with SC/UPC and SC/APC connectores
Split mod	130x20x220mm	3RU 4HP with 8x1:2 with SC/UPC and SC/APC connectores
Patch mod	130x20x200mm	3RU 4HP 19” with 12 SC/APC adapters
Patch mod	130x35x200mm	3RU 7HP 19” with 12 SC/APC adapters
Patch mod	130x35x200mm	3RU 7HP 19” with 12 E2000/APC adapters

Central Office

Cable Management

Fiber Organizer 19” | Fiber Subrack | Fiber Storage Tray

- Install splice or split modules;
- Fiber management system;
- Material plastic, zincor or steel sheet;
- Supports for fiber R>30mm;
- Fixing accessories;
- Customizable color (std: RAL7035).

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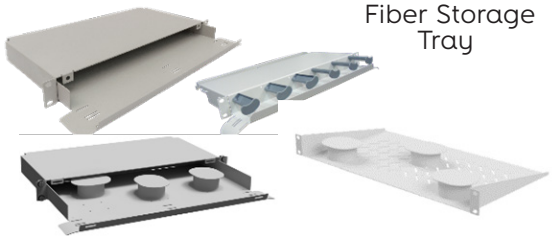
Fiber Organizer 19”

Fiber Subrack

Fiber Storage Tray



Type	Dimensions(HxWxD)mm	Capacity
Fiber organizer	55x515x75mm	1RU 19”
Fiber Subrack	178x515x222mm	Subrack 3RU 19” 84HP for splice/split modules plus 1RU Fiber storage tray
Fiber storage tray	50x483x292mm	1RU 19”, Fiber storage subrack rear
Fiber storage tray	47x483x300mm	1RU 19”, Fiber storage subrack front
Fiber storage tray	44x481x236mm	1RU 19”, Fiber storage slide tray with spools and fiber routing for left and right sides
Fiber storage tray	44x482x243mm	1RU 19”, Fiber storage tray with spools and fiber routing

Central Office

Delivers a decentralized service in high or low population density areas.

Covers the preferred area with all services.

Provides robustness, security, and scalability. It's resistant to environmental damage, vandalism, insect and rodent attacks, and other similar threats.

General features:

- Compact solution;
- Modular design with hard body double walls;
- Multiple colors;
- Pole, wall or floor installation.

Standardized or highly customized solutions:

Customized for several markets (USA, France, etc.).

Central Office

Outdoor Cabinets

GPON OUTDOOR CABINET 3000V2

- Compact active equipment;
- Designed for one OLT2T0 equipment;
- Suited for service delivery in low-density areas;
- Provides robustness, security and flexibility;
- Modular design;
- Thermal and electrical efficiency;
- Hard body double wall;
- Open door locking system;
- Door locking in 3 points;
- IP55 protection level;
- 2 Sub-Racks for splitting and splicing of optical fiber terminations;
- Pole, wall and floor installation;
- Working temperature between 40°C to 55°C.

Download datasheet
Scan the QR code to view more information

Type	Dimensions(HxWxD)mm	Capacity
Outdoor Cabinet 3000V2	800x500x400mm	Max. Equipment capacity 19”/9RU (320mm equip. depth)

Central Office

Outdoor Cabinets

GPON OUTDOOR CABINET 6000

- Active equipment;
- Compact solution;
- Embedded heat exchange and climate control;
- Modular design;
- Hard body double walls;
- AC/DC converter with battery backup;
- Power distribution unit;
- 4 Sub-rack for split/splice/WDM/Cex;
- Incorporated cabling management;
- IP55 protection level.

Download datasheet
Scan the QR code to view more information

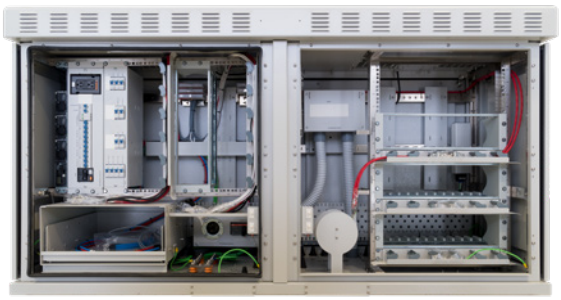
Type	Dimensions(HxWxD)mm	Capacity
Outdoor Cabinet 6000	1326x1250x580mm	20RU in 19/21" + 20RU in 19/21"

Central Office

Outdoor Cabinets

GPON OUTDOOR CABINET 6001

- Active equipment;
- Compact solution;
- Embedded heat exchange climate control;
- Modular design;
- Hard body double walls;
- Open panels locking system;
- Panels locking system with 2 points with duo high security cam locks;
- Isolated batteries compartments;
- 1 Sub-rack for primary;
- 3 Sub-rack for split/splice/WDM/CEx;
- Incorporated cabling management;
- IP55 protection level.



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Type	Dimensions(HxWxD)mm	Capacity
Outdoor Cabinet 6001	900x1829x600mm	17+16RU in 19”

Central Office

Outdoor Cabinets

GPON OUTDOOR CABINET 18000

- Active equipment;
- Compact solution;
- Modular design;
- Air condition system up to 4000W;
- Hard body double walls;
- Door locking system with 2 points and prepared to receive the special operator key lockers;
- Incorporated cabling management;
- Module for up 12 batteries 12V/170Ah;
- IP55 protection level.

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Scan the QR code to view more information

Type	Dimensions(HxWxD)mm	Capacity
Outdoor Cabinet 18000	1825x2180x716mm	2x33 + 4x18RU in 19/21”

Central Office

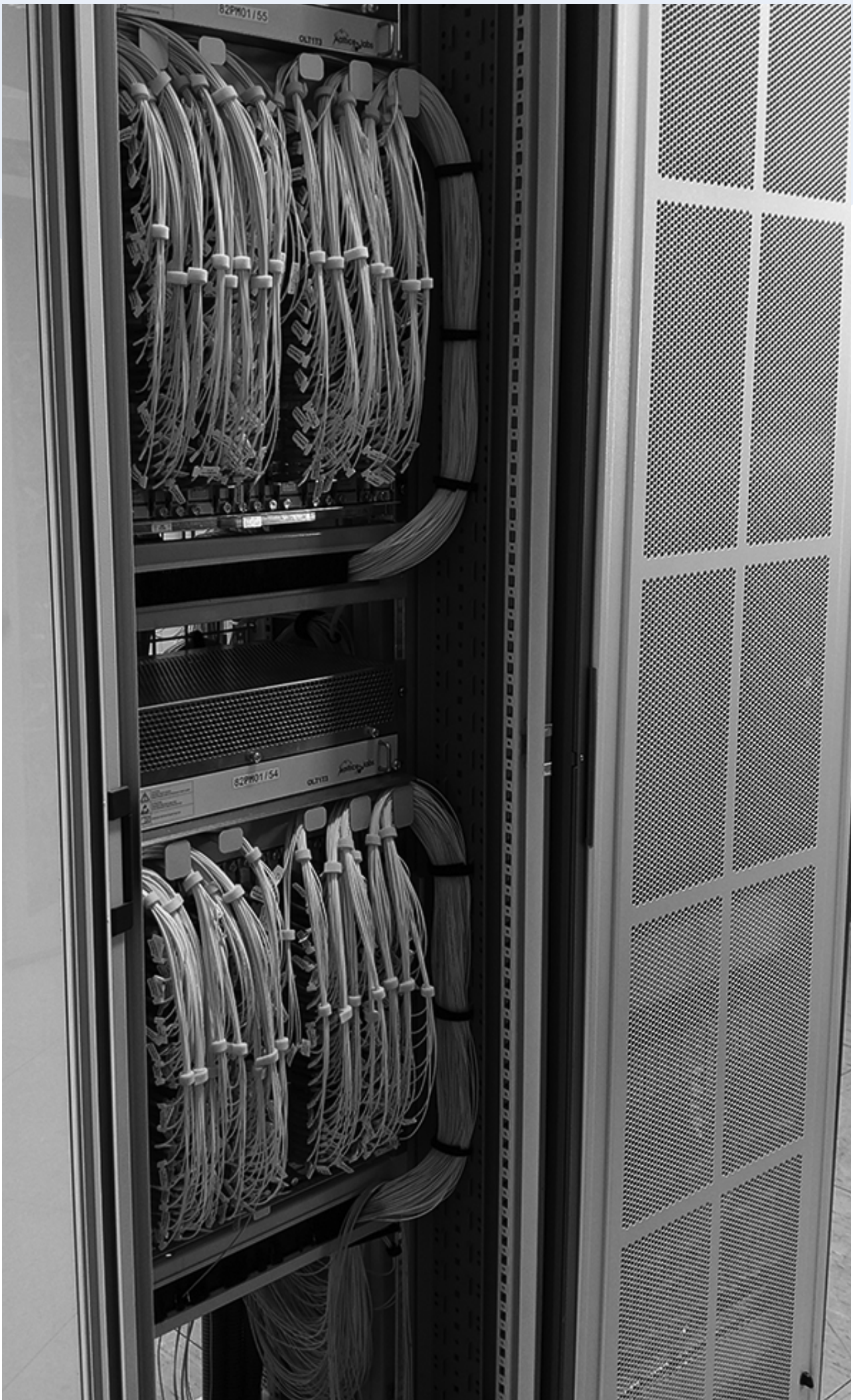
Outdoor Cabinets

OUTDOOR CABINET AR32

- Active equipment;
- Separated AC power compartment;
- Door stays for each door;
- Document power pockets and laptop holder;
- Central fiber cable management;
- Battery tray;
- No permissible points for vandalism;
- Lifting eye bolts for easy deployment;
- Robust RC2 double cylinder swing handle;
- Air exchange thermal solution;
- Outer parts can be removed without interruption of service;
- Open door alarm;
- Base plates with cable glands and rubber grommets;
- Standards: IP55 (EN 60529), IK10 (EN 60068-2-75), RC2 (EN 1627), and Class 4,1 (ETSI EN 3000191-4);
- Mounting directly in the concrete base or the socket.

Download datasheet
Scan the QR code to view more information

Type	Dimensions(HxWxD)mm	Capacity
Outdoor Cabinet AR32	1600x2000x500mm	2x 19” 22RU



Fiber Concentration Point

The OSP network is divided into transition points (FCP, NAP, and MDU components), which create flexibility points across the feeder, distribution, and access network.

General features:

- Flexibility and scalable solutions;
- Modular design;
- Multi-access enclosures;
- Pole, wall or manhole installation.

Standardized or highly customized solutions:

Customized for several markets (USA, France, etc.).

Fiber Concentration Point

Cabinets

FCP SRO-18RU | FCP SRO-288OF PRE- CONNECTORIZED | FCP SRO-25RU | FCP MINI-SRO-152OF | SRO768 UP-GF

- Optical distribution for FTTx networks;
- Modular solutions;
- Built-in cabling management;
- Standard splitter modules;
- Pole or ground installation accessories;
- IPx4 protection rating;
- Customizable color (std: RAL7035).

Download datasheet
Scan the QR code to view more information

FCP SRO-18RU

FCP MINI-SRO-152OF

SRO768 UP-GF

Fiber Concentration Point

Cabinets

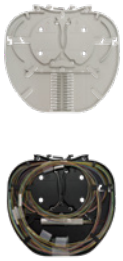
Type	Dimensions(HxWxD)mm	Capacity
SRO 432 1D RT	1200x750x500mm	18RU 19”
SRO 288 1D RT	1200x750x500mm	18RU 19”
SRO 144 1D RT	1200x750x500mm	18RU 19”
SRO 576 RT + Cable	1100x750x500mm	25RU 19”
SRO 288 1D RT + Cable	1200x750x500mm	288OF + 7/14HP splitter modules
SRO 576 1D RT	1100x750x500mm	25RU 19”
SRO 432 1D RT	1100x750x500mm	25RU 19”
Mini SRO PM	680x520x450mm	152OF + 4HP splitter modules
SRO768 UP-GF w/ Pedestal	1065x785x322mm 2015x785x322mm w/ plinth	768 client

Fiber Concentration Point

Split Enclosures

JSO-ORG/SPLIT | JSO-144/ 288/ 432/ 720 | JRO-128/34 SC | JFO 24-144OF

- Multi-access optical enclosures;
- Modular solution;
- Splicing capacities from 24 to 720OF;
- Different port configurations: 4+1; 6+1;
- Mechanical port or shrink sleeve port options;
- Fiber management compliant G652 (R<=30mm);
- Multi-color trays;
- Installation on wall, pole, manhole, or strand;
- Protection level IP68;
- Customizable color (std: RAL9005).



JSO-ORG SPLIT

JSO-144 288 432 720

JRO-128/34 SC

JFO 24-144OF

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Scan the QR code to view more information

Fiber Concentration Point

Split Enclosures

Type	Dimensions(HxWxD)mm	Capacity
JRO 6+1 PM	610x Ø 225mm	128SC + Up to 360OF
JRO 34SC/APC 1:32 PWM 2+2+1M	480x Ø256mm	120OF + splitter 1x1:32
JSO288 SC PWM	630x Ø225mm	288 to 432OF
JSO720 SC PWM	790x Ø225mm	720OF
JSO288 144FO SC SM(6+1)M	480x Ø210mm	144 to 288OF
JSO720 SC PWM P4+1	790x Ø225mm	720OF
JSO432 SC PWM P4+1	630x Ø225mm	432OF
SPLICE ORG JSO SC 12OF GR	124x132x4,5mm	12OF
SPLIT ORG JSO 1:4 BK	124x132x4,5mm	1x1:4
SPLIT ORG JSO 1:8 BK	124x132x4,5mm	1x1:8
SPLIT ORG JSO 1:16 BK	124x132x4,5mm	1x1:16
SPLIT ORG JSO 1:32 BK	124x132x4,5mm	1x1:32
JFO144 24OF SE PWM 4+1	450x Ø230mm	24 to 144OF
JFO48 SC PL SM 4+1	480x Ø180mm	48OF
JFO144 SC PL SM 6+1	450x Ø180mm	144OF

Network Access Point

ODP Boxes

ODP-12/24 EXTERNAL | ODP-16 EXTERNAL IP67 | ODP-34SC/APC 1:32 EXTERNAL | ODP-12 INTERNAL | HUP16/2

- Distribution network and drop connection to the client;
- Scalability;
- 8, 12, 16, 24, 32 customers;
- Several configurations available according to the client's needs: with or w/o adapters; with or w/o locker; with or w/o splice trays, splitters, etc.
- Mechanical fastening for easy opening/ closing;
- Wall, pole or manhole mounting accessories.

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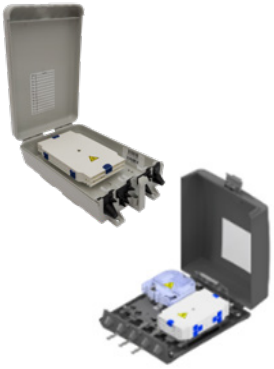

ODP-12/24 EXTERNAL

ODP-16 EXTERNAL IP67

ODP-34SC/APC 1:32 EXTERNAL

ODP-12 INTERNAL

HUP16

Network Access Point

ODP Boxes

Type	Dimensions(HxWxD)mm	Capacity	Note
PDO12 EXT PL 48FO PWM	265x150x71mm	48OF	(2x24)48 splices/Max. 96 splices (4x24)
PDO16 SUB PL 72FO PWM	450x Ø230mm	72OF	Loop possibility
PDO24 EXT PL 72FO 4+2	265x235x90mm	Up to 144OF	4 splice trays R30 for network distribution and 2 trays for network drop
PDO12 SC/APC INT PL 12OF	153x105x66mm	12OF	With 12 SC/APC adapter
CRO 34SC/APC 1:32 WM 4+2+1M CQ	380x245x130mm	Up to 60OF + 1x1:32 splitter	With 34 SC/APC adapter
HUP16/2	173x111x(64 or 32mm)	8/2 ANT crimp splice protector	With LC duplex adapt with or without pigtail

Multi-Dwelling Unit

Multi-Dwelling Unit

MDU12/24 SC ADAPT | MDU24 SPLICE | MDU24/48 SC ADAPT | MDU72/144 SC ADAPT

- Building terminal box or optical distribution point for FTTH networks;
- Stackable with similar boxes;
- 2 compartments: one for fiber termination and one for patching;
- Several configurations available according to the client's needs: with or w/o adapters, with or w/o locker;
- Cable strength member fixing;
- Wall mounting accessories;
- Customizable color (std: RAL9001).

MDU24/48 SC ADAPT

Download datasheet
Scan the QR code to view more information

Type	Dimensions(HxWxD)mm	Capacity
PDO24 INT P 24 SC/APC 24OF 2LK	155x330x75mm	24OF
PDO24 INT P 12 SC/APC 12OF 2LK	155x330x75mm	12OF
PDO48 INT P 48 SC/APC 48OF 2LK	155x330x105mm	48OF
PDO48 INT P 36 SC/APC 36OF 2LK	155x330x105mm	36OF
PDO12 INT M 96OF	268x340x108mm	96OF
PDO12 INT M 72OF	268x340x108mm	72OF

Multi-Dwelling Unit

Terminal boxes

DROP BOX SC ADAPT | DROP BOX SPLICE | OUTLET2 SC ADAPT | OUTLET2 SPLICE

- Transition point between the external network and the active equipment;
- Compact design and easy installation;
- Drop cable entrance allowance;
- Several configurations available according to the client's needs: with or w/o adapters;
- Wall fixing accessories;
- Fast cover fitting (screwless).

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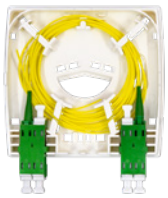
DROP BOX SPLICE

OUTLET2 SC Adapt



OUTLET2 LC Duplex

Type	Dimensions(HxWxD)mm	Capacity
DROP BOX SC/APC	40x110x20mm	1 splice /SC Adapt
DROP BOX SPLICE	40x110x20mm	1 splice
OUTLET2 1SC/APC INT PL WM	14,3x83,6x80,4mm	Max. 2 splices
OUTLET2 2SC/APC INT PL WM	14,3x83,6x80,4mm	2 splices
OUTLET2 1FO WM	14,3x83,6x80,4mm	Max. 2 splices
OUTLET2 2FO WM	14,3x83,6x80,4mm	2 splices/SC or LC Duplex Adapt

TEST LABS AND CONTROL

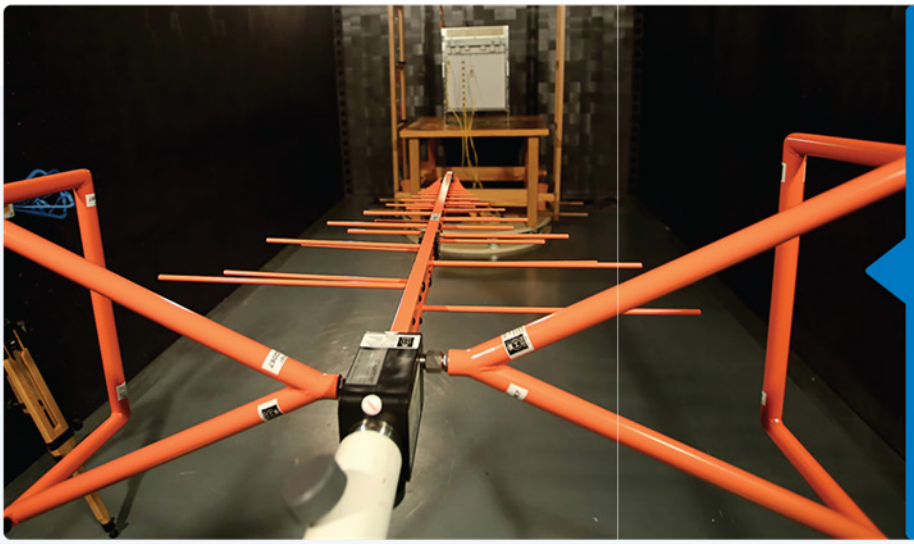
Test Labs and Quality Control

Development Design

After product specification, the development process starts with schematics and PCB (Printed Circuit Board) design, followed by micro-electronics development and simulation, prototypes bring-up and unitary tests. Altice Labs develops PCBs that are among the most complex in the world.

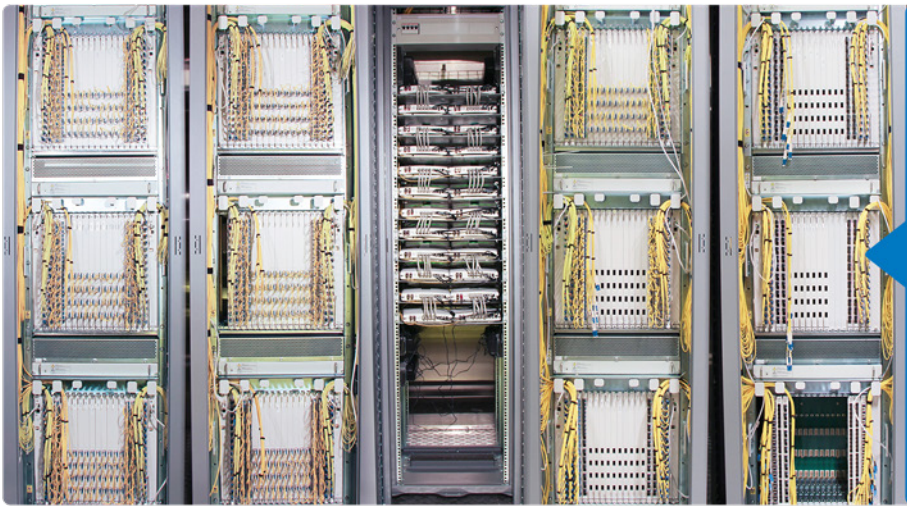
Test & Industrialization

Quality assurance is guaranteed by hardware, software and systems validation in simulated highly loaded networks, according to specific functional and non-functional requirements.



Conformance and Interoperability

Electromagnetic compatibility testing (EMC), CWMP – CPE WAN management protocol (TR069), GPON interoperability, Wi-Fi, ADSL/ADSL2+ interoperability, interworking compatibility with telecommunication networks, acoustic – voice terminals and CWMP – CPE WAN management protocol (TR069). This lab also certifies CPEs from different vendors.



Reliability Demonstration

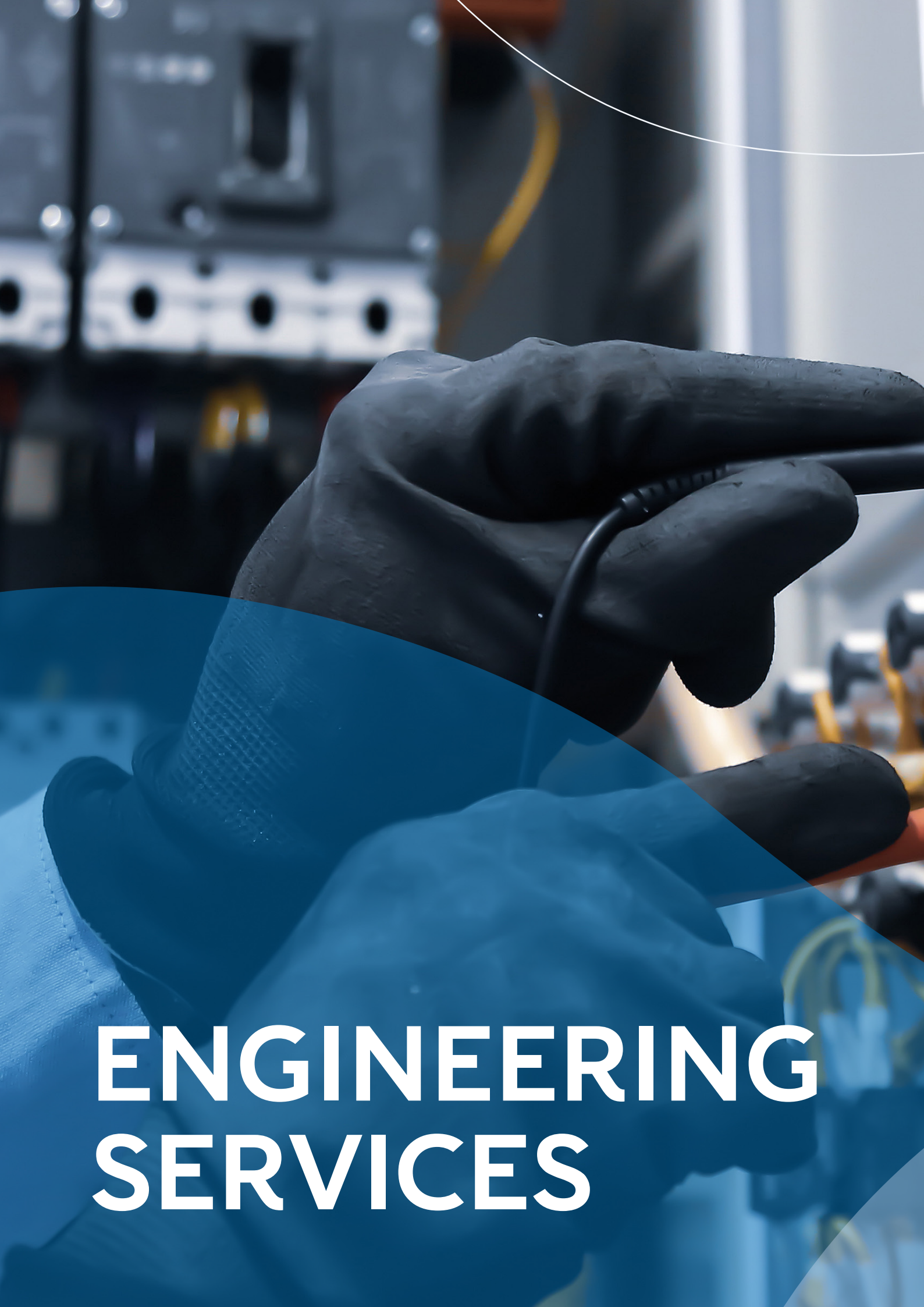
The product Reliability Demonstration Test (RDT) is a process to demonstrate that the calculated MTBF (Mean Time Between Failures) is coherent with the system's life cycle behavior. This test is achieved through accelerated aging by continuous temperature cycling, with simulated traffic, while being continuously monitored by external test equipment through automation.

Environmental and Mechanical Certification

Certification: user safety testing (IEC 60950-1), environmental (Ka, climatogram), mechanical (vibration), resistibility. This lab also certifies products from different vendors.

Prototype Production

Complete assembly line designed for prototypes and pre-series, with high flexibility to improve downtime, to change between productions, and capable of handling all sorts of electronic components. Fully automated for surface-mounted devices and semi-automated for conventional components. The assembly quality is assured by automatic optical inspection.

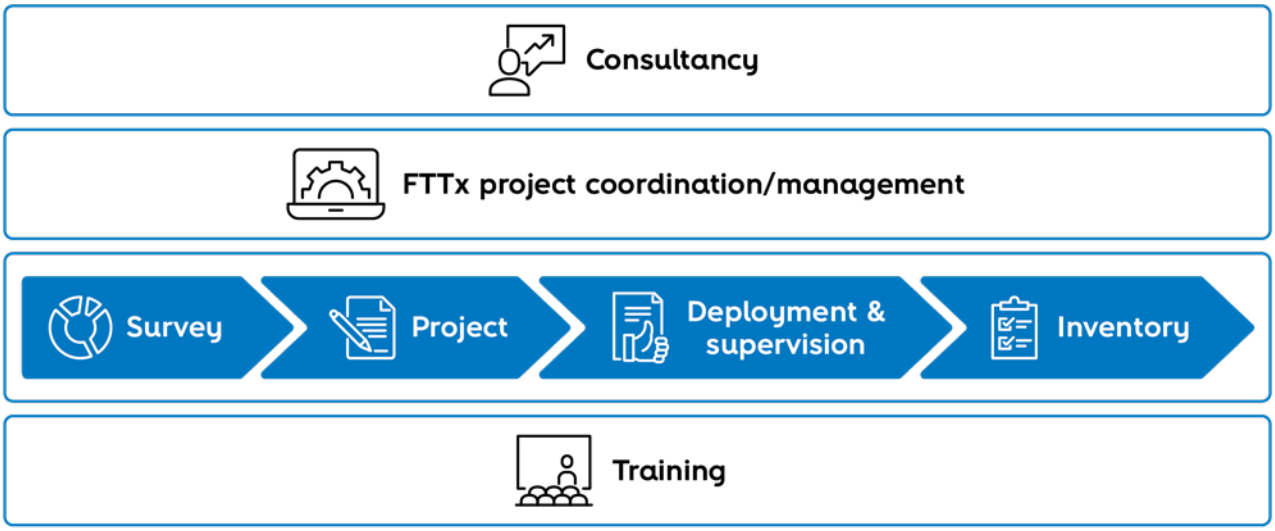


ENGINEERING SERVICES

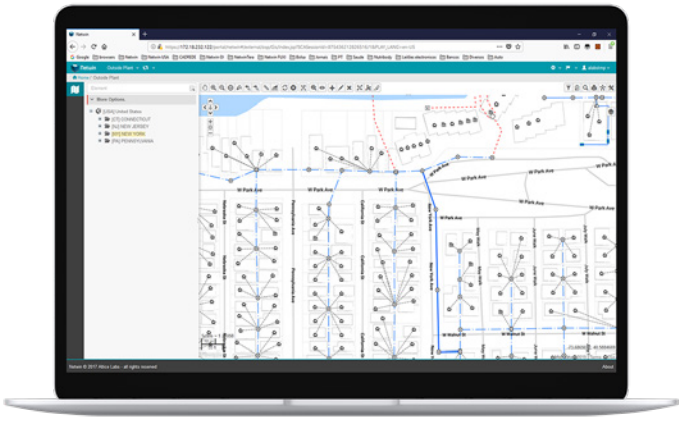
Highly Skilled Team with a Proven Track Record

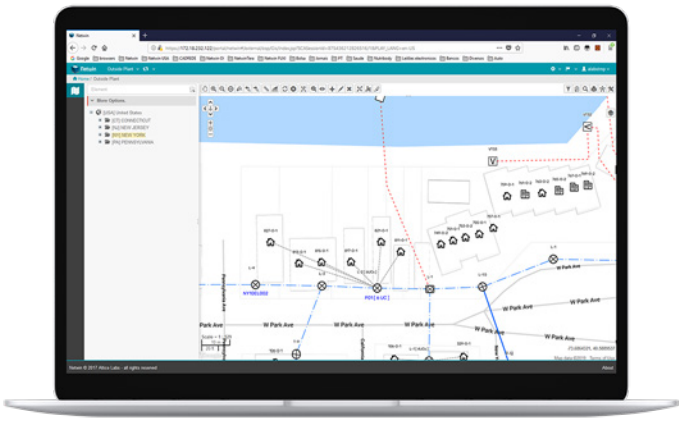
Altice Labs holds a proven track record of highly skilled engineering service delivery. From the beginning of the FTTx project plan until the field deployment rollout, our teams seek excellence, pursuing the best practices and tools while ensuring a successful business plan for all stakeholders.

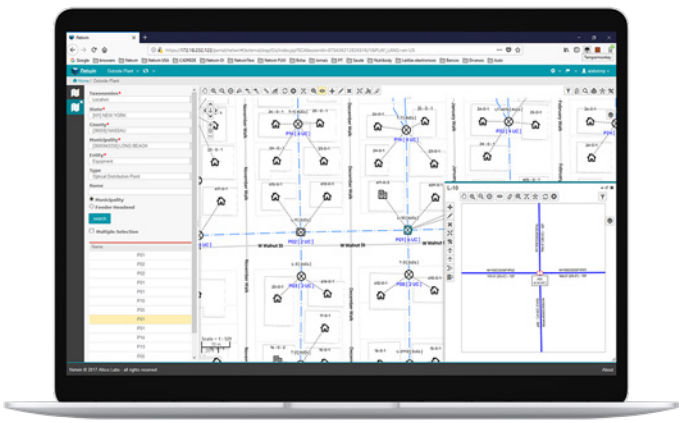
- Consultancy, audit, and network design of P2P and P2MP Outside Distribution Network
- Specially skilled teams for Project Coordination, Project Management, and Contract Supervisory
- Full cycle of FTTx service operational tasks, which include Survey, Project, Deployment, and Inventory
- Rollout speedup & Total Cost of Ownership (TCO) optimization
- Pay-as-you-grow | Future-proof | HW optimization
- Comprehensive training programs



Engineering Services Portfolio







Aiming to deliver a differentiated and added value service, Altice Labs uses the best-of-breed market tools to implement a recursive cycle following Survey, Project, Deployment & Supervision, Inventory, and Audit phases. Some of these best-of-breed tools are a part of and described in the Altice Labs' Operation Support Systems catalog.

MAINTENANCE SUPPORT SERVICES

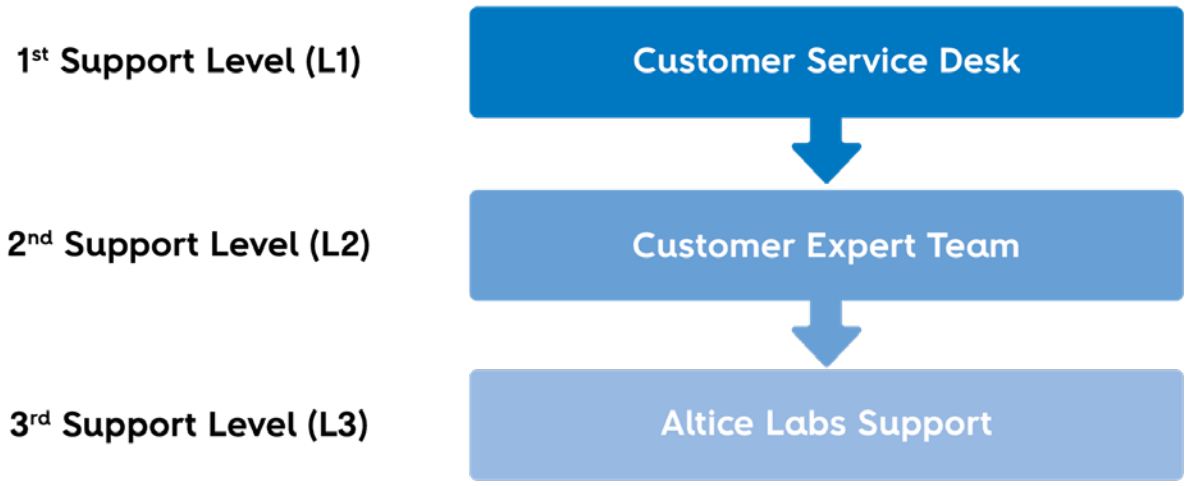
Highly Skilled Support Team with Relevant Know-How and Experience

Highly skilled technicians provide after-sales services supported by the best market tools, according to dedicated contract specifications.

The following after-sales **service components** are available:

- **Maintenance and Support** – reactive activity for failure recovery and defects/errors correction of the object under contract;
- **Preventive Maintenance** – proactive activity designed for early detection and avoidance of potential failures in the object under contract;
- **Operation** – configuration, parameterization, and administration activities over the object under contract;
- **Hardware Repair** – reactive assistance in case of hardware failure;
- **Advanced Hardware Replacement** – fast replacement of faulty hardware by spares. This service includes adequate spare management procedures.

According to the Information Technology Infrastructure Library (ITIL), Altice Labs has defined three levels of support for incident management framed within the operation procedures of our networks.



Incident management support levels

Additional dedicated support models can be addressed upon mutual agreement.

Several service levels can be selected, considering the corresponding Service Level Agreement (SLA) availability and response times.

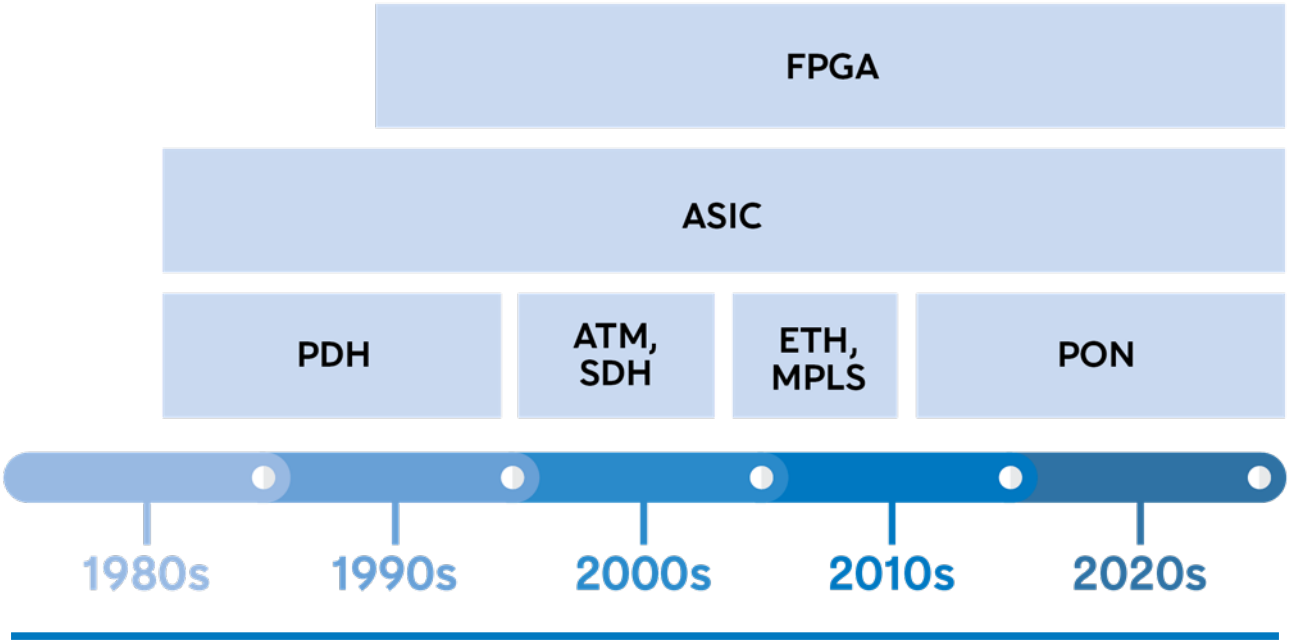
Gold **Silver** **Bronze**

ALTICE LABS ADDED VALUE ECOSYSTEM


TEAM

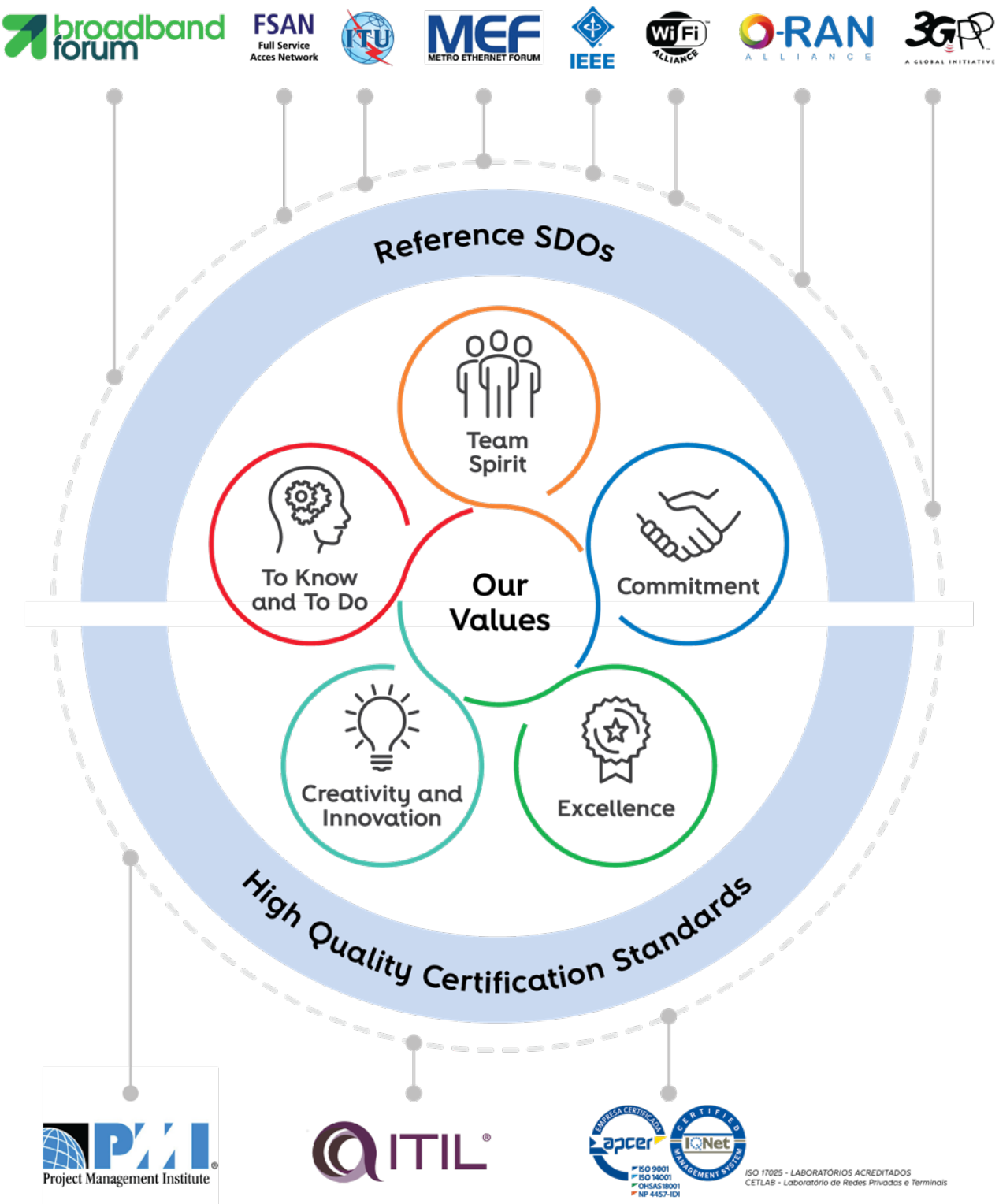
Added Value Ecosystem

Over the past years, our development teams have undergone new challenges and achievements towards complete technology portfolios. Today's PON product line results from all the experience translated over strong FPGA and ASIC expertise.



Altice Labs Major Technology Enrollements

As a telecom market vendor or a valuable technological partner, Altice Labs' current market position totally and closely commits to service excellence delivery in each customer solution.



altice labs

About Altice Labs

Delivering key telecommunications technologies since 1950, Altice Labs has been shaping the future of technology, enabling Communications Service Providers and Enterprises to offer advanced and differentiated services to their customers and users.

Altice Labs is an innovation and transformation catalyst supported by a strong and dynamic Innovation Ecosystem. Through technology, we are committed to improving people's lives and how companies do business.

www.alticelabs.com