Nokia universal next-generation PON
One platform to go from GPON to next-generation PON
The last few years have seen an explosion in ultra-broadband technologies and services. Today, 1 Gb/s services are commonplace and many fixed access operators are looking to offer multi-gigabit services. In most cases, the reason is simple: download speed is the ultimate marketing weapon in a competitive broadband market. But increasingly, operators are looking beyond download speeds towards boosting upstream capacity as well.

Symmetrical or high bandwidth upstream services have long been important to large enterprise customers. But today, small businesses and even residential customers are all demanding higher upstream bandwidth. They might only need it occasionally – for example when using cloud storage or sharing video files – but when they do, the network must deliver. For operators, upstream services are an opportunity to differentiate their customer experience.

There are also operational advantages for high upstream capacity. As the world prepares for the arrival of 5G mobile services, operators need an infrastructure that can backhaul huge amounts of traffic from a multitude of small cells.

Increasing upstream bandwidth is a job for next-generation PON technology. The challenge for operators used to be choosing the right flavor: XG-PON, XGS-PON or TWDM-PON? The wrong choice can lead to a technology dead-end or an unviable business case. What operators need is a sure way to migrate to NG-PON that strikes the right balance between near-term investment and long-term thinking.

Introducing Nokia universal NG-PON

With the Nokia universal NG-PON solution, that choice is easy. We make it possible to converge various PON technologies onto one platform and one line card. This makes network evolution – from 1G to 10G and beyond – simple, flexible, efficient and, most importantly, risk free.

With Nokia universal NG-PON, you can evolve your network at a pace and cost that suits your specific business needs.

• If you’re a new entrant, you have a choice of PON technologies – you can connect GPON, XG-PON, XGS-PON or TWDM-PON optical network terminals (ONTs) all on the same platform. This lets you deliver the right service and operations at the right cost.
• If you have an existing GPON network, you can add XGS-PON and TWDM-PON services on the same infrastructure and same access node as existing GPON customers.
• If you’ve started deploying XG-PON, your evolution options were severely restricted. But now you can introduce Nokia universal NG-PON without having to replace your XG-PON ONT installed base.
• As services and needs evolve, you can introduce TWDM-PON optics onto the same platform, resulting in an additional 40 Gb/s bandwidth and new ways of decreasing operational costs through wavelength mobility.

Nokia universal NG-PON gives you a clear and cost-efficient migration path towards NG-PON – no technology lock-in, no future forklift upgrade. Your initial investment in network assets and outside plant is extended and you can “pay-as-you-grow” by simply changing electronics. This accelerates monetization of new services and maximizes your return on investment.

Nokia universal NG-PON also enables new forms of network sharing through wavelength unbundling for wholesale or co-investment opportunities.
The Nokia universal NG-PON solution

The Nokia next-generation PON solution includes:
- Optical Line Terminals (OLTs)
- Optical Network Terminals (ONTs)
- Wavelength Multiplexer with embedded co-existing element
- Access Controller advanced management solution.

Optical Line Terminals
7360 ISAM FX
The 7360 Intelligent Services Access Manager (ISAM) FX is a high-capacity access node for mass-market fiber deployments, delivering capabilities to meet bandwidth demands today and smoothly evolve to next-generation fiber technologies to meet the demands of tomorrow.

The 7360 ISAM FX access node simultaneously supports multiple PON and point-to-point technologies. It has a non-blocking backplane architecture that can deliver 2x100 Gb/s to each slot, 2x1.28 Tb/s switching capacity and 360 Gb/s uplink capacity. It is available in three size variants (FX-4, FX-8 and FX-16) suitable for all types of fiber networks: from hundreds of subscribers on FX-4 to thousands of subscribers on FX-16.

The 7360 ISAM FX gives you the flexibility to choose the fiber technology and deployment density that best suits your techno-economics and service offering.

Meet bandwidth demands
- Supports a non-blocking, high-capacity backplane of 2x100 Gb/s per slot
- Simultaneous support of multiple fiber access technologies:
  - Point to point (36 ports x 1 Gb/s symmetrical and 16 ports x 10 Gb/s symmetrical)
  - GPON (16 ports x 2.5 Gb/s downstream, 1.2 Gb/s upstream)
  - XGS-PON dual rate (8 ports x 10 Gb/s downstream, 10 Gb/s or 2.5 Gb/s upstream)
  - TWDM-PON (8 ports x 10 Gb/s symmetrical with tunable optics)
- Smooth evolution with pay-as-you-grow approach.

Deployment flexibility
- Available in four-slot (FX-4), eight-slot (FX-8) and sixteen-slot (FX-16) shelf options.

Lower OPEX
- All services available from a single platform offers operational advantages: residential, mobile transport and business applications
- Single fiber network offers flexible support for multiple service and content providers.
The Nokia 7362 ISAM Dense Fiber (DF)-16GW gives you flexibility in your fiber deployment and helps optimize your business case. With the Nokia fiber portfolio, you can cost-efficiently address all types of deployments: high volume, high user density with ISAM FX and lower user density with ISAM DF. This means you can optimize the business case to connect users with gigabit services no matter where they are, meet their bandwidth demands and generate new revenues.

Meet bandwidth demand
- High capacity, non-blocking access node to meet demand for gigabit services
- 8 x 10 Gb/s uplink capacity
- Supports 16 ports of GPON
- Supports 4 ports of next-generation PON technologies (XGS-PON and TWDM-PON), boosting the speeds of fiber networks up to 40 Gb/s.

Deployment flexibility
- Compact design small form factor (1RU) allows cost-efficient gigabit deployment in small or lower user density areas
- Flexibility to deploy from the central office, cabinets, within multi-dwelling units, office buildings, etc.
- Temperature hardened for outside cabinet deployments.

Easy integration into existing networks
- Stand-alone operation requires no additional aggregation device.
- Same software as other ISAM products for simple mix and match
- Same management platform, the Nokia Access Controller.

ISAM FWLT-B line card
The Nokia ISAM FWLT-B is a next-generation PON line card, supporting XGS-PON dual rate and/or TWDM-PON just by plugging in the corresponding optics. The card can be deployed in the Nokia 7360 ISAM FX and co-exist with GPON. The FWLT-B has 8 ports, each supporting up to 10 Gb/s bit rates.

Deployment flexibility
- Choose a variety of optics interfaces:
  - 10G/2.5G fixed wavelength
  - 10G/10G fixed wavelength
  - 10G/10G tunable wavelength
  - 10G/2.5G tunable wavelength
- GPON, XG-PON and XGS-PON just by plugging in different optics.

Return on investment
- Capture new revenues with 10 Gb/s symmetrical or asymmetrical services by including a line card in your existing access node
- Keep GPON/NG-PON on the same platform to enable a cost-efficient evolution on the same passive and active plant.

Improve operations
- Only one card to validate, deploy and operate for various next-generation PON technologies (10 Gb/s symmetrical or asymmetrical, fixed or tunable optics)
- Converge all services on one network: residential, business, mobile backhaul.
Optical Network Terminals
Nokia has a large portfolio of Optical Network Terminals (ONTs) designed to deliver gigabit services to the premises in a wide variety of deployment situations. They are available in different variants with different types of user interfaces including Wi-Fi and gigabit Ethernet and can be deployed indoors or outdoors for residential or business users. There are simple Layer 2 ONTs, as well as a fully integrated solution with Layer 3 functionality.

The Nokia portfolio includes ONTs that support current and next-generation PON technologies including GPON, EPON, XG-PON, XGS-PON and TWDM-PON, so that operators have flexibility to deploy the right service at the right cost.

<table>
<thead>
<tr>
<th>PON interface</th>
<th>Model</th>
<th>Service</th>
<th>Forwarding type</th>
<th>User interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>XG-PON1</td>
<td>XG-020X</td>
<td>Residential</td>
<td>Gateway</td>
<td>1 x Gb/s Ethernet, 1 x 10 Gb/s Ethernet</td>
</tr>
<tr>
<td></td>
<td>XG-250WX</td>
<td>Residential</td>
<td>Gateway</td>
<td>2 x POTS, 4 x 1 Gb/s, 1 x 10 Gb/s Ethernet, Wi-Fi 11n + 11ac</td>
</tr>
<tr>
<td>XGS-PON</td>
<td>XS-020X</td>
<td>Residential</td>
<td>Gateway</td>
<td>1 x Gb/s Ethernet, 1 x 10 Gb/s Ethernet</td>
</tr>
<tr>
<td></td>
<td>XS-250WX</td>
<td>Residential</td>
<td>Gateway</td>
<td>2 x POTS, 4 x 1 Gb/s, 1 x 10 Gb/s Ethernet, Wi-Fi 11n + 11ac</td>
</tr>
<tr>
<td></td>
<td>XS-050X</td>
<td>Mobile backhaul</td>
<td>Gateway</td>
<td>4 x 1Gb/s Ethernet, 1 x 10 Gb/s Ethernet</td>
</tr>
<tr>
<td>TWDM-PON</td>
<td>TW-080GX</td>
<td>Business</td>
<td>Bridge</td>
<td>8 x 1Gb/s Ethernet, 1 x 10 Gb/s Ethernet</td>
</tr>
<tr>
<td></td>
<td>TW-240GX</td>
<td>Residential</td>
<td>Gateway</td>
<td>2 x POTS, 4 x 1 Gb/s Ethernet, 1 x 10 Gb/s Ethernet</td>
</tr>
<tr>
<td></td>
<td>TW-240WX</td>
<td>Residential</td>
<td>Gateway</td>
<td>2 x POTS, 4 x 1 Gb/s Ethernet, 1 x 10 Gb/s Ethernet, Wi-Fi</td>
</tr>
</tbody>
</table>

Flexibility
• Deploy them in any location, indoors or out, to serve residential or business customers
• Integrated and simple ONTs available
• Different options with different number and type of ports.

Reduced OPEX
• Low power consumption
• Power monitoring
• Early problem detection.

High performance
• High bandwidth
• Delivers connectivity to wired and wireless devices within the home
• Supports full triple-play services
• Delivers voice services over IP (VoIP).
Wavelength Multiplexer

The Nokia Wavelength Multiplexer with embedded co-existing element completes an end-to-end NG-PON solution that allows operators to add XGS-PON and TWDM-PON wavelengths in incremental steps, with gradual investment and minimal interruption of service during upgrades.

**Figure 1. PON wavelength plan**

![Wavelength Multiplexer Diagram](image)

Different PON technologies operate on different wavelengths, as illustrated in the figure above, to ensure that they can co-exist on the same fiber infrastructure without overlapping. The Wavelength Multiplexer with the co-existence function ensures that wavelengths from different technologies are combined on a single fiber. It combines two essential functions in a single product:
- The co-existing element is needed when NG-PON technologies are introduced as overlay in an existing GPON network. It multiplexes the wavelengths of all technologies and puts them on a single physical fiber.
- It combines TWDM signals of different wavelengths into a single fiber.

**Features**
- Height of 6 RU (other form factor than FX)
- For deployment in 19” and broader racks
- 12-slots for WM cards
- Single controller card
- Fan-less
- Not separately managed (alarms coupled to FX shelf external alarms input)
- Can be deployed in Central Office (CO) environment (between -5°C and +45°C).
Access Controller
The Nokia Access Controller management solution can efficiently support you throughout the entire lifecycle of your fiber access network. From the initial deployment onwards, the Nokia Access Controller gives you a comprehensive view on the utilization and health of your network and helps you with automating troubleshooting and providing valuable insight for network upgrades. Powerful provisioning functions let you deploy new network elements and new services faster and smarter. And it is also ready to support both SDN principles and TWDM-PON wavelength mobility.

Accelerate time-to-service, reduce errors and truck-rolls, and slash deployment and management costs with the Nokia Access Controller.

Activate
- Install new network elements more quickly and simply with automatic node turn-up and plug and play provisioning. Take the guesswork out of network design with pre-defined playbooks, reduce truck-rolls and errors through automation.

Maintain
- Anticipate potential problems and react more quickly to service degradation with proactive health-checks, advanced monitoring and automated troubleshooting procedures.

Evolve
- Gain detailed insight into network utilization to help plan your upgrade to next-generation PON through software campaign management, comprehensive reporting and TWDM-PON wavelength management.

Control
- The Nokia Access Controller’s modular architecture grows with your business, in a traditional, SDN or hybrid environment. Use the same powerful feature set across all technologies and transition to SDN whenever you are ready.
Nokia credentials

Nokia is the world leader in fixed access technologies and we can help you make a successful move to next-generation PON. Our award-winning FTTH solutions have been deployed by more than 200 operators and power some of the biggest and most advanced fiber networks in the world. Supported by innovations and expertise from our Bell Labs researchers, we were the first to deliver 10G technologies over fiber; first to demonstrate 10G symmetrical PON; first with commercial deployments of TWDM-PON and XGS-PON. In fact it was our innovation of fixed wavelength TWDM-PON that resulted in the XGS-PON standard. We are committed to leading the industry into the next-generation PON era and to helping you get more value from your fiber network.