

Nokia Altiplano Open Access for digital infrastructure builders and broadband wholesalers

Application note

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Introduction

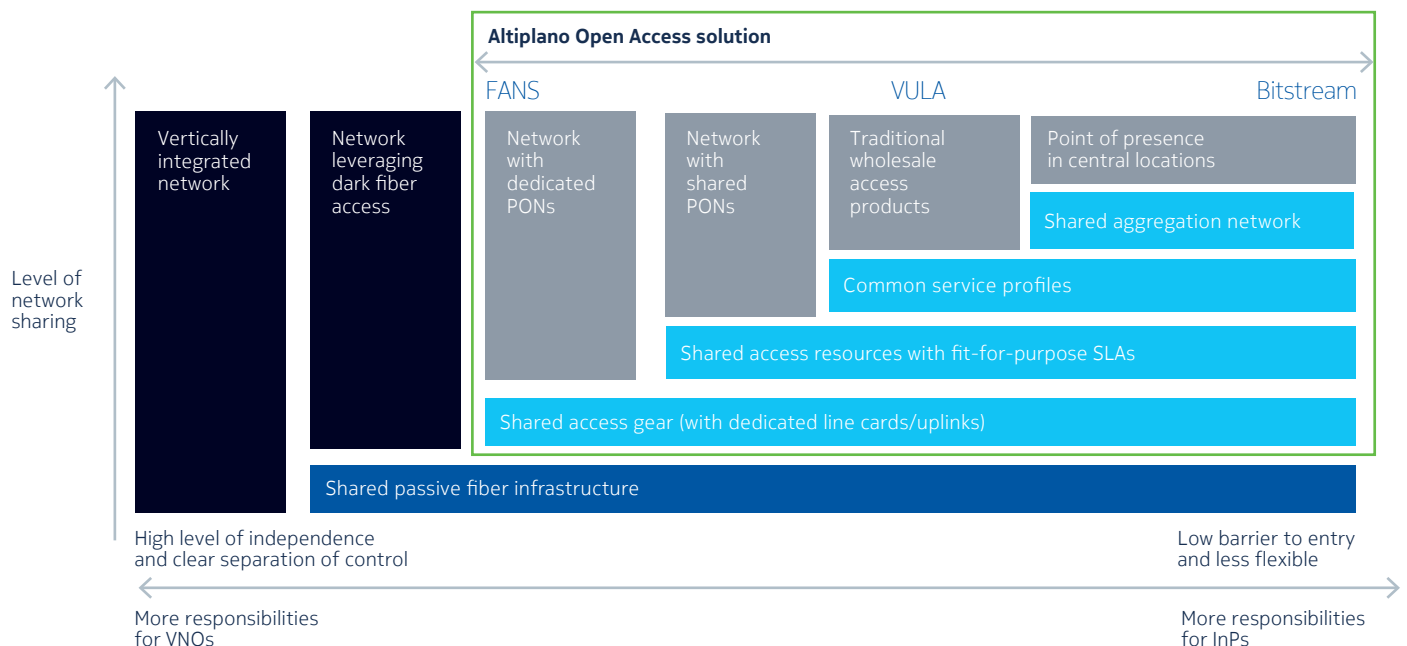
Fiber-to-the-home (FTTH) is today's dominant broadband access technology and a key asset contributing to the commercial success of network operators. As the telecom industry is preparing for the next wave of FTTH rollouts, there is a global trend to build more neutral-host open access networks. An open access network is an independent wholesale network, owned and operated by an infrastructure company, with the purpose of offering a share of the network to third-party service providers through commercial wholesale agreements. It brings flexible consumption models and commercialization of broadband as a new utility (like energy or water). Open access networks result in better broadband for more people: reaching underserved populations and rural areas, improving the capital efficiency for operators, and leading to higher valuations of the network ecosystem on the financial market.

For a long time the industry has lacked a satisfactory framework for operators to successfully outsource access networks. Now, the Nokia Altiplano Open Access solution changes the game: the network offers open access connectivity which can be consumed 'pay-as-you-grow' by service providers and offers steady long-term return on investment for investors and capital sponsors.

The open access model

Compared to vertically integrated networks or physical layer unbundling, open access delivers much greater flexibility and opens the network to more market segments and more service providers that would otherwise need to use parallel networks. Open access models handle the dynamics of various types of tenants and addresses their need for on-demand access connectivity. Since duplication of active equipment and multiplication of passive infrastructure is avoided, the open access model improves time-to-market and capital efficiency, maximizing the homes passed, customer acquisition rate and return on investment for FTTH.

Figure 1. Levels of network sharing



The wholesale opportunity creates different roles with new business models and partnerships. The infrastructure providers (InPs) own, build and operate the FTTH network. They bring expertise in the rollout of asset-heavy infrastructure, can take on capital intensive projects with long payback times. The virtual network operators (VNOs) offer high-speed internet access and other telecommunication services. The VNOs can benefit from a competitive wholesale offering that offers non-discriminatory commercial terms, fast time-to-market, and lower overall subscriber acquisition costs. VNOs include:

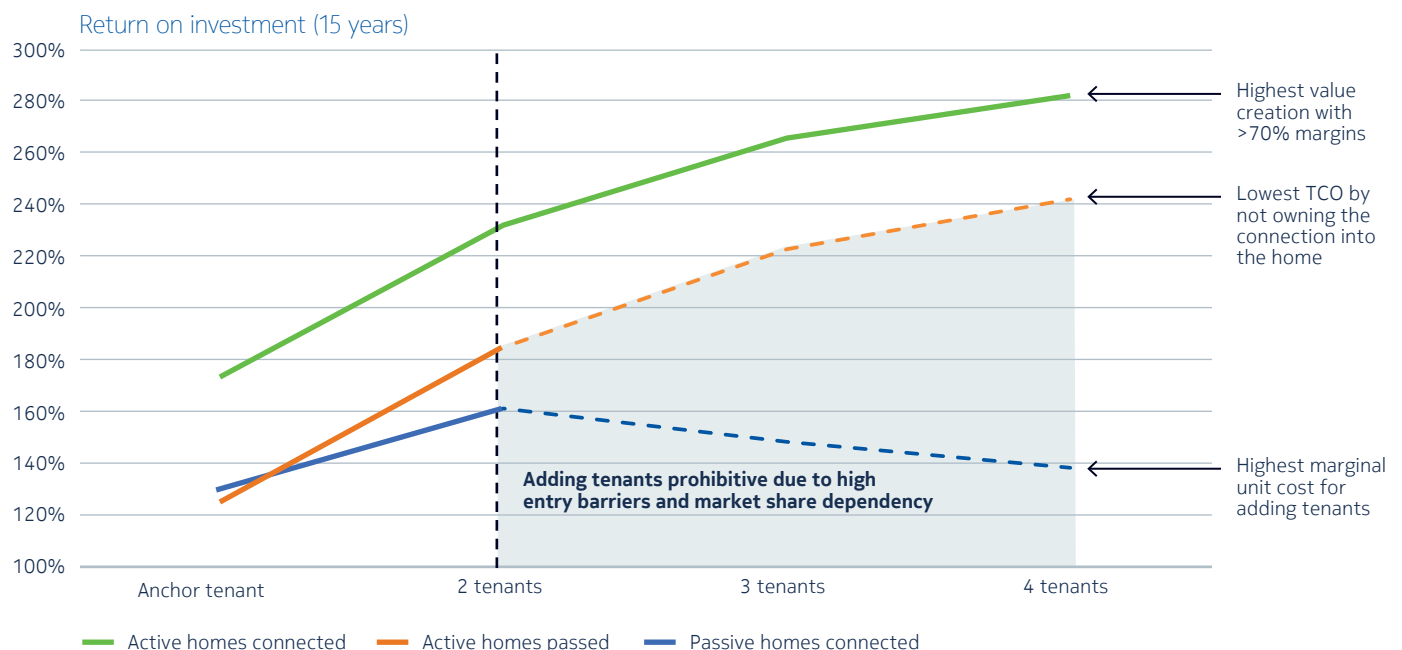
- Telecom companies that outsource their access network infrastructure
- Operators wishing to maximize their service coverage or compete out-of-region
- Mobile operators requiring 4G/5G mobile backhaul services
- Service providers of IoT services, Wi-Fi hotspot or Wi-Fi mobile offload/roaming

Wholesale access separates infrastructure from the services being provided. It is vital to create full transparency and clear responsibilities between the InP and each VNO. Consequently, price settings will reflect these responsibilities, related to network exploitation, take rates and contractual commitments.

Business case

The anchor tenant is the foundation for a successful business case; onboarding additional tenants and revenue streams further increases the InP's return on investment. With active network sharing the overall business case delivers the highest returns on investment (ROI) with the highest monthly revenue. It delivers the highest value creation without the active equipment impairing the business case. Regulation, competitive positioning, or local custom can dictate which active scenario is preferred: homes connected, or homes passed. Not owning the last drop and home connection lowers the cost significantly to build and operate the infrastructure, but ROIs drop below 200%. Finally, passive network sharing ends up with the lowest ROI and also the highest marginal unit cost for adding tenants.

Figure 2. Business case for open access networks



The low entry barriers for additional tenants are a big advantage favoring active network sharing. Since tenants are leasing only network resources like bandwidth, without building physical access network infrastructure, their investment in capital is much smaller. Active network sharing also works for existing FTTH networks, as it puts lower demands on the network layout: no difficulties with co-location points, manually switching fibers between splitters, or the need for multiple fibers to each location.

Software-defined networks

Software-defined networking (SDN) and network function virtualization (NFV) introduced a powerful and versatile way to share network resources. With Nokia Lightspan access nodes and the Nokia Altiplano cloud platform, Nokia delivers an open and programmable solution that can easily scale to serve more tenants. Nokia's open access solution enables sharing of the network resources among VNOs, including passive cabling, equipment, and ports, with strong operational isolation and process automation, while increasing flexibility and maintaining network visibility and control for the VNOs.

Traditional network sharing solutions with virtual unbundled local access (VULA) and bitstream access (BSA) burdens InPs with significant operating costs, either due to lack of monitoring and management capabilities, or due to the high involvement in service definition, activation, and support. These are restricted in flexibility and integration is handled between vendor-specific software and the OSS. This increases the cost associated with on-boarding tenants and constrains service offerings.

Alternatively, by leveraging SDN, VNOs can use open interfaces for more flexibility in service creation, network integration and optical network unit (ONU) selection, independently from the InP. The SDN approach offers programmability and responsive control of all aspects of the network: configuration, authentication, diagnostics, and fault processes. The APIs offer real-time access to data and allow to automate processes, leading to rapid response times and improved customer satisfaction during troubleshooting. Importantly, VNOs can define their own abstraction to integrate with back-end systems and choose between different wholesale products: BSA, VULA and Fixed Access Network Sharing (FANS).

The benefits

For InPs, Nokia Open Access brings the following benefits.

- Open and programmable platform for wholesale fixed broadband services
 - Higher network utilization with virtual network consumption model
 - Open and standardized APIs for easy integration with VNOs
 - Competitive environment to attract public and private financing
 - True neutral-host infrastructure to satisfy regulatory constraints

- Easy onboarding of tenants and their services
 - Support for residential, mobile backhaul, enterprise services
 - Flexible deployment models for small and large VNOs
 - Catalogue of predefined service offerings that can be tailored
 - Highly scalable amount of network slices
- Reduced operating costs and complexity
 - Separate services from infrastructure with advanced SDN automation
 - Automate VNO/InP touchpoints to handle service requests
 - Centralized single-point-of-control for OAM, privacy and security

For VNOs the solution brings:

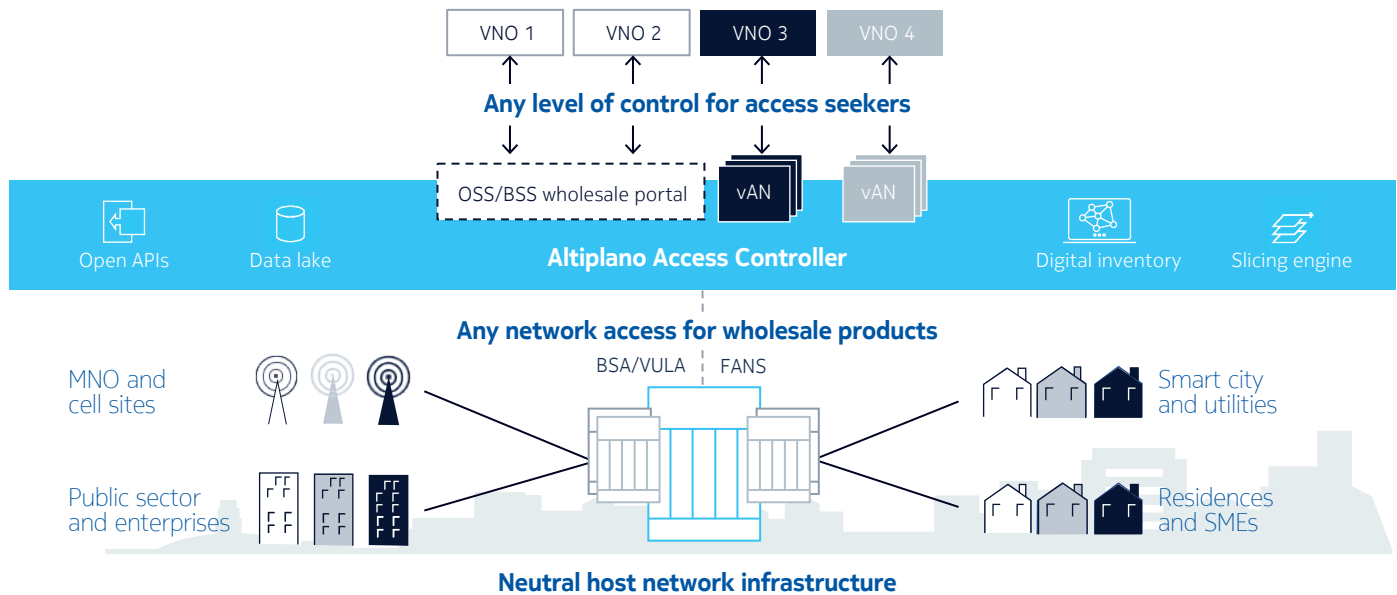
- High service design flexibility
 - Opportunity for service and price differentiation with deterministic SLAs
 - Easy integration of back-end systems and service provisioning via open APIs
 - Custom level of control — full FCAPS or just service health
- More autonomy to control the customer experience
 - VNO flexibility to handle service requests and first line support
 - Fewer VNO/InP touchpoints for fast response time and low operating costs
 - Reduced ping-pong escalations due to clean separation of connectivity and service
 - Access to real-time and historical OAM data for customer care and service operations
- Consume FTTH services on demand
 - Automated tenant onboarding, subscriber allocation, and network inventory tools
 - Easy on-demand plan management, upgrades, and usage reports

Altiplano Open Access solution

Nokia provides everything broadband access providers need to wholesale. We provide best-in-class design expertise, solution blueprints and a true open access platform that support network sharing and service-lifecycle management based on open and standardized APIs. The Altiplano Open Access solution advances the industry to treat fiber access as transactable and transferrable assets and allows services to be automatically provisioned while reducing manual touchpoints between the InP and tenants.

The solution offers any level of control for the access seekers with flexible integration to suit their needs: from full FCAPS management to service health views. The solution also offers any network access to wholesale products with multiple network sharing options: access at the granularity of a line card, a PON port, a passive fiber outlet, ONT, or user interface.

Figure 3. Altiplano Open Access solution

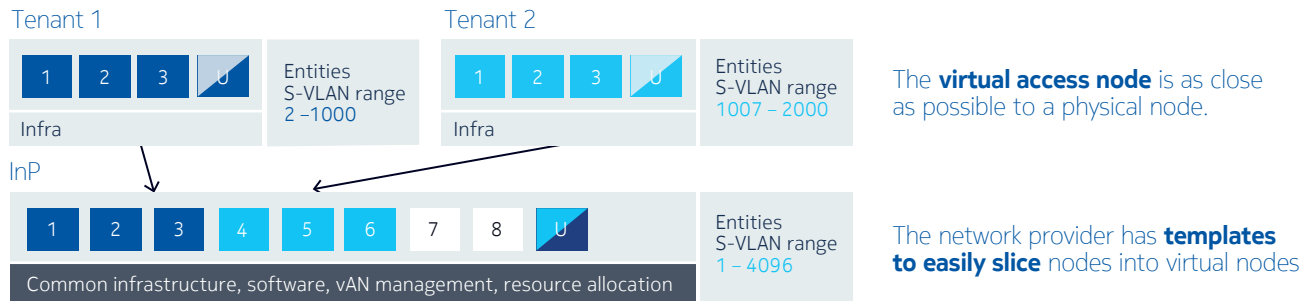


Powerful tools are required to monitor and control the network with transparent reporting for both the InP and tenants. Our Altiplano platform simplifies processes and procedures for asset exposure, service integration, subscriber management, resource isolation, and consolidation of data. The solution enables sharing of the access network in different configurations, all from a single platform

- The **Altiplano Access Controller** is an SDN access domain controller that spans FCAPs silos to provide provisioning, assurance, and automation for the fixed access domain. The InP uses Altiplano to configure and manage the physical network infrastructure. VNOs can have separate instances of Altiplano allowing them to autonomously provision subscribers, configure services, monitor health, and automate operations processes within their network partition.
- The **Altiplano Slicing Engine** provides resource partitioning and isolation features to ensure that each tenant operates in a fully independent way and is unaware of resources outside of its own slice. The slicing model is highly programmable and extendable, allowing fine-grained control of access node resources and slice bandwidth—isolation, differentiation, and optimization.
- The **Altiplano Digital Infrastructure Inventory** allows self-service connectivity services for automated tenant onboarding and allocation of passive resources, such as drop fibers and PON ports, and corresponding active resources. This helps to maintain inventory databases as end users change provider, add services, or move to another location.

The Altiplano solution uses virtualization to divide the access network into logical network partitions, or virtual access networks (vANs). It allows the InP to share its passive and active network resources as slices of a physical access network and provide independent control of these vANs to VNOs. The vAN resources can elastically be scaled up and down and customized to meet each type of service requirement. The owner-like experience provided to tenants is particularly appealing for vertically integrated operators. It gives them the freedom to operate a vAN just as they would a real one. Service providers that do not require this level of control can rely on slices with pre-defined services and benefit from advanced monitoring and troubleshooting. This helps provide service retailers the customized capabilities they need to support their business.

Figure 4. The device view of the virtual node model



The resources of the shared network infrastructure are treated in different resource categories:

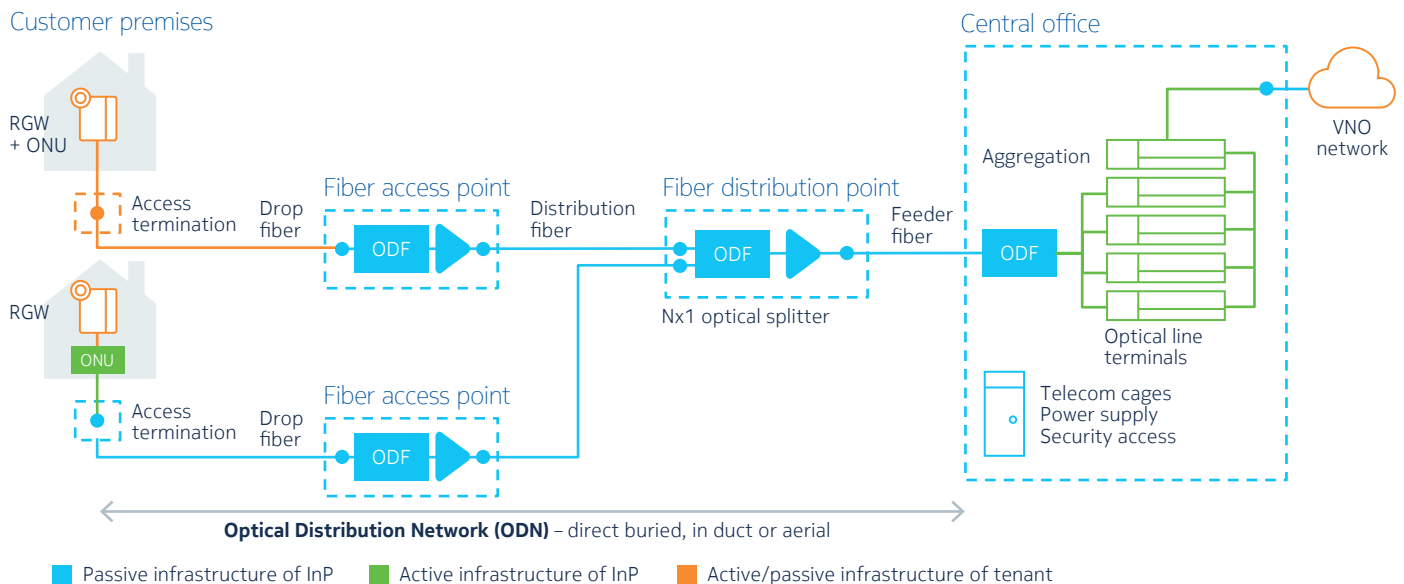
- Resources that are **allocated** one-to-one to a slice – e.g. PON ports, SLA (CIR/PIR) MAC learning, ONTs
- Resources that are **shared** between slices – e.g. uplinks, PON bandwidth
- **Segmented** resources for which there are limited entries – e.g. profiles, VLAN IDs
- **Common** resources which remain the responsibility of the InP – e.g. node backup

The subscriber experience is strongly linked to service stability and troubleshooting support. The Altiplano Open Access solution makes no compromises: even at the verge of responsibility boundaries, VNO and InP can have a joint view. The VNO can independently access operational indicators and performance counters that are of most interest to them. These capabilities enable the VNO to monitor performance, troubleshoot PPPoE sessions, review DHCP/IGMP statistics and check ONU status. These capabilities provide effective assistance to the customer care agent in troubleshooting the customer service.

Deployment models and demarcation strategies

The virtual slicing concept can share active and passive network resources at various levels of granularity. The slice boundary can be flexibly defined to provide the VNO access to a line card, PON, passive fiber outlet or a small form-factor optical network terminal (ONT). This supports a wide range of physical deployments with active demarcation (InP owned ONU), passive demarcation at the home (VNO owned ONU), or at the fiber drop installed by the first VNO signing up the subscriber.

Figure 5. Ownership of FTTH assets in the open access model



In wholesaling, it is not straightforward for VNOs to take full ownership of the customer premises equipment. The choice in demarcation model and the single-box vs. dual-box approach at customer premises will strongly influence the installation, troubleshooting, monitoring and maintenance.

Automated subscriber activation processes

The InP can build a virtual network offer with SLA that assigns a virtual access node and interconnection points to the VNO. Automation is crucial to reduce the manual touch-points between InP and VNOs and simplify interactions related to sharing OLT, ONU and outside plant. The VNO can then independently add subscribers and subscriber services. When the VNO receives a new subscription request, they will use the digital infrastructure inventory to trigger an allocation request. This request will launch business processes within the InP to bind the subscriber location to the VNO, locate the virtual access nodes and PON serving the location and provide APIs for the VNO to activate their virtual access network and configure the services requested by the subscriber.

Carrier-grade traffic control and QoS in the nodes

The InP provides a virtual network partition which the tenant can use to autonomously design and operate its services. To help support this autonomy, SLAs and monitoring are put in place to drive mutually beneficial behavior across tenants and enforce resource isolation. The InP controls the amount of bandwidth available to each tenant as per the SLA. Each tenant gets a resource partition that supports isolated traffic flows according to different QoS models and L2/L3 forwarding schemes. These schemes ensure fairness on a per-user-per-service level and guarantee proper isolation between VNOs. It also enables more independent VNO operational practices, network integration and differentiated service design within the policies and SLA terms as agreed with the InP.

Partitioning resources in this way is possible thanks to Altiplano's support of open standard YANG models and the strong QoS support in the Nokia Lightspan access nodes. Nokia Lightspan provides state of the art performance isolation with SLA enforcement. The nodes implement network traffic control in the data plane (queues, meters, markers, shapers, droppers, schedulers) and control plane (signaling and routing protocols). Everything needs to work together to assure the right traffic is prioritized and bandwidth is appropriately allocated across subscribers and services in all conditions. The solution supports also to use TR-413 3rd-party access nodes.

Standardization in the Broadband Forum

Standardized interfaces are key. These allow the efficient exchange of data between parties, lower the operating costs and act as a catalyst to attract more network partners. By standardizing the interfaces, an open competitive network environment is created for running innovative broadband services.

Nokia has been actively involved in the work that led to the Broadband Forum's TR-370 specification of FANS providing the overall framework for sharing access networks among multiple tenants. In FANS, slices are exposed as virtual access nodes (vAN), with the same management interface as the physical node, maximizing portability of provisioning and operational automation practices. The open and standardized APIs with NETCONF/YANG ease integration and avoid vendor lock-ins. Each party can run its own SDN controller and different OLT hardware layouts can be managed in a unified way.

Conclusion

Retail fixed services will increasingly rely on a mix of business arrangements to achieve wide geographic expansion and commercial success. With the rise of open access networks, digital services are no longer just the result of physical device behaviors, but also the result of software functionality: Nokia enables tailored digital service offerings to the market and creates a monetizable service set that can be consumed on demand.

The Altiplano Open Access solution offers unique operational isolation and process automation, whilst increasing flexibility and maintaining network visibility and control for the VNOs. It allows wholesalers to become the infrastructure partner of choice with the most advanced set of digital broadband services.

As the leader in wholesale access networks with 250+ fiber networks deployed worldwide, 20+ neutral-host open access networks, some with more than 100 retail service providers, Nokia provides:

- **Future-proof solutions.** Sustainable infrastructure investment with industry-accepted information models to deliver multiple services like residential, enterprise and mobile anyhaul.
- **End-to-end delivery.** Nokia ensures the full solution is enabled with a widely proven product portfolio, including the services to deploy and manage the network.
- **More than an equipment vendor.** We work collaboratively on new applications and solutions with our customers to ensure the success of the network and the business model.

About Nokia

We create technology that helps the world act together.

As a trusted partner for critical networks, we are committed to innovation and technology leadership across mobile, fixed and cloud networks. We create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Adhering to the highest standards of integrity and security, we help build the capabilities needed for a more productive, sustainable and inclusive world.

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