Nokia and American Tower's approach to neutral host FTTH deployments

White Paper

The neutral host model, where digital infrastructure companies build shared assets such as passive optical networks to enable flexible wholesale network capacity to service providers, is becoming a growing proportion of the fiber market.

With traditional dedicated fiber network wholesale solutions, service innovation and market differentiation were difficult for network tenants due to the rigid design, lack of network visibility, and limited control in service delivery. Nokia's Altiplano Open Access solution, an add-on to its Altiplano software suite, enables a more flexible service design tailored to the needs of both large and small operator tenants. The resulting shared infrastructure provides the control and flexibility necessary to run innovative broadband services that differentiate in subscriber experience, drive faster time-to-market, and improve capital efficiency.

This white paper will explore how American Tower entered the network business with a Network-as-a-Service (NaaS) model for Fiber-to-the-Home (FTTH). It integrated the standard American Tower platforms with the Altiplano SDN solution, which serves as a slicing engine to create different network partitions for network tenants. We will describe its deployment model, how American Tower competes in this market while maintaining its Real Estate Investment Trust (REIT) status and highlight the benefits and challenges for infrastructure providers, network tenants, and subscribers.

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Fiber-to-the-home (FTTH) is today's dominant broadband access technology and a key asset contributing to the commercial success of network operators. Fiber is a significantly more sustainable technology than other types of fixed broadband technologies, as well as being more cost- and power-efficient to operate. FTTH networks allow almost infinite capacity growth and bring fiber for everything: mass-market residential connectivity, highly reliable enterprise services, and robust fiber transport for many 4G and 5G cell sites. FTTH combines the lowest energy requirements and greenhouse gas emissions with superior scalability and bandwidth evolutions to 25G, 50G, and beyond.

As the telecom industry is preparing for the next wave of FTTH rollouts, there is a global trend to build more open-access wholesale networks.

A brief history of open access networks

The origins of optical network sharing

Much of the cost of deploying access networks comes from providing a subscriber physical connection. As the expense of digging and trenching dominates this cost, network sharing has one objective: to open the broadband network to multiple Internet Service Providers (ISPs) and avoid the cost to overbuild with parallel networks.

At first, regulatory bodies required incumbent network providers to share the copper networks inherited from public telephone companies. To achieve this goal, operators used a passive layer-sharing approach, a method that offered the appropriate level of physical separation between operators, as well as a simple process to identify each subscriber. With the advent of more advanced, bandwidth-hungry applications, including HD video teleconferencing, these copper transport technologies began to be replaced by fiber networks, requiring the deployment and operation of new network infrastructure. Operators then had to find ways to make these investments viable from the start, forcing innovation in deployment modalities and requiring a high degree of automation from the onset.

Telecom operators started to deploy last mile fiber in areas where their business plans justified the investment. This led to a first wave of fiber rollouts in high Average Revenue Per User (ARPU) areas, but low-density or rural areas were left out, which left a portion of the population underserved.

This gap encouraged governments to take actions to close that digital divide and attracted long-term investors to fuel a next wave of fiber investments. It also required operators to offer active layer sharing to improve the business case for deploying FTTH everywhere. However, this approach did not bring flexibility and transparency in the way that was expected. Traditional business models were still based on owning the end-to-end value chain and the lack of control held back differentiation. The industry needed another solution to create a truly open and competitive environment. This inflection point turned into an opportunity for neutral host optical networks.

The incentives for the neutral host model

The first neutral host network deployments needed regulatory support, were typically publicly funded, and consisted of national broadband planners and municipalities with a need to address broadband requirements in suburban and rural areas. The regulation made the addressable areas more attractive and often one company was uniquely granted the rights to deploy fiber in an area. The networks were de facto-neutral and as there was no competition, could easily impose a service delivery model on their tenants. The tenants had limited control over the service they could deliver and had limited visibility of the service's health.

A new breed of neutral host optical networks has come recently into the picture, allowing approaches with longer-term business plans that justify the access network investment in areas where the business case is challenging economically for traditional full-service telecom providers. This new model tackles building FTTH networks in areas where ultra-high-speed broadband (UBB) access is needed to replace aging, obsolescent cable platforms and obsolete DSL-based broadband services.

These new neutral host networks leverage an existing subscriber base that justifies the deployment of CAPEX-intensive FTTH networks, and their deployment simplifies the process of providing UBB to multiple operators' subscribers, all the while minimizing the carbon footprint associated with building and operating multiple telecom networks. The combined take-up rate of multiple operators' subscribers also helps lower the high initial risk, minimizing CAPEX-investment for the existing or new virtual network operators that can leverage the shortened time-to-market to improve their financial returns. A simpler, unified network is particularly desirable in areas where underground ducts are saturated, where obtaining civil works permits is difficult or time-consuming, and in areas where it's difficult to lease collocation facilities. In areas where multiple FTTH networks are not viable, overbuilding would be avoided.

The neutral host business model is already successful for infrastructure operators like towercos if take up rates exceed those of a single tenant. These infrastructure providers focus on delivering assets for the telco industry, and to be successful, they need the broadband network to become a resource that can be easily consumed and operated by telco operators. Keeping the OPEX costs low is key for investors so that the operating model of the neutral host remains a long-term and low-risk real-estate business. The end result is a win-win for all involved, where virtual operators on the shared network gain from a shortened time-to-market and near-zero CAPEX, and neutral host operators experience a simplified business model with long-term sustainability.

In an open and competitive market, innovation is the key to improving service delivery and defending against customer churn. So, infrastructure providers need to deploy an innovative solution with substantial product-creation autonomy and operational flexibility, whilst retaining sufficient platform controls and security, all in a model that leverages automation to reduce SG&A (Selling, General, and Administrative expenses) and isolates the infrastructure provider from day-to-day operational demands.

Main challenges for American Tower to become an open access provider

American Tower Corporation (ATC) is a global digital infrastructure company, serving customers through a portfolio of nearly 226,000 tower sites and other communications real estate assets in 25 countries around the world. ATC entered the FTTH arena due to requests placed by their MNO Mobile Network Operator customers from the tower side. They were interested in a model in which ATC deployed a neutral host fiber network that adhered to a similar business model as the one already in place for the leasing of tower resources.

Figure 1: ATC offers a comprehensive suite of open access infrastructure solutions

The primary challenge faced by ATC was the integration with multiple operators, and it centers on the integration into the individual OSS/BSS platform of each virtual network operator (VNO). Legacy wholesale solutions turn each integration with a VNO into a separate project, often accompanied by very high development costs, both for the infrastructure service provider and for the VNO. An additional issue faced is time to market, as despite the fact that there is an outside plant ready to be used and there are electronics already deployed, the time to integrate into legacy platforms often takes several months to achieve.

Integration issues are made even more complex when VNOs have different deployment models and demarcation strategies, such as FTTH and FTTB. In situations where a VNO operates in disparate market segments, each set of use cases often requires additional integration.

Why did American Tower choose an SDN solution?

Software-defined networking (SDN) and network function virtualization (NFV) introduce a powerful and versatile way to share network resources. In Argentina, ATC chose to use the next-gen Nokia Altiplano SDN platform, that allows slicing a physical network, virtualizing it and offering any level of control for the access seekers with flexible integration to suit their needs.

SDN solutions match perfectly with ATC's multi-service, multi-tenant objectives.

First, the main SDN objective is automation, to lower the OPEX of an access network deployment and give a reliable path to earn back the investment. With an SDN domain controller, ATC is able to create a dynamically programmable platform to enable network orchestration and process automation.

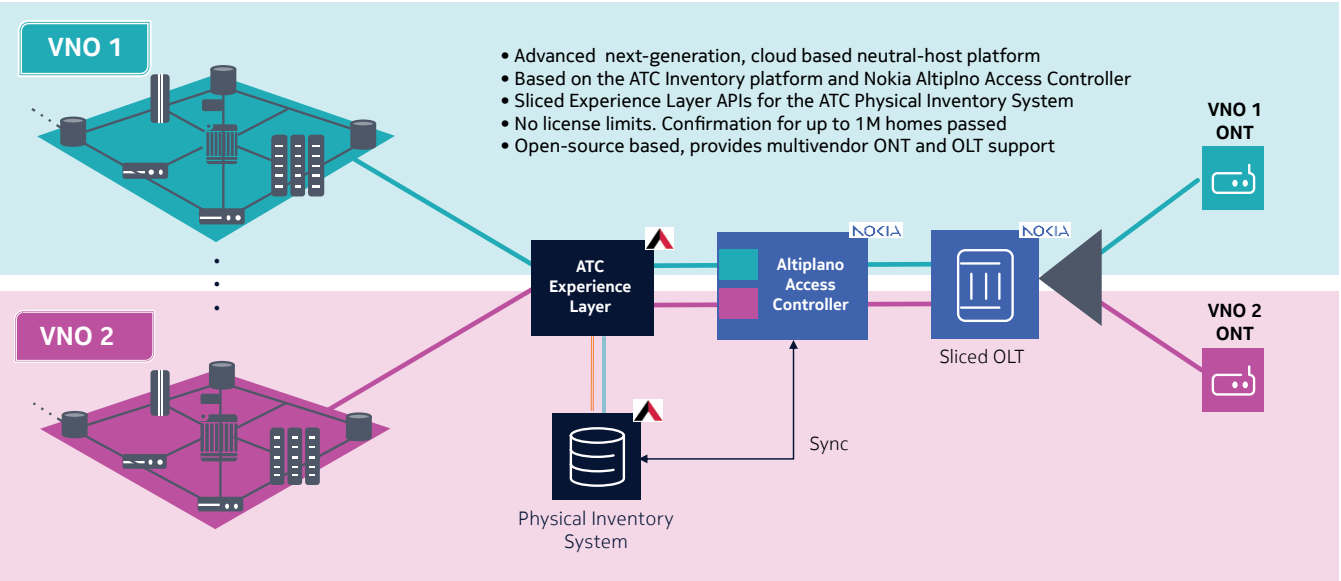
Second, American Tower's intention was to extend their infrastructure model to the FTTH arena, enabling operators to pursue their own subscribers, whether residential, SMB or enterprise. Fixed Access Network Sharing (FANS) using SDN, and Altiplano's ability to offer fully autonomous partitions of the network to VNOs, provided the right structure, one that allows ATC to focus on the health of the outside plant and active elements, while multiple VNOs focus on providing differentiated services to their subscribers.

This solution offers operators or VNOs a level of flexibility previously unavailable through traditional wholesale solutions based on legacy platforms. Thanks to this solution, ATC customers can independently design and develop their services, and take full control over the entire lifecycle: from the moment they execute a sale to the moment they effectively activate a subscriber. This solution also allows ATC to maintain a hands-off approach, all the while providing VNOs the level of autonomy they require, such that the platform seems like an extension of their existing network.

The American Tower deployment model

ATC, in conjunction with Nokia, developed a generic blueprint to deliver the Network-as-a-Service (NaaS) model, creating a standard approach that leverages common elements and standard NaaS platforms, whether it's in Argentina, or any new country where ATC needs to deploy. This standardized approach, along with the Cloud-based architecture, allows the NaaS Open Access solution to be relatively easily transported and turned up in new geographies, as needs arise.

Figure 2: American Tower's SDN Network-as-a-Service platform



There is a big diversity of VNOs, ranging from global service providers that want to operate in multiple countries and regions, to small local brands and companies that want to offer broadband as part of their overall service catalog. Large ISPs will come with extensive network engineering and global practices in network and systems integration, while the small ISPs have less staff and will be pragmatic and adapt. Large ISPs typically seek and require a high level of control and broad coverage in the region, while small ISPs typically target smaller areas where they are already present and are happy with predefined services, system, and network integration.

Small ISPs

Small ISPs, depending on the number of provisioning events they expect to manage per day, can take advantage of a low-effort integration model. By allowing small ISPs to access a web interface for provisioning and post-launch operations, ATC can enable them to quickly start selling services on the network infrastructure. This is a model that suits smaller retail service providers but also B2B ISPs that need to connect a low number of high-value subscribers per month. Smaller ISPs can start selling on the infrastructure service provider's network in a matter of days.

Medium and large CSPs

Larger CSPs can take advantage of the standard REST APIs, which give them access to a dedicated SDN domain controller. This deployment model grants higher levels of flexibility to the CSP, allowing a greater level of flexibility and autonomy. Additionally, ATC provides CSPs access to an inventory database, allowing them to search for available resources within the network. Through the use of Altiplano's standard API layer, the integration process required for onboarding a new CSP has been refined from something that took close to a year, to a process that can take five to six weeks, reducing complexity, integration costs and time to market.

The SDN Open Access solution

Creating virtual access networks

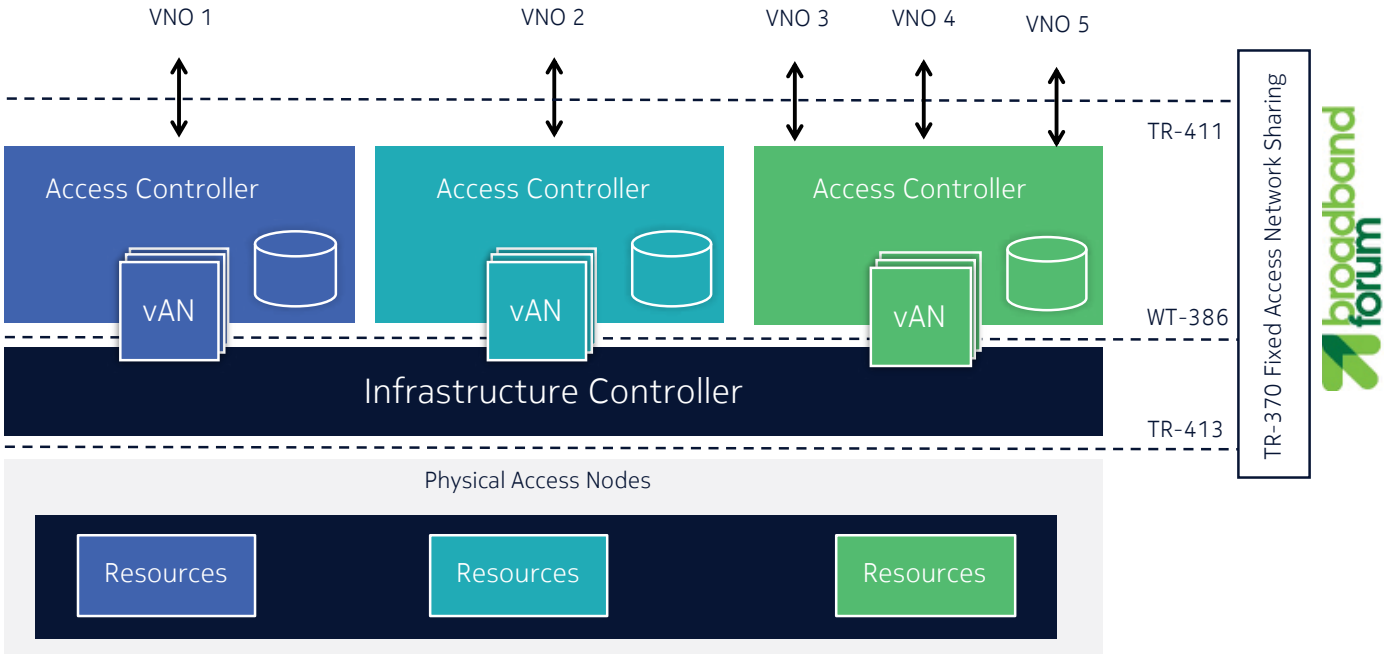
Powerful tools are required to monitor and control the network with transparent reporting for both the neutral host and VNOs. ATC chose to deploy Nokia's Altiplano platform to simplify processes and procedures for asset exposure, service integration, subscriber management, resource isolation, and data consolidation. The solution enables sharing of the access network in different configurations, all from a single platform. It has been developed in collaboration with multiple tier-1 global service providers, pioneering neutral hosts, and standardized within the Broadband Forum (BBF) standardization body.

The solution comprises of 2 main software components:

- An **Infrastructure Controller** used by the neutral host to manage and control the physical access nodes, allocate resources partitions, monitor resource utilization, assure the SLA-based isolation, and ultimately expose the virtual access nodes for consumption by the VNO.
- A **VNO Controller** that allows tenants to autonomously provision subscribers, configure services, monitor health, and automate operations within their network partition. It is a full-fledged controller covering FCAPS use cases on top of virtual access nodes provided by the neutral host.

Technically, the Infrastructure Controller realizes a controlled overlay interface on top of physical access nodes, leveraging virtualization and software defined networking. The overlay exposes the virtual access nodes (vAN), which behave the same as physical access nodes.

Figure 3: Infrastructure Provider providing virtual networks to multiple CSPs

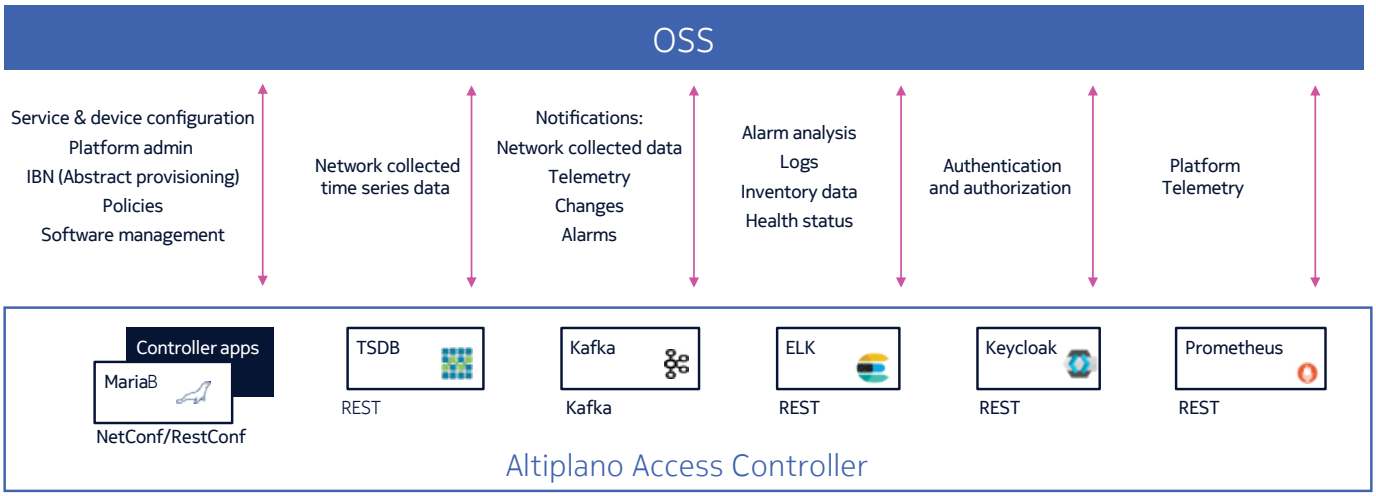


One platform to meet multiple needs

American Tower's Altiplano-based neutral host solution offers multiple integration models for the VNOs, with flexible integration to suit their needs: from a traditional hands-off approach, with integration via a web GUI to full FCAPS management, with corresponding service health views. The VNO can pre-provision service infrastructure, subscriber equipment and services for the locations and physical endpoints connected to the virtual access nodes. Moreover, the VNO can independently design and differentiate its services, fully integrated with the end-to-end network design of the VNO.

The operational views of Altiplano enable general maintenance and troubleshooting. Operational views consist of network views, alarm analyzer and performance management utilities. It provides full access to all virtual access node's configuration, operational status, alarms, and operational control, both current as well as historical data, using state-of-the-art protocols and best-practice IT technologies.

Figure 4: Altiplano's open programmable interfaces and open-source IT best practices



Thanks to the virtual access node and the data plane isolation, the ATC SDN platform allows each VNO to fully independently program and configure the virtual access node according to its service design, the connected subscriber devices, and the back-end network and systems.

VNOs that do not require this level of control can rely on a shared vAN with pre-defined services, simplifying integration, but still allowing them to benefit from advanced monitoring and troubleshooting.

Standardized in the Broadband Forum

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

The Altiplano Open Access solution is based on multiple BBF standards. The overall framework is defined in the TR-370 specification for the SDN-based Fixed Access Network Sharing (FANS), maximizing portability of provisioning and operational automation practices. It defines the key enablers for the Altiplano Open Access technology:

- TR-413: provides a programmable access node interface, which enables the resource partitioning and high programmability of the control and data plane.
- TR-411 intent-based RFS (Resource Facing Service) and network sharing RFS: defines a standard model for intent-based networking. The intent-based RFS defines the northbound interface of the VNO Controller, and the network sharing intents defines the Infra Controller vAN management interface.
- WT-386 issue 2 (in progress): defines the Yang models to program the slicing engine and expose the virtual access nodes towards the VNO Controller.

These standardized models and APIs maximize the physical access node interoperability. It eases integration with the VNO and Infra Controllers and orchestrators, and different OLT hardware layouts can be managed in a unified way. The virtual access network provided by ATC will be able to be managed by any VNO controller: independent of whether it is provided by the infrastructure provider or each VNO runs its own SDN controller.

Automated subscriber activation processes

Automation is crucial to reduce the manual touchpoints between neutral host 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 a virtual network inventory to trigger an allocation request. This request will launch business processes within the ATC SDN NaaS to conduct a lookup in the GIS database, 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. Once the provisioning process is completed, the VNO can deliver and assure services using its assigned VNO Controller.

Conclusion

Neutral host network models such as the one deployed by ATC in Argentina, enable a faster fiber deployment pace with benefits for all stakeholders. Thanks to a standards-based approach where network sharing is being enabled by SDN, it offers open access connectivity which can be leveraged by service providers. This reduces the overbuild of FTTH through an efficient shared network, resulting in increased deployment levels and faster rollouts, delivering ultra-high-speed broadband services via fiber to higher numbers of subscribers.

ATC's FTTH as a service has opened up a new set of opportunities to enhance the FTTH penetration in certain markets. 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: the SDN solution enables the creation of a monetizable service offering that can be consumed via open APIs. It offers unique operational isolation and process automation, whilst increasing flexibility and maintaining network visibility and control for VNOs. It allows wholesalers to become the infrastructure partner of choice with the most advanced set of digital broadband services.

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