

The background of the slide is a composite image. It features a dark, star-filled space at the top, transitioning into a bright, glowing horizon line. Below this, there is a network of white dots connected by thin white lines, resembling a global communication or data network. The bottom portion of the image shows a view of Earth from space, with blue oceans and white clouds, overlaid with the same network pattern.

# **The Evolution of AAA Infrastructure For NFVi Compliance**



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## Authentication, Authorization, and Accounting (AAA)

The advent of network virtualization and deployment of private cloud infrastructure by leading telecoms has caused a paradigm shift in how core networks are built and managed. No longer constrained by the physical capacity or age of servers, software functions like Authentication, Authorization, and Accounting, PCRF, and HSS are free to scale and perform for the demands of a dynamic network.

Network Function Virtualization (NFV), a European Telecommunications Standards Institute (ETSI) network virtualization standard, is preferred by telecommunications decision-makers when deploying an infrastructure stack. In view of the standards, including the latest and those that are being developed around the world, interoperability and vendor maturity becomes a challenge for successful rollouts as the technology is new and still maturing, making NFV the best choice for operators to deploy.

AAA's core functions of authentication, authorization, and accounting have remained largely unchanged. But while the application's main function hasn't changed, the architecture and capabilities have vastly evolved. The emergence of NFV has put more focus on how the AAA is deployed in a virtualized environment and how it interacts with the infrastructure to orchestrate the virtualized nodes, ensuring optimal utilization of resources and smooth operations irrespective of network traffic load.

## Virtualized AAA (vAAA)

The key drivers for service providers to upgrade or replace legacy AAA infrastructure have often been the need for more advanced business processes and the launch of more granular and differentiated services in the shortest possible time. The introduction of new business use cases like voice over WiFi and WiFi offload have also driven the need for more advanced AAA infrastructure with Diameter support. And now, as service providers roll out NFV infrastructure, the latest generation of AAA applications need to be NFVi-compliant and meet all the challenges virtualized deployments face.

Alepo's virtualized AAA is built on a 3GPP-compliant open architecture that promotes flexibility, adaptability, and automation. With this, service providers can introduce new data services to market faster, and stay ahead of the competition as the market evolves with unpredictable business demands.



## Overcoming the Unique Challenges of vAAA Deployment

Network Function Virtualization (NFV) creates an environment that is favorable for innovation in the telecommunications field and is now finally able to meet the stringent performance, availability, reliability, and security requirements for communications networks. NFV presents a major shift to the industry and holds many promises, but to deliver these benefits, key challenges must be overcome. Some key obstacles in AAA implementation on NFV, and how to overcome them, include:

### Challenge

### Solution

1

#### Configuration Management Across Nodes

Most AAA vendor implementations use file-based configurations, where each AAA node runs with its own copy of the configuration file. However, this is unfeasible in virtualization deployments like NFV, as AAA nodes are dynamically added or removed. Such file-based configurations are complex and prone to errors.

#### Centralized Configuration Management

A centralized database helps manage configurations through a web-based configuration portal. Any configuration change is handled through the portal, and changes can be applied to all AAA nodes in real-time. Unavoidable file-based configurations (scripts files, license files, and more) can also be managed centrally and applied in real-time to all nodes.

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#### Lack of Compatibility for VNF Management Interfaces

Most NFV infrastructure vendors use their own custom interface for VNF management instead of a standard-based interface, which makes them incompatible with other vendors and hinders NFV deployment.

#### Flexible VNF Management

Application vendors offering VNFs need more flexible VNF management interfaces, either with specific VNFM based on ETSI-compatible interfaces or custom interfaces based on the NFVi vendor's requirements. This helps the operator expedite NFV deployments, saving total implementation costs.

## Alepo: An Industry-Leading AAA Expert

Alepo has over 15 years of expertise in developing and evolving its carrier-grade 3GPP AAA, designed to optimize mobile, WiFi, and fixed network performance. The 5G- and NFV-compliant AAA is one of just a handful in the market that can be virtualized (vAAA) in any NFVi environment according to ETSI standards. Alepo AAA Transformation employs a holistic approach to network performance optimization with zero downtime and without impacting existing systems.

3

### Impact of Session Cache Synchronization

Each AAA node in NFV deployments is dynamically added or removed based on traffic needs. This requires stateless AAA implementation. Without this, scaling is difficult, as any addition or removal of AAA nodes involves the replication of session states or contexts to other nodes. This adds layers of complexity and results in errors.

### Stateless AAA

Stateless AAA implementation externalizes application states and stores session contexts in a centralized database that can be shared across all AAA nodes. Any AAA node can process an ongoing user session request previously handled by another node and can view ongoing session states. This means request traffic is distributed across all AAA nodes, enabling independent scaling based on traffic needs. For any AAA node restart, the processing is resumed by reading application states from the centralized database to ensure persistence..

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### Common Interface for All Network Traffic

Typically, AAA is deployed with a common network interface for handling applications and database traffic. In addition to security concerns, this also prevents resource use from being optimized based on the traffic type.

### Multiple Networks for Different Traffic

Having a separate network interface addresses key security challenges and optimizes network resources. AAA nodes have multiple virtual network interfaces and each node handles different data traffic, applications, and database, making it more secure and scalable based on traffic.

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### Lack of Load Balancers

Load balancers are crucial in AAA deployments as they distribute signaling traffic across multiple AAA nodes. Some software-based load balancers support RADIUS/UDP messages in the NFV environment.

### In-Built Load Balancer

New-gen vendors offer software-based load balancer VNFs as a part of the vAAA solution. This load balancer implements RADIUS/UDP as well as HTTP traffic load-balancing.

## 6

### Vendor-Specific User Access Management Systems

A typical NFV deployment involves multiple vendors offering their application VNFs. Each vendor has their own access management system for their applications. This adds to operational overheads as user logins and access permissions are maintained in multiple systems. Not all vendors have centralized user access management for their applications, further adding to complexities and overheads, and may also result in access security issues.

### Centralized Access Management

Application vendors offering VNFs need more flexible VNF management interfaces, either with specific VNFM based on ETSI-compatible interfaces or custom interfaces based on the NFVi vendor's requirements. This helps the operator expedite NFV deployments, saving total implementation costs.

## Benefits of NFV

- Reduces CAPEX as all network applications can be deployed on standard commodity hardware instead of custom hardware for each vendor.
- Reduces OPEX as it shares hardware across network applications and reduces resource consumption.
- Enables multiple-vendor deployments with no vendor lock-in.
- Accelerates time-to-market since new services can be launched faster.
- Derives high ROI from new service offerings.
- Scales with traffic volume for business expansion.
- Lowers the risks in deploying new services, increasing the scope for innovation.



## Pioneering AAA

- Highly stable product with 15+ years in the market
- Proven tier-1 deployments
- High-performance scalable solution: 36,000+ TPS
- Standard-based and vendor-neutral
- Expertise in AAA transformation: zero changes to IT systems
- Flexible deployment options: VMware, NFV, Cloud
- Network-agnostic, varied use cases across industry segments
- Cost-effective and future-ready investment
- Active R&D and roadmap

## Benefits of Alepo vAAA

### Virtualized and 5G-Compliant

Alepo vAAA offers flexible methods to integrate with a service provider's NFV infrastructure and has real-world success as one of the first AAA applications to go-live on NFVi. Alepo offers specific Virtual Network Function (sVNF), as well as generic Virtual Network Function (gVNF) provided by any NFVi vendor, to manage the entire AAA VNF life cycle: onboarding, deploying, monitoring, scaling, fault recovery, updating, and undeploying.

The virtualized AAA architecture handles multi-tenancy, multi-network slicing, and multi-level services. The modern and distributed database architecture is ready for integration with the 5G mobile core network and has a robust infrastructure to support dynamic network flexibility, scalability, and performance. Alepo vAAA supports various use cases such as 5G slice authentication, authentication, and authorization for multiple network services in the cloud.

### Highly Flexible NFVi Approach

Various approaches have been adopted by major NFVi vendors in managing VNF instances, creating interworking, and implementing challenges while onboarding application vendors in the ecosystem. It is important to implement a custom GUI to interwork with each NFV infrastructure (NFVi) vendor.

Alepo's in-house experts help support an open and flexible methodology, ensuring the success of every project. Alepo vAAA VNFs can be deployed with its Specific Virtual Network Function Manager (sVNFM), which integrates with a centralized orchestrator using ETSI standard integration. Alternatively, deployment can be done with Alepo vAAA instances managed by a generic VNFM (gVNFM) provided by any NFV infrastructure provider. All these factors accelerate the NFV deployments and help operators save on overall implementation costs.

### Unified Access Management

Centralized management of agents and system users, their roles and permissions, password rules, and passwords are integrated with the operator's existing user management system database, enabling agents to use their existing AAA portal login credentials. It can also be integrated with the operator's existing access management system for a unified system.

## Centralized Configuration Management

Alepo vAAA includes a centralized database that manages configurations through a web-based portal. Any configuration change can be applied to all AAA nodes in real-time. This helps manage configuration files such as scripts, templates, license files from a centralized location for any AAA node in the cluster.

## Enhanced Scalability

In the legacy network, where multiple AAAs are deployed, each node is expected to manage its application states. A next-gen AAA, however, is stateless. Alepo's stateless AAA engines use a centralized database to store sessions and application states, providing the ability to scale AAA nodes independently based on traffic demands. When any AAA node restarts, the processing can be resumed by reading application states from the centralized database, thus ensuring persistence.

Alepo's modern and robust vAAA solution includes a RADIUS load balancer supporting UDP protocol, which manages traffic distribution through AAA VNFs. The load balancer shares the transaction load, resulting in faster responses to incoming requests by optimally using the available servers.

## Effective KPI Monitoring

The AAA nodes can be effectively managed using any SNMP-compliant management tool. It implements standard RADIUS protocol-specific Management Information Base Structure (MIBS) as well as custom AAA application MIBS. The carrier-grade AAA supports the SNMP V1, V2, V3 to interface with the SNMP-compliant management tool.

"As a progressive telecommunications provider, we are constantly modernizing our services and operations, and Alepo's AAA upgrade will enable us to continue doing so. The automation and real-time monitoring fit with our broader DevOps strategy. And the openness and flexibility of the platform provide a state-of-the-art customer experience."

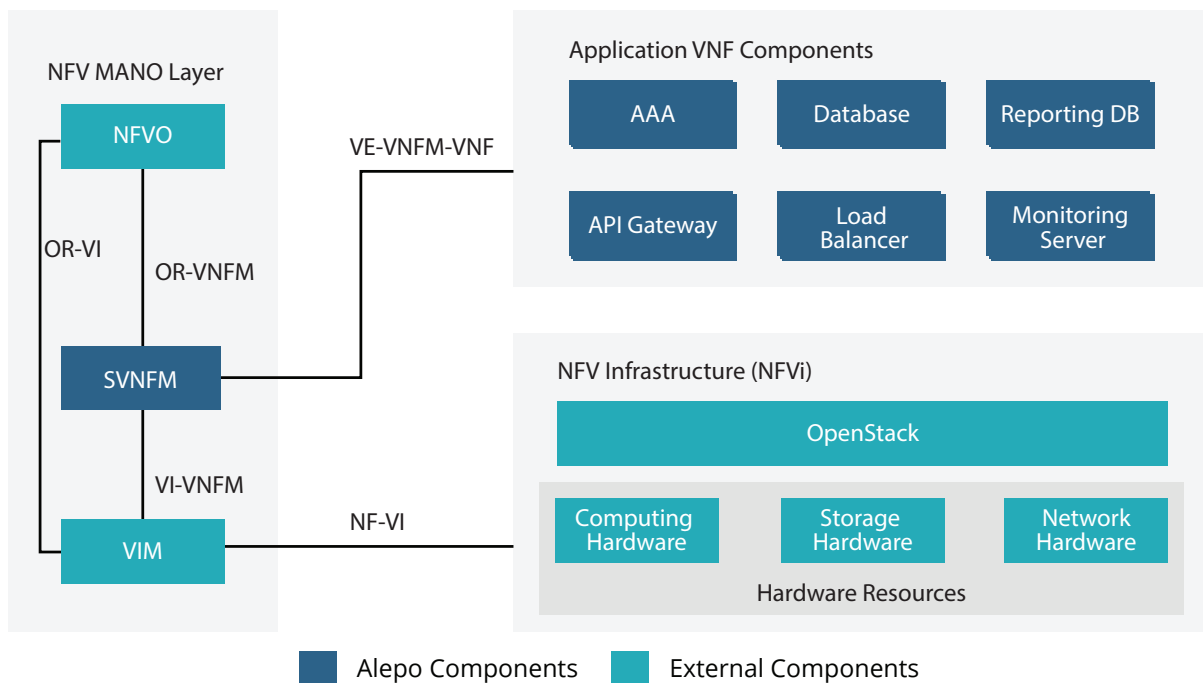
**- Mohammed Abu Rumman**  
*Network Director, Zain Jordan*



## Integration Expertise

Alepo AAA's proven and scalable integration framework ensures it is quickly deployable and fully functional with any best-of-breeds network. It is built on high-performance web services, enterprise service bus, a rich library of proven REST APIs, an integrated RADIUS/Diameter client, IPv6 support, open Java portal technologies, and leading industry standards to facilitate smooth and seamless integration – all of which help reduce the time and risks of integration as well as the total cost of ownership.

### Alepo vAAA Deployment Architecture



## Client

Leading South Asian mobile network operator (MNO).

## Project Outcomes

### Increased Revenue Margins

The improved BI capabilities helped the operator introduce targeted promotions, increasing revenue within the first few months of deployment.

### Improved Network Performance

The network modernization helped ensure consistent connectivity across the country, helping deliver an uninterrupted experience to subscribers.

### Reduced OPEX

One comprehensive platform for all services (enterprise GPON, fiber, LTE) helped reduce operational expenses as well as the total cost of ownership (TCO).

## Real-World Success

### Project Overview

The MNO offers mobile, fixed broadband, and DTH services, and its subscribers account for a major portion of the mobile market in its country of operation. To modernize its network, offer an uninterrupted experience to its growing enterprise GPON and fiber subscriber base, and support future LTE network services, the operator decided to upgrade its legacy AAA. However, all vendors it evaluated offered limited scope to accommodate their specific requirement for non-standard customizations to the authentication server. Alepo, an industry leader in fixed and mobile network solutions, was selected as its AAA is one of very few in the market that can be deployed as per ETSI standards and instances provided by any NFVi vendor, ensuring maximum efficiency and scalability with no changes to the existing IT structure.

### Operator's Requirements

- Launch project in partnership with a local integrator and help move towards a virtualized network.
- Migrate enterprise GPON and fiber services from the legacy system to Alepo vAAA with no downtime.
- Offer an uninterrupted experience to its growing subscriber base as well as support future network technologies.
- Facilitate NFV deployment to reduce CAPEX and OPEX, improve agility, and ensure quicker time to market.
- Identify low-coverage areas, facilitate troubleshooting, enhance business intelligence (BI), and help identify revenue leaks.

### Solution Highlights

- **vAAA collects info from the LTE access network**, which is used to identify and close coverage gaps, help with troubleshooting, and improve BI for promotions. It also helps the revenue assurance team pinpoint revenue leaks.
- **Virtualized deployment** with Alepo's Virtual Network Functions Manager (VNFM) in the operator's NFVi environment helps manage virtual instances and scaling; includes VNFs for all modules.
- **Seamless migration** of enterprise GPON, fiber, and LTE services (90K-plus subscribers amounting to 413K online sessions) to the vAAA with zero downtime and zero complaints.
- **Reduced time-to-market** as Alepo AAA facilitated quick introduction of innovative offers and promotions using its enhanced BI reporting.



## About Alepo

Alepo makes next-generation data opportunities a reality, delivering advanced software solutions and services that enable communications service providers to accelerate revenue growth, market share, and business success on fixed and mobile networks. Alepo helps accelerate digital enablement for networks of all sizes, including leading service providers globally. Known as the go-to partner for all things data, Alepo's innovations are highly-scalable, cloud-agnostic, and enable digital-first customer experiences. Alepo is based in Austin, Texas, with a presence in all regions of the world.

For more information, please visit [www.alepo.com](http://www.alepo.com)

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