

## NETWORK VIRTUALIZATION IN CLOUD COMPUTING

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### ABSTRACT

Cloud computing enables a transparent access to information technology (IT) services such that the users do not need to know the location and characteristics of the relevant resources. While IT resource virtualization and service abstraction have been widely investigated, data transport within the cloud and its efficient control have not received much attention in the technical literature. In fact, connectivity is, itself, a service that contributes to the overall performance of the cloud. Network as a Service (NaaS) such that it can be orchestrated with other cloud services. Then, it proposes a network virtualization platform (NVP) as the mediation layer able to provide NaaS to cloud computing by exploiting the functionality provided.

**Keywords:** Network Virtualization, Cloud Computing, research

### 1. INTRODUCTION

Cloud computing has become increasingly popular due to its ability to provide on-demand access to a variety of computing resources such as storage, processing power, and networking. Network virtualization is a critical component of cloud computing, which provides a flexible and scalable network infrastructure to support cloud-based services. In this research paper, we will explore network virtualization for cloud computing, its advantages, challenges, and various approaches used to implement it.

What is Network Virtualization?

Network virtualization is the creation of multiple virtual networks on top of a physical network infrastructure. It enables multiple virtual networks to coexist on the same Physical network, with each network having its own logical topology, addressing scheme, and network services. Network virtualization separates the network's logical functions from the underlying physical infrastructure, enabling the network to be more agile, scalable, and cost-effective.

Network Virtualization in Cloud Computing

In cloud computing, network virtualization enables the creation of virtual networks that can be customized to meet the specific needs of each application or user.

This flexibility allows cloud service providers to offer a range of network services to their customers, such as virtual private networks (VPNs), load balancing, and firewall services. Network virtualization also enables cloud service providers to create isolated network environments for different tenants, ensuring secure data transfer between them.

#### Network as a Service

NaaS is a cloud model that enables users to easily operate the network and achieve the outcomes they expect from it without owning, building, or maintaining their own infrastructure.

NaaS can replace hardware-centric VPNs, load balancers, firewall appliances, and Multiprotocol Label Switching (MPLS) connections. Users can scale up and down as demand changes, rapidly deploy services, and eliminate hardware costs.

**NaaS can be classified in the following service sets**

**The network access service** is composed by the authentication service and the authorization service. The former regards the user identification following a service request in order to grant the access to the network service.

**The virtual connectivity service** offers the monitoring and management of the virtual connections established among users. It is composed by the connection creation service that allows a connection with the specific attributes to be created between a pair of user addresses.

**The virtual topology service** is composed by the topology monitoring and the topology management, respectively for monitoring and managing virtual connectivity information such as the available bandwidth, then packets delay and jitter, and the restoration time.

**The virtual node service** is composed by the virtual node monitoring and the virtual node management, respectively for monitoring and managing information about virtual nodes. The information provided is strictly related to the type of virtual connectivity established

## 2. ADVANTAGES OF NETWORK VIRTUALIZATION IN CLOUD COMPUTING

The benefits of network virtualization in cloud computing are as follows:

**Flexibility:** Network virtualization enables the creation of virtual networks that can be customized to meet the specific needs of each application or user. This flexibility allows cloud service providers to offer a range of network services to their customers.

**Scalability:** Network virtualization enables cloud service providers to create isolated network environments for different tenants, ensuring secure data transfer between them. This capability enables cloud service providers to scale their services as the number of tenants grows.

**Cost-Effective:** Network virtualization separates the network's logical functions from the underlying physical infrastructure, reducing the need for additional hardware and lowering operational costs.

**Security:** Network virtualization enables cloud service providers to create isolated network environments for different tenants, ensuring secure data transfer between them.

### CHALLENGES OF NETWORK VIRTUALIZATION IN CLOUD COMPUTING

The challenges of network virtualization in cloud computing are as follows:

**Network Complexity:** Network virtualization adds another layer of complexity to an already complex network environment. This complexity can lead to performance issues, particularly in large-scale cloud environments.

**Security:** While network virtualization provides secure data transfer between different tenants, it also creates new security challenges. Malicious tenants can use the network to launch attacks on other tenants or even on the cloud service provider.

**Integration with Existing Network Infrastructure:** Network virtualization requires integration with the existing network infrastructure, which can be a complex and time-consuming process.

**Network visibility:** Network virtualization can significantly increase the number of logical technology layers that must work together. This creates a situation where legacy network and data center monitoring tools lose visibility into some of these abstracted layers. In other cases, visibility can be achieved, but the tools struggle to display the information properly so that it makes sense to network operators.

## 3. APPROACHES TO NETWORK VIRTUALIZATION IN CLOUD COMPUTING

The two main approaches to network virtualization in cloud computing are:

**Overlay Networks:** Overlay networks create a virtual network on top of the existing physical network infrastructure. The overlay network uses a software-defined networking (SDN) controller to manage traffic between virtual machines (VMs) and physical network resources.

**Network Function Virtualization (NFV):** NFV involves the virtualization of network functions such as routers, firewalls, and load balancers. These virtualized network functions can be deployed on-demand, enabling cloud service providers to scale their services more efficiently.

## 4. CONCLUSION

Network virtualization is a critical component of cloud computing, which provides a flexible and scalable network infrastructure to support cloud-based services. Network virtualization enables cloud service providers to offer a range of network services to their customers, such as VPNs, load balancing, and firewall services, while also ensuring secure data transfer between different tenants. However, network virtualization adds another layer of complexity to.

Cloud computing services that enables cloud users to request on-demand connectivity without any knowledge of the complexity and the technology details of the network. NaaS is enabled by a network virtualization platform (NVP).

## 5. REFERENCES

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