



Lenovo: Shaping the Future of Telecom with NFVi and Cloud Native Excellence

Streamlining Time to Market with Verified NFVi and Cloud Native Solutions

A Lenovo Telco Brochure

Lenovo



Telco's Face Pressure to Deliver Diverse, Evolving Technologies

Telcos are faced with transforming network infrastructure to support the influx of new applications that can be offered and monetized using 5G wireless networks. Some of the reasons for the transformation are below.

- The surge in demand for advanced, robust, and expandable network infrastructures has mushroomed.
- Rising technologies like 5G, IoT, and edge computing fueling the need for faster connectivity.
- NFVi and Cloud Native Infrastructure present innovative solutions for Telcos to address growing requirements.

NFVi Shifts Telco from Hardware to Software-Centric Systems:

- Transforms network management from physical appliances to virtualized services.
- Helps Telcos cut operational costs and optimize network resource utilization.
- Accelerates the rollout of new services with agile, software-defined infrastructure.
- Facilitates running network functions on standardized hardware, enhancing flexibility.
- Provides scalable solutions to meet the dynamic demands of modern networks.

Cloud Native Infrastructure Enables Innovation

- Cloud Native Infrastructure utilizes flexible cloud computing foundations, including containerization, microservices, and orchestration, for enhanced agility in Telco operations.
- Adoption of Cloud Native principles allows Telcos to rapidly innovate, scale effectively, and bolster service dependability.
- NFVi significantly cuts costs by reducing dependence on proprietary hardware, thus saving on capital and operational expenses.
- Virtualization offers Telcos the agility and scalability to adjust network functions to meet fluctuating demands, optimizing resource use.
- NFVi's facilitation of swift service deployment enables quicker introduction of new services to the market.
- Through virtualization, resources are allocated more efficiently, improving network performance and capacity utilization.





Four Key Features of Cloud Native Infrastructure

1. Microservices Architecture

Decomposes monolithic applications into smaller, manageable microservices, enhancing flexibility and enabling independent scaling.

2. Containerization

Uses container technology (e.g., Docker, Kubernetes) for consistent deployment across environments, ensuring portability and efficiency.

3. Orchestration

Automates deployment, scaling, and management of containerized applications, ensuring seamless operation and resource optimization.

4. Resilience and Fault Tolerance

Cloud Native Infrastructure enhances fault tolerance, ensuring continuous service delivery even in the face of failures.

The importance of NFVi and Cloud-Native Infrastructure in the Telco Industry

NFVi, or Network Functions Virtualization Infrastructure, is a concept that has gained prominence as a solution to this challenge. It enables CSPs to replace traditional, dedicated network appliances with virtualized software solutions running on standardized hardware. NFVi promises to significantly reduce costs, accelerate the deployment of new services, and enhance network scalability. Its flexibility allows CSPs to optimize their network resources according to dynamic demand, resulting in a more agile and cost-efficient network.

Cloud-native infrastructure complements NFV by embracing the principles of cloud computing, enabling CSPs to build networks that are not only more flexible and scalable but also highly automated. This modern approach is characterized by the use of microservices, containerization, and orchestration platforms like Kubernetes, which enable the efficient deployment and management of network services. Cloud-native infrastructure is seen as a path towards achieving unprecedented agility and responsiveness in the telco industry.

Combining NFVi and Cloud Native Infrastructure solutions offers CSPs a holistic approach to network transformation from the classic network appliance approach. By using virtualized network functions (VNFs) or container network functions (CNFs) using NFVi or Cloud Native principles, CSPs can build scalable, agile, and resilient networks capable of handling the demands of modern digital services.

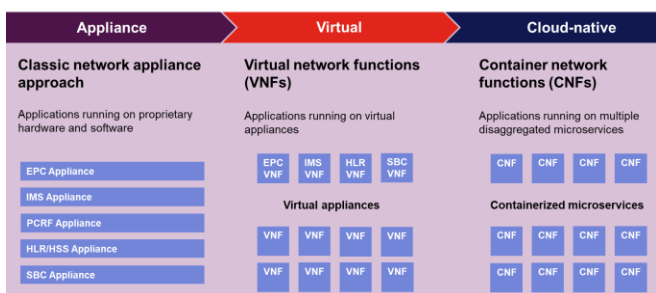


Diagram 1 – NFVi and Cloud Native



NFVi Architecture

Network Function Virtualization Infrastructure (NFVi) represents a shift from traditional, hardware-centric network appliances to virtualized, software-defined infrastructure. By leveraging NFVi, CSPs can optimize their network resources, reduce operational costs, and rapidly deploy new services. NFVi enables the virtualization of network functions, allowing them to run on industry-standard hardware, providing flexibility and scalability necessary for evolving network demands.

The NFV Infrastructure (NFVi) provides a stable platform with hardware and software components optimized for the upper layer VNF ecosystem. The NFVi provides a multi-tenant infrastructure that leverages standard virtualization technologies that support multiple use cases and applications simultaneously.

The Virtualization layer is responsible for managing the virtualized infrastructure, including compute, storage, and networking resources. As shown in diagram below, NFVi architecture can also support running CNFs by providing a container layer on top of the Virtualization layer

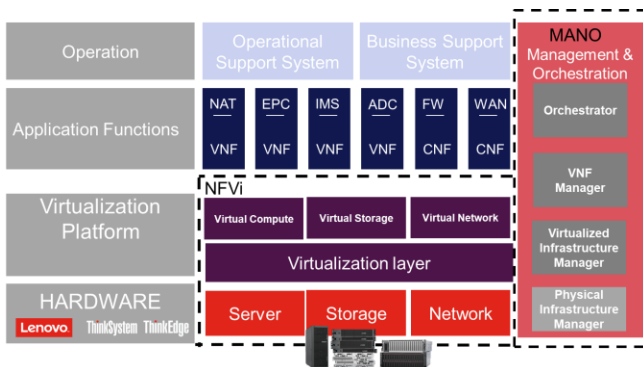


Diagram 2 – NFVi Architecture

Cloud Native Infrastructure Architecture

Cloud Native Infrastructure is built on the principles of cloud computing, emphasizing containerization, microservices architecture, and orchestration. CSPs adopting Cloud Native Infrastructure gain unprecedented agility, enabling them to innovate faster, scale more efficiently, and enhance service reliability.

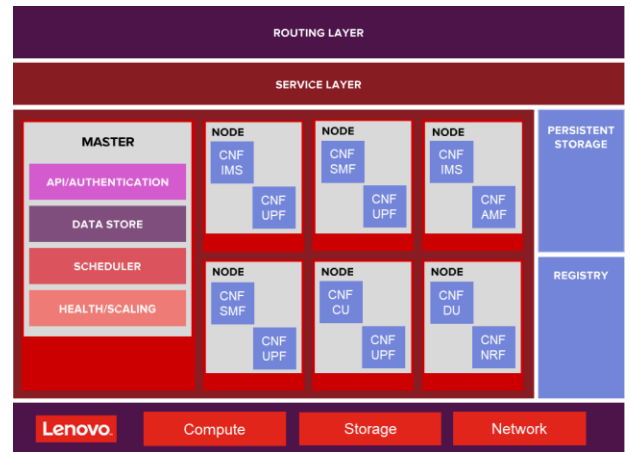


Diagram 3 – Cloud Native Architecture

The infrastructure layer is used to host the applications on physical servers, virtual servers, or cloud.

The service layer plays a crucial role in specifying pods and access policies. It assigns enduring IP addresses and host names to pods, establishing connectivity between applications and facilitating straightforward internal load balancing to distribute tasks among various application components.

There are mainly two types of nodes in a cluster: master nodes and worker nodes. Applications such as Telco network functions reside in the worker nodes.



NFVi and Cloud Native Infrastructure from Core to the Edge

One of the main challenges for telco operators is to deliver network services across different locations, from central data center sites to near edge sites and far edge sites. Central data center sites are the core data centers that host the majority of the network functions and services. Near edge sites are smaller data centers or point of presence at the edge of a CSP’s network, or points of presence that are closer to the end users and devices, usually running RAN network functions and network functions that require lower latency and higher bandwidth. Far edge sites are edge sites at customer premise, closer to the end users, such enterprise gateways or customer premises equipment, enabling ultra-low latency and high reliability.

Both NFVi and cloud native infrastructure can be deployed on central data centers to edge sites. Telco VNFs run on top of NFVi. NFVi consists of hardware and software resources that enable the virtualization of network functions.

Telco CNFs are similar to VNFs, but they are designed to run on baremetal, which is a type of cloud native infrastructure that does not use any hypervisor or virtualization layer. Baremetal infrastructure allows CNFs to access the hardware resources directly, without any overhead or interference from other layers. This can improve the performance, as well as reduce the operational complexity and cost. NFVi can run CNFs by providing a container layer.

To manage the complexity and diversity of these sites, CSPs need a centralized orchestration system that can automate the lifecycle management of VNFs and CNFs across different domains. The orchestration system should be able to provision, configure, monitor, scale, update, and heal the network services in a consistent and efficient way. The orchestration system should also be able to optimize the resource utilization and performance of the network services based on the policies and service level agreements defined by the operator.

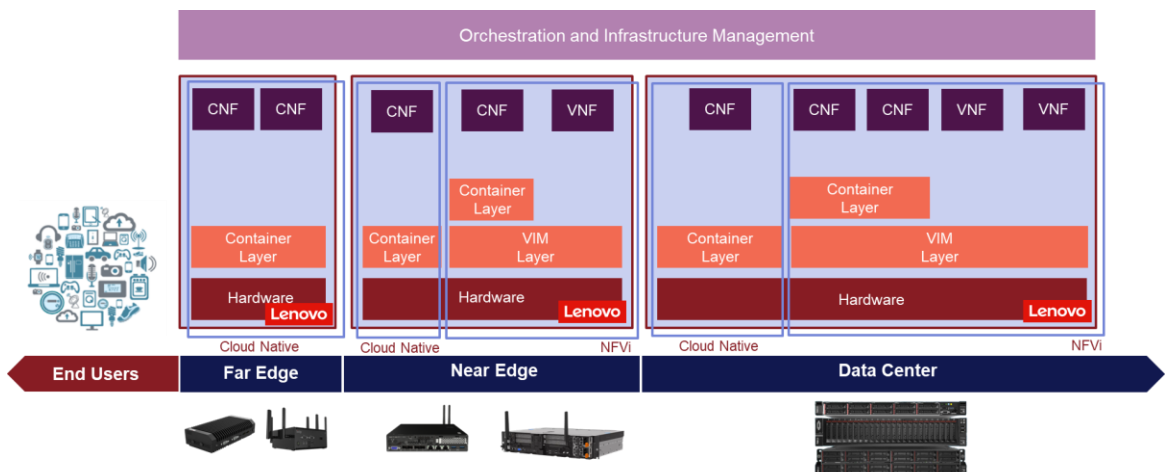


Diagram 3 – From Core to Edge



Leading Telecom Equipment Manufacturer's for NFVi and Cloud Native Infrastructure Verified

Lenovo, a leading provider of data center solutions, offers a robust infrastructure solution tailored to meet the demands of Network Functions Virtualization Infrastructure (NFVi) and Cloud Native Infrastructure.

Lenovo's solution for NFVi and Cloud Native architecture in Telco is already validated by a leading Telecom Equipment Manufacturer, which conducts rigorous testing and benchmarking to ensure the solution meets the requirements of telco operators.

Lenovo's infrastructure solutions are designed to deliver high performance, scalability, and reliability, essential for the dynamic requirements of modern telecommunications and cloud-native applications by integrating SR-IOV, DPDK, high-performance CPUs, accelerated packet processing, and zero-touch provisioning, Lenovo ensures that its servers are well-equipped to address the challenges posed by the evolving landscape of telecommunications and cloud-native applications.

Lenovo's solution for NFVi and Cloud Native architecture in Telco enables telco operators to transform their network services with the power of the cloud. Lenovo's solution helps telco operators to reduce costs, increase agility, improve performance, and enhance customer experience.

Key Features:

- **High-Performance CPU:** Lenovo servers are equipped with high-performance CPUs, enabling the execution of compute-intensive workloads associated with NFVi and cloud-native applications.
- **Power Efficiency:** Lenovo places a strong emphasis on power efficiency in its server configuration. By optimizing power consumption, these servers not only contribute to environmental sustainability but also result in reduced operational costs for CSPs.
- **Storage Flexibility:** Flexible storage options, accommodating the storage requirements of both NFVi and cloud-native workloads. This flexibility is crucial for handling large volumes of data associated with modern network services.
- **Reliability and Redundancy:** Lenovo servers are designed for high reliability, featuring redundancy options to ensure continuous operation even in the face of hardware failures. This is critical for maintaining the 'five nine' availability of mission-critical network services.
- **Zero-touch provisioning:** Rapid, automated deployment and remote system management, simplifying large-scale cloud and virtual functions deployments.
- **Modular platform design:** Accommodate technology choices for Storage, Networking, RAN accelerators, GPU, and specific IO for workloads choices and deployments.

- Air-Cooled
- Direct Water Cooling
- Liquid Assisted Cooling



Lenovo Verified Solutions for NFVi and Cloud Native



ThinkSystem SR630 V3

This powerful 2S 1U rack server designed for agility and speed meets the needs of versatile workloads while providing easy management. With the 5th Gen Intel® Xeon® Scalable processors it provides better performance over the previous generation. With 32 DIMMs of the latest DDR5 memory, PCIe Gen5 technology, and 16 EDSFF drives thru direct NVMe, it offers the speed and density desired by CSPs and enterprises. ThinkSystem SR630 V3 also supports 4th Gen Intel® Xeon® Scalable processors with Intel® vRAN Boost. these processors are designed for powering high-performance, power-efficient vRANs.



ThinkSystem SR650 V3

ThinkSystem SR650 V3 with dual 5th Gen Intel® Xeon® Scalable processors is designed for performance. The SR650 V3 is an extremely flexible 2S 2U rack server with I/O expansion, the newest technology of DDR5 memory, PCIe Gen5 for speed, enhanced system management, and updated security features. It is the ideal server for complex telco workloads and data plane processing.



ThinkSystem SR635 V3

The ThinkSystem SR635 V3 is a high performance 1U single-socket rack server designed for complex workloads like virtualization, VDI, cloud and more. It utilizes one 4th Generation AMD EPYC™ processor with a high core count, and provides flexibility and agility through multiple options for storage and I/O configurations.



ThinkSystem SR645 V3

The ThinkSystem SR645 V3 with AMD®, is the most powerful 2S 1U server in the industry. With increased core density in the 4th Generation AMD EPYC™ processor and PCIe 5.0 memory speed, the 1U ThinkSystem SR645 V3 has the power, bandwidth, and memory to tackle high-performance telco workloads with its ultra dense design.



ThinkSystem SR665 V3

The ThinkSystem SR665 V3 is a 2S 2U rack server has the performance and flexibility to manage a complex set of telco workloads like data plane processing, analytics, virtualization, and AI. The 192 cores of the dual 4th Gen AMD EPYC™ processors and up to 6TB of DDR5 memory maximize the performance of this 2U server.



Lenovo Verified Solutions for NFVi and Cloud Native



ThinkEdge SE450

The ThinkEdge SE450 is the server for Telco and AI at the Edge. The ThinkEdge SE450 is a 1S 3rd Gen Intel® Xeon Platinum processor-based server, with a 2U height and short depth case with flexible mounting options. Designed and built with the unique requirements for Edge servers in mind. The ThinkEdge SE450 is a rugged compact-sized Edge AI server focused on enhanced processing power, increased security, and remote manageability for edge environments.



ThinkEdge SE360 V2

The ThinkEdge SE360 V2 has been designed and built with the unique requirements to address AI applications for Edge servers in mind. Its versatility allows it to stretch the limitations of server locations, giving you new options of connectivity and security. The ThinkEdge SE360 V2 is an Intel® Xeon-D® processor-based server, with a 2U height, half-width, and a short depth case that feels at home practically anywhere. Mount it on a wall or ceiling or install it in a rack.



ThinkSystem SR655 V3

The ThinkSystem SR655 V3 is a 1S 2U rack server with the latest PCIe. Fen 5 memory and flexible storage options. It utilizes one 4th Generation AMD EPYC™ processor with a high core count and is optimized for modern telco and IT workloads.



ThinkEdge SE455 V3

The ThinkEdge SE455 V3 a single socket edge server that utilizes 4th Generation AMD EPYC™ 8004 'Siena' processor with up to 64 power efficient cores and industry leading green energy footprint. It is ruggedized, high-performing, sustainable server for CSP's unique challenges in use cases such as Multi-Access Edge Computing, Radio Access Networks, Packet Core Gateway and AI at the edge.



Lenovo Verified Solutions for NFVi and Cloud Native



Lenovo Storage D1224

The Lenovo Storage D1224 has the flexibility and capacity to handle many different types of workloads. You can start with one D1224 enclosure containing up to 24x 2.5-inch drives as a simple JBOD, and later daisy-chain up to 8 enclosures per SAS Chain (using multiple ports). One chain supports up to 192 drives.

Supported drives include 15,000, 10,000 and 7,200rpm HDDs, secure self-encrypting 10,000rpm SED HDDs, and high-performance/high-capacity SSDs for read-intensive workloads. The D1224 supports RAID-0, 1, 10, 5, 50, 6, and 60, using a variety of RAID HBAs. A single chain can contain a combination of HDDs and SSDs with multiple speeds and capacities. If 3.5-inch HDDs are required, D1212 expansion units may be included in the chain.



Lenovo Storage D3284

The Lenovo Storage D3284 delivers high-density direct-attach storage. It supports mixing-and-matching different drive types for high performance, high capacity, or a combination of the two. Affordable high-density options, combining 7,200rpm NL-SAS hard disk drives (HDDs) with high-IOPS/low-latency SAS solid-state drives (SSDs), enable a multitiered storage infrastructure in a single enclosure or daisy-chain. It supports up to 4 enclosures in a single chain. Chains can be connected to up to three servers.



Lenovo's XClarity Controller Pivotal in Transforming Cloud and Virtualized Functions

- Central to NFVi and Cloud Native transformations.
- Equips telecoms with infrastructure optimization tools.
- Minimizes deployment durations.
- Monitors and manages power usage.
- Boosts efficiency to meet dynamic telecom needs.
- Showcases Lenovo's dedication to NFVi and Cloud Native innovation.
- Establishes itself as a vital tool in the telecom infrastructure.

ThinkSystem Products Form Backbone for Driving the Evolution of Telecommunications

Lenovo ThinkSystem's role in Telecom evolution provides a dependable foundation for telecom infrastructure deployment and scaling.

- Critical to the advancement of telecom technologies.
- Enables full utilization of NFVi and Cloud Native capabilities for modern industries.

ThinkSystem Features:

- Highly versatile and adaptable to NFVi and Cloud Native needs.
- Designed for peak performance, durability, and ease of management.

Impact of ThinkSystem Products:

- Pioneering transformation in NFVi and Cloud Native spheres.
- Reflects Lenovo's dedication to high-performance, cloud-era telecom solutions.



Lenovo is a Trusted Supply Chain Partner



Lenovo ranked #3 in High Tech for technology due to rigorous supply chain process.

Lenovo has once again been named in the Gartner Supply Chain Top 25 for 2023, ranking eighth in this list of global companies with supply chains.

Ranked #9
Gartner Supply Chain
Top 25 for 2022

Ranked #3
Gartner Supply Chain
Top 25: High Tech for 2022

Lenovo is a Reliable Sustainability Telco Partner

Lenovo can work with companies to implement energy-efficient solutions and sustainable practices, which are increasingly important in the telecommunications industry.

Contact Your Local Lenovo
Representative

For more information go to
www.Lenovo.com/Telco

Lenovo Security is ISO 27000 Certified

Lenovo has implemented a stringent Information Security Management System in accordance with: ISO/IEC 27001:2022



#1 9 Years In a Row for Server Reliability*

Lenovo has been at the forefront of promoting sustainability and responsible corporate practices, demonstrating remarkable leadership in sustainability by setting ambitious environmental and social responsibility goals. Lenovo's leadership in sustainability showcases our dedication to delivering innovative technology in a way that positively contributes to a more sustainable and inclusive future.

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