NEXAVM VDI SOLUTION

VIRTUAL DESKTOP PLATFORM
TECHNICAL WHITE PAPER

NEXAVM TECHNOLOGIES

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CONTENTS

Product Overview 4

System Architecture 5

Key Technologies 6

Features 8

Product Features 9

INNOVATION FOR DIGITAL TRANSFORMATION

As the wave of digitalization sweeps the globe, businesses are undergoing unprecedented and profound changes in their operating models, work styles, and productivity tools. Remote and hybrid work have become the norm, and business agility, data security, and cost optimization have become key elements of a company's core competitiveness. Simultaneously, with the rapid development of technologies such as artificial intelligence, 3D designs, scientific computing, and high-definition media processing, the demand for terminal computing power, particularly graphics processing units (GPUs) and parallel computing capabilities, has exploded.

Traditional PCs, workstations, and early virtual desktop infrastructure (VDI) are increasingly showing limitations in addressing these challenges:

- **Increased data security risks:** Core business data, design drawings, source code, sensitive models, etc. are stored in a dispersed manner on employees' local devices, facing security threats such as device loss, virus attacks, and unauthorized access, the risk of data leakage remains high.
- **High complexity in operations and maintenance:** Physical terminal device management, software deployment, system updates, and troubleshooting across various office locations consume significant IT resources and time, resulting in low efficiency and impacting business continuity.
- **Performance bottlenecks and lack of flexibility:** Applications such as high-performance graphics rendering, video editing, AI model training and inference, and complex simulations require extremely high GPU computing power. Work stations are expensive to purchase, have long deployment cycles, and are complex to upgrade and maintain. They also struggle to meet the demands of mobile office and elastic scaling. Traditional Virtual Desktops struggle to deliver the performance required for professional graphics- and compute-intensive tasks.
- **Limited collaboration and mobility:** When collaborating across regions and teams, file transfer is inconvenient, i.e 3D design file sharing among different work stations would be nightmare. Low efficiency and high data leakage risk.
- **Low resource utilization and TCO pressure:** Local workstation resource utilization is often uneven, with performance limited during peak hours and idle resources during low hours. Expensive hardware procurement, frequent upgrades, and dispersed operations and maintenance costs contribute to a high total cost of ownership (TCO).

NexaVM's high-performance Virtual Desktop solution emerged as a key technology to address these challenges and improve productivity. By combining powerful cloud computing resources (particularly GPU resources) with flexible and secure desktop delivery technology, it provides users with an experience superior to that of a local workstation, while also offering the elasticity and management advantages of cloud services.

This innovation has profoundly changed the way work is done across many industries:

Design and Creativity: This platform provides powerful cloud-based graphics workstations for architects, industrial designers, film and television special effects artists, game developers, and others. Users can run professional software

such as AutoCAD, Revit, Maya, Blender, and Adobe Creative Suite smoothly anytime, anywhere, rendering complex models, editing high-definition videos, and synthesizing special effects, significantly improving creative efficiency and collaboration.

Artificial Intelligence and Machine Learning: Provides a ready-to-use GPU development environment for AI developers and data scientists, facilitating model training, tuning, and inference. Flexible resource allocation allows on-demand use of powerful GPU computing power, eliminating the need for local equipment investment and accelerating the implementation of AI projects.

Education, scientific research, and practical training: In colleges and vocational training institutions, we provide students with a unified, high-performance graphic design and programming experimental environment, allowing them to learn cutting-edge technologies such as 3D design and AI development without expensive hardware, reducing teaching costs and improving the teaching experience.

Medical image processing: Empowers doctors and researchers to efficiently process high-resolution CT, MRI and other medical imaging data, perform three-dimensional reconstruction and AI-assisted diagnosis, and improve the efficiency and accuracy of diagnosis and treatment.

Virtual Desktops, especially GPU-powered Virtual Desktops, are no longer just remote access tools. They are evolving into a new generation of digital workspace infrastructure that supports core business innovation, ensures data security, improves operational efficiency, and optimizes IT costs. They represent the future trend of workload migration to the cloud, on-demand computing power, and seamless collaboration.

NexaVM's Virtual Desktop product solutions have a deep insight into the background of the times and user needs, and are committed to providing high-performance, highly secure, highly agile, and easy-to-manage Virtual Desktop services to all types of customers, especially meeting professional scenarios with extreme requirements for GPU computing power, helping customers unleash their innovation potential and win the digital future.

PRODUCT INTRODUCTION

PRODUCT OVERVIEW

NexaVM's Virtual Desktop products are becoming a key support platform for customers' digital transformation, with their advantages in multi-cloud concept, large-scale computing power management, full terminal compatibility, flexible networking, and open system capabilities. While providing customers with efficient, flexible, and secure Virtual Desktop services, they also promote the development of system construction in a more diversified, open, and intelligent direction, helping customers to allocate resources more efficiently and flexibly.

NexaVM's Virtual Desktop products pioneered the multi-cloud concept, breaking away from the traditional Virtual Desktop product's reliance on specific virtualization platforms. They offer flexible compatibility with third-party virtualization resource pools, enabling unified management and deployment of heterogeneous resources. This multi-cloud architecture provides customers with greater flexibility in IT resource development. System deployment can be tailored to business needs, cost considerations, and geographic distribution, enabling optimized resource allocation and maximizing cost-effectiveness.

NexaVM Virtual Desktop offers powerful multi-tenant hierarchical management capabilities, providing each tenant with an isolated management environment and independent resource quotas, ensuring that their businesses do not interfere with each other. This effectively supports the construction and operation of large-scale computing clusters.

NexaVM Virtual Desktop supports compatibility with all terminal types. Whether it is a PC, laptop, smartphone, tablet or other mobile terminal, users can conveniently log in and access the Virtual Desktop through familiar terminal devices, achieving seamless connection between office and business operations.

NexaVM's Virtual Desktop products integrate an Internet gateway with SD-WAN technology to implement functions such as network acceleration and data encryption transmission, easily meeting customers' Internet security networking needs and ensuring that employees can stably access and use Virtual Desktops in different network environments such as LAN, dedicated lines, and the Internet.

SYSTEM ARCHITECTURE

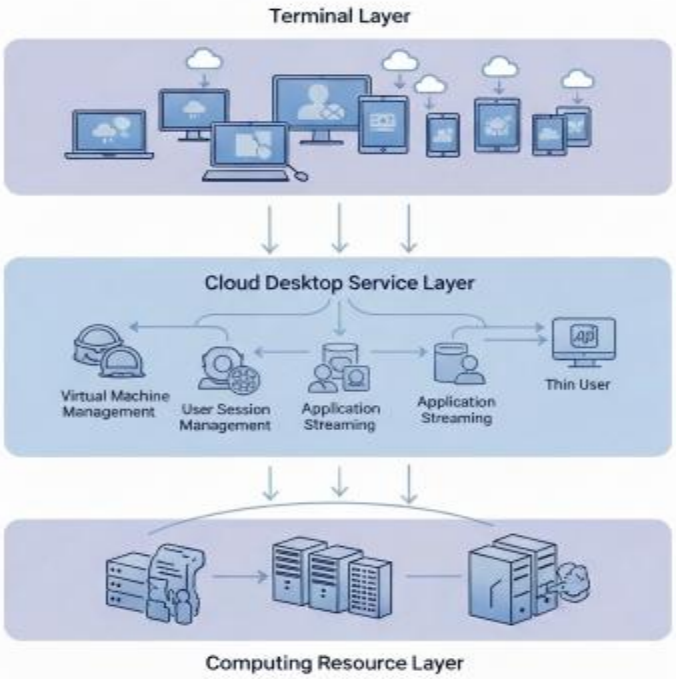
NexaVM's Virtual Desktop system starts from the underlying hardware and is divided into three layers: computing resources, Virtual Desktop services, and terminal access.

Computing resource layer: provides virtual resource management and realizes the pooling capability of hardware resources.

Virtual Desktop Service Layer: This layer provides management functions such as desktop management, policy management, permission management, desktop resources, and monitoring and maintenance, enabling centralized management and operation of Virtual Desktops. Furthermore, various desktop systems, including Windows, Tongxin UOS, KylinOS, and Zhongke Fangde, are released on this basis.

Terminal layer: Provides unified access functions for Windows terminals, Kylin OS terminals, and UOS terminals, enabling cross-platform access capabilities for terminals such as PCs and Thin Clientss.

The specific architecture diagram is as follows:



KEY TECHNOLOGIES

1. Full-Stack Self-Developed and Localized

NexaVM Virtual Desktop products are fully compatible with domestic CPU chips and operating systems, establishing a good domestic ecosystem; at the same time, the core software is fully independently developed, and the entire product stack is self-developed and domestically produced.

i. **Hardware:** Compatible with servers and terminal devices equipped with domestic CPU chips such as Feiteng, Kunpeng, Loongson, Hygon, and Zhaoxin.
ii. **Operating system:** The management platform and Virtual Desktop are compatible with operating systems such as openEuler, Tongxin UOS, Kylin Kylin etc., and can release different types of Virtual Desktops such as Tongxin UOS, Kylin Kylin and Zhongke Fangde.
iii. **Virtualization platform:** Compatible with KVM virtualization technology, etc., it provides deep security

reinforcement for the hypervisor component of the virtualization management layer to improve virtualization efficiency and security.

2. Remote Desktop Protocol

NexaVM's Virtual Desktop remote desktop protocol is based on TCP/IP and uses an in-band transmission solution. Clients accessing the Virtual Desktop do not interact with the virtualization platform. Through underlying technologies such as device drivers, network channels, audio and video capture, and audio and video rendering, the protocol enables real-time, dynamic interactive control between the client host and the Virtual Desktop. Desktop images, interactive control signals, and data transmission are transmitted between the terminal and the Virtual Desktop using different logical channels.

The remote protocol maps desktop resources to local hardware devices and fully simulates the interactive behavior of operating a local computer. This allows enterprises and individual users to access virtual computer desktops located on local area networks or Internet cloud platforms anytime, anywhere, and conduct various work, entertainment, and leisure activities such as office work, design, teaching, and gaming.

3. Any cloud platform connection

The Virtual Desktop management platform can be deployed in the form of application layer virtualization on a self-developed virtualization platform, or on a compatible and adapted third-party virtualization platform, directly calling the API of the virtualization cloud platform to complete the automated management of the underlying virtual machines.

Currently, the product has seamlessly connected to the cloud platforms of mainstream IaaS open source or commercial vendors such as OpenStack, NexaVM, UCloud, and SmartX achieving flexible and efficient Virtual Desktop management without making any changes to the IaaS platform itself.

4. Multi-tenant architecture

Support for a multi-tenant management architecture provides tenant administrators with dedicated management portals, independent organizational structures and user namespaces, and dedicated AD domain configuration options. Tenant administrators can manage resources within their own tenant, including desktop pools, desktops, terminals, images, policies, and user accounts. They can also configure quota limits for desktops, terminals, users, policies, and other resources within their tenant to prevent excessive system resource usage.

5. SDWAN remote access

SDWAN technology is the next-generation dedicated intelligent wide area network. It uses proprietary protocol-based transmission optimization technology to effectively allocate network resources and provide low-cost, low-latency, high-efficiency, high-quality, and intelligent network transmission.

The product integrates SDWAN technology. The SDWAN gateway directly faces the Internet, ensuring the security, performance, and encryption requirements of Virtual Desktop access. It can also play an accelerating role under certain conditions.

FEATURES

1. Open infrastructure ecosystem

Virtual Desktop products are compatible with multiple hypervisors.

- **Compatible with multiple processor architectures**: Both X86 and ARM architecture based servers are supported
- **Support GPU pass-through and virtualization:** To meet the needs of graphics processing and high-performance computing, it fully supports the pass-through and virtualization technologies graphics cards.

2. Ultimate interactive experience in high-end scenarios

NexaVM self- developed remote desktop protocol can support high-resolution displays such as 2K and 4K for key scenarios such as high-end design. At the same time, it uses video encoding algorithms such as H.264 / H.265 / AV1 to dynamically adjust compression parameters according to image characteristics. While ensuring the clarity of details such as text and graphics, it reduces the amount of data and ensures high-definition images, ultimately achieving a high-resolution and high-definition Virtual Desktop experience.

3. Unmatchable user experience of VDI over Internet

Flexible Virtual Desktop access across multiple scenarios (home, office, business trips) with faster response times, smoother image/file transfers, and an enhanced user experience.

- **SD-WAN technology ensures:**
  - Encrypted data transmission for security
  - Accelerated protocol connections
  - Optimized bandwidth utilization
  - High-performance and smooth access experience
- **Gateway cluster deployment with load balancing:**
  - Distributes user sessions evenly to avoid access storms
  - Ensures service continuity even if a single node fails
  - Guarantees reliable access with consistent quality
- **Client integration with SD-WAN SDK:**
  - Performs seamless VPN authentication during login
  - Delivers network acceleration and additional advanced functions

4. Compatibility with Terminals

❖ **Compatible with various hardware devices**

I. Traditional PCs and laptops: Users can install the Virtual Desktop software client on existing computer devices to connect to the Virtual Desktop, effectively reusing existing resources, saving the cost of purchasing new equipment, and improving desktop performance.

II. Thin Clients: A common terminal device for Virtual Desktops. It is small in size, low in power consumption, energy-saving, environmentally friendly, and noiseless. You only need to connect peripherals such as a monitor, keyboard, and mouse, turn on the computer and log in with your account and password to use the Virtual Desktop.

III. Mobile devices: mobile phones and tablets can install the Virtual Desktop client APP to access the Virtual Desktop at any time and flexibly access the Virtual Desktop anytime and anywhere.

❖ **Support various operating systems**

I. Windows system: supports the release of Virtual Desktops equipped with various operating systems such as Windows 7, Windows 10, Windows 11 etc. Users can run various Windows-based applications on the Virtual Desktop, which is consistent with the experience of using traditional PCs.

II. Linux system: Supports the release of commonly used Linux operating systems such as Ubuntu and CentOS to meet the usage needs of specific scenarios such as developers.

❖ **Thin Client Hardware**

Model CPU Architecture Configuration parameters

AA301 **ARM CPU:** Rock chip RK3568; Memory: 2GB; Storage: 16GB; Network: 1*1000M Ethernet port/no Wi-Fi; Interfaces: 2*USB3.0/4*USB2.0/1*Audio/1*MIC/1*HDMI/1*VGA; System: Linux (license-free).

AX201 **Intel CPU:** Intel N95; Memory: 8GB; Storage: 128GB; Network: 1*1000M Ethernet port/optional Wi-Fi; Interface: 2*USB 3.0/4*USB 2.0/1*Type-C (data)/1*MIC/1*3.5mm Combo/1*HDMI/1*DP/1*VGA; System: Linux (license-free).

PRODUCT FEATURES

1. Cloud platform management

The design concept of decoupling the Aixin Virtual Desktop product management platform from the underlying IaaS platform ensures that the underlying IaaS platform focuses on providing stable and high-performance basic virtualization capabilities. The virtual machines provided by the cloud platform can be directly managed and subjected to operations

such as creation, startup, shutdown, restart, and deletion, achieving complete lifecycle management and optimizing the management and delivery of desktop computing resources.

This solution fully leverages the resource elasticity of the IaaS layer and the flexibility of Virtual Desktop management, retaining their respective technical advantages while achieving efficient collaboration, allowing enterprises to quickly build and expand VDI Virtual Desktop environments based on existing cloud platforms to meet the needs of various business scenarios.

❖ **Connect to self -developed virtualization platform**

NexaVM's Virtual Desktop system supports deployment based on its self-developed virtualization system, providing flexible and efficient management of virtual resources, as well as management of policies, users and other related resources.

❖ **Connect to third-party commercial IaaS platform**

NexaVM Virtual Desktop supports public API docking of third-party commercial IaaS platforms such as NexaVM, SmartX, and UCloud and can convert existing infrastructure resources on-site into Virtual Desktop resources to avoid duplication of construction.

❖ **Connect to the open-source OpenStack cloud platform**

NexaVM Virtual Desktop supports standard API docking of open-source cloud platforms, converting projects in the Keystone component of the open-source cloud platform into desktop pools of various forms. It supports calling the Glance component to synchronize image resources, calling the Cinder component to synchronize cloud hard disk resources, and calling the Nova component to create, synchronize and power manage virtual machine objects.

Cloud platform management can be achieved through the following specific operations:

I. Add cloud platform

In the management interface, you can add a new cloud platform by clicking the Add button. When adding a new cloud platform, you need to enter the name, type (architecture), platform address, account password and other parameters of the cloud platform.

II. Cloud platform synchronization

After adding the cloud platform information, you can click the synchronization button to display the relevant resource information such as cluster, node, project, instance, image, storage, network, etc., and the subsequent resource status will be synchronized in real time.

2. Tenant /User Management

❖ **Tenant Management**

NexaVM's Virtual Desktop system utilizes a multi-tenant management architecture. Each tenant has its own administrative permissions and can independently manage its internal Virtual Desktop resources, including user management, desktop pool allocation, and policy configuration. This ensures complete isolation between tenants, preventing interference and allowing each tenant to maintain its own namespace. Administrators of each tenant can only access and manage their own resources without impacting the user experience of other tenants.

The system implements Virtual Desktop deployment based on pooled resource management. All computing, storage, and network resources can be pooled and allocated on demand among tenants. For example, large enterprises can divide desktop resources according to the organizational structure of departments, subsidiaries, and project teams, while cloud vendors can dynamically adjust tenant resource quotas based on customer scale to ensure flexible scalability.

Applicable scenarios of the multi-tenant mechanism:

❖ **Department/subsidiary management of large enterprises**

Large enterprises often manage IT across multiple business units, subsidiaries, or branches, each with distinct IT needs. Traditional IT management models require building and maintaining IT resources for each department, resulting in high costs and complex management. However, with a multi-tenant architecture, a single Virtual Desktop platform is sufficient to create independent tenant accounts for each department and subsidiary, granting them individual administrator privileges. This allows for unified operations and resource sharing, significantly improving IT management efficiency.

❖ **Cross-regional office support**

For large enterprises with multiple offices and multinational branches, a multi-tenant architecture ensures that teams in different regions can share the same Virtual Desktop environment while maintaining independent management. For example, the China headquarters can centrally manage all resources, set up different tenants (such as Asia Pacific, Europe, and North America), and grant regional IT administrator's independent permissions. Each regional administrator can manage desktop users in their own region without affecting Virtual Desktop resources in other regions.

❖ **Multi-customer Virtual Desktop delivery by cloud service providers**

For public cloud service providers (such as IaaS vendors and hosting service providers), our multi-tenant architecture can support multiple enterprise customers to use Virtual Desktop services in the same environment without having to build independent Virtual Desktop infrastructure for each customer, thereby greatly reducing operating costs.

3. User Management

NexaVM Virtual Desktop can be created locally or integrated with existing Active Directory for authentication. Local users support organizational directory trees and two-dimensional grouping, and support password and SMS authentication.

System administrators can create custom permission roles as needed and then create users based on the roles.

4. Desktop pool management

NexaVM Virtual Desktop System supports three types of desktop pools: dedicated desktop pool, dynamic desktop pool, and hosted desktop pool.

❖ **Dedicated desktop pools**

This solution is designed for users who require long-term, fixed personal desktops. These users have one or more dedicated, fixed desktop instances. Each time they log in, they are assigned the same desktop environment or environments, where they perform office work, design, R&D, and other tasks. Personal data can be persisted on the desktops.

❖ **Dynamic Desktop Pool**

A solution is provided for users who use the desktop for one-time work tasks. This type of user usually uses the desktop in scenarios such as window services, call centers, and course learning. They usually use a single software inside the desktop, such as a browser, dial-up software, business software, etc. to work. There is no need to save data inside the desktop. The desktop can be destroyed after use and recreated the next time it is used to prevent various failures during the use of the desktop.

❖ **Hosted desktop pools**

For the large number of physical/virtual desktops that customers may already have, considering transition and cost issues, these physical desktops need to be converted into part of the Virtual Desktop for unified resource management and maintenance.

Application scenarios such as certain high-performance computing workstations or design workstations can be virtualized, but due to their configuration requirements and performance needs, enterprises may want to continue using existing physical hardware rather than relying entirely on virtual desktops.

Through unified management of the Virtual Desktop system, you can manage virtual desktops and also incorporate physical desktops into the pool for resource scheduling and management.

5. Policy Group Management

The NexaVM's Virtual Desktop system is operated by the system administrator or tenant administrator. By associating the Virtual Desktop with the corresponding policy group, the Virtual Desktop client can be given policy control over connection protocol options, peripheral access, data transmission, bandwidth usage, and other dimensions.

❖ **Protocol Strategy**

Control over remote desktop protocol connection options, including the sound quality of speakers and microphones, whether to allow device redirection of microphones, cameras, game controllers, printers, as well as clipboard and folder redirection, etc.

❖ **Peripheral redirection policy**

For external USB device access control, especially when sensitive data or corporate information security is involved, administrators can define which external devices are allowed to access and which are prohibited through policy groups.

I. Prohibit all external devices: In environments with high security requirements, you may need to prohibit the access of all external devices to reduce potential risks.
II. Prohibit specific device types: Prohibit the access of USB storage devices to prevent data leakage or virus transmission, but allow the access of peripherals such as printers and scanners.
III. Authorized peripherals: Authorize specific devices to access through the management platform. For example, authorized peripherals such as printers and scanners are allowed, but unauthorized devices are not.

❖ **Data transfer strategy**

To ensure security during Virtual Desktop access, you can set whether the client allows screenshots, whether to enable the screen watermark function, etc.

❖ **Bandwidth control policy**

The system provides flexible transmission protocol channel bandwidth control, and through policy setting, it prioritizes user experience by setting bandwidth limits for different data channels such as display images, audio streams, camera video streams, and data transmission.

6. Session Management

Tenant administrators can view a list of currently connected sessions, including the terminal source of each session, the Virtual Desktop connected to, as well as the connection time and total duration, and can disconnect specific sessions as needed.

Tenant administrators can view historical session records, including the terminal source of each session, the Virtual Desktop connected to, the connection time and total duration, and the reason for session disconnection.

7. Log Audit

Administrators can view and audit logs through log audit operations. The system records management operations and login operation logs and related information.

Both system administrators and tenants can view management logs and login logs, while tenant administrators can only view login logs.

8. Gateway access

The system can set up a dedicated SDWAN access gateway for each connected cloud platform, and can pre-define which IP address segments are accessed using the external network gateway and which IP address segments are directly accessed through the private network. This allows the end user to not worry about the choice of access method, but the client software automatically selects a suitable access method.

For scenarios of long-distance external network access, when the Internet bandwidth cannot meet the normal experience, Internet acceleration nodes can be deployed on demand to improve the network bandwidth experience.

9. Terminal login

The system supports the installation of client software packages on computers or laptops running Windows 7/10/11, macOS, open-source Linux, and mobile phones.

The client login method supports regular username and password, SMS verification code login. When logging in, you can choose to remember the password or automatically log in after powering on.

After successfully logging in, in the displayed desktop list, in addition to connecting to the desktop, you can also perform basic operations such as power management and viewing desktop details.

For external devices commonly used by default in Virtual Desktops, you can choose automatic redirection, otherwise you can set it to manual mode.

For desktop connection options, you can choose clarity priority, smoothness priority, or adaptive mode as needed. If the graphics card supports it, it is recommended to enable lossless H265 hardware encoding to meet the requirements of high-end design scenarios. For cost-effective low-end terminals, you can reduce the frame rate to meet the smoothness requirements.

For failures that occur when connecting to the desktop, network detection can be used to further identify the background cause, and the background log information generated by the client can be sent to the operation and maintenance personnel to assist in further diagnosis.

It also provides the following terminal-related operation and maintenance functions:

View the list of thin clients, soft clients, and mobile clients.

Terminal version management: Administrators can specify the version number of the client, and the client will automatically download updates after startup.

SUMMARY

NexaVM's VDI solution is a high-performance Virtual Desktop platform built to overcome the challenges of modern work such as remote/hybrid models, data security, and high computing power needs. It delivers performance comparable to local workstations while offering the flexibility, scalability, and centralized management of cloud services.

Key Challenges Solved:

Data Security: Prevents data leaks by keeping information centralized and secure.

Operational Complexity: Simplifies IT management with centralized deployment, updates, and troubleshooting.

Performance Bottlenecks: Supports GPU-powered tasks like 3D rendering, AI training, and scientific computing.

Collaboration & Mobility: Enables seamless access and teamwork across devices and locations.

Cost Efficiency: Optimizes resource utilization and reduces total cost of ownership (TCO).

Core Features:

Multi-Hypervisor Support: Compatible with OpenStack, NexaVM, KVM, etc., for flexible resource allocation.

Multi-Tenant Architecture: Secure, isolated environments for departments or customers.

Wide Device & OS Compatibility: Works with PCs, thin clients, mobiles, and systems like Windows, Linux, UOS, Kylin.

SD-WAN Integration: Ensures secure, optimized, high-performance remote access.

GPU & Protocol Enhancements: GPU pass-through, virtualization, and advanced video encoding for smooth high-definition experiences.

Desktop Pool Management: Dedicated, Dynamic, and Hosted pools for different user needs.

Centralized Policy Control: Unified management of security, bandwidth, and user access policies.