CHINA TELECOM | eSurfing Cloud

开放原子开源基金会 OPENATOM FOUNDATION | OpenEuler

China Telecom eSurfing Cloud

Large Scale Multi-Architecture OpenInfra Deployment Best Practice

White Paper

April 28, 2023

1 Overview

eSurfing Cloud, a subsidiary of China Telecom, is a technology-driven, platform-based, and service-oriented company. With a core philosophy of "cloud-network integration, security and trust, green and low-carbon, and open cooperation," eSurfing Cloud offers a wide range of cloud services to meet the digital transformation needs of various industries and businesses of all sizes. These services include public, private, dedicated, hybrid, edge, and full-stack cloud solutions.

According to the latest China Public Cloud Services Market (H2 2022) Tracker report by International Data Corporation (IDC), eSurfing Cloud ranks third in the Chinese public cloud IaaS+PaaS market with a 10.3% share. Additionally, eSurfing Cloud has experienced significant growth in the public cloud IaaS market, with a market share of 11.8%, maintaining its third-place position. In the global cloud computing market, eSurfing Cloud ranks first among global carrier clouds.

As one of the world's leading cloud service providers, eSurfing Cloud has established a comprehensive cloud-network integration strategy, known as "2+4+31+X+O". This strategy encompasses two large-scale central data centers, four key regions, coverage across 31 provinces, numerous edge nodes (X), and overseas nodes (O). With over 700 data centers in total, eSurfing Cloud has built a new generation of information infrastructure featuring tiered distribution, cloud-edge collaboration, integration of various technologies, and environmentally friendly, intensive facilities.

eSurfing Cloud has fully implemented the "One City, One Pool" strategy, driving the nationwide deployment of computing power. The platform successfully supports the concurrent demands of millions of users across 31 provincial telecom systems and ensures stable usage for over 700 million users. In addition, eSurfing Cloud serves more than 100 million IT PaaS users.

Internationally, eSurfing Cloud has established five public cloud nodes in Hong Kong SAR, Singapore, São Paulo, Dubai, and Frankfurt. In 2023, the company plans to build new international nodes in Macao SAR, Indonesia, Vietnam, and the Philippines. Committed to becoming a leading force in the digital economy, eSurfing Cloud provides secure, inclusive cloud services to users, promoting global digital transformation.

2 Requirements and Pain Points of Cloud Vendors

As the post-Moore's Law era arrives, the traditional approach of enhancing computing power and performance through chip technology improvements is gradually losing its effectiveness. Facing the growing demand for computing and diverse application scenarios, cloud service providers must continuously optimize their diverse computing power and performance to offer more versatile options. The traditional CPU market has expanded from Intel's dominance to include ARM and AMD chips, while dedicated chips such as GPU, DPU, NPU, and FPGA chips are now extensively used, enabling cloud service providers to better support applications in AI, big data, and blockchain domains. This diversified computing is gradually becoming a new paradigm for the cloud computing industry, and demands higher levels of hardware-software collaboration from cloud service providers.

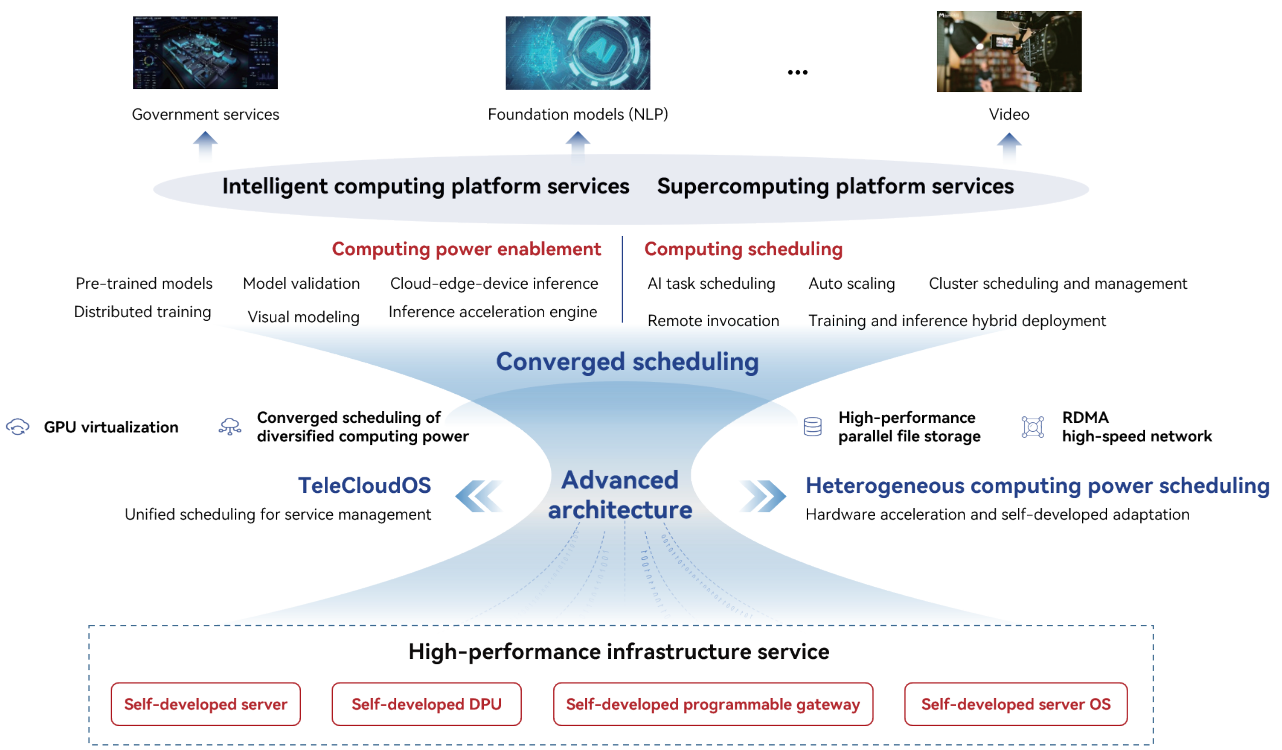
In the northbound ecosystem, as more and more enterprises and institutions, both in the internet industry and traditional telecommunications sector, migrate to the cloud, efficient and convenient cloud adoption has become a critical issue for cloud providers to consider. The continuously expanding cloud computing market provides new challenges for cloud service providers' ability to support a wide range of industries, while the emergence of massive applications like ChatGPT and AR/VR is further driving demand for intelligent computing, thereby creating new opportunities. For cloud service providers, optimizing operational and maintenance capabilities, incorporating machine learning and intelligent scheduling technologies, reducing data center TCO, and achieving green computing objectives have become essential directions for the cloud computing industry.

Starting from 2015, eSurfing Cloud launched TeleCloudOS 3.0, a cloud operating system based on OpenStack Queens. It has been continuously serving Fortune 500 and unicorn customers in the finance, government, Internet, and energy sectors, providing full-stack solutions covering public, private, hybrid, and edge cloud services, in order to fully satisfy the diverse needs of different customer groups. To meet the growing demand for computing power, eSurfing Cloud leverages the advantages of multi-core and multi-state clouds to provide users with general-purpose computing, intelligent computing, and supercomputing capabilities, in order to provide a foundation for the wide range of innovations that will empower the next generation of the Internet. Through years of operational experience, eSurfing Cloud has gradually developed its own energy efficiency optimization and intelligent operation and maintenance systems, and built green and low-carbon data centers.

3 Best Practices

3.1 Overview

eSurfing Cloud is an open, large-scale resource pool-capable, high-performance infrastructure management platform featuring multi-core, multi-state, heterogeneous scheduling, and green energy-saving characteristics.



eSurfing Cloud provides high-performance infrastructure, including x86_64 and ARM64 multi-architecture servers, as well as its self-developed Zijin DPU, programmable gateways, and server operating systems. These components cater to the deployment and operational requirements of eSurfing Cloud's public, private, dedicated, edge, and hybrid cloud solutions, offering customized options that help users reduce maintenance and operating costs. eSurfing Cloud's efficient cloud operating system supports unified management and integrated scheduling of various computing resources. Combined with its high-performance and self-developed foundational hardware, eSurfing Cloud provides robust support for upper-layer computing platforms. eSurfing Cloud offers a diverse range of computing platforms. In addition to providing general-purpose computing power, it also offers intelligent computing and supercomputing capabilities. This multi-computing approach on a single cloud platform is able to meet the diverse needs of different users.

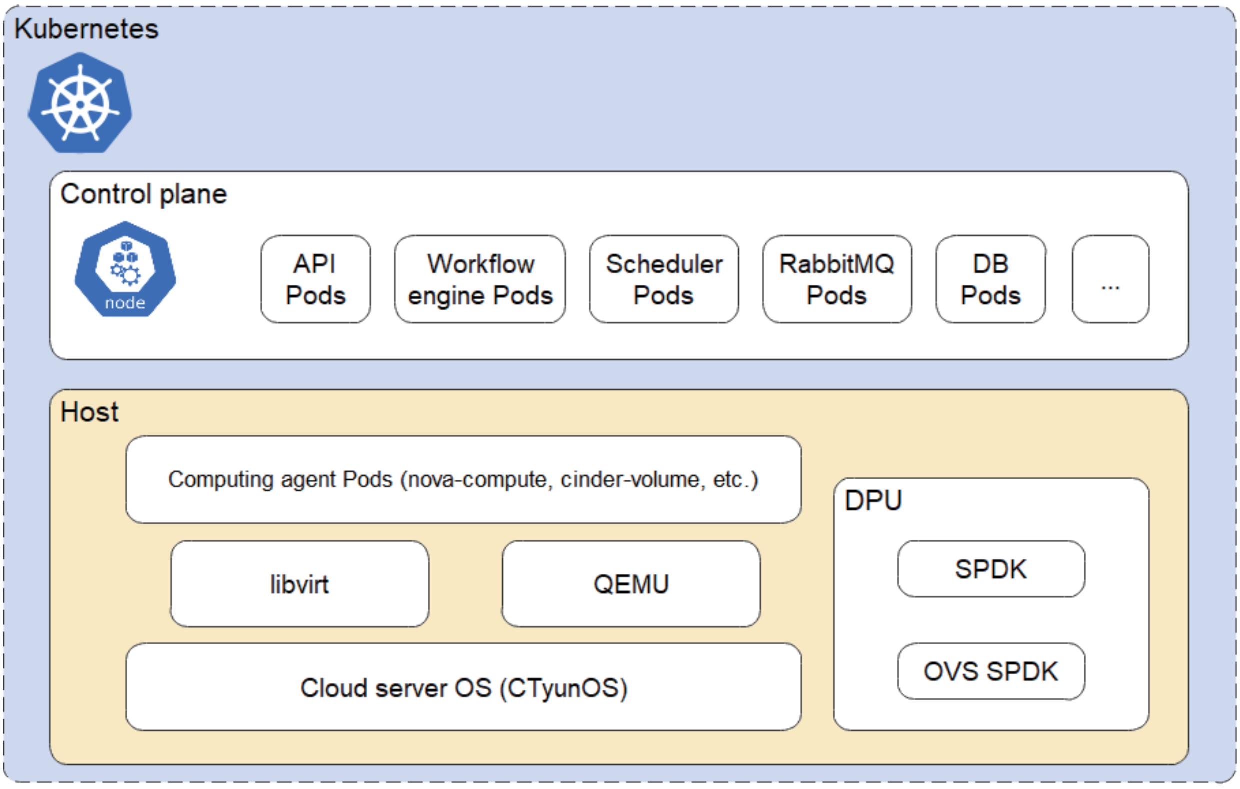
3.2 TeleCloudOS

TeleCloudOS 3.0 is a cloud operating system developed based on OpenStack Queens. It carries the infrastructure services of eSurfing Cloud, including computing, storage, and network products such as Elastic Cloud Server (ECS), GPU Cloud Server (GCS), Dedicated Cloud (DeC), elastic bare metal servers, ultra-fast cloud drives, and VPC. TeleCloudOS 3.0 leverages technologies such as the virtualization layer and large-scale resource pool management and scheduling to improve full-stack performance, streamline deployment, and enable system management and deployment through Kubernetes. As a stable and widely used commercial operating system, TeleCloudOS 3.0 provides various industries with accelerated live migration, improved host high availability (HA), intelligent scheduling, and green computing.

In the SPEC Cloud IaaS 2018 benchmark released by Standard Performance Evaluation Corporation (SPEC), the eSurfing Cloud platform ranked first in overall performance and relative scalability and set a new record in the test scenario of nine hosts of the Arm architecture. The number of replicated application instances, relative scalability, and average instance provisioning time have reached the global leading level, fully demonstrating the excellent computing scheduling capability and large-scale scalability of the eSurfing Cloud platform.

3.2.1 TeleCloudOS on Kubernetes

TeleCloudOS 3.0 integrates the Kubernetes cloud foundation and runs LOKI (Linux, OpenStack, Kubernetes, Infrastructure) to manage the control services in a unified manner. Several innovative features have been introduced based on service requirements, such as enhanced HA pod eviction, improved HA of multiple available zones (AZs), and optimized Kubernetes CPU affinity to prevent control plane services from consuming CPU time slices on the data plane.



3.2.2 Virtualization-Enabled DirtyLimit Live Migration

Live migration is an important basic capability for cloud platforms. Continuously improving the stability of live migration and reducing network interruptions can facilitate the extensive operation of services such as secondary scheduling and defragmentation. During live migration, a large number of dirty pages are generated for VMs with heavy service loads. To successfully migrate such a VM, the rate of copying dirty pages must be greater than that of generating dirty pages. Many migration acceleration algorithms have been invented to meet this requirement, including auto-converge, compression, multifd, and XBZRLE.

auto-converge has been the mainstream acceleration algorithm due to its ability to effectively reduce the VM dirty page generation rate, without being constrained by any particular scenario. However, since auto-converge cannot determine the vCPU that produces dirty pages, it adopts a radical approach that limits all vCPUs to reduce the dirty page generation rate. As a result, vCPUs that do not generate dirty pages during read operations, become "victims" of this approach, causing performance degradation. The virtualization team at eSurfing Cloud has conducted thorough technical research and presented a solution to solve the problem of vCPU performance degradation during migration. The proposed technique involves a software-hardware combined method for vCPU rate detection and restriction that utilizes the Intel PML mechanism and kernel dirty ring feature and serves as the core technology of DirtyLimit.

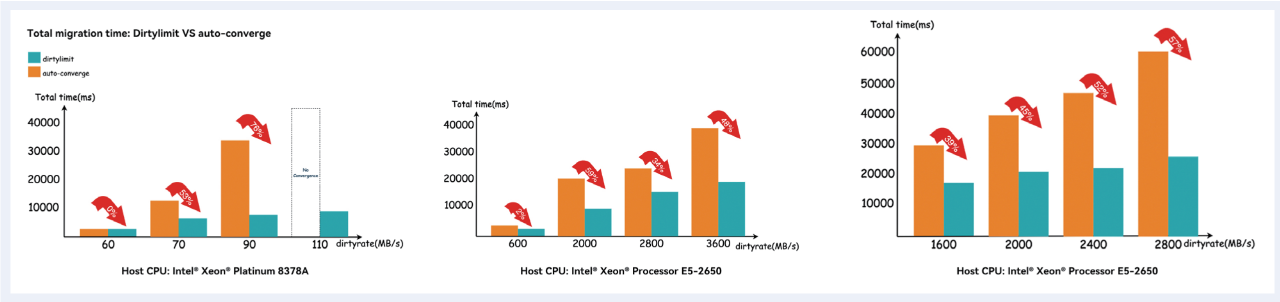


Figure 3-1 Migration duration in different test scenarios

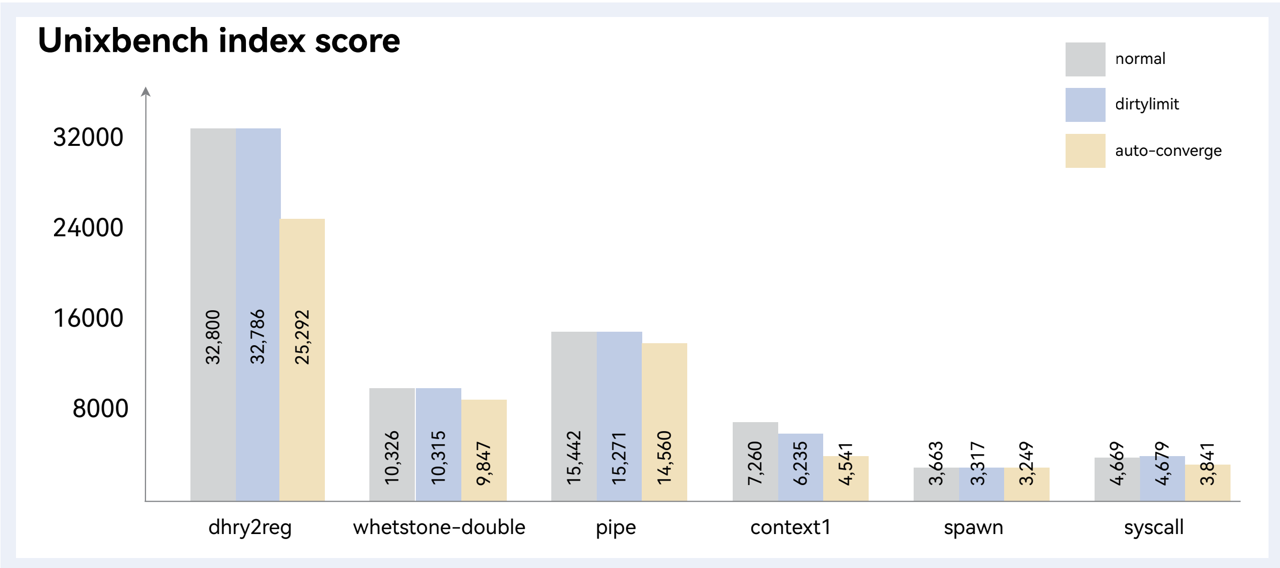


Figure 3-2 VM performance during migration

3.2.3 Host HA

When cloud platforms provide services, availability has always been a key concern. Host machine breakdowns can lead to long service downtime, resulting in a major impact on the continuity of customer business. To meet the service requirements, eSurfing Cloud developed Gemini, a host HA product. Gemini detects various network, hardware, operating system, and kernel faults on the host and performs pre-configured handling actions accordingly, effectively improving cloud server availability and reducing unplanned downtime and O&M costs. It can also quickly detect, identify, and isolate faults to prevent fault infection and automatically recover cloud servers through live migration and evacuation.

Currently, Gemini supports the Consul-based and TCP-based heartbeat detection models to perform HA health checks on the management network, storage network, and tenant network.

The control nodes receive heartbeat messages, diagnose, isolate, and rectify faulty compute nodes, and send alarms to the CMDB platform. The proxy nodes bridge out-of-band addresses through the CN2 network to connect the control and compute nodes. The compute nodes report heartbeat messages and detect memory, kernel, and drives.

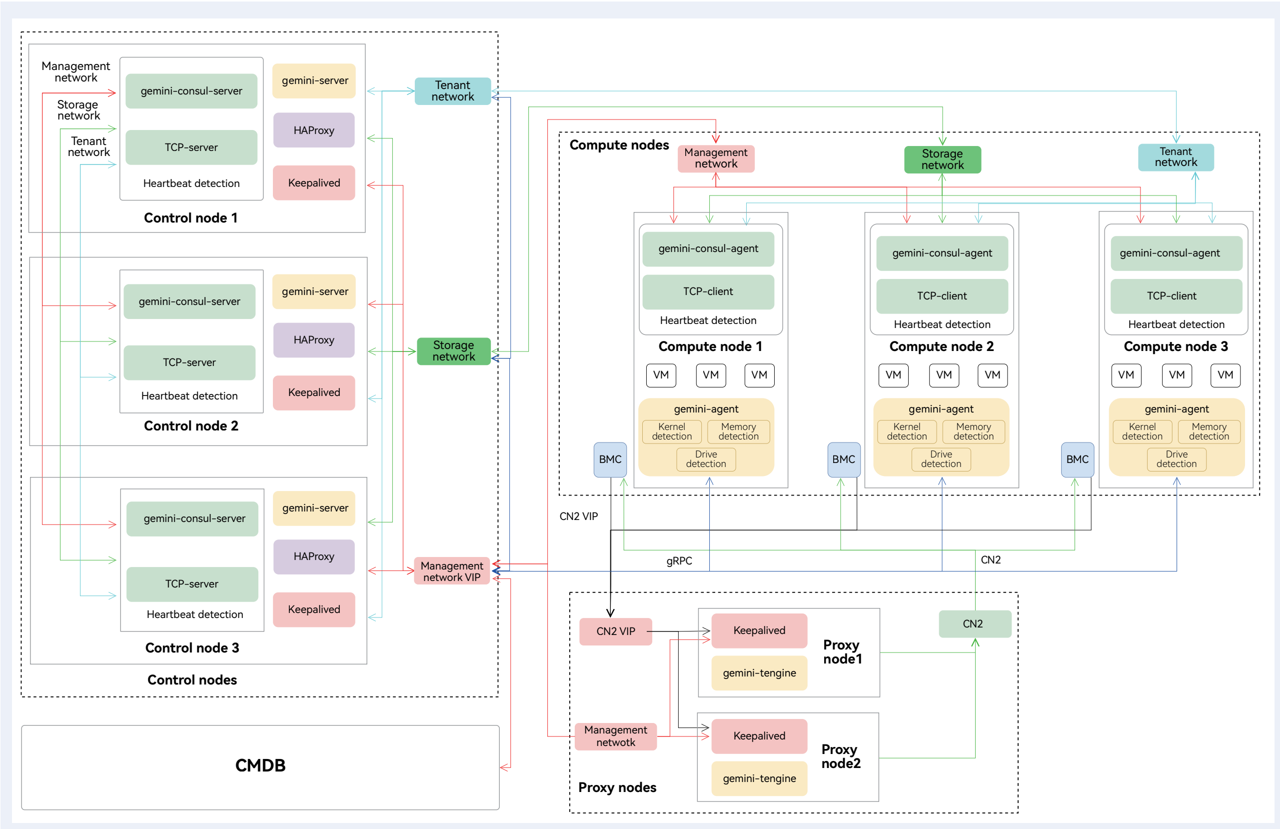
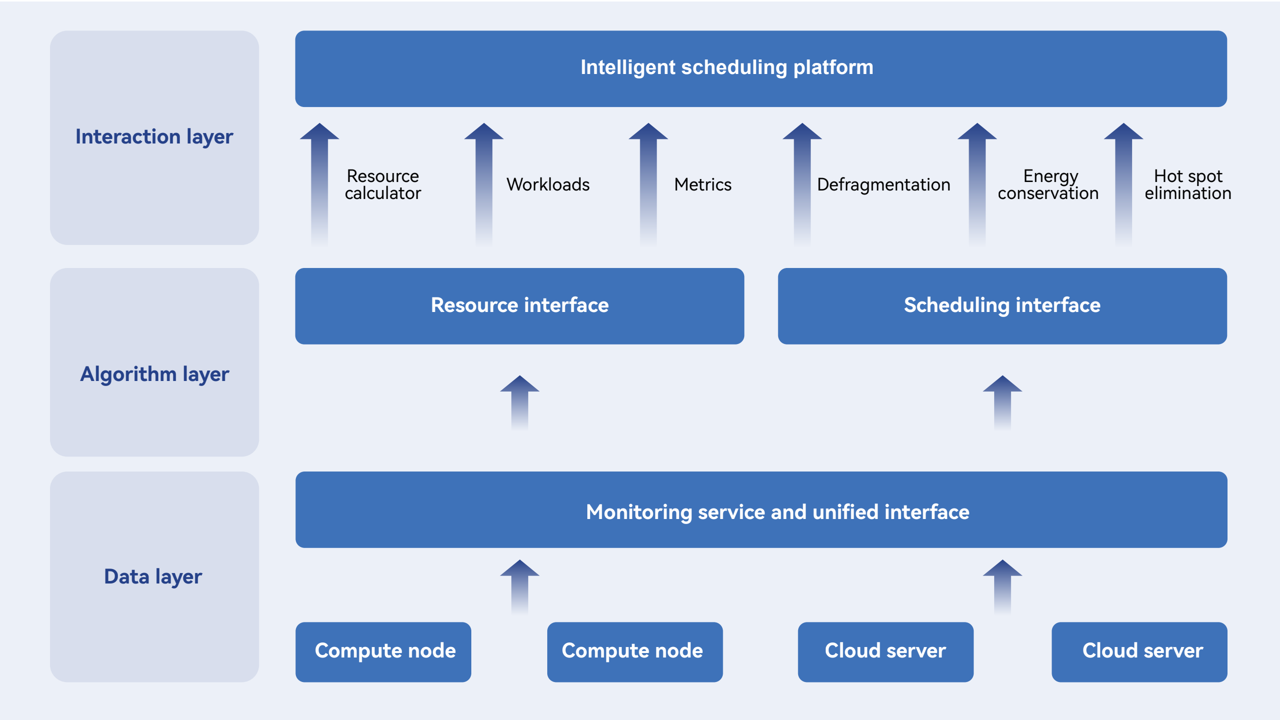


Figure 3-3 Host HA architecture

3.2.4 Intelligent Scheduling Platform for Green IDC and "Dual Carbon" Goal

As cloud computing is developing continuously, clusters in data centers are increasing in scale to meet the growing demand for computing resources. This has led to an increase in power consumption, and research suggests that energy costs can even exceed the hardware costs invested in infrastructure construction. eSurfing Cloud has developed an intelligent scheduling system to increase the number of sellable resources by utilizing technologies such as defragmentation, hot spot elimination, memory overcommitment, and resource hybrid deployment. Energy conservation technologies such as host power management and cooling facility management were developed to reduce data center costs and emissions.



3.2.4.1 Defragmentation

Customers require resources of various specifications and subscribe to and unsubscribe from resources irregularly, causing fragmentation of resources in the resource pool. Even with a large number of available resources in total, the resources of each host may still fail to meet the customer's requirements. The defragmentation feature of eSurfing Cloud can greatly improve resource fragmentation and resource pool utilization.

S6 cloud servers in a resource pool		
Number of hosts	87	
Total available memory of all hosts (GB)	28,327	
Total available CPU Cores of all hosts	10,234	
Theoretical number of VMs (16 cores, 64 GB) that can be created using available resources	442	
	Before defragmentation	After defragmentation
CPU fragmentation rate (%)	19.89	17.08
Memory fragmentation rate (%)	4	0.393
Number of VMs (16 cores, 64 GB) that can be created using available resources	406	439
VM fragmentation rate (%)	8.14	0.68

3.2.4.2 Hot Spot Elimination

Another common problem with resource pools is that the allocation rate is high while utilization is low. Therefore, many cloud vendors choose to oversell CPU and memory resources to increase the utilization of resource pools and thus increase revenues. However, oversold CPUs and memory could cause the hot spot problem, wherein a host becomes overloaded to the extent that it fails to meet tenant service performance requirements or even host a cloud server at all. To make full use of resources while avoiding hot spots, eSurfing Cloud provides the hot spot elimination service to quickly detect hot spots in a cluster and migrate VMs to lower the resource usage of a physical machine to a specified threshold, ensuring service quality. Currently, this function focuses on CPU usage (positively correlated with the average CPU load in 1 minute and the length of the CPU waiting queue) and memory usage.

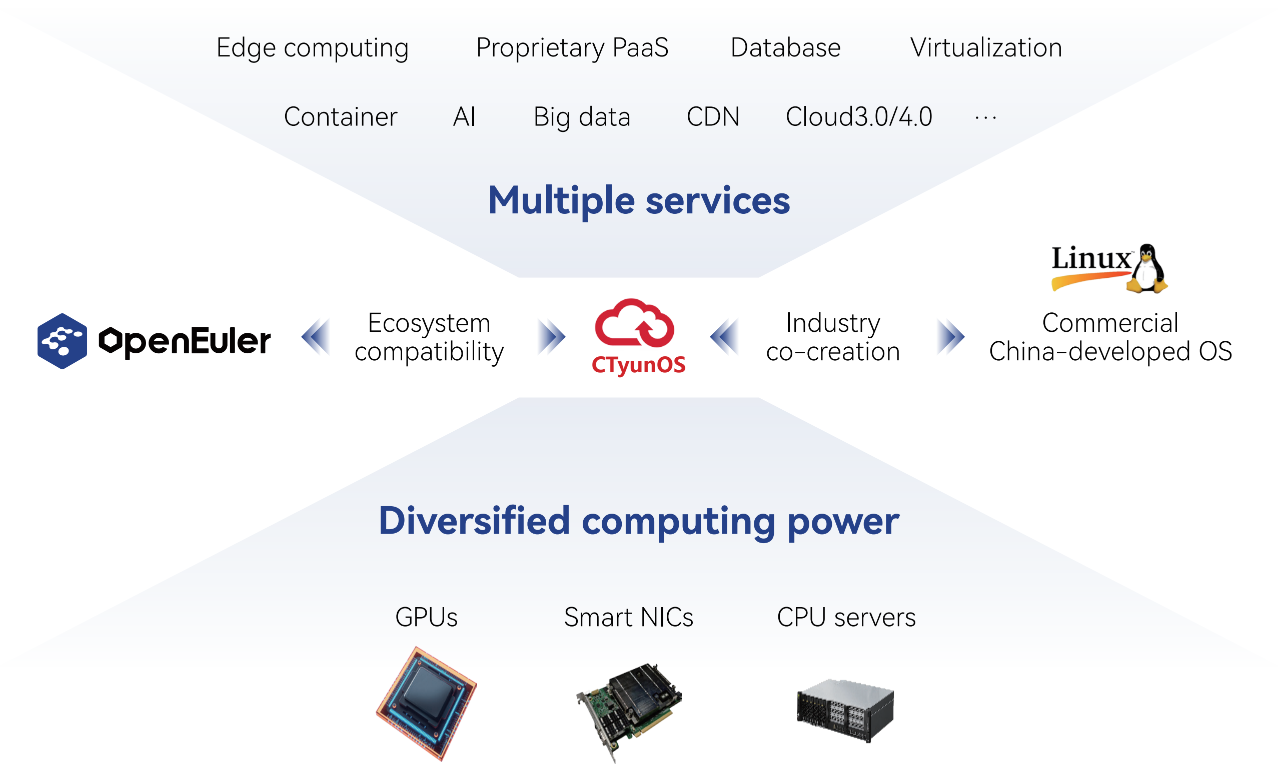
Example Resource Pool	Number of Hosts	Number of CPU Cores	Memory	Maximum CPU Allocation Rate	Maximum Memory Allocation Rate	Utilization	Number of Allocatable Cloud Servers (2 Cores, 4 GB)
Before optimization	12	984	9,200	300%	100%	39.99%	1,476
After optimization	12	984	9,200	Unlimited	150%	80%	2952

In the example resource pool, the maximum memory allocation rate is increased from 100% to 150%, and the maximum CPU allocation rate is elevated from 300% to unlimited. The hot spot elimination feature is used to ensure that each host can deliver cloud servers with committed performance. As a result, the resource utilization of the resource pool improves from 39.99% to 80%.

3.3 Operating System with Secure Updates and Integrated Software and Hardware

eSurfing Cloud has recently released CTyunOS, a commercial distribution of openEuler. The primary focus of CTyunOS is to build an operating system and associated products and services that offer exceptional performance, reliability, security, and scalability. These features are crucial for ensuring a stable and secure running of services relying on the base software of the cloud infrastructure. More than 50,000 sets of CTyunOS have been deployed in and outside China, supporting data center servers and service platforms across thousands of industries. CTyunOS is designed to support a variety of CPUs, including but not limited to Intel, AMD, Kunpeng, Phytium, Hygon, Loongson, and Zhaoxin. The operating system also provides a diverse range of instruction set optimization patches from different vendors. Furthermore, CTyunOS is compatible with several GPUs and DPUs, various types of NICs and RAID cards, and multiple kernel drivers and independent driver installation packages.

CTyunOS, which was developed based on openEuler LTS versions, can be integrated with many software packages, dependencies, and drivers related to application development and service operations. It can also customize series of tools and platforms, such as a pipeline for common vulnerabilities and exposures (CVE) awareness, intelligent repair, and automated compilation/testing/release, Software Bill of Materials (SBOM) and security advisories, push messaging, and multi-source distribution and synchronization.

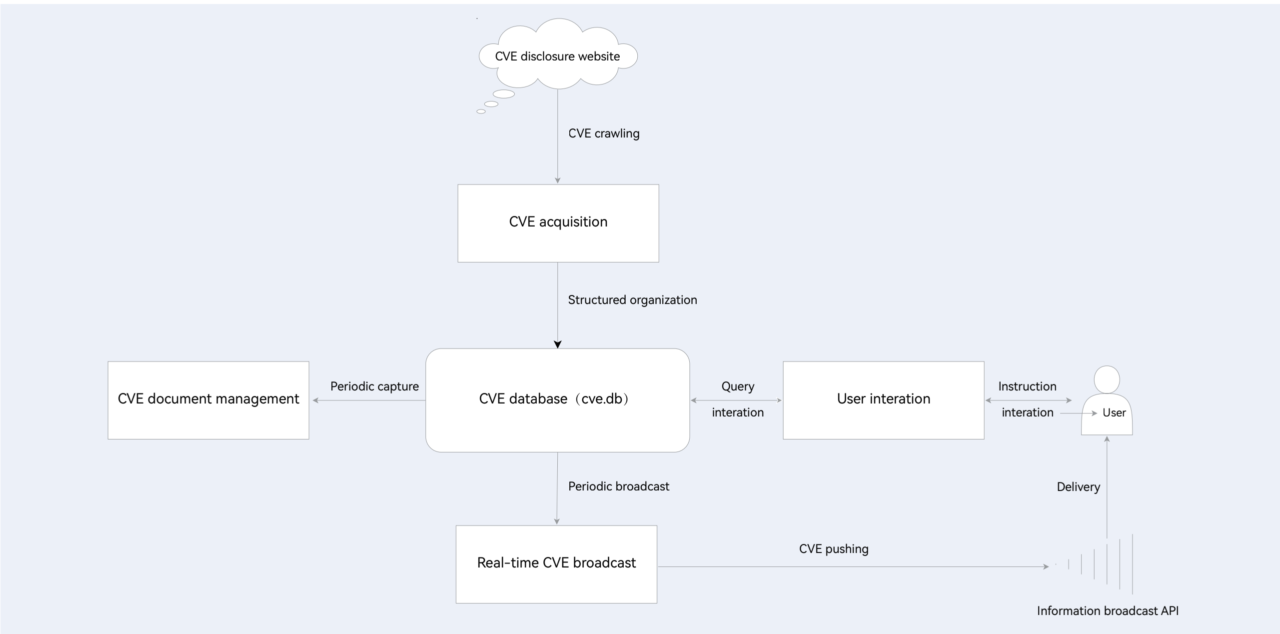


3.3.1 Comprehensive Security Defense

CTyunOS has built technical capabilities in supply chain security and operating system security for each architecture, providing users with a comprehensive shield against security threats.

3.3.1.1 Supply Chain Security: CVE Awareness – Pipeline Fix – Notice

Operating system security is critical, and timely security updates are essential to addressing new vulnerabilities that may arise in software packages. However, manually fixing a large number of CVEs can be a daunting task. To address this issue, we have developed cve-ease, an efficient vulnerability awareness system that automates CVE repair. This system significantly reduces the workload involved in fixing CVEs and saves valuable time and resources. cve-ease is able to collect and process CVE information and then push the information to a specified platform through APIs in real time. Specifically, cve-ease parses the CVE disclosure website to obtain real-time CVE information and then stores the information in a database for information analysis. Throughout this process, cve-ease updates the overall CVE documentation based on the CVE scores, occurrence year, and checking status, outputs the CVE checking documentation based on the crawled content, and automatically takes screenshots of key security pages in the CVE checking documentation. cve-ease is also capable of pushing important real-time CVE information to users and periodically notifying users of crucial CVE information based on the database content. In addition, this tool provides a shell interface for users to query CVE information as needed. cve-ease has been open sourced in the openEuler community for industry peers to utilize this tool.



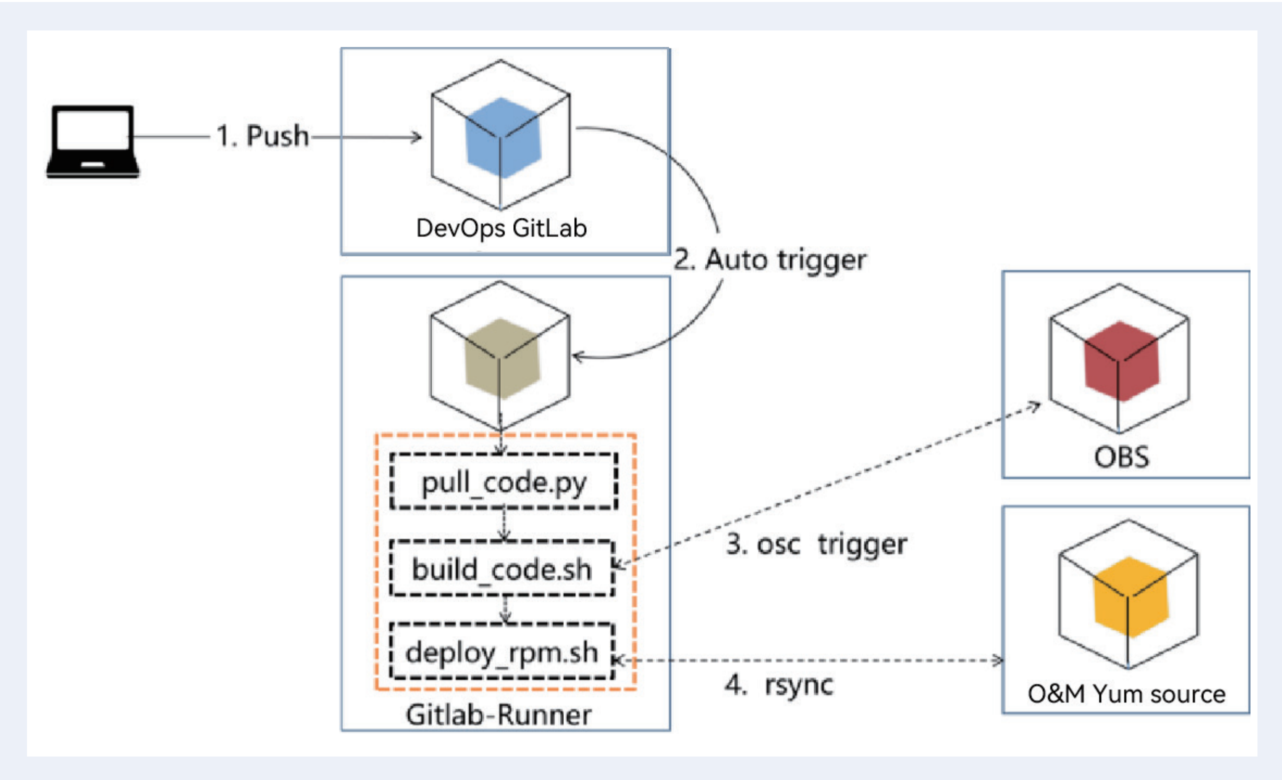
The automated process is as follows:

1. All vulnerability advisories released by upstream communities are tracked in real time and incorporated into our database of vulnerabilities to be fixed. Then, a CVE advisory is generated and distributed to the users who have subscribed to CTyunOS.

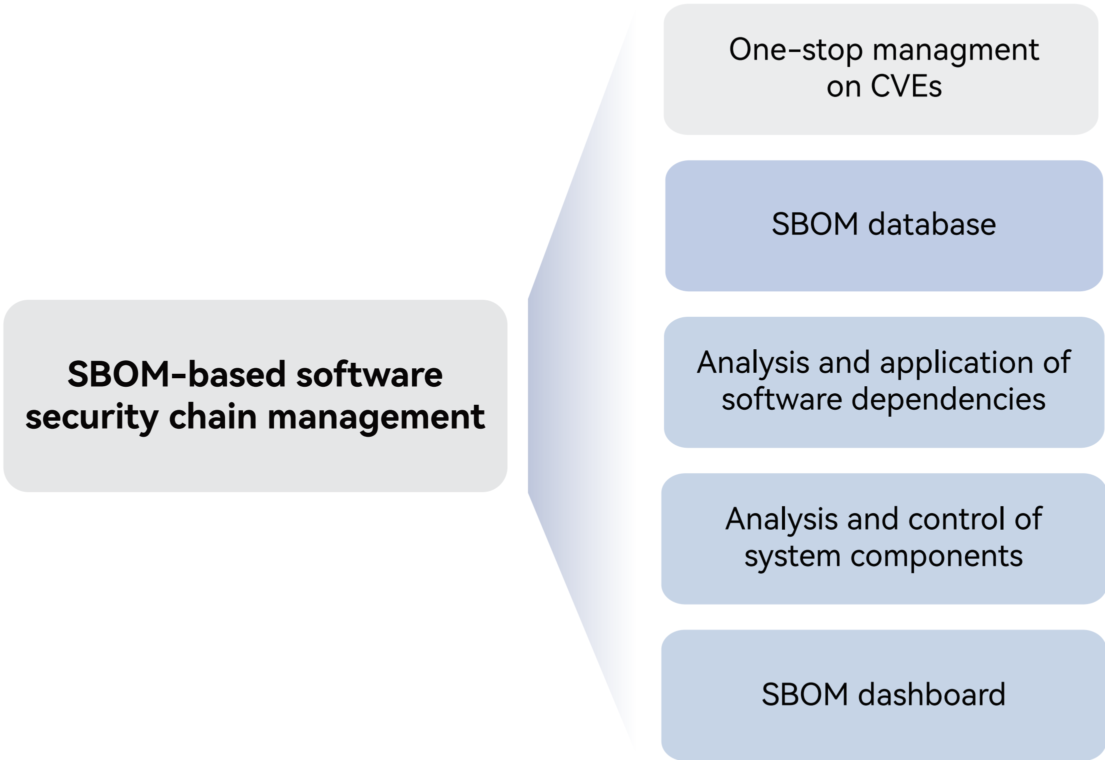
2. The fixed source code from the upstream community is automatically obtained and merged into our own code repository, and then pushed to the OBS build system to build software packages. If a non-upstream repair is involved or a conflict exists, developers are notified and will handle the problem.

3. The RPM package that is automatically or manually built is uploaded to the test source, and the automated test platform of the operating system performs regression testing of its functionality and stability. After passing the regression testing and being reviewed before release, the RPM package is officially added to the release source. A notice stating that the corresponding CVEs have been fixed will be displayed in the advisory.

4. The system will check whether the added RPM package is the core package of the base image of the cloud native Docker of CTyunOS. If it is, the automated pipeline is triggered to re-build the base image of CTyunOS Docker for package update and release.



Once the new software package is released, a range of software information is updated in the SBOM database which is housed on the operating system management platform, and then displayed on the frontend page.



3.3.1.2 Operating Security: End-to-End Security and Trustworthiness

Due to frequent data breaches in the industry, safeguarding data and system security has become paramount. One example of a challenge faced is the fact that system security hinges on end-to-end defense, which is crucial. In response to this challenge, the CTyunOS team has worked with the openEuler community to:

1. Build end-to-end software integrity to provide a reliable system foundation for users. We have provided industry-leading integrity protection that covers the whole system, including trusted boot, integrity protection, and memory measurement.

2. Adopt the SGX technology of the x86 platform, the TrustZone technology of the Arm platform, and openEuler's secGear framework. CTyunOS implements trusted data flow throughout the life cycle by integrating software and hardware. During data flow, hardware provides a trusted execution environment (TEE) that is isolated, encrypted, and measurable, to ensure that a task is executed as expected and no data breaches occur.

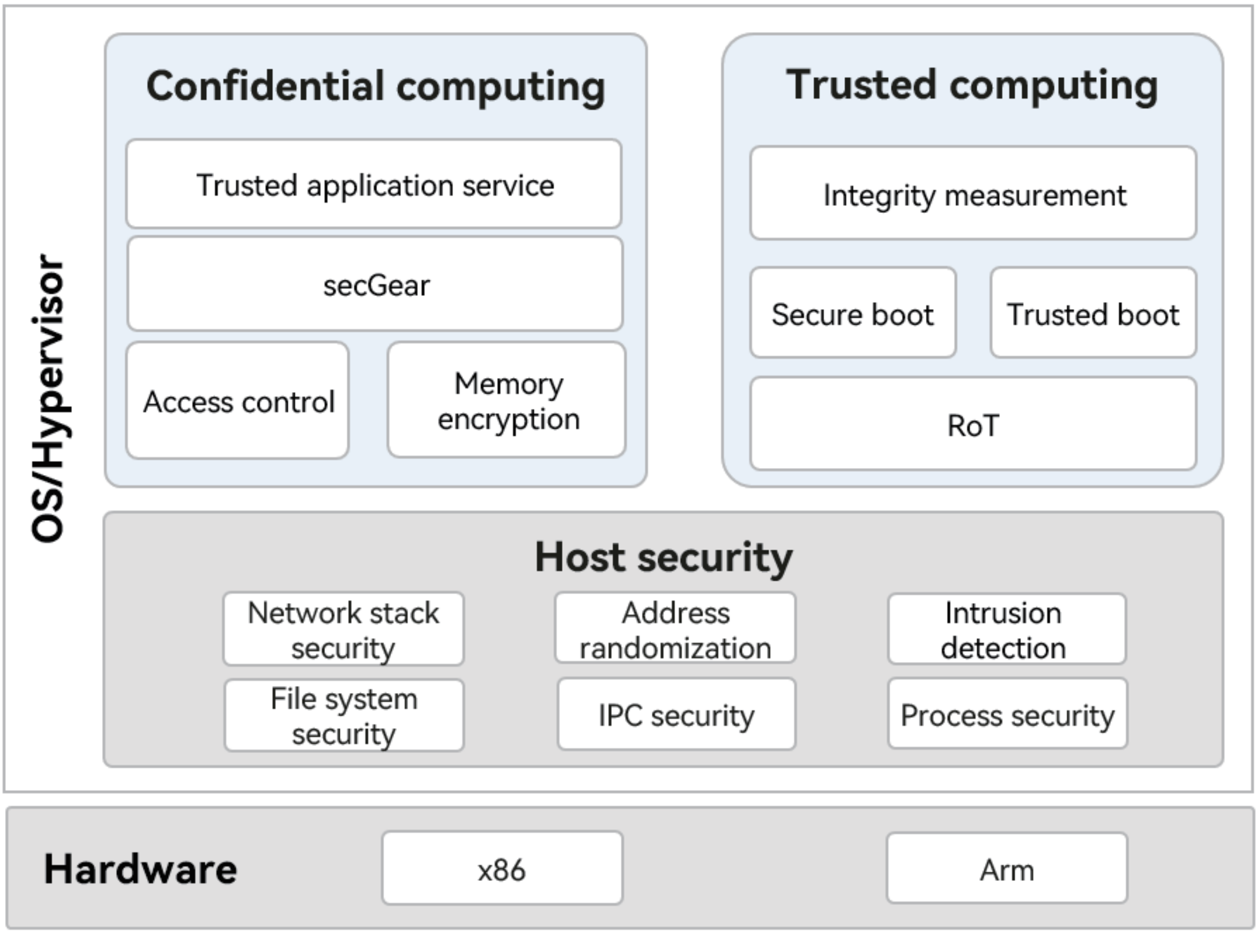


Figure 3-4 CTyunOS's security technologies

3.3.2 Integration of DPUs and GPUs

As we enter the post-Moore era, the marginal costs of enhancing general-purpose CPU performance are skyrocketing. The amplified CPU speed is insufficient to meet computing power demands, leading to significant bandwidth and computing power challenges in data centers. To overcome this issue, DPUs have been created to take on certain CPU tasks and reduce CPU computing workloads.

Zijin DPU 1.0 was introduced by eSurfing Cloud in September 2022, and it made significant advancements in virtualization offloading, hardware acceleration for multiple services, and the proprietary high-performance network protocol. These feats were accomplished by leveraging openEuler's imperceptible offloading technology.

1. The DPU implements zero loss of server virtualization and unleashes computing power. This

not only improves the sales efficiency of elastic cloud servers, but also supports elastic bare metal server services.

2. Hardware acceleration for multiple services provides higher performance and lower latency. Compared with conventional CPUs that solely rely on software, the Zijin DPU increases network PPS performance by 100% and storage IOPS performance by 200%, while reduces network latency by 300% via chip-level hardware acceleration, thereby greatly improving the overall performance of the new architecture.

3. The high-performance network protocol is provided. The high-performance network data plane, NVMe over Fabrics (NVMe-oF) protocol, and error correction (EC) are implemented through hardware. The self-developed congestion control algorithm implements precise flow control by proactively controlling of device-network synergy and achieves ultra-low latency through a low queue depth. This greatly improves the distributed communication efficiency and supports deployment on a large scale. The host CPU environment is physically isolated from the virtualization environment, supporting multiple chips for one cloud and plug-and-play functions.

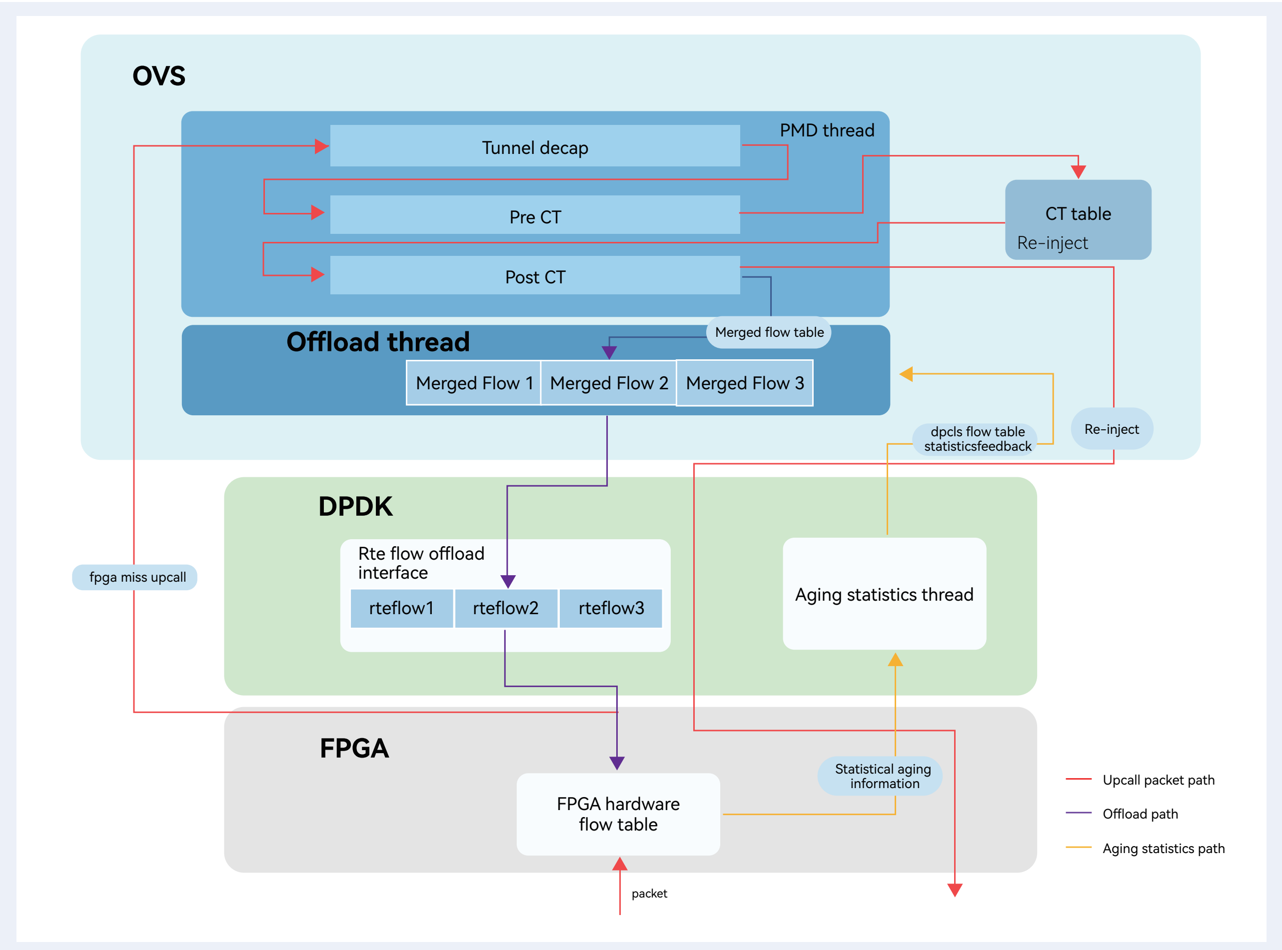


Figure 3-5 An illustration of network offload acceleration

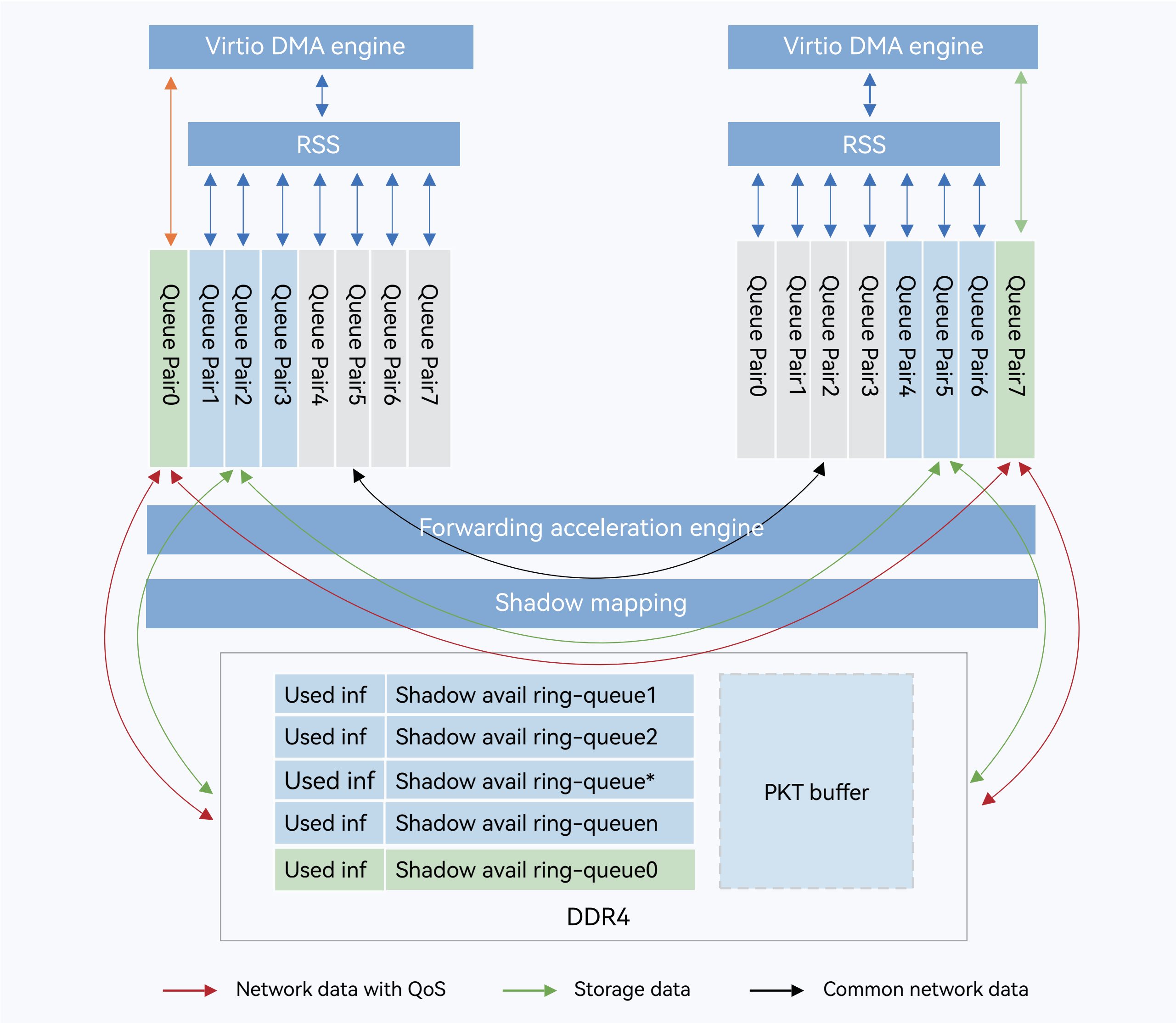


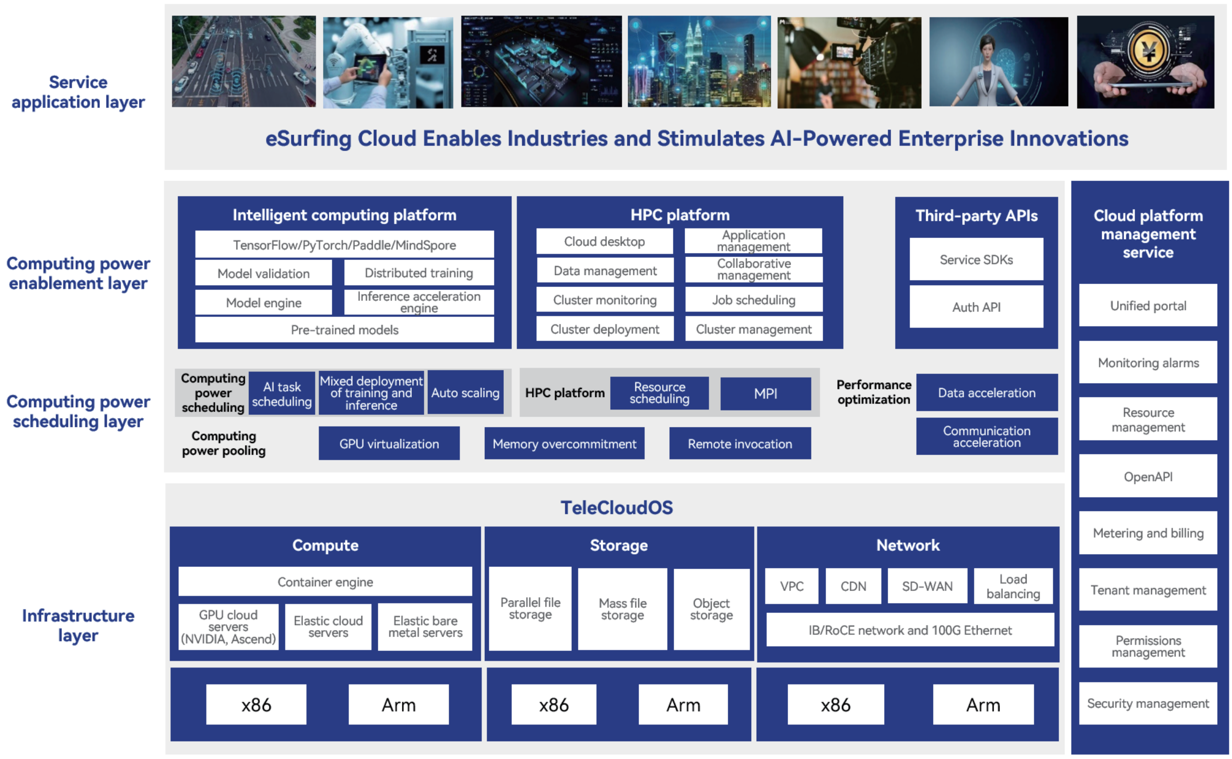
Figure 3-6 An illustration of storage offload acceleration

Furthermore, there's a growing need to virtualize GPU hardware in traditional virtual machines, containers, or other containerized virtual machines. To accelerate virtual computing power on the cloud using physical GPUs, it is necessary to partition and fully utilize the hardware for virtual computing power. Hardware partitioning can be achieved through either general interfaces provided by hardware vendors or programming interfaces like CUDA on a board. However, to utilize the partitioned hardware, it is necessary to modify virtualization and container infrastructures to enable dynamic creation, mounting, and destruction of partitioned virtual hardware. Those processes require an in-depth integration of operating system software. Fortunately, CTyunOS offers the convenience and assurance necessary for basic self-development work in this domain.

3.4 Applications and Solutions in Industry Scenarios

3.4.1 Intelligent Computing

Using the distributed cloud base and massive computing, storage, and network resources, eSurfing Cloud builds an intelligent supercomputing cloud with superior performance, scalability, interconnection speed, and cost-effectiveness. It provides integrated software and hardware solutions for large-scale training such as ChatGPT, intelligent recommendations, autonomous driving, life science, and natural language processing (NLP).

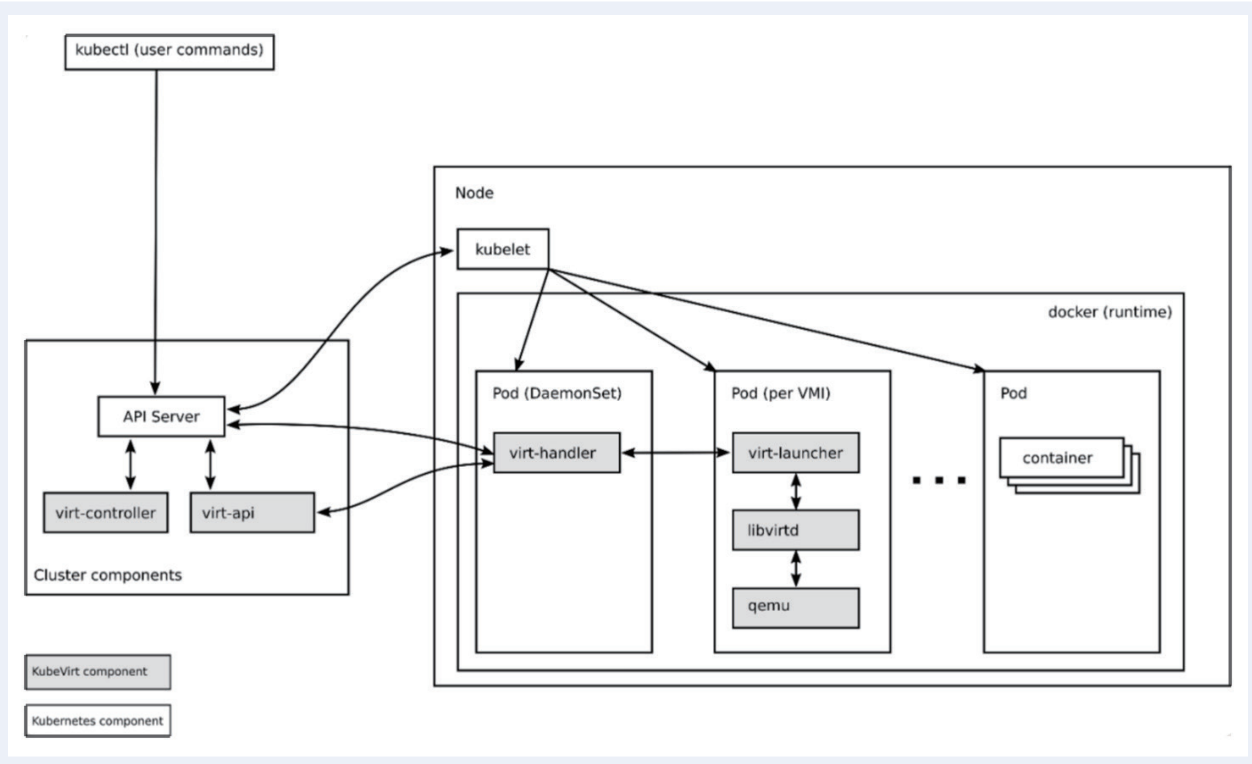


Above the infrastructure layer, eSurfing Cloud has a flexible and efficient computing power scheduling layer that provides AI task scheduling, mixed deployment of training and inference, auto scaling, GPU virtualization, VRAM overcommitment, data acceleration, and communication acceleration. The computing power scheduling layer can schedule different types of resources, such as common cloud servers, bare metal servers, and GPU cloud servers based on s multiple GPUs, such as NVIDIA, Ascend, and Cambricon. It also supports unified scheduling of CPUs and GPUs catering to different cloud scenarios.

3.4.1.1 Diversified Computing Power Scheduling

The diversity of industry applications creates diverse requirements on data and computing power. No computing architecture can meet all service requirements. Computing-intensive applications need to compute scheduling tasks with complex execution logic, and data-intensive applications require efficient concurrent processing of massive volumes of data. Therefore, diversified computing power has become a critical need.

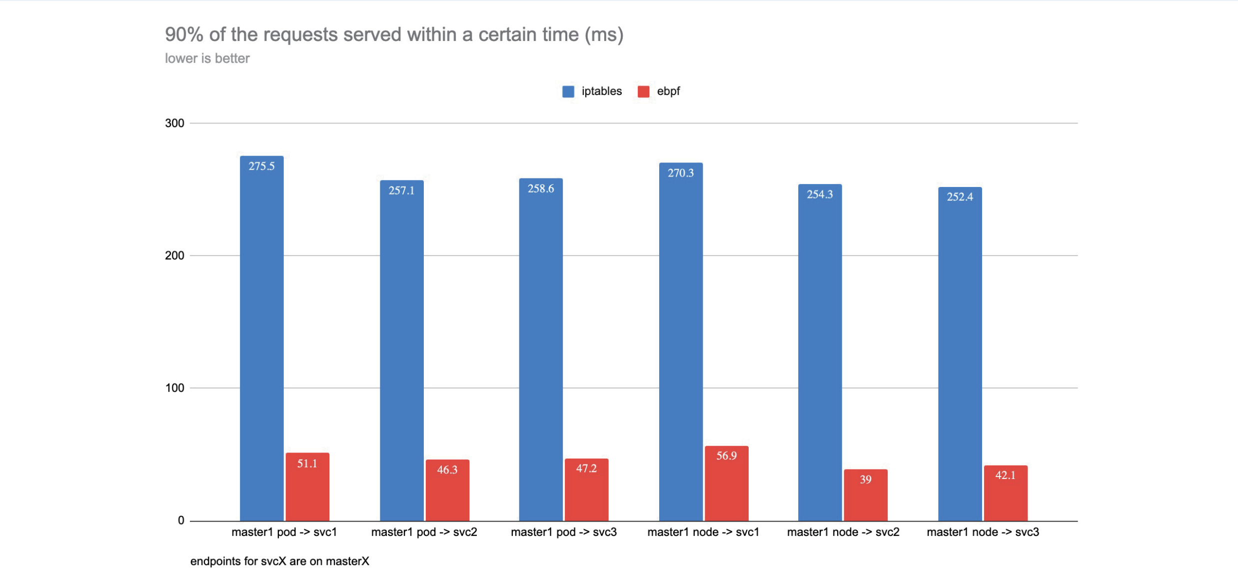
eSurfing Cloud fully utilizes the scheduling and scaling capabilities of Kubernetes to implement unified scheduling and deployment of VMs, bare metal servers, cloud server containers, bare metal containers, and secure containers in the same resource pool.



• KubeVirt's Custom Resource Definitions (CRDs) are used to extend Kubernetes clusters; libvirt, qemu-kvm, and IPMI are used to manage VMs and bare metal instances; and live migration is supported.

• Kubernetes's storage and network plugins are reused together with the Container Network Interface (CNI), which has extensive functions, such as Kube-OVN. This enables the Kubernetesmanaged VM network to achieve functionality and performance close to that of the IaaS network.

• eBPF is used to solve the scalability problems of Kubernetes services and NetworkPolicies. BPF rules allow data packets sent from pods to services to be forwarded directly to the host interface of the IPvlan without iptables and route searching. eBPF ensures that the data packet forwarding path for pods accessing services is the same as that for pods to access pods, improving the forwarding efficiency by 50%.



3.4.1.2 Topology-Aware GPU Scheduling

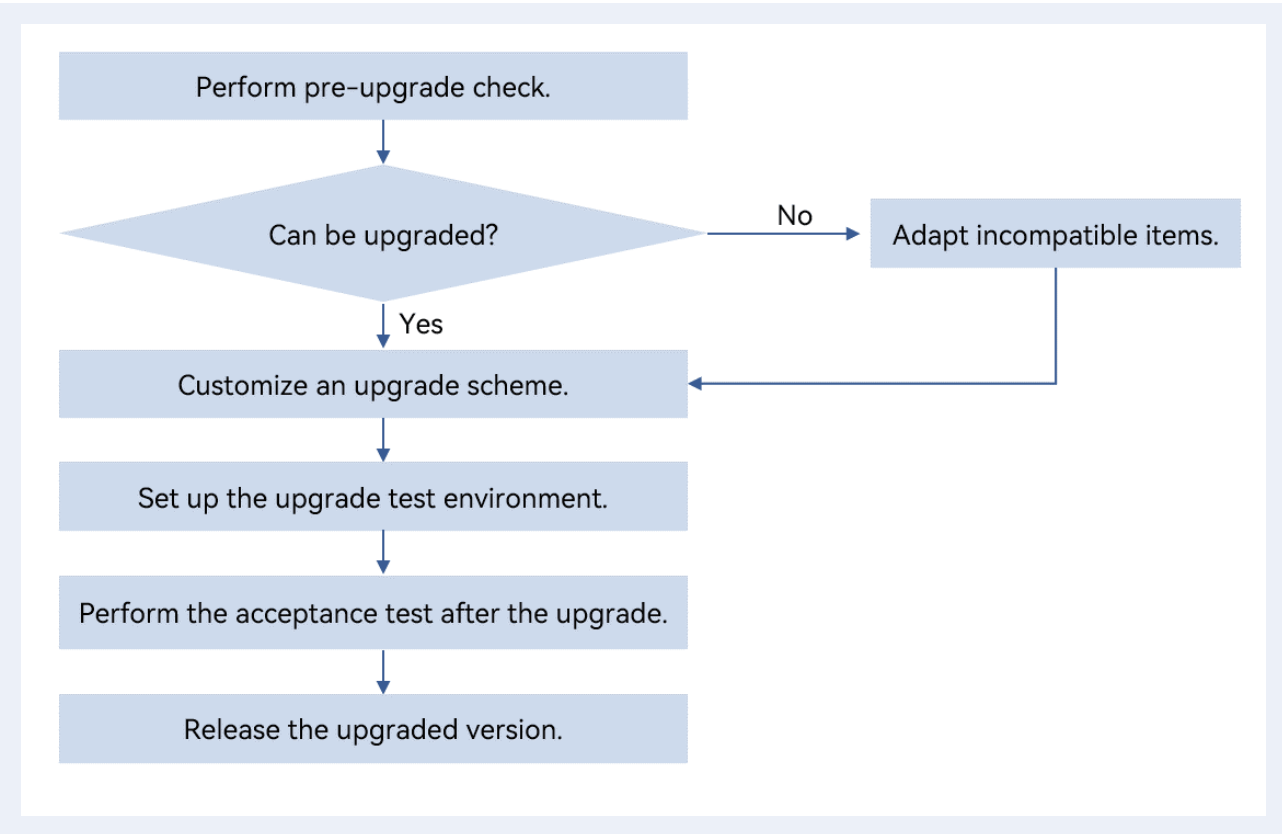
Model training tasks require extremely high communication bandwidth between GPUs. For NVLink, the one-way communication bandwidth is 25 GB/s and the two-way communication bandwidth is 50 GB/s. For the PCIe link, the communication bandwidth is 16 GB/s. Training speeds vary greatly depending on the GPU combination. Because the Kubernetes cluster is unaware of the GPU topology of nodes, the GPUs are randomly selected during scheduling, hence the large variation in training speeds.

eSurfing Cloud implements topology-aware GPU scheduling to select the GPU combination with the optimal training speed. Thanks to GPU topology awareness, GPUs with higher bandwidth will be scheduled to the same task. Performance is more than doubled for typical models such as ResNet-50 and VGG16, which means training efficiency is significantly improved.

3.4.2 Cloud Migration

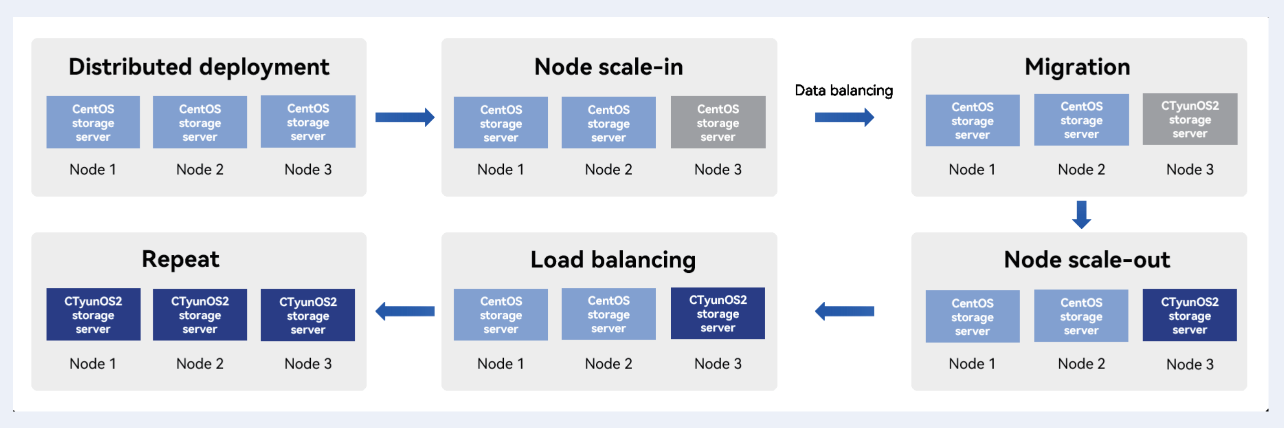
3.4.2.1 Host OS Migration

As CentOS is reaching its end of life (EOL), although there are diversified computing architectures, we choose to develop CTyunOS, an operating system tailored to cloud vendors' infrastructure. Under such circumstance, we started the migration from CentOS to CTyunOS. With the help of the openEuler community, we built a complete tool chain to migrate from CentOS to CTyunOS without reinstallation. In addition negating installation, CTyunOS allows us to continue to run the upper-layer cloud platform and installed applications. We call this innovative migration solution an in-place upgrade. To date, our tool chain has already been adapted to numerous operating system versions and upper-layer software combinations in a wide array of scenarios. The upgrade process is as follows.



X2CTyunOS is a migration tool customized based on openEuler 22.03 LTS SP1. It can migrate all services from CentOS to CTyunOS in all scenarios. X2CTyunOS customization mainly includes the software compatibility database, system software packages, and system upgrade process.

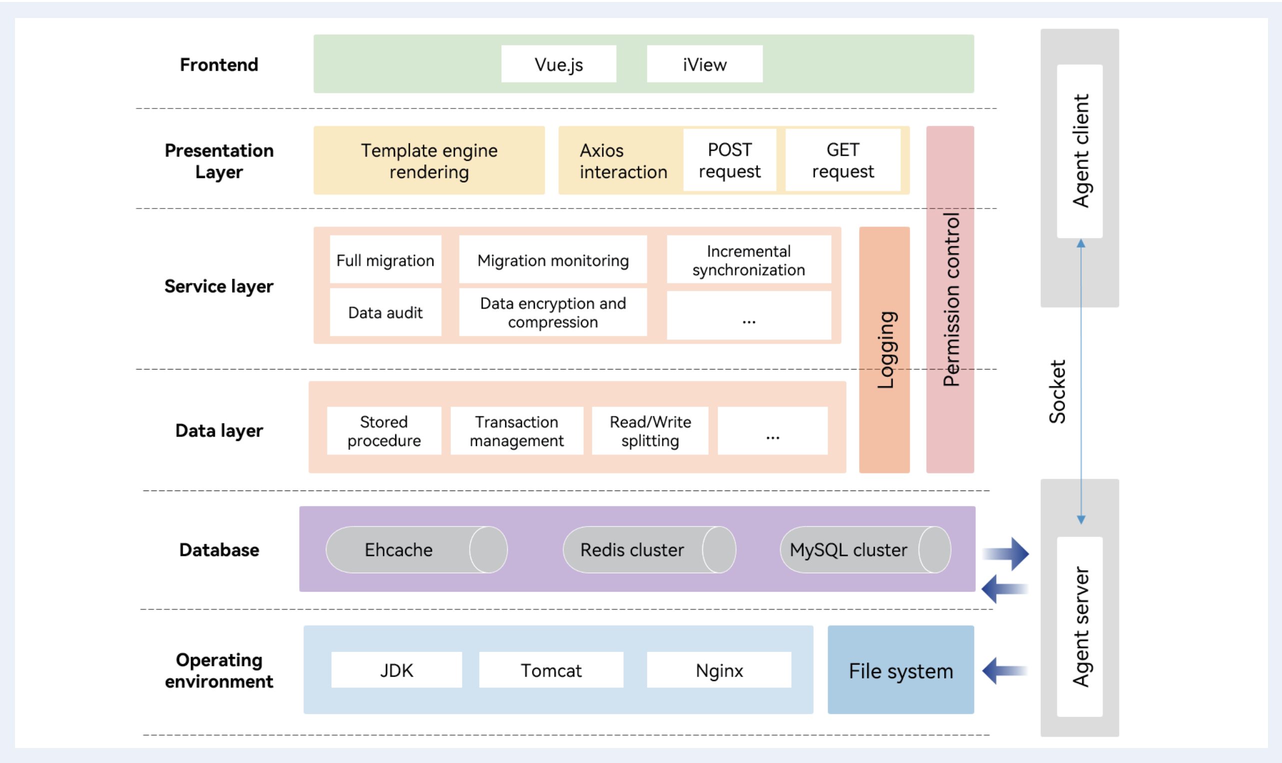
For example, to migrate the host OS of a distributed storage server, the following operations need to be performed.



In this process, the operating system of each Ceph Object Storage Daemon (OSD) service node is changed from CentOS to CTyunOS. The overall migration process does not affect the service structure and performance. Thanks to multi-node load balancing, services are not interrupted during the migration.

3.4.2.2 Cloud-based Applications and Services

An increasing number of enterprises are moving applications and services to the cloud. The eSurfing Cloud migration team focuses on ensuring data security on the cloud and provides full-process migration services for customers with different needs, such as for the public cloud, private cloud, and hybrid cloud. The team uses its self-developed migration tools to help customers achieve smooth cloud service transitions.



• Multiple operating systems: Windows 8 and later 64-bit versions, CentOS, Ubuntu, openEuler, Kylin, and UOS.

• Multiple CPU architectures: x86 and Arm.

• Multiple service types: public cloud, private cloud, dedicated cloud, edge cloud, and hybrid cloud.

• Multiple migration objects: Physical machines, cloud servers, upper-layer systems of cloud servers, and system settings can be packaged and migrated to the pre-configured IT environment.

Cloud Migration Service (CT-CMS) of eSurfing Cloud supports quick migration of applications, middleware, and databases to the cloud. In addition, it provides a set of cloud-based components with high concurrency, scalability, and availability to improve the vitality of localized application systems after they are migrated to the cloud. CT-CMS offers migration solutions with minimum downtime for enterprise customers with cloud migration needs. Moreover, it supports encrypted data transmission to ensure user data security. CT-CMS is compatible with clouds from different vendors. On its visualized interface, customers can use one-click migration to reduce migration difficulties and O&M costs.

4 eSurfing Cloud Actively Contributes to the Upstream Open Source Communities

4.1 Open Source Software Drives eSurfing Cloud Success

To build a diversified computing infrastructure platform, eSurfing Cloud leverages its own independent and secure technologies to create core competitiveness, and utilizes well-known open source software such as infrastructure software OpenStack and Kubernetes and storage software Ceph, which are widely deployed and used in the industry. For example, eSurfing Cloud has developed the TeleCloudOS 3.0 cloud platform based on OpenStack Queens, helping it quickly upgrade the infrastructure and accelerate the implementation of cloud computing production. In addition, Kubernetes is used as the cloud base for orchestrating and deploying OpenStack components to provide alarm monitoring and observability. The continuous evolution and bottom-up technological innovation of the eSurfing Cloud diversified computing infrastructure platform greatly contribute to its success.

4.2 Originating from and Strong Commitment to Open Source

eSurfing Cloud not only uses a wide range of open source software in its products, but it is also an active contributor to the open source software. Since 2017, eSurfing Cloud has been an integral member of the OpenInfra community, contributing more than 40,000 lines of code to the OpenStack project. Additionally, it has played a vital role in the development of core projects such as Neutron and Nova, while also cultivating core developers for projects such as Neutron and Trove. Furthermore, eSurfing Cloud has made substantial contributions to the Linux and QEMU communities, including over 30 commits and over 1000 lines of code, such as the dirty limit feature and fault rectification.

eSurfing Cloud has also taken the initiative to open-source some of its own industrial software. The quality and capabilities of such software is guaranteed though a long period of optimization and fully verified in actual production. In addition to the previously mentioned cve-ease, eSurfing Cloud has also open-sourced CTinspector, which is designed for multi-node O&M and inspection, and has donated it to the openEuler community. Leveraging the eBPF capability and transmission workflow, CTinspector significantly improves inspection efficiency. Additionally, eSurfing Cloud is actively promoting the open-sourcing of GoStone, a Go language version of the OpenStack Keystone component to meet business requirements. GoStone, which has also been donated to the openEuler community, provides basic user information management and authentication and greatly improves feature compatibility and authentication performance.

The aforementioned software projects have been fully open-sourced or are in the process of being open-sourced to the openEuler community, and have been well-received and anticipated by users and partners. We welcome community contributors to work with us in advancing and refining these projects through open collaboration and community building.

4.3 Facilitating the Booming Development of Open Source Software

In recent years, eSurfing Cloud has contributed to the openEuler community and participated in various special interest groups (SIGs), including OpenStack, CloudNative, eBPF, and DPU, to promote the rapid development of openEuler and cultivate numerous maintainers.

For instance, one of the maintainers of OpenStack SIG is from eSurfing Cloud, who together with other contributors, successfully introduced support for OpenStack Queens in openEuler 20.03 LTS SP2. With continuous contributions of eSurfing Cloud, openEuler now supports six mainstream OpenStack versions in eight releases, effectively meeting the needs of openEuler users for cloud infrastructure and receiving widespread acclaim. As a key participant, eSurfing Cloud and the OpenStack SIG worked together to add support for openEuler in the OpenInfra upstream communities. Users can now easily deploy and use the native OpenStack on openEuler, ensuring sustainable performance and quality.

Furthermore, eSurfing Cloud has jointly established the eBPF SIG with community members and taken the lead in contributing to the CTinspector project. In the CloudNative SIG, eSurfing Cloud has maintained version updates of multiple container components and made plans to open-source a Kubernetes-install project that enables one-click adaptation, installation, and configuration of cloud-native infrastructure from compilers and container runtimes to Kubernetes orchestration tools on multiple operating systems. The DPU SIG also has a maintainer from eSurfing Cloud. As a technological leader, eSurfing Cloud has actively participated in the defining of DPU north- and southbound interfaces and the design of DPU OS, and collaborated with OpenStack SIG for the purpose of innovation, thereby promoting the continuous development of OpenStack on openEuler.

In the future, eSurfing Cloud will continue to support and invest in open source software, and actively explore more telecommunications technologies and cloud-native fields. For example, we have been actively learning and applying cutting-edge technologies and ideas from open source projects, such as K3s, Harvester, Rancher, Longhorn in the CNCF community, Kata, Firecracker, StratoVirt in the lightweight virtualization field, and LXC and iSulad in the container infrastructure field, in conjunction with our self-developed technology stack to build a next generation efficient, lightweight, and highly converged cloud platform.

eSurfing Cloud firmly believes that open source software is an essential part of future industrial production and is committed to fostering its sustainable development. By harnessing the collective strength of the community, we will enhance the diversified computing power infrastructure and help eSurfing Cloud move towards a brighter future.

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