

Sangfor Cloud-Edge Collaborative Solution – Transforming Healthcare, Accelerating Smart Hospital Construction with Intel



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深信服科技

"With the growing trends in smart hospital, the healthcare industry is undergoing profound changes, as the traditional Information Technology (IT) architecture can no longer meet the needs to build a hierarchical diagnosis and treatment system, online hospitals, or an epidemic prevention and control system. By integrating the advantages of Intel® Ultra Cloud Client (UCC) in local computing power, compatibility and application experience, Sangfor Medical Hybrid Cloud solution has established an interconnected relationship between local edge cloud and managed cloud, providing medical institutions with a more flexible infrastructure and accelerating their intelligent transformation."

– Yuan Lin

General Manager of Sangfor
Medical BU

Overview

Nowadays, with the rapid construction of smart hospitals, the information architecture of medical institutions is faced with huge challenges, such as increasingly blurred boundaries of medical applications, unprecedented data growth, heavier workloads, and highly intensive application load. The traditional information architecture, which is built and operating separately, and difficult to integrate with infrastructure, has bottlenecks in many aspects like performance, stability, scalability and security. Therefore, it is necessary to have an in-depth rearchitecture. In this context, building a cloud-edge-end collaborative infrastructure has become an important option for medical institutions to empower core services, clinical services, scientific research, external services, desktop clients, etc.

To meet the intelligent transformation needs of medical institutions, Sangfor Technologies Inc. (hereinafter referred to as "Sangfor") has launched a Cloud-Edge-End Collaborative Solution for the healthcare industry based on Intel® technologies. This solution relies on Sangfor Managed Cloud and edge cloud infrastructure, and exploits the advantages of Transparent Client Infrastructure (TCI) and other infrastructures of Intel® Ultra Cloud Client (UCC). It not only enables efficient client management and meets the needs of all healthcare scenarios, but also reduces the total cost of ownership (TCO) of desktop clients and builds a new generation of cloud-edge integrated hospital information infrastructure, empowering the construction of smart hospital.

Challenge: Smart hospital calls for innovative medical information infrastructure

Artificial intelligence (AI), big data, cloud computing, 5G, 3D printing, Internet of Things (IoT), virtual reality (VR)/ augmented reality (AR), cognitive computing, blockchain and other technologies are playing an increasingly important role in diagnosis and treatment, patient services, hospital management and so on. In this context, to optimize the hospital service and management system and promote medical institutions to become "truly smart" from "informatized" is of positive significance for improving healthcare quality and efficiency, optimizing the allocation of medical resources between regions, and improving patients' experience.

In this context, the traditional information architecture of medical institutions is faced with a large number of challenges in cloud, edge and client, which hinder the efficient construction of smart hospital:

● **Difficulty in choosing a cloud solution for medical scenario**

Cloud computing is an important trend of digital transformation. Compared with other industries, the healthcare industry is more sensitive to data security, privacy and concerned about cloud security. Meanwhile, many medical institutions lack the professional ability of selecting and operating cloud solutions, thus requiring a large amount of manpower and material input. In addition, due to the service immediacy demand, it is difficult for hospitals to choose a remote public cloud node as the cloud platform to run related clinical diagnosis and treatment services.

● **Difficulty in fully meeting the low latency and high performance demand of edge scenarios**

AI-assisted diagnostic imaging, medical robot control and some other scenarios have high requirements for latency and performance. However, centralized cloud services are too distant to meet the low delay demand in some scenarios, and bring heavy processing pressure to the cloud platform. With the continuous construction of smart wards, smart logistics and other smart systems, most hospital data are located at the edge, and the data from different IoT sensors and mobile clients require real-time analysis and processing. Therefore, transferring the loads related to machine learning and deep learning to the edge for processing will help achieve the best balance between computing cost and network bandwidth cost.

● **Multiple bottlenecks of traditional desktop clients in management, scalability and cost**

As medical information applications gradually break down boundaries, developing from in-hospital Local Area Network (LAN) to "borderless" multi-hospital-area and Internet diagnosis and treatment, the scenarios like inter-hospital mobile office, Internet hospital, and rapid epidemic prevention and control showed up one after another. Therefore, traditional clients can no longer meet the needs of medical institutions in agility, security and scalability, among others:

- **High failure rate and difficult maintenance of desktop clients:** As the medical information system is constructed in phases, medical institutions often have a large number of desktop clients of different models and configurations, which cost the information department a lot of time in system installation, software updates and security configuration. In addition, these clients may fail often due to delayed maintenance or security attacks, affecting the operation of medical services.
- **Unable to fully meet scenario-based demand:** Different roles in medical institutions, such as doctors, nurses and managers, have different demands in multiple dimensions for desktop clients, while traditional clients can hardly offer personalized application experience for them. For example, in the remote operation and maintenance scenario, a large number of non-hospital operation, maintenance and implementation personnel need to log into the hospital system, but how to control and audit their behaviors and how to manage the system access authority remain a big problem for the hospital information department.

- **High Total Cost of Ownership (TCO) of desktop PCs:** Cost has been a key concern for medical institutions while deploying the desktop client system. Although the purchase price of traditional PCs and virtual desktops is low, they cost a lot in terms of energy consumption, operation, and maintenance, causing high TCO and offsetting the effort of medical institutions in reducing cost for efficiency improvement.

As stated in the *2022 Medical Computer Market Status Report and Sample Survey Report on Computer Demand in Medical Institutions*¹ that among the surveyed medical institutions, the proportion of new PC purchases in hospitals each year accounted for about 10%-19.9%, and the ratio of purchases due to obsolescence vs purchases due to expansion reached 4:1.

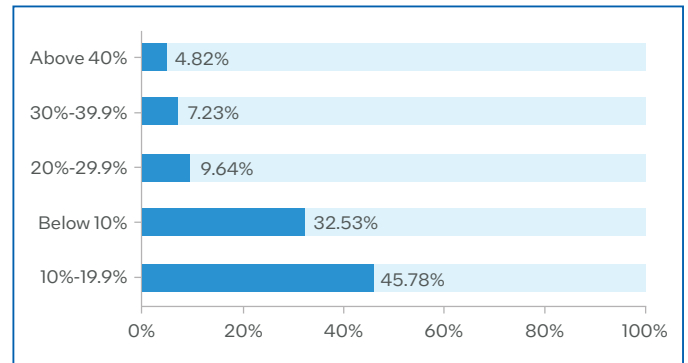


Figure 1. Proportion of new PC purchases in hospitals each year

In addition to the growth of PC purchases, medical institutions gradually raise their requirements for desktops in terms of performance, stability and security, etc. The report also mentions that respondents generally expect dedicated computers for doctors to focus on image display, audio/video features, security and multi-scenario demand in the future. Meanwhile, different medical scenarios have different requirements for desktops. For example, outpatient service, emergency treatment and inpatient department hope that desktops can better support access to medical image files; while Internet diagnosis and treatment needs desktops to better support the functions like AI-assisted diagnostic imaging and one-click sending of remote consultation reports.

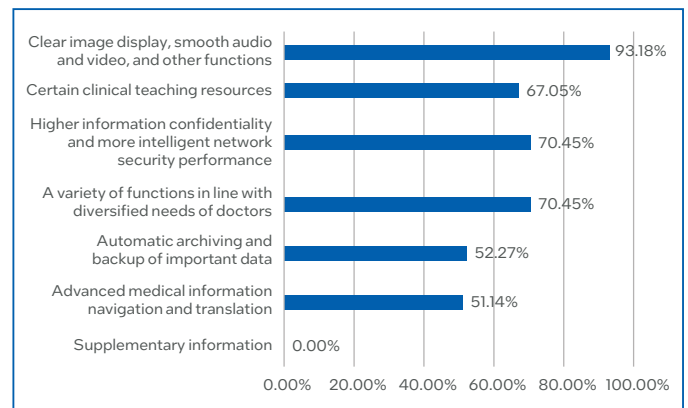


Figure 2. Functions required by dedicated computers for doctors

¹<https://www.hit180.com/60080.html>

Solution: Sangfor Cloud-Edge-End Collaborative Solution based on Intel® technologies empowers medical informatization

Targeting hybrid cloud scenarios of future hospitals, Sangfor Cloud-Edge-End Collaborative Solution builds a multi-level infrastructure covering the managed cloud, edge cloud and desktop clients to achieve unified resource management, platform monitoring and security management, empowering specific scenarios and applications of hybrid cloud. Specifically, Sangfor Managed Cloud carries hospital's external service applications and disaster recovery platform; Sangfor Edge Cloud carries the IoT and logistics services; and the local data center carries clinical core services. For secondary or tertiary hospitals, abandon the original local data center, host all services of the hospital, deploy only the edge cloud, to cache some services and access hotspot data, and use an edge box as a unified management platform for users to log into the cloud. The edge box and the cloud jointly build a unified management platform and an encrypted transmission tunnel for the caching and constant backup of some Picture Archiving Communications System (PACS) data. Cloud desktops serve various scenarios of medical institutions, delivering high performance, unified management, easy operation and maintenance, and low cost.

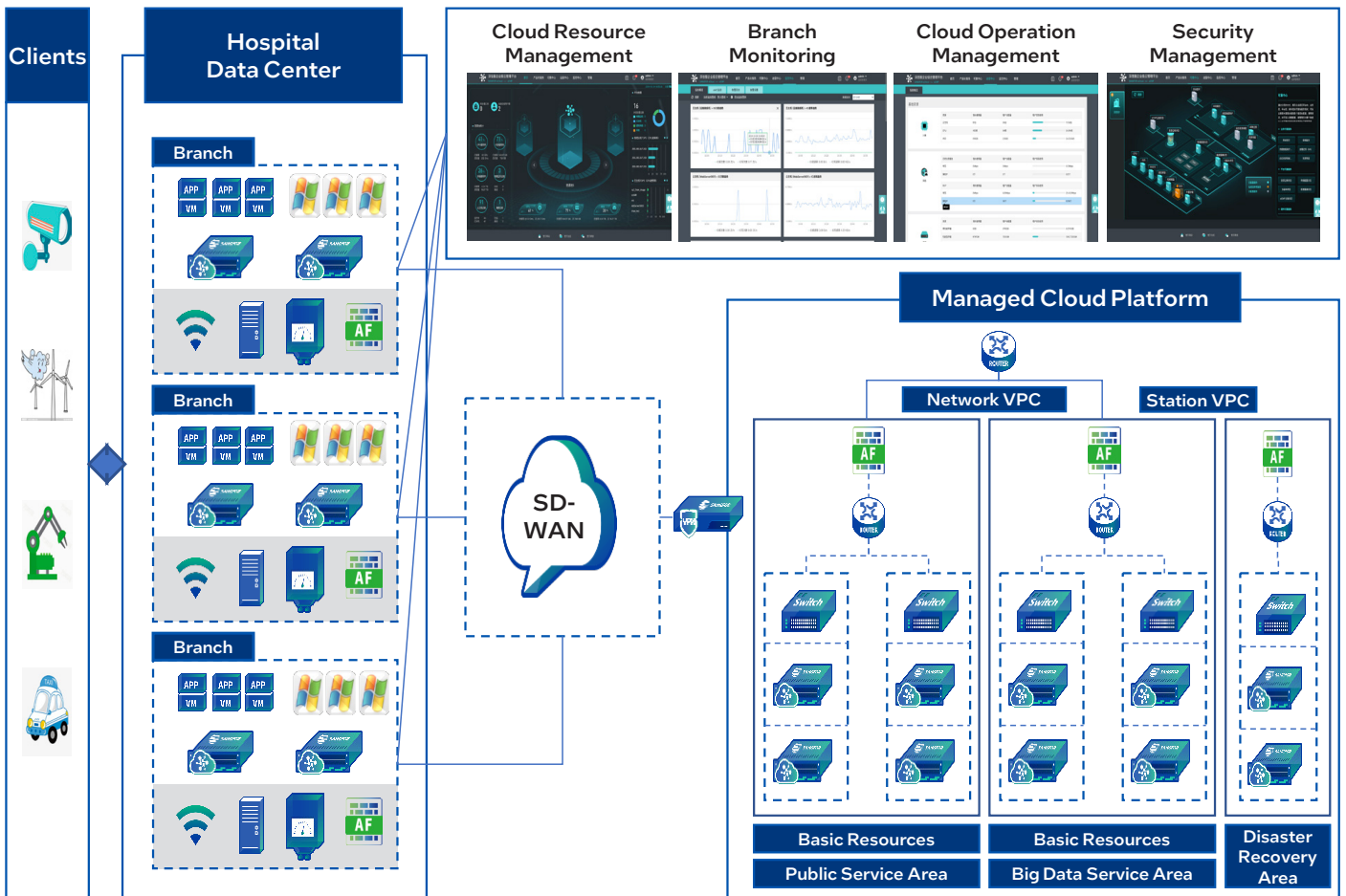


Figure 3. Sangfor Cloud-Edge-End Collaborative Solution for healthcare industry

Cloud: Sangfor Managed Cloud enables efficient cloud deployment

Sangfor Managed Cloud has more than 70 data center nodes all over the country, which provide computing, storage, network, security resources and full lifecycle hosting services, saving medical institutions from complicated selection, construction, operation and maintenance. In addition, with a cloud Data Base Administrator (DBA) expert team and a security expert team, Sangfor Managed Cloud also offers comprehensive attentive services such as database

and security operation, helping medical institutions to reduce cloud deployment burdens.

Sangfor Managed Cloud is equipped with Intel® Xeon® Scalable processors, which not only meet the demanding requirements of digital transformation for data processing performance, but reduce the TCO through automation and resource integration, and improve IT agility and innovation support in the end.

Edge: Sangfor Edge Cloud accelerates intelligent edge computing

Sangfor edge computing system based on Intel® technologies helps extend digital service capabilities to the medical scenarios. It carries PACS, physical examination, hemodialysis and other service systems that need to be connected with medical instruments, ensuring stable experience of storing and retrieving large files online. By optimizing network and link transmission, the edge computing system can also reallocate the workload division among cloud, network and edge to support critical applications that are sensitive to delay. Meanwhile, the edge computing system can enhance the security and manageability of data processing environment, helping users better meet the requirements of data security and privacy protection.

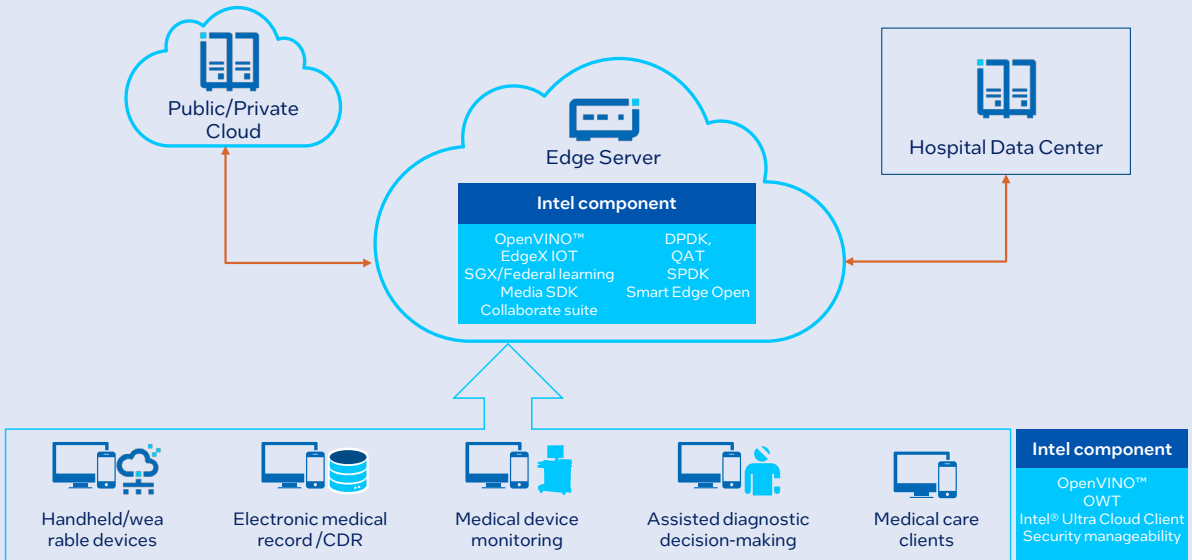


Figure 4. Application of Intel® technologies based SIEP in healthcare industry

At the edge side, Sangfor Edge Cloud provides high/medium/low-end intelligent edge boxes, containerizes edge side applications of customers, and supports the applications with edge Platform as a Service (PaaS capabilities) such as IoT, AI, network and security, making it easier and safer for customers to develop intelligent applications. At the center, Sangfor Edge Cloud also provides a lightweight cloud-end collaborative management platform for edge device management, capability management and customer applications lifecycle management. It can interconnect with customer’s service system and be integrated into the overall solution as a software subsystem.

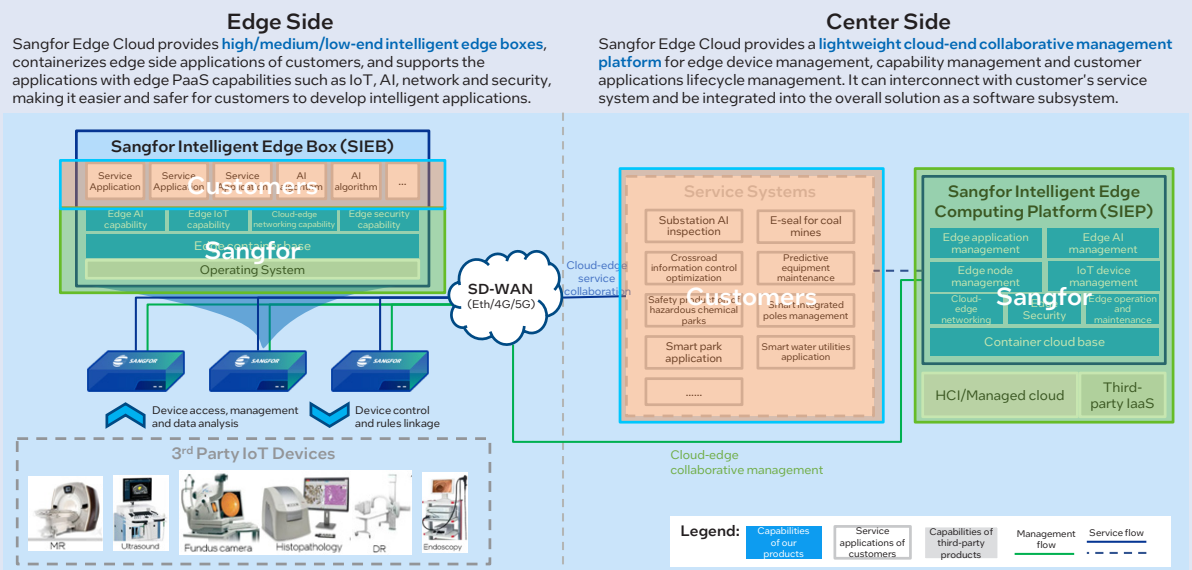


Figure 5. Sangfor Edge Cloud supports cloud-edge collaborative intelligent computing

Sangfor Intelligent Edge Box (SIEB) has off-line autonomy: When the SIEB is disconnected from the center in case of network interruption, the edge nodes will not be dismissed, but continue to serve at the edge, caching data locally; when the network connection recovers, the SIEB will automatically reconnect to the cloud and retransmit data without manual operation. The SIEB has built-in AI computing. Customers can select appropriate algorithms from the algorithm mirror image warehouse of the cloud-end collaborative management platform, and deploy them to the SIEB according to the type of front-end data sources and service demand. Powered by Intel® Xeon® Scalable processors, the SIEB has a range of features for various complex workloads, enabling a cost-

effective, flexible, and scalable edge computing architecture that delivers enhanced per-node performance for critical tasks such as AI and data analytics.

In addition to the SIEB, Sangfor Edge Cloud also supports the edge computing box to handle AI reasoning, device control and other workloads, pushing the IoT capability from the cloud to the edge, thus realizing the access of IoT devices and local data governance. Powered by the Transparent Client Infrastructure (TCI) of the Intel® Ultra Cloud Client, SIEB achieves remote unified management, tapping the full value of intelligent edge computing.

Client: Sangfor Desktop Cloud transforms medical client experience

Based on the medical hybrid cloud infrastructure, Sangfor allows medical institutions to manage clients with desktop cloud in a unified manner. Sangfor Desktop Cloud adopts the converged infrastructure, which gives full play to the advantages of TCI of Intel® Ultra Cloud Client. Based on the converged infrastructure, Sangfor Medical Desktop Cloud solution relies on the edge cloud and Virtual Data Center (VDC) to provide key functions, such as retention of personalized configurations, printer management, monitoring operation, and Virtual Machine (VM) snapshot backup. It supports various types of clients and provides desktop cloud support for upper-layer applications.

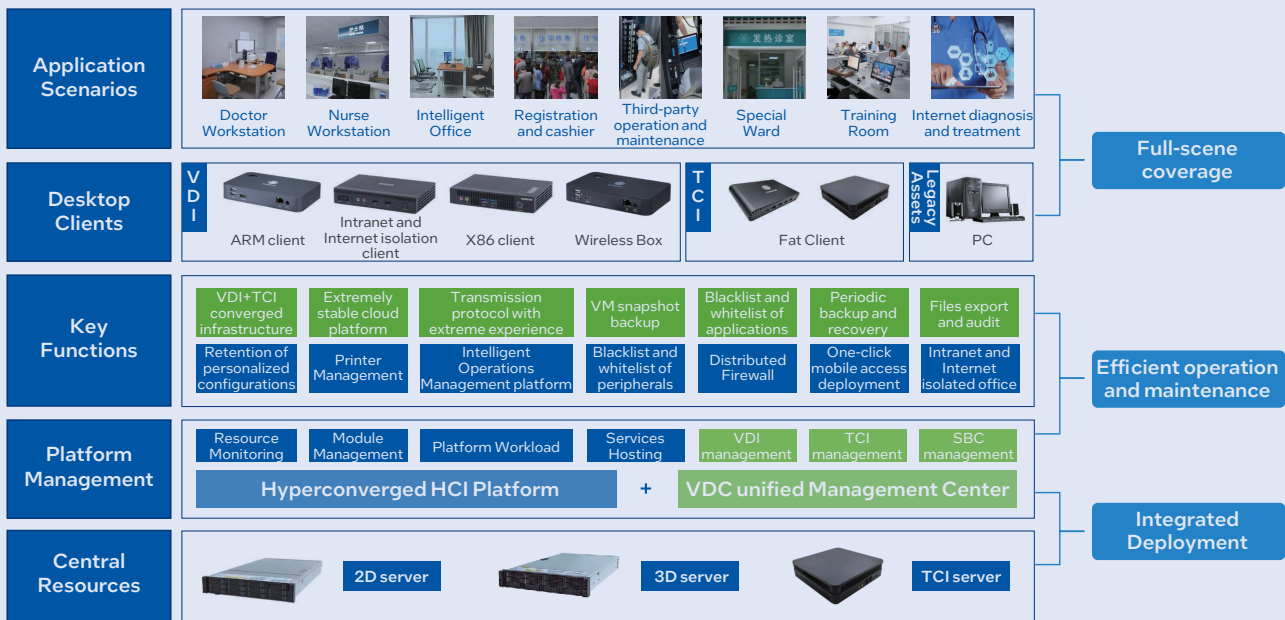


Figure 6. Architecture of Sangfor Medical Desktop Cloud solution

As an important foundation of Sangfor Medical Desktop Cloud solution, Intel® Ultra Cloud Client is composed of TCI and IDV (Intelligent Desktop Virtualization) infrastructures. The TCI infrastructure is a firmware-level pre-boot system management solution without virtualization layer. The client side will be initialized by the server from the bare metal state. At the pre-boot stage, use mirror image of operating system for mass centralized deployment; then boot up the operating system, which is centrally managed by the TCI server. The TCI features personalized account configurations, powerful local computing, flexible centralized management, and excellent compatibility with peripherals.

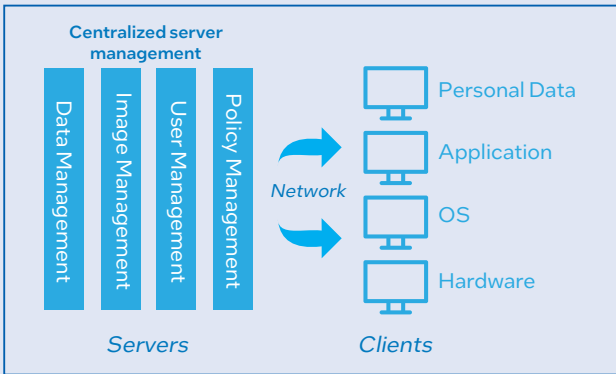


Figure 7. TCI of Intel® Ultra Cloud Client

For medical institutions, the advantage of TCI is the absence of virtualization layer and compatibility with a variety of peripheral interfaces and drivers. Similar to PCs, the TCI supports not only daily office devices like external keyboard, mouse, multi-screen display and printer, but also commonly used medical peripherals such as multi-in-one card reader, queue calling machine, two-dimensional code scanner, high-speed photographic apparatus, receipt printer, and Point of Sale (POS) machine. It is very suitable for medical scenarios like cashier and registration that require peripheral interface test and joint commission.

In addition, it has been years since the informatization of many medical institutions. The old hospital areas of some medical institutions are relatively outdated and need unified management and centralized update of desktop clients. In contrast, with powerful local computing, the TCI has lower dependence on the network. Even in the network environment with insufficient bandwidth and cluttered nodes, it still ensures excellent client experience while delivering centralized release, unified configuration and on-demand update of applications.

Endpoint devices with Intel® Core™ processors inside are recommended for Sangfor Medical Desktop Cloud solution. This series of processors are ideal choices for desktops as they support the demands of different platforms and a wide range of workloads, featuring not only powerful computing, but low power consumption, cost-effectiveness, reliability and security.

Thanks to the flexible architecture and robust scalability, Sangfor Medical Desktop Cloud can customize client solutions for different scenarios of medical institutions:

Doctor workstation

The solution provides a client system according to the characteristics of doctor workstation, including high continuity demand, personalized data and settings, and growing mobile office. The inpatient workstation uses the dedicated desktop mode to ensure personalization to the maximum, while the outpatient workstation uses the recovery mode + Utility Process Manager (UPM) + data redirection to ensure both personalization and the operation and maintenance efficiency.

Nurse workstation

Considering the characteristics of nurse stations like little need of personalized software, a large number of ordinary peripherals, and high continuity demand, the solution provides functions including intelligent shutdown, retention of printer configurations, redirection of user configurations, as well as Universal Serial Bus (USB) control + distributed firewall protection, so as to solve customers' pain points.

Functional office

Addressing the characteristics of functional office scenario, such as more personalized software needs, less peripherals, frequent mobile storage needs, and concurrent internal and external networking, the solution provides functions including dual network office, security linkage, and intelligence operation and maintenance, helping to improve office efficiency and reduce security risks.

Registration and cashier

Focusing on the characteristics of registration and cashier scenario, such as little personalized need, heavy workloads, and high compatibility requirement of peripherals, the solution provides uninterrupted updates, in which the virtual machine service is not interrupted during updates, so as to ensure service continuity. The solution is also compatible with more than 300 types of commonly used medical peripherals to improve compatibility.

Internet diagnosis and treatment

Targeting the characteristics of Internet diagnosis and treatment, such as a wide variety of endpoint devices, relatively less complicated functions than in-hospital devices, and high security protection demand, the solution provides a lightweight access architecture and supports zero trust single sign-on (SSO) to secure data transmission, improving data security without changing user habits.

Remote operation and maintenance

The desktop cloud combining with Sangfor zero trust SSO solves the security control problem arising from the login of a large number of third-party personnel to the hospital service system. The zero trust SSO dynamically controls the authority and behaviors of remote personnel, while the desktop cloud infrastructure prevents data from local storage, thus avoiding illegal behaviors of stealing hospital data through remote login.

Result: Become smart hospitals with high-quality development

Sangfor Cloud-Edge-End Collaborative Solution for Healthcare Industry based on Intel® infrastructure can bring the following benefits to medical institutions:

Efficient convergence of cloud, edge and end

- The solution can help medical institutions establish a highly efficient coordination architecture from the cloud to the edge and the end. Integrating the advantages of cloud computing in agility and scalability and the merits of edge computing in timely data processing and local data protection, the solution helps build a high-performance and robust information environment.

Reduce operation and maintenance burdens of medical institutions

- Sangfor provides medical institutions with managed cloud capability and professional service support, allowing them to effectively cope with various challenges of operation and maintenance management without a large-scale IT team. Thanks to desktop cloud, IT administrators can troubleshoot, restore, and debug all desktops by simply logging into the desktop cloud console, thereby greatly shortening the troubleshooting time.

Excellent foundation platform for innovative applications like AI

- The solution can realize cloud-edge collaborative intelligent edge computing. The software-defined edge intelligence brings AI to each service scene instantly and pushes the IoT capability of cloud to the edge for device access and local data governance.

Flexible security control improves data security

- The solution builds security capabilities from cloud to edge and end, providing medical institutions with host security, antivirus, and classified protection of information security, etc. It also designs a whole lifecycle data protection mechanism for all service links, including online deployment, access control, operation and maintenance, and data storage, transmission and use, in order to create a higher security baseline and more effective protection for medical institutions.

Fully meet the client application demand of various medical scenarios

- Sangfor Medical Desktop Cloud provides targeted client support for various scenarios, including registration and cashier, doctor workstation, nurse workstation, functional office, and Internet diagnosis and treatment, meeting service needs while maintaining a good user experience. Powered by the TCI of Intel® Ultra Cloud Client, Sangfor Medical Desktop Cloud can fully release the performance potential of local clients, achieve the compatibility and experience comparable to that of PCs while retaining unified management capability of the cloud. And its performance will not be affected by poor network conditions.

Lower TCO

- Compared with the traditional solution, Sangfor Cloud-Edge-End Collaborative Solution for Healthcare Industry features higher cost-effectiveness by reducing the cost of construction, operation and maintenance, and energy consumption.

Outlook

With increasing application of new digital technologies like cloud computing, AI and 5G, medical institutions now stand at a crucial juncture of a new round of transformation. Important demands include promoting IT infrastructure transformation, and considering medical information protection, management efficiency and daily office experience. Sangfor Cloud-Edge-End Collaborative Solution for Healthcare Industry has realized cloud-edge collaborative intelligent edge computing, which creates intelligent solutions according to the specific needs of different service scenarios inside/outside the hospital, and provides users with an efficient, convenient and secure smart hospital environment.

Intel Corporation continues to work with Sangfor to fully tap the application potential of Intel® technologies, promote the innovation in solutions including medical desktop cloud and edge cloud, and realize comprehensive integration and optimization from front end to back end and from software to hardware. In addition, the two companies will further cooperate in cloud platform construction and some other fields, explore new medical models in the future, help medical institutions expand healthcare scope and influence, and provide patients with higher-quality and more accessible medical resources and services.

About Sangfor

Sangfor Technologies Inc. is a product and service vendor specializing in enterprise network security, cloud computing, IT infrastructure, and IoT. With two service brands, Sangfor Security and Sangfor Cloud, and one subsidiary Sundray Technology, Sangfor is committed to the cornerstone work of digital transformation for customers from all walks of life, making digitization easier and securer for every user. Adhering to the concept of "continuous innovation", Sangfor always attaches great importance to R&D and innovation, and makes every effort to create convenient products, thus receives widely recognition from the market. At present, Sangfor has more than 100,000 enterprise users.

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