



Huawei's Smart Hospital Solutions





Foreword

The 21 century has seen a fast population growth, an increasingly aging society, and frequent natural disasters. In a deteriorating ecological environment, people are more aware of their health and have higher requirements for the healthcare insurance system. Hospitals need to leverage information and communications technology (ICT) to improve their operational and management efficiency and lower their operating costs to ensure people's health while contributing to sustainable social development.

Huawei is a leading global ICT solutions provider. Based on its rich experience in serving the healthcare industry, Huawei has launched a series of successful solutions, such as "Smart Hospital", "Regional Healthcare", and "Remote Healthcare", which have effectively facilitated the IT-based development of the global healthcare industry.

The "Smart Hospital" solutions cover hospital management, IT-based clinical treatment, and construction of medical infrastructure including networks and data centers. To fit in with different application scenarios of hospitals, Huawei has built an integrated information platform based on electronic medical records (EMR). With this platform, Huawei provides specific solutions in order to build "smart hospitals" and benefit the healthcare industry. The "Smart Hospital" solution series include the Mobile Healthcare Solution, Remote Healthcare Solution, IT-based Development Solution for Primary Medical Care Institutions, Chronic Illness Management Solution, and Integrated Healthcare Cloud Solution. In addition, we open the application programming interface (API) of the platform to our partners to jointly enrich innovative services for the medical industry.

Huawei's "Smart Hospital" solutions effectively lower operating costs for hospitals, reduce medical accidents, facilitate managers' supervisory efforts, and improve patients' service experience. These solutions also help hospitals build a paper-free, PPT slide-free, and wireless office environment with less energy consumption.

Hospitals' Demands for and Challenges in IT-based Development



In the past two decades, hospitals experienced an IT-based development process. At the early stage, the development was focused on administrative management and then on doctors' diagnosis. Now digital hospitals focus their development on how to better serve patients. "Smart Hospitals" are based on digital hospitals and require a number of new medical applications to serve patients, such as network services, mobile healthcare, remote healthcare, and health management. However, the application of new services has caused numerous obstacles to hospitals on their way to IT-based development.

- Each hospital has a number of important information systems that are independent from and incompatible with each other, such as the outpatient, inpatient, examination, scientific research, office, and other systems. The coexistence of so many independent systems makes communication, collaboration, and unified management a difficult task. Hospitals need to consolidate their healthcare information systems to have a comprehensive and clear picture of their operating status.
- Hospitals also need to manage their information resources in a unified manner to achieve their comprehensive operating goals, including efficient utilization of resources, deployment of new services, energy conservation, security control, and cost reduction.
- Primary medical care institutions are short of IT support, so it is difficult for them to provide medical services of the same quality to the public.
- Health management for chronic illness sufferers outside hospitals is difficult and needs to be conducted in communities and households.
- Medical resources are densely located in large hospitals in big cities. The distribution of medical resources is unbalanced.

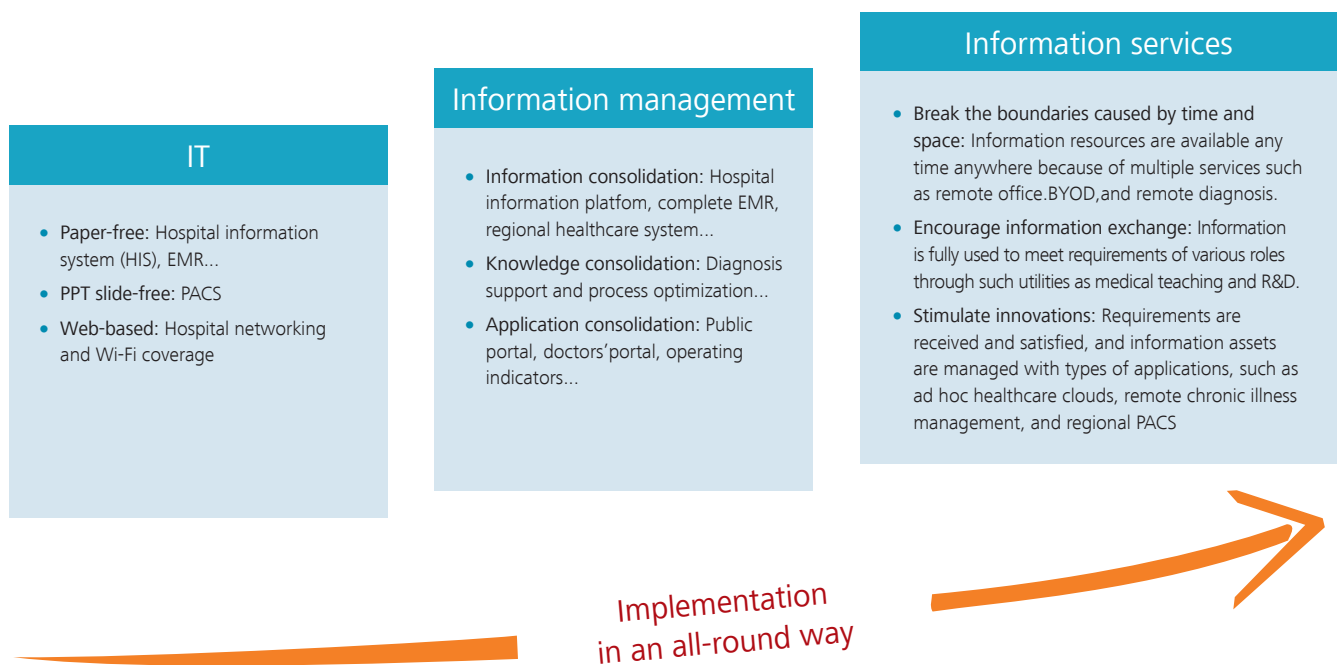


Figure 2-1 Three stages in the IT-based development process of hospitals

To fit in with the modern and IT-based development of hospitals, the "Smart Hospital" solutions need to resolve problems in the following three aspects:

First, IT-based medical services: Build a Web-based, paper-free, and PPT slide-free office;

Second, management of information resources: Consolidate information and applications to take advantage of IT;

Third, service orientation: Stimulate demands for IT-based development, break the boundaries caused by time and space, fully exchange and share information, and strive for continuous innovation.

Huawei's Smart Hospital Solutions



IT development plays an increasingly important role in operations of modern hospitals which need to better leverage IT to achieve communication collaboration, service coverage, and resource consolidation. After thoroughly analyzing the medical industry's needs for IT-based development, Huawei has launched the "Smart Hospital" solutions to facilitate exchange of medical information resources. All healthcare subsystems are converged based on EMR.

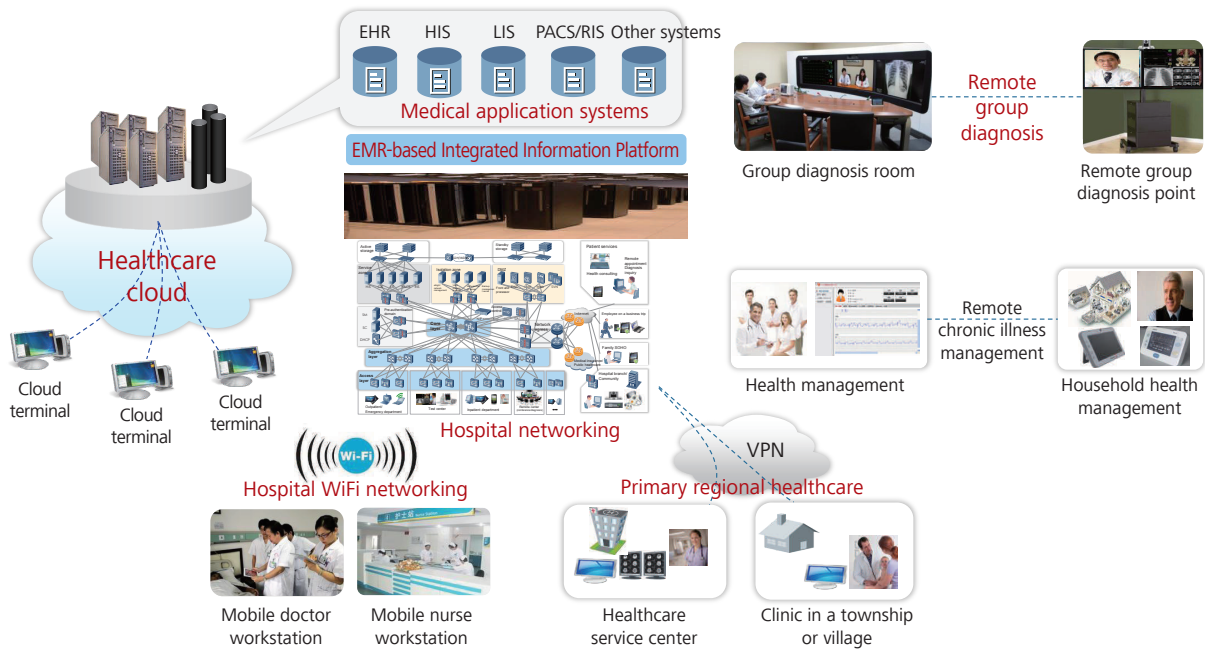


Figure 3-1 Overview of Huawei's "Smart Hospital" solutions

Three highlights of Huawei's "Smart Hospital" solutions:

Extended coverage of IT-based medical services

In addition to ensuring traditional hospital management and IT-based clinical treatment, Huawei's "Smart Hospital" solutions also support abundant medical services, such as mobile healthcare, remote healthcare, chronic illness management, and healthcare cloud.

Consolidated and optimized medical services

The healthcare cloud enables hospitals to optimize and reuse information resources, expand capacity elastically, conduct security controls, and operate with less energy consumption. It also helps hospitals build an EMR-based integrated information platform to collaborate on and optimize medical service processes.

Open and cooperative solutions

The open and converged platform allows Huawei to cooperate with various IT-based medical applications providers to maximize the utilities of these applications.

EMR-based Integrated Information Platform Solution



Application Scenario

Hospitals are patient-centric during their IT-based development process, which requires that the information resource sharing platforms of hospitals be based on EMR. Hospitals need to efficiently apply information resources to clinical treatment and operational management by conducting medical and management services surrounding EMR.

Requirement analysis:

- Establish an enterprise master patient index (EMPI).
- Connect all information systems of a hospital.
- Create complete EMR for every patient.
- Reuse information resources of hospitals.
- Build a basic public health service platform.
- Ensure interconnection with external systems.

Solution Overview

Huawei has built an integrated information platform which collects, stores, and collectively manages EMR information, and is connected with the clinical information system and the management information system. With this platform, hospitals can share information resources internally and remain connected with external systems throughout the clinical treatment process.

Highlights of the Solution

- Focuses on patients and consolidates information resources.
- Provides effective support for doctors to make clinical decisions.
- Helps hospitals' administrative management departments make decisions on operational management.
- Achieves efficient regional medical collaboration based on information exchanges and sharing.



EMR-based integrated information platform of a hospital

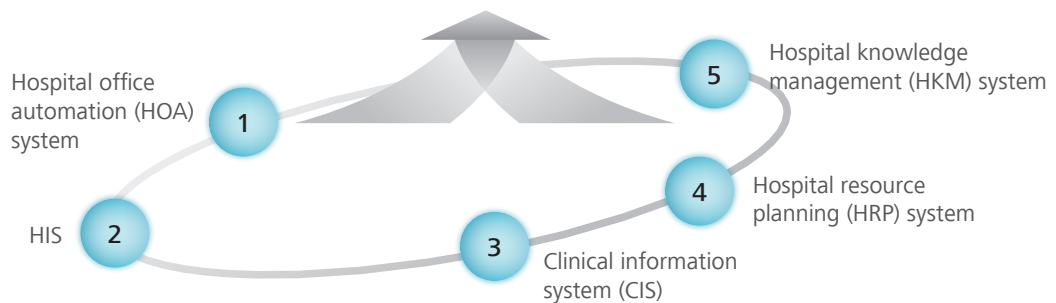


Figure 4-1 Overview of the EMR-based Integrated Information Platform Solution

Network Security Solution



Application Scenario

In the course of IT-based development, hospitals need to build a network system that converges with medical services to support their major activities, such as EMR management, mobile ward round, operation recording, and medical data collection, thereby providing better services for medical staff and patients.

Requirement analysis:

- Healthcare networks carry important data that relates to people's life and health, so the networks must transmit data stably and reliably.
- Medical data is sensitive because it is usually about medical safety, service charges, as well as patients' privacy. Therefore, medical data needs to be strictly protected in the network.
- Medical images have a large size and need to be promptly transmitted to doctors to make efficient diagnosis, which requires the network to provide high-speed storage and access to medical images.
- Medical staff work by shuttling between different locations within a hospital, and they usually go the rounds of the wards. Therefore, mobile network access is required to improve medical care efficiency.

Solution Overview

Huawei provides the integrated digital hospital network solution that enables optimal collaboration among medical staff, medical service processes, software applications, and hardware components. Functional zones are efficiently interconnected while certain sections are isolated for security purposes.

Each element of the solution, including its architecture and technologies, adopts a professional reliability design to ensure that the network has a high reliability of 99.999%. In addition, the solution adopts an all-round medical security design which covers every activity, such as border defense, virus scanning, access control, and remote access.

Highlights of the Solution

- Rapid fault detection and service switchover technologies provide a highly reliable network which ensures service continuity.
- Multiple security measures, such as firewalls, virus scanning, access authentication, and virtual isolation, ensure that the network is free from internal and external attacks.
- GE desktop access and 10GE backbone network contribute to an uninterrupted service experience.
- Secure and green wireless network coverage of an entire hospital enables the hospital to promptly deliver its medical care services to patients on the sickbeds.

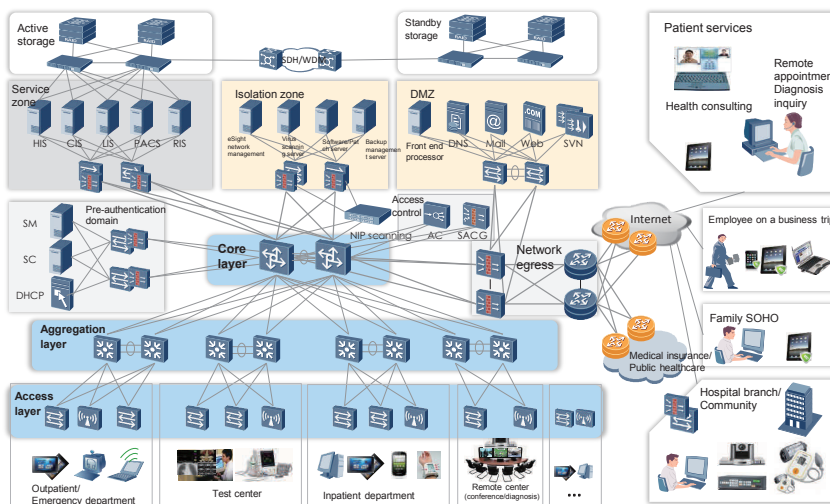


Figure 5-1 Overview of the Network Security Solution

Mobile Healthcare Solution



Application Scenario

As the wireless local area network (WLAN) technologies are increasingly mature and hospitals are on their way to IT-based development, use of WLAN has become a trend for hospitals.

Requirement analysis:

- Medical data needs to be strictly protected, and patient data cannot be stolen.
- The wireless network system may interfere with medical devices and have radiation that affects people's health.
- A stable network system is a basic guarantee for normal service operations of hospitals.
- The network must have a very low latency.

Solution Overview

The Huawei Mobile Healthcare Solution enables wireless access from laptops, personal digital assistants (PDAs), pads, wireless illness trackers, and other devices to the wireless network to support medical staff's activities, such as wireless ward round, assets management, personnel tracking, and online inquiry. With this wireless network, hospitals break space boundaries and can provide ubiquitous medical services for patients, thus improving the work efficiency of medical staff.

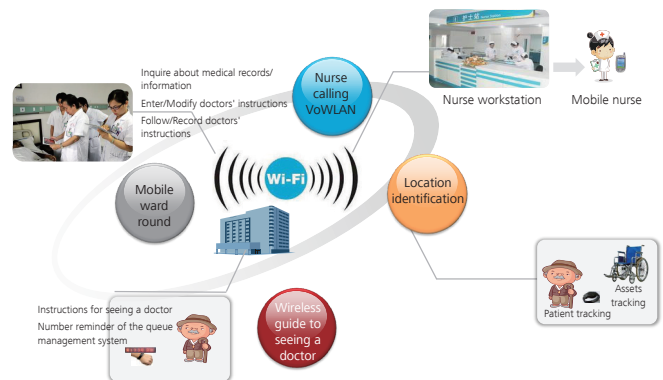


Figure 6-1 Application scenarios of the Mobile Healthcare Solution

Highlights of the Solution

- Ubiquitous: The solution provides coverage of an entire hospital, supports automatic channel, rate, and power adjustments, and enables multiple types of devices to access the network.
- Green: The professional test results show that the wireless signals have no interference in medical devices and no impact on human health.
- Secure: The solution supports mainstream authentication and encryption methods, such as the Wi-Fi Protected Access (WPA), WPA 2, and WLAN Authentication and Privacy Infrastructure (WAPI). It also supports wireless intrusion detection. Users are authenticated using Portal and 802.1x technologies to ensure Intranet security.
- High-bandwidth: The solution supports the 802.11n protocol and dual-frequency bands. The wireless access bandwidth reaches up to 300 Mbps. The solution also supports wireless roaming and multiple wireless quality of service (QoS) protocols like Wi-Fi Multimedia (WMM) to ensure service quality.
- Easy to deploy: The solution supports plug-and-play (PnP), automatic upgrade, and automatic channel selection for access points (APs), dynamic adjustments of equipment rate and power, and load balancing.

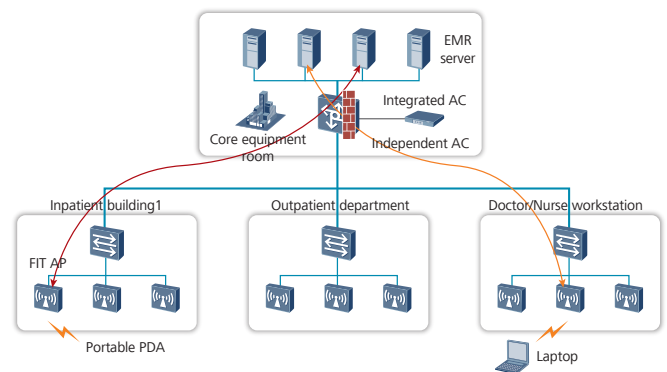


Figure 6-2 Network architecture of the Huawei Mobile Healthcare Solution

IT-based Development Solution for Primary Medical Care Institutions



Application Scenario

Primary medical care institutions have a weak foundation for IT-based development and need to be connected to regional health information platforms. To avoid building multiple grassroots healthcare information systems one by one, improve building efficiency, unify the management of medical service processes of primary medical care institutions within a region, and support collaboration on medical resources within the region, the information platform of primary medical care institutions must be built at low costs and can be easily accessed.

Requirement analysis:

- Small hospitals, health service centers, clinics in villages and townships, and community hospitals currently need to build their own 5S information systems, including hospital information system (HIS), laboratory information system (LIS), clinical information system (CIS), picture archiving and communication system (PACS), and radiology information system (RIS). The operation and maintenance (O&M) costs are high.
- Primary medical care institutions are scattered and isolated from each other in terms of information exchange. Resources can hardly be shared among them, and medical images cannot be backed up for a long time.
- Regional grassroots healthcare information systems are isolated from each other and fail to provide support for making public health decisions.

Solution Overview

The Huawei IT-based Development Solution for Primary Medical care institutions adopts cloud computing, browser, and server technologies, and supports centralized deployment of the 5S systems of the information platform of primary medical care institutions. Primary medical care institutions who rent the system access the network in a unified manner. As a result, they achieve IT-based development at low costs without maintaining the systems. In addition, network capacity can be expanded online for storage, desktop cloud, unified management, and uninterrupted services through cloud-based deployment of the information systems of primary medical care institutions. Multiple access methods are also provided in different network environments to ensure secure and uninterrupted access.

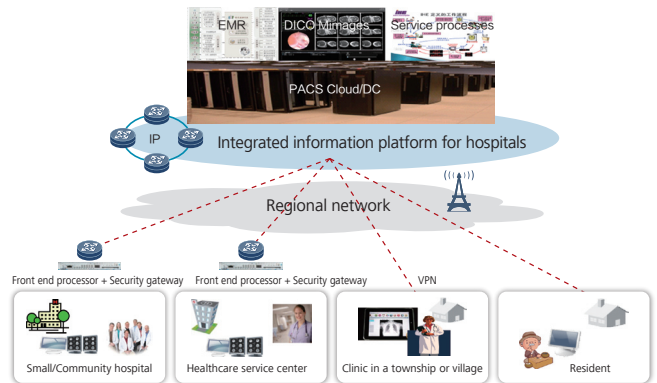


Figure 7-1 Application scenarios of the Huawei IT-based Development Solution for Primary Medical Care Institutions

Highlights of the Solution

- Primary medical care institutions need to deploy only access terminals. With the leased platform software and storage, these organizations do not need to build, deploy, or maintain the 5S systems, thus reducing their total cost of ownership (TCO).
- Medical organizations are connected to the regional healthcare platform through cloud and network technologies. A centralized basic health system is established within a region to unify medical processes, personnel management, logistics management, financial management, communications, and O&M. The unified platform improves system building efficiency, facilitates sharing of information resources within a region, and enhances collaboration on medical resources.
- The costs of managing each TB of data are reduced by 40% because cloud-based and centralized data management, disaster recovery, and backup provide higher security. The IP storage area network (SAN) architecture is highly reliable and enables centralized management, storage, geographical/hierarchical backup, and software running, which makes information search and query more convenient.

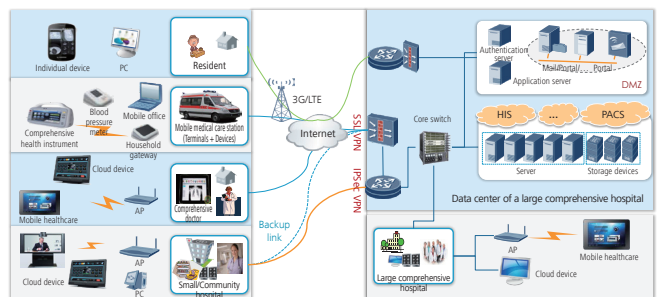


Figure 7-2 Overview of the Huawei IT-based Development Solution for Primary Medical Care Institutions

Remote Healthcare Solution



Application Scenario

The distribution of medical resources is unbalanced across regions. People living in small townships and villages far away from large hospitals feel increasingly difficult to see a doctor. A remote healthcare platform can break the space boundaries and realize remote medical treatment, training, and medical information services. It also resolves patients' difficulties caused by the unbalanced distribution of medical resources and makes quality medical resources accessible to all people.

Requirement analysis:

- The distribution of medical resources is unbalanced, and people's requirements for conveniently accessing medical resources should be satisfied.
- Small hospitals and hospitals in remote areas have limited resources and are unable to provide appropriate medical services to patients in time.
- Doctors have to spend a long time and travel a long journey to treat patients in remote areas, and usually charge high prices. If patients in remote areas go to see a doctor in large hospitals, they also face high expenses and travel a long journey.
- Emergencies must be responded to immediately.
- Medical resources must be transported to emergency sites in time.
- Professional doctors' guidance on first-aid before hospitalization is needed; hospitals cannot be fully informed about injuries or illnesses of a patient.

Solution Overview

The Huawei Remote Healthcare Solution combines modern multimedia network technologies with traditional medical technologies and allows doctors and patients far away from each other to communicate "face to face". The remote diagnosis system and the EMR information system are interconnected, so doctors can view patient information at any time. This gives strong technical support for remote diagnosis.

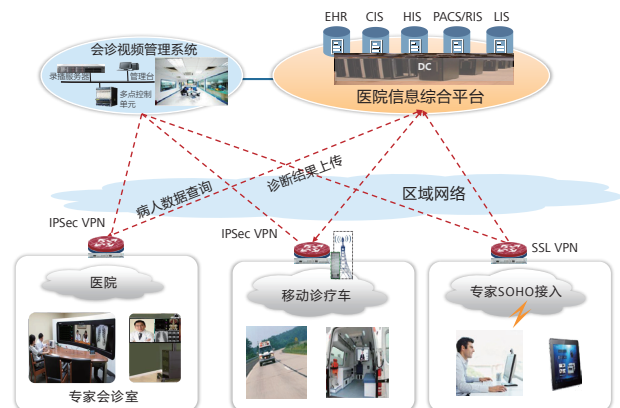


Figure 8-1 Application scenarios of the Huawei Remote Healthcare Solution

Highlights of the Solution

- The solution provides high-definition (HD) and standard-definition (SD) video display modes. If the network bandwidth is more than 1 Mbps, a resolution of 1920 × 1080P is supported and HD videos are displayed at a frame rate of 30 frames per second, which provides doctors with clear and accurate videos.
- The solution provides doctors and patients with high-fidelity on-site experience. Images are displayed on at most three screens, so persons involved in the group diagnosis do not need to switch screens. They can even identify each other's location by hearing from each other. The solution enables real-time recording of the diagnosis process.
- The solution incorporates a complete patient information system, so doctors can view patients' EMR at any time.

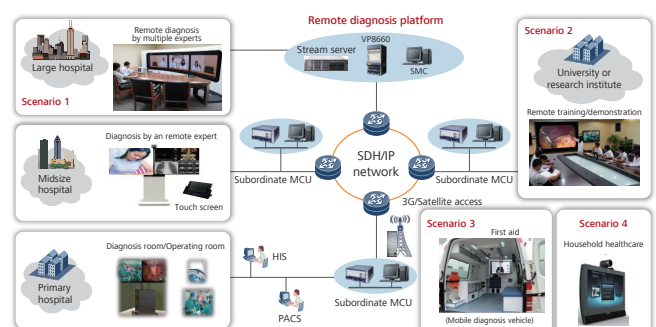


Figure 8-2 Overview of the Huawei Remote Healthcare Solution

Chronic Illness Management Solution



Application Scenario

Currently, one third of the countries and regions around the world have come to an aging society, and approximately 80% of senior citizens suffer from at least one chronic illness. How to prevent and manage chronic illnesses has become a social issue.

Requirement analysis:

- Households need to monitor members' health indicators and avoid doing this in hospitals, because processes in hospitals are complex and time-consuming.
- Different groups of people need to conveniently access diversified medical terminals.
- The existing medical resources should be efficiently leveraged to diversify medical services and simplify service deployment.
- Healthcare networks need to be connected across regions throughout the country to comprehensively leverage social healthcare resources.

Solution Overview

The Huawei Chronic Illness Management Solution incorporates a complete resident electronic health records (EHR) and health service platform which enables residents to regularly monitor and upload their blood pressure, blood oxygen, body temperature, and other physiological parameters. Health service teams analyze these parameters, conduct diagnosis, and give health instructions via voice, video, or SMS. All of these measures constitute an optimal way of managing chronic illnesses.

Highlights of the Solution

- Chronic illness (such as high blood pressure, heart diseases, and diabetes) sufferers are frequently examined in order to identify health risks in time and give them necessary instructions to ensure residents' health.
- Remote health management services are provided for households to satisfy high-end health management requirements.
- Universal chronic illness management services are provided for communities. Such services include identity identification, personal EHR inquiry, self-measurement of physiological parameters, and remote consulting.

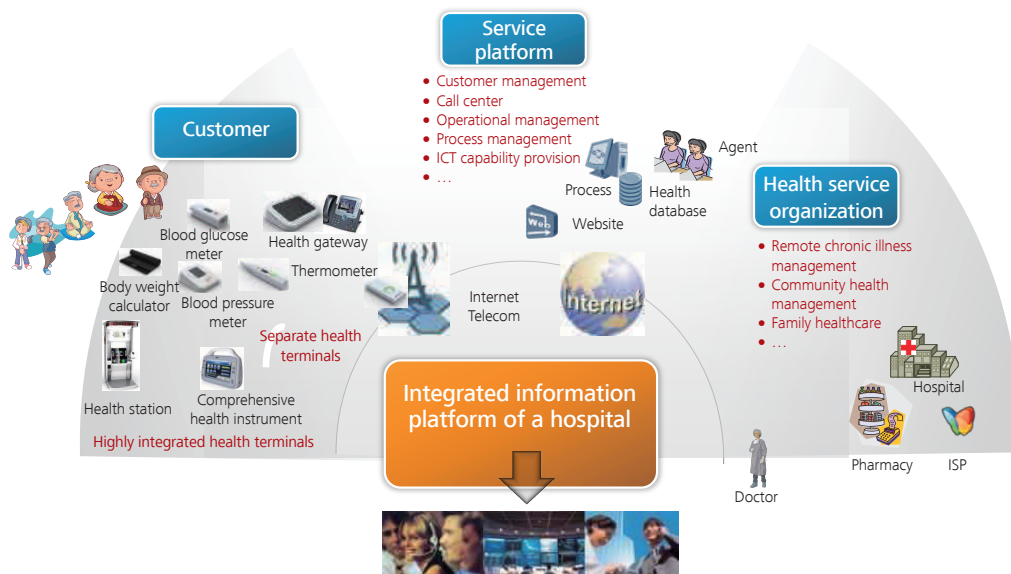


Figure 9-1 Overview of the Huawei Chronic Illness Management Solution

Success Story

Huawei Health Cloud in Shibe Hospital in the Zhabei District of Shanghai



As citizens' demand for public healthcare and basic medical services increase rapidly, the Zhabei District of Shanghai was in urgent need of an improved IT-based system to eliminate the "technical silos", "service silos", and "information silos" inside and among medical care institutions. The Zhabei District aimed to share medical resources and services within the district and promote development of local healthcare services in a centralized manner.

To eliminate "information silos" and share medical resources, data standardization is an important part in building the regional healthcare platform. The traditional IT architecture is unable to support service expansion, client increase, higher computing capacity, larger storage capacity, higher network security, and convenient network O&M. Therefore, the Zhabei Health Bureau faced multiple difficulties in building the health cloud platform.

- There is no holistic planning, resulting in inefficient healthcare information exchange and sharing between different systems and regions.
- The IT systems are inelastic and difficult to expand. As a result, they cannot adapt to the ever-changing service demands (for example, data growth and new service rollout).
- It is difficult to maintain and manage data centers, which involve heavy maintenance workload and high IT costs.

As such, the Zhabei Health Bureau wanted to construct a health cloud platform and pilot the phase 1 construction in Shanghai Shibe Hospital.

Huawei constructed a customized health cloud platform for the Zhabei Health Bureau. The entire platform was constructed in three stages. The first stage centered on deploying data centers in Shibe Hospital. We started from infrastructure-as-a-service (IaaS) and built a healthcare cloud and a community health cloud using virtualization and desktop cloud. During the second stage, we constructed a regional health data center and incorporated various subordinate health bureaus and CDCs into the regional health cloud to realize unified data exchange. At the last stage, we provided application services like health monitoring by using the regional health cloud and achieved healthcare service collaboration by creating an integrated health cloud.

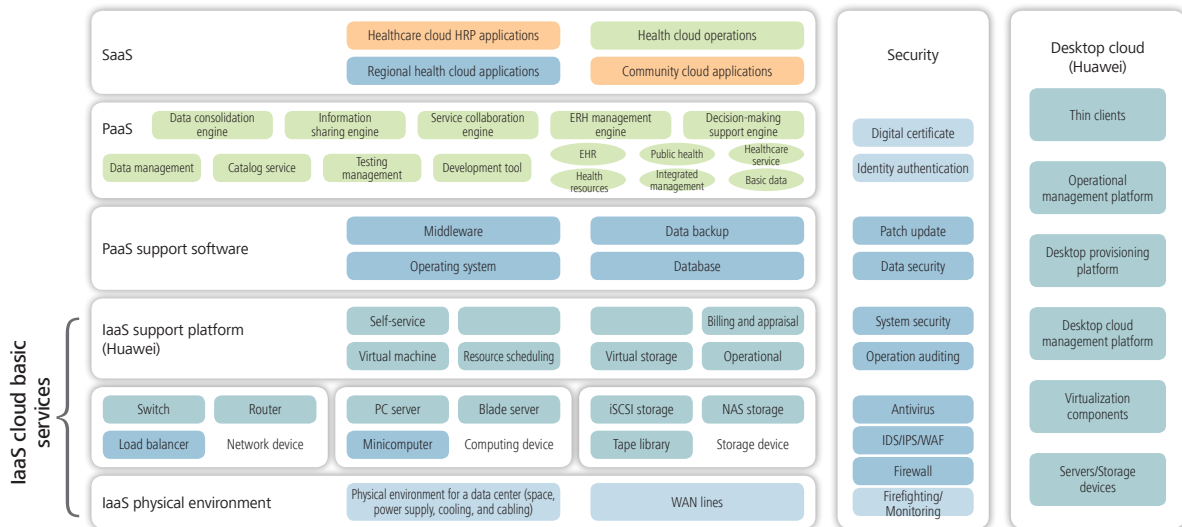


Figure 10-1 Architecture of Huawei's Health Cloud Solution for hospitals of the Zhabei District in Shanghai



During the phase 1 construction project piloted in Shibe Hospital, Huawei ensured resource sharing among different healthcare information systems of this hospital by virtualizing resources and incorporating service systems into the cloud. Management of the hospital and work efficiency of doctors are both improved. In addition, information systems of all hospitals under the jurisdiction of the Zhabei Health Bureau are operated by the cloud data center in a centralized manner to improve O&M efficiency. Thanks to centralized application deployment supported by cloud computing technology, the number of servers for the entire healthcare platform is reduced by 76%, basic software by 75%, and annual power consumption by 47%. Storage resources are pooled, and the storage size is reduced by 40%.



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