Taiwan-based Taichung Veterans General Hospital (VGH) was established in 1982 with the aim to provide comprehensive integrated medical healthcare services. By leveraging advanced technologies, cutting-edge medical research, and the unparalleled expertise of its professional medical team, VGH has made a name for itself as a first-class medical center delivering high-quality and patient-centric healthcare services. It has also built a reputation as a Class A teaching hospital, providing a solid training ground for high-quality medical education teaching and outstanding research and development. In line with its continuous efforts to harness the latest technologies, VGH sought to develop a Hospital Information System (HIS) cloud based on Intel® technologies to take advantage of an open-source cloud platform and software-defined storage (SDS) solution that will enhance utilization rate and flexibility of its resource allocation while reducing management burden and optimizing operation costs.

CHALLENGES

- **Improve daily management of IT infrastructure.** Ease routine management of servers which run up to 1,200 different types of applications to allow IT personnel to oversee work for new system testing and development.
- **Resolve data storage and backup issues.** Enable automation of storage space efficiency to cater to the specific needs of virtual machines.
- **Lower operation costs.** Centralize IT operations to cover management of IT systems in all VGH branches in Taichung, Wanqiao Puli, and Chiayi to reduce operation and maintenance costs as well as to optimize all IT resources.

SOLUTIONS

- **Migrate IT Infrastructure to an Intel® architecture-based private cloud.** Utilize OpenStack® open-source cloud platform with servers running on Intel® Xeon® processor E5 family to build a scalable private cloud environment in which the compute, storage, and network resources can be managed and orchestrated centrally via an administration dashboard, and allows users to easily provision resources needed via a web interface.
- **Utilize Software-defined Storage (SDS) technology.** Harness the advanced storage management capabilities of Federator(r) SDS orchestration system from ProPhetStor® running on Intel architecture to allow IT administrators to provision and monitor storage across disparate vendor systems and commodity hardware.
Intel® architecture-based Healthcare Cloud-in-a-Rack provides Taichung Veterans General Hospital a complete and scalable platform that improves IT management and enhances data storage efficiency.

**BUSINESS VALUE**

- **Improved IT efficiency and productivity.** Centralized IT management through an open-source private cloud infrastructure allowed VGH to reduce complexity and manage and maintain all IT systems and resources of its branches with ease and efficiency.

- **Enhanced business agility.** Building a flexible and scalable IT infrastructure allowed quick development and deployment of new services and applications.

- **Improved system performance.** VGH achieved better hierarchical storage management through an SDS platform that allowed critical systems to achieve higher input/output operations per second (IOPS) access performance while improving literacy performance by 50% and enhancing backup effectiveness by 64%.

- **Contributed to ‘green’ computing.** Built a ‘green’ platform for private cloud services by harnessing Intel Data Center and Intel Intelligent Power Node Manager that enabled VGH to adopt eco-friendly practices to promote energy efficiency and responsible power consumption.

The burden of managing healthcare-related workloads

Hospitals and healthcare providers continue to integrate advanced technologies into their management and operations to enhance their operational efficiency and cost structures. VGH is among those who rely on the latest technologies specifically designed to handle healthcare-related workloads, in order to stay competitive and provide better services to its patients.

VGH’s IT department handles the hospital’s medical, administrative, and clinical teaching information systems, as well as medical research related to information system establishment and maintenance. It also carries out development and maintenance management of all hospital communication devices and provides information and communication integration services. Given the various types of applications catering to different user needs that run under each system, VGH’s information systems have become complex and extremely diversified. To date, the IT department manages up to 100 servers which all run a variety of applications.

Dr. Ching Wen Yang, chief information officer at VGH, explained that to reduce complexity in managing all servers, the hospital’s IT system was transferred to a Linux open-source system architecture, which previously was installed on a mainframe. “The daily routine of managing all these servers, however, has become a daunting task. Due to the hectic daily schedule of routine operations and the implementation of new requirements and designated projects, many new system tests and development work are still pending. Aside from this, we had to manage the IT systems of three other VGH branches in Wanjiao, Puli, and Chiayi, which was also adding to the IT operation and maintenance costs,” he added.
To address these challenges, Dr. Yang sought a solution that could centralize the IT systems and resources of all VGH branches not only to make it easier for the IT department to conduct daily routine operations but also to accelerate new system development and testing environment build up. He found his answer at a software-defined processing, storage, and network seminar hosted by Intel, which showcased the use of a cloud-in-a-rack for HIS, running on an Intel architecture-based open-source private cloud platform integrated with a software-defined storage solution.

**Elevating HIS management with an open-source cloud platform**

VGH worked with Intel to conduct a proof of concept (PoC) project that could effectively handle healthcare-related workloads. The PoC test included migration of the existing HIS to a private cloud environment, system information exchange, and backup support.

AIC*, a leading provider of server and storage solutions, handled the deployment, configuration, and validation of the Healthcare Cloud-in-a-Rack. The private cloud solution combines servers based on Intel Xeon process E5 family and industry-leading open-source cloud computing software, OpenStack. OpenStack allows VGH to orchestrate large pools of compute, storage and networking resources in the private cloud. IT administrators can manage and control the resource pools through a dashboard while allowing users to provision resources through a web interface.

With VGH running about 1,200 different types of applications on its HIS mainframe, it needs an efficient data storage and backup solution in the private cloud. VCH determined that a SDS solution build on SSD will meet the performance and scalability needs of their applications. ProphetStor provided an SDS platform with its Federator SDS solution, which utilizes Intel® Solid-State Drive Data Center S3710 Series and Intel® 82599 10 Gigabit Ethernet Controller to automatically enable multiple pools of physical storage of different capabilities and abstract them into virtual storage pools to allow coordinated data storage, access, migration, and management. With Federator SDS solution, storage infrastructure can be managed and accessed programmatically through a single set of open HTTP REST APIs, which then allowed storage services to be dynamically composed and delivered without the need to utilize any knowledge of the underlying hardware implementation details.

As Federator operates on a separate control path to communicate with the storage systems, there was minimum disruption to data operations. An integrated intelligent resource scheduler delivers storage automatically while monitoring and selecting the storage pool that meets capacity and performance requirements, such as specific Service Level Agreement (SLA) needs. Implementing this storage solution allowed for better hierarchical storage management of different types of data and adapt the allocation of storage resources for use on designated applications.

Migration of VGH’s HIS system to the OpenStack open-source cloud platform was completed in just six months. Testing of the platform involved two healthcare workers who were tasked to ensure that all medical information functions were correct and eight system managers who assisted in building the network environment and in verifying system performance indicators.

- **Software Defined Storage** provides a unified single platform to simplify storage provisioning and effectively utilizes policy choreography storage resources to optimize performance and increase efficiency.

- An open application program interface (API) allows tools and technologies to build and maximize customer value and skill availability. It can also be easily reused in hybrid cloud environments.

- It is a must to provide appropriate storage type in an OpenStack* environment to meet the requirements of virtual machines.
Centralized IT operations and resources redefines HIS management

The impressive score achieved by the customized open-source cloud platform during the POC test convinced VGH to roll out the solution in all its branches.

Implementing the Healthcare Cloud-in-a-Rack platform allowed VGH to benefit from a flexible storage space solution that enabled storage space of different efficiency to be automatically assigned for use by designated virtual machines. This allowed critical systems to receive higher IOPS access efficiency. VGH found that overall read/write efficiency was enhanced by 50% and backup efficiency improved by 64%.

More importantly, migrating to an open-source architecture environment allowed VGH to achieve significant cost savings on IT management and resource maintenance. The solution also eliminated the issue of being locked in with a specific vendor as well as enabled IT administrators to implement new services with ease and optimized efficiency. With a reliable private cloud infrastructure, VGH has also built a centralized platform that makes it easier for IT administrators to manage IT systems and resources of all VGH branches.

In addition, VGH has realized its goal of building a ‘green’ hospital, as the solution comes with management tools such as the Intel® Data Center Manager and Intel® Intelligent Power Node Manager that allowed the hospital to practice responsible energy consumption and energy efficiency.

With the successful implementation of Healthcare Cloud-in-a-Rack, VGH has sold the solution to other hospitals through alliance companies. Moving forward, VGH is also looking at the possibility of providing HIS public cloud services externally through alliance partners so that more hospitals can benefit from a dedicated HIS cloud service integrated with software-defined storage.

Find the solution that’s right for your organization. Contact your Intel representative, visit Intel’s Business Success Stories for IT Managers, and check out IT Center, Intel’s resource for the IT industry.