Transforming the Learning Society in Hong Kong

The Chinese University of Hong Kong transforms their IT infrastructure with Cisco Data Center Business Advantage Architecture

EXECUTIVE SUMMARY

The Chinese University of Hong Kong's Information Technology Services Center

- Comprehensive research university
- Shatin, New Territories, Hong Kong
- 22,619 students, 1,400 faculty staff

BUSINESS CHALLENGE

- Meet the need for faster and more flexible provisioning of computer resources
- Provide more computing power for research
- Overcome inefficient use of human and data center resources
- Expand computing and network capability within a limited physical space

NETWORK SOLUTION

- Virtualize operations with Cisco Data Center Business Advantage Architecture
- Adopt Cisco Nexus Unified Fabric and Unified Computing Systems

BUSINESS RESULTS

- Faster server provisioning and streamlined data center management
- Faster and more efficient allocation of computing resources
- Significant expansion of data center capability within constraints of physical space

Business Challenge

The CUHK has more than 14,300 post-graduate and undergraduate students, mostly Hong Kong residents and including about 1,300 students from overseas and mainland China. There are more than 1,400 faculty staff and 5,100 administrative staff including an IT department - the Information Technology Services Centre (ITSC).

The entire campus is connected to the University Campus Backbone Network via high-speed Gigabit Ethernet links. Connections within the campus network are via high speed 10 Gigabit or Gigabit Ethernet links.

Students have 24/7 access to computers in the ITSC and some faculties and departments also provide students with their own personal computers.

CH Cheng, associate director of ITSC and head of the Infrastructure Division explains, "Our users have high expectations of the data center infrastructure. They want faster and more flexible provisioning as well as lower cost."

Academic users needed more computing power especially in the fields of medical and scientific research and one of the challenges for the ITSC was how to upgrade the network and provide sufficient computing power for their users' needs with a cost-effective solution.

Faculty departments previously purchased their own network hardware, servers and computers but this required high capital expenditure and the ability to expand their computing capability was constrained by budget limitations.

There was also an urgent need for flexibility and speed in provisioning computer resources according to each faculty's requirements.

Expansion of the CUHK's IT infrastructure over the years had increased the levels of complexity. The university's data center was supporting more than 500 application servers, mostly linked by a Cisco 4 set of Catalyst 6500 switches. Maintenance and management was an ongoing challenge as the data center comprised different hardware and software platforms, resulting in system conflicts and incompatibilities. The aging equipment, software and network was also difficult to upgrade because the original software was manually installed and updated for specific academic courses; a very time-intensive process.

In many cases, applications required a dedicated server, even if the application only used a small portion of a server's available physical central processing unit (CPU).

The university's IT department was faced with deploying, monitoring and maintaining a growing number of physical servers. Besides overburdened support personnel, there were other cost considerations including high electricity usage for operation and cooling, excessive cabling and diminishing rack space. The limited physical space occupied by the data center was also restricting their ability to expand. It was clear that newer technology could bring significant operational and economic advantages.

Network Solution

After discussions with Cisco technical specialists it was clear to ITSC that the most effective solution to overcome their data center challenges was to centralize and virtualize the university's computer network and computing resources based on Cisco's Data Center Business Advantage Architecture, a virtual network system which also enables a private cloud platform.

Virtualization replaces the traditional design of an application running on one physical server. Instead, a single physical server can host multiple virtualized servers (also called virtual machines) supporting multiple applications.

Server virtualization also allows multiple operating systems to be installed on a single physical server. Each application runs on a standard, dedicated operating system and only the physical server resources are shared among the operating systems or applications. This design maximizes use of the physical hardware without sacrificing application availability, reliability, or integrity.

Cisco's Unified Computing Systems technology (UCS) radically simplifies the deployment of application processes by using service profiles. This allows holistic management of the system by combining the hardware, networking and virtualization into a pre-configured template. New servers can be created by applying a set of Unique IDs (UIDs) such as MAC addresses and server names to the template. The server is created in the runtime environment, enabling one-to-many deployment and drastically reducing the number of touchpoints needed to create and manage the server population. Managing increasing demand is as simple as deploying a server profile to a blade. Greater capacity can be achieved physically with a keyboard command, or it can be activated as an automated process.

Cisco UCS and VMware was adopted as the foundation for server virtualization in the data center. VMware supports the creation of virtual machines, each capable of using multiple CPU's and multiple gigabytes of memory on the UCS. The number of CPU's and memory allocation can be modified easily as applications grow and the UCS Service Profile allows the ITSC to easily and quickly allocate virtual machines between UCS B200 M1 Blade Servers to accommodate an application’s changing demands for computing resources.

VMware also provides the software that students need for their research and studies, for example, website development and document management, regardless of which computer they use on campus.

Powered by Cisco's end-to-end Data Center Architecture, the CUHK has begun to offer IP phone services as well the networking and computing resources to meet the needs of university departments and faculties.

> "It's very important to select a solution which can integrate all the main components including the network, the servers, the storage and the backup. Reliability, scalability, ease of automation and also tight integration are the main criteria when we select the data centre infrastructure platform."
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> **CH Cheng, Associate Director (Infrastructure)**

The Chinese University of Hong Kong's private Cloud platform is also driven by Cisco's Data Center Business Advantage Architecture offering significant benefits in ease of management and fast provisioning. Cloud services already available include web-based university administration applications including tools for modifying and updating departmental websites and a document management system for administrative use.

Business Results

With a virtualized network and data center available to all departments as a service, costs are charged on a monthly basis which is easier to manage within each faculty's or department's annual operating budget.

By breaking down IT silos and creating virtual network and computing resources, the ITSC expects to further reduce its energy consumption and cooling costs.

Virtualizing the data center servers also dramatically reduces cabling requirements and requires significantly less rack space to deliver more compute and network capability.

The new Nexus switch architecture and FCoE technology allows the Chinese University to reduce up to 50% of Ethernet and Fiber Channel switches, saving up to 80% of cabling and rack space compared to a traditional data center. Nexus and UCS also drastically simplifies data center management so, with the adoption of Cisco Data

Center Business Advantage Architecture, the university's ITSC data center now has the flexibility and agility to rapidly scale up and house more IT utilities.

With the adoption of the Cisco Data Center Business Advantage Architecture the ITSC has achieved increased levels of operational efficiency. The Cisco Unified Computing System bridges the compute, network and storage domains and unifies them into a fabric of shared, virtual services that can be provisioned in a fraction of the time it took previously.

The Nexus "wire once" approach and the use of UCS service profiles has drastically reduced the lead time for provisioning applications and services - work that used to take weeks or days can now be completed in minutes. As a result, the IT team can match the speed of research and education demand driven by the Education Reform.

> "With cloud computing we can dynamically allocate computer resources to applications. At the initial project development life-cycle we do not need a very large computer capacity for our applications so the user can start small. As the application becomes more popular and usage increases the computer resource can be dynamically increased to meet the user's needs. This is the beauty of cloud computing.
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> **Carol Chiu, head of ITSC's Cloud Computing Division**

Cisco's Data Center Business Advantage Architecture provides improved availability, backup and recovery. With a 24/7 operation, a highly secure network infrastructure that ensures uptime with maximum reliability is a critical service.

By reshaping the people and processes of IT and shifting resources to allow for cross-skills training of the IT team, the ITSC is unlocking the tremendous potential of virtual computing by releasing staff to work on higher value projects, providing ongoing career progression opportunities.

- Reduced energy consumption and cooling costs
- IT services charged on a monthly basis, easier to allocate budget
- Increased levels of operational efficiency
- Less cabling and physical space required
- Provisioning of applications and services takes minutes rather than weeks or days
- Dynamic allocation of computing resources in response to users needs
- IT staff can be reassigned to higher value projects

Technical Implementation

PRODUCT LIST
Data Center Switches
• Nexus 7000 Series Switches
• Nexus 5000 Series Switches
• Nexus 2000 Series Switches
• Nexus 1000V Switch
Unified Computing
• Cisco UCS 6100 Series Fabric Interconnects
• Cisco UCS 5100 Series Blade Server Chassis
• Cisco UCS B-Series Blade Servers
• Cisco UCS Manager

The ITSC has deployed an end-to-end Cisco Data Center Business Advantage Architecture incorporating the Nexus 7000, Nexus 5000, Nexus 2000, Nexus 1000V and Unified Computing System. To complete the virtualization architecture the CUHK also selected the VMWare.

The Nexus 7000 and 5000 series provide many important features and values that enable CUHK to virtualize the data center network. These include high density 10GE and FCoE connections dramatically reducing the amount of structure cabling required.

The Virtual Port Channel (vPC) simplifies the network architecture and enhances network reliability by minimizing the use and impact of Spanning Tree Protocol (STP). Virtual Device Context (VData Center) allows more flexible use of Nexus 7000 to architect the network topology.

The Cisco Nexus Unified Fabric and Unified Computing Systems (UCS) provide a number of useful and innovative technologies such as Fiber Channel over Ethernet (FCoE), Extended Memory technology and Service Profile.

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