Solution Overview

Clouds over the capital

Where engineering, natural sciences, and the arts meet: Berlin's University of Technology, which currently has over 29,000 students enrolled.

TU Berlin uses Cisco UCS to lay foundations for cloud infrastructure

> "What is advantageous for cloud computing is a comprehensive virtualization strategy that addresses the servers, storage, network, and applications in a standardized format."

Michael Flachsel
Head of Infrastructure Services
at the TU's IT Service-Center

Berlin's University of Technology (TU) is using the Cisco Unified Computing System™ (UCS) to create a virtualized cloud environment, which will enable the computer engineers at its Institute for Telecommunication Systems to research the technological and economic potential of this new IT model. According to the scientists, cloud computing promises a fundamental change in the way in which IT services will be provided, used, and charged for in the future. IT will become purely a service that is accessed only when needed, and for which payment will only be required if the service is actually used. Deployment of this innovative IT system does not involve any investment hurdles, nor is it necessary to operate one's own infrastructure. The Cisco-based IT cloud being set up by Berlin's University of Technology should directly benefit companies in the city. In the future, the UCS platform will also serve as the basis for providing the TU's campus applications as a cost-effective cloud service.

Founders of start-up companies are only too familiar with the problems of traditional approaches to providing computing. For example, just when the basic computer applications are more or less up and running, new and initially unforeseeable demands are often then made on the system. Only then does it become obvious that the servers are too small, and the overall infrastructure cannot be easily expanded. Unscheduled expenses are usually the outcome. And staff, who already have enough to cope with, have to manage without appropriate IT support. This approach costs a great deal of time, energy, and motivation, which should have been focused on driving the business forward.

Written wisdom: the TU's university library in Fasanenstraße

TU Cloud will Provide Berlin with Economic Incentives

"Cloud computing will soon put an end to this scenario, " says Professor Odej Kao, head of complex and distributed IT systems at Berlin's University of Technology. "Clouds turn IT into a mere service that can be booked when needed and cancelled again afterwards. In terms of efficiency and flexibility, clouds leave all other previously known outsourcing systems way behind." The new IT service paradigm is suitable for all companies, whatever their focus or size, and for start-ups in particular, it can substantially ease the early stages.

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Background

Berlin's TU stands for interdisciplinary links between engineering, natural sciences, and the arts like virtually no other university in Germany. Over 29,000 students are currently enrolled there, supported by about 7400 staff members

Challenge

A research project involving cloud computing requires on-demand provision of precisely tailored computing and storage capacity. The virtualized server landscape that this requires also serves as a test environment. In future, regular TU applications will be delivered as cloud services

Solution

The Cisco Unified Computing System (UCS) is the core of the future TU cloud. The UCS chassis accommodates eight blade servers linked via FCoE to both the virtualized storage network and the 10 Gbps backbone network. Provision of service and role-based management are delivered in standardized format for all infrastructure sectors via the integrated UCS Manager. Configurations can be stored in re-usable service profiles and, where necessary, adapted with little effort to meet new demands

Benefits

- Temporary IT services can be provided as needed
- Extremely high scalability through maximum utilization of resources
- Simplified management: less effort, greater flexibility
- Huge reduction in costs and time
- TU gains advantages in international competition

A future-orientated IT infrastructure for a modern university, Berlin's TU is using the Cisco Unified Computing System

Kao is one of the initiators of the Berlin Cloud-Based Infrastructures (BCI), an ambitious project, which also involves researchers from the TU's Database Systems and Information Management faculty and its IT Service Center (tubIT). Together, they want to create a large-scale cloud environment, which will enable them to obtain scientifically validated evidence about the technological requirements and economic effects of the new IT model. The BCI system is not meant to be used solely by the TU, but to be also made available to technology and new business centers, for example. These centers could then act as cloud providers for their tenants, supplying a solution to the problems typically encountered by startup companies.

The BCI will enable Berlin's TU to distinguish itself once again in international competition through research activities closely linked to the business sector. Professor Kao says: "The TU has managed to create a further unique selling point (USP) for itself, compared to all other German and European universities, and is also providing a sustainable boost to Berlin's economy." This view is shared by the European regional development fund, which approved about half a million euros for the project. Launched in autumn 2009, scientific projects are being supervised by Dr. Matthias Hovestadt, Dr. Dominic Battré, and Philipp Berndt, with Michael Flachsel providing support on the infrastructure aspects.

Virtualization is Beginning of Every Cloud

What can be described relatively simply as cloud IT places enormous demands on the underlying infrastructure in practical terms: "The service concept behind cloud computing cannot be implemented via a conventional data centre," says Michael Flachsel, head of Infrastructure Services at the tubIT. "The basic requirement for this is a systematically virtualized server landscape."

Virtualization helps ensure that the logical view is separated from the physical hardware level. Several operating systems run independently of one another on a physical computer, each one allocated to its own virtual computer. Modern systems allow several hundred virtual computers on one physical server. It is even possible to shift virtual computers to other hardware without the user even noticing. This capability means that the fixed association between application and server hardware has been severed.

In a traditional computing environment, physical servers host particular applications, and this convention has led to the creation of isolated areas of resources, which are inflexible and inefficient. For example, web servers lose their computing power if underused; conversely, if the demand suddenly soars, for example, following an advertising campaign, this spike in usage may overtax processor capacity. Both scenarios are equally unsatisfactory. Unused capacity means investment that is not returning any value. Overloaded processors, on the other hand, mean poor service availability for customers. Moreover, regardless of the current degree of utilization, servers have to be maintained, operated, and air-conditioned, an energy-intensive process. These issues are also relevant to other parts of the infrastructure, and the concept of virtualization, therefore, is something that can be applied to the network or storage systems, too.

Boundary Between Server and Storage Worlds Disappears

"What is advantageous for cloud computing is a comprehensive virtualization strategy that addresses the servers, storage, network, and applications in a standardized format," says Flachsel. This, he believes, would be the only way to achieve the flexibility needed to provide all kinds of infrastructure services effectively

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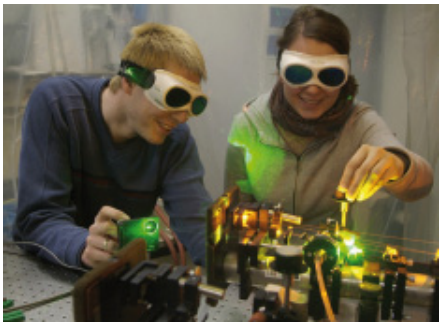
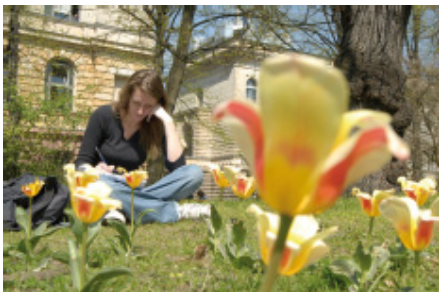


Inquiring minds: students using a dye laser for nanophotonic measurements

"Unified Fabric is a core element of Cisco's vision of a borderless network"

Henning Irgens,
Senior Account Manager
Dimension Data



Working out in the open, a student at Berlin's TU makes the most of the first spring days and goes outside to study

as needed, and to withdraw them equally quickly. That is one of the objectives of the BCI research project. "And that is also precisely the reason why we favor the Cisco® Unified Computing System (UCS) for the prototypes of the future Berlin Cloud," says Markus Hohenhaus, 'Server and Systems' team leader in the Infrastructure Services department. "Although from the outside, UCS looks like a normal blade server system, it is in fact a highly scalable complete system for standardized virtualization of server, storage, and network resources, including common management."

The working memory, for example, can be scaled up to 384 gigabytes. "That is ideal for virtualization," says Hohenhaus. "Normally, it is limited RAM, rather than processor capacity, that indicates the maximum number of virtual machines that fit on a blade server. So Cisco UCS can use its Intel high-performance processors to capacity."

The main point at which Cisco UCS overcomes boundaries is where server and storage network meet: through its integrated Fabric Interconnect. This approach is based on the so-called unified fabric concept, which means one can dispense with the adapters previously needed to connect to both the IP-based Ethernet world and the Fiber Channel (FC) storage protocol. "Fiber Channel over Ethernet (FCoE) is the name of the respective standard, which leads almost automatically to a radical I/O consolidation," says Flachsel. "Per blade chassis, we now need just eight cables, and savings are well over 90 percent." Fabric Interconnect uses FCoE to link the UCS blades with both the virtualized Storage Area Network (SAN) and a Cisco Catalyst® 6500 Series Switch, which is part of the TU's 10 Gbps Ethernet backbone. The Cisco UCS blades do not need their own hard drives, because the operating system is booted directly from the SAN.

Borderless Network is the Cloud Platform

"Unified Fabric is a core element of the Cisco vision of the borderless network," says Henning Irgens, Senior Account Manager at Dimension Data, a Cisco Gold-Partner. The network removes all barriers between applications, technologies, and devices. In a way, a borderless network is the natural platform for realizing the cloud.

Maximum flexibility for on-demand provision of individually tailored cloud services was one of the main purposes for introducing Cisco UCS. According to Flachsel, this objective is being achieved via a radically simplified management system, which is uniform across all infrastructure levels: "Cisco UCS offers re-usable service profiles for configuring virtual servers, plus storage allocation and network connection. These profiles can be adapted to meet new demands very quickly and with little effort. Basic configurations which used to take up to two days can now be carried out in five minutes." That is a good sign for start-ups in Berlin, because it means that young entrepreneurs will in future be able to call up any IT services equally quickly from the capital city's cloud.

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Asia Pacific Headquarters
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