Ozyegin University
Cloud Computing with IBM

Problem
Ozyegin University faces challenges in maintaining high-quality educational, entrepreneurial and research goals due to an exponentially growing number of students and faculty members.

Solution
Apache Virtual Computing Lab (VCL) and several other open source software tools over IBM BladeCenter® HS22 servers and IBM storage systems.

Goals
- Develop a fresh, modern curriculum with courses that enable the faculty to easily adopt emerging technologies.
- Encourage faculty members to use cloud computing-based software and hardware.
- Enable online and offline computer-based exams (for example, programming) with hundreds of students simultaneously.
- Simplify the use of high-performance computing (HPC) and distributed processing technologies for different disciplines to enable computational sciences or e-science quickly.

Results
- Research: We have designed and implemented a cloud-based finite element analysis (FEA) service to be used for HPC research and teaching in several engineering departments.
- Teaching: The combination of USB-bootable operating systems (OS) with cloud applications delivers custom-designed and network-controlled applications (labs and exams) to hundreds of students simultaneously.
- Collaboration: Installation and testing of IBM LotusLive™ collaboration suite is in progress, bringing together the members of IBM Cloud Academy in Turkey.

IBM Cloud Academy

Ozyegin University
Ozyegin University is a new private, non-profit university located in Istanbul, Turkey. The university is focused on becoming an entrepreneurial research university with a strong emphasis on quality teaching. The university was established in 2007, and since then many new departments and research centers have been added. The student body has been growing almost exponentially.

Every registered student at the university is given a laptop, and the courses are managed through an online course management system. Research centers such as Center of Energy, Environment and Economy and Center for Entrepreneurship aim to solve real-life interdisciplinary problems by hosting faculty and students with different expertise and backgrounds.

The goal of the Cloud@Ozyegin Initiative is to inform and support faculty and students at Ozyegin University in the use of emerging cloud computing technologies that can benefit their research, teaching, learning and collaboration. To begin with, the initiative will provide a research and teaching cloud environment for faculty from different departments and their students. Specific focus is on supporting CPU and I/O intensive computational tasks.

The challenge
Ozyegin University needed a quick and simple way to reserve and allocate physical or virtual clusters of servers and storage. The challenges included:

- *Adopting fast changing technologies* – The number of departments and courses is growing at Ozyegin University. Most courses, including computer programming, physics, telecommunications, digital design, embedded systems, and engineering drawing also have accompanying lab sessions. The speed of change in technology and the desire to include state-of-the-art technologies in classes and lab sessions puts pressure on the physical and the IT infrastructures. If not planned carefully, the utilization on these lab or technology investments can be low. E-engineering (for teaching) and e-science (for research) need to be evaluated to become feasible alternatives.

"Ozyegin University has become a very critical and preferred partner for IBM Cloud Academy in Turkey, especially for the development of cloud-based and traditional e-education curriculum. Distinguished research and academic capability of the university is unique and promises a bright future for high quality education in Turkey."

— Jale Akyel, IBM University Relations Leader, Central Eastern Europe and Turkey

- *IT-related burden on faculty* – Engineering software can be hard to install and maintain. These programs usually have multiple parts (front-end, optimizers, solvers, adapters, libraries and so on) that need to be put together to make things work. IT staff cannot deal with the support of all software from different engineering disciplines; however, the faculty member who needs to use that software in his or her course is not necessarily tech-savvy. Open-source software can be buggy, OS-dependent and can lack support, whereas commercial software can be costly. Providing infrastructure as a service (IaaS) support to these types of faculty is not helpful. Software maintenance is still a burden on the faculty. Cloud-based software support customized for specific courses and maintained elsewhere will be helpful.

- *Adoption at the national scale* – One of the goals of the Cloud@Ozyegin initiative is to foster adoption of cloud computing technologies at the national scale in Turkey, primarily at the educational institutions. The software and courses developed as a part of this initiative will eventually be opened for use by other universities. This will lead to the formation of a distributed national cloud-based education network. Services offered can be at the different levels starting from IaaS, going up to platform as a service (PaaS) and to software as a service (SaaS) levels, depending on the flexibility need of that course and faculty.

The solution

Apache Virtual Computing Lab (VCL) and other virtualization technologies are being tested over IBM BladeCenter HS22 servers to dynamically grant researchers and instructors access to computational resources and revoke these resources when not needed. This will allow the faculty to quickly configure virtual machines (VMs) with state-of-the-art software tools such as IBM SPSS Statistics, IBM ILOG® Optimization, analytics or other tools. They will be able to integrate these VMs into their courses or research and dynamically scale up and down as needed. Beyond ease of configuration, the utilization of physical resources typically allocated for these tools will be higher and the amount of sharing and VM reuse will increase.

Dr. Ismail Ari and his graduate students are developing several core e-Engineering platform services as part of the Cloud@Ozyegin initiative. These include a finite element analysis (FEA) cloud service used for mechanical structural analysis, a data mining service for online collaborative analytics and a data stream processing service for complex event processing (CEP) over high-volume real-time data sources such as sensor-based systems.

Prominent open source processing tools from each domain are picked, ported to Cloud and simplified for ease of use. These core services are useful in different fields and the Cloud team is addressing the technical challenges associated with the development and sustainable, efficient management of these services. Just to name a few examples: Job scheduling algorithms are being developed to provide optimal performance to concurrently running HPC jobs, and different cluster initialization methods are being tested to process heterogeneous datasets faster.

Because PaaS are at a higher level than IaaS services, the IT related burden on the faculty is reduced. To foster adoption of cloud-based engineering and science applications nationwide, we are currently testing web portals such as Drupal and LifeRay as the front-end for the processing engines mentioned above. The underlying computational resources can be sponsored by each hosting university for specific platform services, which is our initial model, or allocated from a national computing resource pool for burst handling, cost or performance reasons.

Security and privacy of the data that will be processed by cloud services either in place or by uploading the data to the service site is a major concern for some of the users. To alleviate these concerns our team is working on data pre-processing techniques that will transform the data in an irreversible way before making it visible to the service. The service will work on the transformed data and return the results to be post-processed by the user to obtain the final result.

We develop the above high-performance technical cloud computing services over IBM BladeCenter HS22 servers hosted in an IBM BladeCenter H(PC) Chassis and store data in IBM System Storage DS® 3400. These systems will enable students of several engineering classes to easily run HPC experiments or solve large-scale optimization problems without the need for multi-tiered software installation over distributed systems.

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Produced in the United States of America
12-09

EDB03009-USEN-00