Case Study: Partnership with a Storage Technology Company in Teaching an Undergraduate Level Course

Rajeev Agrawal, North Carolina A & T State University, Greensboro, NC
ragrawal@ncat.edu
336-285-3137
Kim Yohannan, EMC Corporation
kim.yohannan@emc.com
617-462-0172

Abstract

The department of Computer Systems Technology at North Carolina A & T State University offers a junior level course, Storage Technology for Information Technology, in partnership with an information and virtual infrastructure company. The company has created a storage textbook on all the required contents for the course and provides support material for the instructors through its academic alliance. The support material includes lesson plans, PowerPoints, quizzes, samples exams, lab assignments, etc. through a secure, dedicated website. The textbook doesn’t emphasize the use of company’s own products, though they are included as examples and case studies. There is no cost to join their academic alliance which provides self-paced Video Instructor-Led Training (Video-ILT) delivered via online streaming. It is designed to prepare faculty members to teach the course. At the end of the course, students are offered a significant discount for the Information Storage and Management (ISM) certification exam. In this paper, we describe our experience of this partnership including the challenges faced in delivering the content.

1. Introduction

It is in the interest of Information Technology (IT) companies to establish partnerships with educational institutions. There are multitudes of partnership benefits; one is in making a company’s product and technology available to the future IT workforce. Many companies have been in the forefront of these academic partnerships. It is expected that educational institutions respond to the skills required by the market as quickly as possible. Industry-academia can play a crucial role to make that happen. Industry advisory boards also help institutions identify skill sets expected from the graduates. There is a gap between what industry needs and what universities offer [1]. Industry can close this gap by offering course material, letting their engineers give technical lectures directly in the classroom, and providing training to faculty members on the latest technologies.

A large number of companies have established academic alliances and make their products available for free or at a minimal cost. Microsoft provides a library of software through the MSDN portal to academic institutions [2]. The NetApp Academic Alliances Program supports
higher education faculty members and students in learning storage technology [3]. This program provides a portfolio of teaching tools and resources, which can be easily integrated into the classroom curriculum. Similarly, Juniper Networks has established a five module program to cater to different majors, including software development, microelectronics, and telecommunication [4]. Similarly, ARM, BlackBerry, CISCO, IBM, SAP, SAS and many other companies support universities by providing teaching material to faculty members. There are two types of academic alliances: 1) provides their products to the educational institutions and 2) provides their commercial courseware. Many companies also provide free training to the faculty members on their products. These academic alliances have been very successful and a win-win scenario for both industry and academic institutions. In this paper, we describe the experiences of our partnership with EMC, an information and virtual infrastructure company [5]. The rest of the paper is organized as follows. Section 2 includes the related work on academic-industry partnerships. Section 3 describes the resources made available by the EMC Academic Alliance. Section 4 covers our experiences of the EMC Academic Alliance partnership and discusses the lessons learned and challenges faced. Section 5 offers the conclusions of our experience.

2. Related Work

Industry-academia collaboration can happen in four different ways: 1) collaborative research; 2) contract research; 3) equipment donation; and 4) helping faculty to teach the courses of interest to a company. It started with technology transfer from university R&D labs to commercial products. In many cases, faculty members or students started their own companies and many of them have been very successful. For example, Google was started by two Stanford students; on the other hand SAS began at North Carolina State University to analyze agricultural research. In this paper, our focus is on the contribution of industry towards teaching; therefore, we avoid the discussion on research partnerships. For a successful partnership, faculty must define qualitative and quantitative measures to assess success [6]. The teaching material provided by the industry must be carefully vetted for its suitability for the students. The student feedback should be sought to analyze what worked, what didn’t. This feedback may be used to make changes in subsequent course offerings. A data warehouse course was taught in collaboration with industry at North-West University in South Africa and students were very positive about the experience [7]. A course on Electronics Test Technology was run at Monash University in partnership with Freescale Semiconductor and all the learning outcomes were achieved [8]. A computer science course was developed in collaboration with faculty at three universities and industrial partners [9]. The project case studies were used for both instructional and project purposes. The main objectives of the course were to expose students to a variety of real-world projects and to apply techniques and results in real situations.

It has been observed by many institutions that the alumni can play an important role in establishing industry-academia partnerships. This happened in the case of a partnership between Cardiac Rhythm Management (CRM) of the Guidant Corporation and Embry Riddle Aeronautical University [10]. The partnership provided exceptional learning experiences,
scholarships and stipends to the students. The course evaluation of software architecture course increased from 12% to 55% in the excellent category. An industry view is provided by the engineers of Agilent Technologies in [11]. The model proposed is based on the Corporate Social Responsibility (CSR) of Porter [12]. There are three important points of this model; advanced development collaboration, applied domain research collaboration, and broad, basic research collaboration. The main factors of any partnership to be successful are a strong cultural bond, clear communication and a focus on execution.

3. Overview of EMC Academic Alliance

In this section, we describe the main components of the Academic Alliance. As per the listed objective of the program, EMC collaborates with colleges and universities worldwide to help prepare students for successful careers in a transforming IT industry [13]. The program offers unique ‘open’ curriculum-based education on technology topics such as cloud computing, big data analytics, and information storage and management. All courseware and self-paced eLearning are offered at no cost to qualifying higher education institutions. The courses focus on technology concepts and principles applicable to any vendor environment, enabling students to develop highly marketable knowledge and skills required in today’s evolving IT industry. The program offers four courses to prepare students for successful IT careers. Each of these courses correlate and support an EMC Proven Professional certification exam [14]. The courses are:

- Information Storage and Management (ISM) v2
- Cloud Infrastructure and Services (CIS)
- Data Science and Big Data Analytics
- Backup Recovery Systems and Architecture

Any accredited, degree-granting institution of higher education can join the program. The course materials provided under this program can only be used as part of a structured course leading to undergraduate or post-graduate academic credit.

Program Benefits: Member institutions receive numerous benefits through the program. Registered faculty receive video instructor-led training as the first step in their readiness plan [15]. This method provides near-classroom experience and allows anytime-access to training without the expense of travel. The instructor materials provided to help faculty incorporate these courses into their curriculum include course slides, lesson plan guide, student exercises and case studies. Instructors access these course teaching and learning aids through the secure, online faculty community. Faculty are also able to collaborate and share resources with faculty participating in this program around the globe. The program also provides a student portal, a secure website, with free eLearning and resources for students. In addition, the faculty and students receive substantial discounts on associate level EMC Proven Professional certification exams.
Information Storage and Management (ISM) v2 Course: The ISMv2 course has been offered in our department for the last 4 years during the fall semesters. This course is based on a textbook with the same title as the course name and is authored by EMC engineers. This course covers concepts, principles, and deployment considerations across all technologies that are used for storing, managing, and protecting digital information in classic, virtualized, and cloud environments. The course is divided into following 15 chapters:

Section I Storage System
Chapter 1: Introduction to Information Storage
Chapter 2: Data Center Environment
Chapter 3: Data Protection: RAID
Chapter 4: Intelligent Storage System

Section II Storage Networking Technologies
Chapter 5: Fibre Channel Storage Area Network (FC SAN)
Chapter 6: IP SAN and Fibre Channel over Ethernet (FCoE)
Chapter 7: Network-Attached Storage (NAS)
Chapter 8: Object-Based and Unified Storage

Section III Backup, Archive, and Replication
Chapter 9: Introduction to Business Continuity
Chapter 10: Backup and Archive
Chapter 11: Local Replication
Chapter 12: Remote Replication

Section IV Cloud Computing
Chapter 13: Cloud Computing

Section V Securing and Managing Storage Infrastructure
Chapter 14: Securing the Storage Infrastructure
Chapter 15: Managing the Storage Infrastructure

In addition, EMC has formed a partnership with Network Development Group (NDG) to enable NETLAB+ support of the EMC Information Storage and Management (ISM) v2 course and the EMC Cloud Infrastructure and Services (CIS) course. This partnership provides academic institutions with a scalable, cost effective solution to provide virtual hands-on labs to students [16].

4. Lessons Learned and Challenges

Our department offers the Foundations of Storage Technology course, which aligns with ISMv2 course very well. The objectives of this course are:

- Describe the challenges found in today’s complex information management environment
- Evaluate storage architectures, including Storage subsystems, FC-SAN, IP-SAN, NAS, CAS
- Define backup, recovery, disaster recovery, business continuity and replication
Examine emerging technologies including storage virtualization, cloud computing and security
Understand logical and physical components of a storage infrastructure
Identify components of managing and monitoring the data center

We assign the following work in this course:

- Weekly Homework
- Weekly Quizzes
- Class Exercises
- Lab Assignments
- Blog Assignments
- Presentation Assignments
- Two Midterm Tests and one Final Exam

The weekly homework and quizzes are based on each chapter as described in section 3. Class exercises are completed by the students after the lecture.

**Lab Assignments:** We use Openfiler, an open source browser-based network storage management software that can deliver file-based Network Attached Storage (NAS) and block-based Storage Area Network (SAN) in a single framework. In addition, students also complete labs to create different types of RAID storage, and measure disk performance using a Hard Disk Drive benchmarking tool.

**Blog Assignments:** This course covers a big range of storage technologies. To keep the students aware of latest technologies and to improve their writing and critical thinking skills, they must write a 250-300 words blog every week. Students are encouraged to read each other’s blogs and write an insightful comment.

**Presentation Assignment:** Students must create a 4-6 minutes video on a selected storage technology topic.

Overall, students like the way the course has been conducted so far. Based on their feedback, we made necessary changes in every next offering. This course has evolved from being theoretical to hands-on. Initially, students resisted writing weekly blogs. When other students and instructors started commenting on their blogs, they got motivated. They were advised on how to write a good blog and over the course of the semester, the quality of their blogs improved immensely. A few students’ blogs also got the attention of storage companies and were linked on their websites.

There are numerous video presentations provided by the company to cover technical concepts. It was a challenge to make students watch these videos before coming to the class. Since videos are
long, it is not possible to play them in the lecture. We plan to assign a quiz based on each video to make sure that students watch them. Whenever possible, EMC engineers were invited for guest lectures and students really liked them, as this provided them information on the latest developments in the storage world. It has been challenging to organize field trips to the manufacturing facility and state of the art data center of the company because it is difficult to coordinate a date which works for the company and students. We were only able to organize one field trip in last 4 years and we had to cancel it two times due to various reasons. The field trip provided the students a great learning experience and they all mentioned this in the course evaluations. EMC provides a discount on the ISM certification exam, but it has been a challenge to motivate students to sit for the exam. Only a very small number of students have taken the advantage of this option.

5. Conclusions

Our experience of partnering with an information and virtual infrastructure company has been positive. We used all the course material available through the EMC Academic Alliance program. It has cut down the course preparation time and provides us more time to focus on installing infrastructure for lab assignments. EMC supports educational institutions by providing course materials and training to the instructors. The EMC Academic Alliance program has over 1700+ participating institutions in over 70 countries and has educated over 180,000 students since its inception. Industry-academic partnerships can play an important role in keeping the faculty up-to-date with the latest IT developments. From our experience, we find that partnerships with companies can go a long way in improving the quality of education to students.

References


