An Innovative Teaching Program for Network Applications and Services

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Abstract — In this paper, we will present our planning for the teaching program for network applications and services of the National Innovative Communication Education Program (NICE-Program) of Taiwan. The major goal of our teaching program is to organize teaching partnerships among universities to develop outstanding teaching materials for advanced courses in the network applications and services area. To achieve this, we will present the infrastructure of our teaching partnerships among universities and the courses that we have chosen to develop courseware. Four categories in the network applications and services area are identified to be the most important to Taiwan, namely, multimedia communication techniques and applications, network security and monitoring, Internet and Web techniques, and mobile computing applications. We have launched the development of courseware, including textbooks and teaching materials (such as powerpoint slides), at the beginning of year 2003 and expect to run the program for four years. An e-Learning platform is also developed for selected courses to experience the new learning style. Besides developing courseware, several activities will be arranged to extend the program to have more universities to participate and use the developed courseware. These activities include arrange regular, short-term, and promotion courses to incubate seed lectures from universities nationwide, collaborate with industries to develop courseware according to their needs, arrange short-term courses for professionals from industries, international students/professors exchange programs, international contests on network applications, and tours to well-known international companies to help students and scholars in Taiwan learn the state of art technologies in the network applications and services area. Finally, this program will be evaluated annually to assure the effectiveness of the proposed activities.

Index Terms — Communications engineering education, NICE-Program, network applications and services, multimedia communication, network security, Internet techniques, mobile computing

INTRODUCTION

In 2002, the Ministry of Education (MoE) of Taiwan launched a new phase of reform program in communications engineering education: National Innovative Communication Education Program (NICE-Program). The communication technologies are classified into five categories, including optical communication systems, network applications and services, communication devices, broadband Internets, and wireless networks. In this paper, we report the program for network applications and services of the NICE-program.

In the 21st century, Internet and mobile communication will play a major role in our daily life. Several network-related services, such as e-Learning, e-government, e-campus, and e-life, have become more and more mature. As a consequence, we expect that the market of network applications and services will grow steadily in the next decade. According to Datamonitor’s report [1], the investment on applications of mobile communication was 0.5 billions in 2001, but will reach 2.1 billions in 2006. E-commerce on mobile devices, such as cellular phones and PDAs, will be the major market value. Due to the prevalent activities of E-commerce, Internet security becomes more and more important. Thus, the market of network security will also grow rapidly in the next few years. According to Dataquest’s prediction [2], the market value for network and software security will reach 6.7 billions in 2004. The advance in optical communication and switching technology also result in rapid bandwidth growth. A direct consequence of high Internet bandwidth is prevalent of multimedia applications over Internet, such as Internet phone, video on demand, video conferencing, and interactive TV. Multimedia streaming technology is identified as the key technology of these applications. Furthermore, Internet technologies and applications, such as search engine, portal, distance learning, distance medication, XML applications, data mining, and Internet computing, are also expected to have a growing market. Therefore, in this program, we first classify the network applications and services area into four categories: multimedia communication techniques and applications, network security and monitoring, Internet and Web techniques, and mobile computing applications.
GOALS OF THE NETWORK APPLICATIONS AND SERVICES PROGRAM

The ultimate goal of this program is to produce a large number of high quality engineers with state of art technologies in the network applications and services area to promote Taiwan’s international competition in this industry. To achieve this goal, several activities, include establishing a course-promotion center and partner schools, course reformation, developing high quality courseware, arranging regular, short-term, and promotion courses to incubate seed lectures from universities nationwide, collaboration with industries to develop more industry-oriented courseware, short-term courses for professionals from industries, international students/professors exchange programs, international contests on network applications, and tours to well-known international companies, are planned for the next four years. Through these activities, explicit goals of this program are summarized as follows:

1. Educate adequate high quality engineers to meet industry’s need.
2. Establish a teaching center for network applications and services with twelve partner schools which include public and private universities, colleges, and institutes of technology.
3. Develop high quality courseware for sixteen courses and three textbooks which cover the four most important areas in network applications and services.
4. Organize two training workshops each year to incubate at least eighty seed lecturers from thirty seven schools. The best twenty seed lecturers will be given an additional budget to test run a course.
5. Held at least ten distinguished lectures on advanced topics in network applications and services area.
6. Organize at least one short-term training course for professionals from industry each year.
7. Create a website as the communication center as well as the repository for courseware developed by this program such that courseware can be accessed via the Internet.
8. Collaboration between universities and industries, such as promotion courses, seminars of new technologies and new services, communication contest, software donation, intern jobs, etc.
9. Internationalize the program to import state of the art technologies and courseware from oversea. For each year, arrange at least two tutorials with well-known foreign speakers, at least one professor to go oversea to take short courses on advanced topics, one international contest on network applications, and one short visit to well-known international companies.
10. Evaluate the performance of partner school quarterly. On-site visit and evaluate each partner school yearly. Held an exhibition of courseware developed at the end of each year.

ARCHITECTURE AND FRAMEWORK OF NICE-program

The architecture of the network applications and services program is shown in Figure1. The teaching center is located at National Cheng Kung University and chaired by Dr. Chung-Ming Huang, a professor of the department of computer science and information engineering. Twelve partner schools are established which are purposely selected to include public and private universities, colleges, and institutes of technology such that all kinds of schools can have equal chance to join the program. As shown in Figure 1, partner schools in the multimedia communication techniques and applications area include National Sun Yat-Sen University (NSYSU), National Chung Cheng University (CCU), National Dong Hwa University (NDHU), and Southern Taiwan University of Science and Technology (STUT). Partner schools in mobile computing and applications include Feng Chia University (FCU), National HuWei Institute of Technology (NHHIT), and National Pingtung University of Science and Technology (NPUST). Partner schools in Internet and Web techniques include National Taiwan University (NTU), National Chao Tung University (NCTU), National Taiwan Normal University (NTNU), and Chungtai Institute of Health Sciences and Technology (CTC). Finally, the network security and monitoring area has only one partner school, namely, National Cheng Kung University (NCKU).

An open call for proposal was conducted in the summer of 2002. Based on following criteria, eleven courses, which spread over three areas, were selected from around fifty courses as the seed courses for the first year:

1. Courses that are designed with state of the art technologies and are highly demanded by the industry.
2. Courses that are interested to wide population.
3. Fundamental courses are excluded as their course materials are already developed in previous programs.
4. Courses that are too specific will not be considered except that the technology covered is one of the key technologies of the future.

Table 1 shows the eleven courses that we selected. (A new course, “Advance topics in Internet Security”, will be
launched a year later to cover technologies in the network security area.) In general, each partner school is responsible for developing one courseware or textbook. Each partner school is asked to look for collaborative schools to develop the courseware cooperatively so that it can be suitable for general universities as well as institutes of technology. Collaborative schools are also listed in Table 1. Course materials and textbooks developed by partner schools will be delivered to all universities, colleges and institutes of science and technology in Taiwan free of charge so that a large number of students and engineers can be trained. It is expected that the framework of partner and collaborative schools will be an efficient way to increase the quality as well as quantity of professionals in networking industry in Taiwan.

STRATEGIES TO EFFECTIVELY DEPLOY THE NETWORK APPLICATIONS AND SERVICES PROGRAM

Following strategies are adopted to speed up the promotion of the network applications and services program:

Courses Planning and Teaching Materials Production

As mentioned above, eleven courses are selected as pioneer courses of this program. Among the eleven courses, two of them will emphasize on writing textbooks while the rest of them will focus on developing teaching materials, such as presentation slides, documents for hands-on experiments, etc. Textbooks and teaching materials will be co-designed by instructors from collaborative schools. To be adaptive to different needs of different kinds of schools, such as general universities and institutes of technology, different versions of textbooks or teaching materials for a course may be developed. Furthermore, teaching materials in multimedia and electronic types are preferred because of easier delivering and promoting. One or two courses will also be selected to experience the e-Learning environment. A SCORM-compliant LMS has been developed and courseware developed for these courses will also be SCORM-compliant [3]. The LMS also provides collaborative functions for students from different universities to collaborate on a project. Various functions, such as e-Learning tracking, student portfolio, student management, assessment tracking and management, collaboration environment, will be provided for effective and adaptive learning.

Establish of website and database

A website, with URL of http://www.mmnetlab.csie.ncku.edu.tw/center/, is created to collect all the teaching materials, including teaching handouts, transparencies, course information, teaching experience sharing supplies, teaching/learning assistance materials, and so on. All these materials and information are categorized and filed. All documents on the website will be translated to PDF format for easy access. We will also encourage partner schools to prepare courseware in SCORM-compliant format for easy management and exchange.

Training Seed Lecturers

Due to the urgent requirement of manpower and engineers in networking industry, we have to recruit and train more lecturers to educate more students in a short time. Six workshops will be arranged to promote the courseware developed by this program. Professors that are interested in using the courseware will be invited to attend the training program and become the seed lecturers. Currently, three workshops are arranged on July 2, 11, and 15 to be held at NTU, FCU, and NCKU, respectively. These three universities are located in northern, central, and southern part of Taiwan, respectively. At least twenty attendees will be selected to become seed lecturers. They will be given additional budget to try out the courseware developed in this program.

Collaboration between Universities and Industries

One of the major goals for the NICE-program is to enhance students’ background and practical experiences so that they can be workable without delay once they get into industries. Two approaches are adopted to achieve this goal. First, when developing courseware, we will collaborate with industries to develop courseware according to their needs and arrange short-term courses for professionals from industries to train them with new technologies. Second, we will arrange students to do intern job in industry or hands on experiments in the laboratories of some networking companies during the summer.

Internationalization

Internationalization is an important approach to introduce state of the art technologies into the program. Three approaches are adopted. First, we will invite at least three overseas experts to open short courses for the seed lecturers each year. In this year, we plan to invite experts from IBM, Hong Kong University of Science and Technology, and University of California, Davis, California to give short courses on data mining, peer to peer (P2P) applications, and Internet security, respectively, during the summer. Second, we will select at least one seed lecturer to attend oversea training courses to learn the start of the art
technologies. The selected topic for this year is mobile communication and wireless networks. Finally, we will arrange seed lecturers to visit well-known international companies in the networking industry. In this year, we plan to visit the Information Sharing Laboratories of NTT in September to discuss topics on Mobile IP/Internet, IPv6, and audio/video/multimedia communication technologies.

Communication Contest

In the past five years, the MOE of Taiwan will select a university to organize a national communication contest. Starting from this year, the content will divide into five areas and each teaching center of the NICE-program will in charge of one area. In this year, the contest begins in April and ends in June. Winners of the contest will have the chance to go oversea for an international contest or visit well-known companies. To promote the contest to an international event, we will invite Dr. Hiroshi ESAKI and his students from Graduate School of Media and Governance Keio University to demo their project on “Content Cruising System : Autonomous message transmitting system using geographical information in real space.” From next year, we plan to make the contest becomes an international contest to broaden students’ view and have international competition.

Distinguished Lectures

One way is to pass the teaching experience of senior professors in well-developed universities to young professors is to have a seminar or workshop and invite those senior professors as distinguished speakers, we call it distinguished lectures. Making use of well-designed courses, well-written materials, and senior professors’ teaching experiences can quickly convey the state of the art technologies and good teaching styles to junior professors. In this year, we have planned fifteen distinguished lectures which cover the four major areas in network applications and services. Nine distinguished lectures will be held by the end of July.

Performance Evaluation

The success of this program relies on the cooperation of partner schools and collaborative schools. Therefore, a bi-monthly meeting is called by the teaching center every two months discuss the progress of various activities and exchange ideas and comments for improvement. Each partner school needs to submit quarterly report so that the teaching center can keep good track of the progress of each partner school. The teaching center will arrange at least one on-site visit to each partner school during each year. A workshop will be arranged by the teaching center to show the accomplishment of the teaching center as well as partner schools. Besides the connection between the teaching center and the partner schools, the chair and executive secretary of each teaching center also attend regular meetings arranged by the NICE-program office to report progress of their teaching center.

SUMMARY

A new phase of reform program in communications engineering education called NICE-Program has been lunched in Taiwan since 2002. The NICE-program is partitioned into five different areas, including optical communication systems, network applications and services, communication devices, broadband Internets, and wireless networks. In this paper, we have presented the current working status for the network applications and services area. In particular, we have established twelve partner schools. During the next four years, we will develop high quality courseware for sixteen courses and three textbooks. Various activities, including distinguished lectures, tutorials, oversea short-courses, are conducted to incubate seed lecturers such that the courseware developed by this program can be widely delivered to universities, colleges, and institutes of technology.

ACKNOWLEDGEMENT

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REFERENCES


FIGURES AND TABLES

FIGURE 1
ARCHITECTURE OF THE NETWORK APPLICATIONS AND SERVICES PROGRAM

![Architecture Diagram]

Teaching Center

NCKU

Partner School

NSYSU  C  CU  NDHU  STUT  FCU  NHT  NPUST  NTU  NCTU  NTNU  CTC  NCKU

Multimedia communication and applications
Mobile computing and applications
Web Technology
Network Security
### TABLE. 1
Courses that will be developed in the first year.

<table>
<thead>
<tr>
<th>Area</th>
<th>Partner</th>
<th>Course</th>
<th>Collaborative Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimedia communication techniques and applications</td>
<td>NDHU</td>
<td>Multimedia network applications for next generation Internet</td>
<td>Chung Yuan Christian University (CYCU)</td>
</tr>
<tr>
<td></td>
<td>NSYSU</td>
<td>Multimedia streaming technology</td>
<td>National Kaohsiung University of Applied Sciences (KUAS)</td>
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<tr>
<td></td>
<td>CCU</td>
<td>Design technology for network multimedia e-book</td>
<td>Tajen Institute of Technology (TIOT)</td>
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<td></td>
<td>STUT</td>
<td>Network digital media</td>
<td>Nan Jeon Institute of Technology (NJTC)</td>
</tr>
<tr>
<td>Mobile computing and applications</td>
<td>FCU</td>
<td>Technology for mobile agent</td>
<td>Chaoyang University of Technology (CYUT)</td>
</tr>
<tr>
<td></td>
<td>NHIT</td>
<td>Mobile e-commerce</td>
<td>National Yunlin University of Science &amp; Technology (NYUST)</td>
</tr>
<tr>
<td></td>
<td>STUT</td>
<td>Network digital media</td>
<td>National Kaohsiung University of Applied Sciences (KUAS)</td>
</tr>
<tr>
<td>Internet and Web techniques</td>
<td>NPUST</td>
<td>Multimedia application system for handheld devices</td>
<td>National Central University (NCU)</td>
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<tr>
<td></td>
<td>NTU</td>
<td>Internet computing</td>
<td>National Chengchi University (NCCU)</td>
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<td></td>
<td>NCTU</td>
<td>Internet data mining (Textbook)</td>
<td>Ming Hsin University of Science &amp; Technology (MUST)</td>
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<tr>
<td></td>
<td>NTNU</td>
<td>Network computing and XML (Textbook)</td>
<td>Chung Hua University (CHU)</td>
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<tr>
<td></td>
<td>CTC</td>
<td>Technology for transmitting medical images and documents</td>
<td>National Taiwan University of Science &amp; Technology (NTUST)</td>
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<td>National Taipei Teachers College (NTPTC)</td>
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<td>National Chung Hsing University (NCHU)</td>
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<td>Taipei Medical University (TMU)</td>
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