Enterprise Systems Programs at Robert Morris University-Year One Implementation Results

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ABSTRACT

Since 1974, The Computer information Systems Department at Robert Morris University has been offering Enterprise Systems courses at the undergraduate level. By 1985, the courses were offered at both the undergraduate and graduate levels. The inclusion of a required 15-credit Enterprise Systems emphasis in the undergraduate BS-MIS degree program helped fuel enrollment growth in the BS-MIS degree program to reach an all-time high in 1988. Despite wide acceptance by industry, the Enterprise Systems courses were slowly deemphasized in the early 2000s. By 2005, they completely disappeared. In early 2011, with forecasts of the huge demand for enterprise systems professionals, Robert Morris University responded to the demands of the large corporations in the Pittsburgh area and redeveloped instructional programs for Enterprise Systems. The results of year one implementation are presented.

KEYWORDS: IBM Academic Initiative, IS Curriculum, IBM zEnterprise, ABET-CAC, z/OS, COBOL, CICS, DB2, Enterprise Systems Certificates, Undergraduate Degrees, Graduate Degrees Integrated BS/MS degree Program, Online Delivery, Robert Morris University

The Computer and Information Systems (CIS) Department at Robert Morris University (RMU) began teaching COBOL and Advanced COBOL in 1974 as elective courses in the undergraduate BS Business Administration degree program. In 1976, these two courses became required courses in the new BS Business Information Systems degree program. Soon afterwards, required courses in CICS, IMS and DB2 were added to the BS-BIS degree program. Although separate courses in OS/360 were not created, the required core operating system course also included significant coverage of the IBM OS/360 topics and an introduction to JCL. However, the CIS department did not have access to an IBM mainframe. The 15-credit Enterprise Systems emphasis in the BS-BIS curriculum was delivered on a platform utilizing MicroFocus COBOL and various third-party CICS, IMS, and DB2 add-on products. The department performed the Beta work on these products. Although the CIS department had an IBM mainframe from 1990 to 1995 it only served as the MUMPS Development Center for IBM. No other Enterprise Systems instruction took place on this machine. By 1988, the official name of the undergraduate BS-BIS degree had been changed to BS Management Information Systems and undergraduate enrollment peaked at 982 majors. Despite not being able to utilize an IBM mainframe for instruction purposes, the 15-credit Enterprise Systems emphasis in the BS-MIS program was well received by the large IBM users in the Pittsburgh area and nationally by the federal government and EDS who were hiring many of the graduates. By 2000, when enrollments in most undergraduate programs peaked, the program still maintained around 900 majors. However, shortly thereafter, the emphasis on Enterprise Systems in the curriculum was replaced by distributed computing and emerging technology courses. By 2005, the mainframe emphasis had disappeared from the curriculum.

This development was not unique to RMU. Web-centric languages such as .NET and Java for modern programming needs such as mobile apps and the Web became the rage in this era. Thus many university academic computing departments deemphasized the mainframe and discontinued teaching the COBOL language. This was true even though mainframe utilization remained high. According to analyst estimates, 60-80 percent of the world’s enterprises still rely on COBOL to run their business [3]. There are over 200 billion lines of COBOL code with hundreds being written daily and COBOL programs run almost three quarters of the world’s business applications and power almost all global ATM transactions [6]. However, in a recent Computerworld survey of 357 IT professionals, 46% of the respondents said they are already noticing a COBOL programmer shortage, while 50% said the average age of their Cobol staff is 45 or older and 22% said the age is 55 or older [4].
Regarding computing, Robert Morris University has had a strong working relationship with the major corporations in the Pittsburgh area since 1972. Their computing executives have and continue to serve as CIS department advisory board members, School Board of Visitors members, and University trustees. CIS faculty have acted and still are consultants to many of these corporations. Over the years, a strong internship/coop program has been developed, and placement rates for computing graduates have always been 100% or close to it. In the Spring of 2010, several large Pittsburgh-based international banks approached the CIS department and requested that the COBOL courses be offered once again in the curriculum. These firms were concerned that their COBOL workforce was starting to retire and colleges/universities were no longer teaching COBOL and other related enterprise systems concepts. The retirement of the COBOL workforce also created additional problems in the area of tacit knowledge, specifically, that the shortage in regard to the mainframe legacy COBOL skill set can adversely impact an organization since tacit knowledge is lost with an employee’s departure. Tacit knowledge refers to unwritten or unspoken knowledge that is not easily articulated, and exists only with the individuals who obtain the knowledge through their experiences [5]. For example, once a COBOL professional leaves an organization, the knowledge that person accumulated from working with different information systems may be lost, and approximately 50% of the cost of software maintenance is used to recreate this lost knowledge [1]. In addition to employee attrition, other factors relating to and contributing to tacit knowledge loss include lack of documentation from past employees on the mainframe or the programming language and the lack of education of current college students [2]. Recognizing these factors, the CIS department immediately agreed to once again offer our first two undergraduate COBOL courses. During the 2010-11 school year, 19 undergraduate students completed both the COBOL and Advanced COBOL courses. Despite not having earned their undergraduate degrees yet, they received full-time employment.

In the Fall of 2011, IBM corporation and a consortium of several Fortune 500 and smaller corporations in South Western Pennsylvania approached RMU with the request to bring back all of the mainframe courses in the curriculum. The consortium was aware of our past success in this area as well as of the recent success of the first 19 undergraduates who had completed COBOL and Advanced COBOL the previous year. The consortium was concerned about finding new Enterprise Systems professionals, who they expected to be in short supply in the next four to eight years due to attrition and retirements. Recognizing the past position of the CIS Department as a major supplier of enterprise systems professionals and the growing demand for new professionals, the department immediately agreed to bring back the enterprise systems courses at both the undergraduate and graduate levels. Also, an advisory group was formed to help in the curriculum design process (the RMU IBM Regional Planning Group). After a six month period of course design, the five course 15-credit Enterprise Systems Program was completed and adopted. In the March 2012 meeting of the Regional Planning Group, the university was awarded a mainframe computer from the IBM Innovation Center in Dallas to provide a dedicated Z-system for instruction purposes. The Enterprise Systems Program was designed to be delivered online or on-ground as part of either a certificate or part of a degree at either the undergraduate or graduate levels. Year one plans were to deliver all of the courses only in an on-ground format.

The five courses in the Enterprise Systems Program are as follows:

**INFS2130/INFS6130 COBOL Programming (3 credits)**
This course provides the student an introduction to structured programming through use of the COBOL language. Emphasis is placed on structured programming techniques, logic structures, and modular design; the use of design tools such as flowcharting, hierarchy charts, and/or pseudocode; and the interpretation and development of record layouts, report layouts, and quality program documentation. The student becomes familiar with the syntax and logic of COBOL by coding a sequence of increasingly complex problems. The fundamental elements of batch sequential file processing are stressed, with the application of arithmetic verbs, simple and complex IF statements, EVALUATE statements, 88-levels, internal sorting, control-break processing, single-level table processing and sequential file updating.

**INFS3130/INFS6320 Advanced COBOL Programming (3 credits)**
Students are introduced Virtual Storage Access Method (VSAM). The structure and application of an Entry-Sequenced Data Set (ESDS), Key-Sequenced Data Set (KSDS), and Relative Record Data Set (RRDS) are presented and compared. Using the IDCAMS utility students will create and manage VSAM clusters and datasets to support various COBOL VSAM file maintenance applications. Other course topics include advanced table processing, batch sequential file processing and updating, indexed sequential file processing and
updating, random/direct file processing and the use of sub-programs. Additional concepts covered are structured program design considerations, the interrelationship of programs within an information system, coding for program efficiency and clarity, and the creation and use of quality program documentation.

**INFS3212/INFS6212 Enterprise Operating Systems (3 CREDITS)**
Using IBM mainframe hardware, operating systems and applications, this course provides an integrated view of enterprise systems. Students are provided an overview for enterprise physical and logical (LPARs) processors, I/O connectivity, DASD storage, Parallel Sysplex and clustering technologies. An overview of z/OS, z/VM, TSO/E, ISPF, zO/S Unix, datasets in a z/FS file system, JCL, and batch job entry (JES3) concepts are also presented. z/OS programming languages, CICS transaction management, DB2 database management, the z/OS HTTP web server, WebSphere Application Server, networking and security are presented from an operating system perspective. Hands-on assignments are required.

**INFS3131/INFS6321 Enterprise Transaction Processing Systems using CICS/COBOL (3 CREDITS)**
This course focuses on the CICS Enterprise Transaction Processing System and CICS COBOL applications. CICS architecture, resource definition, CSD files and CICS tables are presented. Using a pseudo-conversational style, students will develop and test several CICS COBOL file applications using Basic Map Support (BMS) and the CICS EXEC interface. CICS Web Applications, Web Services, CICS Java Enterprise applications, and CICS security issues will be introduced.

**INFS4241/INFS6242 Enterprise Database Systems (3 CREDITS)**
This course focuses on the design, implementation, testing and application integration of an IBM DB2 enterprise database system. Using local client tools students will integrate the business model with logical data and physical models using a Master Data Management (MDM) approach. Using SQL DDL and DML statements students will implement tables and other structures and test the database design using interactive SQL statements and SQL code embedded in a COBOL application. Stored procedures, DB2 administration and security will be introduced.

**RMU Certificate Programs in Enterprise Systems**
The 18-credit, non-degree undergraduate certificate includes a total of six (6) undergraduate CIS courses, and the 15-credit, non-degree graduate certificate includes a total of five (5) graduate CIS courses. Both programs offer students a foundation and advanced levels of COBOL Programming, Z-Operating System, Transaction Processing Systems with CICS, and database applications with DB2. All undergraduate certificate courses can then be later applied to a BS degree, and all graduate certificate courses can be later applied to a M.S. degree. While some universities offer Enterprise Systems courses in a continuing education format for their certificates, it was decided to utilize regular undergraduate and graduate courses in the Enterprise Systems Certificate Programs.

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<td>- INFS1020 Introduction to Decision Support Systems</td>
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RMU Undergraduate Degree Programs with Enterprise Systems

The CIS department offers five undergraduate degrees in the area of Information Systems where the 15-credit, five courses E/S Program may be easily incorporated:
1. BS Computer Information Systems (ABET Accredited)
2. BS Information Science (ABET Accredited)
3. BS Competitive Intelligence Systems
4. BS Cyber Forensics & Information Security
5. BS Professional Communications and Information Systems.

RMU Graduate Degree Programs with Enterprise Systems

Although each of RMU’s six MS degrees in Computing have 9 credits of electives that may be used for the Enterprise Systems courses, there are three degree programs that fully utilize the 15-credit Enterprise Systems Program:
1. MS Internet Information Systems-Concentration in Enterprise Systems degree program
2. MS Information Security & Assurance-Concentration in Enterprise Systems degree program
3. MS Competitive Intelligence Systems-Concentration in Enterprise Systems degree program

Enterprise Systems Programs- Partnerships with other Universities

Since regular undergraduate and graduate credit-bearing courses are used in RMU’s Enterprise Systems Program, the online courses and degree programs may be used by other universities. Students at other universities may apply as Enterprise Systems Certificate students and have the courses applied to their degrees at their host university.

The Enterprise Systems Program is also an option in RMU’s Online SCIS Integrated BS/MS program. Here the student may concurrently earn an undergraduate degree from their host university and a graduate degree online from RMU.

Enterprise Systems Programs- Partnerships with Industry and Government

Since the Enterprise Systems Program courses are offered both on-ground and online, industry/government employees may take the courses no matter where they are in the world. Also, since regular undergraduate and graduate courses are utilized, most employers can use their tuition reimbursement programs from HR to supplant their low or non-existent training budgets.

Implementation Results from Fall 2012 and Spring 2013

On ground courses: In the fall of 2012, RMU began all Enterprise Systems instruction on the IBM mainframe, and the new COBOL and ZOS courses were offered for the first time. COBOL had 25 students, and ZOS has 17 students. In the Spring of 2013, RMU offered COBOL, Advanced COBOL, ZOS, and the DB2 courses. COBOL had 17 students, and Advanced COBOL had 7 students. ZOS had 22 students, and DB2 had 8 students. CICS/COBOL was planned for Summer 2013.

Online course development: The design and development of the online undergraduate and graduate COBOL and ZOS courses were completed on schedule in December 2012. By May 1, 2013, the design and development of the online undergraduate and graduate Advanced COBOL and DB2 courses were completed. The development of the online undergraduate and graduate CICS courses is currently on schedule for an August 1, 2013 implementation. Departmental policy required that online courses must be first be delivered on-ground before they can be developed for online delivery.
Future Enterprise Systems Implementations

Although the primary emphasis of this paper and the IBM Regional Planning Group was to focus on COBOL, ZOS, CICS, and DB2, other needs relating to the mainframe have become evident. In addition to the aforementioned courses, this summer (2013), Java on the Z/OS platform will be offered on-ground and in the Fall of this year Websphere, which is the middleware and software framework that hosts Java base web applications, will be added to the curriculum. Developing mobile applications with zEnterprise as the data source is a skill needed by many industries so plans are to add a course to the curriculum involving Worklight (the IBM product that supports the full spectrum of mobile applications). Finally, to support the Business Intelligence curriculum, COGNOS will be used.

References