

Integrating PDC Topics into University-Wide Digital Computer Principles Course

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Abstract_ Digital Computer Principles (CSC 115) is a university wide freshman level course offered by the Computer Science department at Jackson State University (JSU) for non Computer Science and non Engineering majors. About three hundred and fifty students register for this class every semester. Last fall, as part of the Early Adopter award program, the contents of this course were updated with some modern Parallel and Distributed Computing (PDC) topics like Client/Server and Peer to Peer paradigms, Parallel Computing and Internet of Things (IoT). In order to accommodate the new PDC topics, some MS Access and Word material in the current CSC 115 course listing was reduced or eliminated. In an ongoing effort to convert CSC 115 course into digital core course; PDC digital contents were also developed for the fall and spring semesters. In order to assess students' perception of PDC topics; a survey was distributed and specific test questions and homework assignments were developed throughout the fall semester. The feedback from students clearly indicated that they had no previous knowledge of PDC and CSC 115 course helped build their PDC knowledge. However, many students struggled to find PDC applications to their major field of study. Consequently, more PDC applications will be discussed in class this spring semester to serve this purpose.

BACKGROUND

Jackson State University has a student population that is over 90% from under-represented groups. This NSF/IEEE-TCPP Curriculum Initiative award will therefore have a direct impact on minority's technology education. Not only will this project enhance the quality of JSU graduates, but also, it will introduce them to the latest advancements in the area of PDC.

The Computer Science department at JSU offers Digital Computer Principles (CSC 115) course which is mandatory for all non Computer Science and non Engineering majors. It is offered every semester; with about ten sections with an approximate average of thirty five students each, making the total number of students registering for this course more than three hundred and fifty students every semester.

THE EARLY ADOPTER COURSE

An ongoing effort has started at JSU to restructure Digital Computer Principles (CSC 115) course. Some Parallel and Distributed Computing (PDC) topics will be added to this course and included in the digital core course. The following is a brief discussion of these topics:

- Distributed Computing Overview (1 hour): Students will learn how multiple computers and processors work as a distributed system.
- Client/Server paradigm (1 hour): The most commonly used communication paradigm in the Internet. It consists of a server and multiple clients. The client requests information from the server and the server responds to the client request. Examples include: World Wide Web (www), web search, online gaming, social networks, email, ecommerce, etc.
- Peer-to-peer paradigm (0.5 hour): Peer-to-peer (P2P) computing was influenced by three major systems: Napster sharing system, Freenet data store; and SETI volunteer-based computing projects. The Napster allowed its users share files through the Internet. The

P2P communication has been widely used in Open Source Software communities and industry. Examples of P2P systems are BitTorrent, Skype, PPlive, Cool Streaming and iPlayer.

- Parallel Computing (2 hours): It is a computation that is carried out simultaneously by many processors sharing some data. There are several ways to implement forms of parallel computing: task, data, instruction, and bit-level parallelism. High Performance Computers (HPCs) can be categorized into three levels: multi-cores, multi-processors, and multi-computers parallel computers. Some of the HPCs consist of multiple forms of parallel hardware components.
- Internet of Things (IoT) (0.5 hour): Nowadays, a lot of devices used in many different applications are equipped with firmware, sensors, electronics, and connectivity to allow them produce new types of services.

The total number of hours to cover PDC topics was close to five. The following topics in the current CSC 115 course listing were reduced to accommodate for the newly added PDC topics: MS Word reduced by two hours and MS Access reduced by three hours.

PROJECT EVALUATION PLAN

In order to assess students' knowledge of PDC topics, a survey was conducted at the beginning of the semester to gather initial feedback from students about their PDC knowledge. Ninety students responded to the survey where 16% were freshmen, 38% sophomores, 38% juniors and 9% seniors. Some of the students' comments were:

- I have not taken any course that deals with PDC.
- PDC education should be used in a way to apply to real life activities. There should be knowledge on how the course applies to the major field of study.
- I would like to get more educated about PDC. Since we use it and it is important in our daily lives.

Both the survey results and students' comments showed that students have no previous knowledge of PDC! However, almost all students expressed their desire to learn about this topic. Some did not mind pursuing a career that may require some PDC background. The majority of the students though, were not sure how PDC can be related to their major field of study.

CURRENT AND FUTURE ACTIVITIES

Currently, we are in the process of refining the PDC material taught last semester. A major challenge is to find some examples where PDC knowledge will relate to the students field of study as well as their future careers. We will continue collect assessment data and feedback from both students and faculty members which will guide us develop a more comprehensive plan to integrate PDC topics into Digital Computer Principle class for the coming semesters. In addition to that, the faculty team involved in this project is preparing to submit an NSF grant to enhance PDC education at JSU.