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INFORMATION SYSTEMS EDUCATION JOURNAL

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Cloud Computing as a Core Discipline in a Technology Entrepreneurship Program

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Abstract

Education in entrepreneurship continues to be a developing area of curricula for computer science and information systems students. Entrepreneurship is enabled frequently by cloud computing methods that furnish benefits to especially medium and small-sized firms. Expanding upon an earlier foundation paper, the authors of this paper present an enhanced model program for including cloud computing as a discipline for further learning technology entrepreneurship. In the program, students can learn skills for leveraging cloud computing practices in the context of an enterprise strategy. This paper will be beneficial to educators exploring new initiatives in industry that might improve innovation projects in a technology entrepreneurship program.

Keywords: cloud computing, cloud service provider (CSP), cloud sourcing, computer science and information systems curricula, entrepreneurship, infrastructure-as-a-service (IaaS), interdisciplinary, platform-as-a-service (PaaS), software-as-a-service (SaaS), technology.

1. BACKGROUND AND DEFINITIONS OF PAPER

"Change is coming thanks to cloud computing: the over-hyped computing trend … actually hides within it the seeds of a genuine information technology revolution." (Morrison, 2011)

Cloud is defined essentially as a breakthrough "model for enabling convenient, on-demand network access [by firms] to a … pool of configurable computing resources … that can be provisioned rapidly and released with minimal management effort or [cloud] provider [CSP] interaction" (Walz & Grier, 2010). Cloud computing is delivered in models of infrastructure-as-a-service (IaaS), consisting of CPU, networking and storage services; platform-as-a-service (PaaS), consisting of framework services to deploy, host and maintain systems; and software-as-a-service (SaaS), including a model of pay-as-you go services to manage network systems (Yachin & Patterson, 2009). Cloud computing may be deployed as a public cloud, a private cloud, or a hybrid of private and public clouds (National Institute of Standards and Technology, 2009). Benefits of cloud computing include cost efficiency in lesser investing in generic hardware systems, faster implementation of features of new products and systems, and flexible provisioning and resource scalability of systems, in a model of pay-as-you-go services (Lawler, 2011). As functions in the office migrate to the cloud, cloud computing is perceived to represent a fundamental migration in the delivery of technology in 2011 and beyond (Srinivasan & Getov, 2011).

Entrepreneurship in the field of technology may be defined as a method for exploiting

breakthrough high-potential models of technology, in order to furnish improved processes, products, services and systems to the marketplace (Byers, Dorf, & Nelson, 2011, p. XV). Medium to small-sized firms may be enabled to furnish new products and systems on the cloud model, having CPU, host and networking systems scaling to requirement (Miles, 2009, September), but not investing in any hardware technology and only paying for used or variable services of the technology, as large-sized firms furnish excess computing capacity or a "spot market" for cloud computing (The Economist, 2011). This enablement lessens a barrier to entry for emerging small-sized firms that might be founded on a cloud computing model (Habiby & Coyle, 2010). Entrepreneurs forming firms founded on the cloud paradigm might formulate ideas for new processes and services into fully functioning products and systems speeding to the marketplace sooner than in traditional ventures (Entrepedia, 2011). Firms may be enabled to initiate opportunities learned from the open innovation (Chesbrough, 2011) or sourcing of technologies on the Internet. They may be enabled to initiate opportunities even more in virtual offices instead of physical traditional offices, through the cloud computing model (Aquino, 2010). Literature indicates entrepreneurship as a nexus of enterprising entrepreneurs and opportunists (Shane & Venkataraman, 2000), of which the cloud may be an example of infinite opportunities in the marketplace. Cloud models may furnish opportunities for processes, products, services and systems (Khalidi, 2011), still to be discovered by entrepreneurial firms.

Despite the benefits of the cloud for entrepreneurial firms, concerns on control and security of information (McCall, 2010), integration and on-demand performance, reliability and scalability of CSP systems (Castro-Leon, Golden, & Gomez, 2010) may be factors indicating immaturity of the model. However, literature is concurrently indicating firms to be bullish about the future of the cloud (Narasimhan & Nichols, 2011), especially business entrepreneurial firms (Keating, 2010) – in a forecasted growth model of five times that of traditional technology ventures (Machi, 2010, p. 1), though they are cognizant of the concerns. Firms may manage the cloud model as another mere model of technology (Montalbano, 2011). Entrepreneurs in firms that are start-ups, or future entrepreneurs that are lab students in schools of computer science and information systems, might exploit interdisciplinary opportunities for processes and services in business non-technology firms or technical opportunities for products and systems in CSP technology firms, as consultants or inventors. Immaturity of the model might be indicative of opportunities in new products and systems, such as a data mining product for gathering information integrated on the cloud at lower cost expenditure (Linthicum, 2011); a system integrating information on the cloud for localized smart-phones and tablets; or a security or storage management system for improving CSP platforms of technology. Medium to small-sized firms might even exploit opportunities that leverage the cloud from office software to sophisticated systems that were once exploited only by large-sized firms in industry (Miles, 2009, January). Large-sized firms might further exploit intrapreneurial opportunities for profit (Pinchot, 2000). Schools of computer science and information systems may benefit by having students cognizant of not only the cloud, but the cloud as an entrepreneurship model of opportunities and possibilities.

2. INTRODUCTION TO PAPER AND PROGRAM

"… Cloud computing is going to make the level playing field [for large, medium and small-sized firms] a reality – great opportunities for entrepreneurs." (Almandoz, 2010)

Pace University is considered an entrepreneurial institution in the northeast corridor of the country (Drucker, 1994), along with other leading institutions in the country (Buchanan, 2011). The Seidenberg School of Computer Science and Information Systems of the university is currently enhancing a concentration in Technology Entrepreneurship in its Bachelor of Arts in Computer Science Program, defined in an earlier foundational paper and funded by the National Science Foundation (Lawler & Joseph, 2011). The concentration is for computer science and information systems students to learn the practices of skills needed to be business opportunists. The emphasis of the program is on the development of competitive ideas for marketable processes, products, services and systems, infused by entrepreneurial innovation if not invention of technologies, in a fictitious firm, or if feasible in an actual firm. The concentration in Technology Entrepreneurship is essentially a fusion of

entrepreneurship, interdisciplinarity, and technology, on projects for firms.

As defined in the earlier foundational paper (Lawler & Joseph, 2011), the flow of the Technology Entrepreneurship program is described below for computer science and information systems majors (*):

- Define an idea for a business opportunity in a process, product, service or system that might be further infused by technologies or invention of new technologies;

- Design and develop a process, product, service or system, or a prototype, in a manner of creativity and innovation that furnishes cutting edge in business opportunity, by integration or invention of solution technologies;

- Develop a business plan for communicating the process, product, service or system, and the potential for profitability, as a new department of a firm or as a new firm, for funding by potential investors;

- Develop customized plans for marketing the process, product, service or system, infused by technologies, to targeted consumers or customers, or firms, in the marketplace; and

- Identify forthcoming innovation in technologies that might impact the process, product, service or system of the new venture.

(*) Finance, management science and mathematics majors are currently included in the program, but are a minority of the students.

The outcomes of the concentration in the Technology Entrepreneurship program are in the learning of analytical, business, communication, creativity and innovation skills on interdisciplinary and technology projects – entrepreneurship skills.

In this paper, the authors, who are also the principal instructors in the Technology Entrepreneurship program, discuss an enhancement for including the cloud model as a course discipline for further learning technology entrepreneurship. The emphasis of the discipline is for computer science and information systems students, and the other students, to exploit the cloud model for breakthrough business opportunities that may benefit from cloud methods and technologies. Students might exploit the immaturity of the model for improved if not new processes, products, services or systems for business non-technology firms, consumers or customers in the marketplace, or CSP technology firms that furnish the potential for profit. They might exploit the cloud for possibilities, if not solutions, from office productivity software or sophisticated systems housed on cloud CSP technologies for products or systems in their own ventures. The focus of the cloud model, as a course discipline in the Technology Entrepreneurship program, is for the students to learn skills that leverage cloud computing practices in the context of an entrepreneurial enterprise strategy.

The inclusion of the cloud model into the Technology Entrepreneurship program of the Seidenberg School is current with the literature. Developers in entrepreneurial firms are excited about the creative ferment and fun of the model (Vance, 2011) and are exploring opportunities for new frameworks of infrastructure processes and products, new methods of programming, and new services in software and systems (Vasan, 2011). They are exploring for example possibilities for new data mining petabyte storage systems on a cloud SaaS platform (eWeek, 2011). Firm managers already leverage productivity software, such as collaboration, data base, e-mailing, middleware and Web conferencing (Black, Mandelbaum, Grover, & Marvi, 2010), and systems, such as customer relationship management (CRM) and enterprise resource planning (ERP) technologies. Students in the Seidenberg School might leverage the cloud platform in a portfolio of entrepreneurial interdisciplinary projects, such a data mining product integrating social media systems, and pure technology projects, such a security management system safeguarding international cloud systems, in a cloud sourcing strategy – leveraging the cloud to the utmost. Students of Generations X and Y are not intimidated by the technology (High, 2009). Schools of computer science and information systems moreover might leverage tools and utilities of CSP technology firms that are partnering with universities (Blankenhorn, 2010).

The inclusion of the cloud computing model into the Technology Entrepreneurship program is current with the dismal marketplace. Computer science and information systems students graduating schools without industry positions are frequently forming entrepreneurial firms

(Seligson, 2010). Entrepreneurs are heroes to students – 51% of teenagers desire to be entrepreneurs in industry (Daley, 2009, p. 4). Entrepreneurial managers, and others no longer employed in industry, are frequently forming firms – firms grew 4.5% or 1 million more self-employed in 2010 (Daley, 2009, 2). Financial firms are increasingly investing in medium and small-sized entrepreneurial firms and technology funds (Rusli & Kopytoff, 2011). The introduction of the cloud computing platform into the Technology Entrepreneurship program of the Seidenberg School may be apt to computer science and information systems students desiring to learn the skills to be distinguished as the best opportunists in the marketplace.

3. FOCUS OF PROGRAM

The concentration in the Technology Entrepreneurship program, enhanced by the cloud computing model, is focused on the below courses of study:

- Entrepreneurship and Technology, a concept course integrating computer science and entrepreneurship in a project for business decision-making;

- Customer Relationship Management (CRM) and Entrepreneurship: Data Mining, a concept course integrating targeted marketing, sales and service in a project for decision-making on strategy;

- *Cloud Sourcing*, *a core course new to the program integrating the practices of cloud computing in the context of domain enterprise strategy*;

- Entrepreneurship and Financial Computing, a domain course integrating algorithmic computing, computer science, entrepreneurship, finance and financial analysis in a project for decision-making;

- Modeling of Financial Processes, Products, Services and Systems through Technologies, an adjunct domain course integrating computer science, finance and information systems in projects for decision-making on implementation of prototyped or real software technologies;

- Entrepreneurial Health Informatics, a domain course integrating governmental mandates, health industry programs and information systems on a project for decision-making;

- Energy Efficiency Entrepreneurship, a domain course integrating energy programs and information systems on a project for decision-making;

- Entrepreneurship and National Security, a domain course integrating national policy on protection and security technology on a project for decision-making strategy; and

- Special Topics in 21st Century Technologies and Ventures, a survey course integrating leading edge marketplace technologies that might impact new ventures.

The program continues to be focused not on generic entrepreneurship and technology, but on an integration of entrepreneurship and technology into the fields of energy, finance, health, security and technology (Vallino, 2010) – fields of interdisciplinary practices that might be improved by introduction of cloud sourcing technology. Entrepreneurial interdisciplinary projects may be attractive to business-expert students, and entrepreneurial technology projects may be attractive to technology-expert focused students, in the Cloud Sourcing course. The goal of this program is for the computer science and information systems students to become business entrepreneurs or opportunists, not pure technologists, knowledgeable now in the possibilities of the cloud.

The program is depicted in Figure 1 of the Appendix.

4. METHOD OF PREPARATION OF PROGRAM

The Seidenberg School of Computer Science and Information Systems initiated the Technology Entrepreneurship program in the semester of spring 2011 (*), as presented below:

2011:

- Customer Relationship Management (CRM) and Entrepreneurship: Data Mining (Spring);

- Entrepreneurship and Technology (Fall); and

- *Cloud Sourcing* (Fall).

2012:

- Entrepreneurship and Financial Computing (Spring);

- Modeling of Financial Processes, Products, Services and Systems through Technologies (Spring);

- Special Topics in 21st Century Technologies and Ventures (Summer); and

- Entrepreneurial Health Informatics (Fall).

2013:

- Energy Efficiency Entrepreneurship (Spring).

2014:

- Entrepreneurship and National Security (Fall).

Each of the courses is 4 credits or 36 credits for the full program through 2014.

(*) Once presented in the school, the courses in the program are to be scheduled in 2012 – 2014 and beyond once a year.

The prerequisites of this program are undergraduate sophomore, junior or senior students with a C+ grade index overall in the university.

5. CLOUD COMPUTING IN MODEL PROGRAM

"Maybe the cloud craze will spawn the next generation of technopreneur millionaires." (Machi, 2010, p. 2)

The Technology Entrepreneurship program at the xxxxx School is enhanced now with the core discipline of the cloud computing model and is depicted in detail in Table 1 of the Appendix.

The course in cloud computing, or cloud sourcing that is denoting the sourcing of technologies, is designed for educating computer science and information systems students in the school on the business dimensions of the cloud – business process management (BPM), entrepreneurship and service-oriented architecture (SOA) – in weeks 1 and 2 of the semester. The course is also designed for educating students on the technical dimensions of the cloud – platforms, products and utilities – in week 3. The element of management of the technical and business dimensions of the cloud – change management, cloud project prioritization and program management methodology – is designed in week 4 of the semester. The highlights of the course are in the execution of entrepreneurship scenarios – interdisciplinary projects (e.g. a data mining system for a client non-technology firm or a new venture) and technology projects (e.g. a security system for a client CSP technology firm or a new venture), in which students explore, if not exploit, ingenuity and improvisation in processes, products, services and systems leveraging functionality of the cloud – in weeks 5-7 and 8-10. The projects are positioned for profitable thresholds or tipping points (Byers, Dorf, & Nelson, 2011, p. 273) in week 11. In the final 12-14 weeks of the semester, the course is designed for helping students in the management and migration of the projects into systems if not ventures.

The deliverables of the Cloud Sourcing course, and the other courses in the Technology Entrepreneurship program, are competitions for the best of projects furnishing opportunities or potentially profitable ventures. The projects are to be developed in incubating small (3-5) student teams, mentored by entrepreneur experts and investors in local industry, who have volunteered to be mentors in the program, and by the instructors. The development is to be done from agile method (Lohr, 2010), emphasizing rapid application development (RAD) prototyping (Byers, Dorf, & Nelson, 2011, pp. 222-225), and from entrepreneurship (Byers, Dorf, & Nelson, 2011, pp. 225-227) and project management principles (Richardson & Butler, 2006), referenced in Table 1. The best of the projects is to be decided by the aforementioned mentors on a panel of fictitious venture capitalists in week 14 of the semester, and the best of the teams is to be granted a cash prize (The Economist, 2010). Interaction of instructors, mentors and student teams is to be in the classroom, discussion forums of the Blackboard Learn System, and if feasible localized meetings at entrepreneurial technology firms in downtown New York City that might beta test the projects.

Cloud Computing Strategies (Chorafas, 2011) is the required text, and Behind the Cloud: The Untold Story of How Salesforce.Com Went from Idea to Billion-Dollar Company (Benioff & Adler, 2009) is the supplementary text, of the Cloud Sourcing course; and Technology Ventures: From Idea to Enterprise (Byers, Dorf, & Nelson, 2011) is one of the required texts, and How to Change the World: Social Entrepreneurs and the Power of New Ideas (Bornstein, 2007) is one of the supplementary texts, of the program.

(The designs of the Customer Relationship Management (CRM) and Entrepreneurship: Data Mining and Entrepreneurship and Technology courses are available upon request to the authors, and the designs of the other courses in the program are in current development by the authors.)

6. IMPLICATIONS OF PROGRAM

"The idea of entrepreneurship is so powerful … and resonates with so many American values that President Obama has … called on entrepreneurs to lift the [country] out of the economic crisis." (Daley, 2009, p. 2)

The design of the Technology Entrepreneurship program in the Seidenberg School of Computer Science and Information Systems, enhanced with the cloud model, facilitates entrepreneurship goals. Entrepreneurs have infinite opportunities in initiating projects leveraging the cloud in essentially an adolescence of maturity of the technology. Interdisciplinary process and product projects further insure numerous possibilities for productive services and systems. Projects might be for entrepreneurs in business client non-technology firms, CSP technology firms, or in new firms formed from project solutions. The impact of the enhanced program as a design is that the cloud computing model in Technology Entrepreneurship furnishes high potential of profitable projects.

The Technology Entrepreneurship program, enhanced with the cloud model, improves the likelihood of marketability of computer science and information systems students who finish the Cloud Sourcing course or the program. Students learn the cloud computing model in the context of interdisciplinarity and the excitement and ferment of leveraging the model on processes, products, services and systems, not pure technology leveraging pure technologies – "something that could be [made] into a business [proposition]" (Dignan, 2008). Students learn grounded-in-reality non-technical skills, distinguishing them from other students learning purely technical skills (May, 2010). They might be employed as interns at entrepreneurial technology firms in the city. These students might pursue self-employment in the marketplace leveraging the skills – more than 50% of the fastest growing firms in the country were formed in a downsized economy (Daley, 2009, p. 3). The impact is that the cloud computing model in the Technology Entrepreneurship program as a design furnishes more potential for practitioner student success.

The new Technology Entrepreneurship program insures an offering that positions the xxxxx School at the forefront of leading edge methodology and technology. The fun of including the cloud model on enterprise solutions insures that the students are also at the forefront of a marketable technology (Marsan, 2011). Schools of computer science and information systems need to be involved with non-technology and technology firms, as the cloud model is further integrated into a mainstream maturing methodology and technology. Schools might join initiatives of firms, such as IBM (Kutzer-Rice, 2011), organizations, such as the National Collegiate Inventors and Innovators Alliance, and other schools, such as the Stevens Institute of Technology (Luftman, 2011), in insuring that entrepreneurship programs involving technology remain state-of-the-art. They might join societies, such as the IEEE Computer Society, in further insuring entrepreneurship knowledge of students (Gates & Romero, Alonso Jr., Klett, Naveda, & Requena, 2011). The implication is that new Technology Entrepreneurship programs as designs furnish potential school success if schools strive to be up-to-date with the inherent technology.

7. LIMITATIONS AND OPPORTUNITIES IN RESEARCH

Evaluation of the full Technology Entrepreneurship program may not be feasible until full implementation in 2014. However, the authors will be conducting a detailed evaluation of the learning outcomes and performances of the students in the Cloud Sourcing, Customer Relationship Management (CRM) and Entrepreneurship: Data Mining and Entrepreneurship and Technology courses of the program in late 2011. Evaluation of the full program in 2014 will include formation of new firms and new processes, products, services and systems by students through technology. Recent registration for the Cloud Sourcing course in fall 2011 is an encouragingly high 25+ students in the Seidenberg School.

The introduction of the Cloud Sourcing course into the Technology Entrepreneurship program will enable exciting opportunities in project

research, as instructors and students in partnership with mentors pursue opportunistic projects. Future graduates of the course, if not the program, will furnish opportunities for further research in entrepreneurship, interdisciplinarity and technology if they personally pursue these ventures.

8. CONCLUSION OF PAPER

The paper expanded the Technology Entrepreneurship program of the Seidenberg School of Computer Science and Information Systems of Pace University. Computer science and information systems students in the school may learn more of the skills for taking advantage of the cloud model on opportunistic projects of technology. They may learn possibilities on projects taking them to potentially profitable ventures not so readily feasible under prior technologies. These skills may be more marketable to the students than if they learned technology entrepreneurship without the cloud computing model. Though further research is pending on the results of the program at the university, this paper in its current presentation will be helpful to instructors in other schools of computer science and information systems in furnishing ideas for integrating a paradigm of technology into their own technology entrepreneurship programs.

9. ACKNOWLEDGEMENTS

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10. REFERENCES

Almandoz, J. (2010). Thought leaders in cloud computing: Jose Almandoz, CIO of Novell (Part 7). In S. Shalini (Ed.), *Sramanamitra*, August 22, 3.

Aquino, J. (2010). How technology changed entrepreneurship. *Open Forum*, March, 1-4.

Benioff, M., & Adler, C. (2009). Behind the Cloud: The Untold Story of How Salesforce.Com Went from Idea to Billion-Dollar Company – and Revolutionized an Industry. Jossey-Bass, San Francisco, California.

Black, L., Mandelbaum, J., Grover, I., Marvi, Y. (2010). The arrival of 'cloud thinking': How and why cloud computing has come of age in large enterprises. *Management Insight Technologies*, White Paper, November, 8,11.

Blankenhorn, D. (2010, March 31). IBM puts entrepreneurship in its cloud. *Smart Planet*, 1-2.

Bornstein, D. (2007). How to Change the World: Social Entrepreneurs and the Power of New Ideas. Oxford University Press, New York, New York.

Buchanan, L. (2011, April). An unsentimental education: University courses in entrepreneurship are better – more useful, more real, more likely to produce actual companies – than they have ever been. *Inc.*, 66-73.

Byers, T.H., Dorf, R.C., & Nelson, A.J. (2011). Technology Ventures: From Idea to Enterprise. McGraw-Hill, New York, New York, XV,222-225,225-227,273.

Castro-Leon, E., Golden, B., & Gomez, M. (2010, December). Cloud computing basics. *SOA Magazine*, 1,3.

Chesbrough, H. (2011). Foreward. In P. Sloane (Ed.), *A Guide to Open Innovation and Crowd Sourcing: Advice from Leading Experts*. Philadelphia, Pennsylvania: Kogan Page Limited, xvii.

Chorafas, D.N. (2011). Cloud Computing Strategies. CRC Press: Taylor & Francis Group, Boca Raton, Florida.

Daley, J. (2009). The entrepreneur economy: While the corporate world struggles to find its footing, entrepreneurs are stepping up with new ideas. *Entrepreneur*, December, 2,3,4.

Dignan, L. (2008). How cloud computing makes everyone an entrepreneur. *Bnet*, June 10, 1-2.

Drucker, P. (1994). Innovation and Entrepreneurship: Practices and Principles.

Butterworth-Heinemann Ltd: New York, New York.

Gates, A.Q. & Romero, R., Alonso Jr., M., Klett, F., Naveda, J.F., & Requena, D. (2011). Cultivating entrepreneurial thinking through IEEE - Computer science student chapters, *Computer*, April, 48-55.

Habiby, A.S., & Coyle, Jr., D.M. (2010). The high-intensity entrepreneur. *Harvard Business Review*, September, 74-78.

High, P.A. (2009). World Class IT: Why Businesses Succeed When Technology Triumphs. John Wiley & Sons, Inc., Hoboken, New Jersey.

Keating, R.J. (2010). Cloud computing and policy. *Small Business and Entrepreneurship Council*, August 26, 1-2.

Khalidi, Y.A. (2011). Building a cloud computing platform for new possibilities. *IEEE Computer*, Technology & Entrepreneurs Analysis, March, 29.

Kutzer-Rice, R. (2011, March 21). Information technology boot camps teach new ideas and technologies. *Smarter Technology*, 1-2.

Lawler, J.P. (2011). Cloud computing in the curricula of schools of computer science and information systems. *Information Systems Education Journal (ISEDJ)*, 9(1), 1-21.

Lawler, J.P., & Joseph, A. (2011). A financial technology entrepreneurship program for computer science students. *Information Systems Education Journal (ISEDJ)*, 9(1), 1-7.

Lawler, J.P., & Howell-Barber, H. (2008). Service-Oriented Architecture: SOA Strategy, Methodology, and Technology. Auerbach Publications: Taylor & Francis Group, Boca Raton, Florida, 27-59.

Linthicum, D. (2011, March 24). Cloud-based business intelligence (bi) is a game-changer. *Infoworl*d, 1-2.

Lohr, S. (2010). The rise of the fleet-footed start-up. *The New York Times*, Bright Ideas, April 25, 5.

Luftman, J. (2011). What is going on with cloud? *Proceedings of the Global Services Conference*, New York, New York, January 27.

Machi, E. (2010). Living in the cloud: Opportunities for entrepreneurs. *Entrepreneurship Review*, March 17, 1,2.

Marsan, C.D. (2011, March 29). Wanted: Cloud computing skills – job opportunities are increasing for information technology (it) pro[fessionals] with cloud-related security, virtualization and development abilities. *CIO*, 42-43.

May, T. (2010, August 23). Imagining the shape of the 2020 information technology (it) workforce. *Computerworld*, 27.

McCall, M. (2010). Cloud spreads through enterprise. *IEEE Computer*, December 18, 1-2.

Miles, D. (2009). Seven reasons why saas can recession-proof your information technology (it). *Smallbixpod*, September 17, 1-3.

Miles, D. (2009). Seven things you should know about cloud computing and cloud services. *Smallbixpod*, January 26, 1-3.

Montalbano, E. (2011, March 22). General Services Administration: Cloud computing is safer than you think. *Information Week*, 1-5.

Morrison, K.S. (2011). Power to the people: How cloud management will transform information technology (it). *Information Management*, March / April, 16-20.

Narasimhan, B., & Nichols, R. (2011). State of cloud applications and platforms: the cloud adopters' view. *IEEE Computer*, March, 25.

Pinchot, G. (2000). Intrapreneuring in Action: A Handbook for Business Innovation. Berrett-Koehler, San Francisco, California.

Richardson, G., & Butler, C. (2006). Readings in Information Technology Project Management. Thomson Course

Technology, Boston, Massachusetts, 49-52.

Rusli, E.M., & Kopytoff, V.G. (2011). Investing like it is 1999: Rush to invest in start-ups recalls era of tech[nology] bubble. *The New York Times*, Business Day, March 28, B1.

Seligson, H. (2010). No jobs? Young graduates make their own. *The New York Times*, December 12, 1-2.

Shane, S., Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25(1), 217-226.

Srinivasan, S., & Getov, V. (2011). Navigating the cloud computing landscape – Technologies, services, and adopters. *IEEE Computer*, March, 22.

Vallino, J. (2010). Cutting across the disciplines: Engineering and computing educators must design curricula that require students to work outside their own domain. *IEEE Computer*, April, 89.

Vance, A. (2011, March 7-13). The power of the cloud. *Business Week*, 54.

Vasan, R. (2011). A venture perspective on cloud computing. *IEEE Computer*, March, 62.

Walz, J., & Grier, D.A. (2010). Time to push the cloud. *IEEE IT Pro*, September / October, 14.

Yachin, D., & Patterson, R. (2009). Market & analysis overview: Cloud computing. *IDC White Paper*, September, 1.

_____ (2011). What is cloud computing? *Entrepedia: The Entrepreneurship Wiki*, March 10, 1-4.

_____ (2011, February 21). 'Big-data' analytics as a service. *eWeek*, 28.

_____ (2011, February 19). A market for computing power: A new spot market makes cloud computing a commodity. *The Economist*, 74.

_____ (2010, August 7). And the winner is: Offering a cash prize to encourage innovation is all the rage. Sometimes it works rather well. *The Economist*, 79-80.

_____ (2009). Cloud defined. *National Institute of Standards and Technology (NIST)*, Information Technology Laboratory, Draft Definition, Version 14.

Editor's Note:

This paper was selected for inclusion in the journal as a ISECON 2012 Distinguished Paper. The acceptance rate is typically 7% for this category of paper based on blind reviews from six or more peers including three or more former best papers authors who did not submit a paper in 2012.

APPENDIX

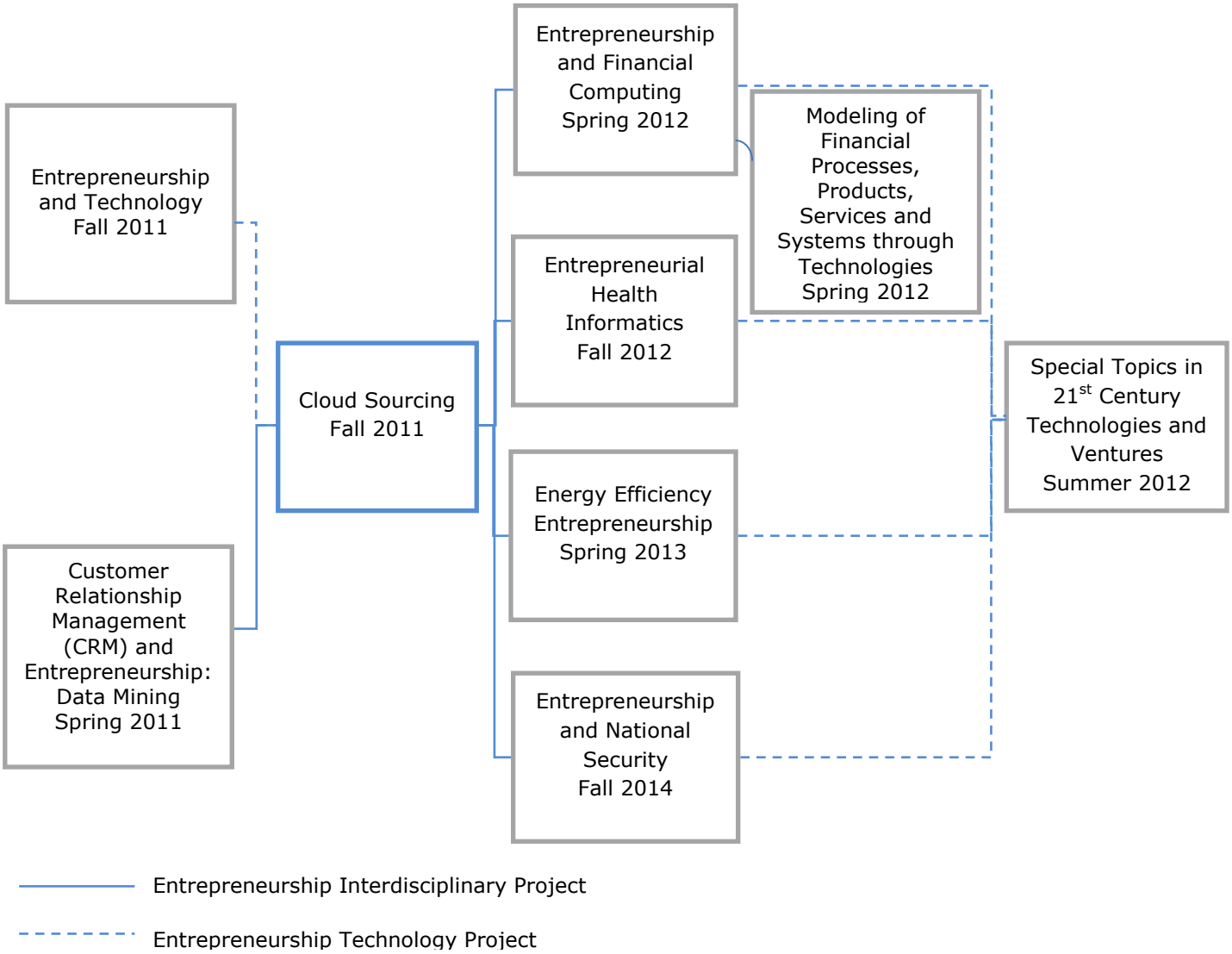

Figure 1: Bachelor of Arts in Computer Science – Concentration in Technology Entrepreneurship Enhanced by Cloud Computing Model – 2011 – 2014

Table 1: Bachelor of Arts in Computer Science – Concentration in Technology Entrepreneurship

Technology Entrepreneurship Program: Cloud Sourcing – Fall 2011 Semester

Week	Modules	Project(s)	Source(s)
1	Business Project Management (BPM) Business Process Management (BPM), Cloud and Entrepreneurship Cloud Models of Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS)	-	Lawler, 2011
2	Cloud Computing as Design Patterns Cloud Computing, Service Orientation and Service-Oriented Architecture (SOA) Cloud Computing Information Model and Infrastructure of Services	-	Lawler, 2011
3	Platforms of Cloud Service Provider (CSP) Technology Firms Product Specific Cloud Technologies, Tools and Utilities	-	Lawler, 2011
4	Change of Culture Management Planning and Prioritization for Cloud Program Management Methodology for Projects	-	Lawler, 2011 Lawler & Howell-Barber, 2008
5	***Entrepreneurship Scenario – Interdisciplinary Project*** **(e.g. Data Mining System)** **Process or Product Scenario** **Critical Success Factors** **Marketplace Forces** **Process or Product Rationale** **Scenario or Story of Process or Product on Cloud** **Outcomes of Story** **Learning of Alternative Possibilities to Story**	Interdisciplinary	Byers, Dorf & Nelson, 2011
6	***Entrepreneurship Scenario – Interdisciplinary Project*** **(e.g. Data Mining System)** **Process or Product Strategy** **Objective** **Definition of New Process or Product on Cloud** **Differentiation of New Competitive Process or Product on Cloud** **Industry Perspective on New Process and Product Plans on Cloud** **Project Scope** **Strategy**	Interdisciplinary	Richardson & Butler, 2006 Lawler, 2011
7	***Entrepreneurship Scenario – Interdisciplinary Project*** **(e.g. Data Mining System)** **Process or Product Prototype Strategy** **Process or Product Specifications** **Prototyping of Stages of System(s)** **Rapid Application Development**	Interdisciplinary	Byers, Dorf & Nelson, 2011

	(RAD) Steps **Presentation of Full Prototype for Funding of System**		
8	***Entrepreneurship Scenario – Technology Project* (e.g. Security Management System)** **Process or Product Scenario** **Critical Success Factors** **Marketplace Forces** **Process or Product Rationale** **Scenario or Story of Process or Product on Cloud** **Outcomes of Story** **Learning of Alternative Possibilities to Story**	Technology	Byers, Dorf & Nelson, 2011
9	***Entrepreneurship Scenario – Technology Project* (e.g. Security Management System)** **Process or Product Strategy** **Objective** **Definition of New Process or Product on Cloud** **Differentiation of New Competitive Process or Product on Cloud** **Industry Perspective on New Process and Product Plans on Cloud** **Project Scope** **Strategy**	Technology	Richardson & Butler, 2006 Lawler, 2011
10	***Entrepreneurship Scenario – Technology Project* (e.g. Security Management System)** **Process or Product Prototype Strategy** **Process or Product Specifications** **Prototyping of Stages of System(s)** **Rapid Application Development (RAD) Steps** **Presentation of Full Prototype for Funding of System**	Technology	Byers, Dorf & Nelson, 2011
11	Positioning of Entrepreneurship Scenario – Interdisciplinary Project and Entrepreneurship Scenario – Technology Project for Thresholds on Tipping Points Responsibilities and Roles Schedule	Interdisciplinary Technology	Byers, Dorf & Nelson, 2011 Richardson & Butler, 2006
12	Industry Regulations Standards on Cloud	Interdisciplinary Technology	Lawler, 2011
13	Risk Management and Security of Cloud Systems through Security Strategy, Security Techniques and Disaster Recovery Planning	Interdisciplinary	Lawler, 2011
14	Migration Planning for Cloud Systems Migration and Uploading Tutorials Systems Management of Cloud and Monitoring of Systems through Service-Level Agreements Trends in Cloud and Technology Entrepreneurship	Interdisciplinary Technology	Lawler, 2011

Course: *Cloud Sourcing*