B20.3362 Emerging Technologies and Business Innovation  
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Professor Alex Tuzhilin

**** DRAFT SYLLABUS: SUBJECT TO CHANGE ****

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**Course Description**

The IT revolution is far from over, and, contrary to the well-known claim of Nicolas Carr, IT *does* matter. In fact, according to Bill Gates, “we’re only beginning to realize computing’s potential” and that “we’re entering an era when software will fundamentally transform almost everything we do” (Information Week, October 18, 2004). These transformations should create intelligent real-time enterprises that would conduct business in a significantly smarter, faster, more efficient and effective manner and that could adapt to the changing business conditions and grow “wiser” over time by leveraging the future generations of Information Technologies. These technologies can be the greatest friends or the worst foes in building such “smart businesses,” depending on how well they are adopted and deployed in the enterprises.

In this course, the students will study the principles behind creation of such intelligent real-time enterprises and how principled adoption of emerging and established technologies leads to building more intelligent and agile enterprises and drives major business transformations. Some of these principles include business-pull and technology push, hype-and-gloom, can-do vs. should-do, crossing-the-chasm, beagle-and-the-rocket, and other principles leading to the creation of “smart businesses,” if applied properly.

The students will also study the principles of technological innovation, including evolution and generations of emerging technologies, different types of technological trajectories, cycles and path dependencies of these technologies. The course will also cover various technological standards, battles between the competing standards, convergence to one or few dominant standards and the winner-take-all phenomenon.

Each of these principles and concepts will be illustrated with various studies of actual technologies. Although a broad range of different technologies will be covered in the course, the main focus will be on
1. Communication technologies, including wireless and mobile
2. “Smart technologies” for building agile and responsive businesses
3. Knowledge and content management technologies.

We will study these technologies, explore various business opportunities that they create, and gain insights into how they could lead to major transformations in the ways we do business and enable the creation of “smart businesses.” We will also consider examples of how some of the companies deploy these technologies and how these technologies support their critical applications and allow the companies to achieve their business objectives. Moreover, we will discuss possible future directions and trends for the technologies being studied, novel applications that they enable and how high-tech companies can leverage these trends.

What differentiates this course from other related courses is the emphasis on solid understanding of both business problems and underlying technologies and deep understanding of how the two interact. This understanding is becoming increasingly important in decision making and in managing modern businesses. For example, should a wireless phone company adopt the CDMA or the GSM standard, should a major retailer adopt RFID technologies, or a financial services company Web services technologies? These and many similar types of decisions are not purely business or purely technological decisions since they involve complex interactions between business and technical issues. The students will also learn that the ability to understand both business and technical issues can often differentiate between the success stories and major blunders. As a success story, the students will study how Virgin Mobile introduced prepaid mobile phone service in the US market in July 2002 in record time and with minimal investments primarily due to the careful selection of business partners and smart integration of software systems and business processes operating in real time both inside the company and with these partners. As a major blunder, the students will study the ambitious plan of Enron in 1999 – 2000 to develop software-based switching hubs to provision high-speed circuits to customers in almost real-time instead of weeks and months it took the telephone companies to provide similar capabilities. Unfortunately, this “revolutionary” network provisioning scheme could not be supported by underlying technologies since Enron IT executives underestimated the scope and complexity of the technical task at hand, which resulted in a major failure of the whole project.

The students will learn the material through the combination of class lectures, discussions, student presentations, case studies, and demos. Periodically, experts from the industry will be invited to share their experiences pertaining to the technologies being studied and discuss current trends and future directions for these technologies and corresponding industries. So far, the following guest speakers have committed to give guest lectures:

- Richard Lynch, CTO of Verizon Wireless
- Craig Samuel, VP of Business Innovation at Unisys Corp. and President of the Institute for Innovation and Information Productivity
**Intended Audience and Prerequisites**

The course should be useful for the students interested in careers in the high-tech companies, IT consulting, investment banking in the technology sector, venture capital and technology entrepreneurship.

Although this course does not have any formal prerequisites, I will assume certain basic familiarity with key technologies, including the basic understanding of

1. how computers work;
2. communication networks and how Internet works;
3. WWW basics.

If the students are not sure whether they have the appropriate knowledge, they are encouraged to examine the content of the following books


to see if they have basic familiarity with key technical concepts. Finally, if you are still not sure if your background is appropriate for this course, you can contact the instructor.

**The Project**

The students will be grouped into small teams (4 students per team on average) and asked to analyze a company or a specific technology covered in the course. The deliverables of this analysis are (1) an in-class 15 minute presentation and (2) a written report that will be delivered at the end of the course. The purpose of this project is to encourage exploration and independent research and to stimulate thinking about emerging applications and factors contributing to the success or failure thereof.

**Requirements and Grading**

Besides the project described in the previous section, there will be three quizzes administered in-class to test the knowledge of the material. The purpose of these quizzes is to encourage periodic review of the course material and strengthen understanding of the concepts covered in class. Finally, there will be cases studied in this class, and the students will be requested to write an analysis of one of the cases (as a group project).

A student’s overall score will be calculated as the weighted average of the scores computed according to the following distribution:

1. Project 40%
2. Case analysis 21%
3. Quizzes (3) 24%
4. Class participation 15%
Some of the factors affecting class participation include showing interest in the subject and active participation in the class discussions, regular class attendance, and preparedness for the classes, including familiarity with the reading materials assigned for the class.

**Case Studies**

The following cases will be covered in the class:

- S. Bradley et al. NTT DoCoMo, Inc.: Mobile FeliCa
- R Henderson, Ember Corporation: Developing the Next Ubiquitous Network Standard
- T. Eisenmann, Akamai Technologies
- T. Eisenmann and F. K. Herman, Google, Inc.

Students are expected to read these cases before the class and be well-prepared to discuss them in class. They will also be asked to write an analysis of one of the cases as a group project.

**Reading Materials**

1. The Reading Packet
2. Handouts and on-line materials


Course Outline

The main themes of the course are:


Discussion of how innovative technologies emerge, evolve and are adapted by businesses, and how technical and business issues are intertwined in making business decisions. The students will also learn about various types of technological innovation and the value of emerging technologies. Finally, we will discuss how intelligent adoption of modern emerging technologies leads to the creation of “smart” real-time enterprises.

The students will learn how these principles are applied in real-life business situations by doing five case studies of various technology companies. These cases (unlike typical Harvard Business School cases) will have a heavy dosage of technical content. Therefore, the students will learn some of the technologies covered in these cases and how they are used in business. In particular, the students will learn the following technologies.

2. Communication Technologies.

Overview of the communication infrastructure, basic communication concepts, types of networks, network devices and broadband technologies. Voice and data networks; circuit switching and packet switching. Overview of some of the packet-based communication protocols, including TCP/IP, overview of the Internet and its structure, including the backbone, local loop technologies, and the “last mile” problem.

Foundations of wireless technologies, different generations of wireless technologies (1G, 2G, 2.5G, 3G and 4G), and corresponding standards (e.g., AMPS, GSM, GPRS, EDGE, W-CDMA and CDMA2000); making sense of these standards and studies of transition paths. Wireless LANs, personal area networks, and the corresponding standards.

Pervasive and smart wireless technologies, including RFID technologies; the paradigm of mobile wireless devices connected into smart wireless networks communicating to each other and to the outside world; location-based wireless technologies. Overview of the mesh networks.

These technologies will be studied in the context of various business applications where they can be deployed. Familiarity with these technologies and prior knowledge of the basic principles of emerging technologies will help the students understand the three cases covered in the course: Akamai Technologies, Ember Corporation and Mobile FeliCa from NTT DoCoMo.

3. “Smart Technologies” for Building Agile Businesses

Overview of various “smart” technologies, including real-time monitoring, business intelligence, web services, and business process management and integration
technologies, for creating agile, integrated and highly automated sense-and-response enterprises.

4. Knowledge and Content Management Technologies.

Discussion of what knowledge and content management are and in which applications these technologies can be used and how. Overview of various knowledge management technologies, including search, retrieval, discovery and taxonomy generation technologies. Overview of the content management concepts. Discussion of how different types of content can be created, collected, transformed and stored in digital libraries.

Familiarity with these technologies will help the students understand the Google case study.