290T: The Business of Software Introduction

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1

Outline

- **Who am I? What can I teach you? What about Niraj?**
- **You, and the course**
- **Reflecting on software**
- **Goals of the course**
- **How to get rich quick**

Introduction to Kurt

- **Professor in EECS**
- **Ph.D. in CS from Indiana University 1984**
- **AT&T Bell Labs, Area 11 1984-1991**
  - **Developed a number of successful (internally) tools for hardware developers**
    - **Plaid – Programmable Logic AID – used to create racks of switching system hardware**
    - **DAGON – brought logic synthesis to Bell Labs – dozens of IC's developed with the system**

Introduction to Kurt

- **Synopsys, Inc. 1991-1998 (now 14th largest software company)**
  - **From Member of Research Staff of $30M 200 person company to SVP/CTO of $600M 3000 person company in 7 years**
  - **As CTO**
    - **oversaw and reviewed technology of over 25 software products accounting for $600M in revenue**
    - **Identified new technology and market opportunities**
    - **Initiated and participated in a dozen corporate acquisitions**
  - **As Manager=>Director=>VP=>SVP or research**
    - **Initiated a number of product ideas and two complete products:**
      - **FPGA Express – FPGA synthesis software – brought to ``product roll-out''**
      - **Formality – market leader in formal verification of circuits –**

Introduction to Kurt

- UC Berkeley 1998-present
  - Professor of EECS
    - As teacher – EECS 244 (Intro to CAD), CS169 (Software Engineering)
    - As a research advisor
      - MESCAL: modern embedded systems, compilers, architectures, and languages – 8 students, 2 post-docs, 2 industrial visitors
    - As an entrepreneur:
      - Cadabra (acquired by Numerical Technology 2000, acquired by Synopsys 2003) – investor/Corporate Board
      - Everest Design (acquired SNPS, 1999) – investor/TAB
      - Right Track CAD (acquired by Altera, 2000) – angel investor/TAB
      - 0-in Design Automation – Series A investor 1998/TAB
      - Tensilica, Inc (upside top 100), Series A investor 1998/TAB
      - Catalytic Compilers – angel investor/TAB – founded Fall 2002, $6M in funding from NEA July 2003
      - Stretch Inc. - Series A investor/TAB – founded 2002, $15M in funding from Worldview, July 2003
    - As a consultant: Cadence (2001-present) Synopsys (1998 – 2000) Ammocore, CoWare, Reshape, VC firms
  - Office hour: 3-4PM Tuesdays, Cory 566

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From a personal perspective

- I'm
  - The child of a patchboard programmer of IBM computers (mother0 and a beta-user of the EPIC/RAPID system (father)
  - Have spent my entire professional career in this industry
  - Feel incredibly fortunate to be a part of this industry, particularly at this formative stage
  - Want you to catch my enthusiasm (if you're not already ahead of me) about this industry and its potential

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Introduction to Niraj Shah

- **PhD candidate in EECS (UC Berkeley)**
  - **research topic: programmable embedded systems**
- **Venture Partner, ITU Ventures (an early stage VC firm dedicated to start-ups emerging from universities)**
  - **Catalytic, Inc – software tools for the digital signal processors (DSPs)**
  - **Hier Design – software tools for field programmable gate arrays (FPGAs)**
- **Education**
  - **MS EECS, 2001 (UC Berkeley)**
  - **BS Computer Engineering, 1998 (University of Arizona)**

- **niraj@eecs.berkeley.edu**
- **Office hours by appointment**

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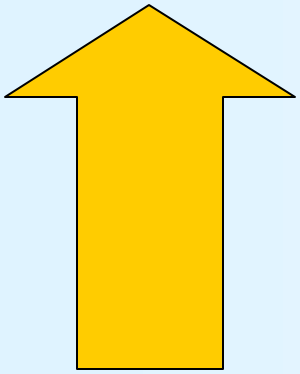
The Typical Engineer



Technology

Market Requirements

- Too busy grooving on the technology to worry about the market
- Presume product marketing's role is to find a customer ``smart enough'' to use the product
- Life sentence at project-leader or below

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Software Engineers

Technical education, and especially graduate education gives engineers the prejudices that:

- **If I build it they will come – if I develop an innovative software idea then the world will beat a path to my door.**
- **Prejudice: The hierarchy is:**
  - **Engineering>>>>Tech support>>Marketing>Sales**

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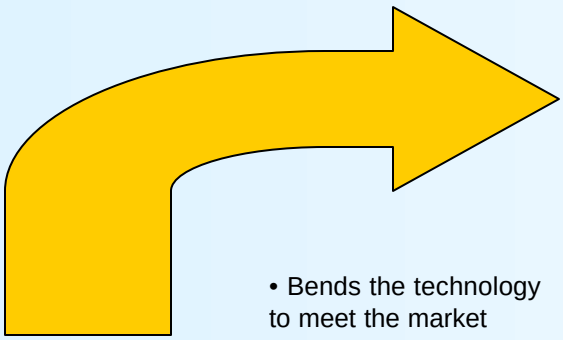
The Savvy Engineer



Market Requirements

Technology

- Bends the technology to meet the market
- Able to influence outside of engineering
- Able to climb up through an organization
- Able to found his/her own company

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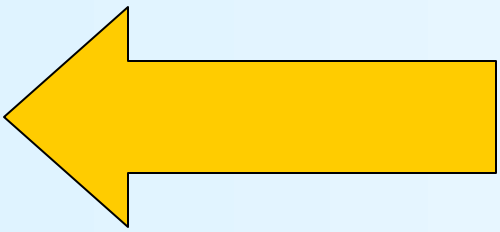
The Typical Product Marketer



Market Requirements

Technology

- Presumes that straightforward communication of market opportunity will cause engineering to make a product that meets it
- Life-sentence as product marketer
  - Preparing product collateral
  - Press-releases
  - Training sales force

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Business/Marketing Types

It is true that marketing belongs at the top of the corporate heap but

- **Software is very much a technology-driven industry**
- **Success will depend on:**
  - **Identifying the technology, product, market**
  - **Working successfully with engineers to build the right product**
  - **Working successfully with sales to sell the product**
- **The hierarchy is:**
  - **Marketing>Sales>Application Engineers**
  - **Marketing>Engineering>Application Engineers**
  - **But a good marketer/business exec, never makes anyone feel that way**

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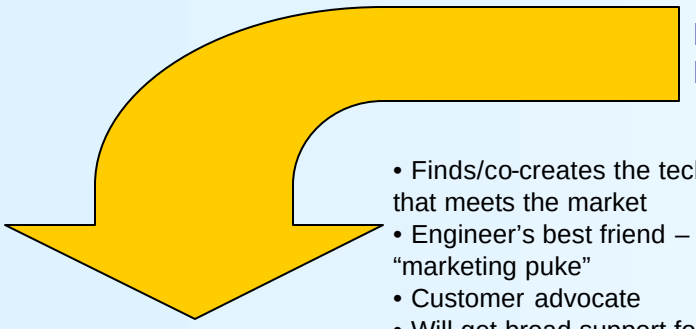
The Astute Marketer



- Finds/co-creates the technology that meets the market
- Engineer's best friend – not a typical "marketing puke"
- Customer advocate
- Will get broad support for rising in organization
- Will know how to pick the engineers with whom to found a company

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Projects

- **Marketing driven:**
  - **Identify a market opportunity and**
    - **Size market**
    - **Develop marketing (product) requirements for product**
    - **Identify key technologies to realize the product requirements**
    - **Show the basic business model**

OR

- **Engineering driven:**
  - **Given a technology**
    - **Show a number of ways of productizing the technology**
    - **Define the product that maximizes the opportunity including**
      - **Risk/Reward**
      - **Competitive environment**
      - **Barriers to entry**

Projects may be drawn from

Work in groups of 4

- **Either technology => product => market**

Or

- **Market => technology => product**
- **Your own technologies**
- **Locally identified (on-campus) technologies:**
  - **Ptolemy II**
  - **MESCAL: NP-CLICK**
- **Product definition/marketing problems at commercial companies:**
  - **http://www.pandorabots.com/pandora**
  - **http://www.catalytic-inc.com/**
  - **Or we'll make some other contacts for you**
- **Markets that you find/define**

Class Facts: Grading

- **Case study questions:**
- **11 assignments x 5 points each: 55 points**
- **Class project (presentation & final report) 25 points**
- **Participation 20 points**
-
- **TOTAL 100 points**

- **Basically, you're signed up to a lot of thinking – not a lot of ``busy work''**

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Stuff to Know

- **Web page:**
  - **http://www-cad.eecs.berkeley.edu/~niraj/biz_sw/**
  - **News group soon**
- **Required book:**
  - **Detlev J. Hoch, Cyriac R. Roeding, Gert Purkert, Sandro K. Kindner, Ralph Muller, Sandro K. Lindner, *Secrets of Software Success: Management Insights from 100 Software Firms Around the World*, Harvard Business School Press; (January 2002**
- **HBS Cases for Course: Copy Central, Northside**

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What is software?

Merriam-Webster's on-line dictionary

- **``something used or associated with and usually contrasted with hardware: as a : the entire set of programs, procedures, and related documentation associated with a system and especially a computer system; *specifically* : computer programs b : materials for use with audiovisual equipment**

What is software?

Oxford University Computing Services:

- ***Hardware*** **is any physical device that makes up/plugs into your computer.**
- ***Software*** **is everything else, the programmes that allow you to perform your various tasks. It includes therefore word processors, databases, spreadsheets, system utilities, antivirus programmes, email programmes, web browsers and indeed almost everything that allows your computer to act as anything other than a paperweight.**

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What is software?

- **My definition:**
- ***Software:*** **the *software* portion of a *hardware-software system***
- **A *hardware-software system* consists of**
  - ***hardware*** **- that takes as input a series of instructions and data and outputs actions and/or data**
  - ***software*** **– the sequence of stored instructions that control the operation of the hardware [note there has to be more than one at a time!]**
- **Key points:**
  - **Software is intangible**
  - **Software does nothing without hardware**

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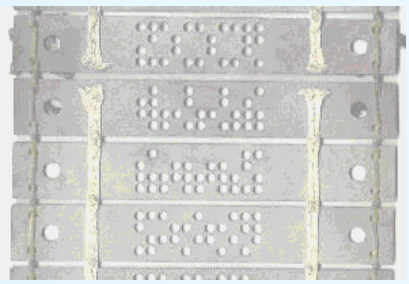
What are the earliest examples?

- **Hint: You needed some sort of hardware device that was programmable**

Jacquard's Loom



www.computersciencelab.com/ComputerHistory/History.htm

http://www.internetinventions.com/management.html

History of Jacquard's Loom -1804

- **In 1789 the French Revolution broke out. Lyon was on the side of the ancien régime. The town was destroyed in 1793. Jacquard, a member of a royalist regiment, had to flee and his son was killed in action. Two years later he could return to Lyon and immediately devoted his attention to his mechanising experiments again. The economy has broken down, but mainly because of this he found manufacturers to support him. He introduced many important improvements that earn him prizes and recognition. Napoleon, keen on restoring France's economic supremacy, was also looking to build up the country's political and military supremacy. In 1804 Jacquard was called to the "Conservatoire des arts et métiers" at Napoleon's behest in order to make mechanical inventions. There he discovered the disassembled remains of Vaucanson's weaving machine. He reconstructed the machine, uniting the best elements of the pattern controls used at the time in a new design that he then went on to perfect in terms of technical maturity.**

http://www.deutsches-museum.de/ausstell/meister/e_web.htm

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History of Jacquard's Loom

- **After working on it for one year, he successfully developed the jacquard loom. The fundamental improvement of his pattern loom compared with all its precursors is the replacement of the mechanical cam roll with the "endless" principle of the punched card control. Jacquard at last made his childhood dream come true and finally rationalised the function of the "draw boy" out of existence. At the same time he discovered a principle that made it possible mechanically to produce patterns of any complexity.**

- **Napoleon was enthusiastic about Jacquard's control system and granted him a lifetime pension. In 1806 Napoleon tried, by means of a decree, to enforce the use of the new loom for silk manufacture in Lyon. However, resistance was enormous. Jacquard was violently attacked and finally worn down with numerous lawsuits. Only when the English competitors begun to use the machine does it quickly gain acceptance in France. In 1810 Jacquard receives the Cross of the Legion of Honour.**

http://www.deutsches-museum.de/ausstell/meister/e_web.htm

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Hollerith - 1890

- In any event, for the 1890 census Hollerith had perfected a system for encoding census returns onto punched cards and designed machinery which could process these to tally the totals corresponding to various statistics. He had earlier demonstrated the efficacy of his approach by reorganising record keeping systems in various large institutions. The success of Hollerith's systems led to his ideas being copied by other companies keen to make money from the lucrative contract for census automation. By the time of the 1910 census this erupted in an acrimonious Patent Dispute between Hollerith's company (Tabulating Machine) and a rival organisation controlled by Edward Durand. Hollerith eventually lost the lawsuit after the case had been appealed to the Supreme Court. Nevertheless, Hollerith's contributions to and application of punched cards was a significant step in the development of automatic computing machinery. The format he developed for storing information continued to be used extensively well into the 1960s. Equally significant was the role eventually played by his company. After merging or taking over rival concerns Tabulating Machine became the Computing-Tabulating-Recording Company. In 1914 CTR acquired a salesman from NCR - Thomas J. Watson. Watson had taken overall control of CTR within five years of joining them. The last name change took place in 1924 when CTR became International Business Machines or IBM.

27

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Many issues already appear

- Software is a mechanism for embodying human intellectual property (e.g. weaving patterns)
- As a tool for improving efficiency, software may appear and be adopted in even the most difficult economic conditions
- Software often developed as a mixed government-industry cooperation
- Standards are always an issue
- Because it is not strongly linked to natural resources software is naturally an international business
- The need for global competitiveness may force adoption of software
- How is software best-leveraged:
  - Unbundled?
  - Bundled with hardware?
  - Producing a product?
  - Aiding a service?
- Because it is so ephemeral, it is prone to legal disputes over intellectual property

28

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How about this?

Piano music on rolls
Invented in 1896, highly popular until the grammaphone

http://www.amica.org/player_piano_corridor/player_piano_corridor_player_piano.html

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No

Basically, a piano roll is not a piece of software.
No "input data"

http://www.amica.org/player_piano_corridor/player_piano_corridor_player_piano.html

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Characteristics of SW

- **Human effort >> capital**
  - **Human IP intensive**
  - **Little demand on natural resources**
- **Value ($$) of IP >> capital cost of object**
- **Continually evolving**
- **May be delivered in a variety of media**

Why is SW industry better...

- **Why is being in the software industry better than printing money?**

Why is SW industry better...

- **Why is being in the software industry better than printing money?**
  - **It's legal**
  - **Materials are easier to get**
  - **It's more fun**
- **Seriously, because one person can do so much with so little - this is not just the greatest profession of our time – it's the greatest profession of all time**
  - **Congratulations on your choice**

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Goals of Course

This course is aimed to help you:

- **Exploit the perennial opportunities in software**
- **Successfully answer the perennial challenges in software**
- **Answer the perennial business questions in software**

Topics included in the course are those that:

- **Make or break a business plan for funding**
- **Make or break a start-up**
- **Could cause an early burn-out of an early stage company**
- **Could cause an established company to miss a quarter – or, to falter**

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Keys to Exploiting the Opportunties

- **Identifying key software industry trends**
- **Identifying attractive software market opportunities**
- **Creating the right business model**
- **Matching the exit option (IPO, acquisition target, cash cow) to the opportunity**
- **Identifying, creating, and managing a successful software development team**

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Industry Trends

- **Identifying key software industry trends**
  - **What are the key trends in the SW industry today?**
  - **Lecture 2,3 HW 1**
- **Typical industry trends:**
  - **Outsourcing of data processing/warehousing**
  - **Development of virtual private networks**
  - **Computerizing customer-relationship management**
- **Fighting an industry trend is nearly always a losing battle**

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Market opportunities

- **Identifying attractive software market opportunities**
  - **What are today's most attractive software markets?**
  - **Lecture 2, 3 HW 1**
- **Industry trends are critically important, but nobody gets rich based on a ``general trend''**
- **To exploit a trend you have to further identify an attractive market**
  - **Computer security software for virtual private networks**
  - **Customer-relationship management software**
- **Ability to successfully identify market opportunities, not just capitalize on obvious product opportunities, is the difference between moderately successful and greatly successful entrepreneurs**

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Business Models

- **The right business model is what makes a successful (in meeting customer needs) product into a successful company**
- **The most commonly overlooked or under-thought question in most business plans**
  - **Lecture 4, HW 5**
  - **Invited speaker: Bob Dahlberg, Intel, Daisy, Synopsys, Re-shape … consultant to many successfully funded companies**

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Successful Entry and Exit

- **Securing the appropriate funding for the opportunity**
  - **Where (and how) do I get my funding? angel, corporate, VC, self-funding**
  - **Lecture 12, HW 11**
- **Matching the exit option to the opportunity**
  - **How do I cash-out (or should I) on this opportunity? How can what I do now affect that? (IPO, acquisition target, cash cow)**
  - **Lecture 12, HW 11**
- **There two issues are highly interrelated**
  - **Before any investor puts a $$ in, they will want to know how (and when) they will get their $$ out**
  - **Ability to successfully attract investment will depend on successfully communicating an attractive exit for the investor**
- **But …**
  - **Be honest with yourself –**
    - **What kind of company do you want to run?**
    - **What kind of opportunity do you really have?**

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People and Teams

- **Identifying, creating, and managing a successful software development team**
  - **Lectures 8,9, Hw 7,8**
  - **Jerry Fiddler, founder, former-CEO, current Chairman of Wind River Systems**
  - **TBD - Microsoft**
- **Ultimately, it's all about people**

Perennial Challenges of SW

- **Turning value into revenue - getting customers to pay for something that's intangible**
- **Changing buying behaviors in a pre-defined market segment**
- **Making the distinction between a technology, a product, and a market-maker**
- **Creating barriers to entry for your product and market – protecting your IP**
- **Finding the right distribution channel for your software product**
- **Learning how to minimize and manage software support costs**

Value => Revenue

- **Turning value into revenue - getting customers to pay for something that's intangible**
  - **Lecture 3, Hw 2**
- **Software's greatest strength during development**
  - **– minimal capital costs and ease of reproduction and distribution**
- **Becomes its greatest weakness at the time of getting $$ for the sale**

Changing Buying Behaviors

- **Often facing significant barriers in ``buying behaviors''**
  - **"My compilers should come for free with my hardware."**
  - **"I buy a lot of chips from Xilinx, they should supply all my software for free."**
- **Changing buying behaviors in a pre-defined market segment**
  - **Lecture 6, Hw 5**

Technology meets the Market

- **Maximizing the market opportunity of a technology**
  - **Most important non-technical skill an engineer can develop**
- **Finding the right technology to meet a market**
  - **Key to becoming *more than* a product manager**
- **Making the distinction between a technology, a product, and a market-maker**
  - **Key to becoming a *successful entrepreneur***
  - **Lecture 5, Hw 4, Class project**
- **Developing these skills is the focus of the class project- more on that later**

Barriers/Protecting Your IP

- **For survivability you need to be able to establish barriers to entry to your market**
- **``There's always somebody willing to lose their shirt.''**
- **Many types of barriers**
  - **Customer loyalty**
  - **Hard-to-beat pricing**
  - **Relationships with strategic partners**
- **Strong intellectual property position/patent position is often the best**
  - **Lecture 10, HW 9**
  - **Invited speaker: Paul Lippe, former General Counsel, Synopsys, former CEO Skolar MD, NTime**

Distribution Channels and Support

- **Finding the right distribution channel for your software product**
  - **Lecture 5, Hw 4**
- **Learning how to minimize and manage software support costs**
  - **Bonus class?**
- **The value of your company will be linked to its profitability and its growth**
  - **Without profitability, value will be low**
  - **Can't hold out because you're losing money**
  - **Most common reason for lack of profitability – lack of sales**
  - **Second most common reason?**

Perennial Business Questions

Should we?:

- **Keep the hardware-software system proprietary and use it to create a unique product or service that we sell?**
  - **Contemporary example?**
- **Bundle hardware and software together and sell that?**
  - **Contemporary example?**
- **Build software independently to run on independently produced hardware?**
  - **Contemporary example?**

Perennial Business Questions

Should we?:

- **Keep the hardware-software system proprietary and use it to create a unique product or service that we sell?**
  - **http://www.pixar.com/**
  - **http://www.ilm.com/**
- **Bundle hardware and software together and sell that?**
  - **http://www.palm.com/us/**
- **Build software independently to run on independently produced hardware?**
  - **http://www.microsoft.com/**
  - **www.synopsys.com**

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How to be a Millionaire - employee

- **Join Synopsys 1/1/91, 15K options (entry MS grad) at $1.50**
  - **Fully vested, post-split, 30K options sell 10/95 at $35**
- **Join Peoplesoft 7/94, 2K options (hotline support) at $2.80**
  - **Fully vested, post-4-splits = 32K options sell 6/98 @ $47**

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How to be a Millionaire – public investor

- **Invest $3150 for 150 shares of Microsoft at their IPO in March 17, 1986**
  - **http://www.microsoft.com/msft/download/IPOsharecalc.xls**
- **Invest Peoplesoft $56K in 2K shares of Peoplesoft in 7/94**
  - **Fully vested, post-4-splits = 32K options sold 6/98 @ $47**
- **Sell short 3.5K shares of Akamai at $300 3/00**
  - **Cover short for $3.5K 9/02**
- **Routine to see 2X price spread within 1 year**

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How to be a Millionaire – private investor

- **1986 Synopsys - $50K buys $50K shares, sell @ $27 2/92**
- **2000 Right Track CAD - $7.5M => $55M ($150K => $1.1 M) in 18 months**

Success as an employee and investor in the SW industry gives you the opportunity (and $$) to be a private investor

Nothing succeeds like success!

Summary

- **This is a great industry**
- **I'll try to make this a great course**
  - **Turn engineers in to product developers and managers**
  - **Turn marketers and business-types into executives**
  - **Turn entrepreneurs into sophisticated entrepreneurs**
- **Will cover the most important topics to make**
  - **A technology into a product**
  - **A successful business plan for the software industry**

Also

- **Drew Isaacs ``Marketing High Technology''**
  - **More focused in some ways (marketing), broader (in technology coverage)**
- **David Messershmidt ``**
  - **“Strategic Computing and Communications Technology”**
  - **http://www.sims.berkeley.edu/academics/courses/is224/f03/**

Next Class

- **A brief history of the software industry**
- **Introduction to the software market segmentation**
- **Identification of key trends in the past (and future) of the industry**