290T: The Business of Software
The Software Industry

Professor Kurt Keutzer
Fall 2003
EECS
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Class News

- Target class size (new course) was 30
- If you're registered, and plan on sticking it out, please show up
- If you're registered, and would rather do something else, please drop
- If you're not registered, and plan on attending, please register

Class Etiquette (ala Drew Isaacs))

1. Be on time. I will begin class at 4:10 PM. If you arrive after 4:10, you will not be admitted to class that day.
2. Come to class prepared, and expect cold calling.
3. Please (make and) use your name card throughout the semester.
4. Beverages are permitted in class, but food is not.
5. If you cannot make a class meeting, or if you will be late for class, send Niraj (niraj@eecs.berkeley.edu) and me (keutzer@eecs.berkeley.edu) an e mail advising me of this in advance. The same is true if you must miss a guest speaker.
6. Laptops, PDAs, cell phones and similar electronic devices will be turned off during class and left in your backpack or briefcase.

Outline

- Evolutionary Models of the Software Industry
- Actual Evolution of the Industry
- The SW industry as it stands today

SeSoSu's History of Software

- Independent programming services (era 1)
  - CUC (1955), Computer Sciences Corporation (1959)
  - One solution at a time
  - Consulting business model
- Software products (era 2)
  - Principally around IBM 360 platform
  - Mark IV file management from IBM, 1967
  - my favorite Reynolds and Reynolds's EPIC/RAPIC 1966, 1967
  - See their history at: http://www.reyrey.com/about/history.asp
- Enterprise solutions (era 3)
  - Independent software solutions deployed at enterprise level (e.g. SAP, founded 1972)
- Packages software for the masses (era 4)
  - Microsoft 1975, DOS 1981
- "Face of the software industry today" (era 5)
  - Internet targeted
  - Netscape 1994

Relationship of Solutions

How about price?
Solution cost to end user?

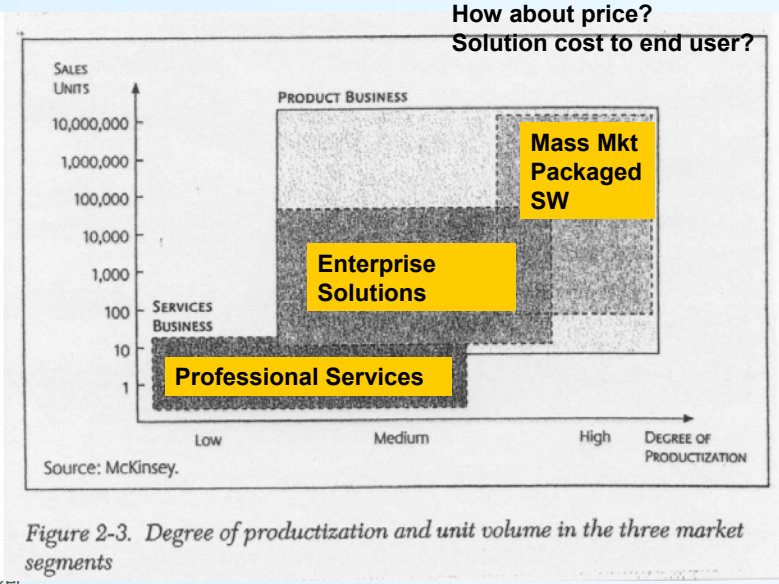

Figure 2-3. Degree of productization and unit volume in the three market segments

SeSoSu's History of Software

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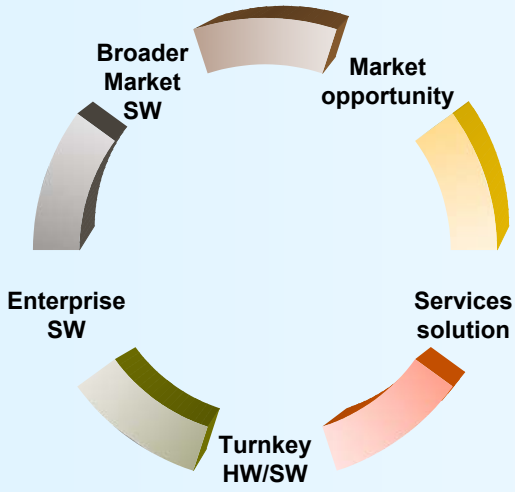
Anything wrong with this picture?

- Mixes underlying technological evolution with industry trends

The Cycle of Software Market Evolution



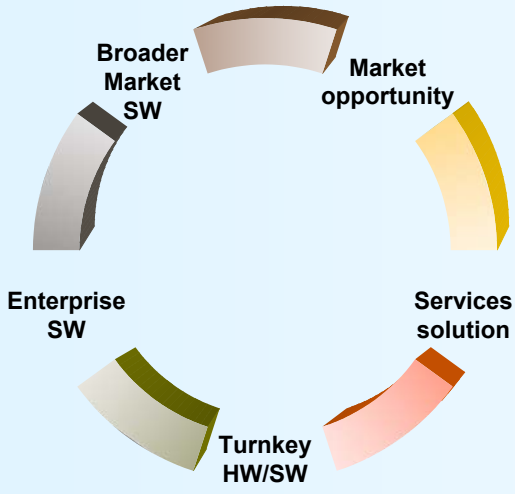
Elements of the Cycle

- Market opportunity emerges
  - Integrated circuit design
- Problem poorly understood but with a few experts and homegrown software tools a service solution is provided
  - IC design services at IBM, Bell Laboratories (1975-1984)
- Partially to simplify software development, partially to exploit buying behaviors and maximize revenue, partially to exploit hardware capability, bundled HW/SW solutions are provided
  - Mentor Graphics (MENT) 1981, Valid Logic Systems 1981, Daisy 1981
  - Bundled IC design software with hardware
- Then to simplify SW development, lower entry costs, and exploit inexpensive platforms, unbundled SW solutions running on standard platforms are provided (at high aka ``enterprise'' prices)
  - Gateway Design Automation 1985?, Synopsys 1987
- Market grows, more ``license seats'' to sell to, attracts ``lower cost'' solutions
  - Synplicity, FPGA Express, Get2Chip

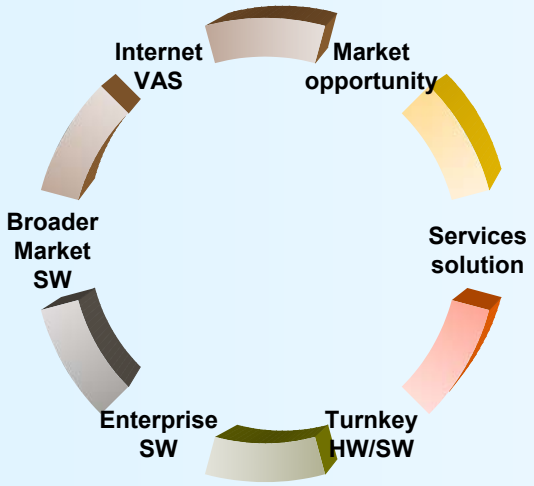
Inherent force of the Cycle

- As the fundamental technologies underlying a software solution become better understood, other forces being equal, then the cycle will progress ``forward'' because it implies a cost reduction for the end customer

Where do Internet VAS fit in?



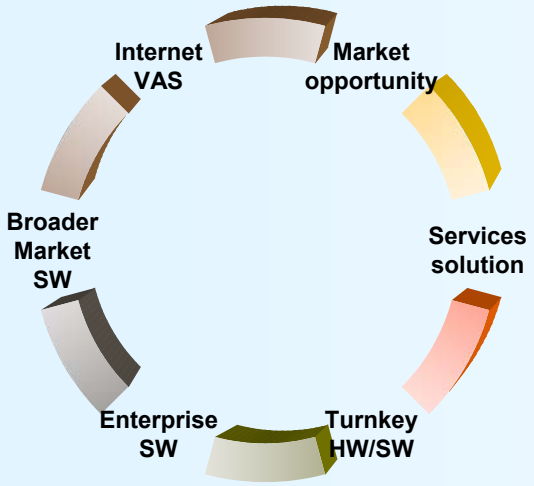
How about here?



Shaping the Software Industry

- End-customer market dynamics
  - Living in the information age
  - Global competitiveness – cost reduction
  - What if gas prices went to $4? $8?
- Technological dynamics
  - Moore's Law
  - Decreasing cost of communication
  - What if Pentiums cost $1
- Financial market dynamics
  - NASDAQ, S&P, DJIA
  - IPO madness/IPO glut
  - Venture Capital Temperament
  - What if you didn't need profit, or even a business model to IPO?
- Software Market Cycle (previous slides)

Who gets stuck? Why?



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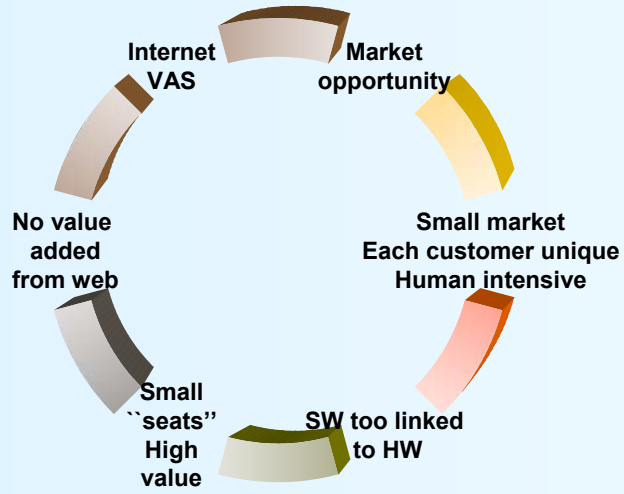

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- Evolutionary Models of the Software Industry
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Actual Evolution of SW Industry

- From Jacquard's Loom (1804) through Hollerith (1890) through IBM 360 (1964) SW is surprisingly the same – strongly linked to and encapsulated in hardware and principally seen as a vehicle for executing hardware
- IBM 360 became a stable platform for developing software but …
- IBM had the market so locked up there was very little opportunity for others
- Few examples, such as:
  - Reynolds and Reynolds: http://www.reyrey.com/
  - 1966 - A new data processing service for dealers, EPIC (Electronic Parts Inventory Control) was announced and offered to a limited number of pilot institutions.

The True SW Industry - Founding

1972 – SAP
1975 – Microsoft, Bill Gates
1977 – Oracle, Larry Ellison
1981 – Infosys
1982 - Adobe
1982 – Electronic Arts
1982 – Symantec
1982 – Amdocs
1983 – Solomon Design Automation => Cadence, James Solomon
1983 – Intuit
1984 – Sybase
1987 – Peoplesoft, David Duffield
1987 – Synopsys, Aart de Geus
1989 – Mercury Interactive
1989 - Veritas
1993 – Siebel, Tom Siebel
1993 – Check Point Software
1995 – Verisign
1995 – BEA, Alfred Chuang, William Coleman, Edward Scott

What they do

- **Microsoft Corporation** (MSFT) PC Software (revenue leader Application Software)
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- **Check Point Software Tech** (CHKP) secure virtual networks (2nd highest revenue, Security Software)
- **Cadence Design –** (currently consultant) software for the design of integrated circuits (revenue leader, Technical & System Software)
- **Mercury Interactive –** business application management
- **Verisign –** the world's leading provider of critical infrastructure and security services for Internet and Telecommunications networks

How they Did - SW Industry IPOs

1972 – SAP, IPO 1988, SAP ADR on NYSE 1998
1975 – Microsoft, 3/13/86, $21
1977 – Oracle, 3/12/86, $15
1981 – Infosys, 3/11/99, $34
1982 – Adobe, 8/86, $11
1982 – Electronic Arts, 9/89, $8
1982 – Symantec, 6/89, $10.50
1982 – Amdocs, 6/98, $14
1983 – Intuit 3/12/93, $20
1984 – Sybase, 8/13/91 $13.5
1987 – Peoplesoft, 10/92, $17
1987 – Synopsys, 2/25/92 , $18
1989 – Mercury Interactive, 10/29/93, $13
1989 – Veritas, 12/9/93, $16
1993 – Siebel, 6/27/96, $17
1993 – Check Point Software, 6/96, $14
1995 – Verisign 1/30/98, $14
1995 – BEA, 4/10/97, $6
http://www.ipomaven.com/ipoprofilese.php3
http://www.forbes.com/equities/

Origins of the True SW Industry

- Characteristics of the real SW industry that was emerging
  - Founders were SW people, not HW retreads
  - Second generation SW developers and managers - many initially working for IBM etc.
  - IP in SW developed could eclipse the IP of the HW it was running on
  - Over time, SW was platform independent
  - Strongly linked to the financial markets

$ Raised in IPO

Founded	Company	IPO	$ raised
1972	SAP	1988	180DM
1975	Microsoft	3/86	$65mm
1981	Oracle	3/86	$31.5mm
1982	Adobe	8/86	$5.6mm
1982	Electronic Arts	9/89	$11.2mm
1982	Symantec	6/89	$16.5mm
1982	Amdocs	6/98	$252mm
1983	Intuit	3/93	$20mm
1984	Sybase	8/91	$49.5mm
1987	Peoplesoft	10/92	$29.3mm
1987	Synopsys	2/92	$27mm
1989	Mercury Interactive	10/93	$26mm
1993	Siebel	6/96	$33mm
1993	Check Point Software	6/96	$42mm
1989	Veritas	12/93	$18.8mm
1995	Verisign	1/98	$42mm
1995	BEA	4/97	$30mm

Dow Jones News, Company Press Releases – By means of Factiva

Forces on SW Industry

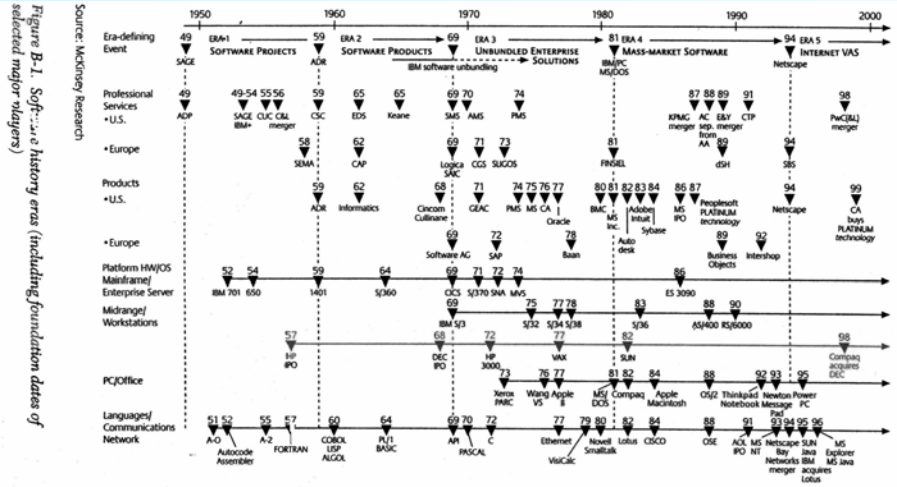
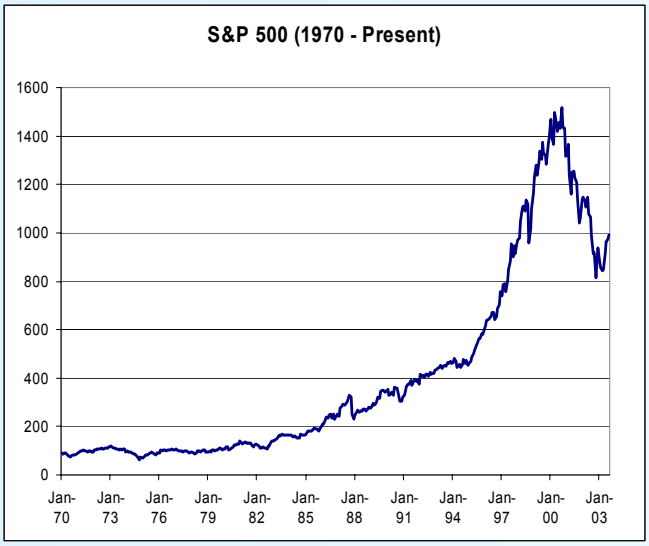


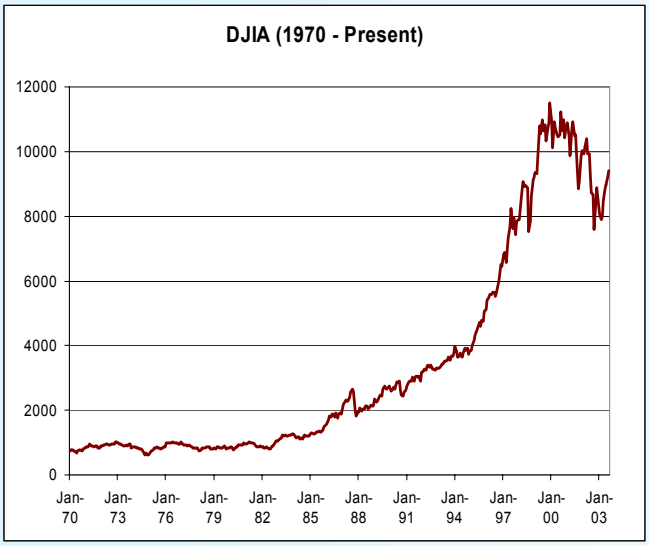
Figure B-1. Software history eras (including foundation dates of selected major players)

Secrets of Software Success – Figure B-1, p. 271

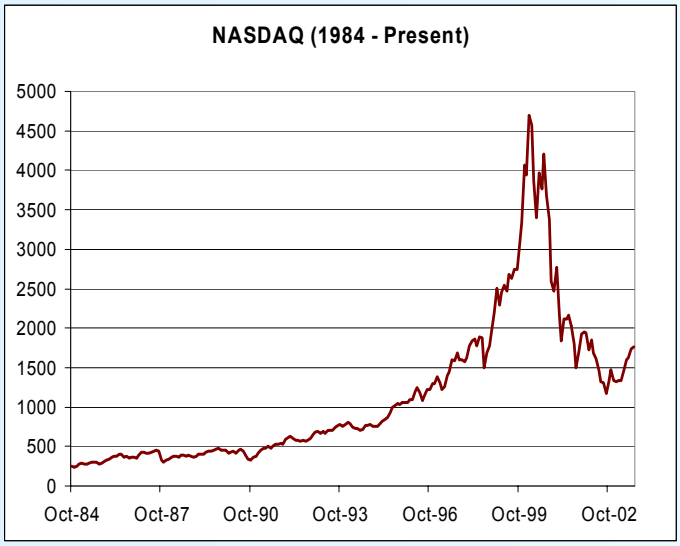
Financial Markets –S&P500



Dow-Jones Industrials



NASDAQ



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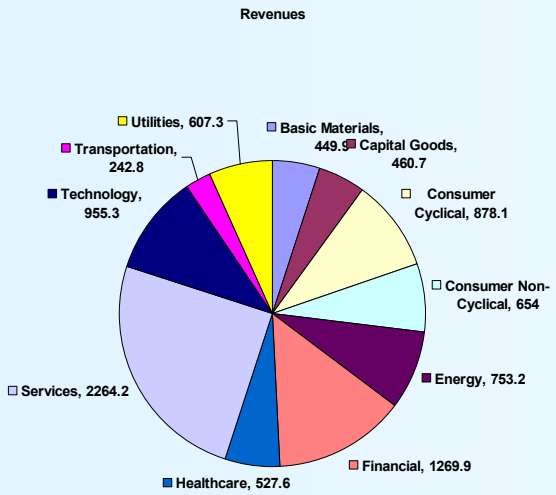
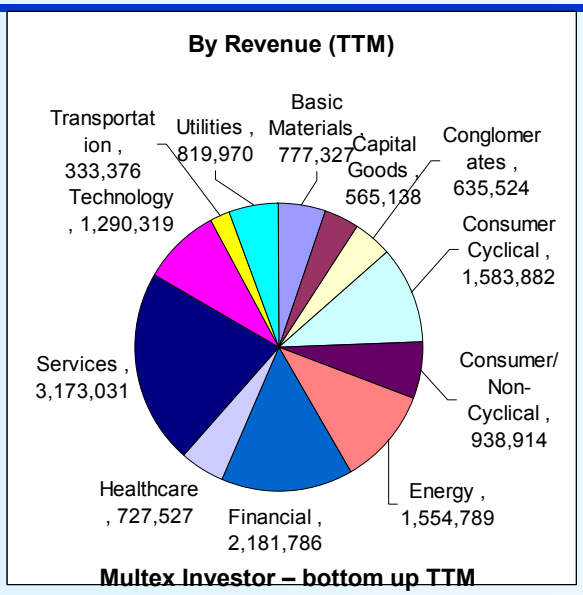
Industry sectors – top down



Multex Market Guide – top down TTM

Industry Sectors bottom up

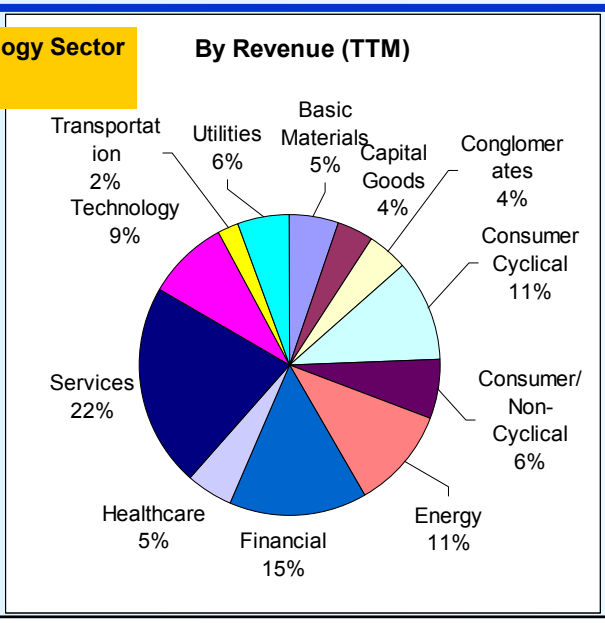


Multex Investor – bottom up TTM

Industry Sector – bottom up %

Entire Technology Sector

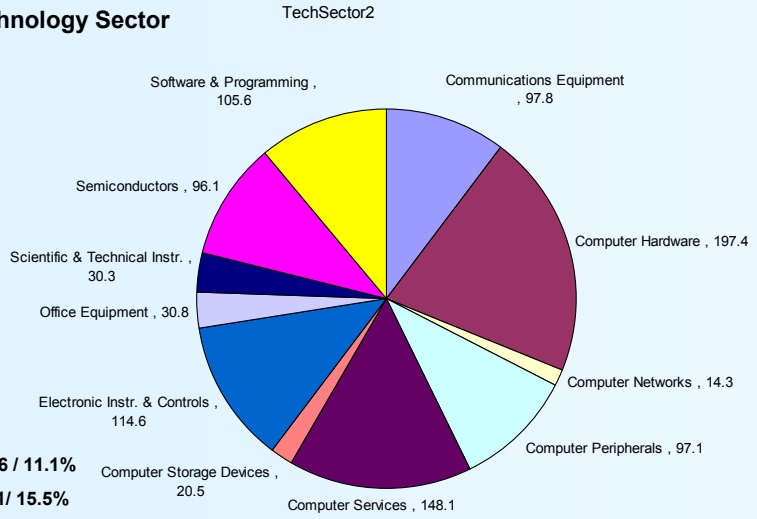
$1290B



Tech sector – top down

Entire Technology Sector

$952B



Software 105.6 / 11.1%

Services 148.1/ 15.5%

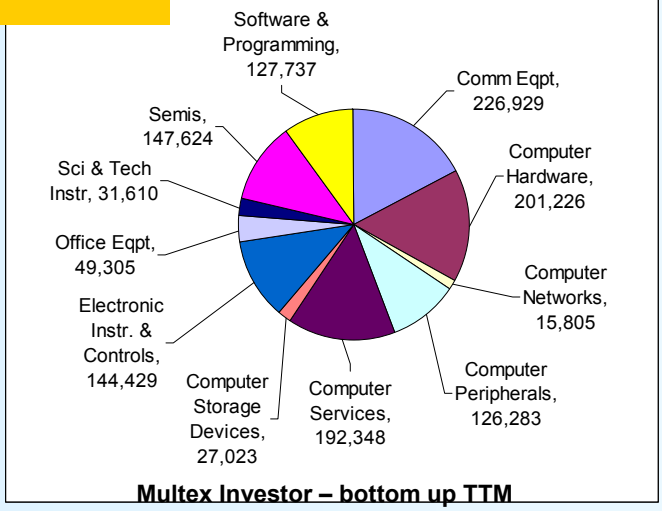
Source: Multex Market Guide – top down TTM

Technology Sector – bottom up

Entire Technology Sector

$1290B

TTM Revenue Breakdown



Multex Investor – bottom up TTM

The size of the SW workforce

- **2.2 million people were employed in the four "core" IT occupations**
  - **computer scientists – among fastest growing professions**
  - **computer engineers – among fastest growing professions**
  - **systems analysts – among fastest growing professions**
  - **Programmers - growth for programmers is much slower, due to the effects of automation and outsourcing of work.**
- **A single employment sector, Computer and Data Processing Services, employs more than a quarter of all of these people and is the fastest growing industry category.**
- **From:"Core Occupations of the U.S. Information Technology Workforce"**
- **http://www.uefoundation.org/wfrep1.html**

Human elements of IT Industry

- 20 million new jobs have been created in this country over the past seven years ;
- Between 1995 and1998, the IT sector has contributed one-third of all U.S. economic growth;
- Between 1996 and 1997, falling prices in the IT sector have knocked almost a full percentage point off inflation;
- (IT now accounts for nearly one-half of all business investment)
- And the marketplace is responding. E-commerce in the U.S. could reach $1.3 trillion by 2003.
- Workers in the IT industry earn 80 percent more than the private sector average--$53,000 as compared to $30,000.

- Testimony of Harris N. Miller
- President, Information Technology Association of America (ITAA)

- http://www.itaa.org/govt/cong/c19991208.pdf

Software and Services in Context

	# of Companies	P/E TTM	Profit Margin %	Price / Sales	ROE %	Sales ($ Bil)	LT Debt/ Equity	5 yr EPS Growth %
Technology (Sector)	--	34.5	0.0	4.8	8.8	952.7	0.3	8.8
Communications Equipment	246	37.1	6.7	5.6	4.4	97.8	0.1	18.3
Computer Hardware	61	26.8	5.2	1.8	29.8	197.4	0.4	5.7
Computer Networks	76	44.5	2.7	3.2	5.3	14.3	0.2	17.8
Computer Peripherals	98	32.5	0.9	1.4	2.7	97.1	0.2	3.2
Computer Services	352	26.2	9.2	3.5	-7.3	148.1	0.5	18.3
Computer Storage Devices	40	29.1	1.9	3.7	5.2	20.5	0.1	-6.9
Electronic Instr. & Controls	242	29.9	-4.6	1.9	-0.9	114.6	0.4	-1.3
Office Equipment	25	22.7	5.1	1.3	20.3	30.8	1.9	-14.6
Scientific & Technical Instr.	144	27.7	5.7	3.4	13.7	30.3	0.4	14.1
Semiconductors	222	52.1	4.0	6.1	2.9	96.1	0.2	-10.6
Software & Programming	587	30.9	20.2	7.0	15.0	105.6	0.1	18

What does it mean that there are 587 SW companies?
What does it mean that there are 352 computer service companies?

Today's Software Market Segments

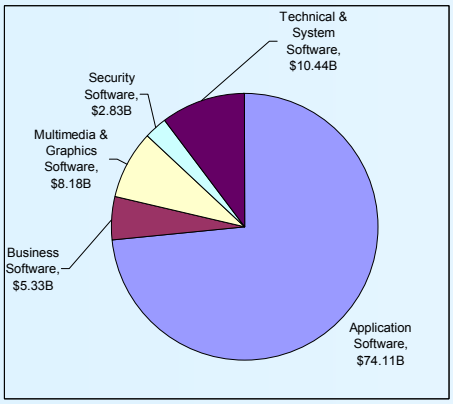
- **Application Software - enterprise application software, supply chain management solutions, document management, relational database management, financial and business applications**
- **Multimedia & Graphics - multimedia based software, including interactive, entertainment and games, graphic design and publishing, and educational software**
- **Technical & System Software - technical software including design automation, design analysis and optimization, computer-aided design (CAD) and computer-aided engineering (CAE), scientific and engineering software**
- **Security Software - security software, solutions and products that protects data and software on computers and networks**
- **Business Software - software for various business applications including retail automation, transactions and billing, staffing and cost-management, banking and accounting, real-time information management**

Services:

- **Information Technology Services - Companies that provide computer technology consulting, development and implementation services in order to solve information technology problems of various organizations**
- **Healthcare Information Services - Companies that develop and provide comprehensive physician practice management systems and software for hospitals, medical practices and managed-care organizations.**

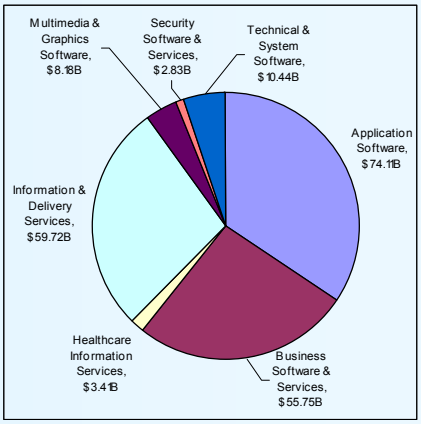
Source: Media General Financial Services

Software Market Segmentation



Software Market (not incl services)

$100.9B



Software & Services Market

$229.8B

Software Industry 8/2003 -1

Corporation	Ticker	Market (Mil)	Rev (Mil)	Net Marg	P/E	Price	High	Low
Microsoft Corporation	MSFT	275738.	32187	31.	27.9	$25.6	$29.4	$21.56
Oracle Corporation	ORCL	$62282.	$9475	24.3	27.9	$11.9	$14.	$7.30
SAP AG (ADR)	SAP	$35144	$8062	15.2	29.3	$28.2	$33.6	$9.93
Computer Associates	CA	$14206	$3164	(6.1)	NM	$24.5	$26.1	$8.65
VERITAS	VRTS	$12668	$ 1579	4.9	168	$30.5	$31.8	$10.29
Electronic Arts	ERTS	$12528	$2504	13.2	39.3	$84.9	$86.3	$47.51
Softbank (ADR)	SFTBF	$9095	$3463	(22.3)	NM	$27.	$32.	$0.25

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Software Industry – 8/2003 -2

Corporation	Ticker	Market Mil	Rev Mil	Mar %	P/E	Price	High	Low
Intuit	INTU	$9042	$1643	14.1	40.2	$44.0	$55.0	$33.3
Adobe Systems Inc.	ADBE	$8019	$1197	17.2	39.9	$34.3	$49.2	$17.7
Symantec Corporation	SYMC	$7196	$1482	17.6	30.1	$47.9	$51.5	$27.2
Infosys Tech	INFY	$6844	$831	25.3	32.6	$51.6	$86.8	$38.5
PeopleSoft, Inc.	PSFT	$5,255	$1,941	9.1	29.8	$16.6	$22.5	$11.7
BEA Systems, Inc.	BEAS	$5054	$947	11.0	50.4	$12.6	$14.00	$4.59

And What they do ...

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Software Industry 8/2003 - 3

Corporation	Ticker	Market	Rev	Marg	P/E	Price	High	Low
Synopsys, Inc	SNPS	$5051	$1106	(16.2)	NM	$65.0	$65.5	$31.8
Amdocs Ltd	DOX	$4598	$1427	8.1	40.3	$21.3	$27.3	$5.85
Siebel	SEBL	$4595	$1418	(8.2)	NM	$9.30	$12.2	$5.33
Check Point Software	CHKP	$3974	$425	58.2	16.6	$16.2	$22.2	$12.6
Cadence Design	CDN	$3543	$1136	6.2	50.8	$13.0	$15.6	$8.65
Mercury Interactive	MERQ	$3398	$444	15.1	52.7	$39.8	$45.6	$15.2
Verisign	VRSN	$3307	$1112	(28.4)	NM	$13.9	$16.1	$3.92

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Assignments

- Send email to niraj@eecs.berkeley.edu and keutzer@eecs.berkeley.edu by 8AM Wednesday
- Simply include answers as plain text in email, make sure your name is in the email
- Label each answer with question number
- Use bullets and phrases, no one reads English prose anymore, but be prepared to articulate and defend your answer well.

First Assignment

Answer THREE (your choice) of the following four questions:

- Question 1a: Slides 9 and 13 give a basic ``cyclical evolutionary model'' of a software market. Give an example of a SW industry sector, market, or even product, that is making a transition from one stage of the cycle to another
  - For example, a market in which successful companies are moving from providing bundled HW/SW to independently packaged (enterprise or consumer) SW
- Question 1b: What is causing this transition to occur?
- Question 2: Is the software industry consolidating, or expanding? Choose a company or sector and give evidence to support your position.
- Question 3a: Interview question at a venture capital (VC) firm: Generally speaking, do you believe that the software industry offers better, or worse opportunities than other technology sectors?
- Question 3b: If better, give an example of an exciting new opportunity and why you like it. If worse, what technology sector do you prefer and why?
- Question 4: On slide 14, three additional factors are named which shape the software industry: end-customer market dynamics, technological dynamics, and financial market dynamics. Give an example of how one such external factor will affect the software industry in the near future.
- Choose just one external factor, here are some hints:
  - 4a: End customer: Increasing pace of life is causing consumers to want more and more continuous access to information and interfaces they need to run their busy lives … what's next and what does that have to do with software?
  - 4b: Technological: For example in the past, the personal computer had a dramatic effect on the software industry, providing for the first time a consumer software market. What technological devices are emerging and what software markets will they create or expand?
  - 4c: Financial markets: How's the current attitude on Wall Street or VC Street (Sand Hill Rd), going to affect the software industry?

Next Class

- In class review of questions
- If there's time, an introduction to business implications of software life-cycle and process