



# Lecture 3

Silicon Valley History

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# Silicon Valley History

- Gold Rush, Movies, and Electronics
- Academic Excellence and Garages
  - De Forest – Vacuum Tubes (1906)
  - Hewlett- Packard – HP (1939)
  - SRI – Stanford Research Institute
  - Fairchild
  - Intel
  - Google



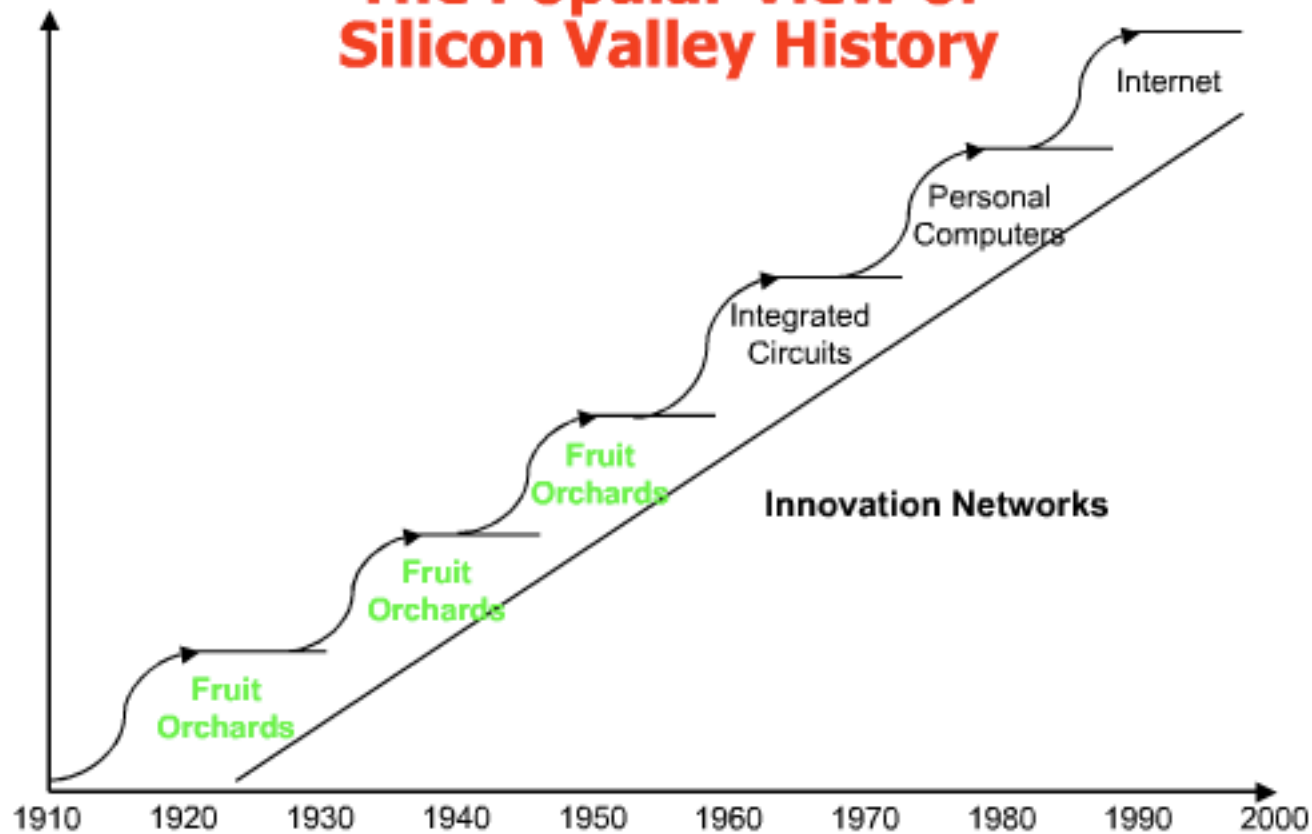
In 1971, when trade press reporter Don Hoefler used "Silicon Valley" to describe the concentration of chip-making firms on the Peninsula, the name stuck. But almost from the start, it stood for more than chip-making.



# Timeline

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## The Popular View of Silicon Valley History

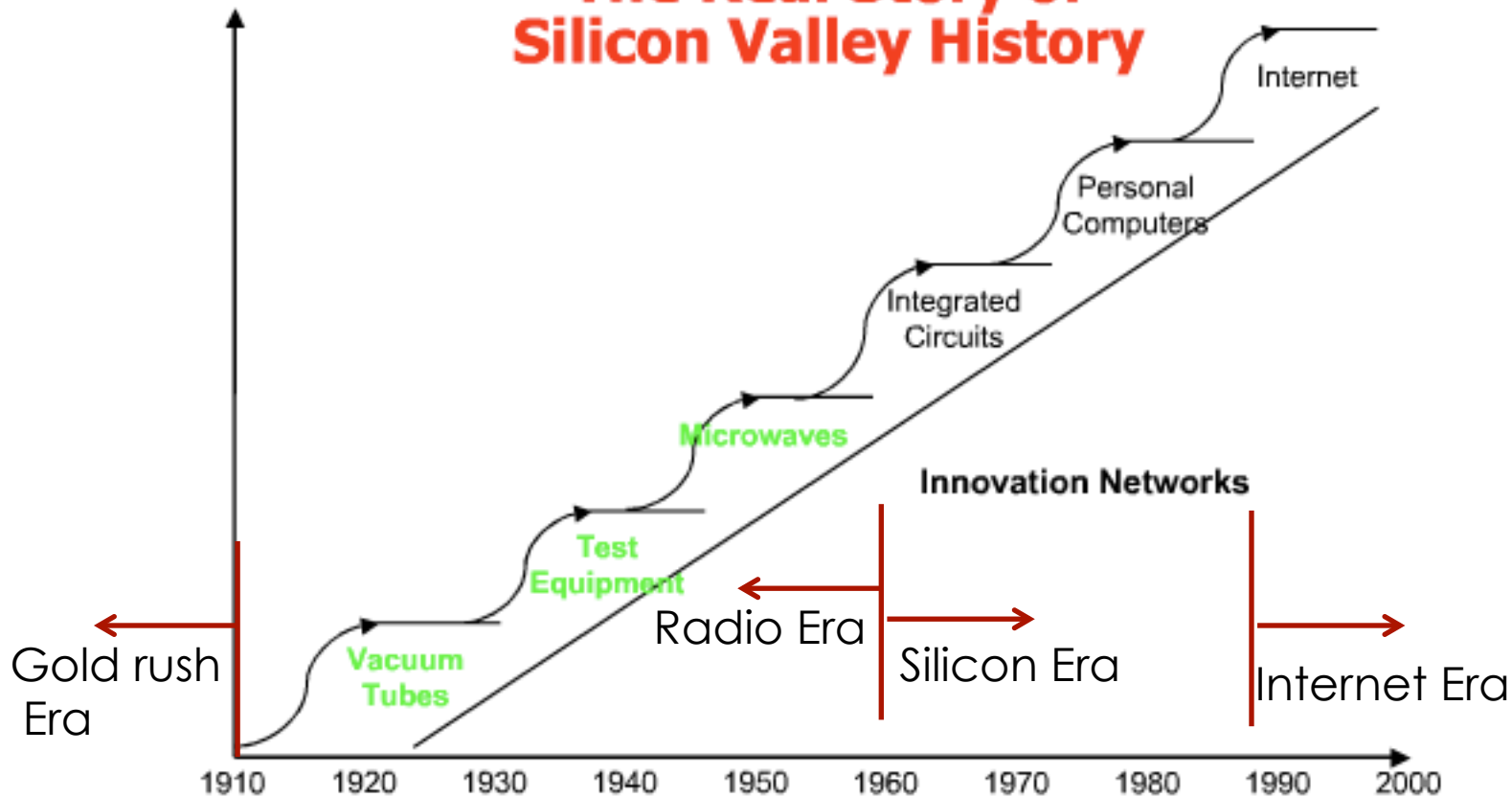




# Timeline

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## The Real Story of Silicon Valley History





# Radio era



# Silicon or Radio?

- The basic culture of Silicon Valley was forming around radio in 1900s: engineers who hung out in hobby clubs, brainstormed and borrowed equipment, spun new companies out of old ones, and established a meritocracy ruled by those who made electronic products cheaper, faster and better.
- As early as 1909, Stanford graduate Cyril Elwell was acquiring patents for new radio technologies and persuading university officials, including then-President David Starr Jordan, "to finance a new company" in Palo Alto that would be called **Federal Telegraph Co.**
- That same year in San Jose, Charles Herrold started a school for radio engineers and began broadcasting to radio hobbyists and later to a small local audience to become what a 1994 PBS documentary called "Broadcasting's Forgotten Father." Back then, the region had none of its present cachet relative to other clusters of radio activity like New York, New Jersey and Boston.
- U.S. naval officials, impressed by Federal Telegraph's technology, gave the Palo Alto firm huge contracts during World War I - the first but not the last time war would fuel the region's tech firms.



# Radio

- Around 1910, Peter Jensen and Edwin Pridham quit Federal Telegraph "to start a research and development firm in a garage in Napa" to improve loudspeakers. In 1917, they formed Magnavox, which built public address systems for destroyers and battleships in World War I.
- The war's end took the wind out of Silicon Valley's sails. The Eastern radio powers, notably RCA, dominated the field during the 1920s and 1930s. The region's entrepreneurial fire cooled but, as history would show, didn't die.
- The next chapter in the Silicon Valley story involves the familiar tale of how Hewlett and Packard hatched the region's first technology giant in a Palo Alto garage.
- Sophisticated versions of this creation epic also credit their mentor, Stanford engineering Professor Frederick Terman.
- Source:  
<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/09/29/MNDTSEMSJ.DTL&ao=2#ixzz1Fcoa4U3i>



# Vacuum Tubes

According to Rogers and Larsen, in 1912 "**de Forest** and two fellow researchers for **the Federal Telegraph Company**, an early electronics firm, leaned over a table watching a housefly walk across a sheet of paper. They heard the fly's foot steps amplified 120 times, so that each step sounded like marching boots. This event was the first time that a **vacuum tube** had amplified a signal; it marked the birth of electronics and opened the door for the development of radio, television, radar, tape recorders, and computers." Also Rogers and Larsen add that, "Lee de Forest had a Stanford University connection; his work was partly financed by Stanford officials and faculty."

*Links Between Stanford University and Industry, by Carolyn Tajnai, 1995*



Moving to California in **1910**, Le De Forest ( photo above -- De Forest, Palo Alto, 1915 ) worked for Federal Telegraph Company at **Palo Alto**. **While there, de Forest finally made his Audion tube perform as an amplifier and sold it to the telephone company as an amplifier of transcontinental wired phone calls.** For this innovation he received \$50,000. By the beginning of 1916, he had finally perfected his Audion for its most important task, that of an oscillator for the radiotelephone transmitter. By late 1916 de Forest had begun a series of experimental broadcasts from the Columbia Phonograph Laboratories on 38th Street, using for one of the very first times his Audion as a transmitter of radio: According to de Forest, "The radio telephone equipment consists of two large Oscillion tubes, used as generators of the high frequency current."" Source: Le De Forest bio. Photo left: Lee De Forest's first Triode or 'Audion', 1906



# Hewlett-Packard (HP) Garage,



Birthplace of  
Silicon Valley



Bill Hewlett and Dave Packard started  
HP in 1939

**Bill Hewlett**, center, with his partner **David Packard**, left, and former Stanford Provost **Frederick Terman**, who inspired the two graduate students to follow their dream of starting an electronics company. Hewlett and Packard honored their mentor by funding construction of the Terman Engineering Building, dedicated in 1952.

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Bill  
Hewlett



David  
Packard

Frederick  
Terman





# HP History

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- Hewlett and Packard tossed a coin to decide whether the company they founded would be called Hewlett-Packard or Packard-Hewlett
- From the 1940s until well into the 1990s the company concentrated on making electronic test equipment:  
signal generators, voltmeters, oscilloscopes, frequency counters, thermometers, time standards, wave analyzers, and many other instruments. A distinguishing feature was pushing the limits of measurement range and accuracy; many HP instruments were more sensitive, accurate, and precise than other comparable equipment.
- Their very first financially successful product was a precision audio oscillator, the Model HP200A. Their innovation was the use of a small light bulb as a temperature dependent resistor in a critical portion of the circuit. This allowed them to sell the Model 200A for \$54.40 when competitors were selling less stable oscillators for over \$200. The Model 200 series of generators continued until at least 1972 as the 200AB, still tube-based but improved in design through the years. At 33 years, it was perhaps the longest-selling basic electronic design of all time.
- One of the company's earliest customers was The Walt Disney Company, which bought eight Model 200B oscillators (at \$71.50 each) for use in certifying the Fantasound surround sound systems installed in theaters for the movie Fantasia.

HP is recognized as the symbolic founder of Silicon Valley, although it did not actively investigate semiconductor devices until a few years after the "Traitorous Eight" had abandoned William Shockley to create Fairchild Semiconductor in 1957. Hewlett-Packard's HP Associates division, established around 1960, developed semiconductor devices primarily for internal use. Instruments and calculators were some of the products using these devices.



# Silicon Era



# Silicon Valley's roots

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Fifty years ago, when most employees expected to stay with one company for their entire careers and the region today called Silicon Valley was an agricultural paradise best known for its prunes and apricots, a group of eight young men who disliked their Nobel Prize-winning boss, William Shockley, made a radical move.

**They decided to quit their jobs.**

Source:

<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/09/30/BUIBSDUEM.DTL#ixzz1F7mtx7UD>

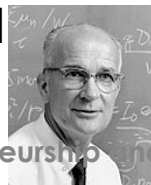


Courtesy of Special Collections, Stanford University Libraries

This dollar bill was one of 10 that were signed as a symbolic contract among the eight men who would start Fairchild Semiconductor, the first successful semiconductor company in Silicon Valley, and their financial backers. Photo courtesy of Special Collections, Stanford University Libraries

Launching their own company; "will be looked on as a shameful act"

William Shockley, Nobel  
winner but bad  
manager



**William Bradford Shockley Jr.** (February 13, 1910 & August 12, 1989) was an American physicist and inventor. Along with John Bardeen and Walter Houser Brattain, Shockley co-invented the transistor, for which all three were awarded the 1956 **Nobel** Prize in Physics.

Read more:

[http://www.kosmix.com/topic/william\\_shockley#ixzz1FdIYPiGK](http://www.kosmix.com/topic/william_shockley#ixzz1FdIYPiGK)





# Fairchild Semiconductor Company

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- Fairchild Semiconductor is established
  - Six of them with doctoral degrees, only one of them over 30, with backgrounds in physics, electronics, engineering, metallurgy or chemistry, they were united in two goals: to build silicon transistors, and to do so on their own terms.
  - Julius Blank, Victor Grinich, Jean Hoerni, Eugene Kleiner, Jay Last, Gordon Moore, Robert Noyce and Sheldon Roberts
  - New York investment bankers: Arthur Rock, Bud Coyle
  - Fairchild Camera and Instrument OF Sherman Fairchild lended \$1.38M over 18 months
    - OPTION TO BUY FOR \$3M

## Founding Fathers of Silicon Valley

Who is Moore?  
Who is Kleiner?

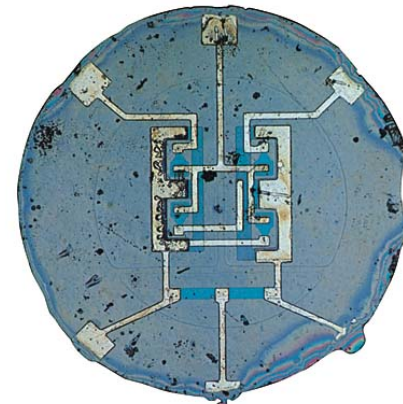
- Read more:  
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# Fairchild Semiconductor Philosophy

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- Fairchild Semiconductor's eight founders imbued the company with a corporate culture that today might be called "quintessential Silicon Valley": open communications, laissez-faire management styles, flat organizational structures and autonomous research groups. The founding team also pushed for a generous distribution of stock options, but the lead shareholder of Fairchild's parent company called the practice "creeping socialism."
- Read more:  
<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/09/30/BULBSDUFM.DTL&ao=2#ixzz1FZq4Nyaj>





# Fairchild

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- Fairchild was one of the first to employ offshore labor to assemble and test its microchips.
- Fairchild employees formed dozens of startups (dubbed the "Fairchildren"), several of which exist today at the heart of the \$228 billion global semiconductor industry.
  - Andy Grove of Intel,
  - Jerry Sanders of AMD, and
  - Charlie Sporck and Floyd Kvamme of National Semiconductor - all of them worked at Fairchild.
- Fairchild's founders and employees would go on to create no fewer than 65 technology companies
- Source:  
<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/09/30/BULBSDUFM.DTL&ao=2#ixzz1FZqtdxN4>



# Transistor History

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William Shockley, who left Bell Labs in 1954 to start its own company in Palo Alto, CA. --> Silicon Valley

Young people, such as G. E. Moore and R. N. Noyce, joined Shockley Company

Moore and Noyce, the "traitorous", as Shockley came to call them, set up in 1957 Fairchild

Fairchild: in 1959 new planar technology

Jack Kilby nor Robert Noyce conceived the integrated circuit in 1959

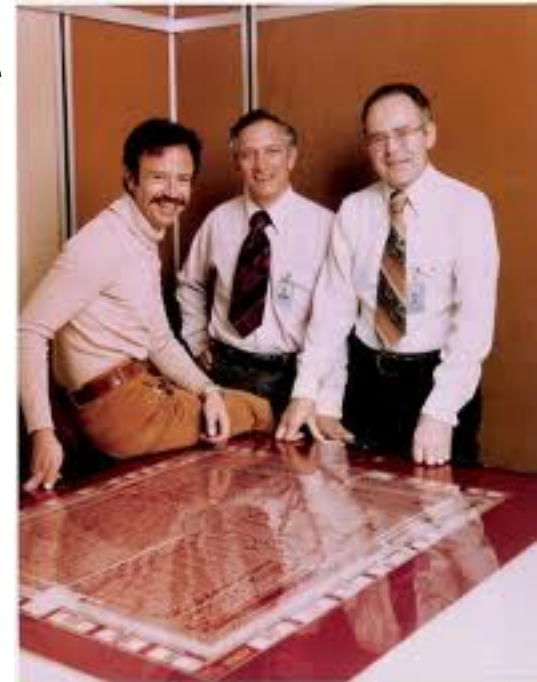
"as the most significant development by Texas Instrument since ... the commercial silicon transistor"



- Intel became the largest of these Fairchildren, and Moore the best known of the eight. But the gang leader was his charismatic colleague Robert Noyce. A technical innovator - in this meritocracy he had to be - in 1961, Noyce designed the first chip that enabled two transistors to work together on a single slice of silicon. Called the "integrated circuit," it is the ancestor of today's billion-transistor chips.

- Source:

<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/09/29/MNDTSEMSJ.DTL&ao=2#ixzz1FcpXDhQN>



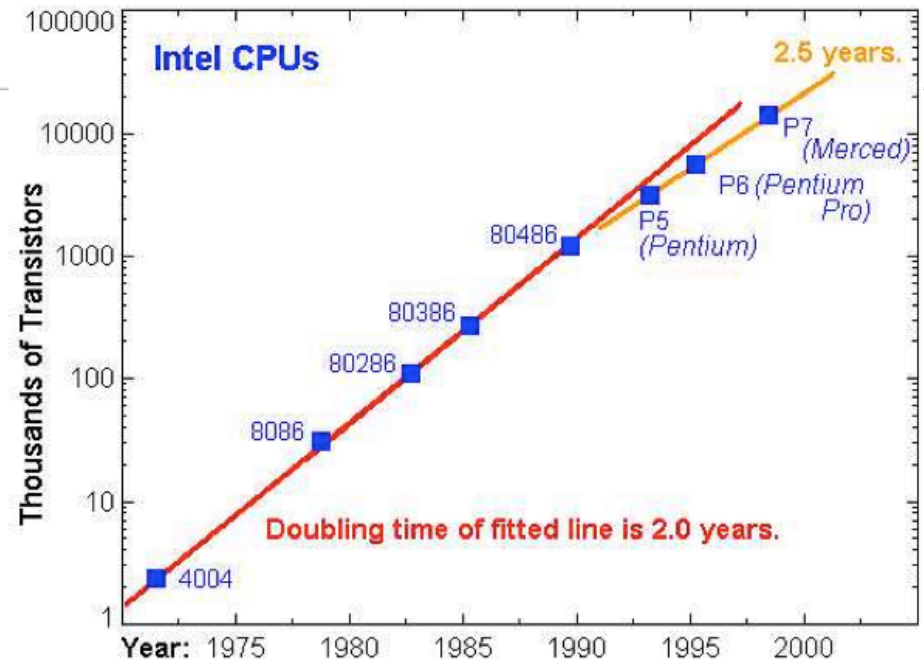
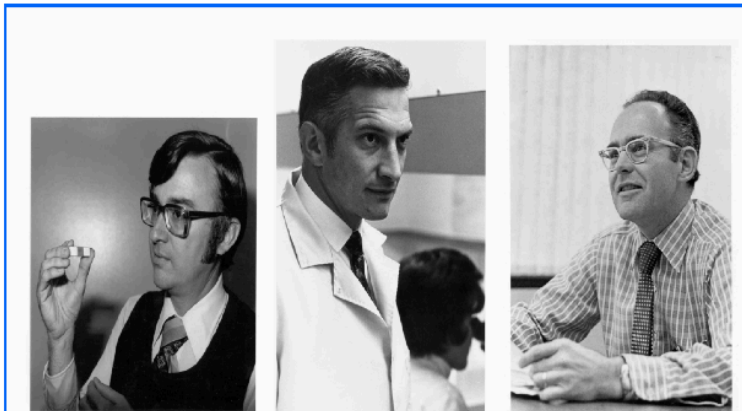


# Intel & Moore's law

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Robert Noyce and Gordon Moore  
(author of "Moore's Law") were  
traitorous of Fairchild!

Ed Hoff, Bob Noyce, Gordon Moore





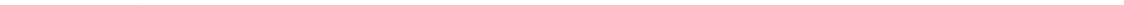
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- In 1975 the Homebrew Computer Club formed, where Steve Wozniak showed off the Apple I in 1976
- **Apple Seedlings**  
Steve Jobs was a friend of Wozniak from high school. They were introduced because we had two things in common: electronics and pranks. It turned out that Jobs had a tremendous drive to start a company. Jobs had worked at Atari and had become friends with some of the key people there, including Nolan Bushnell, the founder. Nolan was his idol. Steve wanted to have a successful product, go out and start selling it, and make some money. Jobs also had excellent product ideas for the upcoming home personal computer.
- To produce the Apple I, Steve and Wozniak formed a partnership. They didn't sell very many Apple Is the first year. They built them at night in the garage.
- At first they expected to sell circuit boards at the Homebrew Club: just put in your own chips and it'll work. Then they got a \$50,000 order from a local store and they were in heaven.



Garage of Steve Jobs' parents on Crist Drive in Los Altos, California



 **Apple Form Factor Evolution**  
1976 through 2007[illegible]

Studio CRT Display   Cinema Display   Cinema Display HD   Airport   Airport Express   Airport Extreme   iLight   Apple iD-ID mouse   iD-B mouse   Desktop Mouse II   Hockey Stick   Pro Mouse (Black)   Pro Mouse (White)   Mighty Mouse



# Government and Military Funding

- The Soviet launch of Sputnik on Oct. 4, 1957, prodded the United States to modernize its missile and space program. The newfangled silicon chips were considered vital - albeit costly - components, and Ceruzzi writes that NASA and the Defense Department bought so many "that the price dropped from \$1,000 a chip to between \$20 and \$30."
- Read more:  
<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/09/29/MNDTSEMSJ.DTL&ao=3#ixzz1FcpoH500>



# Integrated Circuit to PC and Internet

- By the 1970s, therefore, Silicon Valley was poised to capitalize on new civilian technologies like PCs, as exemplified by Apple Computer.
- In the 1980s, excitement shifted to scientific workstations and networking devices from firms like Sun Microsystems and Cisco Systems, and to software like the version of UNIX perfected at UC Berkeley.
- In the 1990s, the point-and-click browser popularized by Netscape ignited the dot-com boom and, after a painful bust and slow recovery, the recent rise of Google and social networking sites such as Facebook signal another wave of entrepreneurship.
- Read more:  
<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/09/29/MNDTSEMSJ.DTL&ao=3#ixzz1Fcq1Dx8m>



# SRI- Stanford Research Institute

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- **SRI International**, founded as **Stanford Research Institute**, is one of the world's largest contract research institutes. Based in the United States, the trustees of Stanford University established it in 1946 as a center of innovation to support economic development in the region. It was later incorporated as an independent non-profit organization under U.S. and California laws. SRI's headquarters are in Menlo Park, California, near the Stanford University campus



# SRI inventions

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## **Banking 1955**

SRI revolutionized banking with automatic check processing.



## **Theme Parks 1953**

SRI identified Anaheim, California, as the site for Disneyland.



## **Movies 1959**

SRI won an Academy Award® for the Technicolor electronic movie print timer.



## **Personal Computing 1968**

SRI invented the mouse and first demonstrated the concepts of interactive computing.



## **Internet 1969**

SRI received the first logon on the ARPANET, the Internet's predecessor, and assigned domain names for many years.



## **Wireless Communication 1977**

SRI sent the first internetworked transmission between three disparate networks.



## **Medicine 1970s**

SRI's Halofantrine saved countless lives as a treatment for drug-resistant malaria.



## **Robotics 1972**

SRI created Shakey, the first intelligent mobile robot.



## **Ultrasound 1980s**

SRI technology made ultrasound practical as a medical diagnostic tool.



## **Broadcasting 1997**

SRI Sarnoff, as part of the Emmy® Award-winning "Grand Alliance", developed the U.S. high-definition television (HDTV) standard.



## **Smart Materials 1990s-present**

SRI invented "artificial muscle", a new class of electroactive polymers.



## **National Defense 2000s**

SRI created intelligence systems for the war against terrorism.



## **Education 1978-present**

SRI conducted the first longitudinal studies of youth with disabilities to improve the U.S. education system.



## **Minimally Invasive Surgery 1990s**

SRI developed first robotic surgical system, now used by surgeons around the world.



## **Speech Recognition 1996**

SRI developed platform technology to automate delivery of customer support.



## First Industry Park after SRI



The **First** building of **Silicon Valley**

First Varian Associates building, Stanford Industrial Park, Palo Alto, California, **1953**. Source: "*Russell and Sigurd Varian - The Inventor and The Pilot*", by Dorothy Varian. Palo Alto, 1983, p.258.



# Stanford's role

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- Carolyn Tajnai clarified this point of Stanford's history in more detail:
- " In the 1950's, the idea of building an industrial park arose. The university had plenty of land over 8,000 acres....but money was needed to finance the University's rapid postwar growth. The original bequest of his farm by Leland Stanford prohibited the sale of this land, but there was nothing to prevent its being leased.
- It turned out that long-term leases were just as attractive to industry as outright ownership; thus, the Stanford Industrial Park was founded.
- The goal was to create a center of high technology close to a cooperative university.
- It was a stroke of genius , and Terman, calling it ``our secret weapon," quickly suggested that leases be limited to high technology companies that might be beneficial to Stanford.
- In 1951 Varian Associates signed a lease, and in 1953 the company moved into the first building in the park.
- Eastman Kodak, General Electric, Preformed Line Products, Admiral Corporation, Shockley Transistor Laboratory of Beckman Instruments, Lockheed, Hewlett-Packard, and others followed soon after."
- Source: Fred Terman, *The father of Silicon Valley* by Carolyn Tajnai, 1995





# Silicon Valley Companies

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## Started by College Students:

- **Hardware:** Apple, Cisco, and Sun. Dell but in Texas.
- **Software:** Too many to count ...
- **Internet Search Engines:** Inktomi, Yahoo, Ask, and Google.
- **Social Network:** Facebook, Twitter, Linked-in and Friendster.

- **Others:** InfoSeek, PowerSet (Bing), eBay, & Craigslist



... Google started in **Susan Wojcicki's** rented garage. But in her mind, that might be the single least important fact about her long and deep relationship with the Internet giant. Thirteen years ago, the then-tiny company's former landlord became its 16th employee and first marketing manager [She then married to Google executive Dennis Troper and introduced a future husband to her younger sister Anne, who married Brin ] Today, she is one of its 12 senior vice presidents, although by one measure she is first among equals: The advertising products she oversees accounted for about **96** percent of Google's revenues in 2010. By [Mike Swift](#)



# Silicon Valley start?

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- Some claim that Silicon Valley has started with radio era.
- Some claim that with Fairchild since the notion that they founded the valley is justified by what financier Rock brought to the party - the money to bankroll bold engineers.
- "The venture capital sector really arises along with the semiconductor industry," according to Lecuyer.
- "Once the venture capital is in place, it makes all the other things possible." according to Lecuyer.

Start:

Radio?

Silicon?

Venture Capital?

- Source:  
<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/09/29/MNDTSEMSJ.DTL&ao=2#ixzz1FcplZxRt>



# Why in California but no other states?

- Which of the main historical features of Silicon Valley has been instrumental in its development? There have long been discussions on this subject and very different points of view have been expressed. Many believe the main reason is the unique features of Stanford University. Others point out that the Valley is an exceptionally favorable place to live on the Pacific coast and therefore any researcher, engineer or programmer who comes there for some reason is not usually willing to leave this place.

Finally, those who actually have an interest in seeing that the research park created somewhere with their participation would obtain adequate government funding usually pay attention first and foremost to the fact that the starting period for the formation of Silicon Valley occurred during the period of one of the peaks of the "Cold War," when high-tech enterprises benefited from the "windfall" of defense programs.

A unique Californian law that was enacted for the sake of gold miners, and explains the law's significance in powering the high-tech boom in Silicon Valley.

A Legal  
Bridge  
Spanning  
100 Years:  
From the  
Gold Mines  
of El Dorado  
to the  
'Golden'  
Startups of  
Silicon  
Valley by  
Gregory  
Gromov



## 1872 law

- The law in question declared null and void any contract between a business owner and employee if said contract in any way restricted the employee's freedom to change employers, even if that meant joining the former employer's competition.
- In other words, any previously signed agreements—for example, an employee contract signed upon hiring—that could in any way limit the employee's right to freely choose his or her place of work were deemed unenforceable in this 1872 law. More specifically, those clauses that were in conflict with this law were deemed unenforceable.
- This law was initially ratified in 1872 as part of California's Civil Code. It is now listed under California Code - Section 16600, also known as CAL. BPC. CODE § 16600, and reads:
- *Except as provided in this chapter, every contract by which anyone is restrained from engaging in a lawful profession, trade, or business of any kind is to that extent void.*
- As a result of this cascade of direct and indirect consequences from the application of this law in Silicon Valley, today a number of generally operating U.S. legal standards, including some of the most important, are practically blocked (“de facto” canceled).



# NCA and NDA

- Anyone who is hired to work in virtually any high-tech company in any of the American states signs an agreement that if he or she ever decides to change in their place of employment, then for a specified period (usually two years), determined in advance, after his retirement from the company, he or she shall not have the right to work for competitors. This is the so-called Non-Compete Agreement (NCA).
- In addition, an agreement is usually signed that prohibits the employee from disclosing, without the express written permission of the employer, confidential information on the company's activities, which this employee will have the opportunity to learn about during his work at the company – this is the so-called Non-Disclosure Agreement (NDA).



# Why this law?

- In order to understand why it was in this time and place—California, 1872—and not in any other state or point in time in American history that lawmakers would have the inclination to apply this particular legal framework to these particular labor disputes, it is worth examining exactly how California came to be the 31st state of USA.
- After some examination of various analogous moments in history, it becomes apparent that Silicon Valley was essentially built on groundwork laid by its first inhabitants—the gold seekers.
- To get from El Dorado County to Silicon Valley by car takes two or three hours, but 100 years went by between the construction of the first El Dorado County Mining Camps (1848-1851) and the arrival of first high-tech firms at Stanford University industrial park.
- The aforementioned law was motivated by a desire to minimize the number of shootings in and around the gold mines of El Dorado and other California areas. If the fortune-seeker, venturesome by nature and armed to the teeth, was unable to resolve a dispute in his favor in a court of law, then it is obvious how and with what tools such conflicts were likely to be settled in the Wild West.
- Thus, it was necessary to create a law that would dramatically reduce the likelihood of disputants resorting to violence to resolve the potentially quite dramatic misunderstandings between gold mine owners and hired hands.





# Gold mine disputes

- Most importantly, in comparison to their employees, the owner of a registered gold claim generally had much more motivation to do everything in their power to ensure that all business problems were resolved in a court of law.
- This is one of many reasons that California's lawmakers developed a legal framework that protected the rights of the employee by guaranteeing access to the most peaceful of all methods for resolving any problem he might have with the owner of the enterprise—to turn and walk away, to leave for any of the surrounding gold claims and the potential new employers they promised.
- Again—and this is vital for a proper understanding of the topic—it was necessary to pass a law guaranteeing workers of any level or position the right to leave an employer and then and there (without any legal obstacles) find a position anywhere he or she wanted, even joining the former employer's competition in a neighboring mine.



# Valley history

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- **1848**—the first year of the Gold Rush. All over the world spread rumors of fabulous gold reserves discovered on the west coast of North America. Gold was discovered in El Dorado County, not far from Sacramento, the current state capital of California, and “El Dorado” entered the vocabulary of treasure-seekers around the world.
- **1849**—the first tens of thousands of the more adventurous of gold-seekers from all over America arrive in California, in what was at that time still a territory of Mexico. Not counting the Native Americans, only about 2000 Americans lived there at the time... Thus, the first tens of thousands of California gold seekers went down in history as the “Forty-niners”.
- **1850**—California gains statehood, becomes known as “The Golden State” ( California is also known variously as The Land of Milk and Honey, The El Dorado State, and The Grape State).
- **1853**—The number of new arrivals to California exceeds 300 thousand people...
- **1872**—as a result of the state's experience during the regulation of the more violent of business disagreements during the first two decades of the state's existence (as noted earlier, this experience was accrued particularly quickly in the first days of the Gold Rush, when the groundwork was laid for California's government) the California Civil Code was adopted, in which the state's lawmakers included a special provision guaranteeing the freedom of employees in the state of California to choose their own place of work





# Valley History

- **1891**—Stanford University is founded by former governor of California Leland Stanford.
- **1910** — Lee de Forest arrives in San Francisco Bay Area. He was by then already well-known as the inventor of the triode (US Patent 879532, February 1908). Of all the influential inventions in the development of electronics and radio technology in the first half of the 20th century, the triode turned out to be the most critical component in the development of transcontinental telephone communications, radio, television, radar and early digital electronics.
- Lee de Forest's arrival in what would later become Silicon Valley began the process of transformation that turned this area into one of the world's central confluences of talent and professional knowledge in electronics. A couple of years later Silicon Valley's development got its first big boost from a series of important defense contracts related to World War I, reaching critical mass 40 years later, in the first decade following World War II.
- **1951**—Stanford Industrial Park is established as a high tech center by businesses working in close partnership with the university. Among the first companies to rent space in the Park were Varian Associates, General Electric, and Eastman Kodak.
- **1956**—William Shockley, co-inventor of the semiconductor triode arrived in San Francisco Bay Area and founds Shockley Semiconductor as a division of Beckman Instruments in Mountain View. On the road to Silicon Valley's development, the baton was thus passed from Lee de Forest, inventor of the vacuum tube triode, to Shockley, inventor of the solid-state triode - transistor.



# Valley history

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- **1957**—The “Traitorous Eight” leave Shockley Semiconductor to found Fairchild Semiconductor.
- **1968**—Two of the “Traitorous Eight” (Robert Noyce and Gordon Moore) leave Fairchild Semiconductor to found Intel.
- Thus, over the course of just 20 years, a mere eight of Shockley’s former employees gave forth 65 new enterprises, which then went on to do the same... Conflicts between creative teams and their veteran leadership were of course common in all American industrial parks, both before and after the aforementioned disagreement at Shockley. However, the crux of the matter is that, with the exception of California, all across America there are many different agreements signed between business owners and their employees that restrict the employee’s right to quit and join competing firms or, even worse, go on to create his or her own company in direct competition with their former employer. These non-compete agreements, which new recruits are required to sign play the role of graphite rods in a nuclear reactor, slowing the chain reaction of creation of new start-ups all over America.
- **1971**—Term “Silicon Valley” by the press.



# 1872 Law's Weight in Gold

- The amount of gold extracted per year during the Gold Rush amounted to 80 million of that period's dollars, worth about \$2 billion in today's money.
- It might be possible to compare this figure with the “gold mines” discovered by the companies operating in Silicon Valley, which were able to expand on the first generation of startups only by provision of this 1872 law.
- For example, the New York Times described gold-rushing pioneer Apple Computer's financial impact as “the iPhone Gold Rush”. Apple's sales in 2010 were valued at around 60 billion USD.
- One might also take into account the “gold” extracted by Intel, which—like many other Silicon Valley startups—would not have got its start had not the 19th century California Gold Rush given rise to the aforementioned 1872 law. Intel's patented “silicon gold mine” produced about 40 billion dollars of sales this year.
- This modern-day gold extraction, legally speaking a direct result of a law dating back to the California Gold Rush 100 years previous, has brought financial gain on the order of hundreds of billions of dollars, earned by tens of thousands of high tech companies in Silicon Valley, all mining the seemingly bottomless gold reserves of information technology.



## Route 128

Although similar to Silicon Valley with respect to its industrial emphasis (electronics), the Route 128 region around Boston presents a study in contrast in terms of its historical development, geography, community life, and degree of interconnectivity between firms.

Like Silicon Valley, the development of electronics-related companies on the 65-mile highway surrounding Boston and Cambridge in the area's major research universities was influenced by academia, industry, and government. The professors and graduate students in the universities devote their energies toward a greater understanding of the world around them. The government, particularly federal agencies such as the Department of Defense and the National Science Foundation, provides the financial support for the academicians to test the hypothesis and perform the experiments. The firms would then produce the physical manifestations of these ideas for the marketplace.



The Massachusetts Institute of Technology, (DuPont, Kodak, Xerox) (Rosegrant and Lampe).



## Route 128

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- Silicon Valley has a regional-network-based industrial system -- that is, it promotes **collective learning** and flexible adjustment among companies that make specialty products within a broad range of related technologies. The region's dense social networks and open labor market encourage entrepreneurship and experimentation. Companies compete intensely while learning from one another about changing markets and technologies through informal communication and collaboration. In a network-based system, the organizational boundaries within companies are porous, as are the boundaries between companies themselves and between companies and local institutions such as trade associations and universities.
- The Route 128 region is dominated by a small number of relatively vertically integrated corporations. Its industrial system is based on independent companies that keep largely to themselves. Secrecy and corporate loyalty govern relations between companies and their customers, suppliers, and competitors, reinforcing a regional culture that encourages stability and self-reliance. Corporate hierarchies ensure that authority remains centralized, and information tends to flow vertically. The boundaries between and within companies, and between companies and local institutions, thus remain distinct in the independent-company-based system.

the regional-network-based system and the independent-company-based system -- illuminate the different fates of the two economies.



# Characteristic of Valley

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- Job mobility statistics show the extent of success of these networks: the average turnover rate for small-to medium sized firms was 35% and the average job tenure (in the 1980s) was approximately two years (Saxenian 1994).
- The spatial concentration of a large number of technology-based firms enabled people to change employers without altering other aspects of their lives. When a person left one firm in Palo Alto for another, there was no need to move one's residence or take one's kids out of a particular school district to enter a different firm.
- The attitude of the Valley served as a catalyst for this risk-taking. In many cases, a small coterie of employees in a firm dissatisfied with their current place of employment would gather together after work to tinker around with some of their own ideas. (Saxenian 1994).
- As people in the region became occupationally mobile, their roles became interchangeable: employers become employees and co-workers can become competitors. The result is that the engineers developed strong loyalties to technology and their fellow engineers and scientists while possessing far less allegiance to a single firm (Saxenian 1994). Although it may seem paradoxical that such cooperation would occur under such obviously competitive circumstances, Saxenian (1994) notes the motto of the region: "competition demands continuous innovation, which in turn requires cooperation among firms."
- Rapid flows of practical information became the currency of choice. Applied scientific research was constantly reworked to develop market goods. It is not surprising that rapid changes led to industrial diversification and contributed to the flexibility and resilience of the economic region (Saxenian 1994).
- The lack of rigid hierarchies extended to the firms themselves. The traditional delineations between employers and employees were not so sharp as on the East Coast, and in some cases they disappeared entirely.
- Beginning with Hewlett and Packard, many of the Silicon Valley companies sought a much more interactive environment between employers and employees. Decentralization of powers followed: major divisions of firms were given a large amount of autonomy (Saxenian 1994).



# Constant Revolution

- Technological innovation produces constant revolution. Large pools of venture capital mean that ideas can be transformed into products more rapidly.
- But it also means that existing companies that are not fast moving will be left behind and ultimately destroyed.
- For engineers this means that you have a chance at becoming wealthy through stock options or unemployed when your employer goes extinct.
- Large technology companies like IBM and AT&T at one time offered their employees stability and lifetime employment.
- At the start of the 1980s both of these companies appeared unassailable. IBM set the standards that the rest of the computer industry followed.
- The computer industry was referred to as IBM and the BUNCH, where BUNCH stood for Burroughs, Univac, NCR, CDC and Honeywell.
- By the end of the decade this had changed. IBM shed tens of thousands of employees through layoffs or forced early retirement.
- The company that set industry standards was now viewed as a "mainframe dinosaur". The companies that formed the "BUNCH" were either gone or shadows of what they had been.



- One of the companies that rose while IBM declined was Digital Equipment Corp. (DEC), which at its zenith was the second largest computer company in the United States.
- In the early 1980s The DEC VAX computer system provided computing power at a fraction of the cost of IBM systems. DEC started selling PDP 11 and later VAX systems to scientists and engineers. But with the VAX they started making big inroads into commercial computing. Where IBM was viewed as a dinosaur, DEC was seen as a cutting edge computer company and one of the most desirable places for an young engineer to work.
- In 1989 Eugene Brooks, who was then working at the Lawrence Livermore Labs., wrote a paper he titled *Attack of the Killer Micros*, which described the impact of the exponentially increasing power of the microprocessor on the computer industry.
- This impact had already been felt by DEC. The VAX and later microVAX computer systems could not compete with computer systems running UNIX from Sun Microsystems and with personal computers.
- DEC's sales declined and never recovered. DEC was eventually purchased by Compaq, a company that built Intel based personal computers.



- The revolutionary effect of technology is accelerating. Silicon Graphics Inc. (SGI) was founded by James Clark in 1982.
- At the time Clark was a Stanford University professor. Like the DEC VAX, the Silicon Graphics workstation was coveted by engineers and scientists.
- SGI systems were used for visualizing large amounts of data in physics and for graphics rendering in movies like *Jurassic Park*. In 1996, at the apex of SGI's success, SGI founded their Silicon Studios subsidiary.
- Three years later SGI was a struggling company, whose profits had turned to losses. The increasing performance of the Intel processors used in personal computers and high performance graphics chips from companies like S3 and, later, 3Dfx, and Nvidia, put SGI into a decline from which they may never recover from.



# Eras of Silicon Valley

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- Silicon Valley got its name from semiconductor companies. The first of these was Shockley Semiconductor, founded by William Shockley. Gordon Moore and Robert Noyce quit Shockley to found Fairchild and, later, Intel. In terms of numbers of companies, semiconductor companies are in the minority in Silicon Valley. However, Silicon Valley still has some of the best VLSI designers in the world. Hewlett-Packard was founded in their era as well, their products made possible by the early semiconductor chips.
- The next wave of companies were software companies, like Oracle or companies whose products were made possible by the microprocessor, like Apple and Sun. This was also the era of the mini-computer, which was faster than microprocessor based system. Mini-computers were built from medium scale integrated circuits (MSI), fabricated on large printed circuit boards.
- **The most recent wave of companies have been networking and Internet start-ups. Some companies, like Cisco and 3Com were founded in the microprocessor era and, in the case of Cisco, grew explosively during the Internet boom.**
- There is another era: the post Internet boom era, which is unfolding now.

Silicon

Software  
& PC

WEB 1.0





# Internet Bubble

- Although much is made of the MOSAIC browser software and HTML, popular use of the Internet was made possible by cheap 12K baud modems, which began to appear around 1994.
- One year later, on August 5, 1995, Netscape ignited the Internet boom which fueled insane stock market valuations for Internet companies.
- Designing and building a computer system takes two to three years. Even with VLSI design, where most of the computer logic can be packaged in a few chips, the boards, power supply, cooling and enclosure have to be designed and manufactured.
- It took Compaq a decade to build a billion dollar valuation. Netscape built such a valuation in one year.
- **The Internet boom attracted huge pools of venture capital. Much of this went to Internet companies, but money also flowed to a variety of start-ups.**



# Conclusion

- Resources:
  - Excellent Academic Institutions:
    - U.C. Berkeley & Stanford
  - Culture - Gold Rush Mentality
  - Past Successes
    - HP, Intel, and Oracle
  - Ready Capital (VC Community)
  - Minimal Bureaucracy
  - Experienced Talent (from around the world)

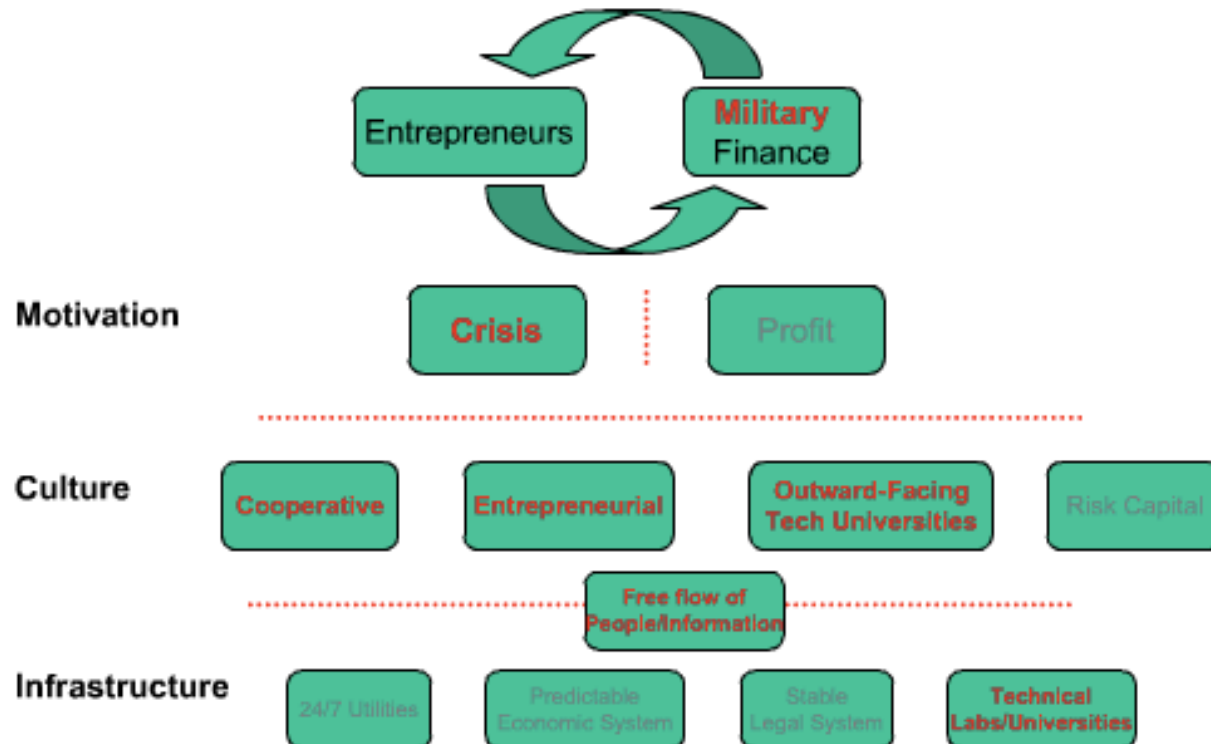


Silicon Valley promotes collective learning and flexible adjustment among companies that make specialty products within a broad range of related technologies. (Saxenian 1994).



# Summary

## Terman and the Cold War Silicon Valley's 1st Engine of Entrepreneurship





# Summary

## Venture Capital Silicon Valley's 2nd Engine of Entrepreneurship

